TEXTBOOK OF HOMEOPATHIC MATERIA MEDICA

Inorganic Medicinal Substances

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Foreword

A TEXT-BOOK of materia medica should not satisfy itself with the mere narration of available facts nor with some kind of arrangement. It should be arranged so that its accuracy is manifestly conformable with reality. In our case where we are concerned with scientific material which has long been completely closed to the vast majority of physicians, a mutual basis for understanding first had to be created.

How far I have succeeded in accomplishing this task by the previous part will be determined by the reception accorded the present section.

This part will be uniform even though it was started at the time the first edition of my "Fundamentals of Therapeutics" appeared. For ten years the work has developed together with my medical activities. The essential thoughts were communicated first at the meeting of the German Central Society of Homeopathic Physicians at Bonn, in 1925, and in greater detail at the international postgraduate medical courses at the Stuttgart Homeopathic Hospital, 1926, 1928, 1930. I would have preferred to postpone the publication even longer in order to more thoroughly elaborate the factual material which is very extensive and which is constantly increasing. Yet there finally seemed to me a more urgent necessity in that this book might bring enlightenment in a difficult but practical and important study.

I am deeply indebted to my friend, Dr. H. Göhrum, of Stuttgart, for his assistance in reading the proof.

OTTO LEESER

Stuttgart,
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Translator's Note

THIS translation of Leeser's Lehrbuch der Homoöpathie, Spezieller Teil; Arzneimittellehre, A: Die mineralischen Arzneimittel has been made possible by the generous assistance of the author, the original publisher, Hippokrates Verlag, Stuttgart, Germany, and Boericke and Tafel.

I am particularly indebted to my associate, Dr. Max. M. Scharf, who prepared the index, to Miss Margaret Wheeler who typed the manuscript, to Mr. H. H. Jenkins, of The Haddon Craftsmen, Inc., who saw the work through press, and to Mr. G. H. Tafel, of Boericke and Tafel, for favors too numerous to detail.

An attempt has been made to provide an accurate translation. To this end Germanic phraseology and sentence construction is often retained, whereby the reader may remain conscious of the origin of the work. Believing that the task of a translator is the correct representation of the author, I have not interrupted the text by comments which would reflect my attitude on many interesting questions raised by the author.

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New York
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THE MEANING OF HOMEOPATHIC MATERIA MEDICA

Experiences on the actions of medicinal substances in disease lie scattered over centuries among all races. A collection of these empiricisms, even if it could be made, would still be unscientific. The last centuries of occidental culture have opened and prosecuted the question of the "how" of an event so penetratingly that our thinking is forcibly directed to the determination of the conditions under which the event occurs. Therefore the content of scientific thinking has become the experiment, that is, the observation of natural events under selected conditions. Materia medica should be or become scientific, that is, have or obtain an experimental basis.

Experimental Pharmacology and Practical Therapeutics

The requirements of practical therapeutics, however, do not stand in any accord with the type and tempo of research progress. It is completely immaterial to the physician who technically intervenes into natural events, whether the use of the drug arises out of folk experience or is experimentally grounded. Indeed, the difficulty of experimentation in biologic fields, that is, the difficulty of avoiding false conclusions, always raises doubt in the mind of a physician on the accuracy of the experimental approach and makes him suspicious

of laboratory science. But in reality it is only the pretension of biologic experimental science, arising out of excessive promises, which makes the great distance between practical demand and theoretic supply seem so insurmountable. In the leap into practice, most physicians leave the experimental science of materia medica of the University behind them.

Now the question is raised: Does this lie in the nature of the fact, is it true that experimental pharmacology and practical therapeutics approach each other with such difficulty or does it lie in the imperfection of the experimental method? And if it involves the last is this imperfection only temporally conditioned and is an improvement to be expected in the future with further development along present lines or is a rearrangement of experimental work advisable? We should not forsake the basic orientation of contemporary science, the experimental method. We should not attempt to *construe* purely out of consideration of the nature of the medicinal substance, from its structure and its natural relationships. But we need to ask: is the plan of experimentation followed up to the present, the simplest, so to speak, the economic way to the goal of practical therapeutics? We must affirm this question and indeed with good reasons. The relative clarity of drug investigation on the animal has so fascinated the laboratory investigator that he does not consider whether or not he treads on apparently uncertain grounds, as long as animal investigation seems to promise so many actual results. For a long time animal research was oriented purely toxicologically, that is, one investigated the *disturbances* on the threshold of ultimate damage to life. In so far as this study was preparatory for the clinic by a transference of re-

sults from animal to man one could not expect much more than a reversal, usually in the sense of a paralysis of single functions, moreover a palliative therapy (example: narcotics). Further, with the simple conditions of animal experimentation one could find additional explanations of previously known drug effects and here and there explain the limits of the field of application (example: cardiac drugs). The highly important results of experimental pharmacology on hormones, vitamines, *etc.*, which have furnished a substitutive therapy, are omitted from the frame of this discussion. But the secret or outspoken claim of this animal experimental method has progressed far beyond these performances, to imply that out of the collected building stones the structure of an objective materia medica will be created in the future which needs only an objective application for the control of morbid processes in man. This claim was excessive: (1) because only a small part of human functions can be paralleled by those which can be represented in animal experimentation; namely, only those *objectively recognizable* alterations of living expressions mutual to animal and man. (2) The experimentally produced disturbances of normal animal functions do not permit a conclusion on the modification of an already disturbed (morbid) human function. (3) The supposition of constancy of the human organism, particularly the diseased organism, is a mental simplification which is entirely incompatible with actuality.

Experimental Therapy

The *therapeutic* experiment on animals represents progress in animal experimental methods. By the incorporation of the therapeutic aspect into the study, the

sources of failure in the transference to clinical trials are limited. In an animal made ill artificially (usually by bacterial infection), the healing effect of medicinal substances is studied and even attempts made to measure it. The original theoretic conception of *therapia sterilisans magna* of Ehrlich could not be maintained long, that is, the conception that bacteria in the body are directly killed by drugs whose type and amounts should not particularly affect the host. In the last decade careful study based on this working hypothesis has shown increasingly distinctly that such a viewpoint of only *damaging* drug effects is not tenable in a therapeutic plan under actual conditions. Generally, it has been shown that damage to the infectious organism by the chemotherapeutic agent does not occur without the active participation of the host. The increase of the defense powers is shown to be just as important, if not more important, for the favorable effect of the chemotherapeutic agent as the disinfectant action.

Walbum's Stimulation Therapy

Walbum's metal salt therapy represents the most significant progress in this "experimental therapy."[1] Walbum's laborious study has materialized thoughts with very noteworthy results, that is, to stimulate *the defense* of the organism of the host against artificial infections and indeed against artificially produced growths (tar carcinoma). Thereby Walbum obtained rules of dosage which are completely in harmony with those of homeopathy, not only in respect to the minimal concentrations (up to the 23rd potency!) but also in the recognition of an optimal dose. This optimum is not only below the dose which is damaging to the bacteria and the host, but it must also remain below the

zone in which it stimulates bacterial growth. Here also the stimulative action on the two biologic units which stand in combat with each other represents the central point. It is obviously shown that the sensitivity of the host must be taken into account in the single phases. As an indicator in animals naturally only an objective sign, the temperature, can be used. Also the increased sensitivity of the diseased organism which stands in combat, in contradistinction to the normal organism, was demonstrated and observed. Just as homeopathy so Walbum perceives in such stimulation therapy an alteration with a long after-effect.

The second problem which Walbum approached in his investigations was a qualitative one, *specificity*. His studies show particularly that in various infections as well as in tar carcinoma, by no means all the metal salts studied had a favorable effect, but at times only one or two; furthermore, various metals acted in different diseases. If one considers that the metals are catalysers for defense ferments or antibodies, this implies a variable suitability of single metals for diverse defense processes. This qualification, adaptability, balance, was ascertained by Walbum in a groping experimental way in that he tested, so to speak, all the possibilities. In such a procedure the difficulty is found in an almost unending task. For even if agents are found suitable for single artificial diseases of various animals, still this adaptability is shown only for these species of animals. Then begins the difficulty of transference of the results to the sick human. Furthermore, it is not easy to reproduce metal salt healing in animals themselves. For example, Walbum[2] found that the nutriment of the animal was essential for the success

or failure of the animal investigation. If fresh milk was added to the food of the mice infected with ratin bacilli, for example, the caesium treatment failed. If a great dependence upon other experimental conditions is shown in experimentally tested cases in animals, then it should not be astonishing that the metal salt stimulation therapy cannot be applied to sick mankind without further consideration, even if one observes all precautions in regard to optimal dosage. Actually the clinical application of this metal salt therapy up to the present has witnessed single encouraging results and frequent observations of failure. This is probably connected not only with the technical difficulties of optimal dosage but probably even more with the diverse other factors in the defense function in man, indeed, those which should be stimulated. Moreover, the significance of Walbum's results above all leaves entirely untouched the possibility of transference to human-clinical relations. Their value lies more in that these therapeutic model investigations demonstrate *the possibility and the principles of a stimulation therapy* in animals through an ingenious arrangement. In regard to the dosage conclusions have results which are in full agreement with the medicinal stimulation therapy of homeopathy.

While the *qualitative specificity* problem can be approached through groping animal experiment, a solution *based on this procedure presents almost infinite difficulties.* Even if one accepts as necessary the limitation of animal investigation to etiologically definite diseases with objective symptomatology (likewise separated from causes), then within this limitation a therapeutic animal investigation can be valued only as a schematic preliminary for clinical study; schematic because at best it can be considered as the general

type of bacterial defense for the animal organism, but not the temporal and individually variable defense functions in man.

The Homeopathic Method as a Necessary Supplement

Here is the starting point of homeopathy. With the postponement of the goal from the etiologic to the entire comprehensible symptomatology it steps beyond the naturally given limits of animal investigation. It considers the specificity problem directly in man. Through the introduction of a second equation it practically determines, so to speak, the X, the specific relation of drug to patient. It is a genial solution if one first answers by observations made on *healthy man* the question *which* of the defense functions is a single medical agent able to stimulate? The symptoms with which a man reacts to a drug make the qualitative "specific" connections available. So we have an equation of cure. The sick man indicates to us the nature of his defense functions in symptoms. In order to stimulate them we need only to compare the signs and to take them as indications. This leads to a solution which can satisfy us practically. Theoretically, we might solve the individual equations by themselves: that is, discover the defense functions in each case of disease in all details of "how" and "by what" and likewise the intermediate processes with which the healthy organism reacts to every medicinal substance. But practically we cannot expect the complete solution of this infinite task but we can use with advantage the available immediate observations as indications, as measuring sticks for determination of the suitability of the agent.

"Humanization" of the Materia Medica

It is exactly the inevitable gaps of all animal experimental drug investigation which are filled in by the homeopathic method. Further, it is an experimental and therefore fundamentally scientific method. For it *places man in the center of natural interrogation* from the start. Through the drug proving on healthy man it gains two heights: first, the avoidance of the source of error of transference from animal to man and moreover the extremely important supplementation of investigative procedures by all the data which are obtainable only from man with the assistance of his capacity for communication, the so-called subjective symptoms. The well-known source of error, the unreliability of these symptoms, is not able to neutralize this advantage nor to reject the method. The meaning of homeopathic provings on men can be perceived in the *humanization* of the materia medica. The difficulties and limits of this attempt we shall consider further but the necessity of such a supplement of all materia medica will depend upon them. This theoretic advantage, moreover, becomes practical only through the therapeutic orientation of homeopathy: it is primarily *a stimulation therapy, it consciously utilizes the earliest, most active phenomena of the organism against a stimulus.* And for this purpose the subtle, functional drug reactions, the individual indicative human reactions, serve far more than the signs of disturbance in any organism, animal or man, succumbing or overcome and passively forced by a stimulus. We assume here certainly with right that the stimulus to an increase in performance is the high goal of therapy rather than the coercion which proceeds to functional incapacity.

Here a remark should be made whose basis will later become clearer. It is a mistake of the meaning of homeopathy when Bier[3] holds an acute mass investigation as narcosis with ether as an especially valuable drug proving "in the sense of homeopathy." The stormy course of depression of definite functions makes such an experiment hardly useful for supporting a stimulation therapy, regardless of whether it has been repeated a thousand times. Only the excitation of secretion of the upper air passages up to inflammation and the stage of intoxication are the paltry yield of active symptoms in this description, paltry because they are not sufficiently precisely described in their development and their characteristics and because the rapidly occurring paralytic symptoms are not described. Bronchitis and intoxication can be produced by many drugs. The homeopathicity of ether to bronchitis is not to be doubted. But it is exactly here that the important individualizing characteristics for a differentiating therapy are lacking.

Briefly, the drug proving in man must be so arranged that the question: *"what expressions of life is this medicinal substance able to excite or increase"* is answered with the uttermost exactness and differentiation, that is, which will respond as characteristic attributes to this one substance. It is exactly for this reason that homeopathy has been occupied over a long period with continuous drug proving. What has been derived from it we shall examine more closely.

Transference of Medicinal Effect from the Healthy to the Sick

First, we must prove the therapeutic meaning of this humanized materia medica in another direction which

is promoted in homeopathy: that these medicinal effects on the healthy can be employed in the same sense to the patient. It is generally known that this transference occurs with the help of the simile rule, also through the comparison of the symptoms of the patient with the symptoms of the proven drug. Thereby nothing more is presumed than that: (1) the symptoms and signs afford the living defense of man against an injury (not once but throughout); (2) that the drug provings likewise furnish such defense symptoms; (3) by the concurrence of many symptomatic signs it is plausible that the defense functions in patients are involved and increased in the same way as they would be stimulated in the healthy. Thereby the increased sensitivity in the patient should find consideration in the dose. More than a great probability cannot be expected as in any biologic measure; also more is not aspired for in such balanced therapy, by the adaptation of the drug stimulus to the patient by symptomatic comparison. But to increase this probability evermore is to a high degree a matter of good drug proving, good art of observation on the patient and the ability to recognize the situation again.

The Scientific Nature of Materia Medica

The new meaning of homeopathic materia medica brings with it a directness in the representation of drug action which, due to its simplicity, at first seems unscientific. But it is at least just as scientific to say at first what *is*, that is, to describe exactly, as to say, what one *thinks* about these manifestations at the time. Particularly when the simple factual description is neglected in comparison to mentally tracing back to common causes or by conception generalizations, there

exists the great danger because at times modern theoretic conceptions must be completely given up in the use of drugs. But the causal or analytic way of investigation has become the flesh and blood of scientific investigators, so that the limits for recognition are stepped over by an excess of premature deductions, of very premature hypotheses, to the disadvantage of obtaining natural control. On the other hand I may remark here that the newest employment of scientific theory proceeds so that the goal of scientific perception is ultimately the revelation of what actually *is* and to see again *in a type of description.* I may mention here especially Rosenzweig and H. Herrigel.[4] Indeed, it is not denied that the causal investigation in its place is also an important source of scientific recognition. It can be further developed within its limits for the control of natural processes. For the *avoidance* of disease, for example, this method of thinking may be regarded as sovereign. And exactly for the peculiar *task of therapy, the influence of tendencies of the total organism or a part,* this mental procedure proves fruitful. *Scientifically* the search down to the ultimate manifestations of the human organism and its exact description also is just as exact as the search for a causal explanation. In one by comparison to a therapeutic method, which homeopathy is, the preference is given to the immediately observable and exactly described manifestation *over* all deductions on disease or organ conceptions but those given from the start. That the new orientation of thinking here conquers a practically new land, I might consider a most significant point in regard to homeopathy.

We are also convinced that it is entirely rational if the *homeopathic materia medica* utters *the speech of the*

sick patient as exactly as possible, that is, describes as exactly as possible by mimicking the patient. This is so much the better for the recognition of the symptom observed in the patient and finding the similar in the representation of the action of the drug. Further, one need not be frightened by the preponderance of merely orally reported, so-called subjective symptoms. They are at once the most subtle symptoms and also the most subtle indications which can be evaluated.

Development of the Homeopathic Materia Medica

What does one find in the homeopathic materia medica? Arising out of drug provings on the healthy are *apparently* endless accounts of symptoms. The symptom register from the Hahnemannian circle of provers and the arrangement according to that pattern, increase the impression of incoherency in that the original proving protocols are no longer reported in their sequential development. Much more the single symptoms are to a certain extent taken out of their original connection as individual pictures and are arranged and related purely from an anatomical viewpoint. From these symptom registers it is usually not determinable from what prover a given symptom arose. Because one must not assume that the name attached (perhaps Hahnemann, Stapf, or Hartlaub) refers to an individual prover. Much more this name signifies only the reporter. This is evident without further discussion in that under the same name, symptoms from men and women appear. The designated reporters are therefore conductors of provings. This is important in respect to a noteworthy objection to all these old provings of Hahnemann in general. One asks himself: Can it be possible that this dozen zealous, self-sacrificing physi-

cians, the first stimulated students of Hahnemann, have produced such an extent of symptoms and indeed by materials which frequently yield so slight an output of symptoms for us? For the appearance of the finest and first symptoms we must presume a type of hypersensitivity to the substance proven and it is exactly these hypersensitivities which we seek. Now should these few people be especially sensitive against all these materials? Naturally, this would be nonsense. Much more it follows that the number of provers, male and female, must have been much larger but that the symptoms were compiled subsequently and divided with rigid system. The highly desirable original crude material for our materia medica is no longer available in this form but in the absence of anything better we must thankfully accept it for the present. But we also have numerous drug provings in the original form of protocols. As especially good in German are those which arise from the Austrian circle of provers. But in the last analysis they too are not only aggregates but also frequently repetitions of symptoms. The register of symptoms as it arises from drug provings is not materia medica, but they offer the lasting basis, *the lasting crude material* for the homeopathic materia medica. To shape this from the crude material, to make it suitable for the student as well as the learned, is the difficult task which must be renewed by each generation with increasing knowledge. This task seems so difficult that, were we not profoundly convinced of the importance of such a "humanization" of materia medica, we would surrender our arms before the imperfection of present work. Also, all sifting, as perhaps in the materia medica of Dahlke,[5] or all subdivisions of sifted symptoms according to guiding symptoms and

organ symptoms, like in the clinical materia medica of Stauffer,[6] still the neophyte always stands before a chaos of symptoms into which at first he cannot bring any sense. If he relies purely on his memory, if he notes individually as many symptoms as possible, then in the determination of the drug he encounters the danger of mere mechanical covering of symptoms. As the thing lies in current homeopathy, there remains nothing else for the student than to gradually derive from the various elaborations of materia medica, if possible also from English-American sources, rational pictures of drugs. It is rational to place the symptoms characteristic and differentiating for the drug in full light, in the foreground of consciousness and the less characteristic more and more in the shadows. Because if one has a patient before him, one should recognize the drug in the symptoms and the recognition is based in the general not on the many mental fragments lying beside each other in a mosaic, but on single outstanding striking trends. As it is in the recognition of a person, so it should also be in the recognition of a disease and likewise a drug picture. For personal variations in this psychologic act there must naturally remain differences: the one is more inclined to conceive the constitution *in toto*, another is more adapted for the subtle details; one sees the total conformation of the pyknic type, the other a wart on the nose. But always belonging to the correct description and therefore to a good drug picture is the differentiation of essential and nonessential, of characteristic and frequent appearance.

Now what happens if the person becoming a homeopath—and one should always remain in the becoming stage—must work out his materia medica from the

several elaborations for himself? We do not possess a single text-book that would satisfy all demands of physicians of the present time. This is due to the fact that only a very few of the number of homeopathic physicians, a number small in itself, have ventured such a work, a labor which each generation must take up again anew. But then it also lies in the special difficulties of this task. School medicine is not much better off in materia medica although there the circumstances are much more favorable. There, clinical experiences have more than one hundred times as much soil and experimental pharmacology adds its objective easily provable single reports in masses. But there too is nothing uniform from empiricism and experimental pharmacology, no modern materia medica develops. For one would hardly hold the compilations of encyclopedias as such. In general, empiricism and experimental data stand uncombined beside one another.

Arrangement of Drug Symptoms and Their Criteria

The real difficulties in a homeopathic materia medica lie in another place. First: *How shall one sift the sympton register?* Here one can actually speak of "the flight of manifestations." Because the numerous, mostly subjective symptoms are variable manifestations difficult to fix. Which of them should one consider and accept as effects of doses of drugs and which be blotted out as independent transient manifestations of the eternally changing events of life? A responsible beginning, enlightened only by the certainty that the original symptom register or protocol still exists for the better adaptor. What are the criteria for this sifting? Most enlightening at first seems the statistical

criterium: the more frequent a symptom has appeared in the proving of a drug, so much more surely does it belong to the field of action of this drug. This numerical conception is simple, but for our task, the working out of an effect picture typical for one drug, it is too primitive. *The one-sided statistical treatment of our crude material would only lead to a sad torso.* The reason for this is as follows: primarily *that* symptom is most frequent which is designated by the most general expression, as perhaps headache. And we can use this the least on account of its generality, that is, because it is common to innumerable medicinal substances. Here the certainty opposes the value. Secondly, this statistical procedure confers an unjustified preponderance upon the *inexact* average mass observation. It is exactly the desired *individual X* which is omitted in mass equations. And drug proving in the homeopathic sense is never a mass investigation but a study in precision in single suitable persons. By the precision certainty is also obtained but it need not be secured at the cost of the individual qualities, particularly in the assemblage of properties of the drug and person. The same defect is intrinsic to symptoms obtained by *force* through large doses in all or almost all men. What they gain in surety through their frequency, they lose in specificity and therefore in differential therapeutic value.

The obtainment of a surety index numerically has only a very limited value in the work of sifting. An agent may provoke headache or nausea or renal inflammation with great constancy (in which one takes into consideration that a definite effect is not favored by the type of injection), still these great aims can serve with the corresponding surety index only for the

classification of the required finer symptomatics. But it is not true that an effect direction of high surety index *must* necessarily also be especially useful therapeutically. How far it may, depends much more upon whether the specifications through characteristic, individual, leading symptoms are possible within this crudely outlined domain of action. There should be *active functional early symptoms* which reveal a lively defense activity: then the outlook for a stimulation therapy will be favored in the determined general direction of effect.

But what certainty have we that these fine individual symptoms belong to the picture of the drug? There is first that they have an unusual, striking character for the observer. Unfortunately, we do not always find this sufficiently stressed in the old provings so that a supplementary evaluation is difficult. Consequently, one next refers to the frequent repetition of such a symptom and if it is only in one prover who naturally must be of the type that the connection with the administration of the drug has a certain probability. From a statistical viewpoint we must be contented with assigning an essentially lower grade of surety to these symptoms.

But we have still another criterion for the acceptance of differentiating rare symptoms from the protocol of the drug picture. There is the possibility that these observations of details fit into *effect associations* determined in some other way. These general associations of drug picture can be determined: (1) through the remaining symptoms of proving, (2) through the major trends of effect, as at times from animal experimentation and at times from poisonings in man and already known materials from the physiology when they

normally occur in the organism. But we must avoid the *replacement* of the subtle observations by the crude. *The viewpoint of classification can and need not suppress the specific content. The specific symptoms must be retained in their originality and immediateness.* The viewpoint that symptoms are accepted when comprehensible through some other connection, also need not be decided onesidedly. Symptoms which elsewise have probability (perhaps special striking character), but fail to comply with any connection, must remain separate conditionally. Because the recognition of the connection is also temporally conditioned. Perhaps in the future one will understand it in its connections.

After what has been said, will animal experimentation, the experimental pharmacology, be of significance for the shaping of homeopathic materia medica? Certainly! *We will not neglect any kind of factual knowledge which can bring clarity into the connection of a medicinal substance to the living organism.* We will also use the relations of medicinal substances inanimate to material, also physical chemistry, where it belongs, namely, where it can contribute to explanation and to the understanding of complicated actions. None of the results of investigation will be intentionally neglected by us, whether it is of the action of a substance on a single cell, the single organ, or the organism. We shall not permit ourselves to become confused by the foolish objection that these investigations have not grown on homeopathic soils, that homeopathy has contributed too little to this type of investigation. Actually, there is only *one* science, but none should believe that they alone have all options. The task of homeopathy was and is to nourish another branch of materia medica which is neglected by all others because

they have not seen the profits for therapy. It all comes merely to how the results from the various fields of research are to be evaluated, on what mental site they stand and how they are arranged to a totality. Since this totality, the drug effect picture, should *serve* only a practical aim, *the therapy,* so it is self-understood that we place the greatest weight on the data appearing to us to be most suitable for it. And these are the characteristic pointed accomplishments of a medicinal substance obtained from the investigation of man. Further, it is well understood: *each in its own place.*

If it is concerned with a different substance which easily gives occasion to poisoning, then we will perceive *toxicologic* experiences as the massive structure on which is raised the more blurred architecture rather than the sketch in which the picture is filled in with single details. The more chronic the picture of poisoning the more it approaches the intentional drug proving in details and therefore its utility for our purpose. On the contrary, from the stormy intoxications we do not derive much, not even for the arrangement of symptoms. The toxicologic *animal* experiment accomplishes little for our intention on the one side because it excludes the possibilities of human reaction from the start. But, on the other side, it provides more in explanation, deductions to systems of lower order because these observations can be systematically arranged with various but previously determined conditions and repeated with approximate accuracy. There one can go back from organism to single organs, from organ to cell, from cell to its ferment, to its energy and salt resources and thereby to physicochemical processes.

If it is concerned with a medicinal substance which normally appears in the organism so we can utilize all that is known to us of its physiologic rôle. This serves for explanation and classification of the data which we have obtained from drug investigations on man. The question of how such physiologic materials in general cause symptoms and correspondingly can have healing effects can be mentioned here only briefly. Necessary for this are, not too excessive amounts of the substance, but alterations in the matter of division, in the place of application, and the administration and frequent repetition can also be of significance here. To this naturally must come on the other side a special sensitivity of the prover. An extreme example of such sensitivity to a substance normal to the body is the iodine sensitivity in hyperthyroidism.

We have proceeded from the sifting of the symptom register and found at the same time that an arrangement is found in which all available knowledge on the action of a medicinal substance in general must be included. The correctness of single drug pictures will also depend upon the available factual material, its intellectual and comprehensible presentation in the control of these facts and understanding of order. The actual observations always must be separated from explanations.

Among the observations the accents must be correctly placed according to the merit for therapy. Among the attempts at explanation, theories and hypotheses must be separated according to the extent of facts through which they are mentally deduced and arranged.

Therapeutic Confirmation

One important criterion for the sifting of materia medica we have set aside: this is *therapeutic testimony*.

Indeed, we have said in general that the symptom especially valuable for therapy must receive a special accentuation. But this is meant only theoretically to a certain extent, of especially characteristic symptoms. In the ideal the therapeutic confirmation for each materia medica is decisive, because this doctrine treats of drugs and they should help. But in the rough actuality the accomplishment of this criterion is not ideal. For therapeutic experience is an uncertain field. On the one side subterfuges can be found for each absence of an expected healing action, on the other side, each favorable action can be doubted and questioned. Only the frequent concurrence with prognosis yields some surety. Indeed, the materia medica should be such that it underlies and enlightens the prognosis, its value depending upon *the grade of probability of the prognosis.* Each therapeutic confirmation of a statement of the materia medica signifies therefore to a certain extent an underlining of this report, even if this report now is concerned with a very general conception as "rheumatism" or a differential characteristic as "tearing pains, worse from rest"; only the profit in confirmation of *differential* reports, as they are designated in homeopathic materia medica, is even greater for the future utilization of a drug. Because the prognosis gains in value through the precision with which it can be made. For the homeopathic materia medica, the testing according to unchanging fundamentals for a century, even if not always with satisfactory criteria, accomplishes much in the sifting of symptoms but still is entirely insufficient. A testing in greatest extent, naturally with exact use of method and good knowledge of the existing materia medica, is urgently desirable. This must be left to time. In the meantime one can use this criterion of confirmation only according to the

measure of personal experience and critical evaluation of reports in the literature for the purpose of sifting. Such a selection is indeed quite involuntary since that which is confirmed by personal experience is more impressive and better retained.

For homeopathy in general each therapeutic confirmation of reports which have been gained by drug proving on the healthy, is beyond this, a confirmation of its methodic presumption, the simile rule.

But the therapeutic confirmation has significance not only for the sifting but also for the *proper arrangement* of symptoms. Because when an unclear report of the materia medica is confirmed, then from the connection in which the comparative symptom stands within the morbid picture, light can be thrown back upon the medicinal symptom. For example, if an absurd sounding symptom as "sticking under the skin of the sole of the foot as if by needles of ice" often serves as a helpful indication for agaricus in organic diseases of the central nervous system, then one is clearer about its connections.

Empiric Additions

Practice, the therapeutic experience, moreover also goes beyond a sifting and arrangement of reports in the homeopathic materia medica. It adds new reports. Empirically proven drugs with undefined limits were indeed the original possession with which Hahnemann also began his refining work. Because in every materia medica it is concerned with *a precision of the primary crude material.* So in homeopathy there are also single *remedies with only an empiric basis* and which have not been generally or sufficiently proven on the healthy. There were and are employed, as in the old school, in

the absence of better knowledge on general organ specificity or even on a diagnosis of a disease. I recall in this connection for example, solidago virgaurea as a renal drug, sabal serrulata as a prostatic remedy, which has proven itself as such. With others the proving on the healthy has been made more recently as for example that of crataegus oxycantha recently by Assmann,[7] and it is interesting that the empiric use has found supplementary support in the symptoms of provings.

Again, in other agents proven on the healthy, often such symptoms or syndromes are accepted newly in a drug picture which have affected exactly such patients as are cured by this agent. To the so-called "pure" materia medica such reports as observations on patients do not belong. But in the difficulty of working out the individual characteristics of a drug picture one must put up with these additions in the meantime but use the proper caution. Still these supplementing incorporations of observations on cured patients are justified up to a certain extent. Because if one can actually say: this or that agent has had the best healing effect in thin, blond sensitive persons, then we say practically the same as if we proceed from the basis of a study upon the healthy; thin, blond sensitive persons react most markedly to this agent. Because we see the curative action of a remedy also as a reaction of indeterminate sensitivity. However, one should remain conscious of the origin of all purely clinically derived addition symptoms.

State of Materia Medica

It should be very clear that the homeopathic materia medica is not rigid or finished. And *the knowl-*

edge of single medicinal substances, whose working domain is *de facto* very different, *is also in varying stages*. In the one drug as perhaps crataegus, the emphasis lies still on the empiric organ specific side; in another, as perhaps sulphur, is the elaboration of the drug picture characteristic of homeopathy preponderant. In the presentation these differences must come distinctly to expression, *each drug picture must be conceived and represented as possessing a special individuality* in itself. But the student in many cases again desires another selection or another emphasis: to one from the beginning the clinical or the organ specific reports are retained, for another the importance lies more in the subtle delineating detail symptoms. For each method of consideration there is available room in homeopathic materia medica in the various elaborations. The inconceivably great difficulties of this study will only interest those who are profoundly convinced of the meaning of this homeopathic materia medica in theoretic and practical respects.

CONSTITUTION AND CONSTITUTIONAL REMEDIES

HOMEOPATHIC CONSTITUTION THERAPY

Before we start upon the real subject of this book, the doctrine of the mineral medicinal agents, it is proper to discuss *the meaning of the constitutional method of consideration and constitutional therapy in homeopathy.* Likewise in this field the new orientation of homeopathy and the inclusion of the therapeutic aim is decisive for obtaining a fixed point in the actual relations to be studied.

UNION OF DRUG ACTIONS AND CONSTITUTIONAL TYPES

One must not forget that *the point of departure for homeopathy is a practical therapeutic one*, and theory plays a secondary rôle. The method of treatment of disease according to the simile rule is oriented on the uttermost individualization. One proceeds from the proving on the healthy individuals whereby single individuals succumb to definite substances earlier than others and one recovers easier and earlier from effects than the other. These persons indicate that they have a lowered threshold to a stimulus in a definite direction; it may be that an organ shows itself as especially sensitive perhaps by the appearance of frequent micturition and burning from small doses of cantharis or a hypersensitivity of the entire person perhaps against phosphorus by the occurrence of a great num-

ber of disturbances of general well-being in a proving. Likewise drug proving on the healthy determines the differences of men in degree and direction of adaptability to the influences of materials of the environment. Now the homeopathic method at the same time contains the task of again discovering these symptomatically demonstrated sensitivities in sick patients and indeed from the symptoms of their natural disease. These, too, are signs of failure against some type of damaging influence, signs of reversion, of insufficient adaptability of man or single-organ systems in certain directions. The finer the symptoms are, the earlier they appear, the more usable they are for the differentiation necessary here. The gross symptoms which forcibly appear in all men after sufficiently large doses are much less characteristic. So the physician familiar with the homeopathic drug pictures recognizes in the rare, peculiar, many times often nonsensical sounding symptoms, the characteristics of the patient concerned, and with their help is able *to determine the adaptability of the drug to a "differential-therapeutic" point* (whereby he must always remain conscious of the danger of overpointing!). Thereby a special significance is gained exactly by the psychic symptoms and the so-called modalities, that is, the dependence of the symptoms, the improvement or aggravation by accompanying circumstances (weather, temperature, position of the body, time of day). According to the recognition of characteristic traits of a patient in an image of drug actions, one speaks in homeopathy of a lachesis case, of a sulphur man or a phosphorus type. *The originally practical therapeutic consideration becomes a fruitful discovery and division principle for constitutions.*

This pivotal point of all homeopathic constitutional

considerations will be appreciated exactly if one will compare it with the modern doctrine of constitutions. The conception of a patient in terms of healing agent is found even in Paracelsus. Even at the beginning of the volume "Paramirum" it states: "stress in our drugs the cure and not the causes because the healing shows us the cause." His successor of the last century, Rademacher, has taken over the founding and the nomenclature of diseases ex juvantibus from him. But *homeopathy has through experiment,* the proving on the healthy, *first subjected the union of state of disease with drugs to systematic observation.* Thereby an entirely new, promising way is opened for the investigation of constitution.

Naturally, one does not interpret "constitution" by a rigid and sterile meaning which conceives only the totality of inherited individual characteristics nor does one proceed from the establishment of a general law of inheritance rather than from the conception of personality. To establish inborn and inherited factors signifies practically a determination of boundaries for the physician. He can utilize positively only a dynamic clinical constitutional conception in that the tendencies to deviation, the disturbances of bodily configuration in definite directions come into expression. In this the conception of diathesis and disposition is included. The constitutional method of consideration of the physician must be subordinated to the general biologic principle of adaptation. We will discover in the constitution of a man, degree and direction of adaptability. The individual lines which interest the clinician are those from susceptibility up to the breakdown of functions. Increased demand in a given direction, in general, conditions greater deterioration in this direction.

In homeopathy the personal tendencies are drawn to a point through comparison with drug sensitivities. Thereby it frequently becomes a collection of properties combined with each other—perhaps a definite type of menstruation, a body habitus and a kind of mental orientation. Without such a guiding viewpoint the arrangement of interrelated signs and tendencies of a person remains statistical, very general and therefore indefinite or it is suggestive of intuition and subjected to accident and subjective arbitrariness. This does not deny the usefulness of a conception so obtained for description of frequent connections between definite manners of reaction and organization, for example Kretschmer's attempt to discover connections between body habitus and psychologic manners of reaction[1] and to present them statistically. It is also not to be denied that the newer investigation of constitution according to the causal side has brought to light valuable knowledge on constitutional relationships. Especially the dependence on endocrine processes (in combination with the autonomic nervous system) has brought much clarification. Moreover, the serologic and hematologic differential and division characteristics prove themselves significant. Only it is necessary that all these lines of investigation and possibilities of explanation should not be treated one-sidedly and left uncombined beside each other, but an attempt at unification should always be made. The point of departure will always remain the observation of different psychosomatic organization and reaction types and the permanent acceptance will be enlightened by division according to related tendencies on the one side and according to causal explanatory possibilities on the other. The merit of all classifications rests upon the reliability of the

observations on which they lie, on their agreement with facts; naturally not simply the already known but also the still to be found. All schematic classifications opposed to organic life contain something provisional.

The current usual groupings as lymphatism and arthritism, because of their great breadth, are far removed from the simple actuality of an individual and their characteristics and limits are still very poorly determined. These conceptions proceed out of a more or less intellectually guided review of clinical sequels. At present they are quite indispensable. But that their provisional nature and indefiniteness become ever more uncovered is the task of the future so that exactly observed special types gradually become more definitive (whether it is accomplished by tracing back to the remote cause, or the collection and arrangement of a discoverable tendency lying in it).

HISTORY OF THE HOMEOPATHIC CONSTITUTION DOCTRINE

The historic development of the constitution problem in homeopathy is very peculiar. It begins with an alteration in the Hahnemannian type of thinking which v. Grauvogl especially undertook. In his "Organon of Rational Healing" (1810), Hahnemann had presented his new method of healing systematically. The suitability of the curative remedy according to the similarity of the symptoms was extolled as the sole directing line. Some years later (1816–1817), he became doubtful whether his precepts up to that time also embraced chronic diseases so that the best and the most complete healing results were obtained. It occurred to him that in protracted diseases the presenting transitory symptomatic picture was not sufficiently obvious for the de-

termination of the medicinal agent. He recognized that in chronic diseases "one had to deal with a separate fraction of a deep lying original evil." Then he sought for the original evil, for a cause as uniform as possible which would account for the infinite diversity of chronic disease manifestations which are so frequently alternating and vicarious in the same individual or indeed in the descendants. Here a basic damage to the human race must be found. Hahnemann was not satisfied to make the anlage, the complex of endogenous conditions, responsible for the chronic disease relationships, but he went a step farther to the conception of a few exogenous causative damages. According to his view, they must be of a "chronic miasmatic nature," or, as we say today, chronic infections. He determines this as follows: "All chronic diseases of man—even those which yield of themselves, and are not aggravated through perverse treatment—show such a permanence and continuance that, as soon as they have developed (and have not been basically cured by the art), increase ever more with the years and continue for the duration of life, not lessened even by the intrinsic powers of the most robust nature nor by a healthy mode of living and diet, still less conquered and removed, never depart of themselves, but grow and increase until death. Therefore they must have their basis and origin totally in persistent chronic miasms whose parasitic existence enables them to continually increase evermore in the human organism."

Let us overlook for now that this foundation is not compulsory and follow Hahnemann's mental processes farther. The postulated chronic infection must be such that it first causes local symptoms, after whose (spontaneous or artificially effected) disappearance a great

number of variable maladies follow in which no actual healing occurs. (Example: syphilis.) According to Hahnemann, so far as Europe is concerned there are only three such chronic infections as causes of "not all but most chronic evil," namely (1) syphilis, (2) sycosis or figwart disease, and (3) the psora which has the itch eruption lying at its base. In respect to syphilis Hahnemann gave a significance which is approximately that which we attribute to it at present. By sycosis he understood the general involvement of complicated gonorrhea in which the local symptom is expressed as the figwart. Hahnemann ascribes only a relatively insignificant rôle to sycosis as a cause of chronic maladies; moreover, it appears only from time to time. In the time of the French war, 1809–1814, it must have been very extensive, and if one follows Hahnemann's report it seems to have had some extraordinary manifestations (large, elevated, brown, dry nodules in the axilla, on the outer throat, on the scalp, *etc.*, shortening of the tendons of the flexor muscles, particularly of the finger) combined with it.

THE PSORA THEORY

Hahnemann emphasized the psora as of outstanding importance: "The oldest, most universal, most pernicious and still usually mistaken chronic miasmatic disease." At least seven-eighths of all chronic illness he traces back to the psora, and only about one-eighth charges to syphilis and sycosis together.

Hahnemann published his theory of chronic diseases and with it the psora in 1828 in Vol. 1 of "Chronic Diseases." At that time he was seventy-three years of age. If one reads this discussion through with an open mind, then he notes, in contrast to the tense sequential

speech of the Organon, many repetitions which do not serve to explain the theory farther. Although one does not have the impression of a loquacitas senilis, there is the ring of incompletely formulated mental sequences. Only in a type of summary has Hahnemann finished these thoughts and then, capricious as he was, attributed itch as the cause of psora and therewith the majority of chronic diseases. He gave the most unimportant aspect of the entire psora theory an excessive accent and there was and still is the danger that the good is cast away with the bad, that is, in this instance that theoretically and practically important thoughts on the relations of chronic diseases remain unconsidered.

If Hahnemann perceived as the point of departure of psora the infection with itch and the itch eruption as its externally localized symptom, then we cannot follow him. It is naturally to be considered that Hahnemann included much more under the conception of itch than what we know as the effect of Acarus scabiei. He includes all types of itching eruptions as local symptoms. Hahnemann would be quite understandable at present if he had made the tubercle bacillus the cause of the basic malady psora, or better, could have made it. A universally present infectious agent by which every individual is, so to speak, set apart and which provokes important defense manifestations in the skin—that appealed to him as the cause of psora. His mistake does not become less by the fact that he could base his statement on a widely spread viewpoint of the period on the results of the itch, as on Prof. Autenreith, of Tübingen. Moreover, one gains the impression from reading the sixth edition of the "Organon"[2] that he later avoided calling the itch the sole cause of psora. In §§ 78–83, which treat of the

chronic diseases, the itch as is the cause or the skin eruption as the local expression of psora is not expressly mentioned and here one can interchange without further discussion chronic infections with itching skin eruptions with psora. Only in § 204 of the sixth edition of the "Organon" Hahnemann expressly mentions the itch eruption as "primary, vicarious and the local symptom preventing the outbreak of internal psora." Moreover, it proceeds particularly from this paragraph that the Hahnemann of 1842 no longer generalized on the psoric origin of chronic diseases as he had in 1828. He also cites prolonged unhygienic modes of life and the damages from the prescriptions of the old school as causes of chronic disease and states that the greatest part of the remaining chronic diseases "from the development of the three chronic miasms mentioned: internal syphilis, internal sycosis but particularly and in far greater proportions the internal psora prevails." If in place of psora we place tuberculinization, then Hahnemann is not far removed from our present position. Naturally, under protracted unhygienic life the psychic causes of chronic diseases must be included as Hahnemann stresses sufficiently in other places; and further, in place of drug damages one need simply place chemical intoxications because certainly the industrial agents belong here. Alcoholism can be assigned either to dietary sins or to chemical intoxications. Finally, we would not include chronic gonorrhea in a series of diseases as those chronic illnesses caused by syphilis and tuberculosis, otherwise we would have to include perhaps malaria and dysentery. But it is true that syphilis and tuberculosis among the infections are the most important reorganizers of the individual and

contemporary mankind and it is fitting to speak of syphilism and tuberculism.

The theory of Hahnemann is an audacious attempt to trace back all chronic maladies to one or a few infections as causes. The attempt does not succeed. Even the proof for the infectious origin is incomplete. Hahnemann states: because not even the most robust nature and the soundest method of living will not overcome the chronic malady and avert its increase so must the cause lie in a constantly active infection with an independent parasitic existence. The conceptions of the most robust constitution and the soundest mode of living are too general. For example, in an apparently robust constitution single organs may be defective, so that the normal use in the course of life leads to chronic disease (for example, contracted kidney). Here it seems to us that Hahnemann did not sufficiently consider the living reciprocal play between external damages and internal living conditions even though the tracing back to a few infections as the cause of countless numbers of chronic maladies is excellent for that time.

Although Hahnemann takes for a point of departure of psora only the name of itch, in actuality he includes all skin eruptions so that he places the signs of latent and manifest psora extraordinarily wide. Psora becomes for him the mother soil of almost all chronic maladies, which naturally he does not designate with names of disease but with the symptoms observed. In his register we find scrofula, rickets, tuberculosis, asthma, benign and malignant tumors, arthritis, psychosis and many others cited as springing from psora. But the unfortunate attempt at simplification is not the essential but simply the recognition of the reciprocal

relation of skin manifestations with so many chronic internal maladies. In the skin manifestations he perceives always the lesser evil and in the recession, either without assistance or even through external treatment, a fatal aggravation of the total process. For this reciprocal relation whose neglect can be so harmful, he cites almost 100 examples from older writers which are added to the conclusions drawn from his own observations. Nowadays one comes ever more to a recognition of the outstanding significance of the skin as a defense organ. I refer here merely to Much, Bloch, and Hoffmann and to the conception of esophylaxis. The observations of older writers on the harmful results of forcible suppression of skin eruptions, of old ulcus cruris, of hemorrhoids, of foot sweats, *etc.*, and the corresponding reports from patients deserve the complete attention of physicians even if a complete explanation of this reciprocal relation between the skin eruptions and internal diseases still lies in the remote future. The old physicians as domestic physicians and observers over a long time had much more occasion to determine these connections. But also among us most will concur in the probability of the correctness of such observations in one another example. The secondary exanthem of syphilis today finds a corresponding decision on its clinical course. (Naturally, the chronic results of an acute exanthem as measles are included here.) This aspect of Hahnemann's doctrine of chronic diseases still remains living in the homeopathic school and even today in contrast to the custom of most non-homeopathic physicians the treatment of eczema or ulcus cruris is a radical one. But from the direction of total medicine it may be assumed as probable that in this fundamental, that is, the denial of external treat-

ment and the necessity for internal treatment of such morbid manifestations, that the homeopathic conception is correct—entirely apart from the characteristic homeopathic principle of medicinal therapy.

Hahnemann's theory of chronic diseases at first glance has nothing to do with the doctrine of constitutions. In contrast, the division into syphilis, sycosis, and psora is distinctly related to exogenous causes of disease. Further, Hahnemann expressly stresses that even the most robust constitution cannot remove a psora which has once succeeded in developing. According to him only the form and manifestation of the psora will be modified by the constitution of the individual concerned, furthermore, by the influence of the milieu, fate, mode of living and weather influences. And still the three divisions of Hahnemann have become an important part of the conception of constitutional disease and therapy in the homeopathic school. This has its basis in that, according to Hahnemann, the three forms of life damage are so fundamental that they bequeath definite predisposition to disease from generation to generation.

So it seems likely, opposed to Hahnemann's conception, to permit three uniform causes to become the principles of division and from this three types of disease relationships and anlages. A further basis for this interpretation is found in that Hahnemann has prescribed definite drugs or groups of drugs for the three chronic evils. The agent for syphilis is mercury, for sycosis, thuja (tree of life) and in the second line nitric acid and for the diversified manifold "psora," a great group of antipsoric drugs at whose peak stands sulphur. The antipsoric agents are discussed by Hahnemann in the first edition of "Chronic Diseases" in three volumes

(twenty-one drugs) and in the second edition (1835–1838) in four volumes (forty-seven drugs). This union to related drugs gives the triple division, a classification principle which we have discovered as the characteristic for the homeopathic conception of constitution. But thereby it is not said whether or not the division so obtained by Hahnemann is fortunate, that is, approaches actuality. This can be denied with fair certainty.

ANTIPSORIC DRUGS AS CONSTITUTIONAL DRUGS

With Hahnemann the psora as the basis of chronic diseases is overemphasized so much that one can simply speak of the psora theory and neglect syphilis and sycosis. For later homeopathy Hahnemann's psora became interpreted as a composite of disease susceptibilities, corresponding in extent to lymphatism and arthritism. The etiologic unification was not retained. The limits of psora had been drawn so wide that it practically included the predisposition to almost all chronic diseases. So, according to him, apart from the references mentioned to certain associations and reciprocal relations of morbid manifestations, there was nothing left if a fixed, connecting point between the tendencies lying in the psoric predisposition to a group of drugs with known symptomatic effects had not been given. Hahnemann has associated psora with a very *superior class of drugs, the so-called antipsoric drugs.* The erroneous conception of a uniform cause of psora did not have the consequence in his therapy whereby sulphur became a universal remedy. Much more Hahnemann stresses: "For the cure of developed psora something more than mere sulphur is required." Sulphur is only an outstanding member of this class of

medicinal substances. Among them are to be understood especially agents with general and prolonged effects which are suitable for the protracted deep-seated maladies which embrace the total organism and vary in their symptomatic expressions. These agents are also selected according to the simile rule. But corresponding to the great difficulties of the task which consists not only in the removal of the obvious malady but also the predisposition, the symptom record must be taken much more completely than in acute diseases. For the cure of chronic diseases it is not sufficient to observe the symptomatic picture at the time of observation. Here more attention is to be devoted to the characteristics of the person in his earlier history, and his apparently healthy days regarded. It is exactly here that the keenest recognition is needed especially by the modalities and psychic peculiarities. These special requirements must also be met by the symptomatic picture of the drug suitable for "psoric" diseases. They must be generally acting remedies not affecting merely single organs; they must prove thoroughly characteristic by the modalities; in the proving symptoms they must be rich in such trends as are strikingly observed in apparently healthy men and permit recognition of a tendency to abnormalities. In homeopathy one calls such agents *constitutional drugs*. But this rank is attained not only from the results of provings on the healthy but also from clinical observations. So a drug can possess the capacity for producing a general and fundamental alteration of the body composition in that after its administration signs of disease which had apparently disappeared as skin eruptions or foot sweat again appear. It is indeed no accident that Hahnemann's antipsoric drugs (also in our meaning, constitu-

tional agents) are predominantly inorganic substances. For them the observations of Hahnemann were surely well founded, that drugs as sulphur, calcium carbonate, sodium chloride, phosphorus, carbon preparations introduce especially general and at the same time especially persistent transformations of the organism. We should keep the physiologically active substances in mind in this sense.

In the undertaking of a constitutional therapy there is already the implication that the constitution is not an unalterable state. As discussed above, this conception does not involve the restriction of constitution to inherited properties but the dynamic definition presumes a psycho-somatic "constitution" in which the flowing connection of inherited disposition up to the present disposition is regarded. With a constitutional therapy perhaps the highest aim of medicine is reached.

The doctrine of chronic diseases and their healing is a break from the pure method of Hahnemann, which selected the drug for each patient on the symptom similarity. For the chronic evils, syphilis and sycosis, this is very distinct. Because for these Hahnemann has prescribed one or two healing remedies without regard for the individual symptoms. Here he falls into the error which he had cast at the medicine then existing, namely, to base the drug indication on the name of a disease, even if here etiologically definite connections of disease are present. For psora, the central problem of older Hahnemann, the break with the simile principle is, however, only a seeming one. Because for this "hydra-headed monster" he stresses a great number of drugs and for the selection among them, the simile rule is the supreme guide. The emphasis on this group of antipsoric remedies—today we call them merely consti-

tutional drugs—is simply one limitation which the master has shown. Because the selection among them requires a more extensive perfected use of the simile rule than is necessary for acute and localized diseases. For Hahnemann the endeavor towards better accomplishment, namely, the removal of *predisposition* to disease in addition, has been the occasion for an improvement in method. The theoretic substructure which he erected shows many defects which are not merely temporal but also dependent upon his capricious disposition. But for constitutional investigation the drug types derived by him from a systematic elaboration can furnish a valuable contribution and medical art is shown the way out from the fatalism of apparently unalterable predisposition. The increasing insight into the constraint under which the disease predispositions arise need in no way retard the freedom of a transforming fact.

RADEMACHER'S THREE UNIVERSAL REMEDIES

Hahnemann's triple etiologic division of chronic disease relations was the one source out of which v. Grauvogl[3] created. From it he made without hesitation three biologic forms of illness, also predispositions. His second source was the three states of Rademacher,[4] who determined them simply through the drugs to whose healing powers they are subject; sodium nitrate, iron and copper. For Rademacher these three agents are the universal remedies in the sense of the old alchemists or iatrochemists, particularly in that they are remedies for the basic diseases of the *total* organism (not them alone, but as representatives of three groups; for example, sodium nitrate as chief of the earthy and alkali salts). Universal remedies are not panaceas in any

sense of the word, but they are used in contradistinction to organ remedies, that is, from agents which are suitable for disease of a single organ.

First, one should note that the three states of Rademacher through their *relation to healing remedies* are characterized in the meaning of Paracelsus and homeopathy. Second, the affections designated through these drugs involve the entire organism so that one should ascribe to them *general universal* effectiveness. Rademacher emphasizes that these materials are "friendly" to the body, that is, they are not poisonous foreign materials (although this naturally cannot hold for man in respect to copper). But in any case it signifies that he also perceived the physiologic substances as especially suitable for such general actions. It is also worthy of note that it is furthermore exclusively concerned with inorganic materials (also in regard to the related members of the groups).

A special choice of the agent in maladies of the total organism in contrast to these characteristics seems to be secondary with Rademacher. The selection itself seems to have arisen from his personal purely empiric search. Only in sodium nitrate does he seem to have depended upon the Elixir salis of Paracelsus, for in its method of preparation he would recognize sodium nitrate.

Now it is very plausible that in this search Rademacher has presented a new interpretation of the three basic substances of his predecessor Paracelsus: sulphur, mercury and sal. According to Paracelsus these three basic substances form the physical body. They are not to be placed in any comparison with the conceptions of modern chemistry but with three types or forms into which the composite body is converted by chemical dis-

tillation: sulphur is that which, when completely burned, forms a gas, mercury is the mist and smoke which is precipitated unchanged ("sublimes") perhaps as water and soot (carbon) and finally sal is that which remains in the retort, non-volatile and incombustible. One need not wonder that in primitive analytic chemistry these three generally recurring results of analysis in three forms were conceived and symbolized as *the* three substances of the body; the medicinal powers rested on them. Translated into our speech they take on perhaps the following implication: The basic material which is yielded in the elementary analysis of the living organism will also be of especially general medicinal effectiveness; because their concordance conditions (materially) health, and indeed it depends not merely on quantitative relations but also on local and temporal working together, on structure and the form of the substance.

We need to join ourselves with the sulphur, mercury and sal of Paracelsus just as little as to the iron, copper, and saltpeter of Rademacher when we search for the essential of the constitutional problem. These drugs were nothing more to Rademacher than especially proven test agents, reagents for unknown (and, as he believed, unrecognizable) states of disease and especially those which involve the total organism. In actuality, Rademacher presents the recognition of a disease as a chemical analysis. Also in qualitative chemical analysis we do not recognize the nature of the substance, but we identify it only by means of known reagents. So he identifies the disease through the curative agent and beyond this the nature of the disease remains unrecognizable to him.

An important and (except in the homeopathic school) completely neglected principle of recognition is driven

to a point by him, even if onesidedly. Any other analysis of disease than that through the test drug is disdained by Rademacher, obviously from the apprehension that further analysis always admixes theories which press the medical treatment in the wrong direction. For this official medicine, the so-called physiologic school gave him ample illustration. But that he undertook the differentiation of the processes of disease through exact detailed observations which were in a position to ensure the union of disease with the medicinal agent without theoretic accessories, signifies a superlative absence of presumptions. Methodically considered, his purely empirical groping procedure is the exaggerated scientific method; but it can avoid complete sterility only in that Rademacher as well as many of his pupils through instinctive comprehension perceived that what was to them orderly observation of details could furnish them with drug indications. Since the path from disease signs to drugs had been broken at that time by homeopathy, Rademacher is comprehensible only as follows: this self-willed, highly endowed physician in his rural seclusion built a method entirely onesidedly from the findings which he had made among the old alchemists and particularly Paracelsus and which stood in crass contrast to the therapeutics of his time. A theory based on the experiences of a single physician in search of cure and indeed so unsystematically, can also not develop a personal school. But all preconditions for amalgamating with homeopathy are clear at present. We shall later mention this connection with respect to the constitution theory.

GENIUS EPIDEMICUS AND MODALITIES

Before doing so it is necessary to take into consideration another important fragment of the Rademachian

method: the so-called *epidemic status, the genius epidemicus*. Today one tends to associate the epidemic appearance of diseases onesidedly with the extension of a living excitant. Before the time of bacteriology another onesidedness was pardonable, and the current atmospheric-telluric influences were made responsible for the frequency of forms of disease. The general importance of this external condition can in no case be denied. The growth and extension of the excitant as well as man depend upon this atmospheric-telluric constellation. It is apparent that also here Rademacher goes back to the alchemists. In Paracelsus the so-called "astronomy" signifies not only an analogy of the microcosm (man) and the macrocosm (world), that is, all that occurs in the cosmos has its miniature in man but also the constant transference of powers from the cosmos to man; man is constantly subjected to atmospheric-telluric influences, there exists a "concordance" between materials and powers in man and those in the cosmos. Alteration in the substantially conceived powers of the cosmos was the *equivalent and cause* of alteration of substances in man, which signified disease.

Rademacher was moreover correct when he found the *constitutio epidemica Sydenhams* in the astronomy of Paracelsus. The epidemic influences without further analysis were made responsible for the appearance of epidemic forms of disease at certain times or much more (according to his Paracelsian manner, to recognize the disease from the drug) *that diseases frequent in a given region at definite times were subject to the same drugs.* With "constitution" this doctrine of *constitutio epidemica* seems to have nothing to do and Rademacher did not unite genius epidemicus with constitution. This would also not correspond with his "intellectual" medi-

cine of experience. But for him constitution must be as unrecognizable and conceptual as disease. *But indirectly the dependence of disease on the epidemic status was an important proof of the constitutional factor.* Frequency of forms of disease as frequency of drug indications referred on the one side to the prevalence of equal external causes, but on the other side also to similar typical *predisposition.* This also held for the living excitant as for the atmospheric-telluric influences as causes of disease. Because the susceptibility or nonsusceptibility (immunity), for example, against scarlet fever, also contributes to the recognition of the constitution, naturally in much smaller extent than perhaps the relation of an organism to moisture and cold. Grauvogl has correctly seen that what Rademacher represented very generally by genius epidemicus, a purely empirical temporary union between form of disease and curative drug, is an important complex, and what is called in homeopathy the *"accompanying circumstances."* But while Rademacher accepts the totality of external conditions as an indefinite circumstance, homeopathy attempts to observe the contemporary external conditions and so far as it is possible to split them into single measurable fragments; this is the dependence of man (in his transition from health to disease) on external conditions, the so-called modalities. There can be no doubt: the solution of genius epidemicus into detailed observations of external dependencies is not only scientific but also significantly improves the prospects for the discovering of healing agents. Rademacher goes far too wide in his skepticism when he concludes: because the dependence of diseases upon external conditions is never to be recognized in all details, so in general one can neglect the

partially recognizable details obtained through observation. There is the same disregard for detail observations as for disease symptoms: and according to him they are also unsuitable for the determination of the healing remedy because they cannot offer a *complete* recognition of the disease. This is a *prescientific* viewpoint which still considers the question according to the nature of the totality. On the other hand, homeopathy, in agreement with science of the modern age, questions according to the "how": with what signs in detail does a man react to external conditions which also can be determined in particulars? It is better to have partial measuring sticks in hand than to have none at all.

The genius epidemicus and its precision through modalities signifies nothing else than susceptibility, sensitivity of definite individuals to generally prevailing atmospheric-telluric conditions. It also makes the constitution conspicuous in the same sense as an intentional drug proving will determine the sensitivity to a medicinal substance. Only in the genius epidemicus, the telluric-atmospheric influences form a natural mass experiment which shows average tendencies, typical dispositions to disease. In so far as constitutional types are sought, this general, naturally given criterium is entirely suitable. The difficulty exists only in gaining typical groups from the diversity of external conditions which correspond to human reaction types.

Rademacher circumvents this difficulty by accepting a division from another side: by proceeding from empirically found curative agents or groups of agents which are suitable for affections of the total organism in various epidemic situations. The weakness of this division lies in that in actuality, leaning on a bygone

primitive epoch of chemistry, it is supported only by the experiences of this single observer and a few of his students. Seen from modern chemistry and pharmacology, it is not clear in any way why sodium nitrate, iron and copper should be prototypes of such general drug action. But mentally, Rademacher's theory of three epidemic universal remedies, that is, three agents for the entire organism, which fit the genius epidemicus, contain all the presumptions for the consideration of constitution as they exist and are essential in homeopathy, namely:

(1) *The union of the manner of reaction of the organism with the drug and the differentiation accordingly.*

(2) *The union with the general influences of the environment* (genius epidemicus which are determinable in details as "modalities").

(3) *The general constancy of the manner of reaction recognizable by the type* (that is, their value for the total organism).

It is striking that this analysis of constitution is a purely dynamic, functional one. The usual description of types in sound and sick days according to form, tonus, color, preponderance of organ systems, *etc.*, is not even considered. Moreover, in homeopathy they are used as a rough basis so far as they can be obtained, but they are still insufficiently available. The functional and therapeutic viewpoints likewise have predominant significance for the constitutional consideration.

Rademacher, just as little as Hahnemann, intended a representation of constitutional types with his three types. v. Grauvogl first undertook the transformation and simultaneously an amalgamation of both theories

with his conception of constitution. One need not go into details on the compulsion and arbitrariness which accompanied him in it.

GRAUVOGL'S CONSTITUTIONAL TYPES

Grauvogl comes to a special doctrine of constitution in that he goes back to the chemical *elements* of the organism, hydrogen, oxygen, carbon and nitrogen. In principle he does the same as Paracelsus had done with primitive chemistry. Indeed, it seems very logical to bring the constitution of the organism into dependence with the constituents, the chemical constituents. In this chemical foundation of constitution Grauvogl is in no way original but he proceeds in close conjunction with many predecessors and from the existing status of physiologic chemistry. Gerlach has shown this.[5] Also the construction of three constitutional types on the basis of the relations of structural materials, H, O, C and N, the representation of the *hydrogenoid, oxygenoid and carbonitrogenous constitutions* is no discovery of Grauvogl's, nor is it the essential in his representation. Much more essential is his attempt, in conjunction with that of Hahnemann and Rademacher on the one side, to unite his three constitutions to drugs and on the other side to external circumstances, modalities, telluric-atmospheric influences and to empirically fix them.

The *hydrogenoid constitution* is characterized by predominance of reduction processes, through greater water content of the organism, particularly in the blood. This type is aggravated by cold and damp weather, by water in any form. One sees that a correspondence exists between the excess of water (or hydrogen) in the organism and in the external world in a Paracelsian

sense. A further sign of disease on the basis of the hydrogenoid constitution should be the periodic course; and by Grauvogl this is brought into connection with nerve maladies and electric disturbances in particular. Still, this characteristic stands far behind the first. As agents for diseases which arise from the hydrogenoid constitution, according to the theories of Grauvogl, such materials serve which lessen the influence of hydrogen or water on the blood, which increase the oxidation of hydrocarbons. In the classification of these as well as in both other constitutions, Grauvogl proceeds mentally in a completely *nonhomeopathic sense according to the scheme of chemical contrasts.* He perceives the cause of chronic diseases in an excess or deficiency of substances from which the organism is composed. In the case of the predominance of hydrogen and the deficiency of oxygen he would introduce drugs which will increase oxidation, leading to a sort of chemical balance. Such a chemical substitution therapy leaves the reactivity of the organism entirely out of consideration and yet Grauvogl is otherwise thoroughly familiar with the dynamic principle of drug action. Even in 1876 E. Schlegel[6] referred to this internal contradiction of Grauvogl. But in regard to the classification of remedies to constitution he has not erred as in his theory; for the hydrogenoid constitution he advises primarily the alkali salts. The opinion that they essentially promote the influence of oxygen cannot be proven; one can say much better that the alkalies (apart from the picture of their drug effect) theoretically seem suitable for the hydrogenoid constitution because they withdraw water and indeed especially from those places in which it collects. The comparison of the Rademachian sodium nitrate state with the re-

maining alkalies as accessory agents to the hydrogenoid constitution is reasonable. More remarkable is the comparison to the sycosis of Hahnemann; the maintenance of this union can only lead to error. The designation "hydrogenoid constitution," however, can still serve as a frame which embraces lymphatism and the tetanoid types from the side of modalities and the related medicinal substances. Precision may come, so far as is possible at present, from this conception.

The opposite to the hydrogenoid constitution is the *oxygenoid.* It is characterized by increased oxidation processes, by a lessened resistance of the organic compounds to the influence of oxygen. It was not unknown to Grauvogl that organic materials are first prepared through fermentative splitting. He also desired to designate the increased fermentative-oxidative splitting as oxygenoid. Consumption and hyperesthesia, defects in albuminates and fat, energetic utilization of oxidizable materials, lessened storage imply this constitution. Since it was not conceivable that the increased destruction was traceable to an excess of oxygen, Grauvogl considered the defect in the organism to be in dysoxidizable materials, particularly carbon and nitrogen. In this obviously false deficiency theory stands a contradiction since according to Grauvogl the oxygenoid constitution has an aversion to meats, which they need most but cannot utilize. Then again the character of the modalities and the nature of the adapted drugs was led into bypaths by this theory. Because this type should feel better air-rich in carbon and nitrogen. Obviously better supported by observation is the report that these irritable, hypertonic, thin men feel especially bad in great tensions of the atmosphere, *before* a storm, tempest, and rain, that they have the so-called almanac

pains, while they feel better after the rain and also during fog. To see therein an influence of air electricity, the charges in clouds and fogs has, at any rate, something in it. One only wonders why dry heat is not included as an aggravating factor for this constitution.

The classification of remedies in the oxygenoid constitution again is untenable, so far as it follows the theory of an equalization of a deficit. The carbonaceous materials, according to their effect picture, are certainly not oxidizing agents as Grauvogl would imply. That Rademacher's universal iron belongs here is in correspondence with homeopathic thoughts. The most perfect example of an oxygenoid manner of action, iodine, is not cited by Grauvogl in this series, although potassium iodide is (with a mistaken basis).

One can place the oxygenoid constitution in contrast to the hydrogenoid or torpid lymphatic, tetanoid and call it erethistic-arterial, basedowoid.

The third constitutional type of Grauvogl, the *carbonitrogenous* is characterized through accumulation and retention of carbohydrates and nitrogen in the organism and indeed insufficient oxidation.

The first signs of such a condition are increased respiratory frequency which not rarely is associated with a lessened pulmonary capacity and slight expansion of the thorax. Corresponding to the respiratory rate is increased pulse frequency. The patients feel best in open air (cold and damp do not aggravate in this state). A definite sign of the retention process is the pale urine which tends to be poor in chlorides and phosphates. In the blood picture one notes early "unusual turbidity, the so-called melanotic blood cells. The blood is richer in them because of the suppressed progressive metamorphosis which is possible only as the result of an insuffi-

cient influence of oxygen and in the organic fluids and tissues." Thereby Grauvogl gives the physiologic-chemical and symptomatologic characteristics of a disposition which we designate today as arthritism or as bradytrophism. He has also correctly seen or foreseen that in this state fermentative destruction, fermentation prevails in contrast to oxidative processes, as we know today in carcinoma.

As curative remedies of the carbo-nitrogenous constitution Grauvogl gives a variegated series, beginning with copper in agreement with the third state of Rademacher, but actually incorrectly if one reflects on the copper effect picture. Of the remaining metals cited which he counts as oxygen carriers according to his equalization theory, the same holds. Likewise phosphorus in any case does not stand in the correct position since its entire picture of effect is oxygenoid. Sulphur alone which Grauvogl took over as the great psora-remedy of Hahnemann shows the essential depression of the metabolism for the carbo-nitrogenous constitution, particularly of the skin and intestinal functions, the tendency to fermentative processes and to venous stasis. Carbon itself shows these actions much more strikingly but Grauvogl does not place it in the series. According to homeopathic thinking and according to the effect pictures as they are furnished by the provings, graphites and the other carbon compounds must actually stand in first place.

Grauvogl's doctrine of constitution suffers in that it is overconstructed. And yet it is not to be denied that in his three great types he has created a classification whose differentiations have a vast justification in actuality. If one actually subjects many ideas of Grauvogl to a revision, then the basic trends of his constitu-

tional doctrine remain useful: particularly the recognition through suitable agents, that is, groups of drugs, further through the dependence on general external conditions (modalities) and finally as far as possible, the tracing back of the constitutional differences to varying conditions of the organism itself which is finally pursued down to the structural elements themselves. The description of the type differences is the constantly assumed but still inaccessible intermediation between the analytic, physiologic-chemical and psychic investigation on the one side and the determination of tendencies (sensitivities for drugs and external conditions) on the other side.

NEW CONCEPTION OF CONSTITUTION

Our present attitude toward the question of constitution should approximate reality as far as possible. But actually there are no types but persons. Therefore, we should give to each person his own constitution. We need speak of constitutions only in order to comprehend peculiarities of individuals in certain respects and to describe them with type conceptions. To determine this property as a deviation from an imaginary norm is as foreign to reality as it is useless. It is only by the special relations of a living organism to its environment that we can determine its properties. But it is not the characterization of a man in all respects that interests us, when as physicians we speak of constitution, but chiefly in his tendency to become sick. It is necessary to appreciate this intimate actual state before one can begin a study of its basis. A division according to inherited and acquired properties does not help us here. For the recognition and utilization the tendencies can be observed in their transient connec-

tions; likewise a rigid separation of constitutional anomalies and transitions to disease is not justified in actuality. Our most important task must be the *recognition of susceptibility*. The more the disposition reveals itself in the total person and not merely in the single organ, the sooner the conception of constitution can be applied. Eventually, we can depart from the conception. It would be better to speak of the anlage, the disposition of the total person. On the one side one can seek to recognize the present individual-historic developmental relations from the inherited and acquired, on the other side the organic configuration of the total disposition from the disposition of the parts. But a worthwhile synthesis is obtained first through the *recognition of direction*. As through the function of the organic structure the arrangement and meaning of a part becomes comprehensible to practical understanding so also the recognition of "for what purpose" in the anlage first yields a worthwhile unit.

Now there would be nothing more simple than to perceive the anlage from the disease itself. So far as this is possible, it is done. But from the designation as arthritism, lymphatism, neuropathy, one can only conclude that extremely general groups with uncertain limits are indicated more than they are precisely fixed by details. This is dependent upon the fact that out of a great series of diseases which are manifest in the history of a person or his family, it is difficult to ascertain the red line which establishes the endogenous factor. Because the common factor therein cannot be determined without a comparative series. If now it is difficult—through comparative experience on the course alone—to group types of diseases themselves, then it is even more difficult when one attempts to determine the

morbid *relationships* in a mutual anlage. But in spite of its indefiniteness the sketched conception derived from clinical experience remains an approximation to actuality. Furthermore, one will be justified in repeatedly undertaking a circumscription and compression of the actual connections, if they are sufficiently general, from their own viewpoint and position. The point of departure for such divisions will be the various morphologic or chemico-functional bases which concern the entire organism. So from the fixed mesenchyme there will be a division into tense and relaxed fibers. From the vascular system will be cut off subdivisions of lymphatic, venous, arterial types, partly into lymphatism, arthritism, and neuropathy, into hydrogenoid, carbonitrogenous, and oxygenoid constitutions. By another the point of departure for the subdivision will be placed in another direction. From the blood cells one can likewise proceed into subdivisions where the accent is placed more perhaps upon the eosinophile cells than has occurred up to the present. The progress in the study of blood groups is promising in this respect. Likewise serologic subdivisions seem very plausible. Of greater comprehensiveness are the types determined by incretions which are traceable to disturbances in equilibrium in the interaction of the endocrine glands. Through this subdivision the old conception of dyscrasia becomes superfluous. The division into hypo- and hyperthyroid of B (basedowoid) and T (tetanoid) types (according to Jaentsch) is only a beginning. Standing in close physiologic relation is the subdivision which divides the autonomic nervous system into vagotonic and sympathicotonic types. Here certainly much onesidedness is experienced. Like all onesidedness this can only lead to bringing classifications into discredit.

But if one remains conscious that thereby only a seeming preference for the physiologic and pathologic function of one significant process is recognized for the total organism, then the conception retains its justified place.

All these attempts to fix these indefinitely determined clinically derived dispositions into universal tissue systems, systems of chemical or nervous regulation, must be further supplemented. The division of Grauvogl is nothing more than a further attempt at division which goes back to three types of metabolic utilization; and indeed it is the most radical because it even goes back to the chemical elements of metabolic utilization. If now in a subdivision according to the preponderance of reduction, oxidation, carbon and nitrogen retention, one daringly leaps over the great gaps in our knowledge of the intermediary processes, then these types adapt themselves by virtue of the total recognition as well as the clinically derived aspect, so that the physiologic-chemical triple division can be used with reservations for approximating actuality.

But the Grauvogl hypothesis signifies more than an elaboration from the analytic side based on human systems of varying power. In this respect it would have only a very hypothetical value because of the errors in so many intermediate steps in its foundation. But since the types through their dependence on external influences (atmosphere and environment) and particularly through (experimentally ascertained) connections are determined *according to tendencies*, it achieves new significance. The systematic use of exogenous determining factors for type division, the recognition of tendencies and incidence through single facts which arise either from involuntarily given or arbitrarily introduced observations, which fill out the otherwise

empty space between the "innate" (the conditions constituting endogenous factors) and the "for what purpose" of the anlage which otherwise are indicated only by a very generally sketched outline of disease, this is the fundamental new part and the important supplement which is characteristic of the homeopathic doctrine of constitution.

We need not discuss the methodic advantages but that which seems preliminary and conjectural in Grauvogl's representation can be altered and circumscribed by a better adaptation to the facts.

Therefore we shall purposefully select the way from the particular to the general and proceed from the diversity of the person. Yet how can we conceive the universal properties of a person, how can we gain the synthesis, the formula for the characteristics which are so diversified? Where is the super-conception for the morphologic, physiologico-chemical, vegetative and psychologic characteristics? *The characterization of a person in all its details seems extended between a hypothetical unitary basis and a hypothetical unitary tendency.* Neither is comprehensible as a unit. There only the comparison helps, a second comparison, an analogy, a further as-if. Such a purely practical analogy is obtained through a comparison with a drug effect picture. Here we have a connection to a uniform test; a unit as-if of the basis and the tendency at the same time.

Let us take as an example perhaps a calcarea carbonica person; this is one whose entire manner of reaction seems altered in the sense of a constant calcium carbonate influence. This signifies first that all his properties are such as if they were brought about by the introduction of calcium carbonate and calarea carbonica is the unitary basis for it. Actually, the knowl-

edge of this alteration *is* obtained by the observation of calcarea carbonica influence on man. At the same time the calcarea carbonica person signifies a susceptibility, a partiality, a tendency, a trend to calcarea carbonica. All true indications of the calcarea carbonica effect picture are characterized in so many fragments of a man who is sensitive to this substance, who reacts easily to it. What is here stretched between the known unitary basis and uniform tendency in signs, that we can attempt to sketch with conceptions as lymphatic, torpid, vagotonic, cold, hypotonic, hypothyroid, tetanoid, phlegmatic, hydrogenoid but the single trend remains fixed. The advantage which we have gained thereby does not only consist in that we have determined a personal type through an "as-if known" but we have also the advantage of possessing an image of a person represented by it, and which is reproduceable through the same technic and (because of its great constancy) easily registered and can be used again as a test object. Calcarea carbonicum sensitivity can be repeatedly determined and fixed through studies on man and these observations registered and again made recognizable in other people. The characterization of a person by a medicinal substance seems at first heterogenous but it is at least a very practical tool. It is likewise a rope thrown out which can draw itself from the water by its own fibers.

CONSTITUTIONAL SUBSTANCES OF VARIOUS RANKS

The likeness between the way of reaction of men and the drug actions leads so much better to the recognition of the endogenous constitutional factors: (1) the more general the way of reaction of the entire person is influenced and at the same time, (2) the nearer the nor-

mal, that is, without severe disease making assault, the characteristics of reaction can be determined. We seek to embrace the typical in the actions in men to *all* drugs. But only single organs or organ systems are altered by a number of medicinal substances. Such organ affinities at best can lead only to a determination of organ disposition. The smaller the drug stimulus is which provokes symptoms, the greater is the endogenous constitutional organ factor, the organ disposition. So moderate doses of cactus can make obvious a cardiac and aortic disposition, small doses of cantharis, a weakness of the urinary passages. But one will then speak of a cactus or cantharis case because such an organ weakness is not typical for the person as an entirety and because with somewhat greater doses of the drug, morbid reactions in these same organs can be evoked in all men.

Other substances act on an organ system, as vascular and lymphatic apparatus together with the mucous membranes and finally on all organs and all cells as perhaps mercury and lead. But the general effect is of such a nature that the disposition plays a subordinate rôle; in certain amounts and with certain repetitions of doses they are merely "poisons." They give typical general morbid reactions but none typical for the person of typical disposition. They involve, indeed, the general basis of the living system but are too violent, too little reversible in their actions, in comparison with those which can respond with functional characteristics and reaction tendencies.

That substance will fulfill the two requirements mentioned for the recognition of constitution to the highest degree which has a vital physiologic function in the organism. Its influence on the general foundation in

structure and function is established without further discussion. And the symptomatic expressions obtainable through it will always proceed out of the physiologic norm. The drug pictures of substances normal to the body will be perceived typically in constant deviations but still those standing nearest to the normal. Because for their appearance the endogenous factors play by far the most important rôle. If the introduction of the material occurs in not too unnatural a manner (for example, not through the injection of a non-physiologic form and amount into the blood stream), for the appearance of effect there must be presumed a special sensitivity to this substance, a special orientation. But should one simply designate such a special sensitivity to a substance as if a disturbance in the equilibrium in the economy even of this natural substance must exist? If this is obtained typically in the beginning with the assistance of a chronic proving, then we secure a point with this substance where the likeness between constitution and drug picture of effectiveness is very close. Here the experimentally obtained unitary basis of a general alteration of reaction of the organism is identical with a basic substance of the organism. In other words: the line of activity of actual observations leads to a point which can be mentally fixed as a postulate, especially that the peculiar way of reaction of an organism, its special "constitution" must be found in the relations of its structural constituents. Constitution considered as dependent upon tension differences of the constituents will be in this way *comprehended in actuality* in single directions, the experiences and description made available as the function of a constituent. It is therefore not amazing that the drug picture of the substance natural to the

body has furnished constitutional types κατ' ἐξοχήν and that these seem as *constitutional agents of the first rank*. Without the deeper basis being perceived, practical experience in homeopathy has led distinctly to this result. One need only think of the rôle of sulphur, phosphorus, calcium and potassium, of sodium chloride as homeopathic constitution agents of the first rank after which silicea, the carbon substances, then iron and iodine stand in a close position (with some slighter extent of general effect).

Between these constitutional agents of the first rank and the characteristic organ agents in the narrow sense stand a series of medicinal substances which by their effect picture stress so distinctly the endogenous factors as sensitivities in particular directions that they tend to become arranged as constitutional types. But their less fundamental secondary rank as constitutional agents (not as medicinal substances in general) can be recognized in that either the extent of their endogenous conditions is essentially narrower and perhaps only involves one organ system or that the effect picture is derived from a progressive clinical picture of disease. There are drug pictures such as those of sepia and pulsatilla which correspond more to the sensitivities of certain developmental phases, the female involution and evolution periods. Their constitutional aspect can be conceived as though it occurred through one incretory organ (here the ovary). So far as the incretory organ shapes the constitution such a drug may have an indirect influence. They are *derived constitutional agents*. If aurum influences the arterial system in the sense of red high blood pressure, then it enters into the apoplectic habitus only in a sense derived from the clinical picture of disease. If lycopodium and berberis

are especially suitable for the lithemic-arthritic alterations so are their constitutional associations likewise derived from clinical sources. The constitutional fragment of these drug pictures is more or less extensive but never so fundamental and essential as in agents natural to the body and the constitutional aspect is always derived. *Extent and intensity of the constitutional aspect in single drug types can also be graded.*

If we admit thereby the physiologically necessary structural substances to a special position, then we also associate them in the sense of the old theory of elements; only science has shown us still other elementary constituents of the organism than those the Greeks or Paracelsus accepted in their time. Likewise we do not proceed hypothetically from the elementary constituents of the organism but in this theoretic method approach by the empiric method through the drug types.

SCHÜSSLER'S BIOCHEMIC THERAPY

This is the place to glance at the so-called "biochemistry" (commonly called biochemic *therapy*) of Schüssler.[7] For the originally homeopathic physician, W. Schüssler, the decisive impression was that the mineral substances natural to the body must have an especially unique position. With grotesque onesidedness he limited his entire therapy to twelve so-called cell or tissue salts: ferr. phosphor., magnes. phosphor., calc. phosphor., kali phosphor., kal. chlorat., kal. sulfur., natrum muriat., natr. phosphor., natr. sulfur., calc. fluorat., silica, calc. sulfur. The last was later struck out and it should be noted that silicea, the anhydride of silicic acid, is not a salt. The election of tissue remedies or physiologically functioning agents as Schüssler originally and suitably called them was based to some ex-

tent arbitrarily on the basis of the ash analysis of the organism available at that time (1873) in Moleschott's book, "The Circulation of Life," which was the totality of physicochemical knowledge for Schüssler. Likewise, the followers of Schüssler, there being only a few physicians among them, have not altered Schüssler's system, except that here and there recently iodine is mentioned as a physiologic agent but without the indications being given. It is remarkable at least that sulphur appears only in the form physiologically inactive (so far as known) the sulphate; likewise of the physiologic rôle of iron in the phosphate form, nothing is known. With these temporarily conditioned errors of refinement one might be satisfied. If Schüssler, opposite to the homeopathic method, had brought actual improvement or progress on a scientific basis, then one could follow him in his small partial field. But, unfortunately, this is not the case. Moreover, in any case retrogression predominates when he took over the indications of the remedies previously employed homeopathically, although he emphasized the value in a few positive reports of previously not or only rarely used drugs. In place of the effect picture of homeopathy in all its extensive details as obtained by studies on the healthy, Schüssler prescribes according to a deficient compend, to a certain extent only by inscriptions: the tissue or organ on which the agent concerned should act and to this a series of clinical diagnoses. Likewise the crude anatomic and pathologic conception circumvented by homeopathy is in no way original and is again brought to light and all differentiating peculiarities in the symptomatology, all individuality, constitutionality thereby falls into discard. Only for a few previously little used and unproven salts are single new

indications given by Schüssler and which have proven themselves useful. Considered in general, such a sad section from the enormous factual material of the homeopathic materia medica could be nothing more than an ephemeral episode if such a simplification and compression of medical knowledge had not met the desires of many who could prepare themselves with a few tools and "sketchy" thoughts.

Now it is still to be considered whether Schüssler has not promoted the scientific basis of medicinal action of substances normal to the body, at least to some extent. This, too, cannot be affirmed. His general theory consists in the tissue salts balancing a deficit arising in a disease. From Schüssler's own discussion it cannot be said with certainty whether or not the deficit and its balance occurs entirely materially, that is, quantitatively. However, it must be noted that his minimal doses of drugs which he took over from homeopathy would never be sufficient for this. Many places in his "Abgekürzte" therapy permit one to suppose that he was thinking more of a functional deficiency of the material in the cell. The general presentation proceeds along the ground that disease has its basis in a disturbance of molecular movements of a salt; from this a deficiency in these salts occurs in the cells; the cure by means of this salt consists in a balance of the deficit. This eventually allows room for the acceptance of the idea that he considered healing as a functional *excitation* of the disturbed molecular movement which can then lead indirectly to a balance of material deficits and that he did not have a direct substitution therapy in mind. In any case Schüssler does not give any actual details on the "how" nor could he do so on the basis of the physiologic knowledge available at that time. The adoption of so general an idea as a pre-

liminary working hypothesis, moreover, has too little productiveness for it to serve as the sole basis for a therapeutic procedure. To sacrifice drug proving on the healthy as a means of assistance is certainly not progress. Much more Schüssler retrogressed to methods which utilized intermediary physiologic chemical actions of a substance, not only for explanation of therapeutic effects, as is correct, but as the sole justified guide in therapeutic management. Such a motivation of use of drugs remains dependent upon the current partial knowledge of intermediary processes and theories built thereon. Actually Schüssler's theoretic foundations raise hardly more than a claim to validity. So remains of his "system" only that which he took over from homeopathy for the most part, independent of all theory in respect to useful indications and transmitted according to his manner. All the rest is overwhelmed by the physiologic chemistry of Moleschott on whom he supported himself. Also to some extent arbitrary is the prescription of the sixth or twelfth decimal potency as the only dose.

POSSIBILITY OF ACTION OF SUBSTANCES NATURAL TO THE BODY

Naturally, with this critique on the claims and theoretic foundations of Schüssler's system, nothing is rejected relative to the therapeutic utility of his tissue remedies. Homeopathy has always maintained the medicinal effectiveness of materials natural to the body. This does not refer to disturbances provoked by injection into the blood stream or by oral administration in enormous amounts of such substances as sulphur or sodium chloride. Much more it has and does assert that regulating and healing effects of these substances can also be observed by smallest amounts under defi-

nite circumstances; indeed, such an action may even be obtained in the healthy under suitable conditions of investigation and symptoms produced by small amounts of such physiologic substances. If we assume these considerations which have remained uncontested within homeopathy are correct, then we must still question how such actions are possible. To this explanation belong obviously *certain presumptions on the part of the organism*, particularly special sensitivity to the material involved. By drug provings on the healthy it is exactly these symptomatic sensitivities which are developed as signs of the constitutional type which is named after the substance. And again in the therapeutic use the totality of morbid symptoms indicates by its similarity with those known to us from provings that the sensitivity probably lies in the direction of this substance. These presumptions on the part of the organism obviously are not sufficient for the desired explanation. Because the substance is introduced daily in the food in an amount at least equal (with calcium for example the daily utilization by the organism amounts to one gram!) so that the minimal amount medicinally introduced must seem to be superfluous. If, however, with the potencies of such substances, characteristic effects can be obtained, then the basis for this may lie *in the drug having another form*, than that in which it appears in the food. With solid drugs the method prescribed for preparation requires, even up to the dilution of 10^{-6}, trituration with sugar of milk and indeed for one hour with each step in the dilution (today decimal dilutions are usual, that is, one part to nine parts of the vehicle). Our ideas today proceed from the thought that the alteration in the size of the particles signifies an entirely *new state of form* which is made responsible for the new possibilities of action.

Up to a certain step we can appeal by comparison to the known peculiar actions of the colloidal state. How far beyond this the state of form attained by the prescribed preparation differs from the usual molecular solutions in their possibility of action, we can only form provisional general ideas; so for example that by definite states of division of the material, new ways open up in the organism, perhaps equally to cell groups which reflexly regulate the threshold for the material concerned. Experimental points of attack are present for a closed circle of effects, by alteration of the ion milieu in the vegetative nervous system and receptive cells to again balance alterations in the ion milieu. These are encountered later in this book (Loewi's study: vagus irritation, which can also be effected through potassium preponderance, produces alterations in physiologic perfusion fluid through the heart muscle which can also act on a second nerve-heart muscle preparation in the sense of a potassium stimulus). So the thought lies near that an altered unusual state of form can be responsible for a new unusual way and rhythm in the effects of ordinary daily used materials.

It must always be remembered that the *amount* of substance attained or attainable by the potentization prescribed in no way agrees with theoretically determined amounts. For this the technic employed is decisive.[8] Therefore it should be stated exactly in each case under discussion (for example the preparation of potencies in the same container or in several). To what step in the potency actions attained by this or that technic is merely a matter of observation and therefore not discussed here.

If now the experiences of homeopathy on the effectiveness of potentized substances natural to the body are considered correct, then the detailed drug pictures

furnish constitutional types of first rank for these drugs, as has been discussed above.

SUPERIORITY OF OBSERVATIONS OVER THEORY IN THE DOCTRINE OF CONSTITUTION

But we do not fall into the error of attempting to construct the medicinal effect of substances normal to the body from their chemical properties. The opposite method alone is correct: *the individual drug pictures obtained by observations exist by themselves, independent of any construction.* Subsequently we may progress from them to better insight and survey and with increasing certainty and knowledge the drug picture will proceed even more clearly in the direction of *chemical regularity* as it is fixed by the periodic system of elements. The greatest caution is necessary in such considerations. Because the actions from the elements are changed and varied under the conditions of experimental study: first through the chemical affinities of atoms and atom groups in which they are applied as drugs; then again through the preferential affinities which they have for certain materials of the organism. Only when one considers the total systems of powers, in and on which the action of elements proceeds, can one hope to arrive to some extent at its characteristic effect.

The factual material available up to the present impels us to foresee the natural lawful connections more in a preliminary way than to determine exactly each individual case. But *the method of the conception and the therapeutic evaluation of constitutional types* as it is transmitted to us by the history of the thought which has been described *may well hold as a great acquisition of homeopathy as for all medicine.*

THE MINERAL MEDICINAL SUBSTANCES

INTRODUCTION AND SURVEY

Our task is to learn the mineral substances as medicinal agents for the living organism and primarily for man. This requires looking over an almost infinite amount of scattered material and arranging it for practical purposes. On the one side we have the psychosomatic unit *man* who seems to present an enormous diversity in systems of powers, an infinite source of problems which from all our physiochemical, physiologic and psychologic and pathologic interrogation seems to grow ever more complex—on the other side we have the apparently simple natural mineral bodies, indeed the *original material.* It is the power relationships of these two types of natural forms which we desire to learn. It is logical that we look over at first the simplest, the basic materials or elements from which the entire character of the world accessible to our senses and from which the human body is composed.

THE PERIODIC SYSTEM OF ELEMENTS

Materially considered the entire world is composed of ninety-two elements or, more correctly, *the analysis of the world shows ninety-two elements.* Of these only two, elements 85 and 87, are unknown. If elements exist of higher atomic weight than uranium which is the 92nd, then it must be assumed that they are still less stabile than uranium which is continually in the proc-

ess of destruction. The newer investigation has pressed to the immediate vicinity of a claim to a *complete* knowledge of all the elements of the world. But not only the delineation of the diversity of all possible elements and their almost complete knowledge is attained but also the requirement toward *unification* has been widely accomplished for, in principle, it is plausible from exact atom investigation that these ninety-two elements are composed ultimately of one basic substance, hydrogen, H. Still, at present, this is only of theoretic interest.

The series of elements has become a *system* through the discovery of a principle of classification. Mendelejeff and Lothar Meyer in 1869 and 1870 arranged the elements then known according to their atomic weights and, by breaking down the series according to seven elements, obtained a periodic system. In broad outlines it was thereby shown that the elements whose chemical relationships were then known came to stand under each other as the alkalies lithium, Li, natrium, Na, potassium, K, rubidium, Rb, caesium, Cs, in the first column and the halogens fluorine, F, chlorine, Cl, bromine, Br, iodine, I, in the seventh. But new investigation has brought a final arrangement of the system of elements and also the correct arrangement principle. Thereby the periodic system of elements has become a natural *system*. Now we finally have certain ground beneath our feet (see Table 1). We call the horizontal series the periods; at the beginning stands a period with only two elements, hydrogen, H, and helium, He; then follows two periods of eight, then two periods of eighteen, then a period of thirty-two. After the great period of thirty-two elements there follows an incomplete period of six remaining elements.

TABLE 1

I	II	III		IV	Nebengruppen Va	VIa	VIIa	VIII	Ia	IIa	IIIa	IVa	V	VI	VII	O
1 H																2 He
3 Li	4 Be	5 B		6 C									7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al		14 Si									15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc		22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y		40 Zr	41 Nb	42 Mo	43 Ma	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	Seltene Erden	72 Ha	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 —	86 Em
87 —	88 Ra	89 Ac	90 Th, 91 Pa, 92 U													

Seltene Erden: 58 Ce, 59 Pr, 60 Nd, 61 Il, 62 Sm, 63 Eu, 64 Gd, 65 Tb, 66 Ds, 67 Ho, 68 Er, 69 Tu, 70 Yb, 71 Lu

The period numbers of 2, 8, 18, 32 are not an accident but they are connected with the structure of the atom. As is well known, today we believe that the atom consists of a positive nuclear charge around which one or more tracks of negative electrons circulate. Now the period numbers depend on the number of tracks and the number of electrons. Here one need not go into further details.

Nowadays the standard arrangement or division principle is no longer the atomic weight but the so-called *ordinal number*, which in the table stands over each atom symbol. This ordinal number is equal to the number of positive charge units of the atom nucleus involved. Since the atom nucleus again consists of positive protons and negative nuclear electrons, the ordinal number Z equals the excess of positive protons P over the negative nuclear electrons, E, Z = P-E. The atomic weight which was formerly the basis of classification is only an approximation function of the true ordinal number. Since the ordinal number represents only a definite positive nuclear *excess*, the total number of nuclear charges and thereby the atomic weight is not unequivocally demonstrated by this difference. Actually it is known of many elements that in spite of equal ordinal numbers they are still of different composition, and they differ in the total number of charges. One more or one less pair of protons or nuclear electrons allows the ordinal number to remain unchanged, giving a so-called *isotope*, that is, a type of element belonging to the same place in the periodic system. The union of such isotopes in which the absolute number of charges is different is actually decisive for the atomic weight of an element. Therefore the atomic weight for oxygen = 16 should not be a whole number (see Table

2). But since the chemical separation can go no farther than to the elements and the isotopes are only physical masses, for our consideration the chemical elements remain the ultimate units. But it is indeed possible that the individual isotopes of an element are definitely different for living processes. We do not know. The position number in the periodic system, the ordinal number, or, what is the same, the number of excesses in positive charge units, is the characteristic for each element. Only in few elements is there a spontaneous radiation of nuclear charges, radioactive destruction, with the transmutation of the element to a lower ordinal number and in single ones, an artificial attack on the nucleus has been successful, particularly by destruction with cathode rays.

The ordinal number is the quantitative expression for the property of each element. Likewise the still less accessible structure of the system of charges is certainly of even greater significance. *The specificity of an element is to be sought in the number and structure of charges;* through them both the speed and the impulse of movement is given so that one might well say: *the rhythm of self-radiation of the single elementary atom.* By the number of nuclear charges from within will the arrangement of electrons rule out to the outer limit of electron atmosphere as a solar system by its sun. The law by which the atom structure is controlled will be dictated by the size of the nuclear charge through the intervention of electrical attractions and repulsions whose uniform adjustment extends out to the atom periphery.

CHEMICAL VALENCES

And this *outermost atom periphery* is *the site of origin of chemical valences.* The chemical actions of

the atoms are determined by the electrons of the outermost ring and on their number and their arrangement depend the chemical properties of the element. While we see fixed in the nuclear charges, their number and structure, the inner autonomy of the element, we find in the number and arrangement of the outer valence electrons the outward connection of atoms to each other, its combination possibilities and chemical relationships.

GROUP DIVISION

The equalities in the outer electron rings of the elements come into expression in the *vertical series or groups* of the periodic system. The position in these groups is the standard for the manner of chemical reaction and thereby the chemical similarity of the single elements. *These groups of affinity are given compulsorily in the natural erection of the system.* A glance over the vertical series of the system on the 8 chief and 7 accessory series and the 3 triads in which Group VIII stands in the middle and moreover the sister group of rare earths informs without further ado that the chemical affinities of the elements in this classification are brought into the correct arrangement. Because of the great significance the periodic system and the chemical kinships have for us, we should devote a brief genetic and general chemical consideration to it.

Let us represent the formation of elements as they must have occurred in the world development. An atom is made out of the one preceding it in the periodic system through addition (or better, inclusion, because it concerns the internal structure) of a hydrogen particle, that is, a nuclear charge unit and an

outer electron. In it the number of outer electrons grows only stepwise in the formation of a new element, for the capturing power of the outer ring attains a limit which cannot be surpassed or it could no longer maintain an equilibrium. For reasons of stability further electrons must take a place on a new outer ring. As with the year rings of a tree the ring, outermost until then, will pass within. Exactly as living organisms can maintain development only in certain forms so there is *a law of self-preservation for the development of materials.* The difference is merely that in inanimate objects it can be calculated what forms have the best durability and what have not. The entire idea of the development of the atom rests upon the Bohr atom model conception which is well founded on chemical systematics and spectroscopic facts. We have every reason for the belief that the outermost ring of electrons (or better, electron shell) cannot surpass the number of 8 electrons without losing its stability. But those elements whose outer ring is saturated by 8 electrons are chemically inert and among these is the so-called noble gas helium, He (which, naturally, since it has an ordinal number of only 2, can have only 2 electrons in the outer ring, neon, Ne, argon, Ar, krypton, Kr, xenon, Xe and emanation, Em). This group in our table is designated as the O-group. The noble gases are stabile because their outer electron ring is complete, they have no loosely locked electrons which they can detach and no electron hunger. Since they do not enter into chemical reactions, we can leave them out of consideration. Theoretically they interest us as types of electromechanical stability or saturation of the atom form.

TABLE 2

*German Atomic Weights for 1931**

Ag...	Silver.....	107.880	La...	Lanthanium.	138.90
Al...	Aluminum...	26.97	Li....	Lithium.....	6.940
Ar...	Argon.....	39.94	Mg..	Magnesium..	24.32
As...	Arsenic.....	74.96	Mn..	Manganese..	54.93
Au...	Aurum.....	197.2	Mo..	Molybdenum	96.0
B....	Boron.....	10.82	N....	Nitrogen....	14.008
Ba...	Barium.....	137.36	Na...	Sodium.....	22.997
Be...	Beryllium...	9.02	Nb...	Niobium....	93.5
Bi....	Bismuth....	209.00	Nd...	Neodymium.	144.27
Br...	Bromine.....	79.916	Ne...	Neon.....	20.18
C....	Carbon.....	12.000	Ni...	Nickel.....	58.69
Ca...	Calcium.....	40.07	O....	Oxygen.....	16.0000
Cd...	Cadmium....	112.41	Os...	Osmium.....	190.9
Ce...	Cerium.....	140.13	P....	Phosphorus..	31.02
Cl....	Chlorine....	35.457	Pb...	Lead.....	207.21
Co...	Cobalt.....	58.94	Pd...	Palladium...	106.7
Cp...	Cassiopeium[1].	175.0	Pr...	Praseodynium	140.92
Cr...	Chromium...	52.01	Pt...	Platinum....	195.23
Cs...	Caesium.....	132.81	Ra...	Radium.....	225.97
Cu...	Copper.....	63.57	Rb...	Rubidium...	85.45
Dy...	Dysprosium..	162.46	Re...	Rhenium....	186.31
Em..	Emanation...	222	Rh...	Rhodium....	102.9
Er...	Erbium.....	167.64	Ru...	Ruthenium..	101.7
Eu...	Europium...	152.0	S....	Sulphur.....	32.06
Fl....	Fluorine.....	19.00	Sb...	Antimony...	121.76
Fe...	Iron.....	55.84	Sc...	Scandium...	45.10
Ga...	Gallium.....	69.72	Se...	Selenium....	79.2
Gd...	Gadolinium..	157.3	Si....	Silicium.....	28.06
Ge...	Germanium..	72.60	Sm...	Samarium...	150.43
H....	Hydrogen...	1.0078	Sn...	Tin.....	118.70
He...	Helium.....	4.002	Sr....	Strontium...	87.63
Hf...	Hafnium....	178.6	Ta...	Tantalium...	181.36
Hg...	Mercury.....	200.61	Tb...	Terbium....	159.2
Ho...	Holmium....	163.5	Te...	Tellurium...	127.5
In...	Indium.....	114.8	Th...	Thorium....	232.12
Ir....	Iridium.....	193.1	Ti...	Titanium....	47.90
I.....	Iodine.....	126.93	Tl...	Thallium....	204.39
K....	Potassium...	39.104	Tu...	Thulium....	169.4
Kr...	Krypton.....	82.9	U....	Uranium....	238.14

V....	Vanadium...	50.95
W...	Wolfram....	184.0
X....	Xenon.....	130.2
Y....	Yttrium.....	88.93
Yb...	Ytterbium...	173.5
Zn...	Zinc.....	65.38
Zr...	Zirconium...	91.22

85 elements

Note: Not included: Ma, Ac, Pa, Il, Po, as well as elements 85, and 87.

The striving after greater stability is the impulse to all chemical combinations in which atoms have a common property, that is, to insure a common electron shell. In order to abolish the compound it requires the application of energy from without, and on the contrary the entrance into a compound in general needs no application of energy and frequently is associated with the giving off of energy. In order to understand the tendencies of the individual elements or their groups—for we desire to penetrate into their nature—we shall again cast a glance at the periodic system. However, it is better if in place of taking a flat surface as a perfect representation we employ a cylinder or a curved surface. One should place Table 1 as rolled together so that on the surface of the cylinder there is a sequence of the elements in a *spiral*. It is for this reason that the horizontals are oblique.

The tendencies of affinities of the elements are arranged by the electron status of its outer ring. Let us take, for example, the element sodium with an electron number of 11. The innermost ring has 2 electrons, the middle 8, and the outer ring 1 electron. This single electron tends to be given off from the remaining solid hull. This tendency to give off an electron we call electropositive, because after the departure of the electron,

* From Landolt-Börnstein: *Physik.-Chem. Tabellen*, 5th Auflage 2 Erganzungsband, 1 Teil, Seite 1. Julius Springer, 1931.

[1] Formerly lutetium = Lu.

the positive nuclear charge is predominant. Sodium is univalent electropositive. This holds for all the elements of Group I, or the alkali metals in the same way. Let us now take the chlorine atom Cl, with an ordinal number of 17. This has in its outer ring 7 electrons. For its stabilization it needs 1 electron, it has an electron hunger of 1, and it is univalent electronegative. One might also say: it is 7 valent electropositive, but the departure of 7 electrons is not as easily effected as the acceptance of 1 electron. Univalent electronegativity is again the characteristic of the entire Group VII, the halogens. No wonder that the atoms of Group I and Group VII combine easily and neutralize each other if the medium in which they are present is satisfactory in any way. Group II, for example magnesium, Mg, with the ordinal number of 12, has 2 electrons in the outer ring, is divalent electropositive, Group III, trivalent electropositive, Group VI, for example sulphur, S, with the ordinal number of 16 lacks 2 electrons of the 8 for stability, so it is divalent electronegative. Also here one might speak of 6 valent electropositivity. Group V is trivalent electronegative, Group III, trivalent electropositive and pentavalent electronegatively, both being of significance for the tendencies to combination. Group IV stands in the middle being tetravalent electropositively and electronegatively.

The electropositive valences can also be designated as oxygen valences as they tend to combine with oxygen, O, as well as the electronegative hydroxyl, OH, and the electronegative as hydrogen valences which tend to combine with hydrogen. We see the steplike increase of value or valence in the positive sense from left to right, in the negative sense from right to left.

Whether the individual atoms make more use of their positive or their negative valences depends upon the external conditions. It is to be observed that for example the tendency to give off electrons, likewise to charge itself positively, predominates in actuality. This is particularly the case of the elements with higher ordinal numbers. A glance at chemical compounds teaches, for example, that the OH compounds, also the O valence in Groups V and VI are very significant and further the positive 5 and 6 valences are as important as the 3 and 2 valent negativity.

IONS

For the giving off or acceptance of valence electrons the cooperation of the medium is essential. In general the discussion will follow the most common agent of solution, water, H.OH. Such a medium one calls *dielectric* and the material which exchanges electrons by its separation ("dissociation") through the dielectric medium is called an *electrolyte.* The charged atoms (or atom complices) thereby arising are called *ions*, that is, wanderers, because they wander through the electrolyte solution by the conduction of an electric current and moreover the positively charged atoms wander to the negative pole, the "cathode" and the negatively charged to the positive pole, the "anode." The positively charged cathode wanderers are therefore called *cations* and the negatively charged anode wanderers, *anions.* Yet the ions probably do not develop first as charged atoms by the introduction of an electric current, but their presence, their charge, is the presumption for the conductivity of a solution for an electric current.

The type and stability of union of atoms to mole-

cules determines in the dissociation in water whether the separated ions react with the H^+ and the OH^- ions of the neutral water and produce a predominance of H^+ ions, an acid reaction, acidity or predominance of OH^- ions, that is, an alkaline reaction, alkalinity, or whether it will remain in equilibrium with the ions of the water, that is, react as neutral. The number of freed H^+ or OH^- depending on the type and stability of the compound designates the degree of acidity or alkalinity of a compound. So one speaks of strong or weak acids or bases.

We must mentally review the compounds in inorganic chemistry with their reactions in order to further characterize the elements of the periodic system in detail. Here it is sufficient to outline the broadest tendencies of the elements because after that we may give a preliminary survey of their connections to the organism.

But a special consideration must be given to the middle position of the carbon-group, IV. It is no accident that exactly here the tendency exists for the chemical compounds of the carbon atom to combine with each other, so-called homeopolar compounds while otherwise homonymous charges are repelled. Here, where equally many positive as negative charges are present, an enormous number of compounds take their point of departure which forms the subject of so-called organic chemistry.

COSMIC FREQUENCY OF THE ELEMENTS

So much for the present on the periodic system of elements in general. Now we must consider the elements in their *significance for the composition of the world* in order to subsequently apply the same con-

sideration to the composition of the organism and the significance of the elements in it. In regard to the participation of elements in the structure of world bodies Harkins has shown two facts worthy of consideration. *The first is that in the world composition the elements with even ordinal numbers are significantly predominant over the elements with odd ordinal numbers,* in chaotic meteorites about seventy times, in the more differentiated world crust about seven times. For the cosmos in general the rule of Oddo and Harkins holds that elements of even ordinal numbers are about ten times as frequent as the neighboring elements with odd ordinal numbers. What now is the significance of the even or odd ordinal numbers? As we have seen this proceeds out of the intra-atomic structure, the nuclear structure of the element. One can think of the even-numbered elements as composed purely out of helium particles with an ordinal number of 2, whereas the odd numbered only from helium plus hydrogen particles. The predominance of even-numbered elements in the composition of the world speaks distinctly for their stability in contrast to the odd numbered. It is the same with elements as with living organisms. Their existence or possibility of self-preservation is so much the better, that is, they are more frequently able to maintain themselves the better and they are able to defend themselves against external influences by virtue of their composition. That the helium particle itself is an especially stabile structure is known from other proof and it may be shown mathematically as well.

The second fact is that *the first twenty-nine elements of the periodic system are significantly preponderant in frequency throughout the world.* These twenty-nine lightest elements form 99.99 per cent of the total con-

tent of meteorites and 99.85 per cent of the solid earth crust. But therein the very light elements, lithium, beryllium and boron are quite rare and geochemistry has shown the reason for this in their structure (V. M. Goldschmidt). The elements with higher atomic weights beyond the ordinal number of twenty-nine play a subordinate rôle in the percentual composition of world bodies. These two facts state: the less complex the atom nucleus is, the sooner its formation occurs and the more frequent its existence. Since one can conceive of the development of elements only according to ordinal numbers it is clear that the elements with lower ordinal numbers predominate ceteris paribus, but only ceteris paribus. So far as they particularly satisfy the requirements of external powers in their stability they will combine the greater part of the available world materials in their form.

Of these two rules of frequency, the second, or rule of weight, has the greater universality. The first, the ordinal number rule, will stop with the increasing differentiation of the world from chaos to the earth and its crust to the organism. With the inauguration of chemical affinities new periodicities, as we have seen above in the groups of periodic system, gain in significance for the selection of elements, in other words: the outer electron ring with increasing differentiation of natural bodies annexes influence on the frequency of the elements.

So far as the cosmos is accessible to human observation on the earth, in meteors, in the atmosphere, the sun and stars, not only is the earthly material found everywhere but also the *frequency* of the elements everywhere finds extensive agreement. Evidence suggesting that the development of elements from hydrogen

to uranium has not ended everywhere in the cosmos or that only lighter elements deviating from the earthly ratios appear frequent, has not been found as yet in spite of extensive astrophysical investigations.

GEOCHEMIC DISTRIBUTION LAW

Type and average frequency of elements in the world may be taken as a constant point of departure. The differentiation of the solid structure, like the earth, depends upon the distribution of the elements. The law for this distribution in the earth has been brought to light particularly through the geochemic investigations of V. M. Goldschmidt. Between the theory of distribution of the elements according to their chemical or physicochemical properties and the analytic and experimental findings there exists a remarkable agreement.

The stratification of the earth is primarily the result of a separation of the original molten fluid according to *atom-volume* (the relation of atomic weight to the specific weight of an element). Niggli has divided the elements into the petrogenous and metallogenous (stone and ore builders). The petrogenous elements prevail in the outer strata of the earth (as oxides and silicates), the metallogenous belong to the deeper strata (chiefly as sulphides and the like). *In the periodic system of elements the petrogenous elements belong almost entirely to the chief group, the metallogenous to the accessory group.* This is associated with atom volume which is essentially greater in the elements of the chief group than in the elements of the accessory groups. The metallogenous metals form a condensed type of material and therefore their characteristic position in the deeper strata of the earth.

The outermost shell of the earth which chiefly interests us, the *lithosphere*, is rich in the elements which have a strong affinity for oxygen. Silicates are the chief constituents, next to bound oxygen, calcium, iron, aluminum, magnesium sodium and potassium (*lithophile elements*). Among the elements of the earth's crust there also exists a frequency law to which Niggli has drawn attention; the most frequent elements are oxygen, silicum, calcium and iron with ordinal numbers of 8, 14, 20, 26. This equal difference of six between the ordinal numbers of the most frequent elements of the earth crust must have some connection with the stability of the nucleus. The nuclear structure, by the addition of three helium particles, has obviously obtained a high grade of stability.

In the deeper strata, the *chalkosphere*, are predominantly such *"chalkphile"* elements as are characterized by their marked affinity to sulphur and whose sulphur compounds are easily soluble in iron monosulphide, sulphites and oxides of heavy metals, particularly of iron.

Finally there is the metal nucleus, the *siderosphere*, where the earth is characterized by deposits of iron and nickel and by metals which, partly in the free state and partly as iron compounds, are easily soluble in molten iron (*siderophile elements*).

In the further course of the "massive metallurgic smelting operation" (V. M. Goldschmidt) of the great chemical laboratory of the earth, the elements in the lithosphere distribute themselves, the stone and the slack of the smelting oven processes according to the law of crystallization. This proves to be dependent upon the atom or ion radii, in that the approximation

in size of radii favors the appearance of a common crystalline structure.

There follows then the physicochemical reciprocal actions with the *atmosphere* which contains the easily volatile "atmosphilic" elements as O, N, H, and the noble gases; then with the *hydrosphere* which outside of water contains the "hydrophilic" elements pouring out of the earth crust and their combinations and, finally, the *biosphere* which will concern us in particular.

The reciprocal actions in the lithosphere most accessible to our observation proceed chiefly from physicochemical processes in water solution (weathering, sediment formation, stone metamorphosis).

If the *frequency* of single types of atoms in the world was determined *through the properties of the atom nucleus*, so will the way of distribution of elements be lawfully determined *through the properties of the electron shells. In the same way* we find also, *in the organism,* the nuclear structure of the element the ordinal number standard for the specific property and the appearance of the element, but for the way of distribution and the physicochemical exchange the electron shell is standard, in other words, the group kinships of the periodic system of the elements.

THE STRUCTURAL ELEMENTS IN THE ORGANISM

Lithosphere, hydrosphere and atmosphere in their narrow physical and chemical reciprocal connections are the material basis of the biosphere, the organism. *The question, which elements adapted by their circulation in nature are suitable for the biosphere and necessary or promoting for the life of the organism,* will be answered through the elementary composition of the

organism and its nutriment. In place of describing the progressive material differentiation in a developmental series of organisms in detail, we pass over at once to the status of the elementary composition of the *human* body.

If, by a subtle investigation, slight traces of any element of the periodic system can be proven in the organism, so there is the peculiarity existing in the living organism for it in that *certain elements appear in relatively constant typical proportionate amounts and are characterized by their physiologic importance and necessity.* The limits between elements which are necessary for every organism, those which are useful but dispensable for this or that organism, and those which appear in the organism but which are without significance may appear to shift with the progressive penetration into metabolic events. The basic facts which are important for the material composition of the human organism we can touch upon but only very briefly.

FUNDAMENTAL ELEMENTS

There are primarily four fundamental elements: H, O, C and N, the basic elements of organic substance. They are characterized by the highest degree of combination variations. It must strike anyone that each of them takes the first place in a group in the periodic system. They are the simplest representatives of the kindred groups of various valences: hydrogen is univalent positive, oxygen is divalent negative, carbon tetravalent amphoteric, forming carbohydrates and fats and the combinations with the trivalent negative (or pentavalent positive) nitrogen is the basis of protein compounds.

WATER

The combining of H^+ and OH^- to water, H_2O, the basis of the "hydrosphere" and also of the organism, is the most general medium of reaction for physicochemical processes and in which it remains quite unaltered. As a fluid neutral salt, to a certain extent, of the ions H^+ and OH^-, water has a physical function: the spatial approximation or separation of energy carriers. Moreover, water by virtue of its capacity for evaporation, due to the internal and external temperatures, has significance even for the regulation of temperature of the organism. Being the least differentiated and most general medium of reaction water possesses an enormous physiologic breadth. And since it enters into the structure of organic molecules and again becomes free through the splitting, it possesses a most general nutritional function. But such a mass action is also dependent upon the sensitivity of the organism. So, for example, under certain conditions an excess of water can induce a super-regulation, an excessive diuresis; however, such an excitation through physical mass remains outside of a characteristic medicinal range. Only through alteration of the site of the influence (perhaps through intravenous injection) can water bring about nonphysiologic actions; an alteration of the form whereby water would become a "drug" in the narrow sense is hardly possible, because the alteration of form through temperature for the purpose of activation steps beyond the possibility of internal use. But chemical activation may be ascribed to the materials which water decomposes. Even though the physical mass action of water (by external use in dependence upon its temperature) is important, still it has no

place as an energy carrier in the materia medica. On the contrary the water storage is of great significance as an *object* of drug action. It will be regulated in the main by the grade of swelling of body colloids on the one side, on the salts dissolved in water (particularly sodium chloride, NaCl) on the other side. If the need for water as is signaled by the symptom of thirst is removed by the introduction of water, then this belongs to nutrition, but it is still not a characteristic drug effect. A disturbance of water distribution often steps beyond the physiologic range and then the medicinal influence through increase of bodies' own regulation arrangements (in the places where it fails) is available; but in general not through water itself but only indirectly.

OXYGEN

Just as molecular water so also molecular *oxygen* is considered as food for the necessary physiologic functions of all higher organisms. As the lithosphere is controlled primarily through the oxygen affinity, so are also the vital processes through the union with oxygen (oxidation) with the organic substance. The gas exchange between oxygen and the end product of carbon compounds combustion, CO_2, is sensitive in its great physiologic range only for mass differences of these two gases, but one does not tend to designate this as medicinal. In general, in depression of oxidation, there is no failure in oxygen supply but in the possibility of utilization of the oxygen available. Here again it is not possible to give oxygen a more active form than it has in the atmosphere, so only mass actions at unusual places (in a nascent state, for example, as peroxide H_2O_2) does it come into consideration. The

use of oxidation mediation is more possible through oxygen deficiency (high altitudes).

HYDROGEN AND HYDROGEN ION CONCENTRATION

Hydrogen in molecular form has no place in the metabolism of higher organisms and a medicinal activity of this lightest gas is indeed hardly possible. Hydrogen only as an ion, that is, as a positive-charged, dissociated atom, is active in the organism. Therein the relation to the other active constituent of water, to the OH, is always decisive. (The hydroxyl ion OH is to a certain extent an oxygen ion made univalent.) Preponderance of H^+ (increased hydrogen ion concentration, pH greater than 7) signifies an acid reaction; preponderance of OH^-, pH less than 7 (increased OH concentration) an alkaline reaction. Because the total ion concentration of neutral water in H^+ and OH^- ions equals 10^{-14}, so must there be, in a neutral reaction of water, solution of H^+ equals OH^- equals 10^{-7}. This relation is usually expressed by writing with the negative logarithm as pH, so that pH equals 7 means neutral reaction; a pH under 7 or a preponderance of H^+ ions, an acid reaction; and a pH of over 7, or a preponderance of OH^- ions, an alkaline reaction. The strength of an acid (or base) is determined by the concentration of the dissociated H^+ ions (or OH^- ions). The ratio of reaction equilibrium of free ions, by which the activity is determined, is a reversible one of a type which is generally understood by the mass action law of Guldburg and Waage. The acid-base regulation physiologically is held very constant through diverse regulation agents. The physiologic defense against an alteration of the optimal (H^+, OH^-) ion concentration has such a range that a morbid disturbance in inter-

mediary metabolism, through the introduction of acid or base in a normal way, is as good as impossible. Only when the metabolism is already disturbed toward the acidotic or alkalotic side, when the regulation processes which otherwise function without symptoms are defective and produce morbid symptoms, is the situation given for the medicinal intervention into the acid-base balance.

BUFFERING

The formation of acids is the normal result of the splitting processes, the dissimilation. The physiologic counterbalances for the anions developing are the cations, and indeed here the alkali cations, sodium and potassium, because of their great motility and capacity for exchange, are the most important. The use of ammonia, which arises from protein destruction, is actually a danger signal. The alkali reserve is chiefly formed through the alkaline reacting carbonates and phosphates of the alkalies. The alkali salts of weak acids are suitably formed, and an excess of active H+ ions avoided and temporarily (until acid excretion can occur) made latent. If one takes CO_2 and its sodium salt $NaHCO_3$ as an example, so will the equilibrium

$$\frac{CO_2}{Na.HCO_3}$$

at the instant of appearance of a strong acid, that is, numerous free H ions, shift in favor of CO_2, the alkaline reserve, $NaCHO_3$ diminishing. But since the rush of H+ is collected as a weak acid whose dissociation of H ions is very slight, so in the medium, as perhaps the blood serum, the acid-base balance remains constant. Only the relation of the weak acid to its alkaline salt shifts. And this ratio is a reversible

balance which after the elimination of CO_2 through expiration again shifts in favor of the alkaline salt. This equalization function in the acid-base regulation is called *buffering*. The possibility of buffering is moreover given through the alkali reserve. In the blood it can be determined through the amount of CO_2 which will be bound at a definite partial pressure through the buffering alkali of the blood serum.

Apart from the final balance through the excretion of anions or cations, the intermediate acid-base equilibrium is also ensured through a series of other processes. So almost all proteins are at the same time weak bases and weak acids, so-called ampholytes. They are also suitable for temporarily lessening an excess of active H+ or OH– ions through weak dissociation.

So an optimal hydrogen ion concentration (pH) in the fluids and tissues will be maintained with great tenacity. It is moreover a basic condition for the normal course of vitally important processes. The great variations of food in acid- or base-builders is hardly able to disturb this equilibrium, at most to favorably influence an already disturbed one. An excess of acid in intermediary metabolism, acidosis, develops through incomplete oxidation and therefore incomplete excretion of acid end-products. In such cases the neutralization through strong alkali is naturally excluded, because the introduction of such OH– carriers in the amounts required must act disturbing on the cells and tissues. And the introduction of salts, which induce an alkaline reaction, as sodium carbonate, in such cases, can hardly give more than a transient neutralization; a chemical mass action which attacks the end-products of a metabolic disturbance, which is able to stimulate the intrinsic properties of the organ-

ism to conquer the disturbance, does not occur in any case. It is the same chemical mass equalization procedure which brings temporary alleviation in an excess or deficiency of acid in the stomach through the corresponding amounts of alkaline-reacting salt or acid but which better induces an impairment of the self-regulation of the organism.

Of the destructive actions of strong bases or acids, we need not speak here. The solution of skin and mucous membranes through alkalies, the corrosion through acids, shows us only the impossibility of supporting life through marked increase of the OH or H ion concentration. But if we turn to bases and acids in a dilute state as stimulation agents, as drugs, then we must be clear that the action of the cations (bases) or anions (with acids) used, is shaped so much more acutely and transiently, the freer the OH^- or the H^+ ions are. Their great capacity for reaction is associated with the extraordinary speed of wandering. The strong alkalies, the OH compounds of the organic alkalies and earthy alkalies, can therefore practically not be used as drugs since their action is too brief and crude. The cations can have value if they are employed, for example, the carbonates. The strong acids, as hydrochloric, sulphuric acid, are likewise rarely used drugs of acute effects. With nitric acid and phosphoric acid the dissociation relations are somewhat more complicated, and a slower and more prolonged action is made possible. The similarity in the drug action of the alkali-forming cations on the one side and the acid-forming anions on the other side, and the contrast between these cation and anion actions in the organism in general, will be mentioned later in the summary.

The rôle of H and OH ions in normal and sick

organisms, and the understanding of the remaining anion and cation actions, is so important that they must be studied more closely, even if the ions themselves as constituents of medicinal substances have only a slight significance.

CARBON

The third fundamental element, carbon, C, is the characteristic carrier of organic life. This is certainly connected with the central position of the element in the periodic system. Next, carbon as the lightest and therefore the "handiest" element of the amphoteric group IV, is also adapted for entering into combination with H and O beside one another and for extraordinarily changing relationships and forms. To this is added the capacity of combining with itself in chains and rings (homeopolar binding), which carbon possesses to a greater degree than any other element. It owes this also to its central position in the periodic system.

In silicium and the lightest members of the neighboring Groups III and V (boron and nitrogen), the capacity for homeopolar binding is much less. Moreover even in silicium there predominates a one-sided affinity, namely, for oxygen. Another advantage which carbon possesses, which is not present in silicium, is that the simplest natural combinations of the oxidation end-products, CO_2, and the last step in reduction, CH_4, are volatile. So in spite of all diversity and convertibility of the innumerable intermediate forms, still an easy removal of the used material is made possible.

Elementary carbon on the other hand, similarly as silicium dioxide, SiO_2, is for the organism a firm, chemically unattackable substance. Through its physical

properties when it is placed in a suitable state, such a chemically inactive substance can enter into reciprocal actions by virtue of its surface properties with an organism so that it is a quite universal drug. In SiO_2 these physical powers indeed find physiologic utilization.

Chemically bound carbon is the structural and functional material of the organism. Indeed, as we saw, the simple oxidation product of carbon, namely, the anhydride of carbonic acid or carbon dioxide, CO_2, as the final split product plays an important rôle in the regulation of ion equilibrium. Also the "poisonous" CO appears in slight amounts in the blood, probably developing as an intermediary step in the splitting of sugar. No characteristic drug can be made from either of the gaseous forms of the material, however.

The animal organism must obtain its organic fuel material in a highly complicated form; it requires the preliminary labor of green plants which alone have the ability to build the still so "mineral"-like CO_2 with the assistance of the sun's radiant energy through photosynthesis to higher carbon compounds. These organic preparations are then nutriment for the animal organism as it has implements, agents and ways to gain utilizable energy through the destruction of these materials and to assimilate them. But if a short circuit occurs in this complicated and highly subtle physical chemical fabrication process then they attain poisonous, or in corresponding direction, a medicinal action. This short circuit may arise from the nutrient material being introduced parenterally in a nonphysiologic way, or by leaping over the normal processes and ways intentionally; or it may arise when the intermediary elaboration is imperfect and leads to "poisonous" sub-

stances or intermediate products not detoxified with antagonistic actions; or the usual physiologic processes may fail in respect to the carbon compounds introduced, which, in the metabolism of certain plants and animals form characteristic compounds (alkaloids, glucosides, toxins, animal secretions); or the compounds of so-called organic (better-carbon) chemistry can be artificially synthesized in the laboratory for a definite effect on the organism. Whether by these artificial products a parenteral introduction and a leaping over physiologic limits is obtained or not, still the attempt always goes utterly one-sidedly and equivocally in the direction of action and for the avoidance of untoward actions. The artificial elaboration of such constructed compounds in an extremely narrow path is worthy of remark as an accomplishment of homo technicus. Still all these compounds carry the stamp of one-sidedness, brief palliation, indeed a restraint of a few vital functions. Such a type of action serves a medicinal method which is oriented only to a slight extent to the extreme adaptation of natural vital processes and the use of their reaction powers. And so it happens that in homeopathy these artificially constructed preparations play only a very subordinate rôle in contradistinction to the materials from the great laboratory of nature. For this reason we shall speak of the carbon drugs only briefly in an appendix to the mineral drugs.

Thereby we step over the limits of *mineral substances* in the narrow sense. But this limit is by no means sharp in nature. In metabolism definite organic compounds pass over into mineral (the organic carbon compounds to CO_2, the organic sulphur compounds to sulphates) and reversely mineral compounds to the organic (NH_4 salts to urea, iodine enters thyroxine

and then again becomes free); then too numerous compounds are partly inorganic and partly organic (for example, salts of inorganic cations with organic anions, or the compounds of anions as phosphates with alcohols to form esters). And even if one assumes with Wiechowski that the differentiation is to be made according to the *type of union* and only unions directly on to the C or over N to C as organic and those which are united through the intermediation of H or O as inorganic, still a division of the inorganic materials cannot be made without some arbitrariness. The inorganic type of compound is characteristic for compounds which furnish ions in a watery solution through dissociation whereas in the organic type of union the splitting into ions is possible only after complete oxidation.

In our materia medica we can include the simple carbon compounds untroubled by the type of union to minerals. The limit between the synthetic drug preparations which have a minor significance for us and the natural or artificial derivatives from the plant or animal kingdom can also be left vague. We shall therefore include single definite organic preparation from the plant and animal kingdom as carbo vegetablis and carbo animalis, creosote, petroleum and also such preparations which are available from artificial synthesis and plant destruction, as benzoic acid and salicylic acid, as an addition to the minerals since their inclusion with the plant or animal medicinal substances seems less logical.

NITROGEN

The fourth basic substance, nitrogen, N, in its elementary form as it occurs in air as a diluter of oxygen, is like elementary carbon in that it is not utilized by

the higher organisms. As a gas, no medicinal powers can be imparted to it through an alteration of physical state as can occur in the case of the solid carbon. The animal organism can utilize nitrogen only in combined forms and this happens almost exclusively through the organic union to carbon. Indeed traces of NH_3 or the ammonia cation NH_4 occur as an end-product of nerve and muscle metabolism and somewhat larger amounts are liberated by the kidneys under certain conditions, when in the regulation of buffer capacity of the urine the reserve in fixed alkalies must be spared. Otherwise nitrogen appears physiologically but still constantly as a companion of carbon in metabolism with which it is bound obligatorily in the synthesis or splitting of proteins. Inorganic ammonium introduced into the organism is so foreign and poisonous to the body that as soon as it reaches the liver it is detoxified to urea, $CO^{-NH_2.}_{-NH_2.}$ That nitrogen metabolism is much less intensive than carbon metabolism is evident from the fact that nitrogen is present only in proteins and not in carbohydrates or fats. The ratio of C:N is always positive in the body, and only in the urine can it become occasionally negative, because the greater part of the carbon oxidized to CO_2 is excreted through respiration while the nitrogen is excreted through the urinary passages. Indeed the lightest representative of Group V, nitrogen in its bound form, is always very convertible and very accessible to reduction and oxidation, but the affinity for hydrogen predominates distinctly and it cannot approximate carbon with its central position either in respect to the lightness of the H and O compounds or in the capacity for combination with itself.

The utilization of elementary nitrogen is also impossible for green plants and the derivation of simply bound nitrogen from mineral is made difficult by its inaccessibility (NO is formed through atmospheric discharges and is carried to the earth with rain; ammonium chloride is formed in traces in the lithosphere and ammonia may arise out of the decomposition of organic material). Here of assistance are the lower organisms, the bacteria which are able to carry out the inert nitrogen to NH_3 unions. The plant protein on which the animal organism lives likewise for the most part has the presumption of a preliminary work of other organisms. And where the slow work of nitrification of the soil bacteria is not sufficient to cover the requirement for bound nitrogen, there the artificial nitrogen synthesis occurs as a supplement. Reversely, through the life of higher organisms and also many lower organisms, a part of the bound nitrogen again becomes free and with it life on earth is again lost.

Plants can at least utilize the oxidized nitrogen in the NO_3 form through reduction while this is not possible to any great extent in animals; it is found already reduced in plants in the amino form ($-NH_2$) of reduced nitrogen.

So to animal metabolism the mineral nitrogen, as well as the ammonium and the nitrate form, remains essentially foreign. But both forms have their actions on the organisms which make them poisons and drugs. The regulatory equimolecular mass action of the ammonium cations at the end of the metabolic processes, when it is involved, spares the fixed alkalies in the neutralization of excessive acid excretion, but still is not to be imitated medically. But on the way to detoxification to urea, NH_3 or the cation NH_4 unfolds

irritant actions which can be used medically, and the nitrate form goes through the body without a trace. However, according to all appearances, they also do not remain entirely untouched. The animal organism obviously shows a residue of reduction ability for nitrates, for example, through the enzyme of milk (perihydridase) or the tissues (xanthinoxydase) it reduces nitrates to nitrites, nitrates becoming hydrogen acceptors. This more or less rapid passage into nitrites from the various nitrates occurs distinctly in the medicinal action of these preparations (nitroglycerine, alkali nitrates, nitric acid).

THE METABOLIC OR COMBUSTION ELEMENTS

While the four basic elements discussed compose the energy spending organic combustion material, we now pass to four other elements which to a certain extent represent the combustion apparatus in this burning process in vertebrate organisms, *phosphorus, sulphur, iron* and *iodine.* They can be designated as *combustion elements* in contradistinction to the organic basic elements. I know of nothing better to employ for an example than the match with wood as the burning material, phosphorus and sulphur as easily inflammable acceptors of oxygen which is made available by potassium chlorate. Phosphorus and sulphur are also biologic intermediators; the carrier of oxygen in the vertebrate organism is iron. And the regulator of this combustion system—in the match the release of the necessary warmth is brought about by rubbing—is represented in the animal organism by iodine.

In contradistinction to the crude example from daily life, the biologic combustion mechanism proceeds entirely on an interlocking and fine harmony through

complicated chemical circuits so that for this process a labile dynamic equilibrium is also maintained. Therefore no extreme temperatures need appear. Of the interlocking of enzymatic and nervous regulation we need not speak in this connection. The sulphur containing building stone appears in all proteins down to peptones and protamines, and phosphorus in nucleoproteins and many lipoids. Iron and iodine fulfill their tasks in special organic compounds (hemin and thyroxin). There must be ascribed to each of these four materials a special physiologic rôle in metabolism. Because of the manner in which they normally regulate organic chemistry, we also recognize their paths of disturbance in metabolism. And as always we are forced to a *general supposition of an artificial regulation: that the disturbance circle of a material also shows orderliness;* a supposition which is expressed in physiologic materials as follows: the medicinal action of a substance natural to the body presumes a disarrangement in the physiologic functions and paths of this material. When we repeatedly enter into the possibility of medicinal action of these physiologic materials, then it is always seen that these irregularities or regulations are in no way dependent on quantitative proportions, on excess or defect, but that the local and temporal shiftings and the state of alteration are just as significant.

The four "metabolic" substances which we designate as combustion elements have entirely different functions in the preparation of the cells for oxygen intake and in the intermediation for oxygen itself, but common to them is the fact that they are originally and basically involved in dissimilation. *They influence the body constitution from the metabolic side and here the rela-*

tion to oxygen and to oxidation is decisive. The position of these four metabolic elements in the periodic system of element is certainly not inappropriate for their task. We see sulphur, phosphorus and iodine as anion formers, as representatives of Groups V, VI, VII and iron which may vary between cation and anion building, as the representative of the accessory Group VIII, the heavy metals which serve in the special capacity of a catalysor.

THE TONIC ELEMENTS

On the other side of the periodic system, in Groups I and II, we find again four physiologic elements, sodium, potassium, magnesium and calcium, with an entirely different function. We designate them as *tension elements, as tonic elements. These four substances also have a common labor.* As builders of cations they work together in order to guarantee the state of organic material, as structures on which the living processes play. As they are physiologic, that is, destined for the maintenance of labile equilibrium powers, their electrochemical and electrophysical reactions are reversible to a high degree, while the cations of higher (for example 3) valence and higher atomic weight have few or no reversible actions. Through their positive charges the four physiologic cations are the counterbalance to the anions (HCO_3, HPO_4, SO_4) which are constantly arising from metabolism and which moreover through another anion, chloride, are held in equilibrium and regulated. The tonic work of the cations represents the limit, because tension depends upon limit. The relation of differentiated organic materials to their milieu, for the most part water, underlies the regulation through the electrolytes in general. And this is brought about

in that they owe the electric discharge of atoms or atom complices to ions by separation by water. Their reciprocal relation to water makes it possible to create tensions and to balance them. And of the electrolytes the anions necessarily furnished in the course of life, in turn, are dependent upon other types of intermediary processes giving their counterbalances, *the cation, the independent, indeed, the controlling rôle in the regulation of tension in and on the cells.* The action of the charged ions proceeds on the surface of the body colloids. Colloids are proteins or better said—the organic structures are in a colloidal state as proteins, and, in consequence to the size of their molecules, not in a true solution in water. But thereby the relation of a colloid to water is decisive for its *maintenance* in a colloidal state. Colloids can incorporate and bind (hydration) water in their molecular complex; they can swell or shrink remarkably and owe their stability chiefly to their adaptability to their milieu, especially to water. One calls them *lyophile* or, since the swelling agent is generally water, *hydrophile* colloids. *Hydrophobe* colloids, on the other hand, maintaining their molecular complexes in a colloidal state independently of water, owe their stability to strong electric charges. We will encounter them especially in the metals, which in finest subdivision (high dispersion) with a distributing medium (dispergen) furnish the so-called metal sols. In the organism the hydrophobe colloids are rare (cholesterin, etc.). They are precipitated by ions of opposite charge (Hardy's rule). Indeed the hydrophile colloids also carry an electric charge but the relation to water is decisive for the state of aggregation—whether as fluids or "sols," semi-fluid or "gels," or as solids, coagulated. But the electrolytes act on

the hydrophile colloids through loading or unloading, they influence the state of swelling and the surface tension. Now since most of the hydrophile colloids of the organism have a negative charge so the carriers of a positive charge, the cations, come to have an important rôle in influencing the colloidal cellular constituents. The actions of these physiologic cations can be best read off from the state of swelling and tension of the organic structure. *Na, K, Mg, Ca are the elements which primarily control the constitution of organic structure, indeed the organism, from the structural side and thereby is the relation of organic materials (proteins and lipoids) to water of special significance.* One can also designate these tension elements as form-determining elements.

ION ANTAGONISM

Within this common labor again each of the four cations has its special task. This becomes gradually and partly accessible to our knowledge through the alterations in colloids, cells, or organs, which we observe in one-sided disturbances of ion equilibrium. *One must avoid rash generalizing on the equal or opposing relation of ions from single effects on the total way of action of these ions.* This is frequently noted in regard to the cations and thereby much error has entered this scientific field. This holds especially for the apparent general antagonism of potassium and calcium, which is paralleled by the antagonism of the vagus and sympathetic. We shall see later that this hypothesis is not sufficiently justified. Indeed we will observe opposing effects many times within cation interrelationship entirely synergistic, whereas, when two cations as potassium and calcium or magnesium and cal-

cium neutralize the effect of each, this is characteristic only for the usual effect. On this account one should not speak universally of antagonism. Closely related ions which follow as chemical elements in allied groups, as potassium and sodium, magnesium and calcium may appear as exactly similarly working agents for many purposes, but in respect to other actions their effects are not additive but subtractive and they seem then to be antidotal.

For this there is a simple physical and chemical example: cations as Na, K, Ca each increase by themselves the surface tension of lecithin solutions. But if sodium and potassium or sodium and calcium are employed at the same time in definite proportions, then the surface tension of lecithin remains unchanged (Neuschloss). Another example: cane sugar splitting through invertase becomes prolonged as much when one employs a magnesium salt as when he adds a calcium salt by itself; indeed the calcium salt acts stronger than the magnesium salt. But if one adds the two at the same time and in the same concentration, the one completely removes the depressing influence of the other.

From this one sees that an antagonism in effect can appear, when to judge according to the individual effects of two agents, a synergism, an addition of actions, would be expected; and this, even in a simple reaction mixture. But with increasing complication the possibility of reversal or removal of equal single effects becomes correspondingly complex. In a reactive substrate so many-sided as a cell, an organ, and an organism—where all processes strive to a state of equilibrium, of self-maintenance—the possibility of balancing of and by itself with equally directed powers is completely beyond the limits with drugs. The narcotic cell action of magnesium ions can be removed with calcium ions. But it would be false on this account to ascribe a

universally cell-stimulating action to calcium ions. It is exactly the task to study the conditions under which individually similar or opposing effects can occur through the ions.

For the influence of cations on the state of body colloids one must always proceed from their physiologic equilibrium in the body fluids. *The optimal concentrations of the vital ions in the fluids perfusing the cells of plants and animals correspond in a remarkable way to that of sea water.* One can take this correspondence exactly as a basic fact of the telluric confederacy of the biosphere. Further details, as the corresponding distribution of sodium and potassium between the fluid and colloidal parts of the earth and body, are also available. The individuality which is demonstrated through the enrichment of definite ions in the various organs and organ systems allows many deductive conclusions on the rôle of single types of ions.

COLLOIDAL ACTION OF IONS

The reverse experimental way to demonstration of the action of single ions goes laboriously from one station to another. The point of departure is the influence of ions on the colloid state in general which goes back to the charges and valences of the ions. The influence of swelling of the colloids goes parallel with their water combining (hydration), and this again is dependent on the nuclear charge and the atom radius (Fajans). For the cations in alkaline reaction as they are found in the body fluids, the following series of effect on swelling or flocculation of hydrophile colloids can be arranged: Li< Na< K< Rb< Cs< Mg< Ca, whereby from left to right the swelling to shrinking or flocculating action of single cations is designated. This so-called *Hof-*

meister series or *lyotrope series* also proceeds in harmony with the ordinal number.

Proceeding from this basic series of general colloid effects of the cations by many experimental alterations one has demonstrated the influence on definite organ cells. From the position of the cations which are given in the form of the so-called *transition series,* the preferable action of this or that cation on the definite organ or function can be read off under certain conditions. (The same holds for the anions, only for reasons already mentioned, the influence of the body colloids through the cations is of greater significance.) What is worthwhile for a knowledge of effects of single cations from these reports, will later be discussed in detail in regard to the single compounds.

Outside of the nuclear charge of the cation, the valence is of general significance for its colloid action, the divalent act damaging in much less concentration than the univalent, and the trivalent more than the divalent, so that they hardly come into consideration in physiologic relationships. In physiologic equilibrium these ratios of ion concentration of Na, K, Mg, and Ca come distinctly into expression. In the serum Na: K: Mg: Ca approximately as 100: 1.7: 1.0: 0.5. Moreover, for the interpretation of experimental findings these quantitative ratios are to be regarded seriously. If, for example, the disturbing action in a one-sided increase one time of potassium ions, at another time of calcium ions is to be compared, then correct conclusions are to be drawn only in case the concentration increases occur each time in the physiologic ratio of K: Ca. If, in order to ascertain calcium actions, one would increase the calcium ions just as much as in the corresponding potassium study, then the results would not

be comparable. Because with a nonproportionate overdose of calcium a reversal of effect may appear. The consideration of these quantitative relationships is important whereby a premature one-sided conclusion on cation influences (for example, vagus or sympathetic stimulation) is avoided.

The damaging action of a definite ion excess on the living cells and tissues occurs apparently in that the normal permeability ratio of the plasma envelope is altered. The ions themselves are able to influence the conditions of their permeability. The normal task of ions—which is to guarantee the structure, and thereby the function of the cells, through tension differences (potential differences) on the surface—is to a great extent dependent upon the fact that *the ions are distributed correctly at their sites.* The "inside" or "outside," the direction of the stream between the colloid and watery phase, is just as important for ion action as the quantitative ratios. Site of action and quantity can influence in opposing directions. Frequently the reversal of a false direction of the stream is decisive for the regulation, and for this it needs no greater amounts than are employed in the isolated organ. Here a central regulation through the vegetative nerves can be easily demonstrated.

CHLORINE

Likewise the already mentioned *chlorine,* Cl, is vital as an anion. United with Na as a neutral salt, it participates in the regulation of water movement. Moreover, chlorine is an ever-available, easily movable reserve which can exchange itself for the anions occurring in metabolism and therefore markedly varies. Through this, chlorine is a regulatory factor in acid-

base equilibrium on the side of the anions. It can also separate from sodium, for example as HCl in the gastric juice, introducing a decided change in the pH, which forms an optimum for a partial process in digestion. As chlorine intervenes in a regulatory manner in the dissimilative part of metabolism, so it can condition disturbances there. In this sense the chlorine fraction can become valuable in medicinal materials.

SILICIUM AND THE RARE STRUCTURAL MATERIALS

Finally silicium, Si, in its dioxide, the anhydride of silicic acid, SiO_2, is a substance regularly appearing in the organism. SiO_2 has its position and work especially in the connective tissue. As negatively charged colloids which can incorporate water are hydrophile, it is the opposite to the characteristic function carriers of the organism, in any case for negatively charged hydrophile organic colloids. This rôle in the organism forms the basis for the medicinal activity of SiO_2 when it is made available in a suitable form. Then too, in its actions, it stands very close to the mineral carbon compounds from the same group of the periodic system.

These fourteen elements are the essential participants in the structure of the human organism. Indeed *fluorine*, F, also plays a rôle in its firm calcium compound in the bones and teeth; perhaps similarly traces of *bromine*, Br, a neighbor of iodine, but still with its own physiologic task; perhaps there will also be discovered a physiologic significance for *aluminum*, Al, in the animal organism as in the plant world; but the fourteen elements discussed remain the basic materials, the essential structural elements of the vertebrate organism.

With these elements we find ourselves at the limit of

the cosmic and telluric weight frequency rule. One distinct exception is made by iodine as the sole representative of the fifth period. Its important task in the biosphere is counted in terms of minimal quantities, which are measured in millionths of a gram.

That a general similarity in the composition between the earth crust and organism exists is, indeed, not remarkable. Materially considered, the organism is to a certain extent an outgrowth of the earth crust. But the selection among the elements and particularly their relative amounts shows a distinct and characteristic difference, an increasing differentiation from the inorganic milieu through the series of organisms.

CONSTITUTIONAL AGENTS AND STRUCTURAL ELEMENTS

We have recognized the physiologic materials as *drugs* of a special rank of constitutional agents and cited the reasons for this. We now present the question: *in how far do the structural elements determine the character of the drugs formed by them as constitutional agents?* If we answer this: *through their position in the periodic system of elements,* then we presume a knowledge of the drug pictures of these physiologic materials. But it enlightens the survey if we draw the rough outline now.

On the electronegative side of the system in the Groups V, VI, VII and the accessory Group VIII we have found the structural elements which originally and decisively participate in chemical metabolism. *To these metabolic elements as medicinal substances the constitutions also correspond whereby the altered rhythm of the metabolic and energy exchange gives the impression.* When the splitting processes are increased, it is concerned *with an oxygenoid, warm, febrile tend-*

ing, erethistic constitution of accelerated rhythm. These persons are *hyperesthetic, easily irritable and thin.* From the endocrine side they correspond to an increased function of the glands associated with the sympathetic system under the leadership of the thyroid. They are *"basedowoid" types.* Iodine, chlorine (as a drug constituent), iron, nitrites and phosphorus show these trends distinctly. The position of sulphur on the other hand is dual, corresponding to its partly reducing, partly oxidizing functions in metabolism. In the sulphur constitution the stronger weight lies toward the side of oxidation depression, the incomplete oxidation.

On the electropositive side of the periodic system we found on the other hand in Groups I and II, the tonic, form-giving elements. *If the alkali and earthy alkali metals, Na, K, Mg, Ca, as cations determine the drug picture, then they shape it as hydrogenoid, cold, sensitive to cold, relaxed torpid lymphatic constitutional types stigmatized along the side of the parasympathetic system.* Seen from an endocrine side, they tend toward the *hypothyroid* side, the function of the *lymphocytic* apparatus (thymus) is increased. The neuromuscular tension is altered in such a way that they show a generally prolonged way of reaction with paroxysmal discharges, tetanoid states.

Between these two chief directions stands silicium with the closely related mineralic carbon compounds in the middle as the amphoteric Group IV of the periodic system. These materials act as negatively charged colloids foreign to the body. *They impede chemical metabolism,* assimilation as well as dissimilation. Where silicium is form-giving, cell function is reduced to a minimum. The drug picture of these materials represents *constitutional types which, to some*

extent but not universally, correspond to the carbonitrogenous constitution of Grauvogl. Defective metabolic exchange with the outer world, primarily failure of skin and intestinal function (in carbo vegetablis and animalis, especially defective gas exchange), and on this basis of stagnation, *tendency to suppuration and septic processes* characterize the special constitution picture when it can only imperfectly correct common assaults. The anoxybiotic metabolism seems to be predominant over the oxidative; thereby this drug picture seems to hang together with the *tendency to carcinoma.* Arthritism, venosity, carbonitrogenous constitution fit this type only in a limited way. Much more the conception applies to the sulphur type in which imperfect oxidation is a basic item.

The structural elements and their physiologic rôles are the milestones for enlightening the orientation in the vast field of medicinal actions. From them we proceed with advantage when we peruse the materia medica *according to the single groups of the periodic system.* Thereby we will discover and ever again confirm that the natural affinities of the elements also come to expression in activity on the human organism even when the elements themselves, in the medicinal substances, are followed out as independent energy carriers with definite actions. The consideration on the basis of the periodic system has proven itself very fruitful for the understanding of drug-effect pictures. If it is correct that homeopathy with its subtle method, with its inclusion of drug proving on the healthy, can actually improve our knowledge of the actions of materials on the organism so it will also be shown that such a materia medica can discover the natural order

of substances better than a methodically imperfect pharmacology.

NATURAL AND FOREIGN ELEMENTS IN THE SEVEN CHIEF GROUPS

If the group members of the physiologic elements are able to suppress their chemical neighbors from their functional sites (for example bromine by chlorine, barium by calcium), then this reveals most distinctly *how restricted the sphere of action of the material foreign to the organism is in comparison to the natural substances.* With the narrow range within which the functions are held in equilibrium, damages from these foreign substances arise easily and more distinctly in case these substances enter into intermediary reciprocal actions. The greater the distance is from the normal structural materials and the easier such materials are able to appear in reciprocal actions with the power systems of the organisms, the more toxic they are. For individual foreign elements it is entirely individual to what extent they add or subtract to the influence of these two conditions. The ease with which they enter into reciprocal actions with the organism is, indeed, not only a qualitative matter, a chemical affinity, but is determined to a high degree by the state of form of the substance and then also by site of application. So for example mercury, Hg, and lead, Pb, have a high toxicity by virtue of their capacity for penetration under ordinary conditions while gold, Au, and platinum, Pt, show their toxicity only after special preparation and a special mode of application.

From the position of the elements in the periodic system, the classification of the medicinal substance for the seven vertical groups is yielded without further

discussion. It is advantageous to proceed from the structural element in each group, and then study group members themselves in their similarities and characteristics. But the group relationships do not lie so simply in the accessory groups of the periodic system.

THE RELATIONSHIPS IN THE ACCESSORY GROUPS

The accessory Groups Ia to VIIa with their center which is designated as VIII we may consider in a great class as *heavy metals.* But here the elementary affinities no longer follow the strict lawfulness of the chief groups. In the last we have seen that their affinities rest on the equality in chemical valences, that is, on the number of electrons in the outermost track of electrons. This division-grouping principle, however, fails decidedly in the accessory group. Its elements vary markedly in their valences; one element frequently has different valences in the same direction as is true of ferrous-ferric mercuric and mercurous compounds, among others. This signifies that chemical affinity in the vertical series has less significance. For this an approximation of these elements comes into expression in their horizontal series. If we accept the progressive development of the elements from hydrogen to uranium over an infinite period of time, then in the younger generations of material, once between the chief Groups IV and V in the fourth horizontal period, a sister group of elements existed. The cleft which yawns between Groups IV and V is filled out with ten elements per period. The narrower, to some extent, the distance between the elements therein included, the closer they approach each other in their physical structural properties. *The chemical valence affinities are less but the physical and nuclear affinities more significant.* We can call this affinity

with an analogous biologic appellation, which naturally needs to serve only as an example, a sisterly relationship, and designate the chief group in this comparison with a genealogic tree as the ancestral series. In this respect if we have a still closer sister affinity in the latter inclusion of fourteen rare earths, still they stand even closer in their physical-chemical properties. The elements of this sister group have not attained medical significance, unless in the case of cerium, at least up to the present. Therefore they need not be considered in detail. Finally there is another internal physical relationship in the periodic system, namely, that of the final, radioactive elements. In these elements with highest atomic weight we can observe a fragment of change in form of material qualities in the proportionately brief time given to man. Naturally, however, of the change we perceive only the retrogressive phase of decomposition of elements of high atomic weight which convert themselves through the extrusion of nuclear charges into elements of lower weight. In this horizontal series we have at present before us to a certain extent only element variations whose change is the source of the well-known physical radiant actions. This is a field so large and independent that an extensive treatment can find no place within the limits of this materia medica. If we would designate the horizontal members of the radioactive elements also as the first order, then the rare earths would be the second order and the heavy metals which have outstanding interest for us would be the horizontal third group.

In the accessory Group VIII one finds a special compression of elements. This place which otherwise is filled by one element contains three elements in each period, Fe, Co, Ni, then Ru, Rh, Pd and finally Os, Ir,

Pt. These *triads* are more closely related to each other on the basis of horizontal membership than is otherwise the case with heavy metals.

HEAVY METAL CATALYSIS

From the accessory group, *iron* is the sole element which has an important physiologic rôle in the vertebrate organism. Therefore we will go out from it in the discussion of the accessory group and thereby also discover at the same time the drug pictures of the vertical and horizontal members of elements. Now it is significant that iron acts physiologically as a *catalyzer*. Catalysis means nothing else than that the presence of minimal traces of the substance is sufficient to bring into existence or accelerate a chemical reaction, and under certain conditions also to depress it. Thereby the catalyzers do not appear in the end-products of the reaction, they are not used up, but are only intermediators. This catalytic property we will constantly encounter in other heavy metals in a highly dispersed state, in a colloidal state, and in ionic form, and understand their medicinal actions by it. In the test tube as well as in chemical technic one employs many heavy metals as catalyzers or "inorganic" ferments as Bredig calls them. This capacity is known on living objects as the so-called *oligodynamic action* from the work of Naegeli. It is concerned with traces of metals which still in an amount of 10^{-7} — 10^{-8} (7th and 8th decimal potencies) still act damaging on lower organisms. The same catalytic properties have been used by Walbum in his experimental metal salt therapy. He sought to utilize the catalytic stimulation on living reactions so that only the defense reactions of the organism concerned were increased or ac-

celerated, for example, antitoxin formation. Therein he succeeded with slight concentrations which actually belong to the domain of high potencies of homeopathy.

Metal catalysis is a surface action, a so-called adsorption catalysis. It is favored through increase of the surface, also by the uttermost subdivision. And that this subdivision of the elements of the accessory group can be carried so far, without the particles losing their independence, *depends upon their small atom volumes with high atomic weights.* Their atoms are very small in comparison with their charges, the power of electric attraction from the nucleus out is great. They hold their several positive charges very firmly; their tendency to dissociation, to the formation of free ions, is slight. Here they stand in strongest contrast to the alkali metals which have the largest atom volume, distended atoms, with slight attraction to the nucleus for which reason they easily give off the outer electron and dissociate free ions. Also the halogens of Group VII still have a fairly large atom volume and slight independence. The small atom volume of the heavy metals is an important expression of their nuclear structure and the common properties of this accessory group. Likewise this small atom volume has been replete with significance geochemically for the deposition of the metalogenous elements in the earth.

The strongly charged, relatively small atoms of heavy metals adapt them very well as drugs, through their catalytic properties when the necessary dispersion is given. Because medicinal actions in the sense of stimulation of reactions the exciter is not used up, has a great similarity to catalysis. But on the other side the chemical mass action of the heavy metals is less suitable for a stimulation effect. Because the firm-

ness with which the heavy metals attract and chemically bind other atoms in their vicinity leads easily to irreversible reactions which are incompatible with the dynamic equilibrium of vital processes. So far as a chemical energy exchange with the organic structure occurs, the poison threshold for the heavy metals is low. Also with these unnatural materials it constantly depends upon the conditions (amount, state of form, local and temporal circumstances) whether they will be poisonous or promoting to the organism.

The accessory group are indeed a special class among the elements but they show distinct transition to the chief groups. With the increase in the atomic weight, the metallic character increases also in the chief groups of the electronegative side, so that bismuth is entirely designated as a heavy metal. So horizontal membership on the basis of nuclear structure also passes over into the neighboring chief groups. This can also be followed in the drug pictures.

MODIFICATIONS AND COMPOUNDS OF THE ELEMENTS

We have up to the present looked at the elements as the ultimate carriers of material properties and have found in their natural order, the periodic system, an accessible point of departure and a good guide through the properties of the mineral materials, as must come into evidence in their action upon the organism. But our mineral medicinal substances are for the most part not simple elements, but *combinations* of two or more elements. And even if this is concerned only with a quality of substances, still the action on the organism is by no means unequivocally determined. Of the complicated conditions which the organism presents to the medicinal substance, nothing need be said here. But

of the influence which the position of a molecule of an elementary substance has, is shown by the *modification* of the same substance; one need only think of the yellow and red phosphorus.

In compounds of two or more elements there is a new power system. *But it is still permissible to evaluate the actions of elementary powers within the new structure through comparative consideration.* So in one salt the cation, in another, the anion will be recognized as the chief carrier of medicinal effect, and in another salt the accent will be equally placed. Under the simple conditions of the test tube this is, for example, nothing else than the relation of the salt to water. Only the physicochemical analysis of elementary actions under the extremely complicated reaction conditions of the organism is more often a conjecture than an absolutely certain determination. In the following presentation, the drug picture of the compounds will be arranged where it seems best from these reflections and from didactic reasons.

An anticipation and a postponement in the discussion cannot be avoided for the reason that many elements cannot be discussed in their relation to the organism without taking other natural elements or compounds into consideration, for example, calcium not without phosphates.

ARRANGEMENT

Finally the periodic system of elements is not a simple series but a system of groups. For this reason it is somewhat arbitrary with which group we begin. If we begin with Group I, then it would not be so suitable if we discuss schematically the groups according to the series. It is much better after discussing Groups I

and II which contain the essential cation formers, to go over to Groups VII, VI, and V which contain the chief anion formers. In this way we obtain more rapidly a survey of the electrolytes whose constituents have the least independence and require an opposite supplementation. We find a common basis of explanation for these compounds in the theory of ions. After the short third group, then the amphoteric Group IV follows in which the analysis of actions leads to colloidochemical considerations. A few lower carbon derivatives form an appendix to this.

Finally will the accessory groups as a composite class be discussed after the above represented mutual and arranging viewpoint is presented.

1. THE GROUP I ALKALIES

The alkali metals act as the univalent cations of salts in the lithosphere as well as in the organism. The elements as such have very slight existence as individuals. In air as well as in water they immediately undergo alterations; their electro-positive tendency, the giving off of the outer electrons, goes so far that they decompose water with the production of much heat. In their compounds they dissociate very extensively and they are easily convertible and have a wide range of reaction. This is associated with *their great atom volume*; because the attraction of the outermost electron is so much the less, the greater the relative diameter of the atom. Lithium with the smallest atom volume falls far behind the other alkali metals in respect to free movability and breadth of reaction.

Our consideration can be restricted to the first three members of the group, lithium, Li, sodium, Na, and potassium, K, because rubidium, Rb, caesium, Cs, have neither physiologic nor pharmacologic significance as yet. Of the first three, lithium is not vital to life and is a very much less reactive element than sodium or potassium.

In order to obtain the most comparative picture, we can proceed best from the carbonates of these elements: Li_2CO_3, lithium carbonate, Na_2CO_3, sodium carbonate or soda, and K_2CO_3, potassium carbonate or potash. Here we have the prospect of finding most purely the

characteristic trends of the alkali constituent. The carbonate compounds react alkaline, that is, in the dissociation in water, free OH ions predominate. Taking K_2CO_3 as an example, the dissociation in water occurs according to the formula: $K_2CO_3 + H_2O \rightleftarrows KOH + KHCO_3$. So the alkaline reaction remains as the common factor or the working tendency of the alkaline carbonates.

Sodium and potassium are by far the most important members of this group, in the circulation in the earth as in the organism. The sodium and potassium salts are developed through hydrolytic decomposition from the stones of the lithosphere. Sodium, bound in sodium chloride, is found for the most part in the sea. On the other hand, potassium becomes adsorbed for the most part to colloidal aluminum particles in humus and from there enters into plants. In about equal total amounts (about 2.4 per cent of the earth surface) *sodium and potassium separate even in the earth surface through their affinity to the fluid or colloidal fractions. Similarly in the organism of higher animals sodium and potassium appear in about equal amounts and the same manner of partition between the fluid and colloidal phases is followed.* In this case no apparent differentiation through selection has occurred from earth to man. Such examples of the universal task of elements in all natural structures, on the basis of their properties, make likely analogy considerations on the microcosm and macrocosm which were so often used deductively in pronounced ways in the prescientific age, even if with fantastic elaboration. The significance of alkali cations for water regulation, for the acid-base equilibrium and the colloid state of the organism has been discussed in general in the preliminary survey.

Besides sodium and potassium, lithium plays a small rôle in the earth as a companion, particularly, of sodium. As such it will also be found in the organism without one being able to ascribe any individual action to it at present.

We shall add also to the alkalies ammonium, which, as the ammonium cation, NH^{+}_{4}, behaves as a single atomic alkali cation. And to the ammonium alkali we shall count the preparation causticum which is peculiar to homeopathy.

POTASSIUM

Potassium is one of the most important elements in the cell economy, but our detailed knowledge does not extend sufficiently far for us completely to understand its significance. Quantitative estimation is very difficult because it belongs primarily to the colloidal interior of the cells. We do not know how much potassium is fixed in the cells nor in what state it exists.

The two to three grams of potassium which are brought to the human organism daily from plants does not state anything about how much active potassium is brought to the various places and what is excreted as inactive potassium, the reason being that there exists an internal potassium circulation so that what is used at one place can again be used at another.

RADIOACTIVITY

Potassium has a property which is not known of any other constituent of the organism. As Campbell discovered in 1907, *potassium is radioactive,* it sends out beta-particles, rapidly moving electrons. Possibly the radioactivity of potassium plays a rôle in the catalytic

excitation of cell life as H. Zwaardemaker[1] has suggested. Through beta-radiation, energy should be furnished which maintains the automatism of the heart and smooth muscles, in which apparently no caloric energy is given off. A heart which has ceased to beat in a potassium-free Ringer's solution can be brought again to beating regularly through the radiant equivalent of uranium, thorium, or rubidium, and also through alpha-radiation from radium and polonium.[2]

That it is exactly with potassium and its neighbors, rubidium and caesium, that beta-radiation is observed, may well be associated with the great volumes of these atoms. The slight attraction of the negative charge unit, the electron, to the nuclear center can make freedom and radiation of independent electrons possible, and these are beta-particles.

COLLOID AND CELL ACTION

The univalent cations agree in that in general they favor the swelling of colloids and reversely their power of precipitation is the least. The above-mentioned lyotropic series gives particulars on this. Through the promotion of swelling the univalent cations may ease the entrance and exit of salts and foreign substances from water through the plasma membrane; therefore they stand in contrast to the chief representative of the earthy alkalies, calcium, which is characterized by its caulking action.

Now the action of alkali ions on the cells does not proceed entirely parallel with that on colloids but, according to the cell substrate investigated, it shows *characteristic deviations of the so-called cytotropic or cytotoxic series of cations from the lyotropic series.*

With equal molecular concentration, also with equal

osmotic pressure—presuming weak hypotonia—hemolysis of the red blood cells through the various neutral alkaline salts occurs at different speeds. *The hemolyzing capacity* of the cations takes (according to Höber) the following series: Li, Na<Cs<Rb<K, that is *the most markedly with potassium.*

A first glance into the significance of cell-binding salts for the orientation of cell colloids to a definite state of swelling, which is different in single species of animals, can be gained from the following results: the blood corpuscles of a species of animals are so much more resistant to hemolysis with saponins, the less phosphoric acid and potassium they contain; on the other hand they are so much more resistant to hemolysis from hypotonia, the more phosphoric acid and potassium they contain. The saponin hemolysis will be favored so much more strongly through combination with potassium, the more phosphoric acid and potassium they contain as binding ions, and so much less, the less the blood corpuscle of a species contains of these ions.

MUSCLE

Still more important for a decision on potassium action are the *connections of potassium to muscle cells.* The great content of muscle cells in potassium shows from the start the great significance of potassium in muscle function. The potassium ions seem to possess a special significance for the production of the bioelectric current. The membrane theory of muscle function suggests that in the resting state, the plasma surface membrane is impermeable for potassium ions, but permeable for other ions. From this an electrical double layer results on the cell surface. By stimulation of the muscle a state of alteration of certain cell membrane colloids occurs and thereby an increase of permeability, particularly for potassium ions. On the other hand, the interior of the muscle cell seems free from

sodium ions. An important influence of sodium ions proceeds from the fluid bathing the intermediary substance.

The potassium salts are not able to give back irritability to a muscle which has lost it in an isotonic solution of cane sugar, while all sodium and lithium salts are able to do so. If one places fresh muscle in isotonic alkali chloride solution, it maintains its irritability longest in NaCl; then follow LiCl, CsCl, NH_4Cl, RbCl; and it is lost most rapidly in potassium chloride. For the impairment of muscle irritability one has also the following series of cations: $Na < Li < Cs < NH_4 < Rb < K$.

In this series the contrast of sodium and potassium in respect to muscle is expressed more distinctly. *The reduction of muscle irritability is apparently a special property of potassium* (the equally acting Rb is not of physiologic nor pharmacologic significance and is left out of consideration). According to Höber, this influence occurs through alteration of the colloid consistency of the plasma membrane and, indeed, through relaxation of the plasma membrane. *The removal of muscle irritability by potassium is reversible.* Parallel with it goes the influence of potassium salts on the muscle current. Biedermann[3] found that if one brings a place of uninjured, currentless frog muscle into contact with a potassium salt solution for a short time, a rest current of the same direction and electromotive power appears as in a partial destruction. The part of the muscle coming into contact with the potassium salt will be negative in respect to the remainder of the muscle and it will thereby produce a regular rest (cross-section current). If one washes off the salt producing the alteration, then the original state of the currentless

muscle is restored. The potassium salts bring the muscle into a state in which, if it is stimulated already, it cannot be stimulated further. Because the excitation, just as the potassium salt, produces a local and transient negativity of the muscle and at the same time brings the muscle into a state of nonexcitability. It is presumed that the excitation process running through a muscle is associated with a change in the state of colloids which is released through an electrolytic process within the muscle. The binding salts, particularly the K and HPO_4 ions, in any case here have the chief rôle.

The potassium ion is the chief carrier of positive charge on the inner limiting membrane. If through potassium ions from without, a migration of potassium ions is made possible, then the potential difference ceases and with it the irritability as long as this potassium influence from without is active. *The same ion whose presence within the interior of the muscle fibril is a pre-condition of irritability disturbs or removes this irritability by influence from without.* Apart from the influence of the quantity, the concentration, there is also a shifting of action indeed according to the site of influence. A defective potassium function can be conditioned just as well from too few ions *within* the sarcoplasm as by too many potassium ions *without* the sarcoplastic limiting layer. By what way, in such a disturbance of potassium balance in the muscle, a regulation follows from medicinal doses of potassium, we will obtain an explanation only when the significance of potassium ions for nerve irritability is better known. The same relations as in the muscle fibrils, in any case, seem to be present. According to MacDonald,[4] the destruction of a nerve is associated microchemically

with the liberation of large amounts of previously unrecognizable KCl at the place of injury. Furthermore, the cations reduce the irritability of nerves in the same series as they do muscle, here again sodium the least and potassium most strongly.

The influence of potassium ions on the cardiac musculature seems according to experiments available up to the present to correspond to that on skeletal muscles. If a frog heart, brought to a standstill through a Stannius ligature, is treated locally with KCl, then exactly as in a frog sartorius there appears a rest stream which again diminishes by washing off the KCl with Ringer's solution.[5]

HEART

The reduction of irritability or paralysis of the heart muscle through potassium has been confirmed by experiments on living frogs and rabbits. In order to obtain this necessarily slight increase of potassium-ion content of tissue fluid, in consequence to the rapid equalization capacity of the kidneys and transference to nonsensitive tissue cells, the potassium salt must be injected subcutaneously or intravenously. If the K_2O content in the blood increased from the normal 0.025–0.03 per cent to 0.07–0.08 per cent, then diastolic cardiac standstill occurs. On subcutaneous injection in frogs the pulse frequency sinks and again increases after some time. The blood becomes strongly carbonic-acid containing; the heart is darkly colored. That the cardiac action is conditioned primarily and not through a defect in oxygen can be proven through a study conducted in an oxygen atmosphere. The action occurs on the heart muscle alone, because it also occurs in the ganglion-free heart muscle. In rabbits one also observes

sinking of the pulse frequency and single momentary sudden standstill of the pulse curve.[6]

Potassium added alone to sodium chloride as a nutrient fluid of the heart prolongs the heart beat, reduces the tonus and leads finally to diastolic cardiac standstill. Potassium is here the outspoken antagonist to calcium.

Kolm and Pick[7] have shown that the potassium content of the blood and heart wall is one of the most important pre-conditions for the self-regulation of the heart. It proves that the influence of potassium on the various sections of the heart is different. One can recognize to some extent the *physiologic* function of potassium on the heart of cold-blooded animals.

They found:

(1) KCl stimulates stimulus production in the upper heart, which expresses itself in an increase of inotropy, at times also in chronotropy.

(2) $CaCl_2$ causes diastolic standstill in the heart washed free from potassium; the appearance of calcium contracture is bound to the presence of potassium in the heart.

(3) KCl depresses the tertiary centers of the automatically beating heart even in doses which are non-toxic for the heart as an entirety and which even stimulate the sinus and auricular activity; it is able to remove the excitation of the automatic ventricular centers set into stimulation by calcium and barium chloride.

(4) The capacity of potassium to release contracture of a heart which has been induced by calcium depends upon an increase of impulse which goes from the upper heart (sinus and auricle) to the ventricle found in preparation for contracture from calcium.

(5) On the automatically beating ventricle, potassium chloride is not able to conduct into contracture a heart which has been prepared for contracture by calcium chloride; much more a contracture induced by calcium or barium chloride in the auto-

matic beating ventricle will be released through the addition of KCl.

(6) Potassium salts are able to prevent fibrillation through increase in the nomotopic stimulus and depression of the tertiary ventricular centers.

The toxic actions of potassium are not observed in a resorption from the gastro-intestinal canal because a definite increase of the amount of potassium ions in the blood plasma is not able to take place in consequence to the equalization processes of the organism. But if symptoms have been observed from small doses of potassium salts which point toward an affinity to skeletal and cardiac muscle which was discovered experimentally much later, then it must be considered that the type and form of the preparation administered and furthermore a special potassium sensitivity must have been responsible for the symptoms. In order to disturb the potassium economy, it does not necessarily follow that the point of departure must be taken from an increase of concentration in the fluid perfusing the tissues, but it is possible that from especially fine subdivision the route may be entirely over the vegetative nervous system, that a catalytic-like disturbance of the potassium-ion potential occurs, particularly when there is already a labile equilibrium in this direction. The excitation of an accelerated potassium-ion wandering can act disturbing in the one case, regulating in another. In any case, observations free from objections made in homeopathic provings with potassium salts cannot be denied because the possibility of explanation available for the effects known from animal experimentation cannot be utilized at present. For the explanation of the mechanism of ion effects directly

upon the receptive cells, pharmacologic animal experiment can, however, offer a certain basis.

The influence of alkali salts on smooth muscle is of another type than upon striated muscle. Here the plasma-membrane resistance does not seem to exist with an elective permeability. Consequently, the potassium ion acts more strongly de-swelling, shortening and tonus increasing than does the sodium ion.

VAGUS

The influence of an increase of potassium from without on the skeletal muscle and cardiac musculature is equally tonus reducing, on the contrary in smooth muscle tonus increasing. If, now, one accepts the finding of Dufurdi[8] that the irritability of the vagus is increased through potassium salts, so it seems that this action can be connected with the action of potassium on the receptive organs as a vagus effect.

Zondek[9] found that enrichment of potassium in the nutrient fluid which is nourishing a frog heart acts as a vagus stimulus (calcium enrichment acts like a sympathetic stimulus). On the other side, vagus stimulation leads to intracellular potassium shifting (sympathetic stimulation leads to alterations of the calcium content of a cell). Between parasympathetics and potassium apparently exists a reciprocal relation such as we know exists between nerves and hormones. This relationship is represented best in the study of Loewi.[10] Accordingly, materials form in the isolated heart after stimulation of the parasympathetic nerves which again influence another heart in the same way. If a cold-blooded heart filled with Ringer's solution is faradically stimulated through the vagus, then the fluid which is obtained from the heart is able to bring about a vagus

effect in a normally beating heart. According to Loewi, the product formed through vagus stimulation naturally cannot be potassium because in his studies the action was removed by atropine which is not the case in increased potassium effect. At present we can only interpret the finding in that by a stimulation through a nerve to a muscle cell, the ion shifting thereby provoked is again able to evoke the same action as the nerve stimulation. *This activation of a mixture of ions through the vital process of nerve muscle excitation in this same direction* best enlightens us on the fineness of such reciprocal actions upon one another and makes the action of drugs in high dilution understandable when sensitivity exists, whether in a proving on the healthy, or in a "potassium patient." Would not the suitable potassium preparation succeed in stimulating through the medium of the vagal connections, and intervene in a vicious circle?

If one recalls that voluntary muscle also has a vegetative innervation on which its tonus is dependent, then one can consider how it is possible to regulate the potassium balance between the inside and outside of the muscle fibrils by the vegetative nerves, and thereby the tonus through potassium as a remedial agent.

Placing potassium and the vagus parallel need not be overstretched as has occurred in the counterbalancing of the relations of K:Ca as the vagus: sympathetic by S. G. Zondek. Indeed, in general, a potassium preponderance corresponds to increased vagus influence and it is also very probable that the tonic action of potassium intermediates and regulates via the vagus. But, for example, the influence of potassium and calcium ions in the regulation of the heart does not agree throughout with the functions of the vagus and sympa-

thetic. While the vagus depresses all parts of the heart from the sinus node to the ventricle, potassium stimulates the upper part of the heart.

WATER ECONOMY

The diuretic action of large amounts of salt in the healthy, which is opposite to the effect in patients with damaged capillaries, need not be considered in detail here. There it is merely concerned with an osmotic equalization which has nothing to do with special affinities of the single ions. Of most significance is that potassium acetate is especially useful as a diuretic because potassium carbonate which arises out of it in the organism diffuses less than, for example, sodium chloride.

Like all alkali ions potassium draws water to the place where it is richest itself. With increased administration in the blood by an addition in substance, that is, hypertonic solution, hydremia is the result. But how long this persists depends upon the excretory capacity of the salt concerned. In general, the potassium ion is just as permeable as sodium ions for healthy kidneys, so that equalization rapidly ensues. But isotonia can also be restored through the excretion of other salts and it may result in enrichment of potassium ions in special places, indeed, according to the permeability conditions of single types of cells for this or other ions. So a relative preponderance of potassium ions, for example in the subcutaneous tissues, will provoke a local edema. One likewise knows of such alkali edemas from sodium salts.

KALIUM CARBONICUM

The drug picture of kali carb. is based chiefly upon the results of provings in Hahnemann's "Chronic Diseases," 2nd ed., vol. 4, p. 1, 1838.

CONSTITUTION

The kali carbonicum constitution is characterized *through chilliness, weak circulation, weakness and relaxation of muscles and tendency to edema.* The vegetative symptoms correspond in general to an increased excitation of the parasympathetic nervous system, the so-called *vagotonia.* The rapid physical and mental exhaustion is combined with irritability.

Kali carbonicum belongs to the *cold* remedies which seems to be characteristic for all compounds with cation preponderance. The kali carb. patient is especially *sensitive to cold,* perceives the slightest draft, seeks the warm room. He feels the cold to a certain extent in the nerves, they pain in the cold. He also complains about cold in single parts, especially neuralgias which shoot here and there with pain *in the cold parts; by the application of heat they move to other parts.* In general, *the pains rapidly change location.* Cold sweats appear on the involved parts and there is profuse general sweating on slight provocation. Here we can well recall the sweating of the vagotonics. The sweat glands are indeed innervated by the parasympathetic. This is worthy of consideration in the type of sweating in the kali carb. picture. Especially frequently observed is *the partial sweat,* for example on the back *with the lumbar and sacral weakness so characteristic for* kali carb. and with *the associated sticking pains,* or on the forehead with headaches. The head is sensitive to cold: headache on walking in cold wind, desire to cover the head outside of warm rooms, headache on forced inspiration through the nose with burning pain in the region of the frontal sinus. In cold winds the nose opens, dries and burns and headache develops. On re-

entering a warm room the nasal secretion from nasal and postnasal catarrh recurs and the headache ceases and the patient feels better. Just as the pains, so also should the head neuralgias be conditioned by the cessation of nasal secretion in the cold. Feeling of cold also is felt in the auditory passages, "as though cold air blows in."

The complaints of pharyngitis, in particular the feeling of a splinter becomes worse from cold. The gastric symptoms are worse from cold drinks. A cold sensation is reported in the abdomen, colic with feeling of cold, better from warm applications: a feeling of cold also in the breast; coldness of the extremities. The kali carb. patients are easily chilled, better in warm climates.

The chilliness is worse at evening, before the menses, after exertion, in the open air, after eating. There may be internal heat with external chilliness. The profuse sweatings are worse on eating, from warm food, from mental exertion and writing, from mild bodily exertion.

CIRCULATORY WEAKNESS

The circulatory weakness contributes especially to the great sensitivity toward cold. The extremities are not only somewhat easily chilled but also easily become numb, especially on crossing the legs; also painfulness of the tips of the fingers and toes, sensitivity of the soles of the feet belong here. *The skin is cold, pale and puffy.* Whether the tendency to edema is conditioned centrally through the influence of the heart or depends upon local tissue effect (alkali edema), one cannot always decide. The sacs extolled by Bönnighausen in the drug picture of kali carb., small bag-like swelling between the eyebrows and the upper lids, give the impression of a locally conditioned edema. On the contrary,

the edematous state in old people obviously infers a failure of the heart muscle.

The puffy face in young girls is frequently significant of an anemia and, together with diverse types of menstrual disturbances, is taken as a kali carb. indication. Although the great potassium content of the red blood cells and their easy hemolysis through potassium could afford a biologic proof, the connection to actual anemia for kali carb. is still insufficiently supported.

Perhaps dependent upon the circulatory weakness is the sleepiness after eating, as well as sleepiness at meal time, from the slightest mental exertion; further, a state of exhaustion as exists after severe prolonged illness, loss of blood or loss of other body fluids, after marked seminal depletion, during and after the menses, combined with a weak pulse and pulsations over the entire body. Generally holding is *an aggravation of the complaint after coitus.* To be mentioned here are *the asthenopic complaints* after sexual excesses.

The mental attitude of the kali carb. patient is anxious, disheartened, fear of everything, of fantasies elaborated by himself, of everything possible which threatens him. This state so full of anxiety and fantasies we know indeed of patients with cardiac muscle weakness. Suggestive should be *the terror and anxiety felt in the gastric region* (vagus action?). At the same time there exists an irritability, an indefinite apprehensiveness which is likewise well known in the cardiac patient; the patient is ill-humored, highly irritable.

MUSCLE WEAKNESS

The special action of potassium on voluntary muscle expresses itself in the *great muscle weakness and relaxation* which may amount to a paralytic state. The

elastic fibers seem to become influenced in the same way. The joints fail, *the back and legs are especially weak: weakness in sacral region,* stiffness and paresis in back, feeling as if the lumbosacral region were breaking. *The failure of the back and legs comes on so suddenly and severely* that the patient is compelled to sit in the street if he can find no other place. According to Farrington the triad characteristic for kali carb. is: "weakness, backache and sweating," but it states all too little. Severe sacral backache during pregnancy and after miscarriage, feeling of heaviness in the lumbosacral region with menstruation, give frequent causal source. The pains extend upward and downward in the back, radiate into the glutei, the hip-joints and the thighs. Characteristics for the muscle actions are: twitching and trembling of the muscles, weakness up to paralysis, especially (apart from the back) in the thighs and knees, worse on climbing stairs, loss of power in the extensors. Paretic states in old people who have edema at the same time give indications of the muscular and the circulatory weakness. Other muscle symptoms are: heaviness and drooping of the upper lids, even paralysis (M. levator palpebrae); and difficulty in evacuating the stool and involuntary discharge of urine during coughing, sneezing, *etc.,* show the action on the anal and bladder sphincters.

CHARACTER OF PAIN

To the general characteristics of kali carb. belong also *the pains which in both inner and outer parts are predominantly sticking. That the pains are worse from lying on the affected side* which soon becomes numb, distinctly differentiates kali from another agent with sticking pain, bryonia. The point of difference is that

in bryonia the pain is predominantly in the serous membrane, but in kali carb. it seems to arise more from a stasis in the musculature, in the subcutaneous tissues, in the bronchioles, *etc.* With this agrees *the aggravation from lying on the affected parts and from becoming cold, the improvement from moving around and the change in the location of the place from applications of warmth.* On the mucous membranes the sticking pain seems traceable to dryness. To be mentioned also is the sticking pain as if from a fishbone in the throat, a sensation as if from a splinter on becoming cold, cough with sticking pain in the larynx and air passages, sticking pain in the rectum before and after stool, furthermore stitches in the kidney and right scapular region and especially in the sacrum.

As for all the alkalies, so for kali carbonicum are reported gouty-rheumatic complaints in the joints and muscles. The evidence of failure in the locomotor apparatus, the preferential localization in the back, sacrum, hip, thigh and knees united with the already mentioned modalities give a certain rheumatoid picture to kali carb. Since with kali carb. swelling also often appears, which naturally does not give the impression exactly of an inflammation, so perhaps the combination of such pains and swellings leads to the clinical implication of hip-joint disease and synovitis. Convincing results, however, have not been published. Consequently, the usual intermingling of the uric-acid diathesis and the characteristic gout will perhaps ascribe to all alkalies also an influence on the latter. The alkaline waters have likewise been extolled. According to Bechhold and Zeigler[11] potassium prevents the precipitation of urates. Potassium-rich diet would likewise be recommended in gout because uric acid

experimentally deposited as mono-sodium urate tends to be lessened through potassium-rich food. But a special adaptability of kali carb. for true gout does not appear either from the drug provings nor from homeopathic experiences.

ORGAN ACTIONS

The organ relations of kali carb. can be graded in the following series: heart, respiration, digestive organs.

While formerly pharmacology perceived the alkali cations in drugs as completely interchangeable, in the last ten years many warnings have again appeared on potassium as a "cardiac" poison.

The field of *medicinal actions on the heart* is utilized only by homeopathy. The proving symptoms which refer to the heart are as numerous as characteristic in Hahnemann's writings: cardiac palpitation when hungry; frequent severe palpitation with anxiety; *frequent intermission of the heart beat;* pain in or around the heart as if a band encircled the heart and were drawn together, most noticeable with marked inspiration or coughing but not on bodily movement; climbing a few stairs is very difficult, walking on the level does not cause symptoms. To this are added symptoms in the direction of cardiac asthma as: early (morning) dyspnea; interruption of breathing awakens him in the night out of sleep; râles in the chest at night on lying down on the back; respiratory oppression; oppression of the chest with noisy deep respiration; early pain in the chest, especially around the precordium; sticking pain in the left chest on deep breathing. And further; *spasmodic and choking cough at five in the morning* as from dryness in the larynx with severe oppression of chest making speech difficult, redness of the face and

sweating over the entire body. Another picture: Severe sticking in the left chest after midnight, in the cardiac region, at times in the back, bearable only on lying on the right side; every attempt to lie on the left side is unbearable; the second night he awakened very early with the most severe sticking in the chest, with dyspnea, on lying on left side unbearable even with absolute quiet, and passing only when he turned to the right side; on the third night again when he lay upon his back. It states further that breathing is rapid and superficial and that the patient can hardly stop breathing long enough in order to eat, drink or swallow.

Clinically we have before us the manifestations of *cardiac insufficiency with conduction disturbances and especially dyspnea* which appears in the early morning hours, also during rest in bed and not especially aggravated by exertion or movement. In this syndrome kali carb. has repeatedly proven of value to me.

On the respiratory organs it expresses itself by the easy chilling which is favored through the reduction of vascular tonus. Pharyngitis, laryngitis, tracheitis must have the special modalities when kali carb. is to be employed with some prospect of result. Perhaps kali carb. is also to be considered of use in beginning tuberculosis. Apart from the easy colds with the tendency to catarrhs descending to the chest, neither the other symptoms nor the experience reported up to the present make this indication appear particularly valuable.

Another syndrome signifies a vagus influence, tendency to *spasmodic manifestations in the smooth musculature of the respiratory passages.* The cough is severe, dry, hard, exhausting, with sticking pains and dryness in the upper respiratory passages. The face is puffy, the eyes swollen. Bönninghausen observed a whooping-

cough epidemic in which the edematous sacs appeared over the eyes and kali carb. was the suitable remedy. Especially the persistent cough of a dry spasmodic nature after pneumonia or measles with fleeting neuralgias and the characteristic time of aggravation from 3 to 5 o'clock, often require kali carb. Also in pneumonia itself in the stage of hepatization, kali carb. can at times be useful. One thinks here primarily of stasis through weak cardiac activity. The lower third of the right lung seems to be the elective site of attack: sharp, cutting, sticking pains in the breast, worse on lying on the right, the involved side (opposite to bry.) indicate it. The dry shattering cough, which may lead to nausea and vomiting, has little expectoration, which is tenacious and difficult to remove. The mucus collects in the region of the larynx toward morning: even after release it is not expectorated but swallowed; at times droplets fly from the mouth on coughing.

Another type of kali carb. cough is associated with a weakened heart. Here there are coarse râles in the chest and the cough is loose but the sputum still tenacious, smells and tastes ("like old cheese") offensively; the patient can only sit bent over with the elbows on a stool—this is the clinical picture of the above-mentioned cardiac asthma in a late stage and for which kali carb. at times is in order.

In all types of coughing, *the chief aggravation toward 3 to 5 in the morning* is prominent. This is the time of preponderant vagal innervation, the high point of intracellular assimilative work.

On the *digestive organs* a complete series of dyspeptic symptoms have been described and indeed in the *dyspepsias of old people* kali carb. has been recommended but is much more rarely employed than sodium

carbonicum in which the digestive disturbance is described in almost the same words. Furthermore, it is striking how similar the symptoms of kali carb. in the digestive canal are with those of carbo vegetabilis. This is no accident because plant charcoal contains the admixture of potassium carbonate. The details are: *distensive feeling of the stomach and abdomen with feeling of coldness*, fulness and sensation of heaviness, worse after eating and after cold drinks; feeling of weakness in the stomach not relieved by eating; nausea better on lying down; aversion to bread and flesh and in general against food; desire for sour things; the tongue is coated white, the taste is bad; the gums are loose, there are aphthous ulcers in the mouth, salivary flow is increased. The flatulence gives occasion for colic—eructations momentarily relieve, likewise the application of heat and bending forward. The eructations may be sour. The total picture is more that of an *atony of the gastro-intestinal canal with abdominal plethora*. For this also speak the large stools, difficult to evacuate, the swollen hemorrhoids, extremely sensitive to contact, and burning rectal pain which call for kali carb.

But in general the gastro-intestinal canal offers slight occasion for the prescription of kali carb.; carbo vegetabilis will be preferred in the same syndrome. It lies near to consider the symptom complex as gastro-cardiac, and the first manifestations of cardiac insufficiency express themselves not rarely in a similar gastro-intestinal atony. In the difficulty of evacuation of feces and the easy prolapse of the rectum, the weakness of voluntary muscle, of the abdominal muscles and the sphincter, plays a rôle.

Stitches in the right hypochondrium have led to the

recommendation of kali carb. in old liver maladies with ascites. But this report deserves little confidence and the basic symptoms are entirely insufficient and are better associated with flatulence than ascites.

Complaints of the urinary organs in and of themselves offer hardly any occasion for the use of kali carb. In the already mentioned relaxation of the sphincter vesicae we have in causticum a much more suitable remedy. To be mentioned is frequent, sudden, urinary urgency with the passage of mucus or gravel. Pollakiuria and much sediment are vagotonic signs.

Various forms of disturbances of the menses have been described for kali carb., but none are characteristic. In long-lasting copious bleeding with ever-recurring oozing of blood at relatively short intervals, the weakness, the waxlike pallor and the severe backache suggest kali carb. Hahnemann considered kali carb. as suitable for the delayed menses in young girls. Too late, pale, scanty menses were also cited. But better than the rhythm is the back and sacral pain with radiation to the thighs and particularly the general constitutional type.

DOSE

In general not below the sixth decimal (trituration).

SUMMARY

Type:

Chilly, puffy, pale, weak muscle, exhausted, irritable, anxious; sensitive to cold; circulatory weakness; tendency to edema; vagotonic.

Chief Directions:

Muscles: back and sacral weakness.

Heart muscle: insufficiency, conduction disturbances.

Respiratory organs: spasmodic disturbances, cardiac stasis.

Characteristic and Leading Symptoms:

Sticking; wandering pains, worse from cold, going to another place from the application of heat; sweating on the involved parts; sacs under the eyebrows; anxiety and fear felt in the gastric region.

Modalities:

Aggravation from 3 to 5 in the morning; worse from cold; worse from coitus; worse during and after the menses; worse lying on affected side; better in general from movement.

SODIUM

The cation sodium has its physiologic tasks in water movement and in acid-base equilibrium to such extent, and its quantity in the easily available fluids of the body is so great that any other consideration of its action than according to quantitative chemical viewpoints at first seems remote. Its marked swelling action on colloids, its property of binding water, and the great capacity of dissociation of its salts make it—chiefly as the chloride compound—the chemical regulator of water balance. In acid-base equilibrium it acts in the first place in the form of the carbonate and to a far less extent in the form of the phosphate. Exactly as with potassium we may expect to discover extent and direction of pure sodium effects best in the carbonate (Na_2CO_3) or in the bicarbonate ($NaHCO_3$). But though we are certain of the necessity of sodium ions in the nutrient fluid of the cells for their function, we are still very insufficiently informed on the exact effect of sodium on the cells. As long as we move in the range of crude chemical actions, the alkaline character of the carbonate, the OH influence, will be decisive, and whether sodium, potassium or ammonium is its carrier, this remains of subordinate significance. Neither the severe corrosive action of the hydroxide nor the weak macerative action of the carbonate on the skin and mucous membranes has a medical significance. The neutralization of gastric

acid through weakly alkaline $NaCHO_3$ is nothing else than a chemical mass action, of which the damages naturally require our attention. Experimentally, large doses of sodium bicarbonate before meals lead to a hypotonia of the stomach and shallow peristalsis.

Sodium carbonate or soda, that is, the stronger carbonate step of $NaHCO_3$, is, in addition to the neutral sodium salt, NaCl, which provides a sodium ion, a constant constituent of the blood and the tissue fluids in general. The so-called buffer action of the carbonates against excess acid in the body fluids rests upon the ease with which CO_2 is given off or taken up. It is determined as an equimolecular chemical process in the relative proportions. Furthermore, sodium serves physiologically as an easily available transporting agent for decomposition products. The close connection of sodium to water regulation will be best considered with the chloride, natrum muriaticum, and concerning intestinal excretion, in connection with sodium sulphate.

GOUT AND ACCELERATION OF OXIDATION?

From the fact that in the test tube the oxidation of organic substances proceeds easier in alkaline than in neutral solution, one has concluded that the alkalies, especially the alkali carbonates, play an important part in oxidation processes. Hugo Schulz[12] in particular emphasizes the utility of alkalies in gouty processes. Through the increase in oxidation processes, the burning of purin bodies to urea should proceed more completely and less uric acid residue remain.

Experimentally, no action on uric-acid metabolism has been proven in this sense. H. Schulz reports naturally that small doses of $NaHCO_3$ increase the excretion of urea with a simultaneous reduction of uric-acid output.

When one considers with what tenacity the blood maintains its grade of alkalescence and how an alteration is possible only transiently even from great amounts of alkali, then one can scarcely maintain the explanation that the action on oxidation increase depends upon increase of alkalescence. On the other hand, that one can favorably influence a tendency to acidosis and gout by a persistent alkali-rich vegetarian diet is correct, but it is largely the poverty of such a diet in purin bodies which causes the favorable influence. For purely palliative attack of threatening acidosis, by large amounts of $NaHCO_3$, indeed, some use is made. In gout and the uric-acid diathesis in general, however, such measures are unsuitable. Even a dietetic reorientation in the alkaline direction in manifest disturbances, as the formation of concretions, has empirically insufficient support. Actually (for example by Brugsch) there has been warning against excessive use of alkaline diet (forced fruit régimes, too excessive use of alkaline waters) because it favors the formation of inflammatory urate foci. This is based on experimental findings: according to Pfeiffer and van Loghem,[13] the experimental inflammatory reaction of injected pure uric acid is hastened and increased through alkalies (through large doses of mineral acids it is delayed). If, nevertheless, moderate alkaline water régimes have been found useful at times, then this action in any case is not explainable by quantitative chemical considerations. If the alkalies actually have a connection to the uric-acid diathesis, it might appear from the at times promoting, at times damaging, influence of alkaline springs (in dependence on the dose?) and also from the above-cited experimentally produced aggravation of gout by alkalies, that this effectiveness must lie in another stratum of the liv-

ing process, because the doses coming into consideration are far too small for an equimolecular chemical reaction. One must consider here a catalytic, perhaps a metabolic influence via the way of the vegetative nervous system. According to all appearances natrium carbonicum seems to stand behind lithium carbonicum and kali carbonicum in this respect.

Clinical experiences with alkaline water permit one to conjecture that the alkalies are excreted outside of the urine, and that this occurs rapidly through the biliary passages and the bronchial mucous membranes where they can unfold healing actions. The toxicologic study which Schulz cites of Rossbach (from Nothnagel's Handbook) indicates not a great deal for the secretory mucous membrane action of Na_2CO_3. Accordingly, the intravenous injection of soda solution in animals gave pallor and complete cessation of secretion. One thinks here in any case rather of a spasm of the blood vessels than of an influence on the glandular apparatus.

SODIUM AND CHLORINE

Certainly sodium influences the important optimum of hydrogen-ion concentration in the digestive process. By the development of HCl in the stomach, a great deal of sodium is made free for combination with the carbonate and is then very probably an essential participant in the preparation of the alkaline intestinal juices. This intermediating rôle of sodium in the digestive processes is indeed a chemical mass action on the receptive organs. But, as we know, in a high degree the increase is effected through the vegetative system and this permits one to consider that in the forelying disturbance a medicinal influence of activated sodium is possible in this way. The already mentioned motor de-

pression of the stomach through large amounts of sodium bicarbonate before meals is naturally to be ascribed to the preponderance of the carbonate introduced over the chloride. Similarly lies the case when, from a rectal administration of sodium bicarbonate, the gastric-acid secretion is lessened.[14] The sodium ion is also the physiologic intermediator of the chloride-carbonate exchange, which leads to disturbances also through one-sidedness.

In experiments one saw an increase of secretion in the isolated stomach from the sodium salts. Sodium ions in combination with univalent ions produced a flow of juice, in combination with divalent anions, an increased secretion of mucus.[15] The biliary secretion should be depressed by the sodium ion.[16]

NATRIUM CARBONICUM

Drug provings of natr. carb. are found in:

(1) Hahnemann: *Chron. Krankh.*, 2 Aufl., Bd. 4, 1838.
(2) Kurtz: Allg. hom Ztg., Bd. 26, p. 249, 1844 (refers to Vogler: Use of Mineral Waters, particularly of Ems, 1840).

TYPE

The *natr. carb. type* is characterized through *chilliness* but also *intolerance to heat of the sun, by bodily relaxation and a state of mental exhaustion due to brain fatigue and depression, and furthermore by digestive weakness.*

The coldness of natr. carb. is depicted in practically the same words as kali carb.: sensitive to the least draft and change of weather, against fresh air; cold extremities. The chilliness of natr. carb.—just as the headache and palpitation—are *better from eating.* In this

cold type we see, perhaps, something that appears common in cation preponderance and in the alkali and earthy alkalies subordinated to the hydrogenoid constitution. But natr. carb. is at the same time especially *sensitive to the sun's heat*, which causes headache and vertigo and is very exhausting. But also the sequels of sunstroke are subject to the influence of natr. carb. Finally it is reported of the temperature and weather influence that the natr. carb. patient is *anxious before and during storms.*

The state of bodily and mental exhaustion is not so much that developing from overexertion but offers more the picture of a malaise from overindulgence. All symptoms are *aggravated by mental effort.* There exists an incapacity to think, for any mental labor, poor comprehension, forgetfulness. The lack of vitality expresses itself in the absence of resistance to sensory impressions, hypersensitivity to light and particularly to loud noises. The behavior is depressed, *music causes melancholia, crying.* The patient withdraws from friends and company, even from his family. *The depression is worse after eating.*

This is associated with the digestive weakness. Hypochondriac-depressive frame of mind is indeed the disposition of many dyspeptics. Likewise the sleepiness is related to a state of exhaustion which is prevalent in men who overindulge and to whom regular work is unusual: sleepy particularly after noon and from heat; on the other hand, the night sleep is disturbed; sleepless before midnight from dreams, dreams much (amorous and anxious); awakens early about 5 A.M. with feeling of weakness and desire for food. (According to H. Schulz, they soon fall to sleep and soon awaken again, sleeplessness with hypochondriacal

thoughts and then falling to sleep, toward morning a feeling of insufficient sleep.)

To this there is added a laxness of the limbs and joints and above all, *weakness of the joints of the feet*, parts sprain easily, stumbling. In the knee there is a feeling of tension.

To the entire picture there is added the pale face with dark circles under the eyes and puffy lids; the delicate skin permits freckles to appear easily. There exists a tendency to sweating on the involved parts with pains, from the slightest exertion and during sleep, and particularly on the hands and feet.

DIGESTIVE WEAKNESS

Concerning the organ systems, while the respiratory organs have preference over the digestive with kali carb., the reverse is true of sodium carb. The clinical recommendation of sodium carbonate in *digestive weaknesses* arises from Hahnemann. *The digestive disturbances are provoked through the least dietary failure.* The symptoms consist of acid eructations, distention, pressure and various unpleasant sensations in the stomach (as from a stone, cutting, nagging, pulsation, soreness). *They are worse after eating and better when the food has left the stomach.* On the other hand, the feeling of weakness and the demand for food appears at unusual hours (at 5 in the morning and 11 at night), and the general symptoms as chilliness, headache and palpitation are improved by eating. Gastric function is deranged. Cold drinks aggravate or are given as the cause of the gastric disturbances. *Farinaceous foods and vegetables are borne the most badly and they cause diarrhea. Against milk*

there is an aversion and this too causes diarrhea. According to Kent,[17] natr. carb. is useful in nurslings who are nervous and cold and have aphtha and sore mouths. In general, the bowels are constipated and without desire for stool; large hard stools or stools like sheep dung are evacuated with great effort; or there occurs sudden urgency for stool and the stool is evacuated with haste and flatulence. H. Schulz also reports from studies on his pupils with three to five cg. natr. carb. siccum given in the morning before breakfast, an alteration of intestinal activity. After fourteen days the provers had attacks of colic, constipation alternating with diarrhea, others profuse diarrhea. Moreover, there was one unclear symptom reported; evacuation of yellow, jelly-like masses (like masses of orange) from the bowel, independent of the stool.

OTHER ORGAN ACTIONS

In the second line the mucous membranes of the respiratory passages and the genitalia are influenced. This agrees with the reports on the action of strong alkaline springs containing sodium (Ems, Salzbrunn, *etc.*). The great mucus-releasing action of soda seems to reflect itself more biologically in a stimulation of the mucous glands through natr. carb.

Nash[18] mentions particularly postnasal catarrh as an indication. The symptom of foul odor of (thick and yellow-green) nasal secretion refers to involvement of the posterior nasal divisions. Expectoration of much mucus from the throat, worse from the least draft, reveals the pharyngeal catarrh. Dry cough on entrance to a warm room from outside (frequently an indication for bryonia) may suggest it in a chronic catarrh:

The symptoms: cough with labored breathing, better on sitting up, and cough with coldness in the left side of the chest, concur strikingly with the reports on kali carb. Still, the entire symptomatology of natr. carb. in the upper respiratory passages has no great significance; the direction is apparently the same as with kali carb., but significantly more weakly expressed.

Of the female sexual organs, an acrid, yellow, copious leukorrhea should be mentioned. A remarkable symptom in women cited as a cause of sterility is: discharge of the semen immediately after entry. At the same time the chilly, relaxed, sensitive-to-sun, nervous and dyspeptic state should be present. Natr. carb. does not have a definite type of menstruation, though it is scanty, late, but even too early menses have been reported. The downward pressure in the abdomen is more characteristic for other drugs (sepia, lilium tigr., murex) than for natr. carb. For differentiation is the *heaviness in the lower abdomen, worse on sitting,* in the natr. carb. symptoms.

A rarely employed trend of natr. carb. is designated by the skin symptoms: vesicular eruptions on the knuckles, tips of the fingers, toes, flexor surfaces of joints, also on the body, patchy or circinate. The skin should also be dry, wrinkled and rough, especially on the backs of the hands and feet. An inflammation of the exterior of the nose as well as heel ulcer are mentioned as indications. The external action of soda on the skin seems to have influenced the symptomatology here.

According to the depiction of Kent in respect to natr. carb., there would be a remarkable similarity with kali carb. because he describes most of the sympto-

matology of the two drugs with almost exactly the same words. The general picture: "Old dyspeptics with constant eructations, sour stomach and rheumatism; the bent back is weak, sensitive to cold, their digestive and rheumatic-gouty complaints become worse from change of weather," can be found repeated in kali carb. It is the picture of "cachexia alkaline" as occurs perhaps through the prolonged misuse of Bullrich salts. The loss of resistance against all types of influences, especially against sudden noise, which causes the patient to tremble, nervous excitation and palpitation with great exhaustion, tremulous weakness from slight bodily or mental exertion; the sweating on the involved parts, the puffiness, tendency to edema; also paretic states (lids, swallowing), the numerous identical symptoms in the respiratory, digestive and genital apparatus and mucous membranes; palpitation on lying on the left side, rheumatic pains in the extremities; an early morning aggravation; all such details, for which one naturally seeks many in vain in other writers, approximate each other in the Kentian symptomatology of kali carb. and natr. carb. more than the above-cited most important trends of action give semblance. If we permit each drug to stand beside the other in a flood of complete symptomatology without clinical evaluation, then the unimportant symptomatology in the one picture cannot be differentiated from the important of the other because of the similar text. It is therefore necessary not to confuse the pictures.

DOSE

Natr. carb. in general is not given below the sixth decimal (trit).

SUMMARY

Type:

Chilly, bodily relaxed, mentally exhausted. Sensitivity of the senses, depressive hypochondriacal.

Chief Directions:

Digestive weakness; catarrh of mucous membranes.

Modalities:

Worse from drafts, from cold, also heat of sun; worse before and during storms; worse from mental exertion; music brings on weeping; improvement of general complaints (chilliness, headache, cardiac palpitation) from eating; gastric symptoms and depression at first aggravated by eating and improved after completion of digestion; sensation of hunger at unusual hours (5 A.M. and 11 P.M.).

LITHIUM

The pharmacology of lithium stands always under the influence of a false hypothesis. Lithium carb. has been stamped a "gout" remedy because it is supposed to dissolve uric acid. But this again involves an erroneous deduction from the test tube to the living organism. Actually, lithium urate is only slightly more soluble in water than the other alkali urates. One can neither dissolve urate stones in the bladder by great concentrations of lithium carbonate nor bring the uric acid held in the blood and the body tissues, especially in the joints, to increased excretion. The so-called lithium springs in general cannot come into consideration for this crude chemical effect because they cannot attain the concentration in the body which would be necessary; and in urecidin where one gives several sodium salts at the same time with a lithium salt, one can say nothing of a lithium action through substitution of sodium by lithium. If lithium has an influence on the uric-acid diathesis, then it does not obtain this in any case through quantitative chemical changes in the precipitation and solubility relations in the organism.

From experimental investigations a peculiar manner of action of lithium in contradistinction to sodium is not known up to the present. Clinical facts from which one might proceed are, in any case, not available.

LITHIUM CARBONICUM

C. Hering[19] made the first provings. Confirmed best are the symptoms from the urinary passages: *very frequent micturition that disturbs the sleep and burning in the urethra;* painful and difficult urination (tenesmus); pain in the neck of the bladder and pain which goes into the spermatic cord after urination. Furthermore, in the provings are observed a *turbid urine with much mucous deposit and a reddish-brown sediment in the urine;* also scanty, dark and very acrid urine, voided with difficulty and pain. In connection with this there stands still another proving symptom: pressure in the cardiac region before urination, which ceases after voiding. For this reflex relief after micturition there is also clinical support.

It is probable that the rheumatic-gouty component which lithium carbonate seems to share in common with the other alkalies stands too much in the foreground in the drug picture due to the influence of earlier and no longer maintainable hypotheses. First a gradual stiffness over the entire body is reported. The knees and lower back should be particularly weak; then itching around the joints, rheumatic pains in the shoulders, arms, and fingers, in the arch of the foot and extending up to the knee, swelling and sensitiveness of the finger and toe joints (only during rest, better from movement; still this modality is by no means positive). These rheumatic symptoms have been made the basis of treatment of chronic arthritis when the cardiac complaints are also present. About the heart are reported pains of various types (beating, sticking, pressure, dull stitches) and trembling and palpitation which may extend to painful palpitation

up into the head and between the shoulders. Simultaneously, the inspired air causes a feeling of coldness in the chest. Characteristic for the *cardiac* complaints should be that they *are worse before urination and cease after it.* They should also be worse before and at the beginning of the menses.

The above-mentioned symptoms in the urinary passages have been brought into connection with an action upon the uric-acid diathesis and especially concretions in these organs. A certain diuretic action is common to all alkalies in consequence to their rapid excretion in the urine. Whether a direct stimulus action on the urinary passage by lithium can occur is not known at present.

Another trend, that of the dyspeptic symptoms, places lithium carb. in line with the other alkalies and especially close to natr. carb. They are gnawing and uneasiness in the stomach, feeling of fulness in the temples, and headache. Of the headache it states, exactly as with natr. carb., that it improves or ceases from eating. Likewise the nagging sensation is improved by eating. Moreover, sensitivity of the stomach against the least pressure and also sour stomach is reported.

A striking symptom is repeated in all materia medicas: hemianopia, invisibility in the right visual field. This symptom was observed on the second day of the menstrual period and associated with poor vision for reading. Whether it deserves to be repeated in the materia medica is very doubtful and in any case a clinical confirmation from its use is not known. The same holds for the asthenopia taken as an indication from the same event.

All in all, the lithium carb. picture stands with a

large number of question marks, because the provings are very insufficient.

DOSE

Lithium carb. is employed mostly in the lower triturations.

AMMONIUM COMPOUNDS

Ammonia, NH_3 and the compounds of the ammonium cation, NH_4, form an important step in nitrogen circulation, which occurs between the atmosphere and the biosphere.

In the air the inert nitrogen is merely a nonreactive dilution agent for oxygen.

NITROGEN CIRCULATION

In organic life nitrogen appears predominantly at the ammonium step. To this it is led by single types of bacteria (for example azobacterium), by fermentative and not completely understood means. From the complicated nitrogen compounds of the organism it is led back to simple ammonium compounds or their oxidation products as nitrites (NO_2) and nitrates (NO_3) to the air and soil. Another source of nitrogen compounds is the atmosphere in which oxygen compounds of nitrogen develop through electrical discharges and then reach the earth with the rain.

The elaboration from ammonium salts and nitrates which also become reduced to ammonia is cared for by the plants. Animals have at their disposal highly elaborated nitrogen products which they can convert in a specific way for their own purposes. Since the lower nitrogen compounds (ammonia and nitrates) again develop from living organisms and can be changed again into molecular nitrogen through other bacteria, so a constant new formation of bound nitro-

gen is necessary for the maintenance of life. And since practically in this circulation many nitrogen compounds are destroyed, one adds artificial synthesis as ammonium salt fertilizers.

AMMONIUM IN THE ORGANISM

One cannot speak of a necessary complete metabolism of ammonium in the human organism as it need not be introduced nor utilized as such, but it is only occasionally taken in (for example in cheese) and is then almost completely synthetized in the liver to urea ($CONH_2—NH_2$). Only traces of ammonium salts (0.026–0.015 milligram percent [N]) escape synthesis (or are on the way to synthesis?) and circulate in the blood. But in any case it is not enough to come into consideration for the maintenance of the pH of the blood. When an increased excretion of ammonia in the urine takes place in acidosis, this is explained in that the kidney ammonia is formed by necessity from the ammonium mother substance and indeed for the neutralization of the acids excreted, whereby the fixed alkalies can be spared. An increase in the actual ammonium content of the blood appears only in the final toxic stages of acidosis. In muscle work ammonia is freed from the ammonium mother substance (adeninnucleotide). But it is chiefly liberated from the ammonium mother substance through a ferment of the kidney, the renal ammoniacase. This ammoniacase has its optimal action in an acid medium so that acidification increases the amount of the ammonia liberated and neutralizes the urine.

So one can speak of a physiologic rôle of ammonia only in the phase of excretion: buffering of the urine with a sparing of free alkali. Still, it is worthy of

note that ammonia is liberated in the decompositions accompanying muscle and nerve activity. Since this process is probably irreversible, the weakening and paralyzing influence of ammonia on muscle and nerve can be explained. Furthermore, ammonia develops[20] in the erythrocytes, a fact which again furnishes proof of a damage to the erythrocytes through an excess of their metabolic end-products.

Accordingly, only traces of free ammonia are associated with the normal activities of cells and, in the event of insufficient possibility for detoxication to urea, diverse toxic effects of free ammonia can easily occur. That *the respiratory passages* stand in the first place is explained by the volatile nature of ammonia fumes which furnish the first and best occasion for contact with the functioning cells. If one reflects that an excess of ammonia is excreted from the organism also through the respiratory passages, so the easy involvement of these mucous membranes by ammonia finds its explanation.

PERIPHERAL AND CENTRAL ACTION (RESPIRATORY ORGANS AND VASOMOTORS)

If one departs from the crude corrosion of the mucous membranes which this "volatile alkali" can provoke through swelling and solution of the mucous membrane just as other alkalies cause, then there still remains a complete series of irritant effects on the mucous membranes of the respiratory passages. The most acute effects of the vapors are: edema and occlusion of the glottis, asphyxia. With the rapid resorption and penetration of tissues the actions of ammonium compounds on the respiratory organs are very acute. They go from catarrhal irritant manifes-

tations from small amounts to severe inflammation with swelling and formation of exudates in the larynx, bronchi and pulmonary alveoli, aphonia, spasmodic cough, paroxysmal dyspnea with piping, snorting râles in the lungs, epithelial shreds or blood in the sputum and pain in the larynx and under the sternum.

Characteristic of the acuteness of ammonia action on the *respiratory passages is that central irritative manifestations appear with collapse* symptoms: small and slow pulse, pallor, cyanosis, sinking of body heat, chills, oppression, precordial anxiety; also vertigo, uneasiness, delirium and often spasms.

Exactly this *union of inflammation of the respiratory passages and the reflex central vasomotor collapse*, the union of an "expectorant" and "analeptic," characterizes the chief actions of ammonium preparations in homeopathic use. The common use of expectorants which is based on an increase of amount and fluidity of the bronchial secretion, as with all alkalies, and depends upon the alkalescence of the mucus, does not sufficiently characterize the individuality of ammonium action. Only through the differential symptomatology of single preparations will the selection of a suitable remedy avoid arbitrariness. The inclusion of a "cataleptic" action is an important but still very general characteristic. Again, the recognition of such an obvious fact, as is here made clear in the similarity of the pathologic (toxic) actions and the therapeutic actions, is the point of departure and the indicator for an exact selection of the suitable drug in the individual case.

The *analeptic* action of ammonia and the ammonium salts (together with volatile oils as smelling salts) is

again well known to the laity. The stimulus on the nerve endings in the nose provokes indirectly a reflex excitation of the respiratory center. At first the respiration will naturally be depressed in expiration, which will then be followed by single deep inspirations. In this respect, for obtaining such a therapeutic effect, observation of the dose and the sensitivity of single patients is of great importance. Otherwise, there may be an alarming reflex depression of respiration and the cardiac vagus as well as spasm of the glottis and, especially in nurslings, severe asphyxia and collapse. Here, too, the toxic and the therapeutic actions stand very close to each other.

Occasionally ammonia is used as other skin irritant agents, as camphor. Burning, redness and vesicle formation are the local effects of ammonia water. Here, too, the stimulus will be conducted by centripetal nerves. Ammonia stimulates the free-lying sensory nerve elements (in contrast to the motor) in a special way which after some time passes over into prolonged anesthesia.

For the action on *the peripheral and central nervous system,* it is perhaps of significance that traces of ammonia are set free in nerve activity and an excess as well as a toxic split-product, perhaps, influences function; moreover, one should also consider the great lipoid solubility of ammonia (the possibility of saponification of fats).

If the sensory nerves are preferably involved in acute action, then this is to be traced to their accessibility. The occasionally observed spasms in ammonium poisoning must be considered of central origin. And so much more remarkable is the report of Lewin[21] that in conclusion to *ammonia intoxication, long-main-*

tained muscle weakness, indeed even complete paralysis of the lower extremities is observed. Also a persistent *aphonia* indicates an after-effect and a conclusion that from a long-maintained influence the motor apparatus is not spared. This is less significant for the usual ammonium preparations than for the understanding of the characteristic actions of the clearly related preparation, "causticum."

Central action of ammonia and ammonium salts is well known: they have already been mentioned for the respiratory and vasomotor center. On the blood pressure a central exciting action is observed.[22] Ammonia salts likewise act centrally on sweat production. Therein it is to be recalled that ammonia is also excreted through the sweat; there exists a connection between the receptive organ and the nerve-center action. Formerly, liquor ammonii acetici (spiritus mindereri) was employed as a fever and sweating remedy. That after ammonium intoxication a long-maintained fever occurs can be indirectly explained through the destruction of protein.

ACTION ON BLOOD

Traces of ammonia are found as split-products in the erythrocytes. The lipoid solubility of ammonia explains their great hemolytic property which is characteristically potentiated in combination with saponin. From direct contact with ammonia, the blood at first becomes dark red, then through destruction of the red blood corpuscles, there is laking and finally a ruby-red. Such *blood effects* can appear only in very acute flooding with ammonia. But typical symptoms of intoxication find accord in the homeopathic drug picture

of ammonium preparations with *septic and scorbutic states with a tendency to bleeding.*

Finally, diverse but not characteristic digestive disturbances are observed as chronic effects of prolonged contact with ammonia or ammonium carbonate.

VOLATILITY OF PREPARATIONS

With all ammonium preparations, fresh preparations are important, especially in the fluid ones, because they easily yield ammonia. Mostly is this the case with ammonia water (ammonium causticum) which dissociates electrically only to 4 per cent (NH_3 in H_2O $\rightleftharpoons$ NH_4+OH^-) and is only hydrolytically dissolved and constantly gives off ammonia. It is similar with the combinations of ammonia with weak acids as in ammonium carb. $(NH_4)_2CO_3$. For this reason, especially in the lower potencies, triturations are preferred, as Hahnemann also advised. Somewhat more stable is ammon. mur., salmiac, NH_4Cl. The bromide and the iodide require, on account of their easy destructibility, fresh preparation, for they yield ammonia, bromine, and iodine, all of which escape into the air.

AMMONIUM CAUSTICUM

Ammonium causticum adapts itself only for the attaining of the most acute ammonium actions: *as an analeptic with collapse symptoms; in hemolytic manifestations with bleeding;* as an antidote in snake bite, which also provokes hemolysis with central nerve actions; in acute inflammations of the larynx and throat with accumulations of mucus, if swelling and exudation cause suffocative phenomena or spasm of the glottis; under certain conditions also in diphtheria—but

always with great caution because the poisonous and therapeutic actions lie close to each other.

The late effect of ammonia, especially aphonia, great exhaustion and muscle weakness, pains in the shoulder and thigh muscles, are less two-edged indications, and flexor cramps have also been reported. Even if the simile relationship is quite obvious, still the practical use of ammonium causticum in homeopathy is quite rare because of its stormy and rapidly transient effect.

AMMONIUM CARBONICUM

Exactly as potassium and sodium hydroxides are unsuitable for therapeutic purposes and the carbonates are much more useful for more prolonged acting alkalies, so is this the case with *ammonium carbonicum*, the preparation which unfolds the ammonium effects most extensively and clearly. The complex ion, ammonium, behaves entirely as a simple alkali ion. The slight stability, great volatility, and its rôle in the body physiologically limited to the destructive phase, give it an accent in contradistinction to sodium and potassium, that the action is more transient, toxic and less constitutional.

CONSTITUTION

In this respect ammonium carb. shares the general alkali constitution: *relaxed fiber, tendency to corpulence, always tired and fatigued, slow manner or reaction or defective power of reaction;* weak heart, labored croupy breathing, downcast, particularly around the menstrual period, in which headache, toothache occur with diarrhea on the first day and which are usually too frequent, too profuse and of dark clotted blood. The tendency to bleeding of dark blood (from the mucous membranes) is to be especially stressed in

ammon. carb. in connection with its hemolytic properties.

Just as outspoken as with the other alkalies is the *hydrogenoid constitution* of ammon. carb.: great sensitivity to cold and water (from the latter, bodily uncleanliness, which appears as a clinical report), easy chilling, aggravation before damp (and stormy) weather, from the use of water in any form.

GENERAL ACTIONS

To this is added, more incidentally, a depressed, anxious frame of mind, ill-humor in bad (stormy) weather, mental distraction, poor memory, errors in speaking and writing or counting; sleepiness during the day, at night fearful, awakening from sleep.

The headaches have little characteristic, a feeling of heaviness and beating as well as a sensation as if the brain were loose in the cranium having been reported; it is relieved by external pressure and in warm rooms, but these are insufficiently verified; the aggravation before and during the period has already been mentioned. (There has been reported an aggravation of the headache in evening and morning; this last aggravation after sleep seems to prevail with stupefaction and symptoms and weakness and makes ammon. carb. resemble lachesis.)

This constitutional weakness, slight ability for effort, expresses itself in asthenopia and the appearance of spots before the eyes when the eyes are strained. The fatigue and lassitude *in the extremities* and in the musculature in general in the provings proceed up to *paresis and painfulness*: heaviness and paretic weakness of the arms, the arms and fingers, which morning and night feel dead and stiff on grasping; trembling of the hands; cramps and numbness in the fingers;

pains of fatigue in the hip and thighs, especially in the morning in bed; spasms in the feet and calves; heaviness and great weakness in the legs, many drawing, tearing and crushing pains in the extremities are a few of the reports. Although they have no great therapeutic significance for ammon. carb. itself, they indicate the involvement of the locomotor apparatus as an incidental trend of ammon. carb. actions. There is a failure of the musculature, which on the one side tends toward paralysis (in which respect one should compare the toxic after-effects), on the other side to many so-called rheumatic pains wherein the cold and moisture sensitivity of ammon. carb. cooperates causally. The physiologic excretion of ammonia in muscle and nerve activity perhaps creates a bridge for understanding. This trend of action is more significant therapeutically for the employment of causticum.

The *defective power of reaction* as a basic trend of the ammonium carb. picture permits the agent to be perceived in homeopathy as well as a type of analeptic, and is the basis of its reputation in *adynamic states with fever*, for example pneumonia with low temperature, dulness and apathy when the patient is too weak to cough and expectorate, and shows râles and cyanosis. Also in malignant scarlet fever with adynamic symptoms the remedy is recommended when the eruption comes on to partial development because of the defective power of reaction. A scarlatiniform type of eruption is described in the Hahnemannian provings. Also erysipelas in old weak people with cerebral symptoms, dulness and stupor, is mentioned.

The toxic action on the blood is combined with this adynamia and terminates in hemolysis. The picture is not peculiarly specific but there exists *a great tend-*

ency to dark, fluid hemorrhages, that is, impaired coagulation: appearance of vari-colored spots in the skin, blood-flecked sputum, easily bleeding gums like those of scurvy, bleeding from hemorrhoids, with the menses early, profuse and dark, *epistaxis in the morning on washing*. This last indication of a milder nature is used most. As a warning of irritative manifestations in the skin is severe itching with burning vesicles and pustules after scratching, likewise severe itching and burning in the anus are cited.

ACTION ON THE RESPIRATORY ORGANS

From this picture of general actions is removed the main organ direction of ammonium carb.: on the *respiratory organs*. The inflammatory manifestations, which may extend from the nose to the bronchioles and pulmonary alveoli, characterize themselves as far as ammonium carb. is concerned through the *early disturbance or failure of central regulatory functions* (respiratory or vasomotor center) frequently in association with defective equalization or compensation of the respiratory embarrassment by the muscle weakness of the heart. For the pneumonia (that is, usually bronchopneumonia) the adynamic state with very embarrassed, rapid, noisy respiration, proceeding to pulmonary edema and collapse, have already been mentioned. In this threatening state of failure of the respiratory regulation functions, one can make use of the very acute action and active ammonium iodide (fresh preparation!). Also for the suffocative feeling from the larynx, the simultaneous linking through the iodine is often preferred, for example also in the presence of goiter.

The cough of ammonium carb., whether it is con-

ditioned through laryngitis, tracheitis, or bronchitis, is quickly combined with *dyspnea, feeling of suffocation, sensations of fatigue, weakness, and heaviness in the chest, "audible" palpitation, anxiety,* often cold sweat, trembling, inability to speak, and lachrymation. Universal is the nocturnal aggravation, especially *toward three in the morning.* This time of aggravation agrees with that of kali carb. and is the time of highest physiologic demand in the vagal division of the vegetative system. The patient awakens at this time with an attack of irritative coughing, dyspnea and cardiac weakness or palpitation.

The *dry irritative cough* of ammonium carb. is also *aggravated by every effort and on entrance into a warm room.* A scratchy feeling as if from a foreign body is frequently present. *Huskiness and aphonia* accompany the localization in the larynx; blood-flecked sputum frequently, the bronchitis. In inflammation of the nose the occlusion of the nose at night is so high grade that the patient is awakened out of sleep by the respiratory oppression. In the persistent coryzas the secretion should be acrid, burning, and watery. (The dry, spasmodic, nocturnal irritative cough arising from the throat combined with burning in the throat and feeling of suffocation will often find ammonium bromatum given wherein the bromine linkage is leading for the throat organs and the reflex spastic nerve irritation. The nocturnal aggravation on lying and particularly toward three in the morning is also present here. The spasmodic element is strongly stressed, therefore also the use in whooping cough.)

OTHER ORGAN ACTIONS

The symptoms on the gastro-intestinal canal which may be provoked through a chronic influence of am-

monia or ammonium carb., like many gastro-intestinal disturbances, have no therapeutic significance because nausea, acid burning, hunger and rapid satiety as well as pain in the gastric region give no differential signs in particular of ammonium carbonicum.

It is the same with the urinary symptoms, increased urgency with irritative manifestations of cutting and burning, increased urine and copious red or white sediment. The menstrual type and the accompanying manifestations at the time of the menses have been mentioned under disturbances of a general type. An acrid, corrosive leukorrhea is an accessory manifestation of subordinate significance.

SUMMARY

Accordingly for the selection of ammonium carbonicum are essential:

(1) The relaxed, tired *type* with defective power of reaction, with weakened musculature of heart, especially depressed and hypochondriacal at the time of the menses, tendency to dark bleeding and the signs of the hydrogenoid constitution, sensitivity toward cold, damp weather and water.

(2) The chief *trend* is toward the respiratory passages with failure of compensation through the cardiac power and regulating brain centers, tendency to respiratory paralysis and collapse of the vascular system.

(3) The *modalities*: aggravation: outside of the already mentioned general (cold, damp weather, application of water, menses), especially for cough and respiratory disturbances are the nocturnal and in particular 3 A.M. aggravation moreover from exertion and in warm rooms. There is reported a preference of the right side for ammonium carb.

DRUG PROVINGS

Provings of ammonium carb. are found in: (1) Hahnemann: "Chronic Diseases," Bd. II (7 proving conductors); (2) "Homöopathische Vierteljahrsschrift," Bd. X, 1 (12 provers).

Study with large doses: (3) Wibmer: "Wirkungen der Arzneimittel und Gifte," Bd. 1, p. 131, 1831.

(A characteristic proving has not yet been made.)

RARELY USED PREPARATIONS

Ammonium iodat. is not proven. *Ammonium acet.* and *ammonium nitr.* only with large doses (Wibmer).

Of *ammonium bromatum*: (1) Cushing: "Trans. of Amer. Inst. Homo." 1870, 2nd morning, also 1890.

Outside of the already mentioned spasmodic laryngeal symptoms, for ammonium bromat., eye inflammation is especially mentioned; moreover, an irritation under the finger nail which is relieved by biting on it.

Ammonium phosphor. is mentioned for chronic gout without the symptoms of even a short proving giving the occasion. (C. Voigt: compression of the precordium and chest, nausea, thirst; hard, small rapid pulse, collapsed circulation; fulness and tension in the head, heaviness in the extremities, uncertain, stumbling gait).[23] Allen's report of facial paralysis is likewise not exactly suited to awaken confidence.

If *ammonium benz.* is recommended for gout of the great toe, then this refers more to the benzoic acid component.

AMMONIUM MURIATICUM

Salmiac, NH_4Cl, dissociates as the salt of a strong acid and in contrast to the carbonate is stronger elec-

trically and less hydrolytic. The lack of odor of this salt suggests that no ammonia is set free. Therefore in the organism the liberation of ammonia is less stormy so that the elaboration to urea and the excretion through the urine and sweat in general is more extensive.

With larger doses an increased excretion of a urinous smelling sweat is observed. Moreover, the disturbances of the digestive canal appear stronger: coated tongue, scurvy-like alterations in the gums, burning sensation in the stomach, nausea, constipation, more rarely also diarrhea and colic besides nausea and vomiting, and from persistent use emaciation.

SPECIAL ASPECTS OF AMMONIUM MURIATICUM

One may expect from *ammonium muriaticum a more prolonged ammonium action* and moreover in the liberation from hydrochloric acid and its neutralization (through sodium) *an approximation of acidum muriaticum and natrium muriaticum.* Likewise magnesium muriaticum is recalled particularly by the gastro-intestinal symptoms.

The general *type with relaxed fibers and loss of power* corresponds also to ammon. mur., but on the other hand it lacks the hydrogenoid trend, the aggravation from damp and cold; likewise it lacks the nocturnal aggravation.

In ammon. mur., in contrast to ammon. carb., there exists *a great tendency to periodic febrile states.* Thereby the chill should predominate (stronger evenings) and the thirst is absent; at night the sweat appears. With this is associated the characteristic symptom of ammon. carb.: *sensation of coldness be-*

tween the shoulder blades. This is particularly guiding in the catarrhal processes.

The periodicity (the seven-day type is observed) has also given occasion for use in malaria-like states. This tendency to febrile states is probably to be traced to the chloride fraction. Generally there exists in ammon. mur. a greater erethism in the vascular system, an unrest in the circulation.

ORGAN ACTIONS

The *symptoms of the respiratory passages* are indeed like those of ammon. carb., but *less stormy,* joined with less disturbance on the part of the heart and the central regulatory apparatus. Dyspnea and feeling of suffocation are not so prominent. In place of this the direct influence on mucous secretion appears more in the foreground in ammon. mur. (In ammon. carb. the collection of mucus with râles is secondary and conditioned more through weakness, especially of the heart.) Indeed, ammon. mur. is used by the old school exactly for an increase in mucous secretion. In order to loosen cough, to lighten expectoration, large doses are necessary. The indication is dry, irritating cough with stitches in the chest, worse on lying on the back or on the right side, worse toward morning; noon and evening the cough is loose with copious expectoration and râles.

The laryngitis is combined with huskiness and burning. Burning in small spots in the chest is reported. The colds have an acrid, hot, watery secretion which leads to nasal occlusion as well as loss of smell but not to paroxysmal respiratory oppression as with ammon. carb. Likewise in the throat, in the tonsils, there is merely a simple catarrhal swelling with abun-

dant tenacious mucus present with ammon. mur. Through stimulation of secretion, glandular swelling in the throat should find alleviation, indeed even in persistent goiter.

Among the gastro-intestinal symptoms, deviating from ammon. carb., the *constipation with crumbling stools* is noteworthy, a symptom which recalls natrium muriaticum and magnesium muriaticum and which may be ascribed to the anion. With ammon. mur. the stool is often coated with shiny mucus. Green, slimy diarrheas are more rarely encountered, hemorrhoids, itching, sticking, burning, soreness in the rectum are accessory manifestations, similarly as in ammon. carb. The other gastro-intestinal symptoms are just as non-characteristic as with ammon. carb.

A chronic hepatic swelling with burning and sticking appears as a clinical indication together with sensations in both hypochondria. That the liver is the site of ammonium detoxication is hardly enough to make this indication plausible. An old indication of prostatic hypertrophy has been incorporated in homeopathy without foundation.

The menses are of the same type as with ammon. carb., and still the bleeding should occur more profusely at night with ammon. mur. A protein-like leukorrhea or brown, slimy discharge after urination is incidental.

The more prolonged, more deeply penerating ammonium action than in the ammon. mur. picture is found in the number of neuralgic complaints: most important is a *sciatica, worse from sitting,* somewhat better from moving, lessening on lying, a tensive and contracting-like pain; moreover *neuralgia in amputations*; coccygodynia, like a bruise; lancinating, draw-

ing and cutting pains in the fingers, toes and heels, the heel pain better from rubbing.

PROVINGS

(1) Hahnemann: "Chronic Diseases," Bd. 2.

(2) Gumpert: "Med. Zeitung d. Vereins f. Heilkunde in Preussen," Bd. III, 179.

(3) Rechnitz: "Med. Jahrb. d. K. K. Oesterr.," St. 31, 224.

(4) Wibmer: "Wirkungen der Arzneien und Gifte," Bd. 1.

(5) Böcker: "Beit. zur Heilkunde," Bd. II, 150.

SUMMARY

Ammonium action more prolonged in ammon. mur.; more vessel erethism; periodic febrile states.

Type:

Lax fiber, loss of power.

Chief Trends:

Catarrhs of the respiratory passages (secretory action); neuralgias; constipation with crumbling stools; peculiar symptom: feeling of coldness between shoulder blades.

DOSE

As ammonium compounds in general, the lower up to the sixth decimal are employed.

CAUSTICUM

For 100 years the fight has proceeded about this drug which Hahnemann prepared with the aim of obtaining the caustic principle as pure as possible, or as we would say, to bring the OH action out clearly.

His original tinctura acris sine kali[24] was later given up in favor of this preparation.

PREPARATION

He described *the preparation of causticum* as follows:[25] Calcareous earth, in the state of marble, owes its insolubility in water and its mild disposition to the combination of an acid of the lowest order, which the marble yields as a gas in a glowing fire, and it may be assumed to contain in its composition another substance than fused lime, which, unknown to chemistry, shares with it its corrosive property just as it shares the property of solubility in water with lime water. This substance, although not an acid itself, loses its caustic power to it, and allows, through the addition of a fluid (heat stabile) acid with which it is combined in the earth with close affinity, separation by distillation as watery causticum.

If one takes a piece of freshly fused lime of about two pounds, immerses this fragment in a vessel full of distilled water, for one minute, and then places it on a dry cloth, when there it soon, with the development of much heat and peculiar odor, called lime vapor, falls into a powder. One takes of this powder about two ounces and mixes with it in a (warmed) porcelain mortar, a solution of two ounces of potassium bisulphate (bisulphas kalicus) which has been heated to glowing, melted, and then again cooled and pulverized, in two ounces of boiling hot water, and transfers this thick magna in a small glass cylinder, into a wet alembic with the tube of the latter whose nozzle lies half under water and distills with gradual approach of a coal fire from below, that is, with sufficient heat

to distill to dryness. This distillate, amounting to about one and one-half ounces, of water clearness, contains in concentrated form the already mentioned substance, causticum, which smells like caustic potassium alkali, tastes astringent on the tongue and markedly burning in the throat freezes at a lower point than water and markedly promotes decomposition of animal substances lying in it; by addition of barium chloride it yields no trace of sulphuric acid and on the addition of ammonium oxalate shows no trace of lime.

MEDICINAL CONTENT

For 100 years, exactly as today, one has ever again asserted from chemical facts that this distillate lacked any content of effective substance and stated that nothing but distilled water could arise from it. And indeed not only the opponents of homeopathy, who would then as now ridicule the phantasy of homeopathy, but likewise then as now the so-called critical homeopaths have done so.

Recently Joachimoglu would reduce homeopathy to an absurdity with this example of meaningless assertion. But nevertheless practically all homeopathic physicians have not ceased to use this preparation and have had more trust in their own observations than in chemical deliberations.

Even the trustworthy chemist, Buchner, author of a homeopathic pharmacopeia, showed in 1836 that causticum contained free ammonia. Later, in 1860, Gruner confirmed this, when writing the homeopathic pharmacopeia which is still official in Würtemburg. The apothecary Wagner,[26] in Basel has again found ammonia in the distillate. A completely insufficient

opposition[27] satisfies many who consider this new finding an error.

For this reason at my request the Johannes-Apotheke of Stuttgart have repeatedly prepared causticum and controlled it exactly. The method of Hahnemann was followed as closely as possible in respect to his apparatus. Even a retort of the old form was used.

That there is something in the distillate, which is different from distilled water, one is convinced best through the soda-like odor and the mildly astringent taste. Furthermore, with Merck's universal indicator, it shows that the distillate actually has an alkaline reaction. The fresh preparation has a pH of 8.0–8.5 which decreases gradually after twenty-four hours to a pH of about 7.5. Likewise the fresh preparation reacts weakly alkaline to litmus. With Nessler's reagent it gives a light yellow color, which colorimetrically determined corresponds to about the fifth decimal potency of ammonia. Even earlier it was suggested that the ammonia arises from the lime and indeed from the inclusions of animal tissues. In the burning, ammonia would become free, be taken into solution by the water, and be distilled over.

Also if chemically pure, apparently nitrogen-free, original material is employed (calcarea ustae marmore pro analysi and potassium bisulfuricum crystallisatum [$KHSO_4$], pro analysi, [Merck]), the result remains the same. Up to now it has not occurred that a causticum is distilled which does not give an ammonia reaction. That the control distillates from the same water do not furnish an alkaline reaction nor ammonia need not be stressed.

In what form the ammonia exists in the distillate is still unknown. *At any rate, the preparation must*

be added to the ammonium compounds. Its persistent action which characterizes it beyond simple ammonium hydroxide and other ammonium compounds must be ascribed to still unknown properties which indeed it owes to its method of preparation.

PROVING

The *proving symptoms* from the first edition of "Chronic Diseases" (see above) have been added by Hahnemann in the second edition of 1837 to the symptom of the impure preparation tinctura acris sine kali.

GENERAL ACTIONS

One can consider causticum as a chronic acting ammonium preparation. But it also stands close to the potassium picture although this element has not been proven in it.

LOCOMOTOR APPARATUS

The trend toward *the locomotor apparatus* appears the predominant in causticum. In the second place stands the influence on *the respiratory passages.* The type deviates from ammon. carb. and kali carb. in so far that the chronic, insidious maladies, in causticum, condition a *yellowish, wan facies, and furthermore through the improvement in unsettled, damp weather, aggravation in clear weather and also from dry cold.* Etiologically, indolent affections are reported. Causticum has a depressed melancholic frame of mind but also much terror and irritability: children will not go to sleep alone, cry out on the least occasion. *For the locomotor apparatus, the drawing, tearing, as well as burning pains* are characteristic; and *for the mucous*

membranes, burning pains. The *time of aggravation,* like ammonium and potassium, is toward 3–4 A.M.

Chief indications are: subacute and chronic muscle-tendon-joint-and peripheral-nerve affections of a rheumatic type, aggravated by dry cold and cold winds, through drafts, through movement, better from the warmth of the bed. There exist *great nocturnal restlessness, twitching in the extremities.* The rheumatic inflammations easily pass over into secondary alterations; there are an arthritis deformans, tendon shortening, muscle contractions (Dupuytren), peripheral paralysis with increasing weakness and uncertainty in the muscles.

In its great neuromuscular weakness with trembling and twitching, causticum stands close to kali carb., moreover, the paralytic weakness of causticum goes over much sooner to actual paralysis.

A chief field of application is *the weakness of the sphincter vesicae*: *involuntary discharge of urine* on coughing, sneezing, walking, often unnoted, or enuresis in the first sleep. But urinary retention also occurs and the postoperative type forms a suitable field of employment. Facial, ocular paralysis, ptosis, paralysis of the tongue with indistinct speech, vocal-cord paralysis (recurrent nerve paralysis after diphtheria, from hard goiter, *etc.*). Failure of the lower rectum and of the sphincter ani, "the stool can be passed only when standing," but also partial paralysis anywhere else in the locomotor apparatus, either of rheumatic cause, from cold wind, or after infectious diseases, will be favorably influenced by causticum. Furthermore, sciatica with numbness comes under causticum. Other neuralgias have burning pains, for example, after herpes zoster.

RESPIRATORY ORGANS

On the respiratory organs *the huskiness and aphonia* stand in the middle point. Here the mucous membrane and the peripheral nerve actions come together so that chilling as well as overexertion from singing and talking are reported as causes. Characteristic is *the morning aggravation.*

The catarrhal manifestations involve particularly the larynx and the trachea and are characterized *by a feeling of soreness and burning* (in the larynx, under the sternum, in the chest). The cough is dry, hard, the sputum is scanty and raised with difficulty and must be swallowed. *The cough is relieved by drinking cold water.* The improvement from the warmth of bed does not refer to the cough, but on the contrary the aggravation at 3–4 in the morning was especially evident in the provings. Outside of the involuntary discharge of urine, a pain in the left hip is noted with the coughing. An echoing of the voice in the ears may result from the catarrhal processes in the throat.

OTHER ORGANS

The gastro-intestinal symptoms are without significance except the already mentioned weakness of the sphincter ani. The burning pain prevails everywhere, also in the hemorrhoids, whose condition is said to be worse from thinking about them. In the mouth the burning vesicles and ulcers are worthy of note.

The menses do not have a definite type, but the blood flows only during the day and ceases at night.

On the skin, *warts,* old scars and the results of burning should react, likewise itching and burning intertriginous eczema.

As an extraordinary symptom is reported the feeling as if a hollow space existed between the forehead and the brain, which perhaps can be connected with the feeling of looseness of ammon. carb. In the Hahnemannian symptom register besides diverse trembling and twitching in the muscles, also epileptiform attacks are described. The therapeutic use for this purpose is rare. The dependence upon the weather should guide the choice.

The indications for cataract are very uncertain.

SUMMARY

Chief trends:

(1) Locomotor apparatus; rheumatic affections; peripheral nerve paralysis (sphincter vesicae!).

(2) Respiratory passages (larynx and trachea).

Modalities:

Aggravation from dry cold, in cold weather; better damp weather; rheumatic affection better from warmth of bed; cough worse nights, particularly 3–4 A.M.; huskiness worse mornings; burning pain chiefly predominates.

DOSE

Usually the sixth and higher potencies.

2. THE GROUP II EARTHY ALKALIES

From the group of earthy alkalies we can exclude the first and last member: *beryllium*, a rare element in the earth which has no physiologic and so far as we know no pharmacologic significance. *Radium* indeed belongs chemically to this group, but its actions are so dominated by the decomposing radiations that it seems more suitable to consider it later in connection with the other radio-active element, uranium.

There remain the important physiologic elements, *magnesium* and *calcium*, which appear with many similarities and many opposites in the organism, and then *strontium* and *barium*, closely related to calcium but foreign to the body. Common to all is their appearance as divalent cations. They are not so movable and exchangeable as the alkali cations. The relation of the earthy alkalies to water is likewise different and their salts are poorly soluble. Likewise they are in opposition to the univalent cations in their influences upon colloids. Yet magnesium stands in an intermediate position, and it also has a special position chemically opposite to the heavier elements of the group.

In the actions on the organism the group relationships of these four elements comes distinctly into appearance.

MAGNESIUM

Magnesium has a circulation in the earth similar to that of calcium between the lithosphere and hydrosphere: it is found in the upper earth surface in great amounts (about 2.5 per cent; calcium about 3.5 per cent) chiefly as the carbonate, alone as magnesit and together with calcium carbonate as dolomit. As the chloride and sulphate it is associated with potassium salts. Even in this natural appearance it comes now with potassium and now with calcium salts, so that the *intermediate position of magnesium between the alkalies and earthy alkalies* holds even in relation to the organism.

MAGNESIUM METABOLISM

Magnesium is obviously present in every living cell, indeed in the muscle and nervous tissue the strongest; in the cerebrospinal fluid the magnesium content is higher than in the serum. These are the first suggestions of the very dark rôle in general of magnesium in the animal organism.

Magnesium metabolism proceeds very slowly. In the serum with its content of 2–4 mg. per cent it is present essentially in smaller amounts than calcium. Just as with calcium it exists there only in part as a free cation, and in other parts bound as a complex anion. One might conceive of this as the first reserve. In any case organic compounds are present in the cells. In the bones the affinity for magnesium is much less than that for calcium.

The physiologic significance of magnesium is best known in the green plants. Here Willstaetter has discovered it in an organic form in chlorophyl—similar to

the iron in hemoglobin. One presumes that in the assimilation of carbon dioxide, also a synthetic reduction process, it plays a rôle similar to that of iron in hemoglobin in the oxidation of carbon compounds. Also in organic chemistry magnesium is often used in synthetic reactions as an "intermediator" for the introduction of a new radicle. Grignard has shown a catalytic promotion of organic synthesis with organic magnesium compounds. In physiologic animal investigation no great weight is placed upon the presence of magnesium, because Ringer's solution does not contain magnesium, while on the other hand Tyrode's solution contains half as much $MgCl_2$ as $CaCl_2$. Probably the greater significance comes to magnesium in the interior of the cell.

ION ACTION ON COLLOIDS AND CELLS

In the influence on colloids, magnesium takes a mid position between the alkalies and the earthy alkalies. In its swelling capacity, for example, it stands nearer the alkalies, also in protein salting out and flocculation. The precipitation of hydrophile colloids, perhaps albumin, is reversible through magnesium salts, as with the alkali salts and in concentrations, in which calcium, strontium and barium salts cause irreversible precipitates. For many colloidal effects, as the precipitation of suspension colloids, the positive double valence of magnesium is decisive and in this respect magnesium agrees with the other earthy alkalies as calcium, strontium and barium, and like the other earthy alkalies as an antagonist to sodium and potassium. But outside of the antagonism between the uni- and divalent cations as it appears in living colloids there is also an *opposition in the action of magnesium and calcium* in the living cell wall as the latter is antagonist of not only

magnesium but also the alkalies, which in many cases cause precipitation through swelling. On muscle a swelling action of magnesium has been demonstrated in contradistinction to the de-swelling through calcium.[1] For placing magnesium in equilibrium relatively more calcium is necessary than for sodium and potassium.[2] In an antagonism which manifests itself in the removal of a one-sided damaging influence, the concentration relations are always important.

That the actions of two elements which follow one another in a related group are not additive but subtractive and appear in the end-effects as opposites is something very common as we have already seen in sodium and potassium, and which also occurs with chloride and bromine. This is probably connected with an opposing property of penetration so that closely related ions collect on the site of action, the surface of the colloidal particles. Increased introduction of magnesium provokes an increased excretion of calcium into the urine; thereby calcium goes out of its tissue compounds into ionic form. By increase of the magnesium content in the serum, the binding capacity of the cartilage for calcium is impaired.

An antagonism between magnesium and calcium can be demonstrated on the frog heart. Addition of magnesium to the nutrient fluid slows the heart beat, lengthens diastole and ends finally in standstill in diastole (this action is also shown from intravenous injections on the entire animal) while reversely calcium increase accelerates the cardiac action, lengthens systole and finally leads to systolic standstill. The cardiac standstill from magnesium can be removed through calcium (in a half molar concentration) so that the heart again begins to beat.[3] The excitation of ventricular autonomy through the injection of calcium and barium is possible but does not succeed with magnesium. In such experiments magnesium in general has a

tonus-lessening, vagus-stimulating influence but not in the degree of potassium. In physiologic concentration a co-effect of magnesium for equilibrium in the heart is not evident, since magnesium as already stated can be omitted from the nutrient fluid without any change. On the isolated preparation of bronchial musculature a lessening of tonus is also demonstrated.[4]

The *intestinal* action of magnesium salts need not be concerned with a purgative action as is known of magnesium sulphate. With $MgSO_4$ the fluidity of the stool depends not upon a resorptive action but exactly on the poor resorption of this salt. This saline purgative substance, $MgSO_4$, dissociates very little and has a slight capacity for diffusion: therefore the difficult absorption. The withdrawal of fluid into the intestine is according to all appearances conditioned through an increase of pure intestinal fluid. Through the difficult absorption of this salt, the fluid is held in the intestine and compels the intestine to excrete it.

Intestinal peristalsis by $MgSO_4$ as well as by $MgCl_2$ is *depressed* as well as by intravenous introduction.[5] In the stomach of animals $MgSO_4$ slows emptying, but increases the gastric secretion. But in man the secretion has also been found depressed.[6] According to Wiechmann[7] the magnesium paralysis of the intestine can be removed through calcium; Botazzi[8] on the contrary discusses a synergism of magnesium and calcium.

In any case it may be assumed that magnesium and calcium have some similarity in the intestinal action even if the experimental findings are still contradictory to one another.

By $MgSO_4$ a relaxation of the sphincter Oddi (choledochus) is produced, so that there is increased emptying of the gall-bladder. The secretion of bile from the liver is rather depressed.[9]

The magnesium ions have an important relation to the *nervous system.* Injected in large doses (deci-

grams), the magnesium salts provoke a *narcotic* condition.[10] At first a peripheral paralysis appears, and indeed like a curare effect in that the muscle loses indirect excitability. The respiratory muscles are uninvolved for some time.[11] To this is added then a central paralysis with loss of consciousness. An increase in magnesium in the brain has not been observed quantitatively in single intoxications and only to a slight extent in repeated poisonings. After intralumbar injections motility and sensation in the lower half of the body diminish. The magnesium narcosis can be immediately interrupted through the intravenous injection of calcium, from which it may be presumed that it is concerned with an ion action. But in this antagonism of ions positively nothing is said of calcium acting stimulating on the nervous system by itself. The opposite is much more the case.

The magnesium narcosis is an effect of large doses and does not ordinarily occur after oral administration because of the poor absorption of magnesium salts. By the addition of saponins the absorption is increased so that narcosis can be orally obtained. The special affinity of the nervous system expresses itself in the anesthesia appearing after subcutaneous injection.[12] It is worthy of note that a transient hyperesthesia accompanies the pain of injection and the itching of the skin, and also an irritation of the sensory nerves through the magnesium ions.

The body temperature is reduced by magnesium injections as well as by calcium injections.[13]

CLINICAL USE

Of great interest in respect to the homeopathic use of magnesium salts in *dysmenorrhea* are the studies

of Watchorn.[14] These show a dependence of the pain at the menstrual period upon the variations of magnesium content of the blood. With pains the magnesium in the serum increases. By doses of magnesium before the menses severe pains could be produced in women who otherwise had no pain at the menstrual period. On the contrary, in the premenstrual nausea they found low magnesium values and were able to relieve this nausea by doses of magnesium acetate.

The favorable action of the administration of magnesium in parathyreoprivic tetany is probably to be traced to the liberation of tissue-bound calcium into an ionic form.

Use has been made of the narcotic cell action by a preponderance of magnesium over calcium ions in tetanus, eclampsia and uremia, which naturally could be only palliative. There is still no explanation for the narcotic action. Perhaps the following finding in the suspension colloids points the way: an oil-water phase is shifted through magnesium in the direction of water in oil, through calcium to oil in water.[15] In the significance of cell lipoids for the narcotic action, perhaps by this pattern a bridge might be built from experimental to clinical observations.

DELBET'S VIEWS

Very extensive conclusions for the physiologic significance and the therapeutic evaluation of magnesium salts have been drawn by P. Delbet from studies and analysis. Animals which have been fed with a scurvy-producing diet remain alive about twice as long when magnesium salts are injected or added to the diet.[16] From this he concludes that a favorable effect on the

metabolism through magnesium according to the nature of vitamin. Delbet[17] perceives magnesium as particularly important in respect to germination; in the plant magnesium is very abundant in the seed and more is found in the corm than in the straw. Mice become sterile in the absence of magnesium. Sperm are especially rich in magnesium and the introduction of magnesium is supposed to stimulate sexual function. In children the thymus is rich in magnesium, in the adult, the brain and testes, and with old age the calcium in the testes increases; on the contrary, magnesium diminishes. A number of old-age phenomena were favorably influenced according to his report when magnesium was regularly introduced: old people become more able to work, sexual function is stimulated, muscle stiffness is lessened or removed, likewise senile tremor and pruritus senilis. Studies on the healthy with the use of magnesium chloride solution gave an increase in well being and general activity. With overstrained mental activity, it should, just as has been shown of the phosphate, become free to a great extent and appear in the urine. Muscles, brain and sexual glands were said to be, corresponding to their high content of magnesium, the chief points of functional and therapeutic attack of magnesium. Indeed, even Parkinsonian syndromes and ataxia were said to improve under the introduction of magnesium salts.

But Delbet goes still farther. Proceeding from favorable magnesium effects in skin diseases, warts, papilloma, polyps, he presents a study on mice with artificial tumors and reports a favorable influence. Defect of magnesium in the diet favors the development of carcinoma. Use of magnesium should be preventive

in carcinoma and indeed even exert a favorable influence after its development according to him.

Corresponding to his theory of magnesium deficiency the therapy is a continuous introduction of magnesium as a nutrient material. This is necessary in only small amounts as in the case of other materials, cognizance being taken of the facts of magnesium metabolism. A confirmation of the very extensive assertions of Delbet must be awaited.

The local mass action of magnesium sulphate as a laxative is, just as little as the use of magnesia usta for the neutralization of gastric acid, to be ascribed to specific magnesium action.

MAGNESIUM CARBONICUM

Type

The type of magnesium carb. *is relaxed and sensitive to cold* as with all alkalies and earthy alkali carbonates. One can say that in many respects magnesium acts toward calcium as sodium to potassium, but even more distinct is the intermediate position between potassium and calcium. Exactly as in natrium carb. is the relaxation paired with *great sensitivity*, bodily (against contact, cold air, cold water) as also psychic which makes the patient seem irritable, ill humoured and anxious. The magnesium type is represented preferably by women and children. In general chilliness and tendency to emaciation (the last in contrast to calcareas!) and offensive greasy night sweats are shown by magnesium patients. The relaxation involves also a great part of the musculature as with kali carb., and we recall here the magnesium function in the muscle cells. Indeed, a sunken sinking to the ground without loss of consciousness has been reported

by Hahnemann. This is comparable to the sudden weakness in the extremities. To a much greater extent than sodium, potassium and calcium carbonates is magnesium carbonicum rich with pains, full of *neuralgias, darting, tearing, boring* (with magnesium phosphoricum preferably spasmodic). The pains are worse *during rest, the patient must stand and move about. Cold and contact aggravate, warmth and firm pressure* relieve the pains.

If Delbet has seen as favorable primary actions of large doses of magnesium salts, an increase of the bodily and mental energy, then this does not contradict the states of exhaustion which appear in the provings under other conditions. In the effect there is not only the amount but also the time factor, the frequency of the dose and the duration of observations; moreover, the previous state of the individual and many other factors.

Sleep with magnesium carbonicum is *unrefreshing*; the patient is more tired morning than evening. From 2 to 3 he is sleepless, must arise and move about. Magnesium muriaticum has sleeplessness with great anxiety and restlessness in bed. Both remedies have desire for sleep during the day.

NERVE EFFECTS

A very outstanding trend is represented by the effects of magnesium salts *on the peripheral nerves.* It seems logical to bring this into relationship with the experimentally demonstrated narcotic action and anesthesia. An irritative phase is less observed in the experiments, outside of sensitivity to pain and the crawling which precedes the anesthesia for a time. But drug proving on the healthy has particularly brought out this impor-

tant action phase for therapy. Magnesium carb. has *severe pains in the nerve trunks*; the patient cannot sit still but must move about. With all magnesium salts these pains are *worse at night.* In provings of magnesium carb. these neuralgias appear chiefly in the head and face, particularly nocturnally, at rest an unbearable toothache, or nocturnal tearing; at night must get up and walk about. The toothache is said to occur at every change in the weather; *it is worse before the menses and* during pregnancy. Also a back and sacral pain, nocturnal, as if bruised, belongs to the picture of pain of magnesium carb., as do general soreness, stiffness and aching. A quick, penetrating gluteal pain, pain in the shoulders and arms so that they fall heavily when elevated, in the legs as after toil—walking is difficult—all these symptoms show that outside of the sensory nerves, the muscles are involved.

DIGESTIVE ORGANS

The organ actions of magnesium carb. go, as with all magnesium salts, predominantly on the *gastro-intestinal canal* and on the *sexual organs*, particularly the uterus. For these organ effects, the lower potencies are preferable. Indeed, it is demonstrated that magnesium is predominantly excreted through the intestine and thereby gastro-intestinal effects can occur. This part of the magnesium picture has much in common with the gastro-intestinal symptoms of calcium carb. Entirely as with calcium, in magnesium carb. is a striking presence of *acid in the gastro-intestinal canal: sour taste, sour eructations, sour vomiting, sour belching.* The tongue and oral mucosa burn, are sensitive, especially towards acid. In the diarrhea of children it is especially noteworthy: *the entire child smells sour, the*

stools are sour. The diarrhea is preceded by knife-like pains in the abdomen. A remarkable symptom appears with magnesium carb. exactly as with calcium: Milk passes through undigested or the stool is watery and contains clumps looking like tallow. Possibly this is to be referred to the saponification of fats through the earthy alkalies. An especially striking symptom for magnesium carb. in diarrhea is: *green appearance of the stool, like a scum in a frog pond.* It is also not to be forgotten that magnesium just like calcium has a significant effect on the motility and secretion of the gastro-intestinal canal, which can be explained only insufficiently at present from the ionic effects on the motor apparatus. The fact that milk is poorly borne may be associated with the abnormal acid status. (Neither aversion nor desire for flesh is characteristic, for both are seen in the provings; similarly contradictory are the desire and aversion for green vegetables.)

The dyspeptic disturbances in nurslings may become severe even to athrepsia, just as in calcarea carb. Prevailing in magnesium carb. are diarrhea, but also hard, crumbly dry stools, which are difficult to evacuate, are reported and it is characteristic for their vegetative basis that they appear after psychic excitation or mental exertion. Constipation is otherwise more characteristic of magnesium muriaticum. Colicky, knife-like, constrictive gastric or abdominal pains often precede the dyspeptic disturbances.

SEXUAL ORGANS

Just as calcium so does magnesium have a close connection with *the menstrual event.* The findings cited from Watchorn also suggest this. While with the other magnesium salts both too early and too profuse menses

are reported, it is more often the case with magnesium carb. that the menses are late or entirely suppressed. For all the magnesium salts it holds that the menstrual blood is very dark and tar-like. Cited as characteristic for the carbonate is that the *blood flows markedly at night and ceases when walking around.* Here a vegetative influence on the tone of the uterus is to be considered in explanation. *Many complaints exist before and during the menses*; so for magnesium carb. there are chills, colds particularly in the throat, chilliness, backache and toothache before each menstrual period as well as facial pallor during the period; slimy discharge with lower abdominal cramps is of subordinate significance.

Of the atonic symptoms in the male sexual apparatus are decreased libido and frequent pollutions, in the urinary organs inability to retain and the involuntary passage of urine are reported in the provings.

RARE USES

Less utilized are the skin symptoms of magnesium carb., which are very similar to those of calc. carb. Only the dryness and itching of magnesium are more prominent. Magnesium, however, cannot reach the same rank as calcarea as a remedy for scrofula.

Stauffer reports that magnesium carb. has proven itself in cataract. The cloudy vision of the inflamed eye, "like a feather before it," from Hahnemann's provings, does not give sufficient basis for it and other explanations are not available.

MAGNESIUM MURIATICUM

The chloride compound of magnesium, $MgCl_2$, has the same type and the same modalities as magnesium

carb., but also deviations which make the remedy in many directions similar to natr. mur. This holds particularly for the type of *constipation.* Moreover, *a marked action upon the biliary secretion* has been ascribed to magnesium mur.

A good indication for magnesium mur. is the *headache which is relieved by firm pressure and warm covering.* This corresponds to the usual magnesium modalities, but is emphasized in the headache of this compound.

With magnesium mur. constipation *with hard stools which are so dry that they crumble* when they emerge from the anus, prevails. The stool is like sheep dung and is evacuated only with much pressure. While this syndrome is mentioned merely incidentally in magnesium carb. with magnesium muriaticum it has proven an indication and recalls the dry constipation of natrium mur.

The connection of magnesium mur. to the *liver* is depicted in the following manner: the liver is hard and enlarged, there is a pressing pain in the liver region which is worse on lying on the right side; when lying on the left side there is a feeling of a weight tearing across. With this a gray-white stool and jaundice should be present. These are very distinct manifestations of biliary stasis in which the constipation described might be considered as a supporting factor. We recall that magnesium salts rapidly empty the gallbladder by a mass effect, but depress bile formation. This experimental finding appears as a reversed effect which forms the opposite to the homeopathic employment. In the completely different experimental conditions this is not amazing.

In the *menstrual disturbances* there is *frequent faint-*

ing in magnesium mur. Generally the supersensitivity of the nervous system is strongly stressed and more like the trend of hysteria. The pains of dysmenorrhea radiate to the thighs, the backache is relieved by firm pressure. The blood is black as with magnesium carb. but the menses seem to be too early and too profuse. Slimy leukorrhea after preceding abdominal cramps is reported as with magnesium carb.

The marked atony of magnesium mur. comes into expression in a symptom from the bladder; *the urine can be voided only by pressure on the abdomen.* This indicates a trend in bladder paresis due to spinal causes.

Finally worthy of note in mag. mur. is cardiac palpitation on sitting, it disappearing on movement. The union to the vascular system may well be ascribed to the chloride fraction, because the same is found in natr. mur.

MAGNESIUM PHOSPHORICUM

The introduction of magnesium phosphoricum, $MgHPO_4$, into the drug treasury is one of the fortunate touches of Schüssler. Here also he proceeded from the Hahnemann provings of other magnesium salts, but is believed to have grasped in the phosphate the physiologically functioning form of magnesium in the nerves. And in this respect he was not wrong. For a special physiologic connection of magnesium to phosphate in the organism is very probable.

Magn. phosph. was introduced by Schüssler as a remedy for neuralgia and spasms and indeed this has been confirmed in the Allen provings and in clinical use many times.

Also in magn. phosph. it is concerned with an *over-nervous, rapidly exhausted, usually thin, dark type who*

is sensitive to cold in every form. The right side of the body seems preferred.

The picture of peripheral nerve symptoms predominates. The *neuralgias come and go suddenly, in severe attacks* (as with belladonna, there is generally a close choice between it and magn. phosp.). The attacks of pain are *often periodic, always at night.* The *spasmodic* character predominates, especially in the pains in the gastro-intestinal tract and uterus, but the characteristic neuralgias are sharp, cutting, sticking, piercing, and the site changes often and rapidly.

The headache has the usual modalities of magnesium: magn. phosph. should be the remedy for many cases of *periodic migraine,* in which belladonna acts only in the attack itself. The headache extends with preference from the occiput to the forehead and is combined with nausea and at times with spots before the eyes and double vision.

The *abdominal pains are colic-like,* often due to accumulations of gas and without relief from eructation, and they extend out from the umbilicus, seeming to prefer the right lower abdominal region. Magn. phosph. is to be considered in colics of children where there is loud screaming and rapid exhaustion by the pain. The colic is *relieved by bending double, pressure and external warmth.* The attacks of pain are renewed when they become cold. These modalities hold in general also for the *dysmenorrheas* in which magn. phosph. is given in the 3rd–6th decimal potency almost routinely and often proves successful. The cutting, drawing, pressing, cramplike intermittent pains become better when the bleeding occurs; the improvement from warmth differentiates magn. phosph. from pulsatilla. Likewise membraneous dysmenorrhea is suitable for

magn. phosph. (here borax is to be considered). The so-called ovarian neuralgias, particularly right, are often removed through this agent.

The spastic character of magn. phosph. extends to the smooth as well as voluntary muscle. Even general spasms in children, without fever, during eruption of teeth and after prolonged diarrhea, are considered suitable and show therein a relation to calcium in the manifestations. Chorea, epilepsy and tetanus were given as homeopathic indications before the narcotic action was experimentally known.

A spasmodic dry cough without expectoration has given occasion for the use of magn. phosph. in whooping cough. Closer indications are not certainly known. Spasmodic gulping appeared in the provings and has been repeatedly removed by magn. phosph.

Spasms and twitching of the lids, spasmodic twitching of the face in neuralgia, spasmodic squint, indeed nystagmus, spasm of the glottis, spasmodic occlusion of the throat on attempts to swallow fluids, spasmodic yawning, spasm of the urethra, bed wetting of a nervous origin, vaginismus and finally writer's cramp and other spasmodic states are indications for magn. phosphoricum and show the *affinity for the neuromuscular system.* From the side of the symptoms this has been very correctly appreciated through provings on the healthy. According to the entire nature of the remedy, it should be tried more than it has in paralysis agitans and the Parkinsonian syndromes.

The modalities are the same as with other magnesium preparations, that is, aggravation from cold (air or water) by contact, at night, relieved by pressure, warmth and bending together. Only it seems, in con-

trast to magn. carb., that movement aggravates (according to the provings and in opposition to the report of Stauffer).

MAGNESIUM SULPHURICUM

Magnesium sulphate, $MgSO_4$, as bitter salts, is often used in massive doses for the acceleration of intestinal and gallbladder emptying, yet in homeopathy it is the most rarely employed magnesium compound. As far as a judgment can be shaped it stands very close to natr. sulphuricum. On the basis of its diuretic action—passing of large amounts of light or greenish urine—it, like natr. sulph., has been recommended in *diabetes.* The soft stool soon after rising, diarrhea which is striking by the massiveness of the stool, are just or even more characteristic for natr. sulph.

Much chilliness and shuddering, heat in the head with coldness of the remainder of the body, coldness with thirst are reported.

The menses are too early and too profuse, the bleeding as with other magnesium salts is thick and black. The leukorrhea is said to be thick and abundant with cutting pains in the sacrum and thighs, worse on movement.

Especially in the neck and between the shoulders are pains, with great sensitivity to contact, which makes lying down impossible.

But it is unnecessary to cite further details of this preparation as long as no justification in practice exists for them.

DRUG PROVINGS

The homeopathic provings of magnesium salts are found:

Magnesium carbonicum

(1) Hahnemann: "Chronic Diseases," 2 Ed., Bd. 4, p. 134.

(2) Hartlaub and Trinks: "Materia Medica Pura," Bd. 2, p. 257; and Hartlaub and Trinks: *Annalen,* Bd. 4, p. 451.

Magnesium muriaticum

(1) Hahnemann: "Chronic Diseases," 2 Ed., Bd. 4, p. 178.

(2) Hartlaub and Trinks: "Materia Medica Pura," Bd. 2, p. 237; Hartlaub and Trinks: *Annalen,* Bd. 2.

(3) Lembke: *Neue Zeitschr. f. hom. Klin.,* Bd. 6, November, 1856.

Magnesium phosphoricum

Apart from the report of Schüssler (*Abgek. Ther.*) Provings of H. C. Allen: *Med. Advance.,* vol. 23, December, 1889 (after *Zeitschr d. Berl. Ver. homöopath. Aertze.,* Bd. 11, p. 430.

Magnesium sulfuricum

(1) Hartlaub u. Trinks: *Annalen,* Bd. 4, p. 406.

(2) Hencke: *Neues Arch. f. hom. Heilk.,* Bd. 1, p. 185, 1844.

SUMMARY

Magnesium Carbonicum

Type:

Relaxed, cold, sensitive to cold, nervous sensitivity, easily exhausted, muscle weakness, usually thin women and children.

Chief Actions:

Neuralgias, especially in face, in teeth, worse at night, at rest, moving about necessary.

Gastro-intestinal:

Sourness everywhere, green scum-like diarrhea, non-assimilation of milk; knife-like, colicky pains before the dyspeptic disturbances.

Menstrual Disturbances:

Bleeding, dark, tar-like, stronger at night, numerous complaints before the menses.

Modalities:

Worse at rest, at night, sleeplessness from 2 to 3, from cold in any form, from contact; *better* from moving around, warmth in any form, firm pressure.

Magnesium Muriaticum

Same in type and modalities.

Special Actions:

Headache better from firm pressure and warmth; constipation with hard, dry, crumbly stools; biliary stasis, hepatic swelling; dysmenorrhea with fainting, great nervous ("hysteric") sensitiveness; weakness of bladder evacuations; palpitation on sitting.

Magnesium Phosphoricum

Same type, particularly marked nervous sensitivity.

Neuralgia and Spasm Remedy:

Attacks of pain, suddenly developing and going; periodic migraine; colic better by bending double, pressure and warmth; dysmenorrhea, ovarian neuralgia; general spasms during teething, after diarrheas; whooping

cough; twitching and cramps in the involuntary and voluntary muscles.

Modalities:

Marked right-sidedness; some aggravation from movement; otherwise as magnesium salts.

Magnesium Sulphuricum

Diabetes? massive morning diarrhea? chilliness with thirst; marked leukorrhea with cutting pain in back and thighs; pains between the shoulders, sensitive to contact.

DOSE

The magnesium salts are usually prescribed as triturations in the lower and middle potencies, of magnesium carb. also in the higher potencies, of magnes. phosphor. chiefly as D3, D6, D12.

CALCIUM

The circulation of calcium, Ca, in the lithosphere determines to the great extent the shape of the earth's surface. Outstanding here is the affinity for carbonate. Calcium carbonate, $CaCO_3$, appears in enormous masses as mountain-forming stones. It is practically insoluble in water. But for the circulation of calcium, it is of decisive importance that $CaCO_3$ in water containing carbon dioxide forms the bicarbonate, $Ca(HCO_3)_2$, and this is more soluble. So the carbon dioxide containing water dissolves the calcareous stones and transports the calcium. If the solution loses its carbon dioxide through evaporation or through the synthetic activity of green plants, then the neutral $CaCO_3$ is again precipitated. For the change between precipitation and solution, the greater or lesser amount of CO_2 is decisive, on which a neutral or acid reaction depends.

If the calcium crust of the earth is formed and changed by carbon dioxide—of the original and constant significance of the related silicic acid for the structure of the earth surface we shall say nothing here—so to the change in form of calcium in the organism, the phosphate is determining. Indeed, calcium phosphate compounds appear in inanimate nature (phosphorite which perhaps corresponds to $Ca_3(PO_4)_2$ and apatite, a complex compound of carbonate, phosphate, and fluoride with calcium). But first in the biosphere it has added itself to the anion builder, phosphorus, and so in the *organism the*

affinity of calcium to phosphates is stronger than for carbonates, and essentially so, or better said: the phosphate determines to a higher degree the form and functional change of calcium than does the carbonate. A consideration of the calcium economy is therefore not possible without an inclusion of phosphate (and also carbonate metabolism).

CALCIUM ECONOMY

Exactly as the change between the precipitation and solution of calcium in the earth is conditioned through the acidity of the carbon dioxide containing water, so also the hydrogen-ion concentration of the milieu is the essential in respect to the state of the calcium salts: with acidification the solubility and transportability of the calcium salts increase, and neutral or alkaline reactions favor precipitation. The physiologic states of calcium play essentially between two poles: the precipitation chiefly in the skeleton, mostly in a passive supportive function and at the same time as a reserve depot, on the one side,—and the ionic freedom of the calcium in the body fluids, on the other, upon which the vital reactions with the cell colloid depend. Acidosis conditions increased absorption from the calcium depots, and under certain conditions may effect an osteoporosis, whereby there is increased calcium excretion in the urine. The introduction of alkali favors calcium retention and calcium deposits.

The hydrogen-ion concentration is also a decisive factor for the resorption. The 1 gram of calcium which is taken daily on the average must be split out of the colloid structure of the food, especially from plants and milk, into ions in the stomach and intestine. Absorption occurs in the duodenum and jejunum. So far as poorly

soluble calcium salts are present, the bile assists through the solution of calcium soaps (and to a slight degree of phosphates and carbonates) in the biliary acids. In the absence of bile, for example in biliary fistula, calcium absorption is insufficient and the calcium requirement is filled from the depots and osteoporosis may occur. An excess of fat may influence calcium absorption, and reversely an excess of calcium impairs phosphate absorption. So in young rats a calcium intake far in excess of phosphate introduction can lead to the so-called phosphate poor rickets.

The excretion of calcium occurs in the lower intestinal segments and through the kidneys. The return of used calcium in the intestine makes a balance according to intake and excretion impractical because the unabsorbed excreted fraction cannot be measured. The ratio of the calcium excreted through the kidneys to that excreted through the intestine is variable (1:10–1:12) and is altered under morbid conditions. A relative increase of the urine calcium is perceived as a sign of increased mobilization and passage of calcium ions into the blood.

The calcium content of human serum varies physiologically a little: it amounts to 10–11 mg % (estimated as CaO. Of this only about 2 mg % is in ionic form as Ca^{++} about 5 mg % is not ultrafilterable, that is, in colloid union, the remainder of about 4 mg % is probably present in a non-ionized complex calcium compound. The other conception that a pure, super-saturated, ionized calcium solution is present in the serum has many facts against it. The complex calcium fraction is considered the first line of reserve in maintaining the calcium-ion content and in maintaining the calcium-ion concentration fairly constant in spite of variable use. Complex fractions—as cations—are, it seems, bound to colloids,

perhaps by absorption, perhaps chemically (this is no longer considered a fundamental difference). But only the cation form has the influence characteristic of calcium on the cell colloids, the characteristic calcium activity in the play of vital powers.

Also with calcium we arrive at the constantly recurring demonstration that a purely quantitative conception is not able to express the physiologic or pathologic effectiveness of a substance, if *the state of form* is not considered at the same time. Further quantitative alterations first gain meaning when one compares their values at the various sites of action of the body, if one recognizes further *the trends of wandering*. Because, for example, the calcium of the serum has three ways of removal: (1) into the tissues, for the most part into the bones where it serves definite functional needs or is stored; (2) into the intestine, and (3) to the kidney. The last two ways of excretion mentioned certainly serve a different task. Disturbances in calcium economy can only be decided from alterations in amount and state of serum calcium, when one knows at the same time the wherefrom and whereto.

ION ACTIONS OF CALCIUM

The calcium action in the organism proceeds for the most part from Ca^{++} ions. The maintenance of the physiologic state of the body colloids is not only joined to the presence of calcium but also an optimal ratio of the calcium ions to the remaining cations (Na: K: Ca: Mg approximately as 100: 1.7: 1.1: 0.5). We conjecture the special actions of the calcium from disturbances in excess or deficiency of this optimum.

In the lyotropic series of cations which are arranged according to the swelling influence on the hydrophile

colloids, calcium stands at the end and is designated as the most *de-swelling*. Among the physiologic cations, calcium is the most precipitating principle. (Likewise, the formation of relatively poor soluble salts of calcium has the same basis in the marked water combining capacity of this atom; the chemical way of union is dependent upon the same atom property as the physical; the transition between the two types of combination are flowing.) Likewise, the divalence makes calcium a suitable opposite to the swelling and solvent influence of the univalent cations, Na and K. On the other side the precipitating power of calcium is such that it is still easily reversible, a thing which is no longer the case, for example, with barium. Exactly as the solubility of calcium salts under the conditions of the organism stands at the border of reversibility, this is also true of the precipitation of hydrophilic colloids through calcium ions.

So calcium ions are especially suitable for opposing a resistance against the one-sided swelling and solution tendencies of the alkali-ions, and for delimiting and thickening the surface of colloid structures, particularly the cells.

On this form-giving and form-maintaining of biocolloids, which is indispensable for their functioning, is based the general necessity of calcium for the organism.

The thickening hypothesis for calcium action of H. Meyer is nothing new. Sundelin once said:[1] "Calcium opposes the action of the alkalies which liquidify and obviously works opposite, tonic, drying, contracting." But this hypothesis is now supported through a great number of experiments which have taken their departure from the ground-laying investigations of J. Loeb.[2]

Single examples of this calcium action on single cells are: the segments of sea leech loosen themselves from their band and

separate from one another when they are transferred from sea water to a calcium-free isotonic salt solution.[3] *But on the other side an excess of calcium ions is also damaging.* According to J. Loeb an increase in calcium salts in sea water disturbs the vital activities of mesenchymal cells of certain sea animal eggs so that skeletal building is delayed or depressed. So even here we find the important function of calcium in skeletal formation and that too much or too little calcium conditions entirely the same disturbances. Also in functional respects the cells will be shifted through calcium to the opposite of Na and K. Sea leech eggs whose oxygen use is increased in isotonic NaCl solution, as in NaCl and KCl solution, will easily again be brought to the normal through calcium salts.[4] The hemolysis which is conditioned by potassium ions will be depressed through Ca ions; likewise the hemolysis through the narcotics and hypotonic salt solution.

The thickening action of calcium is decisive for the permeability of the cell-limiting surface for water, for other ions, and also for poisons.

The narcotic action of magnesium salts will be removed through calcium salts, and the fever of sodium chloride and adrenalin will be suppressed through calcium salts. The frog kidney can only retain glucose when calcium is present in the perfusion fluid in definite concentrations.[5] Frog extremities become edematous in a perfusion of the vessels with a solution of sodium chloride if it contains too little calcium. The excretion of injected fluorescein in the anterior eye chamber is markedly reduced through doses of calcium.[6] Artificially produced inflammation (mustard conjunctivitis, pleural exudates) will be depressed by the previous injection of $CaCl_2$.[7] The last, however, has not been confirmed by Levy[8] and Tainter and Deventer.[9]

Beyond the thickening of the tissue cells, a lessening of the permeability of the *capillaries* is very probable. The action of calcium on inflammation (for example, skin exanthemata and eczema)[10] need not always be a *direct* influence on the receptive organ cells and capillaries but can also be obtained by means of the regulating vegetative system.

Similar influences of calcium are effective in *muscle and nerve systems.* Without calcium the skeletal muscles would be found in constant contraction.[11] Likewise calcium dampens the irritability of the nervous system. The over-irritation up to paralysis of the muscle and nerves from a one-sided potassium influence can be avoided through the insertion of calcium ions into the nutrient field.

Calcium introduced into the lateral ventricles of the brain induces a sleep-like state with a marked fall in blood pressure, slowing of pulse and respiratory depression.[12] The irritability of the brain surface can be reduced through rinsing with calcium solutions. By using the calcium-binding citrate solution the irritability of the motor centers increases strongly.[13] Oxalic acid poisoning equals calcium withdrawal and strongly increases the general irritability of the nerves.[14] Calcium causes lessening of reflexes by an increase of excitation of the spinal cord columns.[15]

On the surviving heart a relative calcium increase in the nutrient fluid effects increase of the systole (increase in size of contraction, that is, positive inotropic action) and finally standstill in systole. (Potassium preponderance equals increase in the diastole and finally standstill in diastole) Langendorff and Hueck,[16] Gross.[17]

The calcium ion is necessary for the effectiveness of a positive tropic stimulus.[18] The negative inotropic action of muscarine, that is, vagus excitation, can be removed through calcium salts (just as with small doses of atropine).[19] Here calcium acts as a vagus depressor. The frequency of the surviving heart is increased by calcium (positive chronotropic action.[20] The stimulus formation and irritability is increased;[21] so far the action corresponds either to a vagus depression or a sympathetic stimulation. But by surpassing a calcium optimum the number of beats from the sinus is reduced.[22] Furthermore the calcium influence is revealed much more prominently on single parts of the heart according to Kolm and Pick;[23] accordingly the appearance of calcium contracture is united with the presence of potassium, and on the heart

washed free from potassium, $CaCl_2$ causes diastolic cardiac standstill. $CaCl_2$ (as $BaCl_2$) stimulates the automatic ventricular centers (systolic contracture which can be removed by potassium, and on the other side the status of the ventricle placed, into a state of preparation for contracture through previous treatment with calcium, can be converted by potassium at the sinus node).

But the observations on acute calcium poisoning in man often stand in contrast to these experimental studies on surviving hearts.

Soon after the injection of calcium the pulse frequency lessens, the pupil narrows (also vagus stimulation!), the respiratory frequency decreases, breathing deepens and later, following the initial vagus excitant action, there is a weakly expressed excitant action on the sympathetic.[24] After the injection of $CaBr_2$ in large doses, there is observed[25] in man, sinus bradycardia and often extrasystolic arrhythmia, also a vagus excitation. Lloyd[23] found after the intravenous injection of large doses of $CaCl_2$ on himself, the pulse rate fell to almost one-half, auriculo-ventricular conduction was delayed, then a sinus auricular block appeared, followed by loss of consciousness. The calcium bradycardia can be removed or avoided through the injection of atropine,[27] that is, also a vagus action. But in pathologic processes a tachycardia is also observed after calcium injections.

The blood pressure has been found partly increased and partly decreased after calcium injections. In the increase the peripheral vasoconstrictive action of calcium probably participates, an action which has been proven microscopically (Krowarz).

Since the diastolic blood pressure sinks under calcium action, an increase of the stroke volume and increase of cardiac work may be assumed. Actually in the cat the amount of blood circulating after injection of calcium has been found increased.[28]

The positive inotropic action of calcium, the reduction of the pulse rate, sinus bradycardia up to arrhythmia, and disturbances of conduction up to sino-auricular block (in contrast to the naturally slight increases of frequency in animal investigation, similarly in pathologic hearts in men!), furthermore the lowering of dia-

stolic pressure, enlargement of the stroke volume, all *make the acute calcium-ion action approximate the digitalis bodies closely.* (Compare Weizacker,[29] Loewi,[30] v. Konschegg,[31] Billigheimer.[32] Loewi perceives *strophanthin action as a sensitization of the heart for calcium ions.* In all cases reacting to strophanthin, the capacity of the heart to the demand of the stimulus of the physiologic blood calcium is reduced, and therein lies the cause of defective cardiac function.

According to all, the calcium influence on the heart is better conceived as a vagus action (which also corresponds much more to digitalis!), than as a sympathetic action as S. G. Zondek states. But one cannot ascribe the calcium action in general to either the vagus or the sympathetic alone. It is well to consider that the increase of resistance, which indeed is also here the chief action of calcium ions, is effective not only on the muscle cells but also on the vegetative cardiac nerves. In any case *calcium is necessary*[33] *for the electrical excitability of the vagus as well as for the sympathetic.*[34]

Small doses of calcium increase the irritability of the vagus. Large doses of calcium should pervert the vagus irritability so that electrical excitation induces an acceleration.[36] With a calcium defect the vagal nerve endings on the frog heart are indeed sensitive to adrenalin.[37]

On the isolated intestine the presence of calcium is necessary for the action of sympathetic stimulant poisons (adrenalin) as for vagus poisons (acetylcholin).[38] In high-grade calcium defects, the intestine in experiments becomes almost non-sensitive to potassium and sodium ions as vagus excitors as against muscarine.[39] In general, on the stomach-intestine a sympathetic action is also considered a depression of the motor and secretory functions. But this agrees in no way with the experimental findings; in dogs the motor activity of the gastric musculature should be weakened by calcium but the secretion increases from rectal injection of calcium and is lessened from intravenous injections;

the after-effect of perorally and rectally administered calcium shows always an increased gastric secretion.[40] In man, after the intravenous injection of $CaCl_2$, the secretion of the stomach is mostly increased and also the motility.[41] These are also vagus effects.

That a simple relation of calcium equals sympathetic excitation cannot be accepted—also proceeds from experiments on the surviving human uterus. Gravid and non-gravid uteri behave opposite to shifting of the Ca:K ionic proportions.

While the adrenalin sensitivity (that is, a sympathetic irritability) of the non-gravid uterus is depressed by an excess of calcium, the gravid uterus will be stimulated by adrenalin through an excess of calcium. For potassium excesses under the same conditions, the opposing action is seen.[42] Here it also depends upon the preceding status of the organ whether the calcium excess favors or depresses the sympathetic stimulus of adrenalin.

It is wrong to unite the calcium effect with a part of the vegetative correlative system as the sympathetic. The presence of calcium ions is necessary for the function of the sympathetics as for the parasympathetics. In order to establish the task of calcium ions, one must proceed from the receptive organs.

They may be conceived uniformly as an insertion of resistance against the otherwise unrepressed exchange of colloidal electrolytic charges. Without the calcium resistance the continuous excitation of the cells and their ferment-like subsystems rapidly proceed up to an end-state of non-irritability. The calcium resistance is a partial function of the cations, and therefore calcium seems for many effects as the antagonist on Na and K, and for single effects as the antagonist of Mg ions. *The physiologic resistance represents first the potential which is a precondition for the utilization of cell energy in the*

regulated course of living events. One never sees any sympathetic stimulus effect of calcium which would be represented metabolically in increased dissimilation and would proceed over the endocrine glands supplied by the sympathetic (thyroid, adrenal). Likewise, the tonic action, a sort of sympathetic stimulation, has been gained for the most part only experimentally in excised organs and cold-blooded animals, and this stimulation one can conceive just as well as a vagus depression. Whether stimulus or depression results is dependent upon other conditions, in particular the dose.

The influence on metabolism through calcium is indirect. The tonus of cells will be determined through calcium, and the vegetative regulative state of the cells is again significant for metabolism. The increase of resistance in the cells through calcium will come into expression as a slowing of metabolism, a decrease of dissimilation. Actually the excretion of nitrogen in the urine is lessened by large doses of calcium; the protein balance becomes positive.[35] This perhaps can be explained through the thickening of the cells and the capillaries simply in the kidneys. The lessened excretion through the kidneys under the influence of large doses of calcium is observed with many substances. The water and sodium chloride excretion is influenced by calcium in diverse ways: large doses of calcium increase diuresis after an initial fall, small doses depress diuresis. The sodium chloride excretion, in general, seems increased in consequence to an ion-shifting by calcium enrichment.

In disturbances and stasis in calcium economy, accordingly, we may expect, in consequence to the pathologically increased resistance, *a slowing of dissimilative processes.* The oxygen consumption is reduced to below

normal. This is significant for the *constitutional type of calcium.*

The action of calcium ions on the body colloids plays an important rôle in *the process of coagulation.* So no coagulation of the blood can occur without the presence of soluble calcium salts. Probably the pre-stage of the fibrin enzyme is activated only in the presence of calcium salts. Also for the coagulation of paracasein (cheese) from milk through the ferment rennin, and indeed its precipitation in solid form, the presence of calcium salts is necessary. It is concerned with the discharge of electronegative colloids by Ca.

Likewise if the presence of calcium is necessary for the coagulation of blood, still this does not say that increase of calcium ions promotes the capacity for coagulation. Indeed this is debated at present and the increase of coagulation capacity is assigned to the bound calcium fraction of the blood. It is well known from clinical observations that calcium reduces the tendency to hemorrhage. But it is not certain whether this occurs through increase in coagulability or through thickening and contraction of the vessel or both.

Calcium salts increase the motility and phagocytic activity of the leukocytes.[43] This is as important for the calcium effect on the inflammatory process as the thickening.

The influence of calcium salts on the blood is not reported uniformly. After $CaCl_2$ injections, an increase in the lymphocytes and monocytes and decrease of the neutrophiles may be found; with KCl injections, the distributions are reverse. This can be correctly traced to an influence on the vegetative regulation. Completely uncertain is the influence of calcium on the red-blood-cell picture.

DISTURBANCE AND REGULATION OF THE CALCIUM ECONOMY

If the investigations on single organs and cells give us the first glance into the "how" of calcium actions, then we may more closely approach the *disturbances of calcium economy and its regulation in the total organism*—under what conditions, in what disturbances and with what prospects can calcium salts be used therapeutically?

The calcium economy has its broad basis in the skeleton because here 99 per cent of the calcium is anchored. For this reason the marked outpouring of calcium causes distinct manifestations in the bones.

The tissue reactions of calcium are then best viewed in the bones. But calcium economy can only be considered in relation to the phosphate economy. Not only *is the phosphate the most important supplementary anion to calcium but it takes a leading rôle in the movement of calcium,* both in the introduction and excretion, and *participates extensively in the important matter of state of form.*

Calcium is deposited in the matrix of the bones in the form of a complex CO_3 and PO_4 compound of the type of apatite. The calcium salts are certainly not to be considered as a simple deposit but stand in close relation to the living tissue. Only in dystrophic calcification does a simple deposition come into question. The process of calcification probably consists at first of an absorption union of the complex calcium salts of the serum by the cartilage colloids. For this an increase in phosphate in the serum is necessary, because only in such a serum does union follow only in the cartilage and not in the remaining tissues. In the growing cartilage of juveniles, especially in the

growth zone, and in adults only in the region of a healing fracture in a callus, a phosphatase has been demonstrated (Robinson) which, like the renal phosphatase, is able to liberate inorganic phosphates out of the serum organic phosphate compounds. The appearance of the activation of phosphatase also makes possible a deposition of complex calcium salts into the cartilage basic substance and further explains the enrichment of phosphate in prepared bone in contrast to the usual relation of carbonate to phosphates in the serum.

In rickets or avitaminosis D, calcium economy is distinctly disturbed and the manifestations show themselves most distinctly in the depot for calcium salts, the bones. Here an impoverishment of calcium salts appears; there is a cessation of calcification. In the florid state calcium and phosphates are less retained but in the healing stage the retention is considerably greater. In the serum in rickets the amount of phosphates is even lower than the calcium amount in the blood. The low content of the blood in inorganic phosphates depends upon a defective action of the cartilage phosphatase. The excretion of phosphates through the kidney continues undisturbed as the renal phosphatase is uninfluenced. Probably less calcium is absorbed from the intestine. In rickets the ratio of intestinal calcium excretion to renal calcium excretion is considerably increased in comparison to the normal. The conditions favoring solubility of calcium are less favorable than for deposition in the bones. Because of nonutilization, because of incapacity of the cartilage to deposit it, there is less calcium in the bones. Calcium cannot be absorbed, further not utilized by the bones, if vitamin D fails. Vitamin D probably alters the colloid state of the cartilage. According to all appearances it acts as a transference catalyzer for ultra-violet radia-

tions and activates the cartilage phosphatase. Because, in vitamin D deficiency, the action of phosphatase is depressed, it remains unused by the cartilage and will be found in increased amounts there. Phosphate formation which is necessary for the adsorption of complex calcium salts is subnormal and on this account the serum phosphate is low in comparison to normal. Calcium and phosphate metabolism is also inactivated in rickets and can be again activated through vitamin D. *It is not the deficiency in Ca and Po_4 supply that is in error but the inability to utilize and activate it.*

Now it is remarkable that the experimental rat rickets which is brought about by deficiency in vitamin D and phosphates can be healed through increased introduction of phosphates alone which is not true of infantile rickets. Furthermore *an experimental rickets can be provoked through excessive introduction of calcium.* Such a disturbance in the development of rickets through calcium salts gives exactly an experimental basis for the therapeutic use of calcium preparations in the sense of the simile rule. It is not conceived as a substitution therapy but as an excitation of inactivated, wrongly directed, calcium metabolism. The explanation of decalcification, and thereby the frequent ricketic influence of excessive introduction of calcium, can be diverse. First it could be conditioned through defective phosphate resorption. Or the excess flooding with calcium salts could provoke an acidosis, either through the involvement of simultaneously introduced anions or a reduction of cell respiration, so that incompletely burned acid products appear. For the equalization of acidosis the calcium is poured out of the skeleton and acid phosphates are excreted in excess amounts.

That it is impossible for infantile rickets to heal simply

through the administration of calcium and phosphates, rests on the impossibility of activating calcium and phosphate metabolism in this way. But this does not deny that *an activation could be obtained by calcium salts in another state of form.* Concerning the homeopathic preparations, this can be asserted on the basis of experience. That the activation is obtained easily and rapidly through vitamin D is correct but this does not stand in contradiction. Moreover, vitamin D therapy follows according to the simile rule, even if it is based upon another entirely different train of thought, and is a brilliant accomplishment of the analytic method of investigation. While slight (exactly "homeopathic" doses) of irradiated ergosterin can lead to a calcium deposition *in* the bones in rickets and osteomalacia, large doses, in the normal, cause a calcium mobilization *out* of the bones. Indeed overdoses of vitamin D can produce exactly the rickets-osteomalacia picture!

In osteomalacia the process is fundamentally the same as in rickets with the difference that it is not concerned with growing bones. In this instance there is a dependence of calcium economy on the ovaries. This is distinctly apparent in that osteomalacia can be healed by castration, furthermore from the appearance in gravidity, during lactation, in the menopause. The injection of ovarian hormone causes a lowering of the amount of blood-serum calcium and increased excretion of calcium and phosphate (negative calcium balance); castration makes the calcium balance positive.

The most important regulatory organs for calcium metabolism are the *parathyroids.* Injections of parathormone increase the amount of serum calcium and increase the ejection of calcium and phosphate through the urine (negative calcium and phosphate balance!). Para-

thormone lessens the fixation of calcium in the tissues or releases it from deposit. Overfunction of the parathyroids seems to play a rôle in osteitis fibrosa. This loss of bone salts, however, has no similarity to rickets. *With loss of the parathyroids the serum calcium falls,* the phosphate in the serum increases, and *the picture of tetany appears.* Potassium and sodium gain a preponderance in contrast to calcium—therefore an increase in neuromuscular irritability. The essential is a de-ionization of calcium, a lessened supply of the tissue with active calcium ions.

Outside of parathyroprivic tetany, the respiratory tetany, the phosphate tetany, the alkalosis tetany (or gastric tetany), the bicarbonate tetany are traceable to de-ionization of calcium. With increase of the pH (alkalosis), a de-ionization of calcium is united. But still other factors play a rôle in tetany. In parathyroprivia an increased adsorption of the complex calcium fraction by the tissues is essential. There is also concerned in tetany an inactivation of calcium ions so that it is not surprising that, with suitable calcium preparations, the calcium metabolism is activated and tetany relieved. Simple introduction of calcium ions into the serum is not lastingly sufficient, because these are just as rapidly excreted, and in any case an activation through an alteration of adsorption rations for calcium is not obtained. The tetanic attacks can be suppressed as well through calcium injections as through acidification (NH_4Cl, NaH_2PO_4, CO_2, inspiration, milk diet), that is by soluble calcium ions. But, for healing, a reversal of calcium metabolism with alteration of the power of adsorption of the colloids for calcium is necessary. Likewise the introduction of magnesium is able to suppress tetany through the detachment and increased excretion of calcium ions.

In *infantile tetany* the total calcium in the serum is often markedly low but the phosphate is not increased. A de-ionization of the calcium can be used only in part as an explanation. The chief rôle in infantile tetany is played by increased adsorption of serum calcium onto the colloids. Through this the complex calcium fraction in the serum fails, and the sudden increased demand of the cells for calcium ions, as with the severe crying of children or other conditions producing alkalosis, cannot be covered: sodium and potassium obtain predominance.[44]

In tetany, peculiar, edematous, but firm swellings appear on the hands and back of the feet. Likewise muscle contraction is strikingly delayed in spite of increased electrical irritability. Both are a sign of impoverishment in active calcium ions. Activation of calcium metabolism is able to remove the alkaline preponderance and the tissue swelling (puffiness, urticaria, and edema).

Spasmophilia often develops on the basis of a rapidly healing rickets. In consequence to the suddenly occurring calcification with powerful activation of phosphatase influence, the calcium salts are excessively absorbed on the cartilage colloids. In consequence there appears the impoverishment in active calcium ions. Through parathormone one can release the increased union of serum calcium to proteins. Probably there exists a connection between vitamin D and under-function of the parathyroids.

Other endocrine glands influence the calcium economy, even if not so strikingly as the hormone of the parathyroids. In hyperthyroidoses the calcium and phosphate excretion is increased, on the other hand decreased in comparison with normal in hypothyreosis. The administration of thyroxin releases calcium from the bones

and brings it to excretion, the amount of blood calcium in the serum being only slightly increased when it was previously lowered. In the hypothyreoses, particularly in myxedema, the calcium and phosphates are spared and there is a condensation of bone calcium. The action of the thyroid hormone is weakened by calcium (on the contrary increased by phosphates[45]). *The picture of disturbed calcium metabolism in many traits recalls the hypothyroid state.*

Extracts from the lymphatic tissues, thymus, spleen and lymph nodes, seem to act opposite to the parathyroids. If these extracts are injected, their hormones still being unknown, the amount of serum calcium diminishes and a picture like tetany develops.[46] Thereby a connection, perhaps a reciprocal relation, would be given for calcium economy and the formation of lymphocytes, and the possibility opened for influencing disturbances in the lymphatic tissues through an activation of calcium metabolism.

Vagus stimuli seem to lessen serum calcium, and sympathetic stimuli to increase it. Obviously *the vegetative system is an essential intermediator between the incretory regulation and the state of calcium in the tissues and therefore gives a suitable point of attack and intermediation for the action of therapeutically active doses of calcium.*

CALCIUM THERAPY OF THE SCHOOL

The school *therapy with calcium salts* in different times truly reflects the current stand of theoretic conception and the technical possibilities of employment. A very extensive, purely empirical use of calcium carbonate for about a century underwent a compression on purely chemical indications of acidification of the alimentary

tract, especially when diarrhea co-exists. For a long time there remained in addition good experiences in diseases of the lymphatic system, in scrofulous glands and in skin eruptions, and cognizance and use was made particularly of calcium chloride. In conjunction with the general use of alkalies, calcium salts are still used here and there is rheumatic-gouty dyscrasias with a tendency to deposits. The use of earthy waters in the formation of sediments, especially in the urinary tract, rests even today on similarly uncertain empiric grounds.

For decades, then, one believed calcium was suitable only for neutralizing acids according to chemical laws, then only in the gastro-intestinal canal. Here aqua calcis has the reputation at least of being more useful than the usual sodium bicarbonate, because it is not followed by a subsequent increase of acid production in the stomach as is sodium bicarbonate. Occasionally one attempts to equalize an intermediate acidosis with calcium. In this respect the slightly diffusible and only slightly absorbable calcium carbonate is less useful than the carbonate of sodium.

The internal use of calcium salts seemed unfounded and without prospect especially when, in a calcium deficiency disease, apparently so distinct as rickets, calcium therapy failed. Then, about 1910, appeared a complete revolution, indeed, an overswing, in favor of calcium therapy. Under the impression of the important rôle of calcium in the organism, particularly in the cell nucleus for growth, the danger of calcium deficit would be averted through a protein rich nutriment, as especially suggested by Emmerich and Loew. Particularly at the time of increased calcium need, as during the dentition period and in pregnancy, in addition to a calcium-rich diet (milk, leafy and rooty vegetables), the further use of

calcium lactate was held necessary. The temporary one-sided exuberance for such calcium nutrient therapy has now been fully relinquished, but even today it still correctly exists for special cases with a negative-calcium balance.

Ever more from pharmacologic investigations and studies of normal and pathologic calcium economy, it was seen that a pure quantitative conception was unsuitable as the basis of calcium therapy. The results of investigations, as we have summarized shortly above, allow realization that besides the amount of calcium present in the organism, its state of form in various places, its activity, the direction of streaming of calcium ions, which are the essential carriers of this activity, are of decisive significance. In disturbances of calcium economy it is usually concerned with a defective utilization in consequence to inactivation of calcium through de-ionization or through a wrongly directed streaming away of calcium ions rather than too much or too little calcium.

There is also the possibility of rapid introduction of calcium ions through injection, particularly intravenous injections. Of the many preparations available, calcium gluconate has proved very useful. *Under the influence of injection technic, the difficult point of calcium therapy in acute, paroxysmal states is abolished.* In oxalic acid poisoning the calcium salts act chemically binding and spare or replace the calcium necessary to the organism. In other poisonings (sodium chloride and adrenalin fever) calcium ions defend—through cell thickening even to a certain degree in war gas poisonings—pulmonary edema and acute inflammations. In magnesium narcosis calcium salts act through ion displacement. Clinical confirmation in acute hemorrhage from mucous mem-

branes and skin, also from the lung, exists beyond doubt. The use in tetanic states is likewise soundly based on ion therapy but the mass introduction of calcium ions through injections relieves the acute state only.

The situation is similar in *allergic states*, as asthma, urticaria, hay fever, serum exanthems. Here likewise the injection therapy is often indicated *for the attack*; the action of calcium ions on the permeability of the cells and vessels and on the vegetative steering of this process offers a point of departure for explanation. But a lasting alteration can scarcely be obtained through injection therapy, and only rarely through the more prolonged oral administration of calcium. This rests indeed on the fact that the cases suitable for calcium can be selected only partly by mere diagnosis—the consideration of the constitutional factors can lead further here—but then the massive form of orally introduced calcium salts is not sufficiently active for such an alterative therapy by any means.

The transformation of the ion milieu and the closely joined alteration of vegetative steering are the grounds of explanation of such general nature that thereby almost all diseases could come into question in regard to calcium therapy. Actually an almost innumerable number of indications have been cited as indications for the oral use of calcium in the last decades, but have also for the most part again disappeared. Either the cases were not suitable because there was no lack of active calcium ions, or the massive doses were not suitable for altering the very finely regulated ion milieu of the organism. Through this a decision of experiences with prolonged peroral calcium salt therapy is very uncertain.

Since homeopathic calcium salt therapy demands that the indications be embraced more sharply and at the

same time bring the preparation into an active form, one need not enter into the pro and con of varying reports in single states of disease. If one look only at the diagnosis, then the homeopathic indications correspond very extensively with the usual ones. But the establishment of a definite calcium constitution in homeopathy makes possible a much better selection of suitable cases.

Only single fields of the customary use of calcium need a brief discussion. From pharmacologic experiments on the surviving heart, by which a digitalis-like action of calcium ions has been found, an attempt has been made to employ *calcium therapy in decompensated hearts,* especially those with disturbances of rhythm. The decisions have been favorable on the results in nervous and thyreotoxic tachycardia. The combination of calcium with digitalis proceeds from the thought that digitalis and substances acting like it sensitize the heart for the action of calcium ions. But the reports do not permit a certain judgment as to whether this combination accomplishes more than digitalis alone.

Calcium therapy in *pulmonary tuberculosis,* which repeatedly finds supporters, has no supportable theoretic basis, because a calcium deficiency in the tuberculous lung is certainly not demonstrated and an increased requirement for a calcium deposition in the dead tissue cannot give any true support for calcium therapy. It cannot be assumed that this "calcification" can be accelerated by a further introduction of calcium salts, and, further, this calcium deposition is entirely subordinated in the healing. A favorable palliative effect on the amount of expectoration, the night sweats, the diarrhea, can be ascribed to the cell thickening and vascular action of calcium.

Likewise in *tuberculous glandular affections* the em-

ployment of calcium has been suggested on the basis of promoting calcification of the caseating glands. However, this old empiric therapy certainly has other bases, which stand in connection with the general constitutional tissue actions of calcium.

The calcium action on inflammatory and allergic states of the skin can be explained in general with the cell thickening and through the influence of the vegetative system. According to histochemic investigations, *calcium also has an immediate relation to the skin* as a receptive organ. In the healthy skin calcium is found essentially in the connective-tissue portion; in dermatosis, however predominantly, in the papillary bodies and the epithelium of the cutis.[47]

Also for the removal of edema of chronic renal diseases is the treatment with large doses of calcium to be taken into consideration. It may also be possible that the diuretic action of milk depends upon its high calcium content.[48] The increased excretion of sodium ions, in part, and an influence on the state of swelling of the tissue colloids can be made responsible for it.

Less common is the calcium therapy of *ovarian dysfunctions,* in particular, menstrual disturbances. And further, these offer a very fertile field. For, in the first place, the influence of the endocrine ovarian function on the calcium economy of osteomalacia and gravidity tetanic is known. But further, even *in normal menstruation, a lability in the vegetative system with variations in the amount of serum calcium is present.* In the vagotonic premenstrual phase, in which the function of the ovary, or rather the corpus luteum, is increased, the amount of serum calcium is relatively high, and calcium is mobilized from the tissues. The vagus stimulation is traceable to the outpouring of choline into the blood

and the instigator for this is the incretory impulse from the corpus luteum.[49] And during menstruation the vagus status is maintained. Vagotonic signs, as the increase in secretion of gastric juice, aggravation of vagal neurosis (asthma, urticaria) before and during the menses, are frequent.[50] *Reversely, hypofunction of the ovaries is bound with inactivation of calcium, suppression of ionization.* The ovarian weakness leads easily, however, to small cystic degeneration, precipitant ripening or persistence of the follicle, while the corpus luteum is formed only defectively. Since the corpus luteum acts depressively (endocrinologically) on menstruation, there comes *with hypofunction the stimulus* for bleeding. So are explained the *too early and too marked bleeding from hypofunction of the endocrine fraction of the ovary.*[51] According to all appearance, with this is combined a disturbance in calcium economy in the sense of defective activation, defective ionization. And while otherwise in these states choline or follicular hormone preparations are prescribed, *too early and too severe menses in young girls and in the preclimacteric period are frequently proven homeopathic indications for calcarea carbonica.* This indication is naturally not something derived from reflection on the influence of calcium on the hormonal and vegetative regulation of the menstrual process but from observations of constitution in people sensitive to calcium, for which the method of drug proving on healthy humans is responsible.

CALCAREA CARBONICA

The identity of the Hahnemannian calcium preparation with which the provings were made, deserves to be perpetuated through the ancient name. Indeed Hahnemann thought the calcium substance which he took from

the snow-white, soft middle layer of the oyster shell to be the purest carbonate of calcium, yet, since it corresponds to an excretory animal product, in any case it is not the calcium carbonate of modern pure chemical manufacture. But we retain with advantage the preparation which was proven on the healthy.

The provings of calcarea carbonica are found in:

1. Hahnemann: *Chronic Diseases,* 2nd Ed., vol. 2, p. 308.

2. Koch: *Hygea,* vol. 5, pp. 318 and 401 with chemically prepared calcium carbonate (also p. 270 has a proving of calcarea caustica, Ca (OH_2)).

3. Knorre: *Allg. hom. Ztg.,* Bd. 6, p. 33 (short symptomatic fragment).

CONSTITUTIONAL TYPE AND GENERAL ACTIONS

Prevailing in the drug picture of calcarea carbonica is *the constitution.* The general conception of *lymphatism* gives the outline. *Plumpness in the external appearance, torpid method of reaction,* characterizes the type.

If we perceive the physiologic rôle of calcium ions in an insertion of the necessary resistance in the cells and tissues through which the tension for the rhythmic course of function is established or always reëstablished, then the basic trend of disturbances in calcium economy is a general excess of this cell and tissue resistance, a general slowing of the course of reaction, particularly the lymph stream. Seen from the endocrine side this type goes in the direction of a hypofunction of the parathyroids, the thyroid, the germinal glands and an increased demand upon the lymphocytic apparatus (thymus, lymph glands). A one-sided conception of vagotonia or sympatheticotonia is not justified, but the liability of the vegetative system in general, at special phases of life

and in many morbid states, offers a suitable soil for the effectiveness of calcarea carbonica.

Such a phase is first *the infantile age* in which frequent vagus lability may be assumed. On this is added the rapid growth and bone formation which makes demands on calcium metabolism and can easily lead to disturbances. In the first years of life *ricketic and spasmophilic states* prevail. On the use of calcium preparations in the fully developed states of disease, we have already spoken. But it is especially in the prodromal stage in which the old calcarea carbonica asserts itself in spite of vitamin D therapy. *Laxity of the tissues, particularly of the skin and muscles, sour-smelling sweats on the head, many complaints during the teething of children, paroxysmal spasms, acid-smelling diarrhea, lateness of learning to walk,* and persistence of open fontanelles are distinct indications.

In the later ages of childhood, lymphatism is characteristic for calcarea carbonica. Here also the relaxed tissues are present, a *pasty habitus, suffusion and pallor, especially of the face, and large abdomen.* The children are usually blond and give the impression of "being well nourished," and the pupils are wide. The last-mentioned symptom also speaks for a vegetative liability. There exists, as generally for calcarea carbonica, particularly in this state, *a great sensitivity against cold and dampness, and aggravation from washing.* These lymphatic, easily chilled children sweat readily and *the cold foot sweats* are characteristic. Upon this constitutional background unfolds the well-known picture in the skin, mucous membranes and lymph glands which is called the exudative diathesis and scrofula. Persistent, wet, scabby eruptions, "spots" with burning pain, scald head, unhealthy skin; glandular swellings especially below the

jaw and in the neck but also in the groin, painful (only at the initial stage), also mesenteric glands; swelling of the upper lip; ulcerated scabby nostrils, occluded nose, blunted smell, odors from the nose (scrofulous ozena?); chronic conjunctivitis "with pressure like a grain of sand beneath the upper lid" with burning, cutting, itching, sticking; moreover, involvement of the cornea with phlyctenular keratitis with flow of tears and photophobia—these are unequivocal examples. Likewise the tendency to *formation of polyps* can well be ascribed to the relaxed lymphatic tendency of the mucous membranes in calcarea carbonica. Reports like dryness of the tongue at night and soon after awakening, difficulty in swallowing as from a ball or lump in the throat, and sticking pain on swallowing suggest a thickened lymphatic pharyngeal ring and the mouth breathing conditioned by it. But here calcium iodide is to be preferred.

Special symptoms in the ricketic-lymphatic complex are the *aversion to milk and the desire for eggs*. The calcium-rich milk obviously cannot be digested; "vomiting of acid curds of milk in children," "the milk is passed from the intestine in white coagulated clumps," it states. Probably calcium soaps in the stools are meant in the last report. Perhaps the desire for eggs has the meaning that a phosphorus hunger is thereby signified. Such peculiarities lead—in addition to the constitutional signs and the modalities—much better in the selection of a drug than the signs of disease which develop in the organs.

At the time of puberty the constitutional reports in the materia medica are likewise very characteristic. It states there: great obesity and plumpness in the child. A feminine habitus with hypoplasia of the germinal glands is thereby meant. Actually I have gained a very

favorable impression in a typical, well-expressed case with the prescription of calcarea carbonica in the thirtieth potency. Likewise in the age of sexual maturity, weak sexual properties and atonic ejaculations suggest a hypofunction of the germinal glands.

In girls the type is expressed as blond and obese. Characteristic is the *too early, too severe and too long-maintained menstruation.* The probable connection between these manifestations of ovarian hypoplasia and the disturbances of ovarian hypofunction which is often accompanied by genital hypoplasia and disturbances in calcium economy have been discussed above. The difficulty in sexual development is expressed also in painful menstruation, swelling and pain in the breast before the menses, headache alternating in the temples or crampy gastric pains at the period. *A milky leukorrhea,* often itching and burning, is seldom absent before the menses. But such a leukorrhea can also exist in lymphatic scrofulous girls before puberty and represent an indication for calcarea carbonica. The characteristic menstrual type, likewise in older women, especially in the *preclimacteric phase,* can lead to the useful employment of calcarea carbonica. A relaxed, spongy, often polypous mucous membrane is recognized as the cause of this irregular severe bleeding which is most susceptible to this medicinal regulation, but even bleeding from myomata is said to be favorably influenced by calcium preparations (calcium sulf. stibatum!*). During *pregnancy* a stimulation of the markedly involved calcium metabolism will often be useful. Toothache in the pregnant and falling out of hair in the same group are often cited as indications.

* [Calc. sulph. antimonium—Trans.]

In calcarea carbonica *a depressed and suppressed state* prevails. Children often remain retarded in their intellectual development and are impetuous and obstinate. Depressed frame of mind, anxiety in the evening, going to sleep late because of many terrifying phantasies, anxious dreams, and phantasies during sleep, fear of illness or of losing the mind, inability or aversion to work, loss of self-confidence—all endeavors, but especially mental work fatigue excessively—these illustrate the psychic status in calcarea carbonica. Disturbances in vegetative equilibrium markedly depress the disposition and again psychic alterations easily bring the vegetative functions out of equilibrium. So in the neurosis are found expressions of tonus variations in the vegetative nervous system, alterations of the calcium content of the blood, and, moreover, blood calcium can be influenced by the psychic state through excitation or hypnosis.[52]

Many *complaints in the head* obviously are connected with psychic and vegetative incoordination; persistent dulness, vertigo on arising and by rapid turning of the head, heaviness of the head, dulling, pressing also periodic, unilateral headache, with nausea and cold hands and feet, and most characteristic of all, *a sensation of icy coldness in and on the head.* The headaches are provoked or aggravated through mental effort and forcible movements, but also especially by cold, drafts, and, accordingly, suppressed sweating. Also deserving of mention as an indication is epilepsy in which the attacks are always worse at the time of a full moon. This report must be admitted only with consideration of the constitutional signs.

In general there is a defective power, paretic lassitude in the extremities, heaviness in the legs *as if weighted with lead,* coldness and feeling of deadness, particularly

in the hands and feet as has already been mentioned in speaking of the head. Cold, damp, alterations of the weather, as well as sudden efforts, sprains, easily lead to stiffness and sprain-like pain in the back, lumbago-like attacks and clamminess of the extremities. The muscle relaxation and torpid exchange of fluid prepares the soil for them. An outstanding connection to rheumatic affections, however, does not exist with calcarea carbonica. Entirely unexplained, moreover, is *the favorable action of the agent in painful formation of concretions,* in gallstones and kidney stones, which good practitioners (for example, Hughes) have observed repeatedly. The symptom in the materia medica "flow of blood from the urethra" can refer either to a stone or to a polyp.

ORGAN ACTIONS

Under calcarea carbonica *in the skin* is a mixture of *inflammatory manifestations in the exudative diatheses with the allergic,* which naturally merge into one another. In the provings they are reported: thick groups of light red, painful, itching, pea-sized elevations of the skin as well as raw, purpuriform, shrivelled skin. When constitution and modalities, as sensitivity to cold and damp, speak for it, the above as well as the following are suitable for calcarea carbonica: persistent, nettle-like eruptions, circumscribed edema of skin, moreover nodules like prurigo on the extensor side of the extremities with indolent glandular swelling, which indeed represent a consolidated form of allergic skin manifestations and are often united with eczema. Likewise, disturbances of the skin innervation as in pruritus is often suitable for calcarea carbonica.

Of the *digestive organs* the manifestations within the

ricketic-lymphatic syndrome have been mentioned already. But there also appear some vegetative disturbances in motility and secretion: acid taste in the mouth, acid eructations after all foods, sour, burning, persistent nausea from meat and warm foods, pressing and spasmodic gastric pains, particularly after eating, with vomiting of food, nocturnal gastric spasm, distention of the gastric region, painfulness on pressure, tension in the hypochondria with intolerance of tight clothing. In adults these disturbances are often associated with constipation with hard, white stools. A vegetative influence in the biliary passages (perhaps in a sense of atropine) is also to be considered, and on this side *a favorable action of calcarea carbonica in choleocystopathy and cholelithiasis* is understood. Only rarely mentioned but still worthy of record because of its peculiarity is the observation that the calcarea carbonica patient feels *better as long as he is constipated.*

The inflammatory and allergic manifestations in the respiratory passages are not specific for calcarea carbonica. Only in connection with other, particularly constitutional leading lines do they give occasion for the selection of calcarea carbonica.

According to experimental investigations on the action of the calcium ion on the heart, one should expect marked cardiac actions in the symptomatic picture of calcarea carbonica. But it is to be recalled how great is the cleft between experimental findings on the isolated organ and the results of provings on the total human organism. Indeed, symptoms are cited in respect to the heart: marked palpitation after the least exertion, especially on climbing, oppression of the chest as from an accumulation of blood with tension, relieved by bending the shoulders

back. The vegetative influences on the heart and vessels, however, are of subordinate significance and have not with calcium preparations in any case obtained such therapeutic confirmation as with the related barium.

SUMMARY

Constitution:

Lymphatism:

Type:

Blond, blue-eyed, pale, fat, relaxed, suffused, pasty, plump. Torpid type of reaction.

Juvenile; feminine habitus.

Menstrual type: too early, too severe, too prolonged (hypofunction of the germinal glands).

Partial sensations of cold and partial sweats. Dampness of feet.

Sensitive to cold and dampness.

Psychic: depressed, phlegmatic, depressive, anxious.

Clinical Indications:

Rickets, spasmophilia, disturbances of dentition, exudative diathesis, scrofula.

Disturbances in sexual development.

Polyps, formation of concretions.

Vegetative skin and digestive disturbances.

Peculiar Symptoms and Modalities:

Aversion to milk and aggravation of gastric complaints from it.

Desire for eggs.

Secretions and excretions sour.

Aggravation from cold and damp in any form.

Aggravation from bodily and mental exertion.

Better during constipation.

DOSE

The D 6, D 12, D 30 have proven themselves according to the chronicity and constitutional aspects of the case.

CALCIUM PHOSPHORICUM

In impure form from animal bones, claws and teeth, was obtained the phosphate of calcium, a common drug in antiquity. But only the pure preparation through the precipitation from aqua calcis or calcium chloride or calcium acetate solutions by means of phosphoric acid and sodium phosphate yields valuable observations. The usual preparation consists essentially of $CaHPO_4$.

The provings are:

1. Hering in Jahr's Nouveau manuel de méd. homoeop. Paris, 1840, p. 111 (Allentown Provings, 1837).
2. Schreter: Neues Arch. f. homöop. Heilk. Bd. 3, H. 3, p. 153, 1846.
3. Benecke: Der phosphorsaure Kalk. London and Göttingen, 1850 (chiefly on patients).
4. Cate: Trans. of Amer. Inst. Homo. 1858.
5. Sick: Deut. Z. f. Hom. 1922, p. 360 (published by Meng).

Moreover, calcium phosphor. is included by Schüssler in his tissue salts, but without his having performed any provings.

The phosphate anion contributes several new trends to the calcium picture, particularly in constitutional respects. The impulse to bodily growth is greater; it contrasts with the neuromuscular weakness and psychic failure. Therein the influences of the phosphate frac-

tion become obvious. In place of the plump, inert, calcarea carb. type, calcarea phos. tends to an *asthenic gigantism.* The vertebrae are weak, they can scarcely support the head. The cranial sutures and the joints ache, especially the sacro-iliac joint. The body is *thin,* the abdomen *large but relaxed.* The color of the skin is more gray or brownish. The great chilliness, sensitiveness to damp and cold, change of weather, drafts, as well as easy sweating are the same as with calcarea carb. The scrofula developing on this soil assumes *a more erethistic form.* The state of nutrition is defective. Glandular swellings develop and recur more rapidly. The danger of transition into active tuberculosis is greater. The phosphate fraction is responsible for the *greater utility of this agent in bone and joint tuberculosis,* as also in the first stage of *pulmonary tuberculosis.*

If calcarea carb. is mentally retarded, depressed and slow in mental development, then there is added in the phosphate even a greater *mental exhaustion.* In the rapidly growing child, *school headache* is a proven indication for calcarea phos. Hot head and cold feet, as well as dyspeptic states, are often combined with it. Indeed, in the higher grade of mental retardation with motor unrest, in the so-called *agile or versatile idiocy* after cerebral infantile paralysis, A. Stiegele[53] saw a striking result with calcarea phos. D 6. Also in chronic hydrocephalus the agent is usually recommended. v. Grauvogl gave it during pregnancy to women who had borne hydrocephalic children.

A peculiarity of the appetite can assist in the selection between the carbonate and the phosphate: calcarea phos. has *desire for game and salty foods (bacon, ham).*

Moreover, outside of the ricketic-scrofulous syndrome there exists in calcarea phos. *a greater tendency to diarrhea.* The soft stools of phosphoric acid and marked formation of gas make themselves obvious. The diarrheas are green, hot, undigested, contain gas which is very offensive. Food and especially cold drinks provoke some pain and distension in the stomach and abdomen, after which diarrhea follows. Vomiting of milk is also cited in calcarea phos. It is also recommended in the hemorrhoids which appear with hard stools in older people and this seems to be supported also in the self investigation of the sick.

In general *a more marked connection with the bones* is ascribed to calcarea phos. It is, therefore, used in badly healing fractures, defective callus formation.

In other syndromes of the juvenile age which show similar pictures in the two remedies, calcarea phos. and calcarea carb. can be differentiated best through the constitution, the rhythm.

If the scrofulous and tuberculous process is more acute, the destruction more marked, then one leans with preference on the phosphorus influence and selects *calcium hypophosphorosum,* calcium hypophosphite, $Ca(H_2PO_2)_2$.

SUMMARY

Constitution:

Asthenic tallness

Emaciation, gray discoloration of skin

Easily chilled

Erethism and easy transition to active tuberculosis

Great mental exhaustion, intellectual retardation, motor unrest.

Clinical Indications:

Same as with calcarea carb. but more erethistic form.

Tendency to tuberculosis.

Stronger affinity for bones: bone and joint tuberculosis.

Defective callus formation, sutures and symphyses painful.

School headache

Chronic hydrocephalus and agile idiocy.

Peculiar Symptoms:

Desire for game and preserved meats.

DOSE

Usually in D 6 and D 12 (triturations).

CALCAREA ACETICUM

The acetate of calcium was the first salt of calcium which Hahnemann proved.[54] He later replaced it by calcarea carbonate because of the purer calcium action. Calcium acetate is only rarely used. Of the proving symptoms only the headache, worse after reading and mental effort, (migraine) and the painless nonexhausting diarrhea have been retained. The employment in dysmenorrhea membrancea and bronchitis fibrinosa, severe spasmodic cough which ends with expectoration of bronchial casts, rests purely on clinical recommendation.

CALCIUM MURIATICUM

Calcium muriaticum, calcium chloride, $CaCl_2$ is practically not proven. The study of Wimmer[55] with 0.5–1 Gm. of the substance gave only a diuretic effect and after three weeks, exhaustion, weakness, non-desire for

work, aversion for food. Internal employment of the remedy has been suggested chiefly by Rademacher in persistent vomiting, gastric pain with distension and eructations. For injection therapy of calcium this salt has been largely replaced by others.

CALCIUM SULFURICUM

Calcarea sulfuricum, $CaSO_4$, gypsum, is often not sufficiently separated from Hepar sulfuricum calcarea which is mainly a polysulphide and contains only a slight admixture of calcium sulphate. For a long time Schüssler included calcarea sulfuricum among his tissue remedies and indeed as a remedy for connective tissue. Provings were arranged by Hering and Conant.[56] Calcarea sulfuricum has found an application chiefly in suppuration. It is said to be in place chiefly after an opening is established. With J. Leeser, however, I saw it employed with good result in a recent *mastoiditis*. The remedy deserves a further proving in *lupus*. Cysts, polyps, myoma are likewise mentioned as indications. For myoma Deventer has recommended the double salt, calcarea sulfuricum stibiat. in the second decimal. According to my own observations it actually has a good effect but often causes vomiting.

CALCIUM CAUSTICUM

Calcarea causticum, calcium hydroxide, $Ca(OH)_2$ is seldom used in spite of an extensive proving by Koch.[57] In contrast to calcarea carbonate, it is said to have an acute action.

Calcarea fluoricum is discussed with fluorine—calcarea iodatum with iodine.

STRONTIUM

Strontium owes its name to the Scottish town of Strontian, where it was first found in 1784 in lead mines. Experimental pharmacology has been interested in the cation, Sr, only from the standpoint of how far it can displace or supplant the closely related physiologic calcium. In cell and organ experiment an extensive replacement of calcium by strontium is possible. Only the increase in phagocytosis of the leukocytes is not possible with Sr as with calcium.[58] The substitution of calcium by strontium in most experiments however only shows that these experiments are hardly adapted for bringing to light the characteristics of the substance and only permit the group properties to be recognized.

In any case calcium cannot be replaced through strontium in nutrition, and, moreover, rickets develop in the animals and it is not influenced by cod liver oil. In growing animals under the influence of strontium salts, *peculiar alterations of the bones* are found which are very similar to the sclerosis of the bones produced by chronic phosphorus poisoning.[59] The bony new growth in the cortex as well as in the spongiosa may follow as an atypical substitution to a preceding necrosis.

Of the resorptive poisonous effects of strontium salts, little is known. Lewin reports that strontium lactate

in the form of a powder causes, outside of the usual gastric irritative symptoms, increase in the amount of urine, and large doses, a renal damage and lowering of blood pressure.

The medicinal use outside of homeopathy is only rarely employed and then in close conjunction with calcium therapy. So Hermann believes that one can avert postoperative pneumonia with strontium as with calcium.[60] Grassheim has reported results with strontium in instances of decalcification of bones.[61] Alwens[62] noted analgesic actions of strontium compounds.

STRONTIUM CARBONICUM

Homeopathy possesses a proving of strontium carbonicum by Hartlaub and Trinks, *Materia Medica Pura,* vol. 3, p. 72 (5 provers).

Insufficient provings and rare use have not permitted the drug picture of strontium carbonicum to become definitely and sufficiently fixed. But *the intermediary position of strontium between calcium and barium* is noted very distinctly in the chief trends. The connection to the bony system approximates the remedy to calcium, that to the vascular system, barium.

The bone affections: enlargement, exostoses, osteoporosis and caries should preferably involve the femur in strontium carbonicum: *carious processes in scrofulous children in whom a simultaneous diarrhea co-exists.* The diarrhea is worse at night, better about three in the morning, with ever recurring urgency; after the stool there is much burning in the rectum. Nagging pains as if coming from the bone marrow are reported as subjective indications. Frequent sprains, especially of the ankle with edema, is a clinical indication.

On the other side severe pulsation in the arteries is designated through *congestions to the head and the breast.* Walking aggravates all complaints, particularly a pressing pain, drawing together and dull sticking in the chest in the region of sternum. The last recalls that strontium carbonicum (just as barium carbonicum) can be useful in coronary sclerosis. Walking causes dyspnea with heat and redness of the face, a reference to a status apoplecticus. Ice cold feet with cramps in the calves and soles of the feet show a peripheral circulatory disturbance. In a general arteriosclerosis, the iodine compound, strontium iodatum is preferred.

The congestive states have the peculiarity of being better from *warmth of the heat of the sun, and warm coverings.* This is particularly the case in headaches and recalls magnesium muriaticum. A tensive pain prevails, a drawing tension going out from the neck. Evening aggravation, from lowering the head and a slow increase and decrease of pains (as with stannum) are further indications for strontium carbonicum.

Strontium carbonicum is richer in pains than calcarea and baryta. The pains are localized preferably in the tendons, ligaments and bones. It is said that a right-sidedness predominates.

SUMMARY

Chief Trends:

1. Bones: Femur preferred. Caries with scrofulous nocturnal diarrhea. Nagging pains as if from the bone marrow. Frequent sprains of the ankle with edema.

2. Blood vessels: Congestions, angina pectoris, arteriosclerosis.

Modalities:

Aggravation from walking, from cold, evening and night

Better from warmth (and sun's heat)

Right sided

Slow increase and decrease of pains

DOSE

The rare use up to the present is usually in the lower and middle potencies (trituration).

BARIUM

In nature barium occurs predominantly as the sulphate, $BaSO_4$, more rarely as the carbonate, $BaCO_3$. The barium cation is not physiologically necessary. As a foreign substance it produces poisonous and untoward effects much easier than the physiologic calcium. In experiments many similarities are shown to the action of excessive doses of calcium. This can be understood from the colloid-chemical properties of the positive divalent earthy alkalies. The anti-swelling, solidifying and therefore slowing effect on exchange and function of calcium action is much greater in barium and leads sooner to persistent states of pathology. Therein the higher atomic weight of the element is expressed.

In single colloido-chemic reactions, barium can indeed replace calcium as perhaps in the detoxication of one-sided alkali swelling. But this is a general property of bi- and trivalent cations, as is shown by many inanimate types of colloids as well as by living cells. On the other side, for example, the absorption of $BaCl_2$ (in contrast to $CaCl_2$) becomes difficult or even impossible from the intestine in that barium produces a spastic contracture of the smooth muscle, which delays absorption.[63]

EXPERIMENTAL ORGAN ACTIONS

The tonus increasing and constricting action in barium appears in much less concentration and more intensively than with calcium. $BaCl_2$ added to NaCl or Ringer's solution acts on the

frog's heart in doses of 1:35,000 by increasing the systole, in somewhat greater doses (about 1:10,000) tonus increasing, then weakening the heart beat and causing standstill in diastole, and on the contrary from still further addition, systolic standstill.[64] Doses which on perfusion of the heart from its inner surface lead to systolic standstill, act when applied to the outer side, by producing diastolic standstill.[65] Accordingly, it seems as if barium had a greater difficulty in penetrating the heart wall from without than from within.

In *mammalian hearts* very small doses of $BaCl_2$ (1:17,000) act accelerating and increasing on the ventricle, in somewhat greater concentration (1:5000) soon slowing, and showing tendency to contracture and finally systolic standstill.[66] In a much higher measure than through calcium, the irritability of the ventricle is increased by barium. Indeed a frog heart or a strip excised from the heart coming to a standstill in Ringer's solution can be brought to long maintained beating through a brief influence of barium (in m/1200-m/600), which is not obtained by calcium[67] (positive bathmotropic action). The stimulus conduction (dromotropic action) in mammalian hearts is impaired even through the smallest doses of barium (1:50,000-1:170,000) which happens only with great doses of calcium, while small doses of calcium improve conduction.[68]

The *increased irritability of the ventricle* which expresses itself in acceleration or even extrasystolic tachycardia and *the impairment of conduction from the sinus and auricle to the ventricle* through barium makes it seem an involvement of the vagus but the electrical excitability of the vagus is not impaired.

On *the vessels* barium acts *markedly constricting* which can result in the mesenteric vessels constricting themselves into beadlike segments.[69] There is a marked increase in *blood pressure.* Even excised arteries will be placed in increased tonus by barium. To decide according to experiments barium acts immediately upon the vessel muscle because it remains effective after any type of preceding paralysis. The entire action

very closely resembles the digitalis group of substances and veratrin: *slowing of the pulse and increased blood pressure* are especially stressed as circulatory symptoms in the drug picture.

Barium is also a *strong exciting agent for the muscle of the intestine.*

Barium chloride increases the spontaneous movements; in about 0.1 per cent solution causes a marked increase of tonus with standstill of rhythm; through strong poisoning the intestine becomes hard and stiff. This action remains after paralysis of the nerves of the intestine. It is, therefore, a direct action of barium on smooth muscle.

The urinary output is depressed through large doses of $BaCl_2$ (just as by large doses of $CaCl_2$).[70] Apart from the vasoconstrictive action a narrowing of the urinary excretory passages is also to be considered.

The irritability of skeletal muscle through small amounts of $BaCl_2$ is increased but on longer action the muscle dies. On account of its toxicity for muscle, barium cannot replace calcium in Ringer's solution.

Through immersion of nerves in $BaCl_2$, severe muscle contractions are released, whereby calcium can come into action, depressing as an antagonist.[71] $BaCl_2$ produces such a hypersensitivity in motor nerves that the least mechanical stimulus produces tetanus.

POISONING

In barium intoxication, outside of the peripheral action on the heart muscle and the smooth musculature of the vessels and the intestine, there seems to be still a direct action on the central nervous system which expresses itself in spasms and finally paralysis of the extremities.

The symptoms of an acute *barium intoxication* are described by Lewin[72] as follows: retching, vomiting, gastric pains, diarrhea, chilliness, vertigo, coldness and contractions of the extremities, tension of the facial

muscles, slowing of the pulse, palpitation, increase of the blood pressure, numbness and other actions similar to digitalis, feeling of anxiety, visual disturbances, rarely paralysis. It is worthy of note that, after apparent recovery, persistent muscle weakness may remain. There are also some other symptoms which are observed after medicinal use of barium chloride according to Lewin, which has special interest for us: fever, stomatitis, salivation, swelling of the salivary glands, foetor ex ore, conjunctivitis and skin eruptions. Here one encounters the relation of barium to *inflammations of the glands, particularly of the mouth as well as the skin and mucous membranes.* The nephritis occasionally mentioned represents a remote point of attack.

OLDER USE

It is not amazing that, in the cruder manifestations arising out of newer experimental pharmacology, the finer actions of smaller doses of barium have completely dropped out of sight. A medicinal use of barium salts now-a-days is no longer customary in the school. It was otherwise a century ago. So Vogt[73] states of barium chloride: "If the chloride of barium is administered in small doses then initially one does not note any visible alterations, beyond some increase of secretion on the inner surfaces, in urine production and on the external skin. Only later with a gradual increase of this secretion one notes a greater capacity of resorption in the region of the lymphatic vascular system, indeed lymphatic accumulations diminish, glandular swellings soften and become smaller, *etc.*"

Further Vogt states that "barium chloride is quite analogous to the chloride of calcium and just like this, chiefly acts on the lymph- and glandular system and

the structures standing with them on the same level of organization, where it acts as a solvent agent". Accordingly the reports of Vogt on the clinical use of barium chloride are understandable, namely: scrofula, deposits, swellings, hardenings, exudations, *etc.*, in the glandular structures as well as in the vegetative organs in general. The resorptive action of barium on the glands was also well known to Hufeland. So the consideration of the finer actions of barium on man from earlier times has a certain approximation to the indications of the homeopathic school while barium as a drug has found no mercy before the modern "exactitude" and "objectivity."

PREPARATIONS

The common preparations are barium carbonicum, barium aceticum (usually employed like barium carbonicum), barium muriaticum and barium iodatum.

PROVINGS

The provings are found:

1. Hahnemann: *Chronischen Krankheiten,* 2 Aufl., p. 243. (Barium carbonicum and aceticum).
2. Hering: *Homöop. Viertelj.* Band 10, p. 95.

BARIUM CARBONICUM

TYPE AND LYMPHATIC SYSTEM

One must take his point of departure from calcarea in order to understand the drug picture of baryta. A very similar *constitution* is designated for both. A *torpid scrofula* is the morbid background of it. The *type* for barium is: retarded children who develop poorly, mentally and physically, remain dwarfed, learn to speak and walk late, dull, will not play, learn poorly,

and are fearful and depressed. They are chilly, become chilled easily and have swollen tonsils after exposure to cold. In general there is *the tendency to frequent angina*, also with suppuration, an important indication for baryta, which should prevent the recurrence of inflammation. Symptoms are: feeling of a plug in the throat, can only swallow fluids, aggravation from empty swallowing. They refer to the *chronic tonsillar swelling*. It should be noted that thereby baryta involves the mucous membranes less than perhaps belladonna and apis, but more the glandular parenchyma. In general baryta is *a slowly acting remedy and must be given over a long time* and thereby also stands in contrast to the acute acting remedies mentioned. In chronic throat and pharyngeal lymphatic enlargement, the association with mental retardation and difficulty in hearing is well known and comes into consideration for barium iodatum (as well as calcium iodatum). That chronic inflammation of the mucous membrane of the naso-pharynx in such a state causes sensations as noises in the ears on swallowing and sneezing, echoing in the ear on sneezing is understandable and provocative of further relaxation of the Eustachian tube. (These signs are stressed especially for barium muriaticum.) The flow of saliva at night with barium carbonicum likewise belongs to this field. The chronic inflammation of the mucous membrane with swelling and tenacious, bloody secretion is considered the cause of the foetor ex ore, which is not noted by the patient himself. We also called attention to it under the symptoms of acute poisoning with large doses of barium. Of the other symptoms which correspond to the torpid scrofulous type, baryta has outstandingly offensive footsweat. Cold clammy feet point in the

same direction as with calcarea carbonicum. Other scrofulous symptoms: glands in the neck and about the ear are swollen, swollen abdomen from mesenteric glandular enlargement, crusted eruption especially on and behind the ear, nasal discharge with swelling of the upper lip and nose, scrofulous eye inflammation, chronic cough, leukorrhea in girls likewise belong to the baryta picture but in and of themselves do not offer any satisfactory indications for this remedy. The face of the baryta child is not always puffy and plump, as it is in the type common with that corresponding to calcarea; it may be sickly, thin and look old.

VASCULAR SYSTEM

A second trend in the baryta picture comes into much stronger relief than in the calcarea picture. That is the action on *the heart and vascular system* and moreover on the vessels of the central nervous system. Indeed we know the vessel tonus-increasing, blood pressure-raising, digitalis-like action of baryta from animal experimentation. There may also be a direct influence on the central nervous system which explains many of the nervous symptoms of baryta, but it is striking how closely the symptomatic picture corresponds to arteriosclerosis of the central nervous system. And so this same remedy which seems especially suitable for children because of its relationship to the lymphatic system, belongs to the outstanding *old age* remedies because of its blood vessel effect. It is suitable for old people who are weak and tired. The great lassitude which compels lying down and the sensitiveness toward cold can increase up to a marasmus senilis. Especially numerous are the symptoms of a *disturbed cerebral circulation*: vertigo, anemic headache, weakness of mem-

ory or loss of memory, old age insomnia, aversion to friends, loss of self-confidence, indecision up to senile dementia with childish ways. A complete series of paraesthesias which are found in the symptom register of baryta refer to circulatory disturbances in the brain: for example, a feeling like a spider web on the face (this is also mentioned as a symptom of alumina!), a sensation as if the scalp was stretched tight. With such trophic disturbances are perhaps associated many forms of baldness which are also cited as indications of baryta,—also the "feeling of looseness" in the brain as though it moved here and there on movement of the head; moreover, burning stitches as if from a needle in various parts; numbness, lame and trembling limbs, in particular a numb feeling from the knees to the scrotum which lessens on sitting; numbness in the mouth and vesicles on the tongue; soreness and painfulness of the soles ("awakens in the night with heat and bruised sensation in the soles of the feet, better after standing up"). The senile itching, not relieved by scratching, also belongs here. Cloudy vision in old people with muscae volantes, a pain directly over the eye, a feeling of heaviness as though the forehead pressed upon the eyes, asthenopic complaints, are not characteristic in themselves but only valuable in connection with other indications for baryta. Likewise baryta is the chief remedy for the end-results of cerebral sclerosis, for the manifestations of a typical apoplexy.

Not merely for aneurysm of the cerebral arteries, but also for *aortic aneurysm* is baryta, and particularly the chloride, prescribed. In general it is said to be the best remedy *in the senile heart*, where other remedies seem to act too little. The feeling of emptiness and faintness in the precordia which is reported in the vari-

ous cardiac drugs (digitalis, veratrin, convallaria, cactus, ignatia) is not found in the proving picture of baryta but nevertheless should be especially characteristic for baryta when it occurs in old people (and especially for baryta muriaticum). The *bradycardia* which is present in heart block can furnish a valuable objective indication for barium preparations. Other cardiac symptoms are: palpitation on lying on the left side and palpitation which recurs on thinking about it.

In connection with the senile manifestations on the heart also stands the cough of old people, dry, suffocating (cardiac asthma), worse on lying down and at night, —also a syndrome which digitalis seems to promote. Moreover it is united with a sensation in the larynx as though smoke had been inhaled, and loss of voice is mentioned. It is not clear whether this is concerned with a chronic catarrhal process of the aged or involves a nervous influence of the larynx.

OTHER ORGAN ACTIONS

The *gastro-intestinal manifestations* which are observed in the usual stormy defense processes in the acute intoxication with barium, do not stand out in the chronic picture of barium, in any case, less than with calcarea. Fulness, pressure and heaviness in the stomach after eating are too general to draw our attention to barium in this respect. Single symptoms are cited which can only refer to esophageal ulcer or stricture; sensation of a sore spot in the esophagus after swallowing or the feeling as if food stuck or passed over a sore area. I do not know from what these symptoms are derived nor how far barium has proven itself clinically in esophageal and cardial stricture with "hardening and narrowing of the cardia with pain immediately after

eating". When Cartier reports a favorable result of the treatment of esophageal stricture from the Turin Homeopathic Clinic with baryta and strontium, one does not know to which of the two agents the chief success is to be ascribed.

Then some peculiar symptoms before and during the menses are reported for baryta, just as with the other earthy alkalies: toothache before the period (a symptom which the already mentioned magnesia has), moreover a thick white leukorrhea before the period, and sore throat during the menses.

Finally some clinical indications are given for baryta in the direction of *the glandular organs and new formations*. In hard, persistent goiter of torpid persons, baryta iodatum is preferred. The prostatic hypertrophy, as a similar degenerative glandular process with a slowly increasing hardness, adapts itself to the old age manifestations of baryta. Warts and lipoma are given as indications for baryta and are just as dark as their causal conditions. Though doubted, the report appears that baryta action should also underlie malignant tumors of the breast and pancreas.

The clinical use of baryta in multiple sclerosis which was also well known to the old physicians of the school and indeed has been taken over, should be mentioned without comment.

SUMMARY

The two standard direction lines for baryta are also: (1) the infantile type in the sense of a torpid scrofula with the special indications and (2) the old age alterations in the vascular system.

Characteristic guiding symptoms which occur as general relationships in two systems can hardly be given.

One must, then, take as guiding the chilliness and the sensitivity to cold which are found in both; yet many drugs have these. The mentioned modalities: aggravation from thinking on the symptoms and from lying on the painful side have no general significance; moreover the baryta picture is not particularly characterized by pains.

DOSE

The *dose* is usually from the 3rd-30th potency. However with baryta mur. and baryta iodatum, the lower potencies are preferred.

3. GROUP VII, THE HALOGENS

The close chemical relationships of the *halogens*, that is, the salt formers, can also be found in their effects on the organism. The contrast to the alkalies and earthy alkalies is likewise obvious.

However, there exists between the lightest halogen, *fluorine*, and the heaviest, *iodine*, considerable difference in the affinity for hydrogen and oxygen. With fluorine the hydrogen affinity is predominant, with iodine it has become very slight, so that HI is no longer stabile. Therefore, an increasing affinity for oxygen exists in a series from fluorine to chlorine, to bromine, to iodine.

With increasing atomic weight, the elements of this group gain independence in contrast to other elements under otherwise equal conditions. So fluorine and, in general, also chlorine come into consideration only in the ionic form in action in the organism while iodine certainly and bromine probably unfold important actions in molecular nondissociated form in the organism.

The independent halogen character can be most clearly presented in iodine. For this reason we can best begin with it.

IODINE

GEOCHEMISTRY

Iodine was separated in the earth in the first demixture of molten lava originally in all layers. It has, moreover, become outstandingly a biophilic element,

has increased in living organisms. In the lithosphere, hydrosphere and atmosphere it appears only in traces in company with chlorine and bromine (about 1 part to 10,000 parts of chlorine). In the chalkosphere and siderosphere the amount is even less. As a biophilic element, iodine is obtained also from plant and animal organisms (seaplants, coral, mussels). But one chiefly obtains it from sodium iodate where it arises in company with Chile saltpeter, from plant or animal marine life, perhaps also from volcanic deposits.

The geochemic union of elements from the same related group is an ever-recurring phenomenon. It shows that also in the great chemical laboratory of the earth related elements are separated with just as much difficulty as in the test tube. The common appearance of iodine with chlorine suggests an enrichment in sea water and in sea air. The iodine goes approximately parallel with the total salt content. The decided increase in certain geologic areas (iodine springs!) is traceable to prehistoric plants. Therefore strata containing coal are relatively rich in iodine. Outside of the sea coast where not only the air but also the food is rich in iodine, drinking water obtains significance for the introduction of iodine. Hard calcium-containing water arises from geologic levels (calcium-rich sediment stones), which are very poor in iodine. Apparently there is also *an antagonism between calcium and iodine* in the organism, because McCarrison[74] could produce in pigeons an enlargement of the thyroid by excessive long-continued administration of calcium.

The greater atomic weight in iodine in contrast to chlorine brings a lessened affinity for hydrogen and therefore iodine appears much less in a dissociated anion form than chlorine. In the organism it has much

less ionic action and appears more as a molecule in its organic compounds.

APPEARANCE AND DISTRIBUTION IN THE ORGANISM

Iodine is an element necessary for the mammalian organism but it is not essential for the general electrolytic economy, for the regulation of osmosis and colloid states, but has *specific functions as a catalysor.* Corresponding to this is the extent of iodine economy which moves in the range of gamma amounts (1 gamma equals 1/1,000,000 Gm. or 0.001 milligram). The amount necessary for the maintenance of metabolic equilibrium is about fourteen gammas a day according to v. Fellenberg,[75] but is subjected to considerable individual variations.

In regions where goiter is common, drinking water contains on an average 0–1 gamma per liter, in non-goitrous regions, 1–20 gammas the liter. Iodine is very generally present in plants; formerly it was erroneously believed that it appeared only in sea plants. However, it is still debated whether iodine is a necessary building-stone of plants. Yet it is clear that small amounts of iodine promote the growth of plants. It is worthy of note that Chatin, in 1850, found much iodine in Nasturtium officinale which had long been in use against scrofula, tuberculosis and endemic goiter. Iodine also seems to have an influence on the growth of children. From this it might be concluded that in the Spring the thyroid is richest in iodine and children grow most in the Spring. According to Veil,[76] the highest value of iodine in the blood is in May; according to Breitner,[77] in February. This Spring acme is significant for physiologic function as well as the tendency to disease.

The promotion of development of tadpoles is used

directly as a test for certain organic iodine compounds.[78] But an acceleration of growth is also observed in mammals.[79]

Baumann found iodine in the thyroid in 1895 and in 1927 Harington and Barger[80] made a chemical determination of thyroxin (tetra-iodophenol ether of tyrosin), to which may be ascribed the chief action of the thyroid. Besides this, di-iodo-tyrosin, it appears, has a weaker action.

Iodine is found not only in the thyroid of the organism but probably everywhere. It has been noted in the blood, in the skin and its secretions in the hair, and in almost all organs; only the thyroid, with about three milligrams to one gram of dried substance, is by far the richest in iodine as it contains 1/6–1/7 of the total iodine. In goitrous regions the iodine content of the thyroid is smaller than in nongoitrous regions; in children it is the least but even the thyroid of the new-born is not free from iodine. At puberty the iodine content increases suddenly; between the years of twenty-five and fifty it is highest and then decreases. In women it is higher than in men; in summer, higher than in winter in general. The iodine content of the blood is increased during menstruation. After the thyroid, the skin and hair, ovaries and adrenals are most rich in iodine.

Iodine is taken up with the food (water, plants, especially leafy vegetables, animal substances, cod liver oil, eggs) and is absorbed in the upper intestine, and to a slight extent is exhaled from the air. It is taken chiefly to the thyroid through the blood which absorbs it and then again gives it up according to the need of the organism. In the thyroid, iodine is found exclusively in organic composition as thyroxin and as di-iodo-tyrosin

(the latter a more simple formula and probably a step in the synthesis of thyroxin). Thyroxin is apparently the active principle of the thyroid. However it is probably not free but is contained in an inactive form bound to globulins in the thyroid. In the blood, iodine circulates normally about 65% organic and 35% in inorganic combination.

Iodine is excreted chiefly through the kidneys but also through the bile, faeces, skin (sweat), nasal secretion and, in very small amounts, through the lungs. Inorganic iodine leaves the body much more rapidly than organic iodine, the greater part within 24 hours. It is probable that, under the conditions of the organism in the presence of carbon dioxide, corresponding to the experiments of Binz, iodine dissociates from potassium iodide.

IODINE AND THE THYROID

For the physiologic movement of iodine in the organism, the thyroid is the central laboratory and the regulator of organic combination and absorption. The physiologic significance of iodine is known up to the present only in connection with the thyroid. But this in no way states that thyroid function is exhausted with the regulation of iodine metabolism; on the contrary, the circulation of other elements in the organism, as phosphorus and arsenic and the counterbalance of calcium, will certainly be influenced by the thyroid. But the association—thyroid-iodine economy—is especially important and also the best known. The state of the thyroid and iodine metabolism stand in closest reciprocal relation. Thyroxin is probably the most essential oxidative catalysor in the organism among the mobile, humoral form of hormones (iron on the other hand is the cellularly fixed oxidation catalysor).

The oxidative action of thyroxin comes into expression primarily in the increase of basal metabolism (O_2 use). The metabolic increase is bound to destruction of proteins.[81] Moreover, from *small* doses of iodine there is observed a reversed depression of the previously increased basal metabolism, not only in hyperthyroidism, but in other diseases associated with an increase in cell-destruction processes.[82] Small doses of iodine depress the action of the thyroid and effect an increase in weight; large doses increase thyroid action in rats.[83]

The oxidative catalytic action of iodine in the physiologic organic compound of thyroxin is distinct, that is, produces symptoms in the disturbance of the thyroid. With the excessive flooding of thyroxin out of the thyroid into the blood stream as iodothyroglobulin, which stimulates the sympathetic nerve endings (which thyroxin itself does not do) the predominance of the oxidative processes in the organism increases in a parallel manner; there appear the well-known symptoms of thyrotoxicosis and Basedow's disease. In the untreated *primary hyperthyreosis*, the primary Basedow, the goiter is iodine- and colloid-poor. There also exists a *defective property of absorption.* In the *secondary hyperthyreosis* in the colloid nodular goiter, the toxic adenoma, *high iodine* values are found.[84] In these cases an overproduction also occurs. Reversely, too little or absent output of thyroxin from the thyroid into the blood leads to the symptoms of myxedema, with lowered metabolism and slowed oxidation, *etc.*

From these opposites the rôle of thyroxin as an oxidative catalysor becomes distinct in special symptoms of the deficiency or excess in the blood. The common goiter is considered as an adaptation of the thyroid to an insufficient supply of iodine, covering the normal

thyroxin formation in spite of small concentration of iodine in the blood. If the thyroxin formation is insufficient or completely absent, then the picture of cretinism develops.

Since in disturbed thyroid function all grades of hyperthyroidism can be produced through proportionately small doses of iodine also in the inorganic form, so *the entire picture of thyrotoxicosis belongs to the drug picture of iodine as an iodine effect in thyroid-sensitive persons.* It represents an indirect metabolic fraction of the iodine drug picture and is characterized through the general actions on the metabolism, vegetative nervous system including the psyche, circulation, and blood picture. This action takes a subacute to chronic course with organic iodine compounds.

IODINE AND THE SEXUAL GLANDS

To the intermediary incretory field of iodine actions also belongs that on the *sexual glands.* Whether they are subordinate to the thyroid gland or immediately upon the action of iodine is uncertain. In any case, the ovaries and testes have the highest content of iodine at the height of their functional capacity. By the long-continued introduction of iodine in animals, distinct signs of increased activity can be induced in the sexual glands.[85] On the other side one knows of the atrophy of the ovaries and testes as the end-effect of chronic iodism.

Iodine passes into the milk, and single observations refer to an increased secretion of milk through small doses of iodine (iodized salt). On the other side it has been reported that the secretion is limited by iodine. This agrees with the final atrophy of the mammary glands in chronic iodine intoxication.

The abortion in swine and the sterility of cows can be attacked by iodine medication. However, the physiologic range in the genital sphere is later and more rarely surpassed than that of the thyroid.

DIRECT ACTIONS OF IODINE

From the indirect, intermediary, incretory actions of iodine one can separate the direct influences of iodine. The organic compounds prepared by the thyroid are not responsible for the symptoms of this kind and they are also different from the actions of thyroxin. Whether the indirect or direct actions appear, is dependent less upon the iodine preparation, since the inorganic compounds of iodine can also produce thyrotoxicosis, and more upon *the functional state of the organs*, primarily, on the central regulator, the thyroid. But these direct and indirect actions cannot be sharply separated by any means and one can only separate the actions in which the participation of the thyroid is clear or probable from those in which it is apparently absent. The direct actions of iodine refer primarily to *the skin and mucous membranes* and, among the latter especially, on those of the *air passages*.

Of the diverse possibilities of iodine influence on the organism, naturally the local mass actions give just as few therapeutic indications as the end states of poisoning (for example cardiac and liver fatty changes, glomerulonephritis). There we no longer find any symptoms in which the special defense processes against iodine activity express themselves. However, the protein coagulation by iodine (iodine tincture, iodoform) plays a rôle in disinfection and this mass action has been tried internally, particularly in encephalitis lethargica (in the form of Pregl's solution or Septojod) with

more or less success. With the single introduction, particularly of organically bound compounds of iodine, one may have rapid excretion and relative lack of danger. Indeed, it is exactly this rapid excretion of certain iodine compounds which permits their use for diagnostic purposes, for making visible the gallbladder and renal pelvis for x-ray examination (Tetragnost, Uroselektan, Abrodil). For the drug picture of iodine, however, only the reaction of the organism after the resorption of repeated doses of iodine is useful. They are best known as the untoward actions of iodine or its salts with prolonged medicinal use.

THERAPEUTIC ACTIONS

If one reviews the total effect of iodine, so on the one side will be found much more extensive possibilities in use than in the old school, and on the other side more definite than when the indications are shaped only by diagnoses. Likewise, one comes to the basis of its therapeutic effectiveness much more closely by the consideration of the simile rule.

Actually the scientific, "exact" basis of standard iodine therapy is extremely scanty outside of goiter. And even in the therapy of simple goiter, the theory that one must balance a deficient intake of iodine is insufficient. For the prophylaxis of goiter with iodized salt (with iodine in gamma amounts), the explanation that an iodine deficit is thereby balanced is not enough. According to McCarrison, one type will be favorably influenced, another not at all, and a third type will be unfavorably influenced. If one was concerned with a mere balancing of a deficit in goiter therapy, then the goiter should lessen by sojourn in an iodine-rich air and with iodine-rich food. But actually the thera-

peutic result depends upon the choice of a suitable preparation and the dose. From this one may conclude that the functional stimulation of the thyroid tissue is the essential and this will not be attained through an iodine supply in general, but only through suitable doses of iodine. Certainly food is also a functional stimulus for the tissue which needs this food but only the utilized, adapted food, according to amount and form.

If these relations are considered, so *the homeopathic iodine therapy of goiter can agree* de facto *with the standard use.* The homeopathic indications, according to the symptom register of Hahnemann, are swelling of the neck with numerous sensations of tension, oppression and compression of the throat. The basis is that with iodine one can under certain conditions obtain a functional increase and tissue hyperplasia of the thyroid also in the apparently sound. That the adaptability of homeopathic iodine medication of goiter must be considered not only in respect to the dose but that also the choice of the iodine compound must be based on other, especially constitutional symptoms of the individual patient, is self-understandable (perhaps calcium iod. or barium iod., in the lower potencies in the torpid; arsenicum iod., in higher potencies in the irritable; spongia, with respiratory oppression, *etc.*).

In myxedema and cretinism, in which the functionally active thyroid tissue fails, iodine lacks the possibility of stimulating function, but here a feeding with thyroid substance is promising.

The outcome in *hyperthyroidism* is not uniform. Here the iodine sensitivity in single forms is entirely different. In the iodine thyreotoxicosis which develops from mild stationary forms of Basedow, in part, also in previously apparently healthy, but still predisposed, we

have the picture of an iodine intoxication with predominant general disturbances before us; with an interval of a few weeks it progresses often acutely, but may be chronic and progressive. With this form iodine therapy would not be homeopathic but a type of isotherapy. Since with inorganic poisons an immunity of a high grade is possible prophylactically (as with arsenic) through gradually increasing doses, as this is not known of iodine, such a therapy does not come under consideration in the acute stage. By continuous use of iodine the follicles finally atrophy so that, during or after hyperthyroidism, symptoms of myxedema appear. So the sites of action, the thyroid, the sexual and mammary glands, are finally threatened with atrophy with iodine.

In the primary hyperthyreosis (primary Basedow), the goiter is colloid- and iodine-poor; on the other hand, the blood iodine is markedly increased and here the alcohol-insoluble organic iodine fraction is markedly increased. There exists a defective storage capacity of thyroid gland. Here through inorganic iodine the anomalous iodine metabolism can be regulated, so that the outpouring of secretion of the thyroid is prevented. On this rests *the preoperative iodine treatment of Basedow's disease* (after Plummer) which naturally should not continue with the usual doses more than one to two weeks and which may be unsuccessful if operation does not follow at the correct interval.

The action is explained:[86] Through the inorganic iodine, the organic fraction of iodine is displaced from the blood (perhaps to the thyroid). With this decrease of the alcohol-insoluble organic blood iodine the fall in basal metabolism goes parallel and the clinical symptoms of the thyreotoxicosis diminish.

Accordingly, one may well imagine that by a cautious regard for the dosage of iodine a regulation can

be obtained after some time in these cases, particularly in the "formes frustes," those with a partial Basedow. The therapy of Neisser with small doses of iodine is homeopathic in principle.

Dangerous for iodine medication, however, are the secondary hyperthyreoses which arise from a previously existing alteration of the thyroid, from the colloid nodular goiter (separated by Plummer as toxic adenoma!). In these thyroids a high iodine value is found.[87] There it is concerned with an overproduction of thyroxin. However, clinically these secondary forms cannot always be clearly divided from the primary.

The second great field of employment of iodine compounds in the school is *the syphilitic new formations in tertiary syphilis*, the gumma. These infectious granuloma cannot be sharply separated from diffuse productive inflammations. As infectious new growths which proceed from the interstitial tissue, they cannot always be certainly separated from the tuberculous granuloma, although in general these contain more giant cells. That iodine compounds can bring these infectious new formations of syphilis into retrogression and melting down has been demonstrated clinically in a manner free from objection. But a scientific explanation for this is entirely lacking. That iodine is enriched in such tuberculous or syphilitic altered tissue[88] is not an explanation. A bactericidal, specific action is not considered by anyone and is not confirmed either by clinical or experimental facts. The strikingly slight sensitivity of luetics toward iodine (thyrotoxicosis in luetics is very rare) in any case offers no explanation. It can be traced back to the marked affinity in mesenchyme which tends to inflammatory reaction.

In the untoward actions of potassium iodide one finds

a distinct parallel to the gumma in the *iododerma tuberosum*, the erythema nodosum like nodules in the skin which proceed from the subcutaneous tissue. These are in any case inflammatory new growths which grow rapidly and may be permeated with pus or ulcerated on the entire surface. Through drying of the secretion a picture may develop which formerly was designated as Rupia (Lewin). This structure, which is very akin to gumma, lessens rapidly after the cessation of the iodine just as gumma lessens after the introduction of potassium iodide.

A further similarity with tertiary lues is a mesaortitis which is observed from the subcutaneous administration of potassium iodide (just like that of adrenal injections).[89] The similarity of the reaction according to nature and type, at one time to the spirochetal poison in the tertiary stage of lues, at the other time to potassium iodide, proves the treatment of productive inflammations and gumma with potassium iodide as homeopathic. Thereby no explanation of the details of the healing process is gained but only a new point of departure by a new orientation: the possibility of activating syphilitic inflammatory tissue reaction through an inflammatory reaction to iodine which is similar to it, and of bringing it rapidly to resolution.

Likewise is the situation in the iodine treatment of *scrofulous swelling of the lymph glands*, which is common to both schools. To speak of a solvent action of iodine is merely to cover the lack of clarity by a conception. Among the untoward actions of iodine one finds (Lewin) only swelling of the salivary glands mentioned, but by older homeopathic observers also other glandular enlargements: axillary glands, of which it is stated that they also lessen under iodine, bronchial

glands with compression of the bronchi.[90] Outside of the inflammatory reaction in the interstitial tissue of the gland there can also be drawn into explanation for the especially hard and painless glands as tertium comparationis, the alteration of the blood picture in the sense of a lymphocytosis in disturbances of thyroid function as well as of iodine metabolism. This affinity of iodine for the lymph glands in general is used in homeopathy by the employment of such compounds in which the basic fraction also has a relationship to the glands (calc. iod., bar. iod.). Iodine action alone is too transient. The aggravation particularly of erethistic tuberculosis by potassium iodide causing a rapid melting down of the focus and dissemination makes great caution necessary in the treatment of tuberculosis in patients with Basedow trends.

The further use of potassium iodide in the school in *chronic bronchitis and asthma* likewise stands unfounded there. But again we find bronchitic and asthmatic states described among the untoward actions of potassium iodide. And by proceeding from these parallel manifestations we find an easy approach to explanation of the favorable action. Iodine is also excreted in traces through the respiratory passages and as everywhere the liberation of molecular iodine produces inflammatory manifestations with increase of secretion.

The iodine therapy of *arteriosclerosis* is weakly grounded scientifically, as Romberg's conception that potassium iodide lessens the viscosity of the blood is not confirmed and a vasodilatation by iodine is uncertain in any case. But even on the fact of a favorable action of iodine therapy itself in arteriosclerosis, opinions are divided and many believe that only luetic vascular damages are favorably influenced, but that ordi-

nary arteriosclerosis represents an unjustified field for this therapy. On the other hand, newer animal investigations are cited, which naturally give no explanation. The sclerotic vascular alterations which one can produce through the feeding of cholesterol to rabbits can be prevented by the early use of iodine.[91] The favorable influence on cerebral and coronary sclerosis by iodine is not denied and it is exactly these in which the characteristic symptoms are found in the homeopathic picture of iodine: *headache in old people, chronic congestion, feeling of a tight band, vertigo, worse on bending and in a warm room, rush of blood. Moreover: the heart feels as if stuffed, as if surrounded by an iron band;* these are followed by great weakness and fainting. The patient can scarcely breathe and speak.

On the influence, not only on the heart but also the vessels, by organically bound iodine in thyrotoxic disturbances there is no doubt. The increased acceleration thereby can be referred to the favorable occurrence of vascular narrowing.

In experimental organ perfusions with 0.002 per cent iodine there is at first contraction, later widening of the arteries and capillaries. On the isolated heart, inorganic and organic bound iodine effects widening of the coronary vessels if the concentration of iodine is at most 1:100,000. With decreasing concentration up to 1:6,000,000 the acceleration of flow still increases.[92] In men there is also a definite optimum of dose (five milligrams per dose) for the production of vessel widening[93] and for some time exactly these small doses of iodine in combination with chloral hydrate have been recommended in sclerosis. The importance of dose is obvious, because we have already seen that large subcutaneous doses of potassium iodide can effect a mesaortitis. Likewise the marked variation of blood pressure with great amplitudes in Basedow, as in disturbed iodine metabolism, also speaks for a special involvement of the vessels.

In homeopathy an iodine compound is used mostly in sclerotic disturbances in which the metallic fraction also has a favorable affinity for the vessel, as aurum iod. or barium iod.

Finally, iodine is occasionally used in the school for *chronic metal poisonings* with mercury and lead and this is based on an acceleration of the metabolism, the improved solubility of the metal iodide and, through this, the accelerated excretion.

To the named iodine indications based on diagnosis, on which a completely new light falls through their homeopathic foundation from the symptom picture of iodine, there may be added many others which likewise give good healing results. The treatment of *colds* has become well known; then too *acne* and *furunculosis*, for which the mixture with sulphur is considered indicated. But also where it is concerned with the resorption of an inflammatory exudate as in a pleurisy, iodine compounds as arsenicum iod. will be employed with good results as in homeopathy. In sudden iodine poisoning (intravenous injection of sodium iodide) inflammatory exudates as pleuritis are observed.

But all enumerations of diagnoses will never fix the therapeutic field of action more precisely but will always permit only turning around in a circle. Only the exact determination of the differentiating characteristics by intentional provings gives the necessary directing lines for therapy.

THE IODINE DRUG PICTURE

The provings on the healthy are found:

Hahnemann: "Chronic Diseases," 2nd Edition, vol. 3, p. 376, 1837, by the provers Hahnemann, Gersdorff, Hartlaub and Trinks, Gross and Schreter;

Hartlaub and Trinks: R.A.M.L., vol. 2, 1838. The provings of Trinks, Schreter, Hartlaub;

Jörg: "Materialien zu einer künftigen Heilmittellehre," vol. I, p. 473, Leipzig, 1825. Provers: Heisterbergk, Kneschke, Otto, Seyffert, Siebenhaar, Jörg; *Arch. f. d. hom. Heilk.* (of Stapf), vol. 13, p. 182. Prover: C. Hering.

GENERAL ACTION AND CONSTITUTION

The general actions of iodine are to be considered as an increase of its physiologic endocrine effect, and also to be placed in parallel with the manifestations of a hyperthyroidism. The *metabolic increase* through oxidative catalysis expresses itself in the chief symptom: *emaciation in spite of good appetite and much eating*; bears waiting for food badly and is better from eating. It is entirely possible that in the therapeutic effect the biphasic action of iodine underlies the situation. Because it is also observed that small doses of iodine can depress the metabolism and in particular nitrogen transformation. But in any case it would explain only a part of the mechanism of the therapeutic effect.

The iodine picture is an example of the *oxygenoid constitution* of Grauvogl, in which the oxygen influence is increased. Thereby sudden and severe reactions occur. Psychically the *unrest, the urge of doing something* is cardinal, also the impulse for forcible actions; during *rest* the patient is *anxious*. These also refer to the present more than the future. Characteristic is *the aggravation from heat*, in a warm room, and moreover at *rest; amelioration from walking around and in the open air*. To the internal unrest belongs the *sleeplessness* with waves of heat, alternating with anxious, fear-

ful dreams; furthermore, trembling of the hands, the facial muscles and eyelids, *pulsations and rushes of heat over the entire body, palpitation on the least exertion,* heat of the skin, marked outbreak of sweat and under certain conditions also fever, in short, the outspoken picture of hyperthyroidism.

The congestive headache and the vertigo have already been mentioned in cerebral arteriosclerosis and the symptoms of angina pectoris in reference to coronary sclerosis. One might trace them to an end stage following excessive demands upon the vessels. The influence on the lymph glands, the ovaries, the testes and mammary glands has been considered in general. Hardness and indolence of swollen glands in emaciated children are indications for iodine. According to Rademacher, iodine is especially a pancreatic remedy and in any case iodine increases the secretion of the pancreas like that of other glandular organs. If in the sexual glands an endocrine influence of the slowly given off potential iodine reserve still prevails, then in the lymph glands the tissue-bound, easily freed iodine forms the actual effective iodine reserve.

ORGAN ACTIONS

In any case these are outstanding for the *skin* and *mucous membrane* manifestations. In these fields *iodine idiosyncrasy* not rarely is manifested. Acne and furunculosis of the skin and the gumma-like formations have been mentioned. The coryza and conjunctivitis are extraordinarily severe. The nose runs when the patient is in the open air; in the evening and in a warm room it is occluded; there is often pain at the root of the nose; to these may be added paroxysmal sneezing and asthmatic-like attacks. The strongly diluted drops

of iodine tincture, which has long been known as an agent for coryza in France, outside of homeopathy has become generalized for the abortion and avoidance of colds through Bier. The laryngitis with huskiness, aphonia, constrictive pain, is especially characterized by the *croupy cough*. Likewise edema of the glottis frequently appears in the "untoward" actions of iodine, usually from inhalations of vapors. For the inspiratory dyspnea in such narrowing of the larynx speaks the report: *the child throws his head back and grasps at the throat.* In diphtheria iodine compounds are satisfactorily employed because of the marked connection with the throat.

In exudative pleuritis, compounds with iodine come into consideration as has been already mentioned. But also in croupous pneumonia in the stage of engorgement Kafka[93a] has reported iodine in D1–D3 as frequently successful. It is said to act abortive. Pneumonia occasionally appears in severe iodine intoxications. The entire picture of the subjective and objective symptoms of a beginning pneumonia up to the expectoration of a blood-streaked sputum is described. The cough with iodine is generally *worse in warm rooms and on lying on the back.*

On the gastro-intestinal canal iodine has little that is characteristic. Ravenous hunger and tormenting thirst are manifestations of increased metabolism. The other symptoms are vegetative, as *nagging pain* in the upper part of the stomach which, in combination with the *improvement* after eating, has been used as indications for *gastric ulcer* at times; moreover, a form of watery, foamy diarrhea which may be associated with attacks of constipation with unsuccessful urging.

Through certain foods, in particular cold milk, the constipation is again removed. The vegetative diarrhea in Basedow's disease will also be lessened by milk or other foods such as spinach.

The iodine disturbances in the remaining organs have little that is characteristic. Frequent, light flow of urine accompanies metabolic increase. The urine is said frequently to have a transparent sheen on the surface, a "cuticula," which is probably due to the increased excretion of phosphates.

On the sexual organs the toxic atrophy is preceded by an irritative phase. Formerly iodine was used as an emmenagogue. Too early and too profuse menses are the most frequent form of menstrual disturbance with iodine. The influence of mammary secretion is also biphasic.

SUMMARY

Type:

Oxygenoid constitution.

Mental Symptoms:

Restlessness, anxiety, urge to action.

Trends of Action:

(a) Indirect, endocrine
- Thyroid (goiter, Basedow), sexual glands
- Metabolic increase
- Sympathetic excitation

(b) Direct
- Mucous membranes, especially respiratory and throat
- Skin: acne, granuloma
- Lymph glands: hard indolent swellings

Leading Symptoms and Modalities:

Emaciation in spite of good appetite, ravenous hunger.

Better from satiety.

Worse in warmth and from rest.

DOSE

The dose requires exact consideration of iodine sensitivity. The selection is usually taken from the 3rd to 30th potencies.

IODINE COMPOUNDS

In iodine compounds the rapidly occurring but not long maintained iodine influence is markedly different.

Sodium iodat. is not proven and is very rarely used, outside of the lower potencies for securing an organotropic action of iodine.

Potassium iodat. is proven: Hartlaub and Trinks: "Reine Arzneimittell," vol. 3, p. 37, 1831. It possesses a rheumatic pain component besides the organotropic iodine action: *rheumatic pains* in the neck, back, and especially *the heels and soles of the feet.* The chilliness, also neuralgia and marked tendency to edema (which also appears "transiently" in iodine, especially on the eyelids) permit the distinct recognition of the potassium influence; it also directs attention to the nerves, muscles, and connective tissue. There still remains, outside of the organotropic iodine relations, also the iodine modalities, particularly the aggravation from warmth and in general improvement from movement. Aggravation on lying on the diseased side is a potassium modality, likewise the aggravation from damp weather.

Ammonium iodat. (see under ammonium compounds) unites the iodine influence very acutely to the respira-

tory passages, threatening inflammation of the larynx, the bronchi, the bronchioles, bronchopneumonia with threatening pulmonary edema and impending respiratory paralysis.

Calcium iodat. joins to the lymph glands; it has more chronic affections but acts more acutely than calc. carb.

Barium iodat. has chronic glandular and tonsillar swelling but acts more on the great vessels (aorta); similar is *stront. iodat.*

Sulphur iodat. is a so-called "eutectic" mixture, that is, a mixture which remains saturated on freezing and has a constant freezing point as a chemically uniform body. This preparation has preference in skin affections as acne, furunculosis, and herpes tonsurans.

Ars. iodat. permits the arsenic manifestations to appear most strongly. Exudative inflammations, pleuritis, pulmonary tuberculosis, acrid secretions, tendency to septic processes and diseases of the blood, great malignancy, great prostration and hectic emaciation are the indications.

The heavy metal compounds of iodine have an accord to the metal. Only the metal action is more acute and often joined to a site of predilection which is common to the iodine and the individual metal, for example—mercur. iodat., the throat; aurum iod., the heart and vessels; stannum iod., bronchi; plumbum iodat., the vessels.

BROMINE

Bromine was isolated from the mother liquor of the Mediterranean Sea in 1826 by Ballard. It is often found in the animal organism in slight amounts, particularly in the thyroid. Indeed, the bromine content of the blood is essentially higher than the iodine content. Only in recent times has it become probable that this content of bromine has significance in the human organism for psychic functions.

Bromine is the only element among the halogens which is a fluid under ordinary conditions—chlorine is a yellow-green gas; iodine, a black crystal. The asphyxiating, suffocating vapors which arise from it irritate the respiratory passages markedly, and also provoke intestinal bleeding and produce narcosis in a more marked degree than chlorine. Narcotic toxic manifestations are also observed from iodine vapors.[94] *But bromine represents the high point in the narcotic effect of the halogen series.* Elementary bromine is also a marked irritant to the skin, forming vesicles and inducing corrosion which heals only slowly.

TRENDS OF ACTION

The mucous membrane of the respiratory passage, the skin and the central nervous system remain the chief directions of bromine action when it is introduced in the anion form as well as bromine salts. In the organic bromine compounds as bromoform, bromipin,

the bromine action rests upon the bromine which is split off and the organic component has—according to the aim—only a significance in linking bromine in a definite way.

The effects of massive doses of bromine can be studied in essentials by the alkali salts, and thereby the depressing action on the central nervous system is always pressed into the foreground in therapeutic uses. For this reason bromine salts have an important place as anti-epileptic agents and as drugs which are employed as sedatives and for producing sleep.

SKIN

Before we can detail these actions of bromine salts and consider their explanation more closely we must mention the less observed bromine actions wherein bromine stands very close to iodine. The picture of *chronic bromine poisoning, bromism, stands very close to that of iodism in the manifestations evoked on the skin and mucous membranes.* The exanthem on the skin has the form of ordinary acne. According to analysis, bromine just like chlorine will be preeminently taken up by the skin when introduced in excessive amounts, and the inflammatory skin manifestations in chronic bromism are traced back to the liberated bromine anion, perhaps HBr, which is easily destroyed by the acid reaction of the sweat and the sebaceous glands. *Seborrhea and acne* are the most common untoward manifestations of the chronic use of bromine. Bromine can be found in the acne pustules.[95] Also pustular eruptions, in whose pus bromine can be discovered, may appear. More rarely the inflammation takes the form of a bromoderma tuberosum, a productive inflammation with subsequent breaking

down: from blue-red, nodular enlargements, which rise above the skin, there develop, from the breaking down large, itching, odorous ulcerations. Here also iodine furnishes a comparative manifestation in the granulomatous infiltrations. Very rare is bromoderma nodosum. It looks exactly like erythema nodosum but occurs with fever. Bromine urticaria is also observed.

MUCOUS MEMBRANES

The catarrh of the mucous membranes, preferably of the conjunctival tissue and the upper air passages, appears in the bromine salts—corresponding to their more chronic effect—less acutely than with iodine. The secretions with bromine are more coagulated, slimy, offensive. According to Krosz,[96] one finds pain in the frontal sinus after large doses of bromine, which may correspond to the frequent involvement of the accessory sinuses in acute iodism. Just as with iodine, marked salivation appears with bromine; furthermore, an offensive bromine stomatitis and inflammation of the pharyngeal mucous membrane gives (as with iodine) early occasion for angina. The catarrh of the larynx and bronchi and the increased liability to pneumonia recur as with iodine.

Irritative events also occur on other mucous membranes, but do not have much significance. In respect to the stomach it should be recalled that the chlorine in the hydrochloric acid can be replaced by bromine. Similar to iodine, an increase in the appetite has been mentioned[97] and in the homeopathic provings of bromine one also finds, besides vomiting and pains, *an empty feeling in the stomach and improvement from eating.*

CENTRAL NERVOUS SYSTEM

In the center of clinical interest and therefore also the subject of many studies stand the actions of bromine on the *central nervous system.* The depressive action in animals can increase up to paralysis, especially of the cerebrum, but may also involve the spinal cord, while the peripheral nervous system remains uninfluenced. The well-known manifestations of large doses of bromine in men are: decrease in thinking and of mental acuteness, slowing of speech, a feeling of lassitude and malaise which increase the tendency to sleep. The reflex excitability is decreased (for example, retching and corneal reflexes); vision is cloudy; diplopia, also an ataxia of speech and other movements may appear—moreover, difficulty in hearing, and stupor. Also well known is the reduction of libido and potency by bromine. The depression of the intellectual functions precedes disturbances of sensibility and motility. Even if bromine were not valued as a characteristic somnifacient, still Januschle[98] was able to induce a state of narcosis in guinea-pigs and rabbits before the state of ataxia and paralysis, through subcutaneous injections of sodium iodide; however, only as an acute action of large doses.

With these depressive actions on the central nervous system, which, as we shall still see, are not the sole possibility although still the most used practical division, the bromine action in epilepsy stands in obvious association. For explanation of this action a great number of investigations have been undertaken on the behavior of bromine in the organism; in particular the relation of bromine to chlorine has been studied. The best survey of this field and the practical elaboration

in reference to the sodium chloride diet in bromine therapy are represented by the work of A. Lipschütz.[99]

OPPOSING RELATION OF BROMINE AND CHLORINE

The chief excretion of bromine (as with chlorine) occurs through the kidneys. After excessive administration, bromine (like chlorine) is deposited particularly in the skin so far as a discharge from the blood is necessary, and the excretion through the kidneys does not keep pace. Bromine is held in the organism and only very gradually excreted when no more bromine is introduced. If bromine is introduced for a long time, then the output increases from day to day until finally a bromine equilibrium is reached; that is, as much bromine is excreted as is introduced. At this point also it seems that the bromine load has reached saturation, which naturally can rest at various levels according to the amount introduced daily. Upon cessation of the introduction, the bromine equilibrium is immediately disturbed since the output is maintained, though not at the same level. Storage and excretion of the bromine are particularly dependent upon the chlorine intake, particularly in the form of sodium chloride. The less chlorine taken in, the more bromine stored; the greater the ingestion of chlorine, the greater the excretion of bromine. To be considered naturally is that the bromine excretion requires a much greater time than the very prompt chlorine excretion. Whether the kidneys differentiate between the bromine and chlorine ions, that is—the bromine is held back[100]—or whether the bromine enrichment occurs only through the increased blood bromine by substitution of chlorine with a percentually uniform excretion of bromine and chlorine[101] is not definitely decided. But, in any case, a

substitution of chlorine by bromine occurs, because with the introduction of bromine a loss of salt occurs. Likewise the chlorine in the gastric juice is suppressed by bromine and in place of HCl there is HBr. The substitution of chlorine by bromine obviously is equimolecular.

With the continuous therapeutic use of bromine, about one-third of the chlorine in the blood is displaced; in experimental chronic bromine poisoning of animals, about two-thirds. Bromine also seems to collect where chlorine is found in greatest amounts, the blood and the lungs. Since it is possible through excessive intake of salt to increase bromine excretion and since all the manifestations of bromine poisoning can be removed by the introduction of salt, one has spoken of a functional antagonism of chlorine and bromine. To the "toxic" actions of bromine belong also the suppression of epileptic attacks. The attacks can often be again provoked through the excessive intake of NaCl.

The detoxifying action of equimolecular chlorine salts on bromine salt poisoning[102] can also be shown on *Fundulus*, a fish which can live in sea water as well as distilled water, but dies in various concentrations of sodium bromide solutions. It has been asserted that bromine poisoning is nothing more than chlorine deprivation.[103]

According to the studies of Ellinger and Kotake,[104] it is very improbable that bromine poisoning and simple chlorine deprivations (without substitution by bromine) are identical, for although high-grade chlorine deprivation also leads to paralytic manifestations, the remainder of the picture shows considerable differences. It may be assumed that the bromine ions also have an independent action which cannot be explained by mere replacement of chlorine. The more marked swelling of brain tissue by bromide than with chlorides speaks for this.[105] Up to a certain grade bromine can replace the action of chloride. On the surviving frog heart the chlorides of potassium and calcium

in the Ringer's solution can be replaced by the bromides without functional alterations;[106] likewise the acidity and function of the stomach are improved when an artificially produced chlorine deficit is replaced by sodium bromide in the food.[107] Moreover, in dogs the manifestations of a sodium chloride deficiency can be removed up to a certain degree by sodium bromide.[108] In the last case it should also be recalled that the addition of sodium can lead to the improvement.

It is probable that in bromization the chief action is to be ascribed to the bromine anion itself; that this action is further increased through a chlorine defect, though, on the other side, the sodium salts of chlorine and bromine can interchange functionally to a certain degree.

We have here a very instructive example of a so-called ion antagonism before us: the close chemical relationship of chlorine and bromine makes possible to a certain degree an opposing interchange and displacement. On the other side the displacement of the physiologic chlorine by the less suitable, heavy bromine soon provokes functional disturbances in which the antagonism of the ions appears distinctly. Thereby the foreign bromine action can be removed much more easily through chlorine than an improvement of deficient chlorine symptoms is possible through bromine. A certain syngerism of the two ions rests also upon the close chemical relationship, but an increasingly distinct antagonism is obvious from the completely different physiologic breadth of these ions. Lipschütz draws the practical conclusion from the above-mentioned facts that in the bromide treatment of epilepsy it depends less upon a definite salt deprivation than upon keeping the salt introduced constant, because only through this uniformity of dosage is the effectiveness of bromide made possible.

For the theory of bromine action on the central nervous system it is worthy of note that bromine does not seem to be especially rich in the brain. For its action in contrast to chlorine, a marked swelling of the brain tissue is perhaps of significance, and again the fact that bromine is more lipoid-soluble than chlorine.[109]

STIMULATING BROMINE ACTIONS

Of the various bromine salts, according to the findings of Januschke, it is worthy of note that ammonium bromide in large doses provokes severe paresis, reflex increase, tonic and clonic cramps, and respiratory paralysis. In this salt we have also toxic effects which might permit the remedy to be considered in epilepsy according to the simile rule. But in general chronic bromide medication in epilepsy is conceived as a palliative suppressing therapy.

But that the depression of the brain centers is not the sole phase of bromide action is perhaps most clearly shown by the self-investigation of Schabelitz[110] using sodium bromide in large doses. The trial continued over a two-months period. Very soon, after five grams, appeared an irritable frame of mind, a type of intoxication, with some confusion and uncertain gait. With continuous introduction of bromine great desire for undertaking work and a cheerful frame of mind alternated with lassitude and ill-humor. On the seventh day of taking bromides the variation in disposition ceased and a euphoric frame of mind remained. To inattentiveness and forgetfulness there were added joking, the urge to speak, pugnacity, unrestrained and noncritical attitude, a submanic state with many light and color manifestations, auditory delusions, disturbances of speech and language, cramp from writing, disturb-

ance of convergence, ear noises, disturbance of equilibrium, mislaying of objects, inattention to clothing. Recollections from youth are very animated, while recent impressions are unrecalled.

"As epileptics tend to do, I could not simply name a picture but had to form a judgment about it."

"The disposition was rosy, I made the most beautiful plans for the future and was irritated if anyone contradicted me."

On the twentieth day of bromides there appeared a striking *motor unrest*. With the cessation of bromides and the addition of salt the disposition changed like a flash. Two days after the discontinuance of the bromides, there suddenly appeared marked delusions in the sense of relativity on the basis of a marked feeling of inferiority.

Under the use of bromides the sleep was deeper; during the day there were attacks of great malaise. With progressive bromization the pulse increased from 66 per minute to 110 and sudden increases up to 130 even in the state of complete rest. These suddenly appearing increases could be maintained for hours. Arhythmia and attacks of cardiac anxiety were observed. The appearance was bad, sallow, with temporary congestions of the head. The tongue was coated white and pasty. In the latter periods of bromides there were several days of acid risings, later bitter taste in the mouth. The urinary output varied with the introduction of salt. No manifestations in the skin were observed in the entire bromide period.

In the trial, the impairment of mind is well shown in respect to recently noted things and a slowing of psychic accomplishment of work, but most striking was *the submaniacal state*. Further, one cannot say that bromides in large doses act as a sedative in the healthy.

Much more the therapeutic sedative action corresponds in a homeopathic sense. The same also holds for the vasomotor irritability, the increased pulse rate and the motor unrest.

Exactly the influence of bromine on the psychic functions, as came into expression here in the production of a hypomanic state, is of high interest in respect to the newer investigations of H. Zondek and Bier.[111] Bromine stands in the relation of 100:1 to iodine in the blood. The amount of bromine is extraordinarily constant. Only in the manic depressive insanities it lies 40–60 per cent under the normal, and indeed only in the endogenous and not in the reactive forms. In the anterior lobe the hypophysis contains unusually large amounts of bromine. A substance which resembles thyroxin, in which the iodine is replaced by bromine, released very marked fatigue. These organic bromine compounds should, moreover, be markedly more effective than the inorganic bromine compounds. The hypophysis is perceived as the absorption and regulation organ for bromine, similarly as the thyroid for iodine.

Undoubtedly, bromine has for its most important field the psychic functions, which until now have not received due attention in homeopathy. One was obviously of the opinion that the well-known sedative action was to be viewed as a purely palliative "antipathy." According to the self-investigation of Schabelitz, however, this cannot be maintained in general. So it comes to the point that the suitable bromine preparation in correct dose for the psychic and motor excitation and disturbances of coordination must be determined in order to obtain more than a transient result.

THE BROMINE DRUG PICTURE

The rare use of bromine and bromine compounds in homeopathy up to the present is based upon older observations of intoxication, animal investigations and provings on the healthy:

(1) Höring: "Ueber die Wirkung des Broms und mehrerer seiner Präparate auf den tierischen Organismus," *Gekrönte Preisschrift,* Tübingen, 1838.

(2) Heimerdinger: In. Diss., Tübingen, 1837.

(3) Fournet: *Schmidts Jahrb.*, vol. 22, p. 144.

(4) Hering: *Neues Archiv. f. Homöop. Heilk.*, vol. 2, p. 109, 1846.

(5) Lembke: *Allg. homöop. Ztg.*, vol. 37, p. 115; vol. 44, p. 369; vol. 49, p. 186.

In addition on potassium bromide:

(1) Graf: In. Diss., Leipzig, refer. in *Allg. hom. Ztg.*, vol. 19, p. 126 (eight provers and few organ symptoms).

(2) Korsz: In. Diss., Kiel, 1875.

In many observations on bromism *the chief actions appear in the skin and mucous membranes and central nervous system.* In the provings arranged with bromine water, chiefly irritative symptoms of the mucous membranes of the respiratory passages and of the gastro-intestinal canal are noted. Of the *psychic* symptoms, illusions "as though someone stood behind him and looked over his shoulder," many dreams, anxiety, restless moving around in sleep, trembling and weakness on awakening, are reported; in potassium bromide there is the urgency of occupation, so well known from iodine, and the motor unrest, the hypomanic excited state besides the well-known depressive actions of the psychic functions (thought, conceptions, judgment,

speech); the detailed observations with sodium bromide by Schabelitz read similarly. It is conceivable that for medical use it is not the depressive and paralytic symptoms which are suitable for comparison but the excitation symptoms. *Also that many similarities of bromism exist with the psychic state of epileptics* suggest that, with better adaptation to the single case, bromides may become more than mere palliatives in many forms of epilepsy. Here there is lacking as yet an exact working out of the symptomatology. A modality which agrees with the urgency for moving is also worthy of note for the central nerve action: *the improvement through movement and walking about.* Further, a connection with the sexual function, which may be reduced from large and persistent doses of bromides, may be significant for the selection of bromine. The special bromine symptom, "audible discharge of gas from the vagina," has been reported to me as a symptom from an epileptic with a "distention of the os of the cervix" and at times accompanies states of excitation of the sexual organs.

To what extent the indication of dysmenorrhea membranacea is useful for bromine, still requires testing. The toxic actions of bromine on the sexual organs are like those of iodine. At first the testes and ovaries swell and then atrophy and harden. The breasts also swell and pain.

The chief use of bromine preparations in homeopathy up to the present has been in affections of the upper air passages. All halogens seem to have a special affinity for the throat. Animal investigations have shown a membranous inflammation of the diphtheritic type. However, the bromides are more rarely used in laryngeal croup and diphtheria than the iodides and

cyanides, although the bromine symptoms are pictured as extremely similar to severe laryngeal diphtheria. An indication for bromine is also said to be its general modality: *worse from heat,* from hot water; and the etiology is said to be cooling *after overheating,* excessive coverings, close spaces. For bromine there is a special type of *blond, blue-eyed children* with reddened face. In such children bromine is preferred in *croupy coughs,* also in simple laryngitis, in scrofulous catarrhs, and in hard, nonsuppurative swelling of the cervical lymph nodes, the brunette types corresponding more to iodine.

The hoarseness is, as are all symptoms, worse from becoming warm and from overheating. *Dry cough with hoarseness and burning under the sternum is spasmodic.* Here the well-known use of bromoform in whooping cough is to be recalled. Inhalations provoke coughing in which the inhaled air seems cold, although the weather is warm (indeed, in the state of overheating). Inspiration is labored; attacks of suffocation appear in a warm room and there may be mucous râles in the larynx and air passages. In bromine the inflammation can extend into the bronchi and lungs (pneumonia is frequent in experimental bromine poisoning[112] and also in bromidized epileptics) but still bromine is much more rarely employed than iodine. The laryngeal symptoms are decisive, and thereby the *larynx should be very sensitive,* especially to dust. So bromine is considered a remedy in sailors who have asthma ashore and again lose it at sea.

As with iodine there is also an irritant state of the nasal mucous membrane with much sneezing, which was also observed by Schabelitz on the twenty-second day with sodium bromide. Thereby pressure in the

frontal sinus seems to be frequent. The feeling of coldness of the inhaled air, aggravation from heat and overheating, can perhaps give an occasion to select bromine in place of the usual iodine.

The well-known skin manifestation of bromine are rarely utilized medically. However, Clarke recommends kali. brom. highly in the 30th in simple acne. Ammann has observed an eruption like psoriasis in bromine intoxications and has employed kali. brom. with results in psoriasis.

SUMMARY

Chief Trends:

(1) Psychic: Hypomanic state (sedative and antiepileptic action many times curative?).

(2) Upper air passages: laryngeal croup.
Spasmodic cough (blond, blue-eyed children).

(3) Modalities: better by moving around; worse from heat and overheating.

DOSE

Usually bromine (fresh preparations!) are recommended in the lower potencies, usually as kali. brom.

CHLORINE

Chlorine in molecular form, that is, as the yellow-green gas, comes into consideration for medicinal use just as little as molecular fluorine. The severe toxic action of chlorine is associated with its great chemical activity toward almost all elements, in particular its avidity for oxygen. This is so great that a hydrolysis of the chlorine molecule occurs even in water whereby ClOH, hypochlorous acid, and HCl, hydrochloric acid, are formed. The destruction of water by chlorine is catalyzed by higher temperature and light. By the development of HCl, oxygen is liberated, this constantly oxidizing Cl to ClOH and this again in HCl and O. By this process oxygen constantly becomes free, and so chlorine acts as a strong oxidizing agent on substances containing water and destroys all living substances.

ACTIONS OF MOLECULAR CHLORINE

When chlorine is in a sufficiently strong concentration, the organism is first involved in regard to the respiratory passages: *spasm of the glottis, cough and dyspnea;* the dyspnea is expiratory. If the amount of chlorine entering is sufficiently large, then there soon follow dyspnea, cyanosis, cold sweat, eventually pulmonary edema, accelerated small pulse and death through cardiac and respiratory paralysis. If there is prolonged stay in a chlorine atmosphere of moderate concentration, the reflex defenses are penetrated so that

there develop bronchitis, pneumonia, pulmonary bleeding or edema. Bronchial maladies, pulmonary hemorrhages, the development of tuberculous foci on such a damaged soil, have been observed in subacute toxic concentrations, and, moreover, in chlorine workers, gastric pain, acid eructations, pale, greenish appearance, emaciation, premature old age. The first acute irritative manifestations of small concentrations of chlorine are burning in the eyes and nose. Lewin also reports turbidity and inflammation of the cornea.

In regard to the narcotic action of aliphatic chlorine compounds (chloroform, chloral hydrate), the observation of Cameron[113] is worthy of note, in which is reported a narcosis through chlorine gas (sleeping in the region of smashed boxes of calcium chloride) and free chlorine was demonstrated in the tissues by smell. Moreover, Binz[114] reported narcosis and the appearance of free chlorine in the tissues in rabbits. A cerebral action expressed itself in the proving of chlorine water in the symptoms: loss of memory, especially for names, fear of losing the mind. The mental weakness is particularly worthy of note because of the similarity with more expressed action of the closely related bromine.

Likewise, not because of its therapeutic utility but for the understanding of the working relationships with the other halogens, bromine, and iodine, the so-called chlorine acne should be mentioned here. It is naturally assumed that it is not the free chlorine but organic compounds of chlorine (especially with tar derivatives) which are the cause of this affection of the sebaceous glands. Still, one may assume that the organic combination merely conditions conduction of chlorine to the skin just as the aliphatic compounds favor conduction to the nervous system.

AQUA CHLORATA AS A REMEDY

The homeopathic use of chlorine in the form of potentized chlorine water, *aqua chlorata*, is recommended in croup, spasm of the glottis, asthma with expiratory dyspnea, coryza with sudden flow of acrid corrosive mucus, and loss of voice in damp weather; but it is rarely used. Chlorine water is, moreover, too unstable a preparation since it contains constantly changing amounts of hypochlorous acid and hydrochloric acid, even with fresh preparation and preservation in brown bottles which excludes light. The use of aqua chlorata, which has survived from older medicine in the febrile diseases in which it should produce a slowing of the pulse and lowering of the temperature with an outbreak of sweat, in typhoid, in aphthous stomatitis, in dental spasms, is probably explained by the hydrochloric acid and hypochlorous acids being the active constituents. For the similarity of the indications with those of muriatic acid, as we shall soon see, is striking.

CHLORINE ION AND SODIUM CHLORIDE

Chlorine is of great significance in the organism in the ionic form, primarily in its neutral salt compound with sodium. In sodium chloride are bound two very aggressive elements, each of which attacks water; sodium turns water into a strong alkali, chlorine turns water into a strong acid. And the neutral compound, NaCl, which is so extensive in the lithosphere and the hydrosphere as sodium chloride, is not only taken into the body daily in amounts of grams, but is granted so wide a physiologic range that the thought of any damaging or medicinal effect of this food and condiment at first seems to be very remote. The capacity for adapta-

tion in the intermediary metabolism for quantities of sodium chloride is so great that in the adult twenty to thirty grams in a day scarcely provoke any alterations, at least not for brief periods of observation. It is otherwise in children in whom even three grams of a concentrated solution can provoke fever.

SODIUM CHLORIDE AS A DRUG?

It must seem as highly strange that such a material is conceded to have the medical effect ascribed to it in homeopathy. For this reason *natrium muriaticum* is a favorite source of attack on homeopathy. Still, the problem here is no different than it is with potassium and calcium salts. The homeopathic assertions seem impossible only when the glance is cast at the quantity of the material. Just as little as we deal with quantitative factors in the salts of potassium, calcium and magnesium concerning a theory of deficiency, so is it true of sodium chloride. The different, unusual *state of form* is perhaps one of the conditions whereby we attain new type of working possibilities with such a substance. For the fulfilling of this condition, the type of preparation of such a remedy is significant and should be *a trituration with sugar of milk*, carefully performed up to 6th decimal potency; only beyond this is a dilution in diluted alcohol arranged.

How this potentized preparation differs from a simple solution and by what means it can provoke new kinds of actions can be answered at present only by hypothesis. So might the increased distance between the NaCl particles or even into sodium and chloride ions be better obtained and maintained through the medium employed (milk sugar and later alcohol); in conse-

quence the site of the first influence (the tongue mucous membrane) can be of significance for its unusual working path. It would then be understandable that the preparation can provoke symptoms which are not observed from the usual introduction of larger amounts of sodium chloride even though the organism might be adapted for the usual form.

But the organism would so much sooner react to unusual preparation of sodium chloride with symptoms, the more labile the *sodium chloride equilibrium* was at the beginning. Disturbances in NaCl economy, or in sodium or chlorine equilibrium, alone will favor the effectiveness of the preparation. On this account it is necessary to learn the physiologic rôle of NaCl in the organism, the fact being that the normal and abnormal relation of NaCl in the organism designates the soil on which the preparation of NaCl can unfold special activity of medicinal effects.

PHYSIOLOGIC RÔLE OF SODIUM CHLORIDE

On the step of mass action sodium chloride appears at first the most important factor and regulator for water balance. The behavior of water to dissolved particles, that is, the osmotic concentration or water concentration, will be especially strong and easily influenced by NaCl because NaCl has the great span among the electrolytes of the body, as it also appears the strongest physiologically in the body fluids. Through sodium chloride the diffusion velocity of a solution is increased greatly, and so *sodium chloride is the impulse factor also for the movement of body fluids.* Sodium chloride is easily excreted and easily retained, will be absorbed dry or moist. From all these facts it is especially suitable for the maintenance of

osmotic equilibrium. NaCl furnishes about 60 per cent of the osmotic concentration of the blood. Because of its great breadth of adaptation it does not easily come to specific disturbances. For the understanding of this play of power between water and NaCl it must be grasped that sodium chloride (in contrast to KCl) is a constituent of the body fluids and the cell surfaces are quite impermeable to NaCl, at least for the sodium ion, while the chlorine ion can pass from outside in, and reverse.

Two materials, which physiologically work together as strongly as water and NaCl, appear as antagonists as soon as one attains predominance. The antagonism of a pair belonging together (also in itself synergistic) appears first when the effects are shifted one-sidedly. So water removes sodium chloride poisoning; and sodium chloride, water poisoning to a great extent. If, for example, one has effected a depression of diuresis with pure water, then it is overcome (to the point of isotonia) by a subsequent introduction of sodium chloride. The isotonia of the blood is protected against excessive amounts of water or sodium chloride to a remarkable extent; furthermore to assist in the regulation there are added such symptoms as thirst, dryness of the mucous membranes, hydremia and rapid excretion, chiefly through the kidneys with increased or diminished amounts of urine, according to the availability of water for excretion and the functional capacity of the kidneys. The chloride excretion by the sweat and faeces is slight in contrast to that of the kidneys. It is assumed that a transient deprivation of the cell of water from the introduction of excessive amounts of sodium chloride would not be without influence on the function

of cells. Some alterations of intermediary metabolism could stand in connection therewith. So, it has long been known that, after doses of concentrated salt solution, the urine becomes alkaline.[115] Thereby the carbon dioxide capacity of the blood is lessened, there is a cumulation of fixed acids in the blood, and the acid excretion in the urine is reduced.

To the same field of action also belongs the increased nitrogen excretion from the introduction of hypertonic NaCl solution, which can be maintained for some days after the introduction of NaCl.[116] *Increased destruction of protein* may also be responsible for the enrichment of the blood in fixed acids (reduction of CO_2 capacity). Therein we think of the increased protein destruction and the emaciation in chronic misuse of salt. On the other hand, that NaCl with much water (that is markedly hypotonic amounts which are rapidly absorbed and therefore provoke a rapid transient hydremia) leads to a delay of protein transformation[117] and also acts protein sparing, seems no contradiction; because it is concerned with a relative, transient NaCl deficiency.

The basal metabolism, also the oxidative processes, are increased through hypertonic NaCl solution.[118] According to Verzar,[119] the oxygen consumption is greater than the CO_2 excretion, which signifies a decrease of the respiratory quotient (that is, a plus in the oxidative processes, over increased carbohydrate and fat burning).

H. Schulz[120] conceives that in the organism chlorine through CO_2 is made free from sodium chloride and then chlorine acts oxidizing. If this is not proven, still, in any case, a marked oxidation may be presumed in the development of HCl from NaCl.

SODIUM CHLORIDE FEVER

Closely bound with the increase in protein destruction and the oxidative processes is the much studied *sodium chloride fever.* The increase of temperature through concentrated salt solutions in small children (either orally or parenterally in three-gram amounts) is observed. According to experimental studies[121] on rabbits it is concerned with an increase in heat production and of protein transformation. From the fact that calcium compounds in small amounts suppress sodium chloride fever, one has falsely concluded that it is not a sodium ion action. Not a disturbance of the isotonia, but of isoionia and indeed a relative predominance of the sodium ions, is assumed as a cause. With other sodium salts, as the carbonate and phosphate, the fever is not obtained. Likewise the fever goes parallel with the height of chlorides in the blood.[122] Indeed, after the marked use of NaCl there is a marked output of calcium.[123] This is naturally a necessity of the organism for the maintenance of the fixed alkali reserve. Calcium is, as we know, a very general defense against cell intoxication through its thickening action. If one assumes that NaCl fever occurs through lessening of calcium action, then this would probably occur via the vegetative nervous system to the nerve centers. In agreement with this is the fact that the fever does not occur when the splanchnic nerve is cut and that (outside of calcium salts) the fever can also be suppressed by choline and pilocarpine. The last signifies an excitation of the para-sympathetic and one concludes reversely that *NaCl induces an excitation of the sympathetic* in the sense of adrenalin, and that adrenalin fever can be placed at the side of NaCl fever. Moreover,

calcium here acts as an exciter of the parasympathetic or a depressor of the sympathetic which is in opposition to the usual presentation. It is primarily probable that the increase of temperature is to be ascribed more to the halogen anion than the sodium cation. The detoxification through calcium is not a proof that it is concerned with a toxic action on the entire molecule of NaCl.

But there is still a further antagonism to be mentioned in respect to the two univalent ions, sodium and potassium. Biernatzky[124] reports that the output of potassium is increased through the intake of sodium chloride. Since the potassium action in general corresponds to a parasympathetic effect, then a preponderance of the sympathetic would be explained by the introduction of NaCl. However, NaCl fever cannot be removed through potassium salts. Thereby the antagonism of sodium and potassium ions is chiefly conditioned in that sodium is the outer and potassium the inner ion of the cell.

If one perceives in the anisoionia the cause of the NaCl fever, then this still does not say that the intermediation of the disturbance over the sympathetic would be fundamentally different from the direct cell influence of NaCl. It is much more to be assumed that the alteration immediately on the cells corresponds to a febrile metabolism, that moreover the vegetative system actually only intermediates the process through the nerve regulatory centers as they play between sodium chloride molecules and cell receptor organs. We may assume—as in the experimentally founded parasympathetic and cardiac muscle effects of potassium—that here also *a physiologic circle* exists in which the result is dependent upon where the NaCl acts at the disturbing moment. Thereby it is clear that other quantities and states of form are necessary on the receptive organs than on the nervous centers, in case a direct way can be found for the latter.

Further, it would not be contradictory to the above designated way in which sodium chloride produces fever, if the liver should have a special rôle. This has been assumed by some authors because Rolly[126] has shown that sodium chloride fever appears only when glycogen is present.

Apparently very similar to NaCl fever are the relations between glycosuria and hyperglycemia which can be experimentally produced through NaCl. Here also it is probable that the disturbance in ion equilibrium is vegetatively conducted to the nerve centers. How far the connections to glycogen and to the other metabolic alterations are here related to large doses of sodium chloride is still undetermined.

SODIUM CHLORIDE DEPRIVATION

Perhaps the favorable action of sodium chloride-free or sodium chloride-poor diet, which has recently been so widely advised in various diseases (tuberculosis, lupus, migraine) through a number of food reforms, is to be based on the above-mentioned metabolic and ion relationships. NaCl deprivation would accordingly increase the CO_2 tension in the blood, would displace the fixed acids in the blood and promote calcium ions. But it is also possible that other explanations will be found for this successful dietetic therapy.

The salt-poor diet in nephritis has another basis; it is a sparing and unloading therapy for water economy because in nephritis the capacity for excretion of NaCl is depressed or subnormal. Consequently, by the introduction of salt, the urinary output will be depressed and the retention of water and NaCl will favor edema. Deprivation of NaCl in such cases of retention often again increases the urinary output.

But in our discussion we can say little about the therapeutic actions of salt deprivation because we seek, as the basis of our therapy in the use of NaCl, positive

actions, the tensions of the organism. On the other hand, we cannot assert that the diseases which are favorably influenced through salt withdrawal are caused by an excess of salt. The reason is that the withdrawal of salt might, and probably is, a nonspecific procedure for the transformation of metabolism as a fast or thirst cure.

CRUDE SALT ACTIONS

A laic use is to take concentrated doses of salt in order to arrest hemorrhage, in particular hemoptysis. This has been supported by the reports of v.d. Velden[126] that strong injections of sodium chloride increase the coagulability of the blood. (An increase of coagulation has also been reported for natr. sulf. by Reverdin.) Whether therein a forcible re-orientation in water economy plays a rôle, perhaps the rapid excretion of sodium chloride with corresponding amounts of water out of the circulation into the tissues remains to be seen. In any case an antagonism against calcium does not come into evidence here since it is exactly the calcium ions which are necessary for coagulation and, moreover, it is not known that a subnormal concentration of calcium promotes coagulation, but indeed the contrary.

It is a crude action of salt when the secretion of sweat is depressed by the oral or intravenous use of NaCl. By this means the night sweats of tuberculosis can be removed for a short time. A water retention with the ingestion of NaCl by the tissues gives a close explanation but probably not the entire one.

In seeming contrast to the favorable action of NaCl deprivation in tuberculosis stand the not-to-be-denied results of *sun baths, sea air and sea baths in torpid*

glandular tuberculosis. Here of significance is that *the exudative diathesis shows an increased capacity for NaCl in the skin connective tissue.* The slowing of NaCl metabolism in this important regulator can be removed through the external action of sodium chloride.

The excretion of alkali *carbonates* besides water from the *sodium chloride waters* (as Wiesbaden, Ems) is claimed for the surface of the respiratory mucous membrane whereby there is a mild liquefaction of the mucus. So the alleviating action of this spring water has been explained in chronic catarrhs; the alkali fraction is the essential element here.

Sodium chloride increases the secretion of the saliva and gastric juice, an action on which its use and effect as a condiment depends. But not only hypertonic but also hypotonic solutions provoke an increased secretion of gastric juice, while isotonic NaCl solutions are without influence. On the contrary, the very salty foods again act depressing on the gastric secretion.[127] To some extent the salt introduced at meal time is available for the production of HCl in the stomach. For the remainder, the necessary chlorides are taken from the blood and the CO_2 tension of the blood increases during this withdrawal phase, as Cl and CO_2 stand in an important exchange and equilibrium relation to each other. By excessive withdrawal of chlorides (for example, marked vomiting with loss of HCl in pyloric stenosis) the alkalosis of the blood can increase so far that a gastric tetany occurs.

Cl ION AND ACID BASE EQUILIBRIUM

But for the maintenance of *acid-base equilibrium* the chloride anion is just as important as the Na cation. Here NaCl is a ready reserve of great breadth and indeed, according to the requirements of intermediary

metabolism, the paths of Na and Cl may separate. The Cl can easily be exchanged for the anions arising in metabolism as the carbonates and phosphates. Through its easy excretion, the chloride can spare the anions arising out of the oxidation of organic materials, but on the other side can easily lead to excretion if they are introduced in excessive amounts; then chlorides themselves may be held back. This reciprocal relationship, suitable for equalization, is indeed only one of many for the maintenance of regulation of the intermediary metabolism. Such purely quantitative chemical processes are subjected to disturbances only under extremely unusual conditions and then only through mass substitution or massive deprivation. The acid-base equilibrium in the body fluids is ordinarily not endangered. But if a one-sided demand is placed upon this regulation, perhaps on the chloride content of the organ cells, then functional disturbances will arise there. So it might be considered that, through its exchange relationships with the anions of combustion metabolism and as it participates in a regulatory manner in oxidation processes, chlorides can be involved by disturbances in their course if they are excessively retained. These, then, are the preconditions for a medicinal influence, perhaps with a preparation of sodium chloride in which not the amount but the activity of the liberated fraction gives expression.

REGULATION OF NaCl METABOLISM

Such a medicinal influence would, however, be scarcely possible if it had to be exerted directly on the tissues and the receptive organs. The disturbances of Na and Cl economy notoriously occur in them, but a direct medicinal alteration simultaneously at so many

points is hardly probable in itself. Actually underlying the normal NaCl metabolism is a *central regulation* which is mediated partly through hormones, and is partly of a pure nervous variety.

One knows that the storage in the tissues (chiefly in the subcutaneous connective tissues with the two passages of discharge, to the blood and to the outside in sweat) as well as the excretion is extensively influenced by the *vegetative nervous system.* Very distinct is the influence of the vagus on the formation of gastric HCl. Subordinate centers for the nerve control exist in the medulla oblongata and in the inter-brain. The so-called salt-puncture in the floor of the 4th ventricle (vagus nucleus) effects an excessive excretion of salt, under certain conditions without the participation of water excretion.

Of the *endocrine glands* the most important regulator of NaCl economy is the hypophysis. Hypophysin causes a streaming of NaCl fluid out of the tissues into the blood and increased NaCl excretion, even in the first phase which proceeds with a sparing of water. In the second phase the excretion of both water and chlorides is increased.

In hypofunction of the thyroid, chlorides are retained in the tissues, and by doses of thyroid the chloride stream from the tissues into the blood and the excretion is increased. Reversely adrenalin effects a chloride retention in the tissues. The influence of insulin seems to be indirect through its influence on water economy and acid formation.

Thereby the importance of the endocrine system for NaCl metabolism is demonstrated, but a uniform trend in the meandering paths of hormones and vegetative

nerves is still not distinct. Therefore the manner of action of sodium chloride as a drug remains almost completely shrouded in darkness. The physiologic rôle of NaCl as a regulator of water economy and the acid-base equilibrium in metabolism and the depicted results of disturbances in the NaCl economy make it possible for us merely to outline the field with rough borders in which a medicinal excitation through preparations of sodium chloride seems possible. Only the investigations with such preparations in sensitive men with a labile NaCl balance will permit us to find further helpful indications for the employment as a drug.

NATRIUM MURIATICUM

The provings of natrium muriaticum are found:

(1) Hahnemann: *Chronische Krankheiten*, 2 Aufl., Bd. 4, 1838.

(2) *Archiv. f. hom. Heilkunde*, Bd. 19, H. 3, p. 120, 1842.

(3) Watzke: *Oesterr. Ztschr. f. Homöopathie*, Bd. 4, p. 1, 1848.

As the point of bodily departure for natrium muriaticum we may take an unbalance of water economy in the organism. The disturbances in the movements of fluids seem to permit alterations of the state of tension of the vessels and all secretions. On this basis are to be considered the neuropathic trends of the drug picture. The disturbances in the partition of fluid and in the circulation cause symptoms which are usually suggestive of anemic-chlorotic states. Emaciation and bodily as well as mental exhaustion up to cachectic states, pallor and dryness of the skin, suggest that behind the external picture of the expressed natrium mur. type there are deep general disturbances in the sense of the

old dyscrasias and that these are more presumed than exactly described.

TYPE

The *type*—usually feminine—is *chilly, still heat, especially the heat of the sun is badly tolerated; easy exhaustion on bodily and mental effort*, even on speaking. Very characteristic is the *mental state, an irritable depression*, cries easily, attempts at consolation aggravate, even cause rage; is easily depressed; grief and disappointment, deep and long; unpleasant thoughts are persistent. The natrium mur. patient will not cooperate, hides the cause of his depression, and has an aversion to company. In this depression lies something tense, the forced, hidden basis comes to light in impulsive ill-humor. Occasionally the internal tension is revealed in forced laughter. It is this rhythm which characterizes the depression from secret anger or grief. *The frame of mind is also dependent upon the degree of constipation*, and is especially *bad after the period.* The irritability of the natrium muriaticum patient expresses itself in a special sensitivity toward external impressions, particularly sudden noises. Children are bad when they are addressed.

The capacity for mental work, the ability to concentrate and the memory are impaired; thoughts are easily diverted, indeed, as the result of depression, are of the tense state.

The time of aggravation of natrium mur. is from 10 to 11 A.M. at the time of marked use of energy. At this time appears the so-called "anemic" school headache. The headaches are provoked not only by mental effort, but also by overstraining the eyes, near vision, obviously in insufficiency of the internal recti

muscles, even when complete correction of the refraction error has been made. Further characteristic is *the aggravation during and especially after the period.* This holds not only for the headache but also for other symptoms. The headache of natrium mur. is predominantly in the forehead and temples, often one-sided; it is severe, beating as from a thousand small hammers, and is preceded by darkening of vision, spots and jagged flashes of fire before the eyes; every movement, even of the eyes, aggravates; in general, the eyes are markedly involved. Rest, lying down, sleep, relieves. The periodicity, especially at the time of the menses, the chronicity, the pale face with vertigo, nausea and vomiting, moreover the attacks of numbness and prickling in the lips, tongue and nose, complete the picture of *migraine.* Thereby the salt-poor diet which exerts a favorable influence of many migraines (Bircher-Benner, Gerson) should be compared. But also cases of suppression of the migrainous attacks through massive doses of salt are observed. All this means that in many migraines there is a disturbance of NaCl economy, and probably a chloride retention is present. The ocular and periodic associations indicate it best. The *asthenopia* with feeling of weakness and stiffness of the eyes leads, in prolonged close work, to swimming of the letters on reading and to vertigo and headache. Frequent are the so-called ciliary neuralgias. The *menses* are *irregular, often delayed.* Feeling of weakness is present in all extremities, but the sacral and lumbar regions are especially painful with *a desire for firm support, for pressure against a pillow.* A marked downward pressure of the uterus occasions the patient to sit down.

CIRCULATION AND FEVER

The circulatory disturbances are those similar to anemia. With coldness of the lower extremities go rushes of blood and severe pulsation to the head and chest. *Cardiac palpitation* shakes the entire body, *worse on lying on the left side;* every movement accelerates the circulation, and the general pulsation expresses itself in the head in the hammering headache; fresh air relieves. The vasomotor disturbances may increase to *fluttering of the heart with attacks of faintness* and intermittent irregular pulse; "*every third beat is absent.*" The vascular excitation in the sense of a sympathetic status gives the first indication for its utility in Basedow's disease whereby one thinks of the chlorine component. To this vasomotor syndrome, to which may be added sweating of the hands—loss of power, emaciation and disturbances of blood supply lie at the basis. Fever with a tendency to periodicity also appears in the picture. In old cases of malaria, overtreated with quinine, particularly in the English homeopathic school, natrium muriaticum is recommended apparently on the basis of old folk use. There it should not only be given in the massive ordinary doses, but for a persistent action the higher potencies have proven better. For the fever, the beginning with the increasing chill starts about 10 in the morning; the thirst increases with the fever and the headache increases to bursting, and then improvement with the outbreak of sweating is reported.

METABOLISM

The chronic acceleration of metabolism through natrium mur. is expressed in the *emaciation. Yet the*

appetite is good. With this a further association with Basedow's disease is given. With natrium mur. appear many disturbances of gastric digestion, uneasiness before eating, feeling of fulness, acid burning with cardiac palpitation, sweating on eating. For the gastric digestion it is to be observed that it is also possible for the NaCl influence to act upon the cells preparing HCl, either in a curative or disturbing manner. Special aversions in natrium mur. are against *bread and particularly rye bread*, further against fat; *longing for salt, and great thirst.*

SKIN AND MUCOUS MEMBRANES

Emaciation and disturbances in the circulation determine the appearance of the natrium mur. patients. The complexion is pale, yellow, or an earthy gray. The skin is not well supplied with blood, only slightly elastic, usually not a waxy, puffy pallor, but a gray, dry, withering. The dryness prevails, as we note also in the mucous membranes in which the imbalance in the secretory relationships are also characteristic. The facies may also appear greasy and shiny because the sebaceous secretions are also altered. The defective blood supply causes a tendency to all kinds of impurities, eczema, especially of the seborrhoic type, vesicles and acne particularly in *the folds of the skin* (elbows, behind the ears) and *sites* of transition, particularly at the *border of the hair.* The tendency to acne may be ascribed to the chlorine fraction and recalls bromine and iodine.

The one mucous membrane suffers from dryness and the other from acrid secretions. The lips and mouth are dry even to wrinkling; the tongue has island-like

patches (geographic tongue); particularly dry is the rectum; thereby, the characteristic *constipation with hard*, dry, crumbly stools which are difficult to evacuate, and which eventually irritate the anus and provoke sticking and burning. The degree of constipation is said to go hand in hand with the psychic depressive symptoms. Acrid, copious, watery secretion is noted in the eyes and nose. Here to be recalled is the fact that the lachrymal secretion is an especially high chlorine-containing secretion. The coryza easily leads to persistent loss of smell and taste. Cough is accompanied by flow of nasal secretion and severe flow of tears, many times also with voiding of urine, and is always worse on lying down. In the catarrhs of the upper air passages one recalls the sodium chloride water as of Ems, in which a liquefaction of the slimy secretion is said to occur. Also an acrid, watery leukorrhea occurs in natrium mur.

Many complaints, especially the constipation, are said to be aggravated by a sojourn at the seashore.

Type, general symptoms, and modalities are of determining significance for the selection of natrium mur., the organ relationships being of subordinate significance.

SUMMARY

Type:

Mostly females, emaciation in spite of a good appetite, pale gray cachectic appearance, dry skin and mucous membranes, chilly but intolerant to the sun's heat, physically and mentally exhausted. Tendency to migraine, basedowism; periodicity, aggravation during and after the irregular menses. Mental symptoms: irritable depression.

Chief Trends:

Emaciation, sympathetic excitation, Basedow.

Periodic fever, migraine, ciliary neuralgia.

Circulatory disturbances: pulsations, pounding, fluttering, intermittence of heart.

Skin eruptions, especially seborrhoic.

Disturbances of secretions of mucous membranes; dry constipation, acrid secretion of the nose and eye.

Modalities:

Chief time of aggravation 10 to 11 A.M.

Worse from sun's heat.

Worse before the menses.

Worse at the sea.

Head symptoms worse from mental effort and close work.

Depression aggravated by consolation.

Aversion to bread.

Sacral pain better through pressure.

DOSE

The dose is usually with the high potencies (15, 30). Even in the drug provings on the healthy, the high potencies have yielded considerable symptoms. In the constipation the lower potencies (3–4) have been found effective.

KALIUM MURIATICUM

Kalium muriaticum, KCl, is not proven. Its use arises merely from the theoretic conceptions and clinical reports of Schüssler. Schüssler places it into connection with fibrin. Fibrinous exudates from mucous membranes and serous surfaces are therefore its leading indications.

The *gray-white coating at the base of the tongue*

is said to be an indication in inflammations which exist primarily in the nasopharynx. It is entirely possible that the halogen fraction of this preparation is responsible for the especial affinity for the throat.

But it is also generally an inflammation in the stage of exudation which is taken into consideration in kali. mur. With the few remedies of Schüssler the extent of application must necessarily be very great, and consequently the indications are in generalities. The use of the D 6 in *bursitis praepatellaris* has been verified by myself.

Of the later additions by homeopathic observers there should be mentioned also the digestive disturbances from fatty, heavy foods. Here the gray-white coating of the tongue as an accompanying symptom would be easily understood.

KALIUM CHLORICUM

The potassium salt of chloric acid, acidum chloricum, $HClO_3$, is frequently confused by virtue of the defective nomenclature with the more harmless potassium chloride, our kal. muriaticum. The last, KCl, is often even today in the materia medicas designated as kali chloratum, while this is the name of chlorate of potassium, $KClO_3$. This ClO_3 anion, because of its energetic capacity for oxidation, is a strong poison, first in line for the blood. It converts hemoglobin into methemoglobin and renders it incapable of performing its task of taking up and giving off oxygen. In this process of methemoglobin formation the iron of the hemoglobin acts as a catalysor, activates the liberated oxygen so that a pure, hardly reversible oxidation of hemoglobin occurs. Thereby the divalent iron is converted into the trivalent. (Oxyhemoglobin, on the contrary, is only

a loose addition compound of O_2 with hemoglobin.) In the herbivorous the toxic action by the formation of methemoglobin is much less than in the carnivorous. This perhaps depends upon a difference in the h-ion concentration of the blood. Moreover, it is striking that, through the decrease of alkalescence of the blood, the formation of methemoglobin is accelerated. In conjunction with the formation of methemoglobin, which is a pure oxidation, there is a destruction of the red blood cells. Disturbances may appear through the formation of thrombi and emboli, especially in the kidneys.

SYMPTOMS OF INTOXICATION

From medicinal use, at times, severe toxic symptoms occur from great doses which lead to asphyxial death and, as an irreversible process, naturally give no indications. To these belong the gray-blue discoloration of the skin and mucous membranes, asphyxia with burning and pressure in the chest, vomiting of bilious masses, meteorism, hiccough, swelling of the liver and spleen and, as a consequence of blood destruction, hemoglobinuria and methemoglobinuria, anuria and uremic coma. Disturbances of general sensation as fatigue, apathy, headache, vertigo, insomnia, restlessness, changing sensation of heat and cold with recognizable fever, small, rapid pulse, accompany acute and subacute intoxications. The symptoms of destruction of the red blood cells, as icterus and hemoglobinuria, are indeed mentioned in homeopathic materia medica as indications for hemolytic and septic processes but deserve little confidence so long as no clinical confirmation is available. To the subacute intoxications as well as to those from persistent use of gargles belong: *mucohem-*

orrhagic diarrhea with much tenesmus and meteorism. They have given occasion for employment in dysentery and intestinal affections similar to it in occasional cases.

THERAPEUTIC USES

For a prolonged action of kal. chloricum, two principal directions come into consideration, *the kidneys and the mouth.* The urine and saliva are the two principal sites of excretion for the poison. In the urine part of the kal. chloric. appears reduced to KCl. One knows that the toxic action of kali chloric. is provoked much easier on the damaged kidney. In acute *parenchymatous nephritis* with many casts and much protein, kalium chloric. in the 1–3 potency is recommended by the Americans, as R. Haehl[128] reports. Outside of the urinary symptoms, one must take consideration of the above-mentioned general disturbances of the remedy, particularly the *congestive headache in the forehead and temples and the severe vertigo.* Frequent nosebleed is explainable from the action on the blood and is a further indication. The *nose bleed should alleviate* the above-mentioned head symptoms and the irritable hypochondriacal disposition. Also in chronic parenchymatous nephritis in which the choice of the remedy is very difficult due to the scantiness of the symptoms, I have repeatedly employed kalium chloricum in the D 6 and have gained a favorable impression. Nephritis during pregnancy is a special indication. Pains in the region of the kidney are observed in the course of intoxication, the output of urine is mostly diminished, but there is often much urinary tenesmus.

Of *the mouth symptoms* the marked salivation, great dryness of the mouth and esophagus and foetor

ex ore are cited in toxicologies. In the homeopathic provings the saliva is reported as sour, the taste altered in diverse manners, but especially *inflammatory manifestations of the entire oral mucosa up to ulceration and glandular swelling* are depicted, moreover a feeling of coldness on the tongue and in the throat. (The last is to be valued only as a local symptom since kalium chloric. solutions produce a feeling of coldness as well as a faint bitter taste.) *The easy bleeding from the inflamed gums* harmonizes with the general tendency of the remedy to hemorrhage.

On the other hand kalium chloric. solution is a favorite gargle in inflammations of the mouth and throat, and formerly, when one was not as exactly informed of its toxic actions, it was used more than today in stomatitis, angina and diphtheria, but particularly in mercurial stomatitis where it was often used for protection in mercury cures. Through an oxidizing and disinfecting action this influence was explained without further consideration. But a kalium chloricum solution does not act antiseptically and will oxidize organic substances at body temperature only when the oxygen is activated through a catalysor. Intermediate reactions of the tissue cells in any case participate in the local effect. So long as we do not know these exactly, the similarity of the inflammatory effect on the mucous membrane is to be perceived as a result of these intermediate reactions and is a useful therapeutic guide. Another explanation will be employed as the totality of the effect is revealed in its details.

If now such an oral or throat inflammation concerns a patient with parenchymatous nephritis, then the choice of kalium chloric. is emphasized.

Striking is the similarity of the chief trends of subacute kalium chloric. action with that of mercury: mouth and throat, kidney, intestinal mucosa. And further, the type of inflammation is similar in respect to many symptoms in the two remedies. There is also similarity in the skin manifestations, since kalium chloric. (outside of skin bleeding) can also provoke a papular erythema.

From this similarity in external manifestations, in which an antagonism in cell chemistry may be present, is guided the use of kalium chloric, *in mercury poisoning.*

The choice of kal. chloric can occur at the present time from the organ affinities and objective symptoms as might be expected in an agent which has early toxic actions. Guiding symptoms for the remedy are not as yet known, and of the modalities the improvement by nose bleed deserves only partial confidence.

A drug proving of kalium chloricum is found in Martin's work: *Arch. f. homöopathische Heilkunst,* Bd. 16, p. 181.

SUMMARY

Chief Indications:

Parenchymatous nephritis with congestion of head which is relieved by nose bleed. Stomatitis. Dysentery-like stools. Mercury poisoning.

ACIDUM MURIATICUM

The acute actions of HCl gas are entirely like those of chlorine gas. We designate as acidum muriaticum, HCl, hydrochloric acid, a solution of HCl. Pure acid contains 25 per cent HCl; acid. hydrochloric dilutum, one-half as much.

Even before Hahnemann, acidum muriaticum was

valued in putrid fevers as he reported in his apothecaries' lexicon from pre-homeopathic times.

For the chief homeopathic employment of acidum muriat. in adynamic fevers, the provings from the Hahnemannian circle[129] give some support. Moreover, H. Schulz[130] mentions a self-investigation of Bobrik in which a similar action appeared in the vascular system.

Characteristic for the acidum muriat. *fever* is the *extraordinary* weakness, especially in the legs; the patient slides down in bed, sleeps while sitting up, the lower jaw falls, the tongue is dry, heavy, trembles and is shriveled. Stools and urine pass involuntarily, or the emptying of the bladder is difficult; thirst exists during the chill more than in the fever; the patient tosses here and there in bed; the pulse is rapid and weak, every third beat intermits (as in natr. mur.); the extremities are cold; chilliness prevails and the patient is stupefied. Such is the picture in typhoid and malignant, septic, infectious diseases which holds as indications for acid. mur. Naturally not observed in this degree in the provings are weakening of the pulse, increased rate, heightened tension, intermittence, attacks of palpitation, many other vasomotor disturbances, febrile chilliness and heat, "dead" fingers and blue nails. But in severe intoxications appear similar states of prostration. Perhaps one can bring this into connection with a rapid decrease of alkali reserve.

Similarly as with potassium chlorate, acidum mur. causes inflammatory manifestations in the mouth and throat. The halogen affinity for the throat also comes into evidence here; still the use in diphtheria and similar diseases is rare. Aphthous mouth affections and severe inflammation of the throat with a tendency to bleeding in conjunction with adynamic fevers of an in-

fectious septic type can assist in the selection of acidum muriat.

The physiologic task of hydrochloric acid in the gastric digestion permits one to suspect that the long-continued use can also provoke disturbances of digestion. There develop aversion to eating, especially for fleshy foods, desire for stimulating foods; the taste is disgusting, foul; gas and fluids are eructated; there is an empty sensation in the gastric region and particularly in the esophageal region which is not improved by eating; in the intestine there is colic from gases which at times alternates with an involuntarily discharged diarrhea. The stool passes involuntarily during the attempt to urinate. Hemorrhoids are inflamed a blue-red, they burn and are very sensitive to touch. Warm applications are said to relieve; cold, to aggravate.

Ulcers on the skin and mucous membranes show slight tendency to heal; their surroundings are painful, the secretion foul and decomposed. Decubital ulcers are an example of this type.

Acidum mur. is little used, and then best when inflamed hemorrhoids are present. In severe forms of disease, for which the remedy should be adapted, a convincing performance of the remedy is not as yet known.

DOSE

It is usually recommended in the lower potencies.

FLUORINE

Pharmacologically, we have nothing to do with the action of the elementary fluorine molecule. The chemical preparation of the element is very difficult since it combines with nearly every substance with which it comes in contact but especially with water, forming hydrofluoric acid, HF. For actions on the organism only compounds of fluorine come under consideration, for the most part, acidum fluoricum, furthermore calcium fluoricum, CaF_2, and at times sodium silicofluoride, Na_2SiF_6.

The elementary relationship with the remaining halogens, chlorine, bromine, and iodine, we find of significance only because the actions of fluorine can be observed less than with chlorine and bromine in the form of a gas. We are able to see modified effects only because of the very firm combination to acid or salt. Prevailing for the effect picture is the molecular-chemical relations of fluorine compounds to constituents of the organism.

There are two viewpoints to be stressed:

(1) The calcium compound of fluorine possesses in contrast to the calcium compounds of the remaining halogens an exceptional position, for it is insoluble in water. There is also an easy but final precipitation of calcium by fluorine and a deposition of CaF_2 whereby under the usual conditions the calcium cannot be reactivated again. This connection to calcium is signifi-

cant through the normal appearance of fluorine in large amounts where calcium is also deposited, as in the teeth and bones. If it happens that the fluorides in the organism are made active, then thereby the physiologic paths of calcium, particularly its places of deposit, will be involved as a point of contact.

(2) Active fluorine in the form of fluoric acid, HF, has an extraordinary capacity for destroying silicates. This is due to the fact that the fluorine is charged negatively to such an extent that even hydrogen is withdrawn from firm compounds. Use of the destruction of silicates through fluorine is made technically in glass etching. It is the sole halogen hydrogen compound which also attacks the generally indifferent silicic acid compounds: $SiO_2 + 4\ HF = SiF_4 + 2\ H_2O$. Thereby is the possibility given for the mobilization of silicium in the organism through fluorine. This would show us the way to the first understanding of the extremely striking similarity of acidum fluoricum and calc. fluoricum with that of silicea. If the indicated silicea fails in its action, perhaps, because of overdosage, then according to homeopathic experience the fluorine compounds render good service; one knows this type of therapeutic relationship in which two similar agents follow each other well, in homeopathy as a *complementary relation.* But only extremely rarely are the numerous complementary drug relations chemically so well established as in this case. One can consider that a deadlocked silicic acid metabolism is again mobilized or activated through fluorine if it is only converted at the place from the usual SiO_2 into SiF_4.

This exceptional position of fluorine in the halogen series is very important for the medicinal trend of effect, as can be perceived in the chemical connections

to calcium and silicium, and, in any case, is associated with the fact that fluorine has the lowest ordinal number in the halogen series. Also in the other affinity series, at times, the element with the lowest atomic weight, whose valence electrons are believed to be on the first eight ring, comes to have a special position, as for example, magnesium in contrast to calcium, strontium and barium; and again lithium in contrast to sodium and potassium; or oxygen in contrast to sulphur, selenium, tellurium; or nitrogen in contrast to phosphorus, arsenic and antimony. On this also depends the greater tendency to complex molecular compounds.

APPEARANCE AND PHYSIOLOGIC RÔLE

A very widespread, even though slight, content in fluorine goes through the entire organic and inorganic nature. It can be found in soils and water, in plants and animals. Geologically, it belongs to the lithosphere, especially as the calcium compound, CaF_2, fluor spar, and as the complex sodium-aluminum compound, cryolith. It is hard to say what rôle fluorine plays in inorganic nature and in the plants. In any case it enters the animal body by means of plants. Naturally, in the newborn, small amounts are found in various tissues and this permits one to conclude the significance of a certain physiologic rôle for the element. The bones and teeth are richest in fluorine, and in the latter, more in the enamel than in the dentine, in the second line one finds it participating in the skin, hair, and nails and finally also the blood, muscles and brain. Again, in the results of the elementary analysis of the organism we find the first indication of the working direction of the substance. Naturally, we cannot conclude without further examination from the "appear-

ance in" that there is a physiologic "effectiveness on," but still there is a certain amount of probability. But in any case it is very striking how much the supportive substance is favored. In feeding animals sodium fluoride, NaF, it is the bones and teeth which show many times the normal amount of fluorine.[131] So it is also understandable that the fluorine content in man is found increased with older ages. The content in active fluorine need not be much greater and an increased deposition as complex calcium compounds in the tissues is to be considered. This presumes an inactivated deposited calcium salt; but it is not probable that with this the physiologic rôle is exhausted. To calcium comes the great significance of rendering harmless the extremely poisonous active fluorine ion and in this process a good part of active fluorine action may well rest upon a sudden withdrawal of active calcium ions. Recently an influence of fluorine on muscle function has been demonstrated. It promotes the esterfication of phosphoric acid with carbohydrates in muscle by the depression of lactic acid formation.

HABITUATION

A noteworthy peculiarity is the habituation to fluorides. It has been demonstrated even for the lowest forms of life, for example, yeasts. One has employed this fact in order to make yeasts insensitive to fluorides and then to add disinfecting fluoride compounds and so render the yeasts free from other germs. According to H. Schulz,[132] however, an habituation to fluorine effects also appears in man. It is noted in workers in glass factories in which fluoric acid is used. H. Schulz experimentally confirmed this with cats. From the experience in glass factories, fluorides have been recom-

mended in beginning tuberculosis but without more than a symptomatic improvement being noted. Here one must think of the significance of calcium and silicia for the healing of tuberculosis.

SYMPTOMS OF INTOXICATION

The local and acute toxic actions of fluoric acid and the fluorides have—as usual—only a subordinate significance for our drug picture. Corrosions with fluoric acid on the skin give, in a slight degree, itching, burning, desquamation of the epidermis; in stronger grades, suppuration, vesicles filled with pus, indurated and slowly scarring ulcers. Two per cent sodium fluoride solution instilled into the conjunctival sac produces turbidity of the cornea, according to Tappeiner, and, under certain conditions, scar formation. A corrosion of the upper part of the mucous membrane of the gastro-intestinal canal is the result of concentrated acidum fluoricum, but it may also develop with fluorides where an acid reaction exists, whereby fluoric acid is formed as in the stomach, and corrodes the mucous membrane. In fatal intoxication, the outstanding autopsy finding is the gastric corrosion. Burning and constriction of the esophagus, gastric pressure, eructations, vomiting and general weakness are the external evidences of this intoxication. Outside of vomiting, in studies with sodium fluoride in man[133] and animals, marked salivation is noted, and nausea and headache in man when sodium fluoride has been used as a food preservative. In animal experiment, moreover, appear lachrymation and particularly all types of cramps (muscle trembling, periodic twitching, tonic contractions, trismus, general spasms), somnolence, general weakness, acceleration and deepening of the respiration, lowering

of blood pressure, slowing of the pulse. Tappeiner[134] and Hugo Schulz,[135] report also a nephritis from fluorides; and Siegfried,[136] a focal fatty degeneration of the liver from sodium silico-fluoride.

More essential for us are the actions which have been demonstrated by small doses of fluorides continuously introduced. Since, earlier, when foods were preserved with sodium fluoride, nausea and headache and salivation had been observed, Rost studied this question by animal experimentation[137] (according to the *Handbuch der experimentellen Pharmak.*, Bd. III, p. 287): "In growing dogs an 8–12 weeks introduction of 0.2–0.5 g. of sodium fluoride daily produces in spite of a diet liberal in calcium a ricketic-like process limited almost exclusively to the distal ends of the bones of the forearm and carpal joint, stiffness of the joint, and painfulness when the animal rises. In animals, fed in the same way but without the addition of sodium fluoride, the remainder of the litter remains healthy. The findings were the same in seven series of studies. In another but still unpublished study the author gave growing, meat-fed dogs, after the eighth week of life, gradually increasing amounts of sodium fluoride up to 0.5 g. per day. In the bones and teeth of these animals were noted severe osteoplastic and osteoporotic alterations. At the site of attachment of muscle normally used frequently (as the carpal joint and the skull) thickenings developed in the form of crests or exostosis which finally became distinctly visible in the form of knobs. The teeth were carious and fragile; there were severe disturbances of the jaw. These bony and dental alterations, together with the already mentioned painfulness of the carpal joints on arising, were never absent in animals treated with sodium fluoride." Here we see

the anatomic substrate of chronic fluoride intoxication exactly on those structures which are normally rich in fluorine, and, on the other side, we find good basis therein for the connections to bony formations which develop in the homeopathic picture of action. Not only the connection of fluorine to calcium but also that to silicic acid can be of significance for it. In older animals treated with sodium fluoride, the deposit of white calcium fluoride was distinctly visible.

Worthy of remark still is that formerly an attempt was made to relate fluorine to goiter, but definite results have not been obtained. The halogen nature in any case would give occasion for the attempt. Also, in homeopathy, calcium fluoride is occasionally recommended for struma cystica and it seems to me according to personal experience to have a good influence from persistent use in such cases. The simultaneous connection to the supportive tissues, perhaps via the silicic acid, might be of significance here.

ACIDUM FLUORICUM

Acidum fluoricum was proven by Hering and his circle of provers in Philadelphia (*Neues Archiv. für Hom. Heilk.*, vol. 2, p. 100, and *Trans. Amer. Institute of Homeopathy*, 1).

From clinical use it has been shown that acidum fluoricum has a slowed but deep, prolonged action. The *supportive tissue* is the favored site.

SUPPORTIVE TISSUES

The outstanding affinity to the *bones* appeared in the provings with the 2nd and 3rd potencies with many cutting pains which proceeded from the bones. The animal experiments of Rost confirm this chief action.

Inflammatory bone processes, caries and necrosis, even of syphilitic origin (here one thinks of iodine) are old homeopathic clinical indications, especially when the long bones are involved: but also caries of the middle ear. Moreover, expansion at the glabella belongs here. These indications, extended to exostosis, were taken over by Schüssler in a fitting way for his biochemic agent, calcarea fluorica, as in general this agent is given the same actions by him which we otherwise learn under acidum fluoricum. In agreement with the physiologic appearance, many dental pains in the provings have indicated the use in caries of the teeth. With acidum fluoricum, the discharges of the bone maladies are said to be offensive and acrid. Particularly in fistula, for example, dental fistula, fistula of the lower jaw, and also lachrymal and anal fistula, which naturally do not always proceed from bony involvement, the drug is indicated. Here there exists a close relationship to silicea. It is that acidum fluoricum follows silicea very well when silicea has been given for a long time, perhaps excessively, and has exhausted its action. The differentiating fact is that *silicea is relieved by warmth and fluoric acid by cold.* A trial with fluoric acid is also recommended in chronic arthritis and in defective formation of callus.

A further trend in the same direction as silicea appears to be evident *in scar tissue, the skin, and its appendages.* In the provings old scars begin to itch and become inflamed. Bunions become painful. Marked burning and itching occur in the skin, soreness between the toes (from sweat?). Skin affections, ulcers, heal poorly. The hair mats, falls out; the new hair is dry and breaks off. The nails seem to grow rapidly but show unevenness, furrows; they splinter. The similar-

ity with silicea is distinct. C. Hering describes in detail the appearance of teleangiectasia in his proving of fluoric acid, and the recommendation of the agent in teleangiectasis and naevi deserves great consideration.

This leads to the proven indication in *varices and varicose ulcers*. Here one might conceive of a connection to the elastic supportive substance. The varicose ulcers on the lower leg are said to have a hard glassy border and to be covered with a hard crust; here also there is offensive, acrid, thin secretion. With the weakness of supportive tissue is associated the tendency to prolapse of the rectum and hemorrhoids (in the provings the previously present tendency to prolapse was increased). Also for venectasia the relief from cold should be an indication.

Purely clinical is the use of acidum fluoricum in cirrhosis of the liver with ascites in drinkers. Since here the new formation of connective tissue is secondary, the affinity to the connective tissue cannot be drawn into explanation, but much better can be considered the finding of Siegfried, in which a focal fatty degeneration of the liver with sodium fluoride was demonstrated.

GENERAL ERETHISM

Besides the affinity to the supportive tissues, which we can consider as a crude chemical organ or tissue relation, acidum fluoricum seems according to the provings to have a more dynamic action, that is, an action directed more by regulatory centers, and this field of action to some extent is similar to the picture of iodine effect, so that one may well consider the fluorine ion as responsible. This consists at first of a heated general state, a feeling "as though warm vapor exuded from

the pores" but without fever being present. This febrile sensation is worse towards evening. *Improvement through baths and washing with cold water with desire for them is the corresponding modality.* The marked itching is worse from warmth. The numerous headaches constitute, so far as they are not conditioned by bone pains, the chief signs of increased rush of blood. They are said to be worse as long as urinary urging is absent. Urination should not only induce an amelioration of the headaches but also an improvement in the general feeling. The profuse, acid, offensive sweats also belong to this picture of vascular erethism which is like that of iodine, moreover, a restlessness which makes considerable movement necessary. *Increased muscle activity with exhaustion,* involuntary movements of the musculature of the extremities; "twitching and jerking in the various parts," it states in the provings. In the excitation of the muscles without exhaustion appearing, one should recall the previously mentioned rôle of fluorine in muscle function. Psychically, the state of excitation expresses itself in unusual serenity but may be transformed into a depressive phase with ideas causing anxiety and associated with aversion and indifference towards those in the environment, a trend which is otherwise very characteristic in sepia.

In the sexual system a nervous state of excitation prevails, leading to dissolute acts (even in old people). This sexual erethism is particularly liable to be associated with degenerative processes in the central nervous system.

The total status in acidum fluoricum is said to be aggravated by stimulant agents as coffee (also tea and wine?). However, a desire for spices, herbs, should be

present and an aversion toward coffee. *The aggravation from heat* extends to the digestive processes as well: warm drinks provoke eructations, nausea, diarrhea. There is a strong desire for cold drinks. An increase of appetite up to gluttony, constant sensation of hunger, is often expressed. Here we find a further accord to iodine. Also in fluoric acid the improvement from eating temporarily relieves the feeling of emptiness as well as the heat in the abdomen and the headache. There is an emaciated, cachectic general state as well as a special adaptability for the maladies of the aged (also senile pruritus?) in acidum fluoricum. Parts go to sleep easily; a feeling of numbness and loss of power of the extremities is found in the provings.

Finally, the catarrhal symptoms of the mucous membranes of the nose and eyes as well as the salivation are to be mentioned because of the similarity to the toxic manifestations with those of iodine. Acrid lachrymation and salivation have already been mentioned as toxicologic actions of acidum fluoricum. Therapeutic indications have not as yet been reported for these symptoms. The acute toxic actions on the gastric mucous membrane are less valuable, although the gastric damage seems to be more resorptive than merely local in effect. At any rate, Siegfried observed them in cats after subacute intoxications.

SUMMARY

Chronic remedy

Complimentary to silicea but better from cold

A: Molecular-chemical and tissue affinities

Supportive Tissues.—Bones, teeth, hair, hairs. Telangiectasias. Varicosities.

B: Ionic actions of fluorine:

Vascular Erethism:

Heated state without real fever.

Better from washing and bathing in cold water.

Itching worse from warmth. Aggravation from warmth in any form, also from warm drinks. Profuse sweats.

Muscle unrest. Sexual excitation (as in beginning diseases of central nervous system).

Aggravation from stimulant agents. Headache relieved by micturition.

Psychically: at first serenity. Then depressive-anxious states with aversion and indifference to family.

Sensation of hunger. Increase of appetite but cachexia.

CALCIUM FLUORICUM

In the calcium salt of fluorine the affinity to the bones and the connective tissues (including the elastic fibers) appears to come still more one-sidedly into evidence. The provings are, however, even more defective than those of fluoric acid.

(1) Murch: *Amer. Hom. Observer*, p. 123, 1864, with the original substance without symptoms and with the D 3.

(2) Bell: *N.E. Med. Gaz.*, p. 300, 1874. Of three provers with the 15th and 30th potency.

The chief indications have been taken out of homeopathy by the Schüssler trend and in consequence the minimal so-called biochemic drug treasure has been excessively stressed there.

On the bones and on the teeth are the same carious processes with the same manifestations, for example,

fistula, as with acidum fluoricum. Also chronic arthritis with irritant body formations and ricketic deformities come into consideration. On the teeth the enamel layer is defective. The teeth are loose, and pain on contact with food.

The bony thickening, exostosis, is present in a stronger degree with calcium fluoricum, for example, even ranula. Generally there exists in this preparation a stronger tendency to new formations, especially of a fibrous type: stone-hard tumors, arising from tendons, ligaments and fascia, ganglion, hard glandular tumors as well as tonsillar enlargements, hard cystic formations (for example, of the thyroid), fibroma of the mammary gland; moreover, myoma of the uterus is reported as an indication. To these may be added recurrent hordeolum, chalazion, and cysts of the lids. Displacement and particularly prolapse of the uterus with downward pressure and tugging designate the supportive tissue weakness. Moreover, calcium fluoricum has been recommended to prevent adhesions after operations.

The connective-tissue hypertrophy stands in contrast to the loss in elasticity, particularly in the vessels, so calcium fluoricum is indicated in a series of old-age diseases in which the elastic fibers are replaced by connective tissue and infiltrations (calcium), for sclerotic processes, aneurysms. Likewise cataract and sclerosis of the middle ear with calcium deposits on the tympanum, and difficulty in hearing and ear noises are to be considered here. Varicose processes and naevi vasculosi again appear as indications as in acidum fluoricum. The ulcers are again characterized by hard borders and offensive secretions. Differing from fluoric acid are the persistent suppurations of the nail folds,

cracked eczema of the palms, and itching anal fissure; moreover, corneal ulcer with indurated borders.

As with acidum fluoricum, inflammatory mucous membrane and bony processes likewise of syphilitic origin are counted to its field of action, inflammation and ulceration in the mouth and throat, ozena with crust formation, caries of the nasal bones, strongly offensive, lumpy green or yellow nasal secretion, induration of the tongue after inflammation, *etc.* Here one will always recall the salt in reference to the leading halogen, iodine. Croup-like manifestations in the larynx with dry cough and difficult respiration may be mentioned at least as analogous to the entire group of halogens.

In contrast to acidum fluoricum the aggravation from cold, change of weather and damp weather is reported for calcium fluoricum, which, presuming that it is confirmed, may be ascribed to the calcium fraction. Besides chronic arthritic alterations of the finger joints and synovitis of the knee, one indication has special significance: chronic lumbago with aggravation at first then improvement from continued motion, also in cases where rhus tox. is commonly selected. "Diarrhea in gouty persons" is a report which is repeated only with caution. The same holds for the report of hydrops of the legs and scrotum, a report which emerges from acidum fluoricum as well as calcium fluoricum (but perhaps was confused with a venous stasis?).

From the entire field of indications emerges that calcium fluoricum is eminently a chronic remedy and that it tends to be prescribed with intervals over a long time. The results of the provings, which up to the present are scanty, have not been utilized in this picture of calcium fluoricum. According to the list of symp-

toms, a definite connection to the throat, in particular to the larynx and the epiglottis, may be expected. Manifestations from tickling in the larynx were reported by all provers, many times huskiness and cough, and further, particularly in the 3rd decimal potency, a feeling of oppression and suffocation in the throat, worse at night and from cold drinks, transiently better from warm drinks; at the discontinuance of the proving on the eighth day there was an oppression of breathing as though the epiglottis were nearly occluded. This affinity to the upper air passages is indeed so characteristic for the halogens that perhaps a greater significance is deserved for the croup-like symptoms in the drug picture of calcium fluoricum than the present subordinate place now accorded them.

NATRIUM SILICO-FLUORICUM

This double salt is not proven and has found only isolated clinical recommendation in bony affections (caries), tumors, lupus, and ethmoiditis.

DOSE

The most commonly employed potency of fluoric acid and its salts is the 6th decimal potency, still the acid is used in high potencies, the 30th, when the general symptoms determine the choice.

4. THE SULPHUR GROUP VI

In group VI of the periodic system sulphur has such central position that we can designate the group according to it, particularly since the first element of the group, oxygen, provides no medicinal substance. The transition from the non-metallic sulphur to the metallic tellurium will come into evidence in the effect picture of this substance. Selenium and tellurium appear considerably less significant than sulphur and its compounds.

SULPHUR

In the earth, sulphur, S, is the prevailing element of the chalkosphere. In this layer of the earth, which perhaps extends about 1200–2900 km. in depth, those metals are abundant which have a special affinity for sulphur. Here sulphur plays a rôle for the so-called metallogenous elements (earth builders) which has its group neighbor, oxygen, in the lithosphere for the petrogenous elements (stone builders). With the exception of the noble metals, all heavy metals occur in nature as sulphur compounds. In the earth *crust* the sulphur compounds of heavy metals are fairly strangers. However we shall find the relation of sulphur to metallic foreign substances to be of some significance. Through volcanic eruptions sulphur comes from the great depths to the surface of the earth. The life-endangering forms of this volcanic source, hydrogen

sulphide, H_2S, and sulphur dioxide, SO_2, reciprocal actions of which also lead to the deposition of free sulphur, are bound on the earth surface mostly as completely oxidized compounds, sulphates of alkalies, and particularly as earthy alkalies. In this form they are utilizable for the assimilative activity of plants. The plants reduce sulphates and build organic sulphur compounds. In the reduction from sulphates, bacteria of the soil also participate. Other bacteria and certain algae (for example *Beggiatoa*) further oxidize H_2S and deposit sulphur in their cells; they gain energy from this oxidation as other forms of life from the oxidation of carbohydrates.

For the animal organism the building activity of plants is a necessary preliminary step for their sulphur metabolism; they convert plant protein compounds for their own function. More or less completely oxidized sulphur is excreted, or after death the animal organism undergoes decomposition into H_2S. Then the circulation of sulphur can begin anew.

The chemical property of sulphur which occurs as an atom as the negative divalent (H_2S) as well as the positive six valent ($SO_3 = H_2SO_4 - H_2O$), remains decisive in the living organism. To lead the change between oxidation and reduction is the chief task of organically bound sulphur. So far the sulphur serves merely as an intermediator and its organic compound is not destroyed, so this function is a reversible catalysis. But the sulphur-containing building stone destroys itself in oxidative decomposition and indeed it seems to offer an especially good point of attack in the protein complex.

The diverse forms in which sulphur is able to appear according to its molecular structure, its modifications,

gain considerable significance for the medical use of the pure substance. In homeopathic uses these differences of modifications in general are exceeded through the extensive subdivision.

PHYSIOLOGIC SIGNIFICANCE

All proteins of cells and their higher split products (with the exception of peptones and protamines) contain sulphur. Even from this the great significance of sulphur for the organism can be measured. An important, perhaps the single, sulphur containing building stone is cystin. Cystin is dicystein, a product of the union of two cystein molecules with the liberation of H_2. (Cystein is thio-amino-propionic acid.) Between cystin and cystein we have a transformation relationship of the type:

$$\begin{array}{l} CH_2SH \\ | \\ 2\ CHNH_2 \\ | \\ COOH \end{array} = H_2 + \begin{array}{l} CH_2 \\ | \\ CHNH_2 \\ | \\ COOH \end{array} \qquad \begin{array}{l} \\ \\ -S-S- \\ \\ \\ \end{array} \qquad \begin{array}{l} CH_2 \\ | \\ CHNH_2 \\ | \\ COOH \end{array}$$

The transformation of cystein to cystin occurs in the air through oxygen, naturally with the cooperation of constantly present traces of iron.[138, 139] This simplest form of sulphur-containing building stone is determining for the function of sulphur in the protein molecule, but, through further compounds, the complex gains some new properties. So cystin or cystein forms a dipeptid with glutaminic acid—

$$= \begin{array}{l} CH\ (NH_2)\ .\ COOH \\ CH_2 \\ CH_2\ .\ COOH \end{array}$$

namely the *glutathion* discovered by Hopkins in 1920. Probably this compound is present in most cells. The

easy oxidation to cystin form and likewise the easy reduction to the cystein form also remains in this compound. In contrast to cystin, the cystein form of glutathion is soluble in the fluids of the body. This is a sign that the complex form is better adapted to the functional requirements of the organism. Glutathion has its working optimum at a pH which it presents in the environment of the cells. The limitations of an element always to complicated organic compounds signifies obviously an orientation and a balance of the elementary properties to the reaction conditions in the living system with its very great lability in contrast to the test tube.

One has found further that, in many protein bodies, cells and tissues, the cystein form is present; in others, the cystin form (demonstration[140] of the SH– group of cystein through a color reaction with sodium nitroprusside). In particular it is worthy of note for the chief action that the sulphur-rich keratin in the upper layers of the skin contains the cystin form, while the lower layers contain the cystein form. Perhaps the capacity of absorption of ultraviolet rays by cystin is significant for skin function.[141] In general the predominance of the cystein form seems the active phase; and the exclusive presence of the cystin form, more the rest phase, because, for example, the cartilage cells contain cystein—the cartilage primary tissue, cystin.

The old conception of Heffter[142] that the SH group of cystein functions as an oxygen carrier has recently received further support through the newer studies on glutathion. So the cystein form oxidized in the air to the cystin form also yields H_2. The cystin form of glutathion is again able to take hydrogen on itself (for example the SH group of muscle protein) and thereby introduce an oxidation process of protein. So the ac-

tion can consist at one time according to the substrate of an oxidation process; at another time, in the introduction of a reduction process, and indeed according to the manner of action of a ferment, which is active only under certain conditions.

The physiologic rôle of sulphur-containing protein compounds as the carrier serving for oxidation as well as reduction processes can be accomplished through the regular introduction of nutrient materials which contain sulphur in organic protein combination. How far these proteins are split in order to permit a resynthesis in the organism to cystein or the glutathion fraction of cell protein is not known as yet. It is not probable that the destruction proceeds as far as H_2S. On the other side of protein metabolism, the sulphur fraction for a great part (about three-fourths of the total sulphur metabolism) seems completely oxidized and bound as sulphate ions of alkalies or earthy alkalies, or appears in the urine again as ether-sulphuric acid. The last compound of the sulphate ion with organic split products (phenols) also serves outside of excretion for the detoxication of these products. An intermediate step in the oxidative splitting of cystin is known as taurin, which is paired with cholic acid and, as taurocholic acid in the bile, plays a rôle in the digestion of fats. In the failure of cystin destruction cystinuria appears. The taurin is not excreted through the feces but is again utilized. About one-fourth of the total sulphur appears in the urine normally as organic bound, incompletely oxidized, so-called neutral sulphur. The sulphur excretion in the sweat is merely incidental in comparison to that of the urine. However, the dry excretion of sulphur through the skin and its appendages with their great content of sulphur is of signifi-

cance. The traces of sulphur which are excreted in the saliva as the sulphocyanate (KCNS) have a significance in the detoxification of CN. Whether the traces of sulphocyanate have a certain disinfectant action in the mouth is doubtful.

A special content in sulphur is shown by keratin and probably also the pigment of the skin. Moreover the chondroitin in the cartilage is united with sulphuric acid, and likewise the synovia apparently contain more sulphur than the other mucins. It is not improbable that with this marked presence of sulphur there is a connection between the special affinity of sulphur for the joint surfaces.

A quantitative insight into sulphur metabolism and its morbid alterations is difficult to obtain. The diversity of steps of splitting and the ways of discharge and the still very imperfect numerical conceptions of the single fractions in the blood and in the tissues have permitted only general conclusions up to the present time.

So the relation of neutral, imperfectly oxidized sulphur to the total sulphur in the urine gives a measure of the oxidation of sulphur compounds in the organism. And from the relation of the so-called, paired sulphuric acids to the total sulphur in the urine a point is gained for the measuring of the appearance of toxic intermediary metabolic products (phenol, indol, skatol, *etc.*). These intermediate products are detoxified by the sulphates and probably in the liver. Practically only the estimation of indican and the qualitative diazo-reaction is used for this purpose.

It may be assumed as very probable that the chief function in the splitting and in the oxidation of sulphur compounds occurs in the chemical center of the or-

ganism, the liver. To a remarkable action of sulphur in the liver, in the formation of glycogen, we shall return later.

The adrenals are especially rich in sulphur, particularly their yellow substance. Here the sulphur is said to be present almost exclusively as neutral sulphur.[143] The adrenals are considered as the site of absorption and the regulation of sulphur metabolism.[144]

That in all acute diseases, in consequence to the increased destruction of protein, the amount of sulphur in the urine is increased is not surprising. More remarkable is it that, in chronic diseases generally, the sulphur content of the urine is diminished. One might perhaps conclude from this that there is a depression of sulphur metabolism in many chronic diseases. And it is exactly in chronic diseases that sulphur serves as a medicinal agent of the metabolism.

PHARMACOLOGIC SULPHUR ACTIONS BY H_2S

What disturbances of sulphur metabolism are possible through elementary sulphur? Since it cannot simply be concerned with the introduction of more or less sulphur, so must it be the property of elementary sulphur which permits these disturbances. On the path of sulphur in exercising its effectiveness much is known, especially through the work of Heffter.[145] In the intestine sulphur is reduced to H_2S. This occurs principally through bacteria, particularly in the large intestine, as has been long known; but it can also occur through certain protein bodies of the intestinal mucous membrane and indeed the small intestine.[146] The gastric mucous membrane does not contain this reducing protein substance. This reducing protein fragment is in all probability cystein. Between the H_2S and the cystin

develops an equilibrium of reversible reaction in which the hydrogen remains labile. The diffusion of H_2S out of the intestine into the blood occurs easily. Thereby it must be reckoned that a part of the sulphur is dissolved in the presence of H_2S to polyhydrogen sulphides so that actually a reaction mixture of H_2S, polysulphides and sulphur reaches the intestine.[147] By the injection of finely divided sulphur into the blood stream or the musculature, the same thing happens in general, because everywhere the sulphur meets cystein and becomes H_2S. In this case the disturbance of sulphur metabolism is a very stormy one. With large introductions of sulphur, the H_2S excretion through the lung and skin becomes very obvious.

In any case the pharmacologic action of sulphur is pressed to the side by hydrogen sulphide and the question is whether there is a chronic H_2S poisoning from small doses. From the acutely fatal action of an air containing a strong content of H_2S, not much can be withdrawn for our problem. It has great similarity with the action of another catalyser poison, HCN. Severe, but still not fatal, H_2S poisoning proceeds with loss of consciousness and respiratory disturbances. The milder general symptoms of chronic H_2S poisoning are headache, stupefaction and striking tendency to sleep. Such symptoms often accompany irregularity of intestinal evacuation, and it has been considered—whether rightly or wrongly—as due to actions of H_2S from absorption from the intestine. The general actions of H_2S can increase up to vertigo, states of excitation, intoxication and narcosis, and Lewin[148] has suggested that the delirium of the priestess at Delphi can be traced to H_2S vapors.

The action of larger amounts of sulphur after intro-

duction into the intestinal canal has long been known as *a mild purgative effect.*

Bokay had shown[149] that the action of larger doses of sulphur consists in an increase of peristalsis through the formation of H_2S in the intestine. Under the influence of the H_2S developing from the sulphur the passage through the proximal colon is accelerated so that the thickening which otherwise occurs here cannot occur or incompletely occurs.[150] The stimulating action on the intestine has also been proven on the surviving and isolated intestine of animals. Van Leersum[151] found that H_2S stimulates surviving guinea-pig intestine in Tyrode's solution in a concentration of 1:4,000,000 = 4^{-6}. Gordonoff and Hashimoto[152] studied the action of H_2S-containing water on the isolated rabbit intestine according to the method of Magnus. They found in weak concentrations, for example 1:500,000, 1:1 million but also 1:10 million, an increase of the tonus and the pendulum movements (to decide by the curves with the weakest concentration of 10^{-7} the strongest action). Larger concentrations (1:200) effect a paralysis which is reversible; that is, the transference to Ringer's solution causes it to diminish. (The paralysing and stimulating action can here and there be observed from the same concentration which may be attributed to inexactitude of dose through varying solubility of hydrogen sulphide.)

Moreover the studies which Gordonoff[153] carried out with Umehara on the isolated frog heart do not speak for a different behavior of the heart to hydrogen sulphide. The reduction of the stroke height is observed under large doses (H_2S water 1:10, Na_2S 1:250 and 1:100); weak concentrations, however, apparently have not been tested.

The purgative action is perceived as the first crude regulatory measure against the penetration of massive H_2S in the organism. Thereby it becomes clear that, in such doses generally, action on the intermediary metabolism in the intestine need not become evident. If, however, the H_2S formation in the intestine remains below the threshold of stimulation of peristalsis, then certainly a definite resorption of the (H_2S-polysul-

phide, sulphur) mixture appears. But there are further regulatory trends available so that it need not amount to distinct disturbances in sulphur metabolism, because H_2S is never completely absent from the intestinal canal. *Still there is a chronic action of small doses of sulphur*, likewise after oral administration. This experience of the homeopathic school has been confirmed now through the many studies since those of H. Schulz.[154, 155] They could have been confirmed through the unprejudiced evaluation of experiences with sulphur water cures. In any case the presumption for a characteristic disturbance of physiologic equilibrium through small doses of sulphur has been *a long continued study*. And indeed they have been overlooked by pharmacologists until H. Schulz. We cannot say even today by what experimental arrangement the first regulatory trends are circumvented so that there appear distinct signs and symptoms of disturbance in the intermediary regulatory processes. It is conceivable that the resistance of the periphery is gradually exhausted through the constant repetition of the attack with the very active, diffusible substance in the H_2S form. It is probable that another *site* of resorption, perhaps the oral mucosa, must be involved in order to attain this result. A fine division of the sulphur is another indispensable presumption.

RESULTS OF TRIALS WITH CHRONIC USE OF SULPHUR

The physiologic function of organic cell sulphur to intermediate oxidations and reductions permits one to expect that the actions of sulphur introduced in a suitable form will become obvious in oxidative metabolism. The results of experimental investigations have confirmed this. The trial by Riesser, Simonson and Rich-

ter[156] upon themselves with use of modern methods of investigation of metabolism have made possible for the first time a numerical conception of the effects. The subjective symptom picture in these four series of studies with a saturated alcoholic solution of sulphur (0.035%, tinctura sulphuris or, according to another designation, the fourth decimal dilution of the homeopathic pharmacopoeia) is naturally scanty in contrast to that known from homeopathic provings. But it confirms an essential series of symptoms of earlier provers. Thereby it is especially worthy of remark that one investigator (O. R.) in a second study with two to three times as great dose reported that there were no alterations of sensation and likewise that the objectively observed alterations were slighter than he had observed in the first study. Accordingly, one may conjecture that the dose in all these investigations, in spite of the smallness, still moved around the upper limits suitable for such a purpose. Otherwise the study corresponds in general with those common to homeopathy with pre- and post-observation with several weeks' duration of the introduction of the drug.

With the Zuntz-Geppert method the measured value of the oxygen intake and carbon dioxide excretion gives naturally only a resultant of the total energy transformation. The most distinct result of the study was an *increase of respiratory ventilation*, at rest as well as with definite work during the sulphur ingestion period. The increase of ventilation was distinct only after about two weeks and was greater in the third and fourth weeks (that is under about 1–3 mg.) and in the fifth week even under greater doses of sulphur (about 5 mg.) it was less. In two people respiration was irregular, in the third the respiratory frequency increased

to about double. At the same time as the ventilation increased, there was a slight tendency to increase of the basal metabolism, but this was distinct only with each increase in the dose of sulphur; if the daily dose remained the same then the basal metabolism fell, and moreover it was lowered during the period of after-effect. Further, the capacity for restitution (that is, the duration of increase after an exactly measured piece of bodily work, for which a numerical result was obtained), was determined at the height of the sulphur action. *The capacity for restitution was depressed in all trials.* Furthermore, from the estimation of the so-called ventilation quotient (that is, the ratio of the ventilation volume in cc. to the transformed calories) in rest and work under sulphur action, *an excitation and at the same time an increase in irritability of the respiratory center was disclosed.* Since the absolute height of ventilation in work under sulphur influence was increased in comparison to normal and thereby was bound to an increased supply of oxygen, and though, nevertheless, the restitution was delayed, so must *a depression of oxidation* be assumed. The authors did not decide whether the excitation of the respiratory center and the increase of ventilation conditioned through this by sulphur depended on a direct action of H_2S on the respiratory center, or whether the metabolic products entered the blood in consequence to oxygen depression and acted toxically on the respiratory center, or whether the metabolic products increased the H-ion concentration of the blood and thereby also the environment of the respiratory center. They held it as probable that it was composed of an increase in metabolic end-product action and the direction action of H_2S.

As it tends to happen in exact experimental investigations, there are also findings which prove the opposite. In the Berne Pharmacologic Institute, Siegfried[157] has arranged similar metabolic studies on himself under the influence of sulphur. However the size of the ventilation was not measured. Since he worked with another apparatus, a comparison of the results is also impossible. Siegfried summarizes his results of investigation as follows: The amount of excreted CO_2 and of the oxygen taken in was not influenced in a distinct way with doses of 1–3 mg. of sulphur per day. With greater doses (4–6 mg. daily) a distinct decrease occurred. The respiratory quotient sank with doses of 1 mg. After the discontinuance of sulphur it rapidly rose again. The influence on general sensation and on the respiration was not observed. These later investigations, which apparently should contradict those of Simonson and Richter, cannot be compared with them without further discussion, and in any case do not signify a contradiction. First the introduction of sulphur lasted only fourteen days in Siegfried's studies. That in this time no influence of the general sensation and the respiration was observed agrees in general with the report of Simonson and Richter; likewise, that in the first ten days no distinct influence on CO_2 excretion and oxygen intake in accordance with the basal metabolism was observed. In Siegfried's study, even after ten days with an increase of the dose to 4–6 mg., a decrease of CO_2 excretion and oxygen intake appeared, and the basal metabolism fell. But this does not entirely contradict the reports of the previous workers who demonstrated with higher doses (indeed by them 5 mg. was the highest dose given!) that there was a fall in the basal metabolism. Furthermore Siegfried states that from the start the respiratory quotient, also the ratio CO_2:O_2 fell under the use of sulphur and remained low. On the contrary, the earlier workers had found in general no essential influence on the respiratory quotient. The deviations of Siegfried are without further discussion understandable from the concentration of larger doses of sulphur (he began also with 1 mg., that is, about three times the dose of the earlier workers) to a shorter period of study (two weeks).

It hardly signified a contradiction, much more, a partial confirmation, when Gordonoff and Misushina[158] obtained a lessen-

ing of the basal metabolism in rabbits with sulphur spring water. If the rabbits had taken only 100 g. of Schinznacher Spring in a day, then this would be 8 mg., or a dose many times as large as the one employed in man. The question, whether the definitely determined phase of sulphur influence which consists in a decrease in the basal metabolism and a depression of oxidation can be preceded by a short phase of metabolic increase under other conditions, is not decided through these experiments.

Nothing is stated against the correctness of the many homeopathic provers, of H. Schulz and his co-workers; nor against the subjective symptoms, confirmed by Riesser, Simonson and Richter, wherein Gordonoff (*loc. cit.*) observed no sulphur symptoms with single provers. Indeed it is not to be doubted that, even with the correct arrangement of the proving, there are people not sensitive to sulphur. What interests us, however, are the persons who are *sensitive* to sulphur and the symptoms with which they react to sulphur, because we would not employ sulphur in everyone but only in persons who are especially sensitive to it. And these persons should indicate through their symptoms in the instance of disease that they are sensitive to the sulphur trend. *This also differentiates the homeopathic drug study from the experiments of the pharmacologic school, the one being directed from the start at the individual, the other at the general; the homeopathic provings can satisfy themselves with the qualitative correctness of the details observed while the exactitude of school pharmacology must seek in the numerical conception of general reactions common to man, and must work largely with animals.*

ACTION ON SUGAR METABOLISM

Bürgi[159] and Gordonoff[160] have demonstrated a further important trend of sulphur influence on the inter-

mediary metabolic process; they found histologically and chemically in rabbits and rats, after prolonged administration of sulphur spring water, an enrichment of glycogen in the liver. Moreover the blood sugar level fell under the influence of sulphur and increased again after the discontinuance of sulphur. By intramuscular injection of small doses of colloidal sulphur, the same appeared. Of interest is the dose by which the hypoglycemic effect was still demonstrated (Wüthrich[161]): by mouth 1 mg., intravenously 1/100,000 mg., subcutaneously, 1/1000 mg. per kilogram body weight. Larger doses did not increase this hypoglycemic action but lessened it or even reversed it. These hypoglycemic doses of sulphur were not surpassed in smallness by the purified insulin preparation according to Abel and Geiling.[162] Since this preparation is concerned with a crystalline protein body which contains sulphur in a form easily split off, so the conception is naturally very close that the action of insulin goes parallel to its content of easily split-off sulphur. The sulphur would then have the same relation to insulin that iodine has to thyroxin. However, this conception is not as yet certain.

The hypoglycemic action of sulphur has been confirmed by various workers[163, 164] and also for healthy and diabetic patients, but is still denied by others.[165] A sulphur therapy in diabetes has not, however, become adopted. The reason for this lies in that the hypoglycemic action of sulphur is even more transient than that of insulin. The following report of Gordonoff[166] also refers to this: "The hypoglycemic action (of sulphur) with the serum of the animal which is found at the height of hypoglycemia will also be transferred to another animal. Thereby the blood sugar lowering value of this serum seems to be stronger than that of

the corresponding amount of sulphur." It seems also that definite organic compounds are here better linked to inorganic substances and better adapted for biochemic processes so that a more persistent action is obtained.

FURTHER METABOLIC STUDIES

From another side, Meyer-Bisch and Kühn[167] have attempted to explain the action of sulphur on the oxidative metabolism. They investigated the ratio of carbon to nitrogen, the quotient, C:N, in the urine, before and after injection of sulphur.

The quotient, C:N, in the urine has been discussed particularly by Bickel and his students[168] and utilized in metabolic investigations. In regard to the C in the urine, it is concerned with the dysoxidizable C. If the alteration of the quotient, C:N, is not conditioned through a one-sided N– increase or decrease, so must it be founded chiefly on the oxidation and transformation of non-nitrogen-containing carbon compounds (carbohydrates and fats). The C increases when defectively oxidized products of carbohydrate and fat metabolism appear in the urine. Whether the amounts of C with the nitrogen-containing end products deviate from the normal is also dependent upon the intensity of oxidation in protein molecules. Incomplete oxidation will also here increase the fraction of dysoxidizable C in relation to the nitrogen. Therefore an increase of the quotient C:N in the urine has to be considered as a rule, as the result of depression of oxidation, so far as a one-sided nitrogen-poor diet or marked nitrogen retention in growth does not shift the relation in favor of C. A pathologic metabolic status in which (in consequence of a reduction of oxidation) there comes an absolute or relative increase to the nitrogen in the urine excretion is characterized by Bickel as dysoxidizable carbonuria.

An increase of the quotient, C:N, in the urine is believed by Meyer-Bisch to be characteristic for diseases like arthritis chronica and bronchial asthma. With it,

a numerically conceived deviation from the normal metabolic status, like the dysoxidizable carbonuria, would be gained for these diseases from the domain of arthritism, a characteristic of oxidation depression and its grade in these metabolic disturbances.

As the effect of a parenteral injection of sulphur of 0.003 g., Meyer-Bisch saw a marked decrease of the quotient, C:N, in the urine. This would signify an *increase* of oxidative processes. This action is possessed by sulphur in the healthy as well as patients with chronic arthritis. But if one studies the numbers exactly, then it is observed that the action is only very transient. One can conclude from this that the selected type and the dose of sulphur administered rapidly may induce an increase of oxidation, but that this is of too short duration to accomplish a prolonged healing effect. If the ratio, C:N, in the urine proves itself as a reliable criterion for the metabolic disturbance in arthritism, so for a decision on sulphur action according to this criterion one will need first a great series of investigations with various doses and particularly with long-continued administration in the healthy and the sick. It would be remarkable if *chronic* effect of sulphur in the healthy did not produce a *depression* of oxidation for which so many arguments have been introduced by another side. Exactly with sulphur there is no doubt that its effects become distinct in their peculiarity only with the persistent use of smallest amounts. The parenteral introduction of single doses of sulphur, on the contrary, yields so little specific of sulphur effects that the separation from the action of other "irritant bodies" has not as yet been accomplished.

The works of the Göttingen school[169, 170, 171] have made probable from urine analysis in acute sulphur

injection experiments that the action on the protein and salt and water economy agrees with the action of other irritant bodies as milk, aolan and sanarthrit. The agreement becomes evident in doses of 5 mg. of sulphur.

Thereby the nitrogen output shows a slight decrease. That the intermediate protein metabolism is nevertheless altered can be concluded from the absolute and relative increase of neutral sulphur excretion. In the urine appear paired glycuronic acid and urobilin transiently in increased amounts, a sign of liver damage. Water and NaCl will be retained after a transient pouring out; in consequence, increase of weight and dilution of the serum.

On the contrary, with injection of 100 mg. of sulphur the nitrogen output increases and the neutral sulphur decreases absolutely and relatively, conceivably signs of protein destruction. Further, water will be markedly poured out and weight disturbance (induced in a few hours) will be only slowly balanced; still, on the next day, a dilution of the blood will occur with the retention of water and NaCl. Increase of urobilin and paired glycuronic acid in the urine appears also with great doses. Disturbance of general sensation and fever are more marked with these doses than even after injection of milk.

Measured in these excretory products, the action of 5 and 100 mg. of injected sulphur is exactly reversed; the action curves course entirely different and in consequence a certain quantitative measure gives an exactly opposing deviation from the status of equilibrium. Moreover, the entire investigation with 5 mg. gives us no glance at the characteristic manner of action because the same effects are obtained through all so-called "protoplasmic activating" substances.

The same authors have tried through special therapeutic effects of sulphur in chronic joint diseases, from chemical analyses of the joint cartilage of dogs before and after the injection of sulphur and from human joint exudates, to gain an insight into the local metabolism. They found in dogs, after injections of sulphur, a decrease in total sulphur in the cartilage, primarily through a decrease of chondroitin-sulphuric acid, as well as a decrease in the swelling of the cartilage. A joint exudate from a patient with chronic polyarthritis, who had received an injec-

tion of sulphur six days before, contained more sulphates than are found as a rule in normal blood and essentially more than in the vast preponderance of pathologic exudate studies. So far as the sparing observation available at present permits a conclusion, it may be assumed that, after injection of sulphur, a type of destruction occurs in the specific material of the joint cartilage which manifests itself colloido-chemically in a decreased swelling of the joint cartilage tissue. Accordingly, under the influence of an injection of sulphur, the cartilage tissue, rich in chondroitin-sulphuric acid, would liberate sulphate compounds and they would be found in the joint fluids. Also, the possibility that through an excessively strong action of sulphur a previously healthy joint can be damaged, has been indicated by Meyer-Bisch. An example of ankylosis of the shoulder after SO_2 poisoning has naturally only conditional value of proof that it was concerned with an action of SO_2. Of great interest is the fact that, not only in this SO_2 poisoning but also in two patients who had received sulphur injections, a transient pleuritis appeared. That in persistent pleuritis, as generally in serous exudates, sulphur is often homeopathically indicated and at the same time acts as a resorptive agent, is the contrast of this. The trend to serous membranes appears naturally only with large doses of sulphur.

In the connection with arthritism belongs also the recently discussed question of sulphur action in hypertension. This question up to the present has neither been clinically nor pharmacologically even approximately explained. Ruscniak[172] found a reduction of blood pressure from the injection of sulphur from 1% sulfolein in 2–3 daily intervals of 1–10 cc. intramuscularly. Since he employed other measures (bleeding, rest in bed, veronal) these reports can hardly be evaluated. The French authors, Piery, Bonnamour and Guiguonet[173] have employed the colloidal sulphur in rabbits in doses of 0.01 mg. per kilo, a dose which they had earlier demonstrated as fatal. The transient increase of blood pressure found by them with a subsequent sudden fall is not to be considered a sulphur effect because they gave the sulphur in a 50% glucose solution. From this is explained without further discussion the severe disturbances of respiration, the clonic and tonic cramps, and the final respiratory paralysis. The trial of Gordonoff[174] with intravenous colloidal sulphur in a dose fifty times as great in an

oily suspension is not comparable with those of the French writers, and Gordonoff was not able to observe anything special beyond a falling of the blood pressure—no spasms appeared in rabbits and the animals stood the studies well.

ACTION ON SKIN

In sulphur metabolism the *skin* takes an important part. It is especially available for the investigation of the manner of action of sulphur.

Since antiquity, the skin has been well known as the point of attack of sulphur. The empiric use in skin diseases consisted of the external application, on account of which only a local effect was taken into consideration. But it has been shown that the effects of absorbed sulphur should not be overlooked.

We have assumed that the cystin form in the keratinized cells is the final form of sulphur metabolism in the skin and that sulphur is constantly excreted with these epithelial cells. That sulphur appears in a loose form in the upper surfaces of the skin, in particular in the hair, one knows from the practice of hair-coloring methods in which the sulphur is precipitated through lead or silver salts as the metallic sulphide. Likewise, in the use of cosmetics, the crude action of the polysulphide form in the skin, when sulphur is introduced keratolytically, is particularly solvent on the keratinized substances. Calcium and barium sulphide are used especially for the depilation of hairs. Thereby an alkaline reaction conditions. But still the action is not identical with the keratolysis through hydroxyl ions.

P. Pulewka[175] shows that barium sulphide solutions exert 2–3½ times as great keratolytic action as barium hydroxide solutions of equal OH-ion concentration. In any case there is a special action of sulphur in keratolysis. Menschel[176] showed

that hairs treated with alkalies take on an abnormal extensibility with marked swelling, and on the contrary alkali and earthy alkali sulphides produce a maximal fragility of the hairs. There is no uniform conception on the chemistry of sulphur-keratolysis. While Pulewka ascribes it to the hydrogen sulphide in alkaline solution, Heubner[177] holds the presence of polysulphides in alkaline solution significant. The sulphur of polysulphides can be deposited in the disulphide group of cystin, and new sulphur-rich compounds form which would make altered mechanical properties easily comprehensible.

On the other side, Unna[178] explains the drying effect of sulphur powder through enrichment of the epithelial cells with sulphur which would be considered better as the physiologic process of cornification. It is possible that sulphur applied from without by its transformation to H_2S perhaps converts SH groups in the diseased epidermis into sulphide groups (through H-deprivation) so that the cystein form, pathologic for the surface layers of epithelium, would be transformed into the physiologic cystin form. Kapitowski,[179] employing pure sulphur in the form of milk of sulphur ointment, found a corresponding result also on healthy human skin, namely, proliferative processes in the form of increased cornification and vascular growth. These processes also correspond to a proving on the healthy with the external use of sulphur. They also agree with the skin alterations effected through the long-continued internal use of sulphur. The drying, keratoplastic action of exogenous sulphur was considered as a reduction by the older P. G. Unna. This contradicts the above-mentioned conception of increased cystin formation, for this represents an oxidation. The keratoplastic action of small doses should act by drying first on the horny layer, then the action of the vessels is added, the end-result consisting in a narrow-

ing and drying out of the capillaries. In the sense of a palliative contrarium therapy, the external application would be indicated in moist forms of disease. The acute dermatoses and acute eczemas, however, according to Paul Unna, are exactly a contra-indication for sulphur, while the parakeratotic diseases as psoriasis, parapsoriasis, seborrheic eczema, pityriasis rosea, should also be improved through the external application of sulphur. Naturally, a very dry skin should represent a contra-indication for sulphur because, by it, painful itching and fissuring would be increased.

The keratolytic effect on the horn cells with the stronger development of H_2S represents the destructive fraction of the effect curve of sulphur on the skin. Iwan Bloch, a pupil of P. G. Unna, states: "Accordingly we are confronted by the fact clinically proven with sulphur that small doses can exert a reversed effect on protein substances as compared to large doses of the same substance."[180] Therein one might see an example for the partial recognition of that which has found expression in the so-called Arndt-Schulz law.

The keratolytic end-effect of sulphur is used particularly in scabies where the epidermis and the parasite are to be affected at the same time. But there is also to be considered here another action component of sulphur which makes it especially suitable, because not every keratolytic agent is an itch remedy. Probably the disinfection power is due to the SO_2 formed by oxidation. According to Golodetz[181] any action of sulphur on the skin should be considered only as through H_2S; according to Heubner[182] H_2S cannot appear in reaction with healthy and injured surfaces of the epidermis; his theoretic conceptions cannot be confirmed, however, by experiences as those of Kapitowsky; Maliva[183] particularly has proven the penetration of sulphur in the form of H_2S through the skin by blackening of subcutaneous deposits of bismuth in animal experiments. For the keratolytic action, besides the marked formation of H_2S,

the alkaline reaction is presumed as a prerequisite. The alkalescence serves at the same time as a path breaker for increased action upon the skin. In agreement with this stands the fact that Menschel[184] considers absorbability in the epidermis primarily dependent upon alkali content and moreover Gans[185] has shown that the effectiveness of sulphur agents is increased through raising the grade of alkalescence of the uncornified layer. According to Gans, in fresh inflammatory moist skin eczema, an alteration in the sense of an alkalosis should be present while in dry eczema and in psoriasis a shifting towards the acid side should exist. This difference in H-ion concentration explains many individual manifestations in respect to sulphur action which up to now have been held as idiosyncrasies to sulphur. Gans[150] believes because of the marked alkalescence in the exudative forms of eczema there is a stronger action, Paul Unna holding that it is exactly in these forms that sulphur is contradicted, obviously because of the stronger action. Unna considers exactly the dry processes as most suitable for sulphur therapy, in which, according to Unna and Golodetz, the tissue reacts acid.[197]

After all we must assume that the use or damage of an external sulphur medication is not dependent alone on the dose of pure sulphur introduced but also upon the state of the morbidly altered skin surface, in particular upon a pathologic cystin supply, and on alkaline reaction which probably conditions an accelerated and increased formation of effective H_2S. So would many contradictions in dermatologic reports and experiments be solved.

Similar reflections hold for the usual effect on the skin of sulphur given internally. Moreover, in order to understand the single effects, one must take into consideration the function of the skin organ directed towards within as well as without. Such a possibility of effect has been studied more closely by E. F. Müller and Delbanco.[188] They used sodium thiosulphate for

therapeutic purposes. According to Bauer[189] this is an intermediate transformation product of sulphur. An arsenic or salvarsan erythema can be made to disappear through the intravenous injection of it. Simultaneously the arsenic, which had previously disappeared from the blood and in the excretions (urine and feces), appears again. The appearance of the erythema is conceived as a limited skin metabolic process for the substance concerned. Sulphur removes this store in the skin function and directs it toward the blood. Sodium thiosulphate is also given as an antidote in acute heavy metal poisonings. This should also explain the mobilization of heavy metal depots (for example, mercury) in the skin through sulphur baths. This mobilizing influence of sulphur, introduced by metals through an increase in function of the skin, perhaps has its other side in the participation of sulphur in the compound state with heavy metals. Indeed it is not improbable that the metal is joined to the SH-group of the protein and that its (according to different organ or tissue affinity) toxic action consists primarily in the exclusion of the physiologic rôle of this sulphur group in cell protein. One must not leave out of consideration the particular chemical connections of heavy metals to sulphur which also have a geochemical significance.

A detoxifying rôle of sulphur in the skin has also been made plausible through the so-called detoxin. On this extract from the skin rests the strong antitoxic action of sulphur-containing organic compounds.[190]

The activation of chemicals and irritant poisons in the skin, just as in the total metabolism, includes a metabolic promotion in the first phase of sulphur action. Such an action only apparently contradicts the experimental findings with the long-continued sulphur medica-

tion. They are in agreement with the findings in acute influences of single parenteral doses.

The stages of sulphur action can be easily followed in the skin. At first the metabolism in the skin is promoted and the activity of the sebaceous glands is also increased. The picture of seborrhoea oleosa is, however, less characteristic for sulphur than for the related selenium. With sulphur there soon occur inflammatory alterations in the capillaries and the sebaceous glands (dermatitis, acne). With longer continued doses the proliferation of vessels is promoted and the transformation to keratin, and cornification, is accelerated. This keratoplastic effect leads to dirty, scaly, dry, hard, fissured skin which characterizes the depressed skin metabolism of sulphur patients. Here to some extent the limit of excretion of endogenous and exogenous substances adapted to the skin is obtained; the sulphur disturbance is deep, has become "constitutional." The keratolytic effect, on the contrary, is observed only accurately from massive, usually exogenous, applications.

INTERNAL SULPHUR THERAPY

Only since industry has created colloidal sulphur preparations for injection has the internal use of sulphur again come into popularity. For skin diseases the old practice of local applications of sulphur still prevails; the internal use is rare. But the field of chronic diseases, particularly joint diseases, is opened for the internal use of sulphur, naturally in the understanding of non-specific irritant therapy. A constitutional sulphur treatment is still another step.

Also at present the complete neglect of internal sulphur therapy has yielded to natural sulphur waters, as

baths and drink régimes, a modest and, scientifically, ever-debatable position. The inequality in the action of single springs cannot be placed parallel in any way with the sulphur content. Moreover, the natural springs cannot be supplanted in any way through artificial water in which one can indeed increase the sulphur content and the development of H_2S through polysulphides much higher than in natural springs. The form of sulphur here also is responsible for the medicinal activity. The quantity of alkali- or earthy alkali polysulphides in springs hardly exceeds the fourth decimal potency, and the most active frequently much less. The indications for single springs are presented very diversely. However, one has a reputation chiefly for rheumatic processes in the muscles and joints, for neuritis and traumatic bone and joint affections; the other, for chronic skin diseases, inveterate syphilis, chronic metal poisonings; still another, for chronic catarrhs of the upper air passages or inflammatory diseases of the female sexual organs. Many springs are considered useful in the mild cases of pulmonary tuberculosis, but the progressive cases show an aggravation. The presence of other minerals or even radioactive substances, and the temperature of the water, modify the action considerably so that experiences with springs can be valued only in a limited way for pure sulphur actions.

In general, from antiquity the sulphur springs have been ascribed the property of activation of chronic processes and the excitation of mucous membrane and skin secretions. But experience has also taught that it depends upon the state of the organism how such activation shall express itself and whether it will be useful or damaging. While cardiac activity and respiration are slowed in the usual sulphur water cure, in the

chlorotic, palpitation and dyspnea occur. In the chlorotic the existing insomnia is aggravated and likewise the tendency to cough and bleeding. Pulmonary patients, especially of the erethistic type with fever, may have light hemoptysis from sulphur springs.[191] Generally, febrile and acute inflammatory diseases are considered a contra-indication for sulphur baths. Likewise, by the homeopathic physician the use of sulphur in progressive stages of pulmonary tuberculosis is contra-indicated. The activation is not of use at all times but only in definite degrees and at the right time. To determine this biologic moment, the earliest symptoms of the human organism are of assistance.

The medicinal action of sulphur is always an excitation, an activation, whether it is acute and parenteral with massive doses, or whether it is given at definite intervals with small or smallest but particularly activated doses, and then necessarily with special regard for the suitability. On the other hand, the sulphur action in the chronic experiment on the healthy is entirely different. It can be brought exactly under the conception of oxidation *depression*; the metabolism and the functions of the susceptible receptive organs like the skin are finally slowed because the disturbances cannot be equalized through opportune increase. The symptoms in which a persistent sulphur disturbance is expressed give us the suitable point at which the sulphur can be utilized for activation.

SULPHUR

PROVINGS OF SULPHUR

(1) Hahnemann: "Reine Arzneimittellehre," II Aufl. 1825, Bd. 4, p. 277. "Chron. Krankheiten," I Aufl. 1830, Bd. 4, p. 335.

(2) Wurmb: "Die Reinwirkungen des Schwefels," *Ztschr. d. Ver. d. hom. Aertze Oesterreichs,* 1857.

(3) H. Schulz: "Studien uber die Pharmakodynamik des Schwefels," Greifswald, 1896. Niesel, M; "Ueber die Wirkung fortgesetzter kleiner Dosen von Schwefel beim gesunden Menschen." *Inaug. Diss.*, Greifswald, 1895.

(4) Riesser and Simonson: *Verh. d. Deutsch. Pharm. Ges. Rostock,* p. 46, 1925; and Simonson and Richter: *Arch. f. exp. Path. u. Pharm.,* Bd. 116 p. 272, 1926.

(5) Abegg: *Allg. Hom. Ztg.,* vol. 179, pp. 398 and 406, 1931.

In homeopathy sulphur is considered in chronic diseases as particularly suitable as an activator. The exacerbation of chronic processes is indeed well known from sulphur baths; in heavy metal intoxications, particularly mercury and lead, these materials will be mobilized, and syphilis and malaria may break out again from sulphur baths. This activating, mobilizing capacity of sulphur has long had a very general significance in homeopathy. When acute diseases threaten to pass into a chronic state or chronic diseases return when even otherwise well-selected remedies do not produce the expected reaction, then with sulphur one gives a new impulse. But also the disease which can be recognized through alternating and vicarious appearance of syndromes in a particularly chronic deviation based upon the constitution requires sulphur, if not as the sole remedy, then as an interpolated remedy from time to time. The history gives the indications for sulphur if, in place of an earlier eczema, ulcer cruris, hemorrhoidal bleeding or foot sweat, another syndrome as asthma, ever recurring catarrh, or

periodic headache appears or alternates with the syndrome first mentioned. On these connections of chronic diseases Hahnemann built his psora theory. There sulphur is in the outstanding place among the so-called antipsoric agents which today we would call constitutional agents. The confirmation of the suitability of sulphur again to bring into prominence suppressed or checked disease processes or again to kindle them is found in the fact that after minimal doses of sulphur remnants of eczema not rarely become extensive or an eczema or a gonorrhoeal discharge which has entirely disappeared again appears. Therein we see a guide to fundamental healing. So-called irritant therapy likewise states nothing more than activation of morbid phenomena which we signify as defense processes of the organism. But it is indeterminate because there are no indications by which one employs either sulphur, yatren or milk.

TYPES AND GENERAL SYMPTOMS

Let us first glance over the general symptoms of the sulphur picture. There we seem to hear the complaints of a neurasthenic. Headaches of the most diverse types; pressure, tension, tearing, band sensation, beating; as to the site: anterior, unilateral or the entire head. Here also we have no differentiating characteristics. Characteristic for sulphur is the *feeling of heat at the vertex.* By the rush of blood and surge to the head, cerebral congestion is revealed. At times nausea and vomiting are added. This unpleasant congestive group appears toward morning, on arising after long sleep, for example, on Sunday when sleep has been extended unusually long. Such a description of men who stay at home and who have defective metabolism is

heard not rarely. The dull head and the vertigo is worse in the open air, while in the congestive states there is a desire for cooling. Long standing and bending are especially aggravating. The headaches also show marked dependence upon digestive processes; they will often be worse after eating and drinking. Then again appears the characteristic hungry feeling or weakness toward 11 A.M. or an hour before eating, at times with flickering and spots before the eyes.

The neurasthenic man as he reflects himself in the sulphur picture becomes unable to perform mental work, loses interest, is forgetful, easily fatigued, and even speech is influenced; thereby he has a general bodily unrest, is easily irritated, especially by noise. During the day he is sleepy; even when the night sleep is deep and long, he still remains unrefreshed. Often sleep becomes deep only towards morning so that he awakens with difficulty. Or he goes to sleep soon and awakens about 3 A.M. with anxious dreams, speaking, crying, with twitching and jerking in the extremities which awaken him suddenly, and then he remains awake or sleeps only at dawn and then cannot readily awaken again or else awakens with sweating.

In this general picture of nervousness I might include other symptoms as frequent urination at night and the low stimulus threshold of the sexual system, ejaculatio praecox, many pollutions and tendency to masturbation.

The chief characteristic of sulphur men is the stagnation which we shall consider more closely in the bodily functions. But the *stagnation* is also psychic. He is concerned with himself, is egocentric. He is concerned primarily with impractical things, philosophic

reveries, religious or occult enthusiasm which appears very significant to him but in reality is only a device to avoid real and definite work. He neglects his body and his appearance, is disorderly and unclean. The corresponding is indicated in his internal life. Constantine Hering who introduced homeopathy into United States has called the sulphur patient a "tattered philosopher." But thereby he does not mean a real philosopher but more a sort of spinner of phantasies or inventive genius who never finds anything correct. He does not arrive at an act which is satisfactory or complete. Concerned with himself and his own disordered thoughts, the sulphur type can fall into a hypochondriac-melancholic state, especially into religious melancholia with doubt on his own psychic welfare and always with strict limitation to his own person. The egocentricity and disorder make him useless for practical life. The usual neurasthenic-hypochondriac picture as it may arise out of a mental exhaustion is a preliminary step to this severe state and not rarely is favorably influenced by sulphur. But it is not to be assumed that sulphur is suited to every neurasthenic. But if an insufficient metabolic exchange lies at the basis, the entirety of neurasthenic symptoms predominate and no other drug suggests itself, then I tend to begin with sulphur and believe that it has often proven itself useful.

One can give as the characteristic for sulphur patients, *defective renewal of tissue and fluids.* In its basic trends the sulphur type belongs to the carbo-nitrogenous constitution of v. Grauvogl. But it is not to be overlooked that by the acute irritant effects of large doses, certain trends in the sulphur picture are suggestive of the oxygenoid type: an increased vessel

irritability with heat in the skin and acceleration of the pulse.

ORGAN SYSTEM TRENDS

Out of the embracing picture of nervous-psychic, general symptoms, the stagnation of the sulphur personality becomes distinct. But the three chief trends of sulphur toward organ systems, *skin, venous system, digestive system,* are of a type that add themselves well to these general features. It would be entirely non-homeopathic to place such general representation, which only yields a survey for enlightening summary, at the side of observed symptoms. The reason is that there are many agents which show metabolism on the healthy, which increase the residual products, but which still in *suitable doses* seem to give the impulse in cases of disease for increased excretory activity. They can be differentiated only through the actions peculiar to them, by their symptoms.

The first chief trend of sulphur is *the skin.* It lacks a fresh smooth appearance, but is always dirty red, is *sensitive towards cold water and cold air, is rough, unhealthy,* tends to intertrigo and eruptions and secondary infections of all types, particularly to *eczema, acne and furuncles.*

In his polemic publication W. Heubner[192] denies that the action of sulphur in furunculosis, even if it should be confirmed, is concerned with a homeopathic effect. He states: "Because the introduction of a disease like furunculosis through the ingestion of larger doses is not held possible even among the homeopathic profession and much less has not been demonstrated." I must contradict him: In Hahnemann's "Chronic Diseases," one finds under sulphur the symptom, boil. In

the depiction of the action of sulphur by Hugo Schulz one finds: "Increased sweating occurs, eruptions of the most diverse type develop, particularly furunculosis." But we may permit a contemporary of Heubner who is unsuspected of any homeopathic conceptions to speak. L. Lewin[193] states: "After the ingestion of sulphur, occasionally an acne or miliaria-like eruption appears, very rarely swellings and carbuncle-like formations." From more recent times the experiences of A. Bier as well as his pupil Abegg[194] may be added.

I have mentioned this controversy in order to show that the use of sulphur is well founded homeopathically and that A. Stiegele, who at one time recommended a retesting of sulphur iodatum to A. Bier, was entirely justified from the standpoint of the homeopathic method. But what Stiegele surely did not wish and what, as he himself has stressed repeatedly, would be entirely non-homeopathic, is the generalization to which Bier's reports gave occasion in the medical world, namely that sulphur is indicated for *any* furunculosis. With such an unselected procedure only a certain percentage of results will be obtained. It is not homeopathic when one proceeds to give sulphur on the basis of the diagnosis furunculosis. Only if the furunculosis stands on the soil of such skin and metabolic alterations which lie in the sulphur trend, will the homeopathic physician select sulphur. It might be that he would select arsenicum if there were a diabetic basis, or again arnica if there were a pyemic state in the degenerative condition of tissue and skin, and a tendency to ecchymosis spoke particularly for it. To know the homeopathic use of sulphur means to know the homeopathic

materia medica as completely as possible so that one may proceed differentially—therapeutically.

The form of sulphur eruption goes from erythema over to papular, to pustular and to vesicular forms. Outside of the folds in the skin, the sites of transition of skin to mucous membrane, the curves of the hand, the face and the scalp are preferably involved. A characteristic of sulphur in skin affections is the voluptuous *itching, worse from the warmth of the bed and from woolen covering,* whereby the itching is relieved or replaced by burning. The aggravation through washing and baths and cold air I have mentioned above and may be considered as a sign of reduced reaction capacity of the skin. The emanations from the skin and sweat are offensive and furthermore washing does not lessen them. So, also from this side, uncleanliness appears in the picture of the sulphur type: as a child with unkempt hair, as an adult, a disorderly unclean pseudo-philosopher or pseudo-creator. Generally with sulphur the secretions are offensive, acrid and excoriating. "All discharges burn the parts on which they flow." Therefore the openings of the body, the anus, the vulva, the meatus of the urethra, the nasal orifices, lips, edges of the lids, are markedly reddened, under conditions also inflamed. The breath is also offensive, the stool is fetid; and so from all sides the impression of uncleanliness is increased and this is conditioned by the incompleteness and inertia of metabolism. But still the sulphur patient is sensitive to all disagreeable odors, even from his own body. This is an exception to his indifference to his own body and his environment.

Of the abnormal sensations besides itching, *burning* predominates. Sensation of heat at the vertex has been mentioned above, likewise the itching combined with

burning at the openings of the body. Burning on the soles of the feet and palms, worse from the warmth of bed, makes it necessary to place the feet out from under the covers; but burning is also noted in the tongue, the urethra, the bladder and in other organs. Waves of heat and burning in the skin go over the entire body. This increased vascular irritability makes sulphur very useful in menopausal disturbances. Non-appearance or suppression of the menses may also suggest sulphur. The blood seems unequally distributed; the head is hot, the feet are cold.

This leads to the second chief trend of sulphur: on the circulation, in particular on the venous system. Characteristic for sulphur is the *aggravation from standing.* By standing, the already present venous relaxation and venous stasis increase, and an entire series of secondary complaints increase. Varices with their sequels and hemorrhoids are a special field for the use of sulphur. The superficial veins are also easily relaxed in the sulphur type on going from cold to warmth, and there develops a feeling of puffiness in the face or in the extremities; the face seems swollen and reddened.

Especially numerous in sulphur are the symptoms of an abdominal plethora. And here the trend in the *portal system* cannot be separated from the third chief trend of sulphur on the *intestine.* Likewise an action on liver function is certain. One has concluded an increase in biliary secretion for the green coloration of the stool. In Haarlem oil, indeed, sulphur is considered to be the chologogic agent. In the experience of Rademacher, sulphur is *the* remedy for the portal system. That so good an observer as Rademacher saw good from his very massive doses of sulphur in hemorrhoids and also

saw many symptoms which he considered as arising in the portal system is noteworthy and contrary to the prolonged non-consideration of sulphur in its original form in internal medicine. However, with Rademacher sulphur had only a limited field of application and I might deduce from this that he did not comprehend the unfolding of a substance through potentization, and so the best possibilities of effect were lost. Rademacher obviously knew nothing of the "foolish doses of homeopathy."

Abdominal plethora and dyspepsia are the summary of symptoms for the abdominal organs in the sulphur type, the stagnant stay-at-home type. Hemorrhoids burn, pain and also bleed especially after the evacuation of acrid, liquid stools. Flatulence, distention, flatulent colic, abdominal colic, many eructations are mentioned. The patient can tolerate only the lightest foods and must "restrict the diet ever more." He has a desire for alcohol and sweets, but both are badly borne. He is usually emaciated and has a bent gait. He eats little and drinks much. A feeling of hunger is often present an hour before the usual meal time; *a feeling of weakness and emptiness about 11 in the morning* is considered characteristic for sulphur. The stools are always irregular, *constipation often alternates with vain urging and diarrhea.* A peculiar and characteristic symptom is ever-recurring *early morning diarrhea*, often persisting over years, which drives the patient from bed; to differentiate from other early diarrheas (for example, podophyllum diarrheas) is the fact that with the others the diarrhea is not daily. The decisive method of proving on the health as it is used in homeopathy has shown that sulphur action on the

intestine is not necessarily characterized by diarrhea; more often constipation appears first. Chronic constipation temporarily relieved by diarrhea not rarely finds the correct remedy in sulphur. Just as there is *ineffectual urging* with constipation, so in the diarrheas of sulphur, *tenesmus* is observed, and it has given occasion for therapeutic results in chronic dysentery. A burning, sore feeling predominates in the intestine in the diarrheas; particularly the anus burns after evacuation of the stool and becomes sore and red.

Furthermore, in the sulphur picture come other catarrhs of all the mucous membranes on the least occasion, but particularly on chilling. But it is not necessary to recount all these catarrhal symptoms if they cannot be differentiated by very definite peculiarities as sulphur symptoms. Neither conjunctivitis and blepharitis, nor coryza, nor throat, laryngeal, respiratory or bronchial catarrhs are indications for sulphur, apart from the burning and the previously mentioned acrid type of secretion which many other remedies also have. Usually the selection of sulphur follows only from reflections of a general nature as from the entire type, from a defective tendency to resolution as perhaps in a pneumonia, from the chronic recurrent nature of the process, in particular through the development by suppression of a former attempt at excretion on the part of the organism, *etc.* So, for example, sulphur has very often proven itself in bronchial asthma which appears as the result or equivalent of an eczema. Here as in scrofula, sulphur, apart from the skin manifestations, is the leading agent on account of the tendency to chronic catarrhs, much depending naturally upon the favorable interval of use and upon persistence if one is to obtain a result.

Entirely the same holds for chronic arthritis, recurrent neuralgias and lumbago. Also, in these affections from the circle of arthritism one cannot with due regard for the success and result employ sulphur merely from the diagnosis, but only if sulphur is indicated by the special symptoms of the single case or occasionally if it is used as an interpolated remedy when the reaction to another correctly chosen remedy is insufficient.

SUMMARY

Predominantly chronic diseases or transition to a chronic stage (activation).

Recurrent and vicarious processes after suppression of eruptions or secretions.

Constitution:

Carbo-nitrogenous (with single trends to increased vessel irritability of the oxygenoid type; bodily and psychic stagnation; venosity, congestive stages).

Organ Trends:

Skin: inflammation up to failure of functions. Mucous membranes especially at transition to skin. Intestinal and portal system: abdominal plethora, hemorrhoids, dyspepsia, alternation of constipation and early morning diarrhea.

Special Symptoms:

Burning predominates, also itching; heat at the vertex, nocturnal burning and heat in the feet, otherwise cold feet; offensive secretions and emanations; bodily orifices reddened and inflamed; secretions cause burning; feeling of emptiness at 11 in the morning; early morning diarrhea which drives patient out of bed.

Modalities:

Aggravation of most complaints at night (early morning or 11 in morning, see above). Aggravation from standing (better from moving). Aggravation from washing and bathing and aversion for them. The congestive symptoms are worse from warmth; the skin, from the warmth of the bed; the catarrhal symptoms, from cold and damp.

DOSE

The dosage of sulphur has a very great breadth, from the lowest potencies, perhaps the third, to the highest; the thirtieth and higher have been recommended. In chronic general maladies in which sulphur is used as a constitutional agent one sees action of the high potencies which are missed with the lower. Sulphur adapts itself particularly well for studying the effectiveness of higher potencies, the primary aggravation and the subsequent improvement.

HEPAR SULFURIS CALCAREUM

When hepar sulfuris is mentioned in homeopathy, *calcium sulfide* is meant, while otherwise by it hepar sulfuris-kalinum (potassium polysulfide) is usually understood. The minimal solubility of hepar sulfuris calcareum in water is an important difference of the longer action in contrast to hepar sulfuris-kalinum. Hepar sulfuris calcareum is obtained through heating calcium (the middle layer of the oyster shell) with flowers of sulfur. Thereby arises a yellow-gray, crystalline mixture of calcium polysulfides (CaS_2, CaS_4, CaS_5, *etc.*) and calcium sulfate. The internal use is not common in the German official school and only the

watery solution is employed externally at times under the name of Sol. Vlemingkx in the cure of acne and itch. The H_2S split off acts keratolytically. Likewise the crude actions on the mucous membranes are known to arise from H_2S.

But in homeopathy a very prominent place is taken by hepar. Essentially it has the action of sulfur in its active H_2S form, but still is modified in certain directions through the participation of the calcium ions. The acute and volatile H_2S action in nontoxic doses is prolonged through a preparation of this type by the cells of the skin and mucous membranes being brought into longer contact with it. The calcium links the action toward the lymph glands.

Drug provings are found in:

(1) Hahnemann: Reine Arzneimittellehre, 2 Aufl., Bd. 4, 3/9, and "Chronic Diseases," 2 Aufl., Bd. 3, p. 348.

(2) Vergiftungsgeschichte: Knorre, *Allg. Hom. Ztg.*, vol. 19, p. 233.

METAL POISONINGS

First, hepar has the same significance as sulfur in *chronic metal poisonings*, lead poisoning, and, in particular, mercurial diseases. The symptom, swelling of the gum with flow of saliva, principally suggested the remedy here. Also the large flat ulcers and bony swellings of tertiary lues, with great sensitivity (splinterlike pains) underlie the healing influence of hepar generally after the misuse of mercury. The effect of sulfur baths, which contain alkali or earthy alkali polysulfides, in inveterate syphilis is also known. Hepar should also act well in iodine poisoning.

SUPPURATION

Hepar proves itself more active than sulphur in *all types of suppuration* or inflammations which pass over into suppuration. The untoward actions of sulfur alkalies or sulfur earthy alkali compounds in the skin, which may evidence themselves from irritation of the skin to purulent pustules up to phlegmons and abscess formation, prove the homeopathic suitability of the chief trend of action. It is uncertain whether increase of the power of reaction of the tissue through sulfur is made easier through hepar because it easily forms SH ions from this mixture and therefore can be utilized and become more active—indeed, H_2S is liberated through weak acids as well as CO_2 (the 3rd decimal potency still has a very distinct taste and odor of hydrogen sulfide). It must also be left undecided how far the inflammation-depressing and phagocytosis-stimulating calcium ion action has a share in the favorable influence. In any case, hepar sulf. calc. has proven itself in acute inflammation as well as chronic suppurations, and especially well when due to staphylococci.

In the more empirically directed English, here, as so frequently, the differences between the schools have been bridged by experiences with hepar sulfuris. In proof of this a citation from the materia medica of Sidney Ringer may be introduced[195]:

"The sulfides seem to me to possess the property of preventing and restraining suppuration; so they resolve inflammations which threaten to pass over into suppuration and prevent the formation of pus. This effect is shown, for example, through the action of the local use of sulfur compounds in acne indurata.

"After the formation of pus the influence of this

group on the suppurative process is still very distinct; because the sulfides can accelerate the maturation distinctly, while they simultaneously limit and lessen the inflammation and promote the appearance of the pus on the surfaces and the evacuation of the abscesses."

Then Ringer describes the severe, deep-seated, cervical glandular swellings of nurslings which suppurate persistently and provoke a picture of severe disease. In such cases 0.006 g. of calcium sulfide in sugar of milk may be given every one to two hours with extraordinary success. Likewise in mammary abscess and at times in ulcers, the action of this remedy was very good; in rare cases the pains would be transiently increased, while usually the pains were rapidly relieved. In indolent buboes he has found this remedy much less useful for the promotion of maturation and suppuration. He then continues: "It must be stressed that one has great difficulty in understanding how the same agent can have so diverse and apparently opposing effects as the destruction of inflammation in the one case and the driving out of pus in the other; cataplasms and hot fomentations also suppress inflammation in the one case while they considerably accelerate the emptying of pus in other cases.

"In boils and carbuncles this remedy furnishes excellent results. 1/10 grain (0.006 g.), calcium sulfide given hourly, or ¼–½ grain (0.015–0.03 g.) three or four times daily, will in general prevent the formation of fresh boils while the inflammation in boils already present is lessened, the extension limited and the core rapidly liquefied, so that it separates much more rapidly and the course of the boil is considerably shortened. Where the skin is not open and the slowly separating core is not free, the sulfides frequently convert the boil

into an abscess so that, on opening, considerable pus is discharged and the wound soon heals; or if the middle of the indurated and swollen tissue is still not dead, the pustule dries, the inflammation ceases, the hard node resolves in a few days without the formation of a core and disappears without any discharge. Thereby this agent improves the general well-being in that it removes the weakness and poor health which so outspokenly accompany boils and carbuncles. But in single cases, as in deep-seated abscesses and boils, and in diabetes, it is less active. In carbuncles the sulfides in general prove themselves equally effective in that they resolve the core into pus so that the dead and otherwise slowly separating tissue rapidly is cast off.

"The good effects of sulfides are distinct in certain scrofulous sores which are seen not rarely in children. Scrofulous children at times in the first few months of life show indolent abscesses in the cellular tissue which take a very persistent course. At first only small hard masses, not larger than a pea, are noted under the skin; the skin is natural in color and freely movable over it. The small masses then suppurate and gradually enlarge. The skin becomes adherent; the color is altered into red or even violet, while the small vessels in the vicinity at times enlarge and even become varicose. The tumor can attain the size of a florin and when it is mature, feels soft and spongy. After some time, a small circular opening appears perhaps not larger than the head of a needle and through it a thin unhealthy pus is discharged. Beginning in a deep position, as in the buttocks or in fat children, very slight or no discoloration of the skin is observed. The frequently observed characteristic is then the sharply defined opening as though a piece had been punched out. These formations may

follow one another and continue over months and years and make the child very miserable. In mild cases only a few are formed, in severe cases ten to twelve may be present in different stages of formation at the same time. When healing, a white sharply limited but not deep scar remains. This tormenting and indolent state will rapidly change under the use of 1/10 or 1/20 grain (0.006–0.003 g.) of calcium sulfide. The formation of new nodules at once ceases, for a fresh one is quite rare although the child up to that time may have suffered for months or years with ever-recurring attacks. Many abscesses, especially in the very early stages of development, dry and disappear; other rapidly bring their contents to maturation—the thin and unhealthy pus becomes creamy and 'laudable.' The already opened abscesses improve, the pus becomes healthy and the wounds rapidly heal."

Here Ringer seems to describe an ecthyma cachecticorum. Moreover, he depicts the well-known tuberculous bony affections of the phalanges, the spina ventosa, in which the sole use of calcium sulfide gave definite results. But at times, in place of the improvement of general well-being, under the use of sulfides appears a decided anemia which Ringer traces to the use of excessive doses. In suppurating scrofulous glands the results are also favorable; here one must employ doses of ½–1 grain (0.03–0.06 g.) several times daily and in resistant cases continue it for weeks.

Accordingly, the experiences of Ringer agree entirely with those of homeopathy and likewise the doses range in similar realms. The lower potencies, perhaps D 3, accelerate the maturation and the delimitation of inflammatory and purulent processes while the high potencies under certain conditions prevent the suppuration. Furuncles, phlegmons, paronychia, panaritium,

purulent tonsillar inflammations, suppuration of the serous surfaces, acute as well as tuberculous bone affections, suppuration of the accessory sinuses, glandular suppurations, suppuration of the ear, inflammation of the eyelid with purulent styes, ophthalmias, corneal ulcers with hypopyon—these are all the chief field for the use of hepar sulf. calc., especially when the discharges are thick and have a disagreeable odor "as of old cheese."

Common to the external inflammation is *the soreness on the lightest contact, aggravation from cold,* improvement from warmth, development and increase of pains at night, especially with nocturnal chilliness.

The close relationship of hepar with two so important remedies for scrofula as sulfur and calcarea allows understanding of its special suitability for the manifold phenomena of a scrofulous nature from the same basis as both remedies. To these belong: sickly unhealthy skin (every scratch suppurates); fissured hands; cracks on the feet; itching of the body, especially mornings on arising; bleeding of sores on contact; pustular, nodular eruptions; moist offensive scald head; soreness and weeping between the thigh and scrotum or labia; in the folds of the skin and on the flexor surfaces; scrofulous scleral and corneal inflammation with blepharospasm, lachrymation and subsequent ulceration of the eyes; inflammation of the nose and the upper lip (again with soreness on contact); fissure in the middle of the lower lip, cracks at the angles of the mouth; inflamed glands which can be recognized through the sensitiveness on contact and tendency to suppuration. The various stages of inflammation passing over into suppuration correspond to the following classic series of agents: mercury, hepar, silicea.

GENERAL SYMPTOMS

Of the general indications for hepar the most important is the *extreme sensitivity to cold and drafts* (dry as well as moist cold). Chilliness prevails both day and night and requires excessive clothing or covering. Warm or hot, damp weather is borne better. Any part becoming cold, for example, an arm or leg becoming uncovered in bed, aggravates the most diverse symptoms, especially the catarrhal phenomena of the upper air passages.

There is also *hypersensitivity towards pain*—"apparently light pains cause attacks of faintness"—sore or inflamed areas of skin are hypersensitive to contact. The pains are sharp, sticking, cutting like a splinter, for example, as from a fish bone in the throat. The hepar patient is very sensitive to impressions of the environment, is easily irritated, impatient, "is always changing his position or environment but is always irritated at anything new." The sensitivity to odors is increased, outside of the previously described affections of the nose.

The *sweat is worse at night*, clammy, sour or offensive, and does not relieve. It develops from the least exertion, and is especially marked in the folds of the skin, especially the axilla. The secretions from the mucous membranes, boils and abscesses are often offensive; therein hepar is similar to sulfur.

So far as one may speak of a habitus in hepar, it stands near to the lymphatic, blond, relaxed type of calcarea; still the great sensitivity is a peculiarity which calcarea does not have.

In hepar the headaches are many, and they arise easily from the shaking of coughing, for example, the sensation as from pressure of a nail or plug in the vertex

or temples. A pain characteristic for hepar is a boring and tensive or bursting pain *at the root of the nose* (better from warm covering or firm bandage) and one can use this particularly as an indication for affections of the frontal sinus.

The frame of mind with hepar is the same as with sulfur and calcarea, that is, depressed with crying and anxiety, at the same time with impetuous irritability, with rapid hasty speech and greater weakness of memory.

ORGAN ACTIONS

The chief trend of hepar is on *the mucous membranes of the throat and upper air passages.* There we find swelling of the tonsils and glands in the throat with discomfort in the throat as from a plug, sticking as from splinters or a fish bone; likewise cutting pains running to the ear; itching sensation in the throat; rough, hoarse throat; cough from pain or irritation in the larynx; evening cough from any part of the body becoming cold, from inspiration of cold air; cough worse after cold drinks. All these symptoms in the upper air passages are found chiefly in people easily chilled. In general, the dry stage is not suitable for hepar, which is indicated *after the appearance of the secretion.* Many symptoms suggest simple acute catarrh: sneezing from itching in the nose; coryza from inflammatory swelling in the nose which pains as if an ulcer were present; the coryza is worse in the open air, better in a warm room, and drafts and change in weather provoke a recurrence; coryza with internal febrile chill and irritability and a feeling of soreness in all extremities; in short, coryza, at its high point. Pressure, burning and sticking in the eyes refer to simple catarrhal conjunctivitis. In general, all secretions are *yellow and offensive.*

The nocturnal cough of bronchitis is severe so that the head hurts, but the secretions from the mucous membranes are copious. Outside of the nocturnal aggravation of hepar there is also a morning and evening aggravation of the cough.

A series of symptoms make hepar seem suitable for plastic croupous inflammations of the larynx and bronchi: a deep, moist cough with respiratory oppression; attacks of husky coughing with anxiety and nausea often ending with crying; anxious, husky, piping respiration with fear of suffocation on lying down; nocturnal rising up as from deficient air with crying and great anxiety. According to Farrington[105a] the breathing is so labored that the child throws the head back to extend the respiratory passages. There is a predominantly *expiratory stridor* (in contrast to spongia). The cough is hard, ringing, resounding; and at the same time there are mucous râles. This cough should be worse toward morning. The picture corresponds to a progressive croupous inflammation and the mucous râles indicate a release of the membranes.

Hepar does not have special relation to the lungs and pleura in its symptoms. In purulent pleural inflammation it proves itself useful as in all suppuration, especially after the opening of the purulent cavity where it is superior to simple sulfur. Also in endangering pneumonias with impending suppuration, offensive purulent secretion, emaciation and night sweats, evening attacks of coughing on lying down are to be characterized as indications. For lung tuberculosis the relation to hepar is not particularly close: the same caution is to be observed as with sulfur if the symptoms seem to require the remedy.

The *gastro-intestinal* actions of hepar are less characteristic; they are similar to sulfur, but even less used

as independent indications. An atonic state is to be read out of the dyspeptic symptoms. The stomach easily becomes disordered and there is an appetite only for acids, condiments and wine; aversion towards fat and food in general; in spite of a feeling of gastric emptiness in the morning (as with sulfur) whereby eating improves the general feeling, pressure and distention often appear even after a little food so that sitting and tight clothing are intolerable. Constricting pain and cutting in the abdomen are reported; a distention which embarrasses respiration; colic, sensitiveness and cutting pains in the liver region. The stool may be hard and dry, or infrequent and soft stools will be evacuated with pressure and force. More rarely the stools are whitish, acid, offensive in children (as in calcarea). Blood-streaked, mucus-containing stools like those of dysentery are used more rarely as an indication than with sulfur; in mercury poisoning this form expresses itself and from general causes would give a place for hepar as well as sulfur.

Also the relations of hepar to the urogenital apparatus are of subordinate significance. According to the suggestion of Kafka it is often used in purulent renal inflammations, particularly after scarlet fever. In purulent pyelitis hepar may be in place before silicea. But one must particularly consider the remedy in purulent prostatitis and prostatic abscess. The following symptoms refer more to the prostate than to bladder atony: the urine is delayed and flows with difficulty or the stream is interrupted; retention of urine after attempts at emptying; "nocturnal urination" (as with sulfur); emission of prostatic secretion after urination and with hard stools. As a further indication, dribbling, particularly after the use of mercury, is mentioned. A splinterlike pain in the urethra, just as in

wounds and skin eruptions, is characteristic. But also the report, blood after urination, was useful to me in the treatment of a case, where the symptom occurred in conjunction with gonorrhea. For the female sexual organs perhaps the offensive leukorrhea with soreness and splinterlike pain in the vulva is a single indication which arises from ulcerated states.

Of the skin symptoms, falling out of hair should be mentioned. Concerning the cause, that is, the form in which hepar comes into consideration, nothing definite is said. Perhaps the report is clinical and refers to the falling out of hair in pustular eczema of the scalp, which hepar often heals. It is interesting, in any case, that calcium sulfide (CaS), which gradually goes over into Ca $(SH)_2$, is used externally as a depilatory and in the Orient for shaving.

Finally to be mentioned is a painfulness of the face on touch. Here it is probably concerned with a neuralgia which suggests a beginning inflammation of the mouth or the accessory sinuses. Also drawing, contracting pain of dentition, on biting together, and aggravated by food and warmth (in contrast to the usual relief from warmth) are symptoms of such an inflammation.

SUMMARY

General:

Lymphatic

Suppurations: staphylococci and scrofulo-tuberculous (best sequence: mercury, hepar, silicea)

Hypersensitivity: to cold, drafts; against pain, contact, odors

Offensive secretions, night sweats

Heavy metal and iodine poisoning

Chief Organ Trends:

Mucous membranes of upper respiratory passages

Thick, yellow secretion with simple or scrofulous catarrhs

Croupous inflammations (expiratory stridor)

Skin: unhealthy; ulcerated; falling out of hair

Glands: suppuration

Special Symptoms:

Sensation of splinter (throat, ulcers, urethra)

Sweating without relief

Odor of secretions "like old cheese."

Modalities:

Worse from cold, draft; from chilling of an area, uncovering; cough also from cold drinks (toothache worse from warmth)

Worse nights; cough in evening and croupous cough, mornings

Better from warmth in any form, also in damp warm weather; headache (root of nose!); better from warm covering

Worse from contact

DOSE

I have had good experiences with the 3 and 6 decimal triturations. The higher potencies which are also recommended I have not sufficiently tested as yet.

ACIDUM SULFURICUM

We can no longer expect sulfur-like actions of sulfuric acid, H_2SO_4. For the sulfate anion is the highest oxidation step in the organism, it is the end-product and exeretory product for which no physiologic function

outside of combination and detoxification of noxious intermediate metabolic products is known. Not many peculiar medicinal actions can be ascribed to the sulfates. Indeed, in large amounts, sulfuric acid acts as a foreign, indeed harmful, substance but not in a characteristic way. Much more, the severe poisonous manifestations known of it are more or less common to all strong mineral, that is, markedly dissociating acids and also an effect of free hydrogen ions. Of small doses a peculiar action is only to be presumed because the medicinal site of application of the sulfate ion is different from the physiologic site of development of it. On the way up to the compound form in which the customary excretion occurs, small doses can presumably unfold definite effects. Distinct and great alterations are not present for the above-mentioned reasons.

It is also not surprising if a chronic sulfuric acid poisoning is not known in toxicology. Lewin mentions only: "chronic ingestion of sulfuric acid causes disturbances of appetite and apparently a decalcification of the bones." If the last is true, then this probably suggests an acid action. To be considered in the theory of sulfate action is that the compound with calcium (gypsum) is hardly soluble so that its action, for example, can also consist of an irreversible calcium precipitation (for example, depression of the coagulation of blood!).

Drug provings of acidum sulfuricum are found in:

(1) Hahnemann: "Chron. Krankheiten," 2 Aufl., Bd. 5, 1839,

(2) *Arch. f. hom. Heilkunst*, Bd. 8, p. 190 (contained in 1), 1829,

(3) *Neues Arch. f. hom. Heilkunst*, Bd. 1, 1844.

Also in the homeopathic drug picture, which, however, is not well founded, the symptoms which are common in other mineral acids predominate, so that very few certain characteristics of the sulfate fraction remain. The great weakness and exhaustion, with sweating, cachexia, tendency to bleeding from all organs with dark, thin, fluid blood, and also from the skin (purpura hemorrhagica), moreover stomatitis aphthosa, are also found in hydrochloric and nitric acid. A certain tendency to transition into gangrene and septic processes is mentioned in sulfuric as well as hydrochloric acid, those of sulfuric acid particularly after mechanical injuries.

Perhaps single symptoms serve for differentiation: for example, for the state of weakness *the sensation of trembling without visible trembling.* (The weakness is said to be aggravated by prolonged standing, recalling sulfur.) The pains are characterized through prolonged increase and sudden diminution. This modality was found, so far as I can determine, always in the same prover (Gross), and was stressed for various pains. If such a modality is confirmed, then, because of its great extent, it is naturally more important than such a sensation as the feeling of tension in the face "as though egg was dried upon the skin," which is reported only by one prover (Nehring) in sulfuric acid and which is less reliable.

Acidum sulfuricum is esteemed as a *remedy for drunkards.* This may arise from the empiric use of a mixture of sulfuric acid with alcohol (1:3), ten to fifteen drops daily, for the purpose of alcoholic withdrawal. This indication is supported from the provings through single gastric symptoms. A report of a proving of Hahnemann reads: "Each drink, which did not contain alcohol, chilled the stomach." Further in-

dications are *persistent gulping, loss of appetite, chronic sour stomach and acid eructations, morning vomiting and retching.* The acid eructations should be of such a nature that they blunt the teeth. Furthermore, a great feeling of relaxation of the stomach is said to be characteristic. Aversion to coffee, even to the odor of coffee, goes back to Hahnemann's report. Marked itching and burning of enlarged hemorrhoids are also given as indications.

The drug picture suggests particular utility at the climacterium: the waves of heat with profuse sweats, weakness and feeling of trembling, nervous haste and impetuosity. The last, with an irritable and fretful frame of mind, are given as the chief mental symptoms. On the female organs the tendency to bleeding is decisive for the remedy: menses marked and frequent with dark, thin blood, old cervical erosions with sharp, burning and slimy, bloody leukorrhea. States of irritation and itching are described in respect to the external genitalia.

Whether the modality, aggravation in the open air and from movement as well as improvement in the warmth of the bed, has definite significance remains undecided.

H. Schulz conjectures a connection of sulfuric acid to the liver from the now strikingly bile-colored, now bile-poor, clay-colored stool and the frequently observed appearance of an icteric tint to the skin. This would give a point of transition to sodium sulfuricum with its hepatic affinity. On what the report of Schulz is based and on what observations, I do not know. The occasionally observed yellow discoloration of the skin in those who work with sulfuric acid, in any case, has nothing to do with icterus, but belongs to the crude local actions. Of these crude symptoms of acid in-

toxication nothing is said here because they cannot assist us in medicinal action.

SUMMARY

General Mineral Acid Effects:

Weakness to cachexia
Tendency to bleeding
(Tendency to septic processes)
Aphthae

Peculiarities:

Feeling of trembling without visible trembling
Hasty, irritable
(Pains slowly increase, suddenly diminish?)

Chief Fields of Use:

Gastric disorders of drunkards
Climacteric complaints; waves of heat with profuse sweating

DOSE

Usually given in the low and middle potencies.

NATRIUM SULFURICUM

The sulfate anion is brought closer into understanding of its actions when one considers it in the well-studied sodium compound.

INTESTINAL ACTIONS

Natrium sulfuricum, Sal mirabile "Glauberi," because Glauber discovered it in the year 1658, belongs to the saline purgatives or salts. They are characterized by their difficult absorbability from the intestinal canal in spite of good solubility in water. Absorbability goes hand in hand with capacity for diffusion and the diffusion velocity again depends upon the grade of dissociation. The salts with multi-valent anions (as sul-

fates, citrates, tartrates) dissociate less than those with univalent anions (as chlorides, bromides, iodides, and nitrates. With this is explained the slight absorption of sulfates.

If in purgative salts it is merely concerned with an osmotic attraction of water out of the blood into the intestine (as Liebig assumed), then osmotically equivalent amounts of various salts should unfold the same purgative action. But this has been contradicted by Aubert.[196] The peculiarity of the saline purgatives physico-chemically comes into expression in that their anions, as sulfates, stand at the end of the so-called lyotropic series according to Hofmeister. With increased capacity for precipitating proteins, the anions can be arranged as follows: $SCN < NO_3 < Br < Cl <$ acetate $<$ citrate, tartrate and sulfate. This series corresponds to a decrease in the swelling activity on gelatin. (The lyotropic series for cations has been previously mentioned in the discussion of the alkalies.) As a basis for the variable influence on swelling and precipitation through anions, Hofmeister[197] has considered the different capacity for attraction of water of the anions. Accordingly, water would be withdrawn from the protein bodies in an increasing extent according to the lyotropic anion series. Whether an alteration of the intestinal mucosa accompanies increasing capacity for protein precipitation and is responsible for the defective absorption is still not decided. Possibly it is also of significance that the anions of the poorly absorbable salts, also the sulfates, form insoluble or poorly soluble salts with calcium to which Wallace and Cushny have drawn attention.[198] The combination of de-ionization of calcium ions through sulfates can be invoked for many actions, as has been done by J. Loeb. Similar ideas have also been offered for the phosphate anion (and the other calcium-precipitating anions).

In the middle point of discussions on the action of sodium sulfate stands the *purgative action.* Symptomatic for it, as with all salines, is much rumbling in the abdomen, flatulence, and the thin or watery *evacuations accompanied by much flatulence.* If the salt is taken at the same time as much fluid, then the evacua-

tion of a stool soon follows, but if taken with no or very little water, then the result occurs much later.

For the purgative action of the poorly absorbable salts, the liquefaction and increase of intestinal content is the essential factor; the action on peristalsis is of subordinate significance, and in any case is released secondarily through the increased mass. The emptying from the stomach is even delayed. The increase in fluid occurs in the stomach where the resorption is even slighter than in the intestine. Many experiments have been arranged to determine whether the increase of fluid in the intestine depends upon transudation out of the blood into the intestine according to simple osmotic rules or whether an increased secretion of the glands occurs and this increased secretion is to be traced to the poorly soluble salts. It is now assumed as certain that *an increased secretion* occurs.

Apart from the composition of the intestinal fluid, a finding of Loewy[199] speaks for this, namely, that in the action of saline purges the energy transformation increases, indeed in a manner which cannot be traced to the slight influence on peristalsis. It is important that the purgative action does not occur if the water supply of the organism is too slight (in consequence to previous thirst or intravenous injections of hypertonic salt solution).

For the purgative effect, indeed, a small dose is necessary, but, beyond this, the amount of salt introduced has no decisive significance for the purgative action, nor does the concentration; because, if a hypotonic Na_2SO_4 solution is introduced, so also for the preservation of isotonia, outside of water, salts such as sodium chloride are passed out of the blood into the intestinal lumen. The poor absorption, the characteristic basis for purgative effect, still exists in a hypotonic as well as hypertonic solution of such a salt.

Nevertheless, a slight resorption of the salt still oc-

curs from the intestine. This is dependent upon the duration of sojourn in the intestine. In the usual purgative action the passage through the intestine occurs too rapidly to permit any considerable resorptive actions to occur. But much more is absorbed when only small amounts are administered with little water, so that no purgative action can appear. From the resorbed or intravenously administered salt one can no longer expect *a priori* a purgative effect, at least not according to the enteral mechanism. On the contrary, it is to be considered that then the solution water would be drawn out of the intestine into the blood and that a water deprivation of the intestine would occur. Actually the formerly frequently reported purgative action after parenteral introduction is contradicted through many observations, particularly since one has even reported constipation. This also shows again how important the site of the influence is for the effect, and the "inner" or "outer" use of the same agent can condition contrary deviations from the normal.

The influence of sodium sulfate (or magnesium sulfate) on peristalsis in any case is secondary. According to Baur,[200] after a brief increase of contractions with mild increase of tonus there follows a long depression period which in strong solution approaches standstill. Also Frank[201] saw by direct observation in the opened abdomen of the dog, after oral doses of sodium sulfate solutions, no increase in peristalsis. On the contrary, after intravenous injections, very brief antiperistaltic movements occurred. Also in respect to peristalsis seems the "inner" or "outer" application to act antagonistically on the intestine.

According to MacCallum,[202] defecation is obtained only through repeated injections of small amounts of sodium sulfate and also only through repeated use of brief peristaltic influence. The chief rôle in accelerating peristalsis through saline purgatives in any case is ascribed to the excitation through increased intestinal content and indeed it follows single backward waves. Possibly the precipitation or de-ionization of calcium is the basis

for the increase of excitability of the intestine, as Loeb[203] and MacCallum[202] have assumed.

The discharge of bile into the duodenum is increased by sodium sulfate solutions. This depends probably for the most part on a relaxation of the sphincter of Oddi, but in a slighter degree also on an increase of bile production; however, this is weaker than that provoked through natr. carb.

RELATION TO WATER ECONOMY

Natrium sulfuricum, since v. Grauvogl's time, holds in homeopathy as a preferred remedy for the hydrogenoid constitution. From the start a great sensitivity to water in any form, and an excessive accumulation of water, particularly a hydremia, would be brought into connection with this state. A lability of water economy can be understood to some extent for sodium salts and particularly for sodium sulfuricum. As remedies for the hydrogenoid constitution in the first line of the inorganic stand the sodium compounds, natr. carb., natr. nitr., and natr. sulf.

After oral doses of the poorly absorbed salts as sodium sulfate, at first comes a thickening of the blood in consequence to the marked water withdrawal so that there is an increase in the hemoglobin. Presumed here is that a deprivation of water has not previously occurred, and that the salt is given without or with only a little water. The immediate thickening of the blood through the withdrawal of water toward the intestine soon diminishes. But after about twelve hours a somewhat weaker blood thickening occurs of longer duration. For this the influence of the salt resorbed into the blood is made responsible. In spite of poor resorption, after some time the salt obtains a concentration in the blood which releases an increased diuresis. Now sodium sulfate is a foreign substance which is pressed for excretion. As long as it is present in increased amounts in the blood, and this lasts longer with a poorly diffusible salt in iso- or hypotonic solutions, a hydremia must be assumed. With the

excretion through the kidneys it takes water with it, and it is thereby striking that it does not belong to the swelling materials and also is not resorbed through the tubules, as perhaps sodium chloride, when the threshold in the blood is exceeded. *The water withdrawal toward the urine* with sodium sulfuricum is also *final.* The sodium sulfate diuresis differs from that of sodium chloride also in that it is bound with active work of the kidney. Barcroft and Straub[203a] found that the sulfate diuresis, in contrast to the sodium chloride diuresis, is associated with an increased oxygen utilization of the kidney.

The crude withdrawal of water to the intestine with thickening of the blood cannot be drawn into consideration as a nonresorptive action for the hydrogenoid character of the remedy. A definite absorption appears only when the amounts of salt introduced are so small that they cannot produce a purgative effect. We can assume that, through potentization, the absorption capacity and, with this, the ability for resorptive action can be definitely facilitated. This manner of introduction would therefore correspond more with a direct introduction into the blood. So the hydremic plethora as well as the subsequent diuresis must *ceteris paribus* be more significant and persistent with sodium sulfuricum than with sodium chloride.

DIABETES

To sodium sulfate a special suitability for *diabetes* has been ascribed in homeopathy. Now this has apparently a crude external justification in that sugar may appear in the urine in the sodium sulfate diuresis. But this is also the case in the diuresis with many other salts; indeed, one knows a sodium chloride glycosuria which likewise depends upon a hyperglycemia. Whether perhaps with natr. sulf. some still dark connection to the liver conditions a favored action on carbohydrate metabolism must be left undecided for the present.

BLOOD COAGULATION

Among the clinical reports in natr. sulf. in homeopathy are found (similarly as with natr. nitr., where it is supported by provings on the healthy) influences on the coagulation of blood, in particular in hemophilia. Reverdin[203b] has seen a coagulating effect after small doses of natr. sulf. (0.1 g. hourly). This has been brought into connection with the blood-thickening action, though, with such small doses and such momentary action, how rightly is more than doubtful. Moreover, as regards the use of sodium chloride as a hemostatic in hemoptysis, one might wonder if this is concerned with a general salt action. But it is remarkable that, in the test tube, natr. sulf. acts *depressing* on coagulation; indeed, in consequence to calcium deionization it is often used with natrium citratum for the removal of coagulation.

SCHÜSSLER'S INDICATIONS

Schüssler has taken over his indications for natr. sulf. from v. Grauvogl entirely and together with the defects. Among the latter I count the coupling with sycosis of Hahnemann and the hydrogenoid constitution and also acute gonorrhea, furthermore the inclusion of leukemia in the hydrogenoid constitution. Schüssler has reported natr. sulf. as a remedy for leukemia and, though on another basis, still just as unmaintainable. According to him, natr. sulf. should withdraw water from the leukocytes and so effect their destruction. Moreover, Schüssler perceives natr. sulf. as a stimulus agent and regulator for the secretion of the urinary passages, the biliary passages, the pancreas and the intestine. This seems justified up to a certain extent. But one cannot well speak of this end-product

and excretory substance as a necessary tissue salt. With some right Schüssler has seen a contrast between NaCl and Na_2SO_4 when he believes that NaCl regulates water for the functions of the organism and, on the contrary, Na_2SO_4 promotes the excretion of used water toward the exterior. At least one can again find the contrast between the renal threshold substance, NaCl, and the non-threshold substance Na_2SO_4, in broad directions. Schüssler perceives hydremia as a result of a failure of natrium sulf.

THE DRUG PICTURE OF NATR. SULF.

Provings of natrium sulfuricum are found in:

(1) Hartlaub and Trinks: *Annalen f. hom. Klin.*, Bd. 3, 1832; Bd. 4, 1833.

(2) Crosseria: *Arch. f. hom. Heilk.*, Bd. 16, p. 164.

(3) Lembke: *Neue Ztschr. f. hom. Klin.*, Bd. 11, pp. 97, 105, 113.

Natrium sulfuricum holds as the chief agent for the *hydrogenoid constitution.* In many provings (for example, of Lembke) the aggravation from damp, wet weather, *etc.*, naturally did not appear. But it has proven itself many times. There also exists chilliness; the patient cannot become warm in bed at night. On the contrary, the inclusion of so-called sycosis with wart formation and leukemia can scarcely be maintained. If in gonorrheal rheumatism, which is also ascribed to sycosis, at times good results are obtained, then too the joint pains from the provings offer a certain point of departure for this; but more important than the etiology is the modality worse from damp and wet weather.

To the hydrogenoid constitution also belong periodically appearing complaints. So natr. sulf. has ac-

quired a reputation in chronic malaria. In moist skin eruptions the periodic recurrence each spring should suggest natr. sulf.

Brought into association with the hydrogenoid constitution is the clinical indication of *bronchial asthma*, particularly when morning diarrhea gives a further indication; dyspnea in foggy weather, each new chilling provokes an attack of asthma. Particularly the moist asthma with râles and childhood asthma should be suitable for natr. sulf. On coughing the patient must hold his chest; the cough compels him to raise up in bed. The sputum is said to be thin and greenish. Schüssler has asserted that all secretions are yellow-green in color, and so too the leukorrhea after female gonorrhea.

But natr. sulf. has also an empirically founded reputation in another constitutional domain, in metabolic disturbances from which the triad, obesity, diabetes and gout, remove themselves. A stronger influence on the liver, the great chemical workshop, is attached to natr. sulf. For the excitation of bile preparation and excretion some experimental evidence is available. Naturally, the subjective symptoms, as sensitiveness of the liver region on contact, sticking and tension in the depth of the liver region, worse from pressure and from lying on the left side, can support this affinity only slightly. The disturbances of secretion in the upper intestinal segments, particularly in the duodenum, add themselves for the explanation of medicinal effectiveness in the so-called bilious states with the accompanying headache and migraine as well as inflammatory processes in the biliary passages with icterus. But likewise other functions of the liver and perhaps also of the pancreas seem to be under the influence of natr. sulf. even if a certain basis fails at present. The oft-

repeated recommendation in diabetes, in any case, should not be entirely lost from sight.

Apart from the bilious digestive disturbances to which a bitter taste and a dirty-gray-green or brown coating of the tongue belong, are found many symptoms in agreement with the acid dyspepsia of natr. carb. and natr. phos. The disposition, melancholia with the symptom, music makes him sad, recalls natr. carb. The disposition seems to be dependent upon the digestive disturbances, because, after the evacuation of stool, the cloudy frame of mind should clear up.

Best founded and confirmed through experience are the intestinal actions of natr. sulf.: drawing pains about the umbilicus with flatulence, painful collections of gas, noises throughout the intestine with sudden pinching, then diarrhea with very offensive flatus. Often the stools are said to smell strongly of H_2S. (That a reduction of sulfate occurs in the intestine is, however, excluded.) Lippe has characterized the natr. sulf. diarrhea in the following manner: diarrhea *worse early morning*, first flatulent colic, then yellow watery stools mixed with small clumps of feces, coming in gushes. With each stool is a *marked evacuation of gas.*

Many paroxysmal pains in the extremities and joints are reported, particularly in the left hip-joint, and movement is said to relieve; damp weather aggravates.

Lacking any connection an irritative state of the meninges after head injuries is reported in natr. sulf.

SUMMARY

Constitution:

Hydrogenoid

(Asthma, chron. malaria, spring eruptions, rheumatism)

Chief Trends:

Metabolic disturbances from the liver with bilious states, inflammation of the biliary passages and the duodenum

Diabetes

Morning diarrhea, massive, with much flatus

Modalities:

Worse from wet, damp weather

Worse early morning (diarrhea)

Worse from music (melancholia)

(Pains in extremities better by movement)

DOSE

Usually in the low and middle potencies, mostly the 6th decimal.

KALIUM SULFURICUM

For potassium sulfuricum there is no homeopathic drug picture because no provings on the healthy have been arranged. So far as it is practically employed, this happens from the reports of Schüssler. How easily Schüssler makes it a tissue salt and a remedy may be seen in the first edition of his *Abgekürsten Therapie.* There he states on kalium sulf.: "In order to find the indications of this remedy, I compared the pathogenesis of sulfur with that of kali carbonicum and the symptoms which agreed I considered as those corresponding to kali sulfuricum." A typical combination of two homeopathic drug pictures to form a third unity is entirely arbitrary, indeed, meaningless, and the further equalization of sulfur and sulfates given as the presumption of Schüssler becomes entirely erroneous.

With what right does Schüssler see kali sulf. as an

important tissue salt for function? Indeed, with none. In any case it is not even known today that the sulfate compound of potassium exerts any necessary function in the human organism. Kali sulf., moreover, outside of sodium sulfate and the earthy alkali sulfates, participates in the excretion of the sulfate anion. But the functioning form of potassium is not the sulfate, but primarily the phosphate and the carbonate. But has it a meaning, can it equalize a potassium sulfate deficit therapeutically? Kali sulf. is an excretory material for plants, because it can withdraw from it the potassium which is so important for them, but it is not a tissue or functional remedy for the animal organism. The theory which Schüssler has devised for the physiologic rôle of kalium sulf., likewise appears arbitrary. On the one side it should be found in the epithelial cells of the skin and mucous membranes, and a deficiency of potassium sulfate should depress the new formation of epithelial cells; therefore the dead cells rest as a desquamation on the skin. For this reason desquamating skin processes and the desquamation after infectious diseases are cited as indications. Furthermore, kali sulf. should be found everywhere where the cells contain iron, and it is supposed to participate in oxidations. A series of general symptoms, together with desquamation of the skin and catarrh of the mucous membranes with yellow secretion, is by him brought into connection with this defective oxidation in a purely arbitrary manner. Even if the theoretic foundation is erroneous, still observations on the skin and mucous membranes have furnished a foundation *ab usu in morbis*. However, a very large number of observations of unprejudiced cures on these indications would be necessary and nowhere one finds such material which has

been critically sifted. The same holds for the modalities given for kali sulf.: improvement in the open air and through prolonged movement, worse from warmth and at evening. The thick yellow secretion together with the fluctuating pains and a sad but not anxious frame of mind have led to the designation of kali sulf. as "biochemic" pulsatilla. Apparently worthy of mention is the clinical report: premature mucous râles in the chest, that is, those which appear before other symptoms. For this the potassium fraction might be responsible.

Some older poisonings with larger doses of kali sulf. *per os* show the locally conditioned, gastro-intestinal manifestations: burning, heat in the mouth, stomach and abdomen, nausea and vomiting, diarrhea, and further, cramplike manifestations in the face and in the extremities. Lewin[204] mentions painful burning in the esophagus, twelve evacuations of the stool in two and one-half hours, thirst, frequent vomiting, paralytic weakness of the extremities, smallness of the pulse, coldness of the extremities; later, collapse and brief convulsions accompanied by loss of consciousness. Only after ten days was the locomotor capacity of the legs again normal. This symptom of paralytic-like weakness is interesting in respect to the potassium fraction. According to Lewin there is only one case of chronic poisoning with kali sulf. A man took four grams daily over ten months and died. There was a cirrhosis of the liver and ascites. From this one case no conclusion as to an organ relation can be drawn.

Finer observations on the actions of kalium sulfuricum on the organism are still missing and it is wrong to substitute them by phantasies or assemblage of disease manifestations in which kalium sulf. should be employed with more or less success.

SELENIUM

In nature selenium appears to accompany sulfur. In some rare minerals (zorgit) it is united with heavy metals. Single modifications of the element correspond completely with those of sulfur: the amorphous state as a light red powder which also can be converted into a crystalline and colloidal form. Moreover, there are (corresponding to its higher atomic weight in comparison to sulphur) also metallic modifications: gray-black crystals which form at 150° and have great stability.

The metallic modification is not uniform. It consists of two forms, A and B in equilibrium. Shifting this equilibrium under the influence of light favors the B-form which conducts an electric current much better. On this depends the use of selenium in electric technic as the so-called electric eye and telephotography. The reduction of electric resistance through insertion of a selenium cell into a suitably adapted circuit is used to release an electric current through light.

In the homeopathic drug provings and correspondingly also in therapy, the sulfurlike, amorphous modification has been used. It would be important to subject the so sensitive metallic modification to a special proving if one would approach the selenium characteristics more closely.

The compounds of selenium are similar to those of sulfur, but much more unstable. The element itself is considered in school pharmacology as nontoxic.

By Gassmann[xx] traces of selenium (and tellurium) have been

proven as oxalate compounds of selenium dioxide in the bones and teeth. The asserted non-toxicity of colloidal selenium by Duhamel and Rabière[206] does not hold for intravenous injections, because Philippi[207] saw chills and spasms after intravenous injection of electroselen into men. Achard and Ramond[208] describe alterations of the blood and blood-forming organs after the injection of colloidal selenium. According to Meissner,[209] the inflammatory phenomena which SeH_2 provokes at the site of injection are perhaps to be ascribed to metallic selenium deposited in the tissues. The excretion of selenium occurs as selenium methylate ($Se(CH_3)_2$) which confers on the expired air (just as does the methyl compound of tellurium) a garlic-like odor.[210]

The pharmacologic-toxicologic reports refer in general to steps of oxidation of selenium, or of selenous and selenic acid or their salts, and are not utilizable for the characteristic action of selenium without further discussion.

Natr. selenosum causes[211] in frogs a central narcosis with gradual cessation of respiration and reflexes, and cardiac standstill in diastole. Warm blooded animals are at first anxious and fearful; in the dog we find, following vomiting and diarrhea, increasing somnolence, irregular breathing, lessening of reflexes, clonic contractions, extensor spasms, and finally respiratory standstill. The falling of blood pressure is partly through cardiac paralysis, partly through depression of the splanchnics as well as inflammatory hemorrhagic findings in the bowel, which markedly recalls the behavior of arsenic. This is not sufficient to place selenic acid too close to arsenic pharmacologically as has often happened (for example by Kobert). Selenites are essentially more toxic than selenates. A. Philippi[212] describes a chronic intoxication with selenites and selenates. It was characterized by anuria and lasting glycosuria with selenates, while selenites should cause only mild, transient manifestations.

According to Modica,[213] selenium should produce protoplasmic destruction and increase of nitrogen, sulfur, phosphorus and chloride excretion. The action on carbohydrate metabolism, interesting because of selenate glycosuria, has been studied by Jones.[214]

For a long time selenium compounds were much studied in the treatment of carcinoma because Wassermann had employed organic selenium compounds, as eosin-selenium, with result in mouse tumors. A practical significance has not been attained by this study. With electroselen, that is, colloidal selenium, an improvement of the general state, increase of the appetite and body weight, is said to be obtained. Kranz-Busch[215] sees therein with right a homeopathic involuntaria, since the weak condition is the essential indication for selenium.

THE DRUG PICTURE

The homeopathic drug picture of selenium is supported essentially by the provings of C. Hering[216] and Schreter.[217] The actions determined show a distinct similarity with those of sulfur. This can serve as an indirect proof of the utility of selenium symptoms, since the chemical group affinity of selenium and sulfur was not known to provers.

There are first the *general manifestations of a neurasthenic type*: weakness, exhaustion of bodily and mental effort; benumbed head; pulsation in all parts of the body, especially the abdomen, for days, great tendency to lie down and to sleep; at night, light sleep (catnaps). Aggravation after sleep is a modality of selenium which exists in sulfur as aggravation after extraordinarily long-continued sleep. Moreover, in selenium the great forgetfulness is striking; thereby the recollection of the forgotten should occur in semi-sleep. The entire symptomatology of exhaustion is said to be particularly *worse in hot weather* and to be better when the sun has set.

Even more definite than with sulfur are the *states of weakness in the male sexual system.* It is this indication which usually leads to the choice of selenium. In phantasy there exists a sexual irritability, but still there is a physical impotency: frequent involuntary seminal emissions without erections; or slow and weak erections; ejaculatio praecox; also prostatorrhea. Frequently observed is an unpleasant *sensation of drops which roll along the urethra,* due to a prostatorrhea but also to an after-dropping of urine or to an inflammatory state of the urethra as in chronic gonorrhea. This dropping sensation is observed particularly on walking and after evacuation of the bladder or bowel. The nocturnal polyuria which is important for sulfur should also be noted here. Residual states of chronic gonorrhea to which are joined neurasthenic symptoms are given as indications for selenium.

The sulfur-like affinity for the *skin* comes definitely to expression in the selenium provings. However, up to the present they have not obtained great clinical significance. Subjectively the provings report itching of the skin and biting in various places, particularly on the surfaces of the hands, soles of feet, around the knuckles and between the fingers; objectively small eruptions and vesicles as well as *greasy facies and falling out of hair.* A proven indication for selenium is *acne in the greasy (seborrheic) skin.* Many sensations of heat in the skin, and sweats, are worthy of mention in analogy to sulfur and tellurium.

The effects on the digestive organs in selenium are much less expressed than with sulfur. Hunger at unusual times, as at night, or morning loss of appetite and white-coated tongue, *unusual desire for alcohol* (at

first desire for salt, later aversion to it), tendency to constipation with hard stools, difficult to evacuate, are symptoms which up to the present have been utilized but little. The aggravation from alcohol and tea, in contradistinction to the desires, does not seem sufficiently established as yet.

As more definite than with sulfur the *laryngeal manifestations* are to be emphasized. Perhaps the local inflammatory manifestations from selenium can be used for explanation, as Meissner has conjectured the effect as a deposit of metallic selenium in the tissues after a reduction of SeH_2. "Increasing huskiness at the beginning of singing" has given occasion for the use of selenium in the *hoarseness of singers and speakers.* Moreover, a cough with the expectoration of blood-stained clumps of mucus has been observed, and consequently tuberculous laryngitis has been given as an indication for selenium. Coryza with loss of smell is observed; sudden development and disappearance of the coryza, at the basis of which a state of nervous excitation may lie, is mentioned but once.

Above all, new provings with metallic selenium and increased therapeutic utilization must go hand in hand in order to make selenium indications more precise in the future.

SUMMARY

Chief Trends:

Neurasthenic weakness, especially sexual; impotence; chronic gonorrhea

Skin: seborrhea (acne)

Larynx: hoarseness of singers (also tuberculous laryngitis?)

Special Symptoms:

Drop sensation along the urethra
Desire for alcohol which is badly borne
Worse in hot weather

DOSE

Usually the 6th decimal; in nervous complaints the D 30 is also recommended.

TELLURIUM

Tellurium is found mostly in combination with the heavy metals, as bismuth, silver, gold. Since even slight traces of tellurium in the body by change into $(CH_3)_2$ give rise to a very intensive persistent garlic-like odor,[218] one understands that bismuth paste, as a contrast medium for x-rays, and gold for dentistry must be tellurium-free.

Externally, tellurium has entirely a metallic character. It appears as an amorphous black substance and as a crystalline metal with a silver-like sheen. Its chemical compounds behave entirely like those of selenium but are even less stable than these.

In school therapy, tellurium is limited to rare use in the form of potassium tellurate (K_2TeO_4) as an antihydrotic, particularly in the tuberculous and for foot sweats. To this it may be added here that C. Hering in his proving of six weeks' duration noticed a foot sweat which was somewhat offensive and that Metcalf reported a general warm vapor over the entire body and that Wohler and Bunsen in their work with tellurium compounds reported very unpleasant and offensive sweats which compelled Bunsen to remove himself from company for four weeks. Kranz-Busch[219] is accordingly correct when he perceives the use of telluric acid salts as homeopathic involuntaria.

The element tellurium is considered nontoxic in pharmacology

just as is selenium, and in traces, like selenium, has been found, according to Gassmann (*l.c.*), in bones and teeth. The poisonous action of tellurites and tellurates in animal investigation was first undertaken by Gmelin and is said to correspond entirely with selenites and selenates.[220] With tellurites somnolence appears; in cats and dogs diarrhea, paralysis, respiratory paralysis and cardiac standstill in diastole; a fibrillary muscle twitching is observed, however no spasms (as in selenium).

At autopsy in the cold-blooded, a gray discoloration of the organs is described; in the warm-blooded, a black-violet. It depends upon the deposit of reduced metallic elementary tellurium. L. Beyer[221] found that tellurium is deposited in the nuclei of ganglia, liver, pancreas, rennet-, urinary tubule-, sarcolemma-, lymph- and bone-marrow cells. Telluric acid is reduced in the organism to metallic tellurium, deposited in this form and then converted into metallic telluride.

THE DRUG PICTURE

From the homeopathic side, metallic tellurium has been proven by Metcalf[222] and C. Hering and Dunham.[223]

The skin manifestations are the most outstanding in the provings. Repeatedly and persistently a sticking and prickling feeling as from flea-bites appears, then an eruption like herpes circinatus with annoying itching, which on scratching goes over into pain; furthermore, itching papules on an inflammatory basis which dry after several days and form small white scales. The papular and vesicular eruptions itch very severely, worse at night on going to bed. Likewise the well-known ear symptoms which have given occasion for the employment of tellurium in otitis media when *the discharge smells like herring brine* (trimethylamine) are characteristic skin symptoms on the external ear if one reads the provings carefully: "The ear began to itch, to burn, and to smell; in the external auditory canal appeared a

heavy pain and later a watery discharge from the ear which smelled like herring brine and was acrid; and a vesicular eruption appeared on the auricle, the neck and every place on which the discharge fell. The ear was colored a bluish-red and looked as if infiltrated with water." This picture of a "toxic" vesicular skin inflammation does not apply characteristically to the indication of otitis media with a peculiar-smelling ear discharge. Kranz-Busch (*l.c.*) cites a case history of otitis media which, however, is not entirely convincing. My therapeutic attempt in this direction in single cases of otitis was without results.

Most important in tellurium remains the sulfur-like skin affinity which perhaps later will attain greater significance and exact limitation. The *vesicular formation*, the ring-like configuration, the acridity, the strong odor, can lead further. Whether causally a different type of herpes zoster which in older literature was confused with other forms of herpetic eruptions because of its shape also belongs to the working domain of tellurium, is at least doubtful. The above-mentioned action on the secretion of *sweat* may be ascribed to the skin action.

As a second, less used trend, mentioned only because of the similarity with selenium, is in the flow of coryza with huskiness and lachrymation in the provings, but up to the present it has not attained clinical significance.

A third trend appears to be characteristically expressed in tellurium. Pains in the sacrum are reported; in two provers, pains extending along the course of the right sciatic nerve. This sciatica is much worse from coughing, laughing, effort (bending), from pressure at the time of stool evacuation; better on walking. Another symptom seems to stand in connection

with this neuralgia. This is sensitivity of the vertebra (from the last cervical to the 5th dorsal) with desire to avoid contact on this region. The sensitivity radiates in all directions.

The general manifestations as forgetfulness, vertigo, disturbances of sleep, headache, do not seem to have the significance as in sulfur and selenium. Of the headache the site over the left eye limited to a small circumscribed spot is often mentioned. Symptoms of weakness were less striking than in sulfur and selenium. A certain unrest in the vascular system with sudden rushes to the head and reddening of the face recall sulfur.

SUMMARY

Chief Trends:

Skin: sweat offensive; discharge (from ear) smelling like herring brine

Vesicular eruption

(Neuralgias: sciatica? Sensitivity of the upper vertebra?)

DOSE

Usually D 6 (trituration).

5. THE NITROGEN GROUP V

This group is named after the first member of its group, nitrogen, but as in all the chief groups, here the element with the lowest ordinal number is the least characteristic of the group, because, as an element, nitrogen, in contrast to phosphorus and arsenic, is quite inert and its H as well as O compounds differ considerably from the other elements of the group. The H compounds of nitrogen, ammonia and its salts, do not come into consideration in comparison as drugs with the usual compounds of the other elements of this group, and they have already been discussed with the alkalies. The remaining elements of group V unfold their actions in or on the organism, especially in the various stages of oxidation. And if one compares the already oxidized compounds of nitrogen with the usual compounds of phosphorus and arsenic which are employed as drugs, then the group relationships will become more distinct. The actions on the vascular system, in particular on the capillaries, which give the essential note to the members of this group, naturally vary considerably in degree. And with the increase of metallic character of the elements with increasing atomic weight, the action sphere in this group narrows itself evermore in an organotropic sense. Nevertheless, in the transition of medicinal preparations in the series from nitrogen, N, to phosphorus, P, Arsenic, As, antimony or stibium, Sb, to bismuth, Bi, the red line can be easily followed

which also traces out the group affinities of these elements.

NITRITES AND NITRATES

The point of departure in a pharmacologic consideration of nitrites and nitrates is the action on the vessels and blood pressure. It is not only the NO_2 or better O.NO anion, the inorganic salts and organic esters of *nitrous acid,* but also a number of organic esters of *nitric acid,* as nitroglycerin, whose manner of action is characteristic. Also the inorganic nitrates, potassium and sodium nitrate, still work in the same sense so that one might assume a reduction to nitrites in the organism. Such a reduction by micro-organisms is well known; anaerobic micro-organisms have the capacity for obtaining oxygen out of nitrates; the plants use nitrates for the building of protein, NH_2 compounds, and here also a reduction must occur. It is important that the pharmacologic action of nitrates or nitrites appears only in the true salts or esters, that is, the nitrogen as an alkali metal or an organic radical through the intermediation of oxygen; in other words, it must be inorganically bound; moreover, it must be as O.NO. In the nitro-bodies in which the nitrogen is bound directly, that is organically to the radical, the characteristic action is practically absent.

AMYL NITRITE

Best investigated experimentally of the nitrites is amyl nitrite; of the nitrates, nitroglycerin, the *glonoin,* of the homeopathic materia medica. Even if amyl nitrite $C_5H_{11}.O.N.O$ is used only a little in homeopathy, still one approaches nitrite action advantageously from it, because it has been studied the best.

The transient alleviation which amyl nitrite as well as nitroglycerin gives in angina pectoris through widening of the coronary vessels is generally known. For homeopathy it is interesting as the first fact that the inhalation of vapors of only a few drops of amyl nitrite can produce very definite symptoms. The amount, certainly very slight, becomes effective with the mucous membranes of the respiratory organs acting as the portal of entry, and it is indeed exactly the great dispersion which favors this. The possibility that, by fine division, still other materials could be effective in this way, Hahnemann's olfaction of the high potency, is not rejected without further consideration.

The second fact of decided interest is the particular relation of nitrites to the upper part of the body. If we find so frequently in homeopathic literature reports —acts from above down or from left to right—then at first this seems absurd, but observation teaches it and requires explanation. And one so observed selection of a body region that appears free from objection occurs with amyl nitrite.

The immediate action on inspiration of the vapors of a few drops of amyl nitrite is the feeling of warmth in the head and neck, usually a feeling of fulness and heaviness of the head; the arteries pulsate, vertigo and severe headache often appear. Face, head and neck are reddened; usually this reddening is limited to the head, neck and chest; only rarely does it reach the back or extend to the arms. The lower extremities are not involved in the widening of the blood vessels. The pulse becomes distinctly accelerated, often irregular. It is striking that in other cases the previously irregular pulse becomes regular. Therein one sees that a reversal of symptomatic effect of drug action can also

lie simply in the diversity of the conditions, in the previously balanced or imbalanced state of the organism, and that it is not always the difference in dose which is responsible for such a reversal of the end-result.

Severe toxic manifestations are represented by a type of intoxication with loquacity, at times nausea and vomiting, fainting and collapse; moreover, one will observe after marked and longer inhalations, indistinct vision or yellow vision, muscle twitching, local or general outbreak of sweat. According to Pick,[227] after a full dose of amyl nitrite objects appeared of a yellow color with a blue-violet halo surrounded with wavy borders.

The blood-vessel actions of the nitrites are the most important. They manifest themselves in widening of definite vascular fields, rapid sinking of the systolic and diastolic blood pressure, and acceleration of the pulse. The action occurs very rapidly (in a few seconds) after the inhalation, but has soon disappeared (after a few minutes). In men of middle age the action is more marked than in the very young and very old.

The fall in blood pressure, according to experimental results, is certainly to be ascribed to blood-vessel widening and not to an action upon the heart. An action immediately upon the vessels is established, but, in spite of a large number of refined pharmacologic experiments, it is still debated (between Brunton and others on the one side and Filehne on the other side) whether the action of nitrites on the vessel is purely peripheral or also partly conditioned through central depression of the vasoconstrictors. For the participation of the centrum speaks an observation of Darwin

that under nitrites exactly those parts are reddened which are also reddened by the feeling of shame—a therapeutic indication, perhaps, for this symptom, if it is annoying through an excess. The numerous animal experiments, on the contrary, speak for a pure peripheral action on the vessel wall.

That many questions remained unsolved in this respect is shown by animal experiment when, after compression of the carotid, amyl nitrite is injected into the cranial end (the amyl nitrite in salt solution), it thereby effects an *increase* in blood pressure.[228] Whether the peripheral-vessel action is exerted on the musculature or upon the nerve endings lying in it is still not determined.

Besides the ever again demonstrated vessel widening, the old observation of Gaspeys[229] serves to show that bleeding from injured arteries begins again when amyl nitrite is administered. According to Lisin[230] a wound of the intestine or the lip would bleed less by virtue of the lowering of blood pressure, but when the pressure returned to normal, the bleeding would be greater than before.

According to experiments of D. L. Brunton,[231] the acceleration of cardiac action depends upon lessened activity of the vagus center; according to Dossin,[232] however, also upon stimulation of the nervi accelerantes. In any case this action, at least partly, is the result of fall of pressure as in anemia and also an attempt at balance. As the tonus of the vagus center is greater during middle age, so the acceleration of the pulse in middle life is more marked in comparison to youth and to old age. But by single authors a direct action upon the heart is assured outside of central effects. Moreover, by inhalation of amyl nitrite a slowing of the heart is also observed through a reflex action on the respiratory passages.[233] Outside of the acceleration of rhythm, still further proof of increased activity of the heart can be observed, as for example increased capacity of conduction[234] and heightened contractility.[235] The final weakening and paresis of the mammalian heart through enormous amounts can as well be a direct action as a result of asphyxia in consequence to alteration of the blood (methemoglobin formation). (The influence on respiration consists of

irregularity at first after inhalation, this being a reflex irritant effect, also mild slowing at the beginning; but on repeated inhalation, stronger acceleration follows the initial slowing, perhaps as action upon the vagus endings or upon the respiratory center, the acceleration like the cardiac increase probably being a compensatory attempt in consequence to the low blood pressure.)

The vessel widening of the upper part of the body is associated with an increase of the skin temperature[236] and an increase of heat radiation.[237] Consequently the internal temperature falls. In normal rabbits the decrease in body temperature is only slight. But when the temperature is made febrile by heat puncture, then amyl nitrite evokes a very distinct decrease.[238] Here we have the same demonstration as with the antipyretics with central action, that the fall in temperature first comes distinctly to expression in disturbed temperature equilibrium.

To use the nitrites as antipyretics, where the radiation from the skin (without central involvement) is also desired, has experimental support. The increase of temperature of the body surfaces determines this relationship according to the simile rule. Another is also the methodic indication from the symptoms to the therapeutic result; another, the possibility of explanation of the demonstrated result. If the direct result is the surest for the prospective way, then the indirect observation of the intermediate processes is necessary or desirable for the retrospective explanation.

In connection with the nitrite headaches (obviously through vessel widening), the yellow vision (often with violet borders) seems to me worthy of note. This is a manifestation by no means rarely observed in migraine. Besides cina, which has this symptom of yellow vision as a very prominent one, a nitrite (or nitrate) is to be considered in those cases with this symptom.

Moreover, the action on the eye has been experimentally dem-

onstrated. Filehne[239] found in the frog eye the visual purple supply accumulated by a sojourn in the dark was not altered through nitrite poisoning. But the replacement of the visual red used by light is decidedly damaged under the influence of massive poisoning and the material provided is unstable. Atkinson[240] asserts that sodium nitrite in small doses mildly widens the veins as well as the arteries of the retina, while after large doses a distinct narrowing is observed.

The relaxing action of nitrites on smooth muscle is known from the action on vessels but has also been demonstrated experimentally on other parts of organs, naturally not in general on the organs from nitrite inhalations. In this respect the use of nitrites, by inhalation as well as orally, in bronchial asthma depends on relaxation of the smooth muscle of the bronchi. The burning of the well-known Charta nitrata also acts as nitrites which develop from the reduction of nitric acid. However, Trendelenburg[241] found that sodium nitrite in Ringer's solution produces a distinct increase in tonus on the surviving bronchial muscle. Such seeming contradictions are naturally riddles for those who do not take into consideration the method of introduction and the dosage associated with it. The demonstrations above satisfy us that under certain conditions nitrites act as tonus-increasing, under other conditions tonus-decreasing also on the bronchial muscle. The cases of asthma perhaps suitable for such medication will be selected not merely according to the viewpoint of muscle relaxation or constriction, but according to the totality of the immediately observable symptoms, that is, the symptom dependencies (the modalities).

An action of nitrites has been experimentally demonstrated also on voluntary muscle. The direct influence of nitrite vapors on the resting frog muscles provokes a prolonged hard-

ening with transition to rigidity.[242] Leech[243] found that in a solution of NaCl containing sodium nitrite (1:5000) a suspended muscle remained able to contract only for two hours and that amyl nitrite was just as damaging to it.

The end actions of amyl nitrite poisoning have little significance in this place. Chiefly they are the formation of methemoglobinemia with the accompanying glycosuria and asphyxia, with depression, weakness, and lethargy and the lethal ending affected through the blood alterations. Direct toxic actions on the central nervous system as they appear in the frog, as descending paresis, are not observed in mammals and man.

The nitrites of alkali metals ($NaNO_2$ and KNO_2), according to the studies of several investigators in general, are the same as amyl nitrite, only the salts orally are more persistently effective and they act more slowly. In particular the time of development and the duration of the blood-pressure lowering are found to be greater. The headaches in man should be affected more easily than through the nitrite esters, because the circulatory alterations last much longer.

There is usually one impression which one generally gains: the compounds with organic fractions are more volatile than the inorganic compounds in which the action appears more slowly but is maintained longer.

GLONOIN

Nitroglycerin, our glonoin (a shortening of glycerin, O.N.O.) has clinically and experimentally almost the same action as the nitrites, nevertheless it is a nitrate and indeed the trinitrate of glycerin, the most simple of the trivalent alcohols, $CH_2.OH—CH.OH—CH_2.OH$, in that each OH group is replaced by a NO_3 (more exactly $O.NO_2$) group, that is $C_3H_5(NO_3)_3$—(not,

however, the impossible triglyceride of nitric acid, as it has entered homeopathic literature through an error of H. Schulz). The extensive agreement of action with the nitrites is explained in that in the body the nitrites are formed from nitrates.

It has been shown by Hay[214] that nitrites are formed in the blood from nitrates, which gives occasion for the formation of methemoglobin. Even in the test tube through alkali two-thirds of the nitrates are reduced to nitrites. After small doses nitroglycerin appears chiefly in the form of nitrites in the urine, after greater, for the most part unaltered.

To be noted as a minor deviation from the action of amyl nitrite is the feeling of heat in the larynx and in the throat and that the arteries in the neck pulsate especially strong. An exact description of the subjective head symptoms which undoubtedly are connected with the vessel widening are evident from the first American provings by Hering.

Provings of glonoin are found in:

(1) C. Hering: *American Arzneiprufungen*, Bd. 1, 1857 (provings collected since 1847).

(2) Lembke: *Zeitschr. f. hom. Klin.*, Bd. 2, 1853.

(3) Eichhorn: *Zeitschr. d. Ver. hom. Aertze Oesterreichs*, Bd. 2, p. 18, 1857.

(4) Demme: *Schweiz. Zeitschr. f. Heilk.*, Bd. 1, 1862.

(5) *Allg. Hom. Ztg.*, Bd. 63, pp. 119 and 128, 1862; (Wood and Colby, according to the *Brit. Jour. Hom.*, 1861).

(6) Leibinger: *Deutsch. Zeitschr. f. Hom.*, p. 194, 1926.

Soon after the discovery of glonoin in the year 1847 by Sobrere, C. Hering introduced this remedy into medicine. The provers observed: sensation of enlarge-

ment of the head, the chin seemed too long, the neck swollen, pressure in the eyeball, spots and flashes before the eyes, letters of a book became small on reading, well-known streets seemed strange. The headache was severe, there was a feeling of fulness with pulsation; movement, bending back and particularly shaking the head aggravate; mental work is difficult.

The acceleration of the pulse and the lowering of blood pressure occurs (after about 1 mg.) later than after inhalation of amyl nitrite but also lasts considerably longer (2-3 hrs.). If one perfuses nitroglycerin through the vessels of a frog, then, even in a dilution of 1:1 million, it increases the speed of perfusion considerably and one can recover nitrites from the fluid emerging from the veins even after the use of a solution of nitroglycerin 1:100,000.[245] The vessel-dilating action is much more distinct in warm-blooded animals than in the frog.[246] The severe toxic actions in man are nausea and vomiting, later delirium, loss of consciousness and coma.

There is a great individual difference of susceptibility for nitroglycerin and in persistent employment a strong tolerance is established which is soon lost again after discontinuance of the medication.

GLONOIN IN ANGINA PECTORIS

It should now be considered on the basis of the symptoms of the proving whether or not and how far the therapeutic use of nitroglycerin in angina pectoris is homeopathic. Homeopathic authors, for example Dahlke and Stauffer and Bernauer (the last in *Deutsch. Zeitschr. f. Hom.*, H. 3, p. 12, 1926) consider the non-homeopathicity merely on the grounds that large doses, that is, about one milligram, widen the coronary vessels which would be characteristically the opposite of the coronary narrowing in angina pectoris. I cannot recognize this argument as valid because the similarity or nonsimilarity in the homeopathic method refers not

to such intermediary processes and pathologic-anatomic foundations, but to the symptomatic manifestations.

Now we find in the American provings of glonoin: constriction of the chest, restlessness, anxiety. Cardiac palpitation with pulsation in the carotids, unrest in the arms, numbness and fatigue in the left arm; the pulse is felt in the fingertips. One prover describes after one-third of a drop of the saturated alcoholic solution (three doses): "the activity of the heart proceeded laboriously with a peculiar sensation of oppression. I went into the open air and after a short time the severe symptoms diminished and there remained only a feeling of heaviness and an unpleasant sensation about the heart."

From a proving of glonoin in Schwabia,[247] the symptoms of the eleventh prover may be mentioned. Because of their struma parenchymatosa they seem to have a special lability of the cardiovascular system, for they reported they had previously experienced "now and then very obvious cardiac action." After five drops of the third decimal potency, which is also about one-fourth of the smallest dose used clinically under ordinary circumstances, these provers observed ever again: "After three to five minutes: transient feeling of anxiety. Feeling of oppression in the heart briefly, the cardiac pulsation unpleasantly obvious and the pulse seemed fuller, more powerful, not more rapid."

In the sixth prover on the eighth day of the proving with the fourth decimal potency was reported: "About 11 o'clock in the morning cramplike pains in the left biceps on each movement, particularly bending; it ceased immediately on rest; not sensitive to pressure. The pain increased up to noon and about this time passed over to the ulnar side of the arm. Diminished after about two hours and by evening it was only trifling." On the twelfth day: "In the morning about 11, paroxysmally for a few minutes, cramplike, constricting pain in the chest, particularly on inspiration. Coming and going rapidly and lasted in all about one-half an hour."

Such symptoms are, indeed, not an image of a completely developed case of angina pectoris but are still a very extensive approximation in the symptoms. The repeatedly observed pains in the left arm may be compared to the well-known radiation in angina pectoris and may be conceived as a viscero-sensory reflex. That one cannot produce a momentary occlusion of the coronary vessels as in the severely arteriosclerotic vessels, is certain, but still is not decisive for the question of the homeopathic suitability. How does man react to angiospasm and how to glonoin? That is the question; with anxiety, sensation of oppression and cramp and radiating pain in the arm is the answer. And from this is yielded a certain probability under the homeopathic viewpoint that glonoin is of use in angina pectoris; reversely: if glonoin is helpful in angina pectoris, then this is a support of its proving symptoms.

The use of glonoin in angina pectoris would not be homeopathic if it did not support the help of the organism in an attack but suppressed it. Now there is no doubt that in extreme angiospasm the self-regulation tends to vessel-widening and the symptoms are an expression for this and that glonoin supports this regulation in this sense. We must judge always according to observations, the symptoms, not according to ideas of intermediate events.

When further against the homeopathic justification of glonoin in angina pectoris is cited the brief action and the necessity of doses of about one milligram (also the 2–3 decimal potency), so this too is not valid. Glonoin is also a short and rapidly acting remedy, and so the remedy is suitable for the attack in respect to rhythm. That one cannot obtain lasting results with glonoin in the presence of high-grade structural altera-

tions of vessels is no contradiction. Only if it could be demonstrated—as has not been the case up to the present—that the use of glonoin favors the reappearance of the attack in the after effect, or that an after-stage of angiospasm existed, only then would it be palliative assistance in a case, although at times necessary and justified, to limit it to a minimum in the interest of the total circulation.

The dose of the 2-3 potency in such an acute condition as angina pectoris is thoroughly homeopathic.

The introduction of glonoin into medicine is an outstanding contribution of the homeopath, C. Hering.

OTHER VESSEL ACTIONS

Undoubtedly, according to the simile rule, glonoin is suitable for *hyperemic headaches*. Such headaches are aggravated by *movement*, bending and shaking the head, *from warmth and in particular from the heat of the sun and from wine*; results of sunstroke are considered as etiologic indications. Pressure in the eyes, vertigo, ear noises and pulsation in the ears, spots before the eyes, sweating on the head, often accompany the congestive headache. Nausea and seeming smallness of letters can suggest the remedy in *attacks of migraine with surging, pulsating pain*, which compels absolute rest.

Rushing in the head in the menopause is likewise a suitable field for the use of glonoin.

In the provings the congestion repeatedly led to nose bleed.

After glonoin, increased diuresis is noted in many cases; increased light urine. This symptom occurs not rarely after an attack of angina pectoris as well as

migraine and is ascribed to a release of the spasm in the vascular system.

The peculiar etiologic indication to glonoin, *"results of cutting the hair,"* refers predominantly to tension in the neck and torticollis which one may perhaps bring into association in sudden variations in the vascular tonus of the neck. The influence of vessel width, redness of the skin, in glonoin extends especially to the neck. Outside of the previously mentioned pain in the arms, a burning between the shoulder blades is observed and this is likewise a reflex symptom of coronary vessel disturbances. Moreover, in the sacral region and in the region of the sciatic, weakness, feeling of numbness and pains are noted.

The palliative influence in contracted kidney, uremia and eclampsia should be incidentally mentioned.

The psychic actions: restlessness, irritability, anxiety with sudden variations in vascular tonus and the fatigue, loss of desire for work in the completely dulled head, are not difficult to understand.

Still worthy of note in the last drug proving is the repeated appearance of skin manifestations[248] and in one prover it caused an old frost bite which had disappeared four years before to return. (Here also serves a report from older reports of provings: old scars again break down.) The skin manifestations have indeed up to the present no significance as indications for glonoin, but we recall that glonoin is a nitrate and can hold it as possible that here a nitrate effect comes too weakly to expression. Lewin[249] reports a purpuriform eruption as a rare manifestation in nitroglycerin poisoning: "workers who are concerned with quantities and screening of dynamite have badly healing ulcers on the nails and on the fingers or the plantar surfaces

or between the fingers of both hands; there is an eruption which approximates a psoriasis, besides great dryness and formation of rhagades. Healing occurs on discontinuing the work. Recurrences occur."

SUMMARY

Widening of the vessels from the head to the chest, congestive headaches and migraine with vertigo, ear noises, ocular manifestations

Stenocardia (angina pectoris)

Climacteric rush of blood to head

Results of sunstroke

Torticollis after hair cutting

Aggravation of the headaches and migraine from movement, warmth, sun, wine; afterwards increased light urine.

DOSE

In attacks the third decimal; for persistent action the fifteenth decimal has proven itself to me.

ACIDUM NITRICUM

The poor tendency to healing from the corrosion of nitric acid, HNO_3, has long been known.

Lewin[250] mentions some skin effects from the external use of dilute nitric acid: "after repeated rubbing with dilute nitric acid, the skin shows a diffuse redness on which at first are found isolated elevations similar to goose skin. On further rubbing in, these pass over into pustules and after a short existence form small superficial round ulcers. In the brownish center of each stands a hair. Around this brown zone is found a white pseudomembranous appearance. On this occurs a red inflammatory aureola. The affection soon disappears with exfoliation."

Because this is observed only after external use, one

can draw no conclusions apart from the poor tendency to healing and the tendency to ulcerating processes. Such tendencies are not alone peculiar to nitric acid but also to other mineral acids as sulphuric acid, hydrochloric acid and in a prominent degree to arsenious acid. The relationship in the periodic system permits a comparison of nitric acid with arsenic. In both, but also in the other mineral acids mentioned, the tendency to ulcers with offensive secretions and a general tendency to bleeding is characteristic.

Nitric acid appears to share still a second organ direction with the other mineral acids, particularly on the mucous membranes of the digestive tract and indeed primarily on the oral mucosa: soreness, swelling, easily bleeds, formation of aphtha and ulcers with offensive odor to the mouth, loosening of the teeth and, in nitric acid particularly, a flow of saliva. By the longer use of acid mostly dyspeptic symptoms and at times diarrhea are described. In cases of poisoning the dysenteric symptoms of nitric acid are reported.[251]

In prehomeopathic times, nitric acid like the other mineral acids was used as a diuretic agent and in drinks for malignant nervous fevers. In Russia it was valued as a folk remedy for syphilis. In secondary syphilis with torpid ulcers it has also been repeatedly recommended when mercury had been given for a long time without result. Still others reported that nitric acid was only of temporary value and would actually heal only when considerable mercury had been previously employed.

THE DRUG PICTURE

For the exact characterization of nitric acid we are today almost exclusively dependent upon the reports

of Hahnemann.[252] In recent years I have made a number of provings with nitric acid which will be published separately.[253] They particularly confirm the skin symptoms.

The extensive use in homeopathy has contributed much to the explanation of the picture. So *the sharp splinterlike pains* in wounds, fissures and ulcers, moreover the *localization to points of transition from skin to mucous membranes* and then *the offensive odor of secretions and excretions* (including those of ulcers) are guiding.

The chief involvements are those of the skin and mucous membranes. The oral inflammation with salivation, loosening of the teeth, ulcers which are sensitive on contact and white spots, rhagades, soreness and ulcers at junction of skin and mucous membrane have drawn the attention to mercurialism and to syphilis. These associations have proven themselves. The dysentery-like symptoms of nitric acid have added further similarity for the mercurialism.

Syphilitic affections of the skin, the mucous membranes and the sense organs in which mercury has failed or has already been used in excessive amounts, not rarely speak for nitric acid. In a severe case of congenital syphilis with ulceration of the soft palate it seemed to be very impressive to me.

Likewise, nitric acid is suitable for gonorrhea with splinter-like pain in the urethra and tendency to inflammation and condyloma at the orifice of the urethra. Syphilitic as well as gonorrheal condyloma and rapidly forming warts are the indications which occasioned Hahnemann to consider nitric acid as the second chief remedy (after thuja) in the so-called sycosis.

The third sign of offensive secretions and excretions are again generalized. The *urine* is *offensive*, thereby scanty and dark, it smells (as with benzoic acid) *like horse's urine*. Burning and sticking in the urinary passages, frequent urge to urinate, and inflammatory swelling and secretion of the urethra lead to its use in urethritis, cystitis and pyelitis with infected urine, not merely of gonorrheal origin.

"Cold urine on voiding" is a symptom from Hahnemann's proving.

The perspiration is likewise offensive, particularly the foot sweat which causes soreness and splinter-like pains between the toes. Furthermore in definite stages the night sweats of the tuberculous with tendency to bleeding have a remedy in nitric acid which should not be forgotten besides the closely related phosphorus and arsenic.

The nasal secretion in chronic catarrh (or in nasal diphtheria) is offensive, excoriating, with splinter-like stitches in the nose, the nasal orifices becoming sore and bleeding easily. The secretion is yellow, watery or discharged as green fragments each morning so that ozena and septal caries come into consideration as indications.

Likewise offensive leukorrhea, brown, flesh-colored, watery or tenacious, causing soreness of the vagina and vesicles and ulcers on the mucous membrane, represent the general character of the remedy. Here also exists a tendency to bleeding: metrorrhagia after curettage, the menses are too early and too profuse, associated with excoriating discharge which looks like turbid water, particularly during the climacterium.

Soreness, burning and sticking painful ulcers, with

offensive discharges are the corresponding indications in the male genitals for acid nitr.

Fissures of the anus pain as from splinters. The stool hurts the anus as though it were torn. The pain lasts for hours. Easily bleeding hemorrhoids with such fissures and inflammatory pains often react well to nitric acid. An acrid moisture is discharged from the anus.

The bloody, slimy, acrid diarrhea with tenesmus is an indication not only in dysentery but also in other persistent intestinal inflammations.

Characteristic is the desire for fats and for indigestible things as chalk, earth, *etc.* A pain in the cardiac region on swallowing has been cited as an indication in gastric ulcer. It should prove itself.

A sticking or splinter-like pain as from an ulcer is guiding in the upper respiratory passages. The cough is dry, worse at night (before midnight); during the day it seems loose but there is no expectoration. In phthisis with tendency to bleeding or offensive purulent sputum, with a sensation of great weakness in the chest, great dyspnea and stitches through the chest, nitric acid must be considered.

Certain alterations in the pulse, cardiac palpitation and congestive manifestations may be deduced from the provings, which indicate that a nitrite-like action still persists in acidum nitricum. However, up to the present they scarcely have therapeutic significance.

In the provings conducted by me a papular eruption at the frontal hairline was the favored site; moreover, rhagades on the lips and a special dryness of the lips and mouth in single cases was confirmed. A connection with frostbite and old scars has become still more probable through similar results of proving. As a separate symptom of nitric acid should be mentioned

the improvement by riding in a carriage, which refers particularly to the difficulty in hearing.

A type for nitric acid has been developed from experience. Hahnemann said: "One finds, moreover, that this drug acts more in patients of the firm fiber (brunettes) but is less effective for those of relaxed fiber (blondes)."

As especially suitable for nitric acid are considered brunettes with a yellowish discoloration of the skin, haggard, and aged. The temperament is irritable, angry; the patient has attacks of rage, is revengeful, depressed, particularly sensitive to noises, as street alarms. In addition there is great bodily weakness, tendency to chronic diseases and chilling. The scalp is sensitive (for example, against the pressure of the hat). Headaches are practically never missing from provers and they are of the congestive type. Most characteristic seems to be *the feeling as though a band encircled the head.*

SUMMARY

Chief Trends of Action:

Skin and mucous membranes, especially the border between them—Fissures, ulcers, eruptions—Syphilitic and gonorrheic affections; condyloma—Mercurialism, stomatitis with flow of saliva—Dysentery-like enteritis—Tendency to bleeding.

Leading Symptoms:

Splinter-like pains—Localization to junction of the skin and mucous membrane—Offensive odor of secretions and excretions—Band sensation around head.

Type:

Brunette; haggard; irritable, angry, depressed.

DOSE

My own experiences involve chiefly the fifth and sixth potencies. Still, the higher as well as the lower potencies are recommended.

KALIUM NITRICUM

Potassium nitrate, KNO_3, is used relatively little although it is well proven. Provings are found in:

(1) Jörg: *Materialien*, Bd. 1, 1825.
(2) Hahnemann: "Chronic Diseases," 2 Ed., 1838.
(3) *Arch. f. hom. Heilk.*, Bd. 11, p. 195, 1831; and Bd. 17, p. 123, 1838.

In the drug picture it becomes distinct that the potassium fraction increases the tendency to chest affections in comparison to the nitrite fraction (as well as the weaker nitrate). *Asthma* is the chief indication and indeed the dyspnea seems to arise not merely in the respiratory passages but also from the heart. Palpitation and stitches in the heart and tendency to cardiac weakness also appear in this potassium preparation.

The *dyspnea* is so great that the patient cannot hold his breath long enough to quench his thirst; oppression, constrictive sensation in the chest. The dry *morning cough, worse about 3 in the morning,* also permits recognition of the potassium fraction; bloody expectoration shows the nitrite or nitrate action.

Independent of nitrate appears the *tendency to edema* in potassium nitrate. Indeed, it is still used in official medicine even if other potassium salts as potassium acetate are preferred here. It might be considered as a pure salt action, but from homeopathic materia medica the special suitability of potassium for edema and hydrops is well known.

A certain *tendency to bleeding* is also to be placed to the account of the nitrate fraction, so dysentery-like bloody diarrhea. For this the singular aggravation from eating calves' flesh is reported. The menses, too early and too profuse, are characterized by the dark blood, and before and after the period, severe sacral pains are present. The last recalls kali carb.

The sticking pain in the joints and between the shoulder-blades may be referred to the potassium influence. Peculiar inflammatory manifestations on the alae nasi, redness, swelling, itching with sensitivity, can be due to both components.

Kalium nitricum is suitable for the hydrogenoid constitution.

SUMMARY

Chief Trends of Action:

Asthma with most marked dyspnea, probably also cardiac, with nausea, sticking and burning in the chest; at times bloody sputum—Dry morning cough, worse about 3 in the morning—Dysentery-like bloody diarrhea (worse from veal).

Constitution:

Hydrogenoid.

NATRIUM NITRICUM

Sodium nitrate, Chili saltpeter, was considered by ancient physicians as an anti-inflammatory agent of milder action than potassium nitrate. From this point of view and with traces of iatrochemistry, Rademacher came to the use of natr. nitricum in all possible febrile diseases, especially dysentery, scarlet fever and joint rheumatism. For Rademacher and his school natr. nitr. was one of the three universalia, that is, agents

for such diseases in which the disturbance of *general* well-being was perceived as basic. In the school of Rademacher the massive dose is always to be considered. Likewise the provings by Löffler,[254] arising from this school in which only large nonpotentized doses were employed, cannot expect to give the gradual development of finer symptoms. Besides the feeling of general lassitude, loss or decrease of energy, tendency to sleep, soreness in the muscles and joints, there was an alteration in the pulse; the pulse was weaker, softer and distinctly slower; the face became pale and haggard; wounds, due to bleeding, healed more slowly than usual. The rapidity of coagulation was distinctly increased,[255] the venous blood appeared like expressed cherry juice, the water content greater, the coloring of the red blood cells increased. So here too—apart from the disturbance of general well-being—trends to the circulation, the blood and water economy can be found.

That the thirst was increased from such large amounts of salt is not striking. The intestinal symptoms were very slight, perhaps because the nitrate solution was suspended in gummi arabicum. In two older provers who likewise took massive doses[256] were many complaints of flatulence and acid eructations (besides sluggish stool in the one). Furthermore, in both a sensation of coldness in the lower leg, and in one a chill over the body, in the other alternating sensations of heat are reported.

More restrained in the dose is the proving of Fackelmann[257] under Hugo Schulz. He employed a 1 per cent solution. This proving confirmed the *slowing of the pulse*; moreover, the pulse was intermittent. Also confirmed was the slow tendency to healing of the skin and the ease with which it was injured. (Whether the acne

observed is more than an incidental event remains to be determined.) An important observation is the *tendency to bleeding from the nose and mouth* which appeared in the last week of the investigations which were conducted for several weeks.

Marked thirst and increased diuresis does not seem to be a pure salt action in natr. nitric. since they were also observed with D 3.

In the proving carried out at the Stuttgart Hospital,[258] the various potencies were considered, the 30, 6, 3, and 2. Here the sensitivity of the provers is manifested.

In two provers frequent nosebleed appeared as an unusual manifestation for them (in the one with the thirtieth as well as the second potency). *Constitutional nosebleed at puberty and in the anemic* is a chief indication for natr. nitr. There is no doubt that here the nitrate fraction is effective.

Many times, compression, pressure and other sensations were observed in the cardiac region; in one prover who easily tended to cardiac complaints, the third potency caused such typical aggravation of compression, of pressure and of cramp, that the study was discontinued on the ninth day. (Thereby any occasion for releasing the mild anginoid complaints was excluded.) The nitrate fraction acts here, as in glonoin, as well as in its reduction step, the nitrite. It seems thoroughly justified in suitable cases of *angina pectoris* to use the nitrate bound to an organic radical in the expectation of a better duration of effect. The slow, intermittent pulse which becomes weak and soft, as noted from large doses, also indicates that the heart muscle and the conduction system are included in the action of natr. nitr.

For the exacerbation of old dental diseases or dental neuralgias, which have been observed in a series of

provers, J. Haupt has found a corresponding old report;[259] there was found a periodic facial neuralgia with a cinnabar-red streak on the gum; the gum was swollen, loosened, and easily bled on touch. It is accordingly not improbable that here a nitrate action on the mucous membrane, comparable to that of nitric acid, is present.

Further proving symptoms ascribed to the nitrate fraction are the dull headache, which, according to one observation, was aggravated by the heat from an oven and improved in the open air—further, the rushes of heat to the head, and night sweats.

The Stuttgart provers also had a series of digestive disturbances in complaints of distention, acid eructations with a tendency to diarrhea or soft stool, but the evacuation of the stool itself was difficult or a sensation of unreadiness was present. This was reported in the 30, 6, and 3 potencies while the 2 potency showed constipation (corresponding to the results of Fackelmann's proving with the same dilution) in the same prover who had liquid stools with the third dilution. How many of these symptoms, which at present have gained no therapeutic significance, can be assigned to the sodium fraction and how many to the nitrate, remains open.

Also the general disturbances, lack of energy, aversion to work, disturbance of sleep, as they were also observed in most of the Stuttgart provers with natr. nitr., moreover the numerous fleeting sticking pains in the joints and muscles, with giving way and uncertainty in walking, read the same as with natr. carb. Also frequently observed were chilliness and sensations of cold, particularly on the feet and lower legs, which were also noted in the two first provers of 1833.

Thereby the natrium fraction seems to become manifested in the general symptoms.

These symptoms of chilliness and relaxation, besides the hydremia, which Löffler's investigations with large doses furnished, offer the necessary point of departure for the incorporation of natr. nitr. under the *hydrogenoid agents*. Since the same holds for natr. sulph., one might ascribe this constitutional tendency to the sodium cation.

In general, the hydrogenoid character of natr. nitr. seems to be pressed too much into the foreground. Its affinity for the vascular system, to bleeding, inflammations and fevers, angiospasm, congestions, has been demonstrated as therapeutically valuable. So Stauffer has found it useful in a persistent hemoglobinuria which occurred regularly after each chilling of the feet. For frequent nosebleed at puberty, I can also affirm it as useful. At the beginning of febrile infectious diseases natr. nitr. has been extolled.

With these affinities for the blood vessels, natr. nitr. arranges itself well with the other nitrites and nitrates.

SUMMARY

Constitution:

Hydrogenoid (chilly, relaxed) but still tendency to fever, inflammation and bleeding.

Chief Trends:

Vascular system in febrile diseases—(Epidemic Universal of Rademacher); bleeding (nose, hemoglobinuria); circulatory disturbances (congestions, angina pectoris, disturbances of the pulse).

DOSE

The D 3 is usually employed.

PHOSPHORUS

Of the two modifications of elementary phosphorus, P, only the yellow (better colorless) has pharmacologic significance; red phosphorus is stable by virtue of its molecular structure and shows no or very few reactions and is considered nonpoisonous. On the other hand, yellow phosphorus is extraordinarily reactive and in air it gradually changes from white to yellow phosphorus and in light takes on a layer of red phosphorus.

As an element of the fifth group of the periodic system, phosphorus is trivalent negative but, in contrast to its trivalent hydrogen compounds, the pentavalent positive properties predominate and thereby its tendency to oxygen compounds. The avidity for oxygen gives elementary phosphorus the property of luminescence in air (oxidation to $P(OH)_3$, phosphoric acid). Thereby it is remarkable that the luminescence of phosphorus requires slight amounts of O_2 and on the contrary the self-luminescence ceases when phosphorus is brought into an atmosphere of *pure* oxygen. The light energy in luminescence of phosphorus arises from the chemical energy which becomes free in the oxidation. Above a certain oxygen pressure the speed of this oxidation does not progress with increasing O_2 concentration, but in apparent contradiction to the law of mass action there is a decrease. This behavior recalls a working optimum as it occurs commonly in complicated living processes.

In some chemical reactions phosphorus is a negative or anticatalyzer. According to Bredig, phosphorus slows the decomposition of H_2O_2 even in a dilution of 1 mol in 20,000 liters of water in contrast to colloidal platinum.

PHYSIOLOGIC SIGNIFICANCE

Phosphorus is an indispensable constituent of all living substances. The compounds in which phosphorus appears in the organism are derived from the highest step of oxidation of phosphorus, phosphoric acid. The powerful chemical property of reaction of elementary yellow phosphorus is not employed by the organism, moreover it exceeds physiologic bounds. Phosphorus itself and hydrogen phosphide are very poisonous. The insoluble phosphates of the bones stand at the lowest step of ability to react. In case of necessity the skeleton of the animal is a depot for calcium as well as phosphates, because in one-sided experimental calcium and phosphate deficiencies, only the skeleton suffers. A second step is formed to some extent by the alkali phosphates of the blood and fluids in general. Apart from their physico-chemical importance as salts of a weak acid for the maintenance of constant reaction in the body fluids (so-called buffer action), we must perceive in them the first available building material for the cell constituents containing phosphorus. Furthermore, the phosphatides (that is, the phosphoric acid derivatives of various fatty acids) participate as constituents of many lipoids essential to the structure of cell protoplasm (and indeed exactly in the especially active colloidal part). These labile substances obviously have a great significance in cell life and one may well presume some connection between their diversity in the cells of different organs, also between the specific lipoids and the specificity of organ functions.

According to A. Mayer and G. Schaeffer[260] the phosphorus content of the lipoids is characteristic for each animal species. The phosphatides are markedly avid for oxygen and very easily oxidized. The capacity of the lipoids for reaction with oxygen seems to have special significance for metabolism, and lecithin (mono-amino-monophosphatide) is regarded as particularly important for the respiration of the nervous system.

Finally to be mentioned are the most complicated phosphorus compounds of the organism, the phosphoproteins (formerly nucleo-albumins or phosphoglobulins). Apart from casein of milk and vitellin from the egg yolk, the nucleoproteins come chiefly into consideration for the cell nuclei. The nucleic acid fraction of the nucleoproteids is phosphorus-containing. According to A. B. Macallum[261] and J. B. Collip,[262] the nucleus seems to be free from phosphate ions. Phosphorus is recognizable in the chromatin of the cell nucleus as well as in centrosomes.[263] Youthful nuclei are phosphorus-rich; later, with lessening of capacity for division, the phosphorus content markedly decreases. One also would not go astray with the idea that the *nuclear phosphorus content has a connection with growth and that this connection is also of significance for the inheritable constitution.*

No tissue is free from phosphorus. The heart is apparently the richest in phosphorus in the form of phosphatides in respect to the muscles.[264] In the entire nervous system the P compounds are abundantly present. The liver is the richest of the parenchymatous organs.[265]

An abundant use of phosphorus occurs in normal metabolism. The organic phosphorus compounds are excreted as inorganic phosphates, but the inorganic phosphates have an important task in metabolic and energy changes.

While phosphorus is very easily oxidized in free air, the conditions for oxidation seem less favorable during and after resorption. This is because, in intoxication with large amounts, one finds phosphorus in the arterial blood and in the organs, especially in the liver, in an unbound form for several days. However, it may occur in the lowest step of oxidation in the expired air, in that this shows luminescence. With intoxication with small amounts and fine division, the oxidation apparently proceeds rapidly so that no free phosphorus is found in the blood and the exhaled air does not show luminescence.

PHOSPHORUS POISONING

Phosphorus poisoning must be described here as the threatening background to the phosphorus picture.

Phosphorus vapors release severe phenomena of irritation in the bronchial mucosa which leads rapidly to a pulmonary edema.

In one-half to twenty-four hours after the introduction of the poison the gastric symptoms usually appear. The patient vomits and has a burning pain in the epigastrium and the ejected material smells like phosphorus though later the material is more or less bilious.

Then follows, even after stronger doses, a two- to three-day interval of comparative well being; indeed, one even speaks of euphoria. But still there appears a definite weakness with a nervous excitation and, three to four days after the ingestion, with the transient mental disturbances, the characteristic icterus appears. The epigastrium again becomes painful, the pains draw toward the right hypochondrium. One finds the liver enlarged and sensitive. Pains occur in all extremities;

the patient becomes dejected, the pulse small, and the heart yields accessory sounds.

In the next few days the icterus increases, the liver definitely enlarges, though in some cases becomes smaller.

Then skin and mucous membrane bleeding begins. The vomiting reappears and bloody masses are evacuated; the gums, intestines and uterus bleed; the skin shows small petechia or extensive ecchymosis.

The blood pressure falls with increasing cardiac weakness. Slowing of the pulse is noted with the icterus and this may be maintained well into convalescence. In unfavorable cases the pulse rate is increased throughout the entire time. A high-grade tachycardia often appears antemortem. Fever up to 40° C is frequent.

In many cases the consciousness is clear up to shortly before death. In other cases, somnolence, delirium or convulsive attacks occur in the final twenty-four to forty-eight hours. In a case which survived, a paralysis was noted.

The urine decreases with the progression of the poisoning, and finally an almost complete anuria may exist. Bile pigments and bile acids are found in the urine. Urobilinogen is increased; in severe cases it may be diminished, the result of complete failure of the liver. Protein in moderate amounts is nearly always present. Casts, fatty casts, cellular detritus appear, and the urine usually contains moderate amounts of blood. Among 141 cases, spontaneous glycosuria appeared in six, but an alimentary glycosuria could be provoked in 60 per cent of the cases.

The finding of a milk-like urine is perhaps traceable to free fat. Amino acids and peptone-like bodies and

significant amounts of lactic acid are found and the excretion of ammonia can be considerably increased.

Pain in the throat, dryness in the mouth, redness of the pharynx, catarrhal phenomena of the mucous membranes are observations which may be overlooked by virtue of the more severe symptoms.

In severe poisonings death usually occurs on the seventh to eighth day. In very rare cases improvement may occur after the icterus has appeared, and during convalescence a marked diuresis is noted.

In chronic poisoning one observes, outside of the still to be discussed necrosis of the jaw, pustular eruptions, eczema of the skin, falling out of hair. Individuals may complain of dryness of the throat and of cough. The tongue is coated; the appetite is poor; and the patient complains of gastric pains, tenesmus, hiccough, and meteorism. Vomiting occurs and the stools may be bile-containing and particularly bile-poor.

Pathologico-anatomically, in the *lungs* are observed traces of catarrhal inflammation, more rarely pneumonic foci; exudates, in the pleura; in the *stomach*, infarcts, bleeding into the lumen, in the fundus and the pars pylorica, pinhead to pea-sized ulcers; the mucous membrane is often swollen, hyperemic and hemorrhagic, the mucosa doubled or tripled in size, indurated with marked pigment deposit and flat ulcers. The interstitial tissue is overgrown and many times develops in thick, broad plaques. In the duodenum the solitary follicles and the glands of Brunner are swollen and in the lower intestinal segments inflammatory phenomena are found. The gastric and intestinal contents are usually bloody.

The severe alterations in the *liver* are observed early. The liver is usually enlarged, only rarely lessened in

size. The liver cells for the most part remain but are filled with fat globules. The interlobar connective tissue is often diminished, but many times and particularly in chronic poisoning it is so markedly developed that one may speak of a definite interstitial hepatitis. With time it may come to a smooth induration or form a luetic-like hepar lobatum with numerous, deeply penetrating tongues of scars and finally the classic cirrhosis of the liver with its resultant manifestations: venous hyperemia of the gastric and intestinal mucosa, indurative enlargement of the spleen, ascites, hydrothorax.

The *spleen* is frequently enlarged in acute poisoning as well.

The *kidneys* are swollen for the most part, the epithelium of the urinary tubules filled with numerous fat globules. Connective tissue overgrowth is observed here in many cases.

The *heart* is fatty to a marked degree, the muscle fibers are thickly filled with droplets. The walls of small blood vessels and capillaries are likewise involved and together with the reduced capacity for coagulation of the blood the already mentioned marked bleeding is explained. In poisoning before the menstrual period, the menstrual flow becomes profuse and large hematoma may form in the ovaries. Likewise, brain hemorrhages are frequent in poisonings before the period.

Repeatedly in animal investigations as well as in human poisonings, fat emboli have been observed particularly in the lungs and the kidneys.

The entire musculature, particularly that of the abdominal and thigh muscles, can show fatty changes.

Of the blood effects of subacute phosphorus poisoning, the long known and often confirmed lessened or

absent coagulability is of special significance to us for the bleeding tendency of phosphorus. The depression of coagulation or the absence of it is associated with defects in the fibrinogen and the coagulation-promoting ferment.[266]

The alkalescence of the blood in phosphorus poisoning is considerably reduced. This can be demonstrated titrimetrically as well as through estimation of the CO_2 content of the arterial blood.[267] The diminution of alkalescence is the result of altered metabolism which is accompanied by an increased production of acids. Probably a decrease in the complement is associated with it as Ehrlich and Morgenroth[268] found in the blood of poisoned animals.

The formed elements of the blood likewise undergo considerable alteration, in particular the erythrocytes. It is striking that the different species of animals react differently. Rabbits do not show definite influence; in pigeons there is a high-grade hemolysis; in men appears, partly a decrease, partly a sudden increase of erythrocytes and as high as eight million have been found. This increase was only transient for the most part and this has lent support to the otherwise not certainly determined concept that besides the increase of erythrocytes there is also an increased destruction. The leukocytes seem at first diminished, then slightly increased.

ACTIONS ON THE BONY SYSTEM

Animal investigations and correspondingly the standard therapeutic use of phosphorus in the last decades have been directed primarily to the skeletal system. The most striking manifestation of chronic phosphorus poisoning, jaw necrosis, is the point of departure of

experimental investigation. Wegner[269] obtained in rabbits after a five to ten weeks' residence in phosphorus-containing air in imitation of this condition, a periostitis of the jaw with bony deposits on the alveolar border which went on to necrosis. From these investigations it was further yielded that continuous small doses of phosphorus could act as a formative stimulus on the bones and that the spongiosa was widely replaced by compacta. Kassowitz[270] thereon tested phosphorus clinically in rickets and his recommendation still has value today. This has not been shaken by the fact that today irradiated ergosterin and no longer the great carrier of light (phosphorus) is the method of choice. From the findings of Kassowitz it may be stressed that with continuous and increasing doses of phosphorus a rarifying osteitis in the compacta, a marked growth of vascular rich cartilage and finally a melting down of bony inflammatory processes in the periosteum were found which he designated as like rickets.

In more recent times the rôle of phosphorus in the process of bone building has been more exactly studied in animals by Otsuki.[271] In artificial fractures the resorption and new formation processes require more time than usual under small doses of phosphorus. But thereby was the resorption of old bone still more strongly delayed than the new formation so that a thickened bulwark of bone was the result of this rebuilding. Likewise in growing bones the depression of normal resorption predominated over the depression of new formation so that a broader and thicker layer of bone was the end-effect. In spite of the damaging influence in the process of bone formation, the result

was an excess of new bony tissue. This is also compatible with the findings of Wegner and Kassowitz.

In chronic poisoning of animals with phosphorus, the calcium and the phosphorus content of the bones increases considerably.[272] Bernhardt and Rabe[273] demonstrate a distinct influence of phosphorus on mineral metabolism and the formation of bone. Trisdall[274] found the phosphorus content of the serum remaining at the same height during growth; with the conclusion of growth it rapidly fell and stayed at this level until death, but in a demand upon calcium metabolism, as in bone fracture, the growth level was again reached or even surpassed. The investigations of F. Sauerbruch[275] and G. Hotz[276] in patients with osteomalacia revealed that by the administration of phosphorus the organism gained the capacity to utilize calcium and also to retain and deposit it.

According to all this one may ascribe to phosphorus an influence on calcium metabolism in the sense of an activation and increased retention. It is worthy of note that even Wegner demonstrated a favorable influence on bone formation with phosphites as well as through unoxidized phosphorus itself. The close connection of phosphates to calcium economy has been mentioned in speaking of calcium. If one reviews the bone effects of phosphorus, the phosphites, and phosphates together, then the distance between the pure phosphorus and its various stages of oxidation diminishes in pharmacologic respects though at first it seemed to exist. Certainly it is not immaterial whether phosphorus, phosphites or phosphates are administered, but if we view the matter from various angles it is seen that the difference lies not in the nature but in the intensity. Actually before the vigantol era, on account of the apparent danger of phosphorus, one had come to recommend phosphates in rickets and osteomalacia. That this phosphorus and phosphate therapy follows

definitely the simile rule need not be stressed after the above discussion. In homeopathy it has constantly been calcium phosphate which has been the most frequently used preparation in rickets and in bone therapy in general.

OTHER ORGAN ACTIONS

A certain similarity with the action on the bony tissue can be perceived in the action on other tissues. The end stage of phosphorus poisoning in the form of the so-called fatty degeneration of the liver, the kidneys, the cells of the gastro-intestinal tract, the heart, the diaphragm, the skeletal muscle, and especially the vessel endothelium is well known. But if one follows the process more exactly, then from the prolonged action of small doses always an excitation of function occurs or an increased formation of tissue proceeds simultaneously. Even Harnack[277] has perceived the new cell formation as a minor grade action of the same poison whose stronger action effects death of the cells.

The cell action of phosphorus is best studied on the liver. At first the glycogen diminishes as do the cell proteids; the liver cells contract and show fatty degeneration. But according to the investigations of Opel,[278] at the same time a new formation of young cells occurs. With stronger influence of phosphorus, the substitution by growing connective tissue or the epithelium of the biliary passages seems to gain preponderance.[279] The situation of the kidney elements seems to be entirely the same.

It is worth of remark that also in the liver and heart, the calcium and phosphorus content increases in acute and still more in chronic phosphorus poisoning, while a marked decrease of calcium content and increase in total phosphorus has been found in skeletal muscle.[280]

The well-known appearance of icterus in phosphorus poisoning has been traced to the finest biliary passages by the investigations of Stadelmann[281] and Eppinger.[282] Here also goes a state of

increased secretion with increased amounts of biliary pigments, then apparently a stasis and destruction in the smallest biliary capillaries, a rupture of the capillaries with entrance of the bile into the lymphatic passages.

Here it may be remarked that phosphorus can be indicated in weakness of the heart muscle, nephritides and inflammatory liver affections. But in what form? That is the question in which the similarity of the structural end-results leaves us in the lurch. Here we must still consider the influence on the vascular endothelium and the reduction of the capacity for coagulation by phosphorus. Hemorrhages of all types can be further indications for the choice of phosphorus; also, for example, hemmorrhagic nephritis. Similarly, an icterus increases the indications for phosphorus in pneumonia. Such supplementary structural indications, however, usually do not satisfy us but first the functional and subjective symptoms as they have been obtained from provings on the healthy give us exact differential characteristics.

METABOLIC ACTIONS

The actions of phosphorus on *metabolism,* particularly on carbohydrate and fat, have been studied primarily on the liver, obviously because the liver is the favored site of attack for phosphorus. In investigation of the fat metabolism one proceeds from the fatty degeneration of the liver and other organs. The view that in phosphorus poisoning an increased formation of fat occurs from protein destruction can easily be shown to be erroneous. To the contrary, animal investigation shows rather an increase in fat substitution, naturally not in the hunger stage, but to an increased

degree when sufficient amounts of carbohydrates are introduced.

Through abundant administration of carbohydrates the appearance of fatty liver can be prevented in phosphorus poisoning in spite of the presence of fat depots.[283] This signifies that fats burn only in the flame of carbohydrates, as it has been strikingly expressed.

The fatty infiltration of the liver is indeed a substitution of used carbohydrates and proteins and one may perceive with Rosenfeld[231] that it is the last attempt at a defense against an impending damage to the protoplasm, naturally a defective substitution for the cell material being destroyed. The enrichment in ether soluble constituents (as phosphatides, cholesterin, *etc.*), particularly in the liver, less strongly in the heart and kidneys, in phosphorus poisoning is recognized as fatty infiltration through a series of investigations.[285] In any case the wandering of fat in these organs from the fat depots of the body (in case such are present) has been demonstrated (through proof of the infiltration of a foreign type of fat). For the development of a fatty degenerative infiltration of the organ through transport from the depot also speaks the fact that the fat content of the blood is increased in phosphorus poisoning.

But the fatty degeneration of organ cells rests not exclusively upon fatty infiltration because in actuality the fat content is often not found increased. Much more it is concerned only with a visibility (perhaps coagulation?) of fat in the decomposition of cells, so-called fat phanerosis.

An increase of protein destruction through phosphorus is frequently demonstrated in animal experiments as well as in man through increased nitrogen excretion in the urine. But it seems that this increased protein destruction appears only with a fat and carbohydrate deficiency, also after utilization of this burning material. In general, the results of animal investigation refer to the starved animal. Moreover, Rettig succeeded in avoiding the destruction of protein en-

tirely or approximately through administration of larger amounts of carbohydrate.

Besides the quantitative increase of protein destruction there is also a qualitative alteration. The ammonia excretion in the urine is increased, from which an increased production of the acid in the body may be deduced. Sulphuric and phosphoric acid are increased in consequence to the increased destruction of cell proteins, and lecithin (lipoids), moreover lactic acid and other organic acids, appear in the blood and urine. But above all comes the excretion of imperfectly decomposed protein split products, amino acids (as glycocoll, leucin, tyrosin), albuminoses, oxyprotein acid. Now one knows that in phosphorus poisoning the postmortem fermentative protein splitting in the liver, the so-called autolysis, is increased, and it is possible that the qualitative alteration of protein metabolism is associated with this influence of phosphorus on the fermentative decomposing processes in the liver.

In general one can remark that a material which effects an increased and abnormal protein destruction belongs to the febrile agents, as it happens with phosphorus (and arsenic). Naturally, the already mentioned actions on the fat and protein metabolism are only crude toxic manifestations in the direction of consumption. More than crude directions cannot be presented at the present time for fatty degeneration, fever, and consumption.

Phosphorus attacks the carbohydrate metabolism earlier than the fat and protein metabolism. Through investigations it has been demonstrated that in phosphorus poisoning the glycogen markedly decreases, especially in the liver (less in the muscle). But in spite of rapid destruction of glycogen, no increase of blood sugar content appears and only rarely does man show a glycosuria.[286] Accordingly, the burning of sugar seems increased. On the other side, in certain stages of phosphorus poisoning there seems to be a reduction

of the limits of assimilation for sugar by man and therefore the early appearance of an alimentary glycosuria. How far the glycogen formation is disturbed or prevented is still not determined. In general it seems in the first phase of phosphorus action that the dissimilatory activity in carbohydrate metabolism is increased; in the second phase, the assimilatory activity is increased. If now one considers the production of acidosis and the appearance of organic acids in the blood and urine, then the similarity to diabetes in broad trends is not to be rejected.

Still more than phosphorus itself is phosphoric acid used as a remedy in diabetes. And this will be comprehensible from the important rôle of phosphoric acid and at the same time from the physiologic action of weakened phosphorus on carbohydrate metabolism.

The significance of phosphoric acid in physiologic carbohydrate transformation in muscle function has been brought to light by the works of Embden[287] and Meyerhof[53] and American authors.

Muscle energy is obtained through anoxybiotic carbohydrate splitting. The mother substance, called lactacidogen, is a glucose monophosphate. In muscle contraction, very soon phosphoric acid is set free and this phosphoric acid seems, as Schmitz[288] expressed it, to be the vehicle for conveying new quantities of carbohydrate to destruction. It can be assumed that in muscle work, lactacidogen is destroyed under the influence of lactic acid and phosphoric acid in the dissimilatory phase. Phosphoric acid unites with the hexose molecule again to form lactacidogen—the assimilatory phase. Accordingly, the splitting of hexoses in the animal organism can occur only through the intermediate combination with phosphoric acid. The situation is, however, essentially more complicated. One knows now that other phosphoric acid compounds, as creatinphosphoric acid, the so-called phosphagen,[289] are present in muscle. This compound is also split on muscle irritation and is again elaborated during rest.

It is assumed that the undoubted favorable action of phosphoric acid on the capacity for performance of muscles, which has been proven in extensive investigations conducted on soldiers and workers by the increase in performance and the lessened fatigue, occurs through some type of connection with the discovered physiologic rôle of phosphoric acid. Perhaps the introduction of phosphoric acid serves as a vehicle for the activation of the already present but still not suitable phosphoric acid. The phosphates are just as important in the central nervous system as in the muscle as much for its function as for therapeutic influence. We shall return to this later. Phosphoric acid therapy in bodily and mental exhaustion has long been known to medical empiricism in the form of sodium phosphite-lemonade, indeed before the physiologic basis just discussed and before preparations like Recresal and Tonophosphan (an organic phosphite compound) were known. On the other side homeotherapy, from the beginning through the consideration of the symptomatology, has drawn attention to this chief trend of phosphoric acid and its compounds.

PHOSPHITE AND PHOSPHATE ACTIONS

Experimental observations on muscular organs have brought great probability for the fact that the action of phosphorus does not differ in principal from its oxidation products (phosphites and phosphates) but that it is concerned more with a difference in intensity. K. Engel[201] studied the inorganic phosphites in conjunction with the action of tonophosphans. With sodium phosphite (Na_2HPO_3) he found a complete analogy but with the significant difference that sodium phosphite is not toxic. In a series of surviving organs of frogs and mammals (heart, intestine, bladder, uterus), it was seen that great dilutions (6–8 potency) acted stimulating on the movements, while larger doses (5–7th potency) damaged the function. The hypophos-

muscle through the introduction of free phosphate ions. Staub does not consider that a calcium deprivation is the cause of the functional increase of the mechanically or toxically insufficient heart, for the similarly calcium-depriving citrate does not cause the same actions.

It is worthy of remark that in the studies of Engel essentially larger doses (about 3–4th potency) of phosphates were necessary for the production of the functional increase than of phosphites. Correspondingly, that the poisonous doses of phosphates are still greater has been shown by the studies of Starkenstein.[296] This study had given a complete parallelism of phosphoric acid (the ortho-, pyro-, and metaphosphoric acid) or their alkaline salts with the other calcium-precipitating acids (oxalates, fluorides) in toxic action. Only the doses necessary vary, and likewise according to the method of administration. That it is concerned with a calcium precipitation in the intact animal and in single organs proceeds from the fact that the toxicity can be removed through calcium chloride injections or hindered by them. Also according to Staub, the depression of blood coagulation and the increase in temperature caused by the phosphates is common to all other calcium-precipitating salts and likewise conditioned through calcium deprivation. If one follows Staub in this regard so that the toxic action of phosphates depends upon an inactivation of calcium, then it is not said thereby that there are no other actions which are peculiar to the phosphate anion. Naturally, these will appear more in biologic actions, in actions approximating the physiologic.

Nothing stands in the way of the conception of a fundamental association in the type of actions from phosphorus over phosphites to phosphates; only the speed and severity of the effect and thereby the toxicity is connected to the step of oxidation.

The toxic actions of phosphates can be perceived as calcium-ion deficiency or potassium or vagus predominance on the striated and smooth muscle, and this without tracing the entire action of phosphate back to this de-ionization or synergism. The toxic action on the voluntary muscle and the heart, as with potassium,

consists of a reduction of tonus, while the physiologic potassium as the phosphate is a pre-condition for muscle function; apparently it supplements in the muscle as do calcium and phosphate in the bones. The toxic action of phosphate on the heart leads to slowing of the pulse and to stand-still in diastole, as does potassium. But with both, an improvement in the heart muscle can be obtained after mechanical or toxic damages. On smooth muscle, phosphates as well as potassium acts tonus-increasing. The poisonous action of phosphates expresses itself more distinctly than with potassium in the diarrhea. A significant increase in tonus and the pendal movements has been proven by Starkenstein on the isolated intestine. We shall discover this diarrhea again in the picture of phosphoric acid.

PHOSPHORUS AND PHOSPHATES IN METABOLISM

The influence on cellular metabolism by phosphorus, in particular on gas exchange, has been the subject of many investigations. The results are often contradictory. According to Lusk[296] and Hirz,[297] there seems at first to be an increase in metabolic conversion and gas exchange and then shortly before death a decrease in the action of phosphorus. It arose even more distinctly from the investigations of Nishura[298]: phosphorus in small doses promoted cell respiration. 1/100 mg. of phosphorus injected subcutaneously into rats regularly produced a persistent increase of O_2 use, whereby the weight slightly increased. The gas exchange was influenced for eight days after an injection. If the doses were increased, then a single injection of 1/10 mg. gave a persistent decrease of O_2 use without a distinct influence on weight. Daily injections of 0.5 mg. for three days caused the O_2 use to fall to 1/3 and the temperature to fall to 27° C. Of particular importance is the fact that feeding thyroid substance reduces the consumption of O_2 even with 1/1000 mg. of phosphorus, so that these animals seem at the same time sensitized to phosphorus effects by the administration of thyroid substance.

The gas exchange of phosphorus-poisoned animals was reduced about 20 per cent, the action beginning about twenty-four hours after the administration of phosphorus. Phosphates also promote cell respiration,[299] and here too we have a parallelism between the action of phosphates and phosphorus. Surviving intestinal cells show an increase of respiratory effect even from the slight concentration of N/1000 primary and secondary natrium phosphate, while the optimum lies in a concentration of N/100–N/200, and with higher concentration consumption decreases. Likewise in other instances in organic life catalytic processes are favorably influenced through phosphorus salts. Bucher has already proven this for yeast fermentation and American investigators[300] have shown that carbohydrate and fat formation increases in yeast cells under phosphates. Even for phosphorus a corresponding report is found in Hauser's work in which a yeast-sugar mixture to which phosphorus was added showed initially a more rapid and stormily proceeding production of CO_2 than under normal conditions.[301]

CONNECTIONS TO ENDOCRINE GLANDS

Phosphorus has important connections to the thyroid and its function.[302] In phosphorus-poisoned animals one found alterations in which the colloid was diminished or had disappeared, findings which are also noted in Basedow goiters. On the cerebral ganglion cells the same histologic alterations were found as after thyroidectomy. The iodine and phosphorus ratios stand inverse in the thyroid. The iodine content increases with the decrease in phosphorus and *vice versa*. Phosphates act weaker than elementary phosphorus. Alb. Kocher[303] has recommended natr. phosphoricum in doses of 2–12 G. daily in Basedow. In pregnancy a fall in the iodine content to 1/30 normal is observed and the phosphorus triples. In a Basedow one has seen a similar fall of the iodine and the increase of phosphorus content to double. Under the use of thyroidin an excretion of phosphoric acid occurred and phosphorus treatment caused an enrichment of the thyroid in iodine. The sensitization for phosphorus action by the administration of thyroid preparations has already been mentioned. The reciprocal relation between iodine and phosphorus should not be conceived one-sidedly as an antagonism nor as a synergism.

On the adrenals Neubauer and Porges[301] showed that, through phosphorus poisoning, the chromate discoloration of the medulla is removed and the formation of adrenalin depressed. They trace the lowering of blood pressure in phosphorus poisoning back to the adrenal damage instead of to the cardiac damage as is so frequently done. They also bring the disturbances of carbohydrate metabolism into connection with the functional failure of the adrenals since in extirpation of the adrenals the glycogen disappears and the blood sugar content falls. One has also prevented the disappearance of glycogen in phosphorus poisoning through the injection of adrenalin. Perhaps in analogy with the biphasic action in other organs with small doses of phosphorus there may be a stimulation of adrenal function and also in secretion of adrenalin. Vollmer[305] described after the injection of adrenalin a biphasic action on the calcium and phosphorus content of the serum. The calcium content at first increases and then decreases and the phosphate content exactly the reverse: decreases and then increases.

The influences known up to the present of phosphorus on the endocrine system are not sufficient to indicate its constitutional peculiarity more than a general trend, chiefly in the direction of a basedowoid sensitization. The influence on metabolism through phosphorus may be brought into good accord with this.

NERVOUS SYSTEM

The toxic manifestations on the nervous system are often perceived as dependent upon the alterations in the vascular system. The great abundance of phosphatides (lecithin) in the central nervous system makes it probable from the start that the physiologic rôle of phosphorus likewise corresponds pathogenically and therapeutically. In old times phosphorus was considered particularly as an important agent in maladies of the motor and sensory nerves and also in homeopathy (for example in the monograph of Sorge[300] this trend of action is always stressed).

From newer studies[300a] it has been shown that the phosphatide content of the brain is altered in progressive paralysis. It had been shown even earlier[207] from the derivation of phosphoric acid in brain emulsions that phosphorus was important in the brain and today it is more than probable that disturbances in cholesterin-phosphatid metabolism lead to functional alterations of the brain.[303] It can also be proven that in the retina of the frog, light stimuli discharge phosphoric acid.[309] In peripheral nerves the nitrogen consumption on stimulation is markedly reduced through the addition of phosphatides. In the very lively metabolism of the central nervous system, phosphorus compounds must have even a greater significance. In mental diseases and experiences which are associated with general exhaustion occurs a marked destruction of the organic phosphorus compounds of the central nervous system and the excretion of phosphates is increased. Outside of the inorganic phosphates about 1 per cent of the total phosphate is excreted as organic compounds, and, when the oxidation processes are weaker in mental fatigue, the percentage of organic phosphates increases in the urine.[310]

Naturally the organic alterations in the central nervous system are slight in acute and chronic phosphorus poisoning. Only occasionally paralyses are observed (in contrast to arsenic), once under phosphorus therapy a paralysis of the auditory. The ordinary findings in the central nervous system are apparently a result of capillary bleeding and fatty deposits in the ganglion cells and also degeneration of the columns of Goll and Burdach. Findings of myelitis and pigment deposit are doubtful.[311]

Probably the severe toxic actions are ended by some other occurrence before a destruction of the structure of the nervous system can occur. The severe psychic symptoms which are occasionally observed in phosphorus poisoning and other milder symptoms can be accepted as probable.

The previously mentioned mass investigations with phosphates make it very plausible that not only the muscle metabolism but also the nervous system partic-

ipates similarly in an increase of performance. In larger series of investigations phosphoric acid produces mental invigoration and joy of work. With longer use the frame of mind of the psychically depressed is favorably influenced.[312] In the clinical studies of Staub[313] with di-sodium phosphate in cardiac patients, the patients in many instances reported themselves rapidly relieved, one patient as though he had been freed of something. Similar actions are observed with tonophosphan in the cyclothymic depression states. Likewise involuntary psychic results are observed.[314] Many patients under the use of phosphates complain of much dreaming and disturbances of sleep, others of wandering pains in the extremities, restlessness and hypersensitivity to noise. It is to be observed that these symptoms appear first under large doses of phosphates. In the first few days of a phosphorus poisoning a euphoria is noted.

In any case the old clinical observation that impotency is favorably influenced by phosphorus and by phosphoric acid belongs to the picture of psychic excitation, and perhaps depending upon a similar action are cheese and egg yolks, these foods being particularly rich in phosphorus contents.[315]

THEORY OF PHOSPHORUS ACTION

If now one glances over the facts known up to now, then the old question, in what form does phosphorus come into action, can no longer be answered either—or, and particularly neither as pure phosphorus or in the form of an oxidation product (phosphites or phosphates). Much more we shall say: phosphorus can act damaging in the body-foreign, elementary form as well as in phosphites and under certain conditions even in the physiologic form of phosphates.

After its resorption phosphorus goes through oxidation steps to phosphates. The reverse way to PH_3, which one has assumed for toxic actions, can be designated today as practically excluded. Current pharmacology makes a sharp line of difference between pure phosphorus and phosphoric acid in respect to action on the organism. But we have seen that the middle position of phosphites offers a point of departure for this difference is not a fundamental one, but one of degree and action celerity. Phosphorus can act in the type of phosphites or even by a more protracted course under small doses in a manner approximating phosphate action. (For example, the bone effects.) In the last case the phosphate action appears in the foreground in the ion synergism and antagonism, in particular in connection to calcium. In carbohydrate, lipoid and protein metabolism the phosphorus, as well as its oxidation steps, seem to be used as the physiologic phosphates.

The phosphite step still has a very acute toxic action; still in minimal doses the functional increase experimentally comes into appearance. A stepladder of actions leads from the promotion of cell respiration to its suppression with the end result of fatty degeneration. For the toxic action one must consider that the phosphites also press forward to further oxidation and to draw oxygen on themselves energetically, and thereby apparently anoxybiotic, fermentative destruction of cell nutrition material and eventually also protoplasm is effected. This is correct only when pure phosphorus in quite considerable amounts enters into reaction before an oxidation can be accomplished. It is very probable, because primarily the phosphorus-containing constituents, the phosphatides, are attacked and because in the attempt to reach physiologic paths,

the lipoids with phosphorus affinities, the cells are more or less damaged, whereby the lipoids are increased or are transformed into another colloidal state.

That poisonous action occurs through combination to the phosphatides is also made very probable purely chemically. Willstatter and Sonnenfeld[mo] have shown, for example, that the olefines (unsaturated open carbon with a double C bond) appear in the phosphatides and unite with oxygen and phosphorus to phosphorates. Initially this reaction occurs very slowly, and this agrees with the pseudo-incubation stage of phosphorus poisoning.

We found in phosphoric acid the conception repeatedly lying near that the "action in" and "action out" go parallel or much more the pathologic actions stir up physiologic traces, but that the phosphorus compounds peculiar to single organ systems are still determining for the trend. Since we can further make plausible a natural graded effect connection between phosphorus, phosphites, and phosphates, so the stronger actions of phosphorus can be followed in the same paths.

DRUG PICTURE OF PHOSPHORUS

Provings on the healthy are found in:

(1) Hartlaub and Trinks: "Reine Arzneimittell," Bd. 1, 1828.

(2) Hahnemann: "Chron. Krankheiten," 2 Aufl., Bd. 5, 1839.

(3) Sorge: "Der Phosphor ein grosses Heilmittel," Leipzig, 1862 (p. 115 older provings and p. 123 personal provings on 15 people).

TYPE

To phosphorus corresponds the slender, rapidly growing, delicate man usually of light complexion with

delicate transparent skin, blue, often glistening eyes, delicate, silky blond or reddish hair. The development of the internal organs and of the connective tissue often does not keep pace with the rapid growth, so that an easily crumpling type appears. We have also the *asthenic type* before us, as it unfolds itself preferably at or after puberty. In the morbid increase of this type we see consumption, increased tissue destruction and hectic types of fever. To the asthenic body build corresponds the manner of psychic reaction. Psychically phosphorus belongs to the schizothymic group of Kretschmer and indeed with special stress upon the hyperesthesia. The phosphorus type is also sensitive and delicate psychically; also supersensitive toward sensory impressions, against light, noise, music, odors, perfumes and contact. Such people are also sensitive to personal influences. In general they are in need of support, they feel badly when they are alone and they welcome moving around and contact with healthy people. Dahlke's view that the desire for massage and the improvement from it may be explained from this psychic situation is quite enlightening. The great sensitivity for impressions permits such people to proceed in an animated manner; indeed, it approaches ecstasy and clearsightedness which signifies the extremely fine sensitivity. To these corresponds the alert, animated facial expression; the psychic processes are found without difficulty in the gestures and mien. On the other side, from the intensity and the tempo of their experiences, these delicate people become easily fatigued, become tired and indifferent and ever demand rest. Memory fails; sleep improves. The conversion from the animated, indeed excited and at times vehement, state to fatigued, indifferent, and anxious picture is

sudden. Usually the phosphorus patient has many fears, fear of being alone and of homesickness, dismal forebodings and fantasies which make him anxious in the evening, at night, and particularly before and in storms. Thereby cardiac palpitation and trembling can appear. The excitation goes in morbid instances to delirium as in adynamic fevers and drinkers; manic states and delusions such as appear in paralytics are cited. On the other side goes the depression from indifference to the environment to a depression with disgust for life, apathy and stupor. *Tension and relaxation alternate suddenly.*

To the psychic picture also belong the increased libido and erotic dreams; however, there is sexual weakness. By the paradox of sexual excitability in these sensitive people many symptoms of anxiety may be explained in the phosphorus type.

According to the classification of v. Grauvogl, phosphorus corresponds to the oxygenoid constitution because characteristic for this is the consumption and hyperesthesia and moreover the aggravation of complaints from alterations of air electricity, particularly the weather. This modality is especially characteristic for phosphorus. Nevertheless, v. Grauvogl does not include phosphorus under the remedies for the oxygenoid constitution.

Increase of tissue destruction with insufficient building up, unnatural hunger, ravenous hunger at night, sudden congestion and sweats, hectic types of reaction show, if one seeks an exponent for the phosphorus type, from the endocrine system that there is a predominance of the thyroid. That there is a close connection between the thyroid and phosphorus should not be surprising.

The sudden alterations in blood distribution, the tendency to congestions and vertigo, may possibly be associated with the acceleration of metabolism under the leadership of the thyroid. Naturally, a direct action upon the vessels and the arterial blood may explain such symptoms. Here belong rush of blood to the head, congestion, pulsation and burning headache, which are improved by cold; warmth in any form (room, food) aggravates the headache; the face shows circumscribed redness and heat. All sensory impressions and mental efforts aggravate the headache.

GENERAL SENSATION

It is chiefly the behavior of general sensation, hunger and thirst that are characteristic. The marked hunger has a certain spasmodic nature. Soon after eating, the hunger returns. The patient must arise at night to eat. Before or during the headache ravenous hunger exists. Many complaints, especially the nervous, are improved by eating but improvement does not last long. The patient can sleep better when he has eaten something. The hunger is spasmodic and at other times there is an aversion to food, or the patient desires food but will not eat it when it is brought to him.

The severe *thirst* for cold water is similar in nature. The quenching of the thirst relieves only momentarily; the thirst reappears when the water has become warm in the stomach and then vomiting often occurs. Correspondingly there is a desire for cold, refreshing, moist food.

TENDENCY TO BLEED

A *tendency to bleeding* goes throughout the entire picture of phosphorus. The reduction of coagulability

of the blood with diminution of the fibrinogen and the involvement of the capillaries up to fatty degeneration of their walls in poisoning shows this trend in the end effect. The striking reduction of CO_2 content of the blood and the nonoxidation of the otherwise so oxygen-avid phosphorus in the arterial blood gives the bright red color to the hemorrhage although a perfectly satisfactory explanation is not obtained thereby. In hemorrhagic diathesis, particularly purpura hemorrhagica, phosphorus is an important remedy. Easy bleeding from wounds, bleeding from the nose, lung, stomach, intestine, kidney, uterus, from granulations, ulcers, tumors and polypi, into the skin, mucous membranes and serous surfaces as petechia and suggillations are indications of phosphorus which, because of their final character, are naturally indications only in conjunction with other signs of therapeutic value.

NERVOUS SYMPTOMS

Phosphorus in homeopathy has always been considered an important remedy for spinal cord diseases. With the great number of subjective symptoms one does not know whether they are to be ascribed to general weakness in the neuromuscular system or to the domain of organic disturbances of the motor and sensory centers. In this respect one need not expect any action when column degeneration is completed but only in the beginning, the stage of development, can it be considered therapeutically. In this same sense the following sensory and motor irritative and paretic manifestations can be evaluated only as the fleeting transition from functional to organic disturbances: the bodily and mental exhaustion proceeds up to the highest grade of paralytic weakness, which the arms and

legs show particularly, trembling on the slightest occasion; can hardly hold objects; the gait is trembling, uncertain, stumbling; numbness and formication up to complete anesthesia, especially in the finger tips, increasing motor and sensory paresis in the fingers and toes. Muscle trembling and tendon contractions are also mentioned by Lewin as precursors of the paralysis. How far the external pains of various types are referable to neuralgias may be left undecided, but in any case they are aggravated by cold and relieved by warmth, details which will be noted in contrast to the head and gastric symptoms. The neuralgias associated with the teeth are likewise improved by warmth. Beginning bony processes in the alveoli may cooperate here.

The nervous symptoms are worse from mental and bodily effort and fear, and the great sensitivity of the psychical symptoms toward many fine influences has previously been mentioned. In the field of spinal cord action also falls the sexual irritation and weakness so far as they are not psychically conditioned; moreover, some symptoms from the sphincters, as the sensation of the anus being open, paralytic weakness of the bladder. Clinically, phosphorus is given for most diseases of the spinal cord, in particular progressive spinal paralysis, tabes, myelitis and multiple sclerosis. It is self-understood that by employment based merely on a diagnosis, only very little success may be expected and further in individual selections only where the symptoms of the system disease itself indicate possibilities of regulation. In respect to the cord degeneration of pernicious anemia, phosphorus is to be seriously considered by virtue of the similarity to the total disease.

EYES AND EARS

Phosphorus is an important remedy for internal diseases of the eye. That phosphorus physiologically plays a similar rôle in the retina as in the central nervous system may be concluded from the previously cited phosphorus excretion from the frog retina through illumination. In homeopathic materia medica, the color vision, particularly red and green vision, is mentioned. In retinitis and glaucoma, phosphorus is especially indicated, and in retinitis albuminurica the nephritis adds itself in a confirmatory manner. Gray and foggy vision and improvement of vision at twilight have given occasion for employment in beginning cataract, in turbidity of the lens and choroiditis. Rapid increase of shortsightedness at puberty is a constitutional indication.

Auditory paralysis is observed in phosphorus poisoning. As characteristic for the indication in internal auditory diseases is the difficulty in hearing the human voice, the echoing and droning of the patient's own voice and that of others, as though the ears were stopped.

RESPIRATORY ORGANS

As the important action of phosphorus on the respiratory organs we found from pathologico-anatomic sections at autopsy relatively little point of departure. In older animal investigations (cited by Sorge, l. c.) hepatization and tubercle-like formations are described. On the nasal mucous membrane old catarrhs with painful dryness, frequent sneezing and easy bleeding are described. Clinically, bleeding nasal polypi are reported. In blepharo-conjunctivitis phosphorus is frequently the choice.

The *pharnygeal catarrhs* of phosphorus have tenacious, light colored mucus; the mucous membrane is dry and glistening. The larynx is very sensitive to contact and cold air; painful burning occurs in the larynx on speaking or there is severe prickling. The huskiness is worse evenings, also after use of the voice. In milder cases there is a sensation in the larynx "as if stuffed with cotton or velvet." The peculiar inflammation makes speaking impossible through rawness, dryness and pain, or occasions inaudible speech. Thereby a constant stimulus to cough exists in the larynx and there is a hard, dry, painful cough. Phosphorus is also frequently employed in laryngeal tuberculosis. Since this is usually secondary, the same indications hold as exist for the use in pulmonary tuberculosis.

Inflammation and dryness in phosphorus have a tendency to descend into the trachea and bronchi.

Through the entire symptoms of the upper air passages goes *the aggravation from cold air; aggravation from speaking and laughing in the cough. The cough is aggravated by going from the warm into the cold.* The hard, dry, painful cough may arise from the larynx as well as the upper air passages or from sensations at the pit of the stomach. The expectoration is slight, tenacious, is detached with difficulty and at times is bloody.

Cough belongs to the nervous component of phosphorus; cough provoked by strong odors or by the appearance of strangers, cough from confusion. As so frequently we find here also the crude symptom from the receptive organs simultaneously sublimated again in the reflex symptoms.

Congestion is characteristic for the lungs and this

may be of an active type (direct capillary effect) or passively conditioned from the right heart. An important symptom is the oppression, the feeling of heaviness as from a heavy weight on the chest, constriction as if from a firm bandage, with feeling of anxiety and weakness, burning pains and heat rising to the head. Another characteristic is sticking in the left chest, better on lying on the right side. *The aggravation from lying on the left side* is generally considered as an indication for phosphorus, particularly in pneumonia. Phosphorus is a leading remedy in all types of pneumonia. Thereby one need not go so far as Fleischmann from the Austrian homeopathic school for whom phosphorus was the sole remedy in pneumonia. It is reported that it is suitable especially in the stage of hepatization, but it may be used at resolution of lobar pneumonia. The typhoid form of pneumonia is especially suitable for phosphorus when dusky facies and delirium are present. Phosphorus is also suitable for infarct and pleuropneumonia, the frequent sticking pain being a special indication.

The phosphorus cough in lung affections is so severe that it shakes the entire body, and the patient must hold the chest with his hands. The thirst for ice cold water is characteristic.

The suitability of phosphorus for pulmonary tuberculosis proceeds even from its predisposing constitutional type. To this is added the tendency to hectic fever and the bleeding. The euphoria of phosphorus poisoning may be compared with that of severe tuberculosis.

Phosphorus is often in place even in persistent catarrhs of the respiratory passages when they recur at each chilling and tuberculosis is feared especially as arising, after acute diseases. Always characteristic for

the cough is the occurrence on going from the warm into the cold. If a florid tuberculosis is in progress, then extreme caution with the doses of phosphorus is in place. I myself believe in many still afebrile cases a hemoptysis must be brought into association with the first phosphorus medication even with high potencies and I now use more of the phosphate in the form of calc. phosphor.

Many of the chest symptoms cited perhaps belong to the cardiac action. That an action occurs on the cardiac muscle is indeed shown in the final fatty degeneration. In this as well as in myocarditis phosphorus is to be placed alongside of arsenic. Affections of the right heart and the disturbances in pulmonary circulation arising out of it come into special consideration for phosphorus. The subjective symptoms have already been mentioned in the lung affections: pressure in the cardiac region, severe palpitation, worse from movement and lying on the left side, worse evening or the patient awakens at night with it; congestion to the chest, feeling of suffocation, the more severe symptoms of stasis with râles, dyspnea, anxiety, bloody expectoration. Modalities, as thirst for very cold water, thereby can guide to the remedy. By other suitable symptoms phosphorus may be considered in endocarditis in the course of febrile diseases. Accidental cardiac murmurs during puberty and with rapid growth makes the entire type suitable for phosphorus. The close connection of phosphorus to the thyroid also explains the use in goiter heart and in vegetative cardiac disturbances.

DIGESTIVE ORGANS

The phenomena from the digestive canal are known in broad trends from acute and chronic poisoning. In-

flammation of varying grade causes the following trend: gums swell, bleed easily, ulcerate.

These symptoms as well as the simultaneous tearing pains in the jaw accompany phosphorus necrosis. The tongue and likewise the oral mucosa are markedly coated, now clayey white, now yellow, or dry, wrinkled and bleeding in fever.

The pains in the stomach are of diverse types, and perhaps the burning which extends to the throat and into the intestines is the most frequent. Eructations and vomiting of sour fluid, mucus or bile occur. These general gastric symptoms state nothing in themselves. *But the desire for ice cold water and the transient improvement from it,* further the vomiting of water as soon as it has become warm in the stomach, the aggravation from warm food, indeed in a warm room, are the characteristic trends.

The vomitus may also be bloody, an indication for ulcer particularly in combination with spasmodic contractions and attacks of cutting pains which are transiently relieved by eating. In the coffee-ground vomiting of carcinoma and burning, phosphorus stands beside arsenic as a choice.

The symptoms of an ulcer or a severe gastritis naturally need not be present but there may be more nervous dyspeptic complaints as burning pain after eating, sour and frequent empty eructations, belching and regurgitation of the food soon after eating, distention of the stomach and abdomen; a weakness or sensation of relaxation in the stomach may suggest phosphorus if the modalities concur, particularly the peculiar behavior of hunger and thirst. A clinical indication is the postoperative vomiting after chloroform narcosis.

On the intestine the symptoms entirely correspond to complaints of mild dyspepsia up to the most severe ulcerative processes; empty and relaxed feeling in the abdomen, or retraction as if from a heavy weight, abdomen painful on contact, rumbling and colic in the abdomen, flatulence, colic, drawing, cutting, sticking; severe manifestations are tympany, a gurgling from gas goes from the stomach through the intestine and is accompanied by involuntary stool; this may be observed in intestinal tuberculosis and typhoid. Diarrheal stools of the most diverse types have been described, but particularly those which accompany the most severe intestinal processes; painless, copious, very exhausting diarrheas, markedly offensive, gushing, yellow, watery, or white or green, slimy stools with fat or sago-like inclusions, bloody stools as broth, involuntary on each movement. With the failure of control of the intestinal activity appears a sensation as if the anus remained open, a symptom which because of its rarity and peculiarity is useful. A paretic state of the intestine can make the evacuation of the intestine difficult.

More rare with phosphorus is a constipation with long, hard, small stools which are difficult to evacuate, "like a dog's stool," thin as a pencil. This stool should be white and this permits one to deduce a relationship to disturbance of the liver.

The peculiar, sago-like or tallow-like inclusions in the stool are perhaps traceable to pancreatic disturbances. Even if the pancreas is not particularly involved in the picture of poisoning, still here too a fatty degeneration may be present.

In phosphorus poisoning sugar is often observed in the urine. The marked thirst likewise suggests diabetes, and phosphorus stands beside arsenic in this

connection. But phosphoric acid will be used more in diabetes than phosphorus itself.

The liver cells are involved in all their functions by phosphorus. Icterus in febrile diseases, in particular pneumonia, is a further indication for phosphorus. Of the subjective symptoms in the region of the liver are mentioned feeling of fulness, sensitivity contact and sticking pains. Acute yellow atrophy and liver cirrhosis are such profound destructive processes that in spite of the most extensive similarity to phosphorus not much can be expected. If catarrhal icterus, in which a hepatitis may be presumed, is present and threatens persistent parenchymatous damage, one may be sufficiently early with phosphorus. The fatty and amyloid degenerations of all parenchymatous organs are to be valued to a certain extent only as end-symptoms showing that an organotropic connection of phosphorus exists for these cells in general and that the effect of phosphorus approaches the grade of such deep and profound diseases.

URINARY AND SEXUAL ORGANS

Likewise acute and chronic nephritis and hematuria are indications for phosphorus only in connection with the differentiating symptoms. The urine shows nothing characteristic, only at times is turbid, white and milky.

On the female sexual organs there appears in the symptoms primarily a tendency to bleeding. The menses are too copious, bright red, too early and last too long. Accompanying symptoms are: a sensation in the back as though it would break, ice cold hands and feet, dark circles under the eyes, nausea and apprehensiveness. In the progressive consumptive processes, in which naturally caution must be used in

giving phosphorus, the periods may also be absent and bleeding from the nose or hemoptysis appear in place of them.

As an inflammatory manifestation is to be mentioned the occasional appearance of an oophoritis with severe pains during the period and in the region of the ovary. The pains radiate down the inner side of the thigh. Further, there may be copious leukorrhea of different types, yellow, white, watery, excoriating or milky.

The extremely increased sexual irritability and tendency to masturbation in both sexes has been mentioned above among the nervous symptoms. There may be aversion to coitus and anesthesia in the vagina, and in the male, at times the increased libido, with impotence, ejaculatio praecox and frequent spermatorrhea.

SKIN

The manifestations in the skin in phosphorus are strikingly few in contrast to arsenic. Petechia and ecchymoses have been mentioned. The homeopathic symptom register mentions yellow-brown patches at various sites of the body. Possibly by this, pityriasis versicolor is meant, the appearance of which in tuberculous patients, particularly in the pulmonary form, is quite common. The indications would then be selected from the clinical picture. On the other hand damage to the adrenals by phosphorus could explain such pigmentation.

Finally, one finds mentioned patchy, falling out of hair with desquamation on the bald spots. Alopecia areata is frequently taken as an indication for phosphoric acid.

The general impression of a phosphorus patient is, apart from the previously indicated constitutional

signs, naturally dependent upon the existing consequences of the disease present. So a hectic spot or an earthy color of the face of the severe tuberculous patient or the edematous swelling of the renal or cardiac patient can give expression to the external picture.

SUMMARY

Type:

Asthenic, rapidly, growing; delicate, sensitive, hyperesthetic; in need of support, mentally animated but rapidly exhausted up to apathy.

Rapid change, "wavering"; fear of being alone, anxious in the evening and before and during storm; markedly increased libido but sexual weakness.

Consumption and hyperesthesia characterize phosphorus as an oxygenoid remedy.

Basedow trend; increased tissue destruction with insufficient tissue building; ravenous hunger; congestions, hectic types of reaction.

Guiding Symptoms:

Ravenous hunger, at night or soon after eating; thirst spasmodic.

Chief Trends:

Tendency to bleeding of all types (capillary endothelial damage; reduction of coagulability).

Adynamic fever (delirium sopor).

Consumptive processes.

Protoplasmic poison effect.

Special:

Functional and organic spinal cord processes; disturbances of sexual function.

Eyes: retinitis, hemorrhages, glaucoma.

Respiratory passages: pharyngitis; tenacious mucus.

Laryngitis: larynx sensitive to contact and cold air; huskiness, worse evenings, sensation of cotton in the throat; cough worse from cold air and in going from warm to cold rooms, from speaking, laughing.

Pulmonary congestion, sensation of oppression from the right heart; aggravation from lying on the left side; pneumonia especially adynamic forms.

Pulmonary tuberculosis: constitution, hemorrhages (caution!), euphoria.

Heart: particularly right heart, with disturbances in pulmonary circulation, myocarditis.

Congestions: worse on left side, worse evening.

Accidental murmurs in rapid growth.

Digestive tract: inflammatory, easily bleeding up to ulcerous processes; gingivitis to necrosis of jaw leading.

Gastric symptoms, worse from warmth; thirst for ice cold water, finally vomiting from it; ravenous hunger with transient improvement from eating; gastric ulcer or duodenal ulcer.

Dyspeptic, inflammatory or ulcerous gastro-intestinal processes. [Much gurgling and colic, involuntary stools, hemorrhages (typhoid, tuberculosis, *etc.*); sensation of anus remaining open; copious, painless, very exhausting diarrhea.]

Tallow or sago-like inclusions in stool; relation to diabetes.

Liver: strong affinity; icterus especially as an accompanying symptom (pneumonia).

(Degenerative liver processes, yellow atrophy and cirrhosis are not important in spite of the pathologico-anatomic similarity).

Urinary organs: nephritis, especially with hematuria.

Sexual organs: tendency to masturbation; increased libido with impotence.

Menses: excessive; sensation as if the back would break; oophoritis and polypi.

Skin: petechia, ecchymosis; patchy falling of hair.

DOSE

The potencies from the 3–30th are common. In active tuberculosis the 10D seems best because of less severe primary action.

ACIDUM PHOSPHORICUM

Provings of Acidum phosphoric. are found:

1. Hahnemann: *Chron. Krankheiten,* 2 Aufl., Bd. 5, 1839.
2. Heinigke: *Allg. Hom. Ztg.,* Bd. 79, p. 157.
3. Schelling: *Allg. Hom. Ztg.,* Bd. 84, p. 43.

GENERAL NERVOUS SYMPTOMS

Corresponding to its inertness phosphoric acid lacks the varying, erethistic, sensitive, exalted character of phosphorus, and is at the same time a relaxed phosphorus.

The *mental and bodily weakness and exhaustion* stands in the foreground in phosphoric acid. States of exhaustion from overwork, after diseases, from sorrow and grief, from excesses in venery, especially masturbation, or from lactation, night sweats, diarrhoea, in general exhaustion after excessive demands upon the vital functions, are held as especially suitable for acidum phosphoricum. As with phosphorus the exhaustion from too rapid growth is a noteworthy indication. Puberal states with frequent seminal emissions of an atonic type and sexual weakness give the psychic and

somatic picture of phosphoric acid especially distinctly. Palpitation and irregularity of cardiac action in too rapid growth, dark circles beneath the eyes, pale face, dilated pupils, weakness, paresis and burning of the back and sacrum, weakness of the legs, then above all phosphaturia which so often appears in sexual-neurasthenic syndromes are the bodily phenomena. Poor comprehension and concentration, poor memory, indifference, dullness, inability to perform mental work, lack of ideas, moreover, depression, apathy, dissatisfaction with one's self, aversion to speaking, in particular homesickness, indicate the psychic state in phosphoric acid. But nervous excitation with sleeplessness and sensitivity to all noises is also observed as an accessory action of too large and long maintained doses of phosphates. Such nervous unrest and depression need not be considered a contradiction to the depression which prevails in the picture of phosphoric acid; the sleepiness during the day, particularly morning and evening, the nocturnal disturbance of sleep with restlessness and dreamy sleep or sleeplessness in the symptomatic picture of phosphoric acid are just as little contradictory. A brief sleep may often remove the fatigue and be sufficient to refresh in phosphoric acid.

Persistent confusion, headaches, especially of a pressing and constricting type mostly at the vertex, as from a weight, worse from shaking and from alarm, worse after coitus and use of the eyes, better from lying down and from sleep; vertigo, worse at evening, on standing and walking, pains as though the eyeballs were pressed together and back into the head, impaired vision (in masturbators?), easily provoked visual disturbances, hypersensitivity to noises, complete the details of the picture. If calc. phosphor. is frequently used success-

fully in the headache of school children, so the phosphate fraction is the essential.

Easy premature falling out of the hair is known from phosphorus poisoning. It and alopecia areata are clinical indications for phosphoric acid. The hair also becomes grey prematurely. One might say that the phosphoric acid patient is subjected to grief, care, sorrow and depression to an unusual degree.

ORGAN AND METABOLIC SYMPTOMS

Especially important is the previously mentioned connection with the male sexual system and the phosphaturia. The excessive seminal discharge with impaired potency, prostatorrhoea on defecation indicate that atony prevails in phosphoric acid while in phosphorus the increased irritability is stressed in sharp contrast to sexual weakness.

The phosphaturia does not depend upon increased output in the urine from increased intake or increased phosphoric acid formation through protein destruction. Phosphaturia is better characterized as a calcariuria because in it there is an increased excretion of calcium through urinary as well as intestinal organs. Furthermore this implies a disturbance of acid-base equilibrium, which is closely bound to the vegetative nervous system. Phosphaturia can be regarded exactly as a partial manifestation of a vegetative neurosis. Naturally one will not consider the therapeutic action of phosphoric acid or an alkali phosphate as a crude chemical balance but more in the sense of a change in vegetative processes. It need not involve a definite independent phosphaturia. More commonly the excretion of an alkaline urine, light in color, copious in amount and becoming turbid from the precipitation of

earthy phosphates has been ever again reported as an indication for phosphoric acid when the typical nervous, particularly sexual-neurasthenic symptoms are present. The frequent nocturnal urination likewise belongs to these nervous symptoms.

The gastro-intestinal symptoms distinctly indicate their vegetative origin: white, watery, painless diarrhoea, not particularly exhausting, indeed, at times bringing considerable relief, with marked formation of gas, distention, fermentation, colic and abdominal noises. The conception of a disturbance of cation equilibrium associated with a vegetative disturbance from phosphates seems likely. Acid eructations, vomiting, sour risings belong to the same group. The complaint of gastric acidity however gains more significance with natrium phosphoricum. The dyspeptic disturbance of acidum phosphoricum is described in the following manner: "after each meal pressure in the stomach as if from a weight with sleepiness so that he can do nothing."

The close connection of phosphates with calcium metabolism permits one to understand that phosphoric acid is also suitable for crude tissue disturbances, although here the calcium compound is more often employed. Thus the diarrhoea may have a ricketic basis. Acidum phosphoricum is particularly useful in periosteal inflammations with a severe pain, worse at night, "as if the bone had been stabbed with a knife" as well as for pains in amputation stumps. According to its entire rhythm acidum phosphoricum has a middle position between phosphorus and calc. phosphor. and this should be considered in its employment for tuberculous diarrhoeas or bone affections.

That acidum phosphoricum is preferred over pure

phosphorus in diabetes has already been mentioned. In favor of the choice is the fact that a psychic factor essentially contributes in the etiology. The copious, light urine is an external simile relation; weakness and heaviness in the extremities has also proven itself in practice.

The clinical indications in the respiratory organs are very similar to those of phosphorus; however phosphoric acid lacks the hectic character of phosphorus while the apathy, stupefaction, stupor and adynamic type of fever stands more in the foreground. This fever together with a sleep from which the patient can be awakened by speaking, but gives only short answers because of the great need for rest, may assist in the choice of acidum phosphoricum in pneumonia as well as in typhoid. Profuse night and morning sweats are important accompanying manifestations.

A feeling of weakness in the chest on speaking, which also occurs in stannum, is mentioned by Hahnemann. Moreover pressure behind the sternum which makes breathing difficult, dry cough from tickling in the chest, worse at evening on lying down, hoarseness and a salty expectoration are cited as details.

The modality of relief from warmth refers chiefly to the chest symptoms. The nervous symptoms are improved by sleep, even when it is brief, as well as by moving in the open air.

SUMMARY

Like phosphorus but sluggish.

Bodily and mental weakness and exhaustion.

Etiologic: grief, sexual excesses, lactation, too rapid growth, night sweats, diarrhoea.

Predominantly a picture of sexual neurasthenia with

phosphaturia; sexual atonia; depression, apathy, inability to think. Better from sleep, even when it is short, and from moving in the open air.

Frequent nocturnal urination.

Painless, white, watery, not particularly exhausting diarrhoea (with considerable colic and gas). Complaints of gastric acidity.

Bone pains, "as though the bone was stabbed with a knife," worse at night. Amputation pains.

Diabetes. Psychic causes. Heaviness and weakness in the extremities.

Adynamic fever with stupor (pneumonia, typhoid); profuse night and morning sweats.

Chest symptoms (weakness in the chest, oppression of breathing, tickling cough) better from remaining in the warmth.

DOSE

The usual potencies are from the 1-6th; on the other hand Dahlke prefers the 12-30th.

NATRIUM PHOSPHORICUM

The secondary alkaline disodium phosphate, Na_2HPO_4 is meant. It is not surprising that in sodium phosphate the gastro-intestinal symptoms stand in the center. This aspect of phosphate action is increased through the sodium component.

The chief indication is the *complaint of acidity* which occurs after the excessive ingestion of sugar and fat; sour taste, sour eructation, sour risings, sour vomiting. The diarrhoea is green or yellow, painless as with acidum phosphoricum.

Schüssler conceives a connection to lactic acid and moreover to its decomposition into H_2O and CO_2.

Natrium phosphoricum should therefore be directed against excesses of lactic acid and should also be a suitable remedy for diabetes. As a further characteristic he reports a yellow color of coatings and secretions, in particular a thick yellow coating on the tongue and generally over the posterior part of the mouth; likewise the ocular and nasal secretions, expectoration and leucorrhoea should have this yellow creamy nature and moreover the coating on ulcers. Schüssler even proceeds farther from the totally unproven conception that natrium phosphoricum has a particular relation to the white blood cell picture, that it is indicated in swelling of the lymph-glands, and even a remedy for leukemia. If one compares the results of Farrington's[317] proving on 19 provers and almost exclusively with potencies, including the very high, then practically nothing can be found therein to confirm this indication. The clinically proven report of "sour burning" was discovered by Neidhard.

If the provings, at present very scanty, are reviewed then the agreement with those of natrium carbonicum and phosphoric acid is very great. The depression, particularly after the loss of semen, anxiety and poor memory, especially recall phosphoric acid. Dilatation of the pupil is a special report which has also been made for acidum phosphoricum. Just as phosphoric acid, so natrium phosphoricum has frequent nocturnal emissions which are followed by weakness of the back and trembling of the knees.

A further trend of action is alleged to be available for gouty rheumatic disorders. According to Schüssler natrium phosphoricum should keep the urates in the blood dissolved and absence of natrium phosphoricum should give the occasion for the precipitation of urates.

There is not the least basis for such a hypothesis. From the symptoms of the proving, a series of symptoms referred to the muscles and joints, in particular synovial crepitation, exists; clicking in the joints is often reported; but it has not been confirmed that a gouty-rheumatic trend of natrium phosphoricum has more definite clinical significance than the other alkaline salts.

How the clinical reports of oxaluria and jaundice have come into the clinical picture of natr. phos. is not apparent. Natrium sulfuricum has more claim to consideration for a liver action in any case. The origin of the recommendation in morphinism (H. Schulz) is likewise unclear. The administration in large doses in Basedow's disease by Kocher has been mentioned above.

Thus for the present only the *acid burning* remains as a sure clinical indication for natrium phosphoricum. Whether the report of Schüssler about the yellow creamy secretions will be confirmed must be left undecided at present. The general actions in common with acidum phosphoricum or natrium carbonicum are not expressed so characteristically that one should give preference to natrium phosphoricum over these remedies in definite cases.

DOSE

The most commonly employed dose is the D 6.

KALIUM PHOSPHORICUM

The acid monopotassium phosphate, KH_2PO_4 is the preparation meant. In kali phos. both constituents unite in their actions to form the picture of *muscular and nervous exhaustion* as it arises partly from over-

work and partly from psychic causes. The mental state consists of marked anxiety, depression, bad memory and downcast nature particularly from acidum phosphoricum. To this potassium adds a note of nervous irritability because we know besides the anxiety and fearfulness also the "critical," irritable, restless disposition from potassium. Kali phos. has proven valuable in brain fatigue from excessive study. Generally the early morning aggravation, as well as from cold, is traced back to the potassium influence; aggravation after coitus is common to both components. The association with sexual weakness exists here as with acidum phosphoricum. Sticking pains, sensation of numbness, motor weakness up to paretic states, weakness and sensation of cold in the back, trembling (especially in the calves) are signs of potassium; the same is true of the weakness of the bladder sphincter and enuresis.

The diarrhoea of kali. phos. is present in the early morning on arising, is worse after eating and shows its vegetative character by a dependence upon nervous factors. Colitis mucosa is an indication given by Schüssler. A decomposed odor to the stool is cited as a peculiarity.

Generally still another special trend to decomposition processes is ascribed to kali phos., this apparently originating from the report of Schüssler since he has recommended the remedy in septic states with fever and hemorrhage, carbuncles, typhoid and typhoid-like fevers, scurvy, noma, phagedenic chancre, gangrenous states, etc. We need not attribute much significance to this side of the kali phos. picture. It is entirely clear that for the trend of Schüssler with its minimal materia medica of 12 or rather 11 remedies, a breadth of clinical indications are attributed to a single remedy

which can be scarcely justified. If one will refer to phosphorus, for example, a greater part of its indications have been taken over for the phosphate; entirely apart from this, we possess a large series of much more active remedies in these septic and adynamic states. It is similar for the clinical indication of albuminuric retinitis and gastric ulcer where we prefer phosphorus and in alopecia areata where we may use acidum phosphoricum. Kali phos., just as acidum phosphoricum, is much better when selected as a remedy in convalescence after severe septic and especially typhoidal diseases.

A further report from the proving of H. C. Allen[318] that all secretions, stools, urine, sputum, and nasal secretion should have an orange-yellow color requires considerable confirmation.

Generally kali phos. will be selected when the muscular and nervous exhaustion is combined with neurasthenic-depressive states showing definite relation to the kali component, particularly in the modalities.

DOSE

The most commonly used is the 6th decimal.

ARSENIC

Arsenic is a "chalkophilic" element, that is, its characteristic site of deposit is in the sulphur-oxygen shell of the earth. Thus it appears in the lithosphere only in traces in the sulphide compounds (orpiment and realgar), moreover compactly in crystalline pieces and in combination with heavy metals and their sulphides. In the lithosphere it does not have the possibility of stabilization by precipitation with calcium as does phosphorus. As a rare element with an uneven ordinal number, it finds no special conditions for enrichment in the lithosphere; it also remains "foreign" to the organism, that is, it is not enriched by natural selection and combination.

Arsenic appears in a number of springs and is used therapeutically in this way.

For example the Durkheimer Maxquelle contains 19.6 mg As_2O_3 in a liter and most of the other springs are iron-arsenic waters, Levico, 6 mg, Val sinstra 3.7 mg, Roncegno 42.6 mg, Guberquelle 6 mg As_2O_3 per liter.

There are two allotropic modifications of the element, exactly as with phosphorus. The yellow arsenic corresponds to the yellow or colorless phosphorus and is a typical non-metal (molecular size As_2). It is volatile even at low temperatures and has a garlic-like odor. Like yellow phosphorus it acts strongly, reducing even more rapidly than yellow phosphorus it is transformed

by light (especially by short waves) or by warming into the metallic modification, which corresponds to red phosphorus. Metallic arsenic which conducts electricity is grey, black or brown and is stabile at ordinary temperatures.

From arsenic-containing soils arsenic passes into plants and for this reason it is not surprising that the animal body, likewise the human, contains light traces. Gautier[219] in particular has found it regularly in the thyroid moreover in the thymus, the brain and in traces in the skin and hair and he ascribed a physiologic role to it. It is said to leave the body in men through the hair and in women with the menstrual blood and milk. It remains longest in the hair. Bertrand[220] goes so far as to give all cells an arsenic content. But later investigations have shown that the occurrence of arsenic in the body is not so regular. In any case it is not proven that arsenic is a physiologically necessary constituent of the organism. It is conceivable that the ingestion of traces of arsenic in the food varies according to geologic conditions. Moreover the arsenic-containing smoke or coal comes into consideration as a source.[221] The hair of men who live in the English manufacturing cities regularly contains arsenic in traces while the hair of people in regions where peat is burned is always free from arsenic.

Even if arsenic is not a physiologically necessary constituent of the body, still frequently traces are found in the normal and it is remarkable that the thyroid seems to be the depot while the skin and accessory structures are excretory sites with definite affinity.

When we speak pharmacologically of arsenic we always mean arsenious acid or its anhydride As_2O_3, $(H_3AsO_3)_2$—3 H_2O, arsenic trioxide. It appears in an amorphous or crystalline form. The arsenites correspond to the phosphites and they stand in the same relation to arsenates as phosphites to phosphates. Qualitatively the arsenates, also the AsO_4 anion, have the same action as the arsenites but the toxic manifes-

tations with the arsenates appear much more slowly, a property which closely recalls the behavior of the oxidation steps of phosphorus.

The toxic action of arsenic acid is much less than that of arsenious acid. It has even been assumed that the arsenates can only unfold a toxic action by reduction to arsenites. If arsenic acid is introduced into the body then it is reduced to arsenious acid. H. Schulz and Binz[322] proved that this reduction does not occur outside the body, that is, not with chicken protein by itself. If arsenic acid is injected subcutaneously then it is reduced to arsenious acid and then 66% or more is excreted through the kidneys. The toxicity of arsenious acid to arsenic acid should be in a ratio of 10:6.[323] Apart from the small intestine, the liver is said to particularly participate in this reduction. One has made the easily split out hydrogen of the SH group responsible for this reduction. In any case the danger in arsenites is that they will not be oxidized to arsenates in the body, while phosphites will be transformed to phosphates.

In the body the arsenic is probably combined to the nucleins. At least arsenic combines with the liver nucleins in a very stabile compound which is easily split by acids or through alkalies.[324] In the blood arsenic is bound by absorption to the blood corpuscles for the most part.

It has been assumed that arsenic can appear in place of phosphorus in its physiologic compounds, especially in calcium phosphate of the bones, in the phosphatides, and the phosphorus-containing nucleins and in this way can be deposited and unfold its toxic action upon the cells. As yet the substitution has not been proven. But in any case the chemical similarity of phosphorus and arsenic stands so close even in their pathologic effects that one can consider arsenic as a dangerous double of the physiologic phosphates. Its toxic actions are remarkably similar to those of imperfectly oxidized phosphorus; as a protoplasmic and capillary poison especially in the acute actions, as nerve and bone poison in the more chronic poisonings. The conjecture seems

likely that arsenic unfolds its destructive action just as unoxidized or incompletely oxidized phosphorus along the track of the physiological phosphates.

In arsenic poisoning the liver and kidneys contain the most arsenic; then follow muscles, bones, brain. In acute poisoning it remains longest in the bones, in chronic most in the liver although it will be found even longer in the skin and its appendages; the spleen likewise takes up relatively large amounts, the heart muscle more than skeletal muscle.

The excretion of arsenic occurs through the kidneys, the gastro-intestinal mucous membrane (also after parenteral administration), the bile, the milk glands, the sweat glands, the skin and epidermoidal structures (hair, nails).

The local actions of arsenic on the mucous membrane must be considered as inflammation and slow necrosis. Because arsenious acid lacks the chemical properties for a characterisitc corrosive action, that is, protein precipitation. The necrotizing cell actions are used for the destruction of dental pulp. The epithelial mucous membrane alterations by arsenic (protoplasmic atrophy, vesicular turbidity of the cell nucleus; finally the entire cell becomes a homogeneous transparent mass, leucocytic infiltration and serous imbibition) appear only gradually after some hours.[325] The turbidity of epithelium has also a capillary, inflammatory cause which leads to cell death from saturated solutions of arsenic.

By subcutaneous injection one can effect suppuration and tissue necrosis with dilute solutions. Repeated application to the external skin can provoke an eczema.

Arsenic can destroy any cell of the human organism which it reaches in sufficient concentration. But only the acute or chronic introduction practiced in the favored manner makes the series of results and the intensity of the disturbing actions comprehensible.

ACUTE POISONING

The action in *an acute poisoning* is greatly dependent upon the form of the arsenic introduced. Thus it is

observed that horses die in a definite time after the ingestion of 2 grams of the dissolved and only after 64 grams of the solid form of arsenious acid. First it exerts a marked local irritating action on the part of the mucous membrane with which it comes in contact. If the poison is taken into the empty stomach in an easily absorbed form then stormy manifestations soon appear. Dryness, severe burning in the mouth, in some a metallic taste are noted. "The poisoned are overcome by a cold paroxysm, an intolerable anxiety, vomiting, oppression in the chest, a cold agonizing sweat on the forehead and a general trembling of the extremities alternating with one another."[326] The most severe pains are felt throughout the entire digestive tract, salivation, soon vomiting which is at first colored green due to the admixture of bile, but later may contain some streaks of blood and diarrhoea. The liquid stools are bloody or like rice water, marked tenesmus is added. The abdomen is at first retracted then distended. Severe thirst with great dryness of the mouth, esophageal spasms may appear; the uvula swells and aphthous ulcerations are observed on the tongue and oral mucous membrane. The face becomes cyanotic, the eyes encircled with dark rings, puffy, the skin, in particular the hands, feet and tip of the nose, become cold. In the calves and hands severe spasms occur. The pulse is accelerated, small, and thready. There is precordial anxiety. "The unspeakable anxiety and the burning, tearing overwhelming pain at the pit of the stomach torments with increasing severity."[327] Respiration is labored, the patient collapses and the sweat may smell like arseniuretted hydrogen. If the course is longer owing to slower absorption or smaller doses then the vomiting is repeated every day or two, esophageal

complaints, boring gastric pain, unquenchable thirst, petechial hemorrhages and mucous membrane aphthae appear. Erythema, eczema, urticaria-like skin eruptions are observed after internal administration. They usually involve the face but may occur on the entire body. It may result in extensive desquamation and loss of hair. Icterus is also observed. Finally there is jactation, delirium, loss of consciousness. The urine is scanty, bloody and contains albumin; death occurs with convulsions and trismus. With very large doses a severe even fatal collapse may occur within 12 hours after the administration or even sooner, or the cholera-like picture of asphyxia arsenicalis may be seen. In other cases the cerebrospinal symptoms stand in the foreground: vertigo, stupefaction, head and body pains, anæsthesia and paræsthesia, partial paralysis.

CHRONIC POISONING

The chronic poisoning may progress in various stages without the picture always being a complete one. Increased salivary secretion is often an early symptom; the bronchial secretion is also increased and tenacious. The patient emaciates, the facies often presents a grey-dun color, at times is somewhat icteric and more rarely bronze-like, or, particularly in brunettes, darkly pigmented "spots," "arsenical melanosis" are noted. Petechial hemorrhages appear. Angina is often encountered and with it a mild conjunctivitis even from the first doses. The gums are lividly discolored and bleed easily. The skin becomes dry, desquamates, erythema appears, the hair, nails and teeth may fall out. Vasomotor disturbances appear in the form of marked sweating of the hands, legs and feet and there is light cyanosis of the upper and lower extremities. Trophic

disturbances with gangrene are rare. The patient complains of vomiting, unpleasant taste in the mouth, headache, burning in the palms, yellow discoloration of the eyes, gastric pressure, constipation or at times bloody diarrhoea; they feel weak and prostrated. The appetite disappears entirely, mild febrile attacks occur paroxysmally or there is a feeling of fever without increased temperature, dull headache, a sensation of vertigo, pressing pains over the eyes, some nocturnal insomnia, and old rheumatic complaints may again become manifest. The patient is depressed without reason, cries easily and is easily irritated.

The mucous membranes coming into immediate contact with arsenic reveal chronic catarrhal states: coryza with dryness of the nose, laryngitis with hoarseness, bronchial catarrh, conjunctivitis, oedema of the lids, blepharadenitis, also otitis media by progression of the pharyngeal catarrh to the tubes and middle ear.

The bones may also be drawn into involvement. Lewin mentions (Eulenburg's Encyclopedia) a man who worked in an arsenic factory for 34 years. In his markedly reddened and thickened nose the septum was destroyed, the entire mucous membrane was converted into an ulcer, the left and right turbinates were covered with ulcers and crusted; a fragment of the superficially necrotized vomer was removed as a sequestrum. More rarely a joint inflammation appears.[328] H. Schulz mentions one on himself in that he suffered from an arthralgia of the ankle after working for a long time with arsenic.

The nervous system is markedly influenced, motor and sensory arsenical neuritis having been observed and produced experimentally in animals. Paralysis and disturbances of coordination are the result. The paral-

ysis may appear as early as 24 hours after the ingestion of the poison and may disappear in 2-3 days, but it may also persist, or reappear only during convalescence from an acute intoxication.

The nervous diseases are associated with frequent, severe, tormenting, tearing, cutting, sticking, lancinating pains. They are often present during rest and become increased on movement or pressure. Pains like those of sciatica and facial neuralgia are observed in hut workers. The paralysis remains longest in the toes. With the beginning of nerve involvement paraesthesias are noted: crawling, formication, numbness with a feeling of rippling in the urethra and disturbances of deep sensibility. The perception of pressure and temperature is often markedly reduced, but the toes and fingers may be hyperesthetic; a sensation of cold may occur; paralysis of the vocal cords, ambylopia, atrophy of the optic nerve with amaurosis are questionable, herpes zoster rare. The tendon reflexes, including the patellar reflexes are lost and may not return even after recovery. The pupillary reflexes may be absent and with the disturbances in coordination which are observed at the time of improvement may present a tabetic-like picture, "Tabes arsenicalis."

After 8-14 days weakness appears then paralysis which can also involve the back and limb muscles. The muscles most commonly used are most markedly involved and as a rule the extensors more than the flexors. Neck and throat muscles may also participate, more rarely the sphincters.

About two weeks after the onset of the paralysis, atrophy is noted. Electrical investigation indicates the most diverse disturbances up to complete reaction of degeneration. Likewise manifestations of motor irrita-

tion are observed: trembling, athetoid movements, spasmodic contractions of the great toe, arms and legs. During the sixth week the paralysis improves but cure may not occur for as long as 5 years; residuals with paralytic contractures may remain.

Insomnia, sensation of vertigo, headaches are frequent, irritation, depression, poor memory occurs, the thoughts are dissociated, indeed stupor may be present, more rarely coma and epileptic states.

The peripheral nerves as well as the central nervous system are considered the point of attack of arsenic. Diseases of the anterior horn cells, degeneration of Goll's column and alterations in the pons and medulla are found in the spinal cord and a neuritis of the paralyzed extremities has been found repeatedly.[329]

Albumin is found in the urine in considerable amounts, the result of epithelial fatty degeneration. More rarely copper oxide reducing substances are found. Frequently oedema and "dropsy" are reported as terminal phenomena. Pulmonary tuberculosis is often added as a complicating disease.[330]

Occasionally a parenchymatous oophoritis is observed.

Anatomico-pathologically the acute gastro-intestinal form of poisoning is characterized by a hemorrhagic necrotic inflammation of the gastro-intestinal mucous membrane, partly with pseudo-membranous deposits; Peyer's patches and the solitary follicles are markedly swollen. In the subacute and chronic poisoning the fatty degeneration of the cells in the liver, kidneys, heart, vessel endothelium, and pulmonary epithelium predominates. At times the spleen is swollen. The adrenal damages are also worthy of note: also inflammatory swelling, hemorrhages, nuclear cell degeneration.

METABOLISM

The point of departure for a consideration of the metabolic effects of arsenic is the fact that under long continued small doses in animals and man an increase of weight and sense of strength is observed. Horses are given arsenic by hostlers to obtain increase in weight, animated gait and a glistening coat. Animal investigations with therapeutic doses frequently result in a better appearance, increase of weight and greater growth of the arsenic animal in contrast to controls.[331]

This fact is utilized practically in arsenic eating in Styria, the arsenic drinkers in Whitebeck and perhaps a knowledge of this action is the basis for the use of fumes of arsenic containing tobacco as it is said to occur in certain areas of China.[332]

Even if the increase in weight is often attributed to the improvement in general well being or increased appetite, still this does not explain it entirely. Because the increase in weight is observed with a constant diet,[333] so that a direct effect on the dissimilation and assimilation processes may be assumed. In general the basis seems to consist in an increase of assimilatory processes.

The experimental results show a great dependence upon the dose and the individual sensitivity. According to Nishiura[334] 0.005-1 mg. of arsenic in rat investigation nearly always increases the gas metabolism and only exceptionally produces a depression; on the contrary large doses reduce the temperature and the gas exchange. In man chronic arsenic medication (0.01-0.15 sodium cacodylate per day) in general produces a reduction of the basal metabolism. Simultaneously with the decrease of metabolism the weight increases. This is shown most distinctly in men who previously had an increased gas exchange. To these belong particularly those affected by hyperthyroidism, and they require very careful watching with arsenic

medication.[335] The sensitization for arsenic through hyperthyroidism, which we also found in phosphorus, has been experimentally confirmed.[336] In rats fed with thyraden, doses of arsenic produce a reduction of the artificially increased metabolism, which have no effect in normal animals.

Under small doses of arsenic the protein metabolism on the whole shows a tendency to addition and there is lessened nitrogen excretion. Such a conclusion may be drawn from investigations in sheep by Weiske[337] and studies in men with atoxyl[338] give results in the sense of a slowing of protein metabolism. On the other hand it has been demonstrated that toxic doses of arsenic always increase the excretion of nitrogen also protein destruction.[339]

In any case with larger doses of arsenic the situation is similar to phosphorus and with smaller doses of arsenic it is still doubtful whether the addition actually involves the protein metabolism. A parallel with the metabolic promotion through phosphates seems likely.

Arsenic resembles phosphorus to a great extent in respect to effect on carbohydrate metabolism and the liver action.

The fatty degeneration of the liver found in arsenic poisoning has been previously mentioned.[340] The glycogen content of the liver diminishes very rapidly under arsenic, many times even after a few hours, and moreover before fatty infiltration is recognizable.[341] It seems here as in phosphorus poisoning, that an increase in the blood sugar does not occur, so that here as there, one must assume a utilization of glycogen in the liver itself. The muscle glycogen (according to Rosenbaum, *l. c.*) seems to diminish less in acute poisoning, but considerably in chronic poisoning.[342] Glycosuria is not observed constantly in experimental arsenic poisoning, on the contrary (according to Luchsinger, *l. c.*) there is an easily provoked alimentary glycosuria, exactly as with phosphorus. On the other side Begemann[343] saw an artificially produced alimentary glycosuria become less and disappear under long continued doses of arsenic.

Likewise an influence of sugar economy certainly exists but the end results are apparently contradictory

and dependent upon the dose and the previous conditions. A further proof in the direction of diabetes is afforded by the observation of Hiratas[344]: After subcutaneous injections of arsenic the cells of the islands of Langerhans increase.

Increased amounts of lactic acid in the blood reduce[345] the CO_2 content of the blood in arsenic just as in phosphorus poisoning. Increased lactic acid is also found in the liver, muscles, and especially in the intestine and kidneys,[346] moreover also in the urine.[347] This increased appearance of acid substances, lactic acid in particular, can also be associated with increased protein destruction as with alteration of carbohydrate metabolism. Nothing is known about the influence of fat metabolism by arsenic except the already mentioned fatty infiltration of the organs and vessels.

On the whole the intermediary metabolic effects of arsenic are very similar to those of phosphorus. As with all substances which cause protein destruction in toxic doses, the results are revealed in heat economy. Small intravenously administered doses of arsenic produce an increase of temperature in rabbits.[348] On the other hand the temperature falls considerably after toxic doses.[349] Agents of protein destruction are pyrogenetic!

Whether one can draw a hypothesis of the explanation of metabolic effects in arsenic as in phosphorus, wherein the oxidative splitting is depressed and the fermentative anoxybiotic is increased, must be left undecided.

In any case reports are available where arsenic has accelerated autolytic processes in the liver.[350] However, Hess and Saxl[351] have seen a depression of autolysis from large doses.

ARSENIC EATING AND HABITUATION

Of special pharmacologic interest is the habitual ingestion of arsenic for the maintenance of health and

increase of strength and power. The eating of arsenic for increasing strength was mentioned by Avicenna in 1165. The arsenic eaters of Styria are best known. They are very healthy people, usually men with laborious occupations. They begin eating arsenic at 18 but still reach old age, remain healthy, are happy, combative and sexually potent, which must be traced to the eating of arsenic. The disposition is happy and they regard arsenic as a good remedy against shortness of breath. The ingestion increases and diminishes with the moon; with a waning moon they take aloes in increasing doses until diarrhoea occurs. They proceed so far that they may swallow 0.4 g of arsenic without disturbance (maximal single dose is 0.005 g!).

The complete well being of these arsenic eaters stands in sharpest contrast to the severe disturbances in chronic industrial arsenic poisoning. This contradiction is explained by experimental investigation in that with the slowly increasing ingestion of arsenic the intestinal epithelial obtains the ability to prevent or only very slowly absorb arsenic.[352]

The amount excreted through the urine may fall to 0.3% of the quantity ingested. Dogs who have tolerated continuous slow increase of arsenic by mouth for months up to many times the fatal dose die from acute arsenic poisoning from the usual dose when it is administered subcutaneously. Moreover a general cell habituation is not present but the habituation may be based upon the altered intestinal conditions. Thus a high grade tolerance to dissolved arsenic introduced into the stomach does not exist as for the administration of a powder.[353]

ACTION ON BLOOD

A favorable action of arsenic in anemias has long been observed but the action has not been explained up to the present.

The influence of arsenic on the number of red blood cells and the hemoglobin content in animal experimentation gives extremely variable findings, some investigators reporting an increase in the erythrocytes and of the hemoglobin, particularly in anemic animals, others find no alteration of the blood and still others a decrease in the erythrocytes and of the hemoglobin. According to many investigators after medicinal doses in the healthy and sick there is usually a *decrease of the erythrocytes*, more rarely no change in the count. Here also the damages of the red blood cell picture through an organic arsenic compound must be included, as with atoxyl (the sodium salt of aminophenylarsenic acid). It produces a decrease in the number of erythrocytes and the hemoglobin content, moreover a poikilocytosis and anisocytosis.[354] This picture of intoxication which is similar to pernicious anemia may also support arsenic therapy of this disease in a homoeopathic sense. The conception[355] that peripherally increased destruction of blood caused an increased regeneration of red blood in the bone marrow seemed at first to find some basis in the marked redness of the bone marrow in chronic arsenic poisoning, but exact investigations speak against the conception. There is no increase in the erythroblasts.[356]

There is a distinct reduction of the oxygen utilization of the red blood cells whereby the anemic cells seem to be more sensitive than the normal;[357] even 0.003 of arsenic acts distinctly depressing. English investigators could prove no increase under arsenic medication, but found that the erythrocytes became much more resistant to hemolysis and therein see the favorable action in pernicious anemia.[358] Thiele[359] could not confirm this report. Perhaps some light is thrown in this connection by investigations on the influence of the thyroid on the increased nitrogen excretion with O_2 deficiency and the increased blood formation in high altitudes.[360] It shows that after removal of the thyroid, O_2 deficiency does not increase nitrogen excretion and that in athyroidetic animals the high altitude not only does not promote new blood formation but even depresses it. From the similarity of arsenic action to that of high altitudes the thought seems likely that the blood action of arsenic occurs through the thyroid, moreover feeding thyroid can stimulate the formation of blood.[361] Likewise Isaac[362] believes that the

thyroid has special significance in the blood regeneration by arsenic.

Certainly the stimulating action of arsenic on the red blood cells is decidedly dependent upon the previous state, the lability, sensitivity and on the dose. But there is also a destructive blood effect. And thus therapeutic use arranges itself—immaterially of the school—according to the simile rule.

Likewise the reports of the influence of arsenic on the white blood cells are contradictory. By administration of Fowler's solution up to maximal doses the number of leucocytes diminishes often up to one half. Thereby the neutrophiles are particularly involved. If the lymphocytes are markedly increased, then they fall distinctly.[363] But these alterations are by no means constant; in other cases the number of leucocytes increases.[364] With toxic doses at first a decrease appears which is soon followed by a hyperleucocytosis if the dose has not been lethal.

NERVOUS SYSTEM

That psyche and central and autonomic nervous systems succumb to the action of arsenic is obvious from observations of acute and chronic poisoning.

In his studies Pistorius[365] observed immediately after the injection of arsenic and before the appearance of intestinal irritation, a vomiting which was of central origin in his opinion. Moreover he had the impression in his animals that by gradual poisoning via the subcutaneous route, at first those centers of the brain and medulla which communicate sensory impressions or transmit reflexes from the vessel nerve centers are paralyzed. Perhaps the leucopenia from arsenical medication is obtained through the autonomic nervous system similarly to the leucopenia obtained by intracutaneous wheals.[366]

The respiratory center itself is also involved in arsenic action. Subcutaneous doses at first produce only an increase of respiratory frequency, perhaps a direct excitation of the vagus nerve. The respiratory center is in an "irritated" state so that excita-

tion of the central end of the vagus leads to tetanus of the inspiratory muscles while otherwise only an acceleration of respiration occurs.[367]

Studies by Ringer and Murell[368] on frogs showed that the diminution of reflex excitability is traceable to central paralysis and is not the result of cardiac failure. The excitability of the motor nerves is retained longer, but then is lost and finally the excitability of skeletal muscle. How far the paralytic state in arsenic poisoning is conditioned directly central or from circulatory disturbances is also not as yet determined.

Conduction by peripheral nerves is reduced by arsenic. The paralysis observed in acute arsenic poisoning is probably provoked through a rapidly appearing paralysis of the intramuscular nerve endings. Arsenical neuritis has been observed after therapeutic doses.[369]

HEART AND CIRCULATION

A marked influence of arsenic on the heart and vessels exists beyond any doubt according to the manifestations of poisonings.

Experimentally it has been demonstrated many times that a decrease in the cardiac frequency and finally standstill in diastole is provoked by large doses of arsenic. Very large doses of arsenic can produce an acute paralysis of the heart in which contractions no longer occur after electrical or mechanical stimuli.[370] Loewi concludes from this that a paralysis of the cardiac ganglia as well as the muscle exists. Intravenous injections of large doses in mammals give corresponding slowing of the pulse and falling of the blood pressure,[371] still the action on the blood pressure is not solely dependent upon the heart, but indeed similarly to phosphorus, on the adrenals and on the vascular system, especially on the splanchnics. With small doses of arsenic and subcutaneous injection in warm blooded animals Leeser[372] saw at first an increase in the pulse frequency. We have here also the same conditions as in phosphorus and the phosphites. In the cardiac paralysis after larger doses Leeser found the heart still irritable after some hours, so that according to his experience the heart muscle itself is not paralyzed. According to S. G. Zondek the standstill caused by arsenic can

be again removed through calcium ions, while potassium ions increase the action of arsenic.[373]

The capillaries stand under the special influence of arsenic. Arsenic like phosphorus is an outstanding capillary poison. Above all the splanchnic vascular field is prominent arsenic action.

The action involves the capillary wall itself, because after severe poisoning splanchnic stimuli no longer release any contraction.[374] The intestinal capillary walls are markedly widened and completely filled with blood. There is a high grade stasis oedema with marked exudation which results in a pseudomembranous deposit on the intestinal mucous membrane.[375] The capillaries of the other parts of the body are also involved even if not to the extent of the intestinal vessels. The severe vascular disturbances consist not only in a paralysis but also an increased permeability of the vessel wall. Through this comes *the preparation for oedema*. In dogs,[376] and in rabbits[377] with an artificial hydremia a marked oedema follows arsenic, an accelerated outpouring of intravenously injected fluid out of the vessels. Transudation occurs also in the pleura, the pericardium and brain ventricles.[378] The peculiar fact that the intestinal wall capillaries succumb to arsenic action so rapidly is not as yet explained. Perhaps it may be associated with the fact that the gastro-intestinal mucous membrane is an important site of excretion for arsenic (even after parenteral introduction). Furthermore it is striking that the organs to which a special capacity for reduction is ascribed, as the intestinal mucosa and the liver also are special points of attack in arsenic poisoning.

GASTRO-INTESTINAL CANAL

The severe manifestation in the intestinal mucous membrane, particularly the large intestine in arsenic is explained most naturally by the capillary action. At the same time a cell damage due to excretion is to be considered just as in the kidneys.

The pseudomembranous deposits in the inflamed intestine

consist of dead epithelial cells and hyaline droplets which are embedded in a congealed mass of transudate (Pistorius, *l. c.*). In the small intestine only a hyperemia is found. The early vomiting even from parenterally introduced arsenic will be perceived as a reflex action of the excreted arsenic on the gastric wall. However an increased gastric secretion is observed from arsenic.[379]

SKIN

An acute inflammatory manifestation in the skin can appear in the form of pemphigus and dermatitis herpetiformis. Arsenical therapy of these affections follows the simile rule. The skin manifestations in poisoning are likewise observed in animal experimentation, especially erythematous eruptions and falling out of hair.[380] Of particular interest is the communication reported by Geyer[381] on the so-called Reichensteiner disease which is produced by drinking arsenic containing waters. It is expressed by *melanosis* and *hyperkeratosis*. These chronic actions appear only after prolonged use of the water, while people newly arriving in the district react with intestinal catarrh and other digestive disturbances in the first few weeks. The hyperkeratosis, like psoriasis and lichen on the other side form a well known indication for arsenic, not only in homoeopathy but also in non-homoeopathic dermatology.

The formation of pigment, arsenical melanosis, is individually very different. Wherever the arsenic solution comes into contact with the pigment cells, a pigmentation appears after an interval. This pigment consists of melanin.[382] However there is probably a connection between the formation of pigment and adrenal injury by arsenic.

CARCINOMA

The persistent injection of an alcoholic arsenic solution continued over months into the grey mouse leads to a keratotic flat epithelial cancer.[383] In other cases injection of arsenic is without influence.[384] In regard to the severe damages of coal workers Belgian students[385] have found arsenic regularly up to 0.06% of the final product of coal and likewise in aniline dyes. The experimentally produced tar carcinoma, however, can hardly be traced to coal arsenic since arsenic-free tar produces carcinoma. It is well known that since antiquity (in Egypt, India, Greece and later Arabia) arsenic has always been employed as a cancer remedy, especially by means of external application. Paracelsus states that the cause of cancer is "a natural arsenic" and therefore he employed realgar against foul ulcers. This use has continued to the present in the form of Zeller's paste and Poljsak's salve which has been tested and recommended by Aschner. Arsenical keratitis and arsenical melanosis have actually been suggested as internally produced precursors of carcinoma. Moreover the malignant lung tumors (lymphosarcoma) in arsenic workers are considered the result of arsenic action. Arsenic may also—just as roentgen and radium rays—produce cancer as well as heal it under certain conditions.

For explanation of the action of arsenic on carcinomatous tissue it may be recalled that a cell poison such as arsenic first destroys the cells least capable of resistance, for example carcinoma cells. The external application of arsenical pastes indeed depends upon the elective relation of arsenic to carcinomatous cells.

Sancyoshi[386] found that arsenic acted particularly upon young

markedly proliferating cells. Others have referred to the production of fever by arsenic.[357] Fever as a sign of cell protein destruction can have significance for the melting down of carcinomatous tissue.

The consideration of the metabolic processes in the cells leads deeper. O. Warburg has shown that carcinoma cells show an increase of the anoxybiotic fermentative process at the cost of the oxidative. A depression of oxygen consumption in the cells is also known of arsenic. The assimilative action of the usual arsenical medication in the first phase can be explained by this. But if the anoxybiotic cell process gains a definite preponderance so the cell chemistry becomes carcinoma-like and finally goes over to anoxybiotic cell destruction. Thus arsenic can favor the transformation and the destruction of cell in the sense of carcinoma and it will depend upon the dose and the existing state of reaction of the organism whether such a stimulation through arsenic will result favorably.

BONES

Concerning the influence of bone growth by arsenic the observations indicate entirely the same as they did with phosphorus.[358] The growing animal fed with arsenic has more strongly developed bones. The cortex is thick, under the epiphysis is a compact bone layer, the arsenic stratum, exactly like phosphorus. The Haversian canals of the compacta are smaller, the spongiosa is transformed into compact bone, hand and foot bones are transformed into solid bones. Lardelli[359] also saw rabbits with a thickening of the cortex from Valsinestra spring water.

Not much use has been made of the possibility of using arsenic as a stimulus for the bone building process, like phosphorus and the phosphates up to the present. Still the similarity of the two chemical neighbors is worthy of note in this respect.

THEORY OF ARSENIC ACTION

Up to the present we have found extensive analogy between the action of arsenic on the organ cells and capillaries with that of phosphorus. One might imagine that the cell poisoning effect of arsenic, as with phosphorus, is combined with the regular oxidative cell metabolism. The depression of oxygen utilization of the red blood cells favors this as well as the stimulating action on assimilative processes. The destruction of cells, the splitting of protein, and the necrosis then could be an anoxybiotic process. The capillary poison effect does not oppose this idea, moreover the inflammatory action on the capillaries can be conceived as a prestage of fatty degeneration and of a necrotizing end-effect on the vascular endothelium. The hypothesis of Binz and H. Schulz, that the cell damage occurs through the oxidation of arsenious acid to arsenic acid and again reversely by reduction of arsenic acid to arsenious acid, also by a change from oxygen consumption to oxygen yield, does not seem generally applicable, particularly since the oxidation from arsenious acid to arsenic acid has not been proven in the organism up to the present. From the very slow excretion of arsenic out of the organism one might plausibly conclude that arsenic enters into a very firm compound with cell constituents and by transformation of this constituent the cell function was markedly influenced, indeed the entire cell was finally destroyed.

The apparently promoting action of arsenic proves to be the result of depressing or destructive influences; the increased assimilation probably results from depression of oxidation, the increased bone building, indeed in analogy to phosphorus, is probably an over-reaction to bone destruction. A stimulating action on the blood

is still not confirmed experimentally, consequently it is also not explained. From the clinical use however such an end effect is not to be doubted.

Experimental knowledge is still too rudimentary to provide a detailed explanation of the effect mechanism of arsenic.

ACTION ON SINGLE CELLS

Some data have been secured on the actions of arsenic on bacteria and protozoa. They have become particularly important because of the attempts to obtain a parasitotropic sterilsatio magna by the aid of organic arsenical compounds as atoxyl, salvarsan, etc.

If at first we study the bacterial action of inorganic arsenic, then it is striking that the arsenic sensitivity with single types of bacteria is entirely different. Streptococci, cholera vibrio and typhoid bacilli are injured by very small amounts of arsenic while staphylococci, coli bacilli and proteus not only retain life with great concentrations but even thrive.[390] We also see closely related types of bacteria are influenced entirely differently. We need merely assume that also in the organism the defense against the toxins or the decomposition products is favored in the same way in order to understand that in homoeopathy arsenic has proven itself much more useful in streptococcus sepsis, cholera and typhoid than in the suppurations or inflammations provoked by staphylococci and coli. In homoeopathy arsenic is not employed in the infectious diseases named because these organisms are arsenic sensitive, but the guiding line is the similarity between the responses of the organism, on one side to the particular organism, on the other to arsenic. If now the germ which is able to provoke a "morbus arsenicalis," that is, produces effects similar to those of arsenic, is sensitive to arsenic even

in the test tube, then there exists a probability of a deeper connection: the chemical affinity of the arsenic to the germ under the complicated conditions of the organism might prepare them, as an opsonin does, for the assault of body cells, and on the other side it would be exactly the skin cell powers with an affinity for arsenic which would be stimulated; arsenic also acts in consequence to its affinity on both sides as a link of the attack.

With the yeast and mold fungi similar conditions exist. Marked dilutions of arsenic (1:40,000) promote fermentative capacity of yeasts.[391] Through small doses of sodium arsenite, not only fermentation but also the inversion property of yeast was increased.[392] With larger amounts of arsenic, fermentation is depressed, the regeneration and new formation of yeast cells limited or removed and finally the yeasts are killed. Fungi are remarkably insensitive to arsenic and single forms have the capacity to convert solid arsenic compounds into gaseous forms, as is recognized by the garlic-like odor. These types also seem to be affected in respect to their vital activities precisely by large amounts of arsenic.

The effect of reciprocal play between arsenic and the cell is also not dependent simply upon the elected dose, but essentially upon the peculiarity of the cells. Naturally we have as yet no view regarding the chemical basis of these differences. Perhaps the phosphate content of the cell has significance.

CHEMOTHERAPY

Especially important for chemotherapy is the action of arsenic on protozoa. Here rapid killing is found with great doses, with moderate doses growth but death after a longer time, in markedly dilute solutions (1:10-20 million), on the contrary, increased growth.[393] We will do well not to consider according to a simple schema: stimulation, depression, death but the recipro-

cal play between living organisms and poison should be considered as a struggle under definite conditions, in which now the living organism and now the poison is victorious. Then stimulating stimuli can be understood as an over-reaction to a damage, just as perhaps the excessive new formation of bone in arsenic poisoning; one cannot as yet say that this is a stimulation, an increase of vital activity. For example it can be doubted whether the cells stimulated through the smallest doses of arsenic have the same duration of life and functional capacity as would occur under the usual conditions of life.

Likewise among the protozoa it seems that single types are especially sensitive to arsenic and indeed the trypanosome. Naturally in experiments with arsenic that one does not kill the trypanosome intra corpus, but they diminish in the blood only transiently.[394]

An improvement of parasitotropic actions has been sought as is well known by means of the organic compounds of arsenic. Arsenic is contained in these in a non-dissociating form which reduces the toxicity for body cells. At least it takes longer in the cells to liberate arsenic from an organic compound than an inorganic or dissociable form. Moreover it is assumed that the distribution of such organic arsenic compounds in the various cells is different than with the inorganic and that they can reach other cells before they are split so that an enrichment is obtained which would not be possible with an inorganic arsenic compound because the latter would produce an acute action on the body cells. The question is simply, how far the union to the parasites (spirochetae, recurrent spirilla, trypanosomes) is obtained—a still undecided question.

The cacodylate (a secondary aliphatic arsenic compound) has indeed quantitatively less toxic action than

inorganic arsenic, but qualitatively the same and seems otherwise to possess no therapeutic advantage. Atoxyl (that is, the sodium salt of p-amino-phenylarsinic acid, also a benzol compound) has proven effective against trypanosomes and certain spirilla diseases although it has no action on these organisms in vitro. A participation of the organism (perhaps a conversion into another compound) must occur. The alterations in the direction of effect express themselves in a stronger injury to the central nervous system, in particular of the optic nerve and retina (blindness), ataxia, loss of reflexes, furthermore, in the previously mentioned degenerative blood picture (poikilo-and anisocytosis). The related arsacetin (acetyl-p-aminophenylarsinic acid) is supposed to be less toxic, but more effective in trypanosomiasis and recurrens. Spirocid or stovarsol (acetyl ester of p-oxy-m-aminophenylarsinic acid) is supposed to have the advantage of a good spirocheticidal action by oral administration, but is extolled particularly for injection in Plaut-Vincent angina. Finally most used is salvarsan (besides its compounds, neosalvarsan and silver salvarsan and neosilver salvarsan). Ehrlich obtained these products by the reduction of phenylarsinic acid because he assumed only from such a reduction of phenylarsinic acid compounds in the body a parasitotropic action is obtained. Salvarsan is the dichlorohydrate of dioxy-diamino-arsenobenzol.

Spirochetes and trypanosomes can surely be diminished in the blood by salvarsan, but for how long, is another question. Moreover increased salvarsan fastness of the parasites must be considered, therefore treatment in the early stage has rich prospects. On the therapeutic results and the possible injuries from salvarsan I cannot enter here; I can, however, from per-

sonal experience contradict the report that no blindness occurs in salvarsan in contrast to atoxyl. The social hygienic value of salvarsan therapy in syphilis however ought not be questioned.

Malaria, recurrens, lues, particularly in the primary stage with phagedenic ulcers represent a field of employment for arsenic also in homoeopathy. The meaning of organic compounds perhaps may be conceived in the different combinations of arsenic effects by the organism. And "another binding," however, is probably associated with an alteration in the amount, the concentration and the frequency of doses and thus permits the great diversity of possibilities of influence with arsenic to be understood.

CUSTOMARY USES

The uses still in vogue in the school today are blood diseases, states of weakness with emaciation and skin disease representing merely a limited and insufficiently definite section out of the great domain of action of this polycrest. The doses of water cures (5th-6th potencies) do not differ considerably from those in homoeopathy.

The paths and type of actions of arsenic in the human organism are known through thousands of poisonings even if the effect mechanism is dark in single details. The provings of the healthy with various potencies have only the meaning of improvement and refinement of the symptomatic picture: first for improvement of the early symptoms, which especially arise in the vegetative, regulatory, vasomotor-trophic disturbances, and then for the determination of the finer circumstances, the modalities, among which the well known symptoms of arsenic appear from the poisoning.

ARSENICUM ALBUM

Intentional provings of arsenicum album are found:

1. Hahnemann: *Materia Medica Pura,* 3 Aufl. Bd. 2, p. 41, 1833, and *Chron. Krankheiten,* 2 Aufl. Bd. 5, 1839.
2. Imbert-Gourbeyre: *L'Art Med.,* Bd. 17, p. 433.
3. Robinson: *Brit. Journ. of Hom.,* Bd. 25, p. 320.

Of Natrium arsenicosum:

1. Trans. of Penns. State Hom. Soc. II, 186 (according to Allen's Encyclopedia, vol. 6, p. 473).
2. Imbert-Goubeyre: *L'Art Med.,* Bd. 17, p. 440.

Of Arsenicum iodatum:

1. Beebe: *U. S. Med. and Surg. J.,* vol. 1, p. 339.
2. Blakeley: *Hahne. Monthly,* vol. 3, p. 265.
3. Thomson: *Lancet,* 1838/39, p. 176 (Allen Encyclopedia, Bd. 1).
4. Hale: New Remedies, 4 Ed., p. 372, 1875.

Of Cuprum arsenicosum:

Hale: New Remedies, 4 Aufl., p. 74, 1875.

STEP-LIKE GRADES OF ACTIONS

In the domain of arsenic action various steps can be differentiated. The most crude local necrotising action of the cell poison corresponds to the malignant septico-gangrenous and embolic processes, phagedenic ulcers with offensive, often cadaverous, acrid secretions, ulcers which bleed easily and possess the general characteristic of the remedy, the burning pain. At another step stands the blood destructive action resembling a pernicious anemia and the general cachexia. A further section is designated by the capillary poison effect which stands

very close to phosphorus. It is from the poisonings which run acute and subacute courses that all the acute inflammatory manifestations on the mucous membranes and parenchymatous organs with the final result in fatty degeneration are embraced. The organic heart and vessel damage represents the severe cardiovascular syndrome at this step. The neuritic and trophic disturbances correspond to a more chronic course. Finally there are the vegetative and vasomotor symptoms and allergic states which characterize a grade of special arsenic sensitivity and which appears only at times in the beginning of chronic action or in a sufficiently fine intentional proving. The accompanying psychic symptoms can in any case show all stages of the most profound melancholia, greatest unrest and anxiety of the acute intoxication and excessive sensitivity.

In the most severe general diseases, malignant tumors with cachexia and pernicious anemia, arsenic belongs to the similar but still only rarely helpful remedies. From antiquity ever again one returns to arsenic, obviously because occasionally good was obtained from it in such dubious cases. In spite of improvement of the knowledge of indications the homoeopathic method has often employed it in these destructive processes but the situation is so dubious that convincing results are rare. In malignant lymphoma arsenic is likewise generally used. One may see a temporary result from arsenicum iodatum D 3.

In the severity of cell action, the firmness of combination, the generality of effect possibility and the preference for the parenchymatous cells, arsenic can be best compared with the most virulent toxins of many bacteria; therefore the great similarity of the arsenic

picture with cholera, with acute sepsis as well as those with a more protracted course.

The similarity to sepsis can serve at first for enlightenment of certain general actions of arsenic.

COMPARISON WITH SEPSIS

In sepsis as in arsenic we see the high grade weakness, so difficult to explain by tissue sections, increasing anemia from diminution of the erythrocytes and of the hemoglobin. The anemia in arsenic has an entirely toxic degenerative note and between the degenerative anemia and the fatty degeneration of the organ and endothelial cells certainly exists some connection because the fatty degeneration is observed especially in pernicious anemia. *The extreme anxiety and restlessness in addition to the great weakness,* and the feeling that death is inescapable, one finds in arsenic in sepsis. The chills in sepsis correspond to the periodic chills and the so-called cold fever in arsenic. The periodicity cited as so characteristic for arsenic is not strict but depends upon the periodicity of metabolism. It expresses itself in *a chief time of aggravation,* namely *from midnight to two in the morning.* The great *feeling of coldness, the desire for warmth, the improvement from warm drinks,* corresponds to the collapse phase of sepsis (and cholera) and is also more peculiar to the acute arsenic picture while the mild vasomotor phenomena, as *headache, improvement from cold* have and—what suggests the congestive nature of these—*aggravation from lying down.* The cold sensation of arsenic apparently has less constitutional character than an acute, and this modality is not universal, but merely, similarly to phosphorus, is present in a reversal to some other condition. The *great thirst* of the arsenic picture is *characterized*

by frequent ingestion of only small amounts of fluid. This corresponds to the great restlessness in which, just as in sepsis, the organism is found in an acute arsenic status. In the more chronic states, absence of the thirst is not a contraindication to arsenic.

The similarity of arsenic and sepsis can be followed further in respect to the manifestations in single organs. If one recalls the malignant, septico-gangrenous anginas and oral inflammations, the parenchymatous nephritis, as they occur in sepsis and scarlet fever just as they do in arsenic, then one frequently finds a suitable remedy for them in arsenic; in the toxic but still therapeutic cardiac action, myocarditis, dilatation with arrhythmia, bad pulse, lowering of the blood pressure and coldness of the body, as well as endocarditis; in the splenic swelling; in the erythematous and at times petechial skin phenomena, all of which refer to the septic character and to arsenic as a suitable remedy. A toxic herpes zoster with the characteristic *burning pain* also falls in the field of indications of arsenic, and also appears in sepsis. To these are added the septic and phagedenic ulcers of arsenic on the skin and mucous membranes which tend to become gangrenous, likewise with burning pain, the corneal ulcer. Ulcera cruris has more a trophoneurotic character; its black base, the flat extension in width, indicates the poor tendency to healing. Thrombophlebitis and septic-embolic foci suggest arsenic as one of the most important remedies.

Such a comparative consideration shows that arsenic has been an important remedy in sepsis in homoeopathy but is in no way always *the* remedy. Here the character and rhythm of many arsenic symptoms should be distinctly comparable. It is worthy of note that (according to Gies) arsenic is considered an antidote to snake bite among the Brahmins.

COMPARISON WITH CHOLERA

The comparison of the most severe gastro-enteritis of acute arsenic poisoning to the picture of cholera is likely. Even Virchow could not differentiate between arsenic poisoning and cholera from the pathologico-anatomic findings. The signs of arsenic are: rice water stools, great lassitude, severe colic, cardio-vascular collapse, cramps in the calves, ice cold body, fear of death, aggravation of the diarrhoea and of the vomiting from eating and drinking as well as at night, with burning thirst, aggravation from cold drinks which are vomited immediately, improvement from warm drinks and the application of other forms of heat. If convulsive phenomena appear, then cuprum arsenicosum will be preferred. The comparison is naturally drawn only to the picture and not to the diagnosis. In cholera infantum arsenic or an arsenical compound is frequently in place, but it can, for example, be just as well indicated in the similar botulism or paratyphoidal diseases, also in gastro-enteric conditions with less severe total pictures which are provoked by cold foods or drinks or spoiled foods. The diarrhoeas are always extremely offensive, at times bloody, very exhausting, so that a dysentery-like picture comes into consideration for arsenic. The abdomen is sensitive to pressure and distended. Throughout the entire gastro-intestinal canal a severe burning pain prevails, thus, for example, in the markedly inflamed hemorrhoids in which the nocturnal aggravation and the improvement from warm applications furthermore suggest arsenic. Cold foods and drinks cause gastric pain, vomiting, and diarrhoea. The great weakness and the other modalities are always guiding.

OTHER MUCOUS MEMBRANE SYMPTOMS

The gastro-intestinal canal syndrome in arsenic need not manifest septic and toxic trend which corresponds to cellular and capillary damage. Thus arsenic can be helpful in gastric ulcer with burning pain where in all probability vasomotor-trophic causes rather than toxic causes play the chief role. The following gastric symptoms of arsenic can have gastritis as a basis: pain after eating and drinking, sour burning and eructations of sour and bitter but very acrid fluid, loss of appetite, great aversion to food, can hardly bear the sight or odor of foods, longing for acids and coffee.

On other mucous membranes and organs the transition from organically inflamed to vasomotor disturbances in arsenic is still more distinct. Thus in the respiratory organs there is less often septic lung inflammation or pulmonary gangrene; likewise catarrhs of the respiratory passage (with dry cough, pain in the chest, aggravation after midnight, from drinking and in cold air) are rarely arsenic indications; more frequent are the asthmatic states with the typical time of aggravation, anxiety and restlessness and the inability to remain recumbent, accompanied by a dry hacking cough and a sensation of oppression and a scanty foamy expectoration. Hahnemann cured himself of a threatening suffocative catarrh which was aggravated each night after lying down by the use of arsenic. It is also not excluded that a chronic bronchitis with emphysema lies at the basis of the asthma. Moreover the nervous allergic forms of asthma react very well to arsenic which then is naturally given in the higher potencies. For explanation one can refer to the heightened irritant state of the respiratory center in arsenic poisoning;

moreover the early action on the capillaries which is associated an abnormal permeability can also be made responsible. Finally the eosinophilia and the leucopenia under arsenic are signs of a simultaneous action on the autonomic system.

On the nose an actual inflammation with thin watery, acrid secretion is present with burning and sneezing without relief; but also the allergically precipitated hay fever or the vasomotor rhinorrhoea is a good indication for arsenic. In any case the aggravation in the open air holds more for the latter form.

On the conjunctiva exactly the same situation prevails. The burning and acrid lachrymation are guiding. Blepharitis with chronic reddened, swollen, desquamating lid borders appear at times and corneal ulcer frequently comes into consideration for arsenic. On account of the trophoneurotic effect character one would think of arsenic first in herpes cornea.

On the female sexual organs are septico-ulcerative inflammations with burning, thin, acrid, corroding offensive leucorrhoea the chief indication. The inflammation can also proceed from the ovary and there is a burning pain in the ovarian region and a tendency to profuse and too early menses and to metrorrhagia. The relation to carcinoma of arsenic is naturally important for this organ.

CIRCULATION

Arsenic is suitable not only for the already mentioned severe organic states of the heart with insufficiency and arrhythmia but also for milder disturbances such as precordial anxiety, worse at night, palpitation with restlessness, anxiety and loss of strength in vasomotor lability.

The tendency to oedema in the arsenic picture will

be ascribed not only to myocarditis and nephritis but also to the direct influence on the capillaries which leads to greater permeability. In nephritis it is also the acute and subacute forms proceeding from the capillaries which are suitable for arsenic.

SKIN

Likewise on the skin we know a stepladder of cancroid and septic manifestations (toxic erythema, malignant eroding ulcers with stinking secretions, carbuncles) to the more trophoneurotic ulcera cruris and herpes zoster and finally to vasomotor-allergic states as urticaria with burning pain and great restlessness. For the more chronic action we recall the frequent presence of arsenic in the ectodermal structures and its excretion through these which shows the affinity perhaps more obviously than in phosphorus. In particular it proves itself as suitable in dry, desquamating skin processes, hyperkeratosis up to ichthyosis and psoriasis (for all these ars. iod.!). Furthermore lichen ruber is an indication for arsenic in both schools. In the chronic poisoning the hyperkeratosis involves outstandingly the palms of the hands and the soles of the feet. The itching in skin affections is characterized in arsenic by the aggravation from cold and scratching, which then passes into burning. Falling out of hair, as occurs in phosphorus and phosphates is present, but not frequently used therapeutically.

DIABETES

Arsenic is an important remedy in diabetes. The influence demonstrated first by Hirata in regard to the islands of Langerhans is to be considered for explanation as well as the firm combination with the liver cells

and the reduced sugar tolerance in arsenic poisoning. Precisely in the severe forms use is often made of arsenic. But especially in gangrene, phlegmon, carbuncles on a diabetic basis it deserves (besides secale which in contrast to arsenic has improvement from cold) great consideration. For me it has repeatedly given greatest service in the D 6.

NERVOUS SYSTEM AND MENTAL SYMPTOMS

In the nervous system the neuritides and neuralgias which appear in the picture of poisoning, are not rarely therapeutic indications. Polyneuritis, facial neuralgia, ciliary neuralgia, sciatica causing furious pain, worse from cold and contact, better from warmth and before all the periodicity of the pain, the midnight aggravation and the burning pain suggest arsenic. Extensive paralyses are scarcely suitable for arsenic. Flexor spasm, trembling, athetoid-like movements of the poison picture occasioned the earlier school use of arsenic in chorea which though not common in homoeopathy is considered homoeopathic. Headaches of a vasomotor type, improved by cold and keeping the head erect have already been mentioned. But also severe vasomotor paroxysms, periodically recurring, unilateral migraines with feeling of coldness or burning with great lassitude and restlessness should cause one to think of arsenic. But especially when the migraine appears as an equivalent of malaria, arsenic has proven itself for me, as in general, arsenic in periodic manifestations after malaria which have been treated by too much quinine, it is the most important agent. In malaria itself arsenic has been recommended from time to time outside of homoeopathy. Outside of the periodicity of the febrile attack, the destruction of blood and cachexia, the

splenic swelling in arsenic poisoning—to be sure hardly differentiating—are parallel manifestations.

Of the mental symptoms the great anxiety and restlessness with fear of death stand in the foreground. The patient constantly changes his position. Doubt drives him from one place to another. In spite of fear of death there also exists the hopeless melancholia with tendency to suicide. The arsenic patient shows great sensitivity toward his own pain which makes him furious and moreover he is fussy and pedantic about disorder in the environment.

TYPE

That the emaciation and cachexia, often predominating in the total impression in many severe morbid processes, underlie the suggestion to arsenic is not surprising; in the acute toxic states the facies is often hippocratic.

If one compares the picture of arsenic to that of phosphorus similarity of intermediate disturbances and the pathologico-anatomic end stages, the more septic, malignant, ulcerating, gangrenous character in all refer more to arsenic, moreover the greater disposition to trophic and vasomotor disturbances. If with phosphorus one can indicate the inflammatory and cell degenerative actions still as morbid increases and reversal of physiologic phosphorus functions, then the greater malignity of arsenic may be ascribed to its body-foreign nature. If the hypothesis is correct, though it is not proven as yet, that arsenic displaces phosphorus from its physiologic position, then from this the degenerations in its manner of action can be understood. In arsenic we cannot expect a constitution fixed from birth as from the life necessary phosphorus. But still from the endocrine side a certain orientation of the

arsenic type to the functional domain of the thyroid may be assumed. Because the thyroid plays the chief role in the control and regulation of traces of arsenic which stands very near to the physiologic; furthermore hyperthyroiditic men and animals are sensitive to arsenic (as for phosphorus). Likewise the finer arsenic effects will be suited much better for the hyperthyroiditic, oxygenoid type. Also without reference to the severe intoxications, the cardinal psychic symptoms, restlessness, anxiety, the vasomotor manifestations with tendency to fever, the emaciation proceeds out of this endocrine trend.

ARSENIC COMPOUNDS

In all compounds the arsenic fraction determines the action.

Arsenicum iodatum: AsI_3 is slightly stabile and still insufficiently proven. Outside of the clinical indications mentioned on p. 279, the transient improvement in malignant lymphoma has been mentioned.

Cuprum arsenicosum, $CuHAsO_3$, is often of value in uremic and eclamptic spasms in D 3 and has seemed favorable in preuremic states and in general anasarca even if not permanently. In severe gastro-enteritis it may be preferred to arsenic when the tendency to convulsions exists.

Natrium arsenicosum, $NaAsO_2$, is recommended in severe inflammation of the nose and accessory sinuses with pressing pain at the root of the nose.

Kalium arsenicosum of approximately the following composition $KAsO_2$, $HAsO_2$ has been the cause of frequent medicinal intoxication as Fowler's solution, in which the skin manifestations, particularly the parakeratosis, stand in the foreground. In contrast to arsenicum album it is said that the itching is aggra-

vated by warmth. Kal. arsenic., is occasionally recommended in the lower potencies in severe oedemas of chronic nephritis or myocardial weakness in place of arsen. alb.

Calcium arsenicosum, $Ca_3(AsO_3)_2$, was proven by Hering in 1848 (Jahr, New Manuel or Sympt. Codex. New York, 1852). Its use however occurs in general with the view of shaping the arsenic effect more persistently in deep chronic affections and rests on clinical indications: in malignant glandular tumors, mesenteric lymph gland swelling, liver and spleen swelling in children (in India); in chronic nephritis, when the kidney region is particularly sensitive; moreover in epilepsy with rush of blood to the head, pulsation and pain about the heart before the attack. Similar vasomotor manifestations should also suggest the remedy in fat women at the menopause.

SUMMARY

Chief Trends:

Parenchymal cells and capillaries.

Carcinoma, malignant ulcero-gangrenous process, septic embolic foci.

Toxic-like action: example: sepsis, cholera. Malignant angina, parenchymatous nephritis, myocarditis.

Inflammation of all mucous membranes; gastro-enteritis.

Protein destruction: fever, degenerative anemia. Fatty degenerative changes in organs.

Cardio-vascular syndrome: tendency to oedema.

Great weakness and cachexia.

Diabetes. Results of malaria.

Trophoneurotic: neuritis and neuralgias. Ulcera cruris, herpes zoster, corneal ulcer, gastric ulcer. Diabetic and senile gangrene.

Vasomotor-allergic: asthma, hay fever, cardiac neurosis, headaches and migraine.

Steps of Intensity:

Malignant-necrotizing; gangrenous-septic; inflammatory degenerative; trophoneurotic-vasomotor.

Mental Symptoms:

Anxiety and restlessness.

Fear of death and still, hopeless melancholia with tendency to suicide.

Hypersensitive toward their own pains and fussy about disorder in the environment.

Guiding Symptoms and Modalities:

Restlessness and anxiety (with great weakness).

Periodicity.

Aggravation time 12-2 at night.

Great feeling of coldness, desire for warmth (particularly in acute states); gastro-intestinal manifestations better from warm drinks, worse from cold; in headache (vasomotor), improvement from cold and elevation of the head, aggravation from lying down. Itching worse from cold.

Great thirst, frequent but for small quantities (restlessness in acute states).

Burning pain, externally and internally.

Offensive, even cadaverous offensive, acrid secretions.

DOSE

Arsen. alb. has often proven itself to me in the 6, 12, 15, and 30th potency. For the choice of the potency the above mentioned steps from destructive cell processes to vasomotor symptoms can be used as one guide. Still one sees immediate improvement in severe organic diseases at times even from the high potencies.

ANTIMONY (STIBIUM)

Antimony compounds, particularly in the naturally occurring sulphide, served in antiquity as cosmetics for coloring the eyebrows and for the treatment of skin diseases and wounds. Even today antimony is used in the Orient in the treatment of the Bagdad boil. Paracelsus used it as a powerful arcanum. According to Latz[395] of the seven arcana two are antimony preparations: Pulv. solaris niger and Pulv. solaris ruber. In 1604 Basilius Valentine published the work "Triumphal Chariot Antimonii" and extolled antimony in the French disease, eruptions, cancer, intermittent fever, asthma, gastric maladies, epilepsy, and melancholia. If the iatrochemists held the use of antimony extensive, then the Galenic were just the opposite. Physicians were excluded from their organizations because they employed the very dangerous antimony. This fight in the school over antimony lasted approximately a century. In spite of the prohibition the Paris faculty favored the use of antimony as the so-called pox-salve for diversion to the skin, as an antiphlogistic, an emetic and expectorant. In 1836 an extensive study was published on antimony by Sachs (Professor in Königsberg) but the use was infrequent. In school therapy at present the employment of antimonial preparations as expectorants or in larger doses as an emetic is not common. Recently antimony as Sb_2O_3—in analogy with arsenic—has obtained chemotherapeutic significance in trypanosome and spirilla diseases.

CHEMICAL POSITION AND PREPARATION

Corresponding to its position between arsenic and bismuth, antimony (stibium), Sb, has a more marked

largely with it. Spiro[396] assumes that the slighter pharmacologic activity of antimony in contrast to arsenic is due to the greater stability of the complex compounds. But in other groups of the periodic system we also see that with an increasing heavy metal character, an element tends to become foreign to the body and with it the extent of action is limited.

ENTRANCE AND EXCRETION

Antimony compounds are absorbed from all mucous membranes[397] as well as from the skin.[398] Excretion occurs through the faeces, urine, milk, and bile. After parenteral administration the greatest part is excreted into the stomach and intestine. Antimony is obviously retained for a long time in the body and then is excreted slowly in the urine long after the administration is discontinued. Thereby it collects chiefly in the liver. In acute poisonings the kidneys and intestines are also found the sites of excretion.

In contrast to arsenic it is not possible to obtain an habituation with antimony: resorption is not lessened on persistent administration but rather increased.[399] Therefore previous treatment with antimony seems to increase the sensitivity of the animal; this is connected with the slow excretion and absorption. Brunner found trivalent antimony much more active than pentavalent.

ACUTE AND CHRONIC INTOXICATION

Locally antimony compounds in soluble form exert very strong irritant action on the skin and mucous membranes. On the uninjured skin the inunction produces a marked inflammation with follicular pustule formation which leave behind small pox-like scars. After the ancient use of antimony ointment on the hairy scalp, as the "pox-ointment" or martyr's salve, gangrene of the scalp with periostitis and deep ulceration often occurred.

But skin manifestations are also observed from the internal use of antimony, particularly on the genitals,

arms and back. They consist of pustules up to the size of peas which may arise from small red papules at the stoma of the gland follicles. Deep necrosis may occur from the internal use. Christopherson and Gloyne[400] have observed a goose-like skin after the long continued injection of tartar emetic as well as the marked appearance of roughness, moreover, a leucoderma in the negro.

In poisoning by antimony vapors stupefaction and frontal headache appears, then chest symptoms, severe painful cough, partly dry, partly with tenacious sputum difficult to evacuate, and piping and rales in the chest. Then the gastro-intestinal symptoms pustules on the genitals were observed, finally great prostration, decrease of sexual potency and swelling of the testes.[401]

After the ingestion of toxic doses (maximal dose 0.2 gram pro dosi) pains in the mouth, a metallic taste, and aphthous-like vesicles or pustules on the oral mucosa are encountered. The lips swell. The patient complains of difficulty in swallowing. Nausea, vomiting, gastric and abdominal pain occur, the stomach and the hepatic region are particularly distended. There is increased salivation, then retching and finally vomiting of bile containing gastric contents. Simultaneously colicky abdominal pains appear, the stools become mucoid, the bile content often increases and many times in animal studies the stools are bloody.[402]

Chilliness occurs, the face becomes pale, the throat rough, the voice fails, respiration is greatly impeded. The pulse is small, clonic and tonic spasms occur, the skin is cold and covered with clammy sweat. With vertigo, collapse and loss of consciousness, death occurs. The urinary output is lessened but not to the extent noted in arsenic poisoning. As effects incidental to intravenous injection[403]: immediately after or dur-

ing the injection a slight redness of the face and slight feeling of oppression to respiration many times accompanied by an irritant cough. A metallic taste in the mouth is mentioned just as rapidly. Soon after the injection there are muscle pains, particularly drawing pains between the shoulders, in the upper arms, in the back muscles, with a feeling of stiffness in the entire musculature, even in the muscles of the jaw. This sensation may persist 1-2 days and impair movement.

Outside of Nobiling's study[404] the actions on the respiratory passages have received little attention in German literature. Ringer,[405] however, knew the increase of secretion in the bronchi after small doses—in the sense of school medicine—of antimon. tartar. as well as the good therapeutic results in catarrhs of the respiratory passages, particularly in children, with frequently repeated doses of 1 mg.

In acute poisonings in animals bronchitis and pneumonia have often been found. The anatomic findings in acute poisonings in the stomach and intestine as well as in the liver is exactly the same as in arsenic poisoning.

INVESTIGATIONS ON MAN

Concerning chronic antimony poisoning the best information is given by the older investigations on healthy men by Nobiling[406] with tartar emetic and the studies of Mayerhofer[407] with ant. sulf. aurant., Sb_2S_3, whose experiments were long continued and arranged according to the method of homoeopathic drug proving. Less suitable are the more recent reports of Schrumpf and Zabel[408] because they also include the alloy poisoning of typesetters in which lead as well as antimony participates. They found downcast facial expression, nervousness, irritability, insomnia, lassitude

especially mornings, sensation of vertigo, headache especially frontal and occipital, widespread local pains, neuralgic pains in the extremities, nausea, anorexia, gastric and intestinal disturbances and constipation. They also report a leucopenia and an eosinophilia as an experimental finding. The proving of Mayerhofer with ant. sulf. sur. yielded the chief action on the bronchi, then the gastro-intestinal canal and skin similarly as they are described in the homoeopathic drug picture.

The study of Nobiling with tartar emetic deserves more detailed presentation:

"If tartar emetic is given internally in small doses increasing from 1-12 mg. then the following manifestations become evident by degrees: pressure and heaviness in the precordia, heavy dull head, discomfort, restless excitable disposition, soreness of the extremities especially the thigh; tearing and drawing in the joints, febrile chills, accumulation of saliva in the mouth, pasty mucous coated tongue, thirst with internal heat, particularly congestions toward the head, great lassitude and malaise, therefore also great tendency to sleep, with anxious dreams, frequent irregular full pulse, vertigo, flickering before the eyes, tired, sad, sunken eyes which are surrounded by dark circles, pale downcast face, increased collection of mucus in the throat and sensitive swallowing. If used for a longer time the appetite diminishes, pressure in the stomach causes great sensitivity, severe, sticking, frequently recurring pains of short duration in the intestines, nausea, anxiety and frequent irresistible yawning are added; respiration becomes labored and on the chest and around the region of the heart an unpleasant anxious sensation occurs. On the skin of the back a sensation of cold makes itself unpleasantly obvious and

then extends to the legs. The abdomen is somewhat distended and extremely sensitive to contact. At first the stool is normal, but gradually becomes irregular, often pasty, but at times solid and in the intervals there is constipation. In consequence to the marked drinking of water which the insipid taste in the mouth makes necessary, the urinary output is increased, thereby is the urine clear and watery but is hardly altered in its chemical characteristics.

If tartar emetic is used for a longer time and in gradually increasing doses, then all the manifestations appear in greater degrees. The nausea increases to severe vomiting, frequent eructations and belching, the stool becomes a thin, muco-bilious diarrhoea with a tense, distended abdomen which is sensitive to contact. The gastric but particularly liver region is distended, the liver dullness on percussion is increased about a finger's breadth downwards, in marked cases the liver is palpable under the ribs and very sensitive on pressure. Colic and rumbling develops in the intestine with tearing, cutting and pinching in the abdomen, with tension and tearing in the lower extremities. The sensation of warmth over the entire skin surface is increased and there is itching. The appetite is entirely lost and if something is eaten then the nausea is renewed and there is the inclination to vomiting. The throat becomes rough, swallowing impaired and very sensitive. The tongue is covered with a dirty slimy yellow coating, the taste is insipid and pappy. *The secretion of mucus is increased and in the chest, stasis becomes noticeable in the lesser circulation.* The head is heavy, pressing, dull and extremely painful in the frontal and vertical regions.

With small continuous doses there is lessened force and slowing of the heart and consequently of the

pulse; the heart beats to a diminished degree but with a distinctly perceptible lesser intensity at the normal site. Respiration is labored and likewise slowed; the face is discolored; weakness extends over the entire body; emaciation occurs and with this the deep position of the eyes and the difficult movement of the extremities is explained. The vomiting is usually accompanied by a copious outpouring of cold sweat over the entire body, but large drops appear on the forehead, and this is accompanied by flickering before the eyes, weakness and vertigo.

RESULTS OF ANIMAL EXPERIMENTATION

The animal investigations available for explanation of antimony action give only a very defective picture of the intermediate processes. The similarity with arsenic is great, still the action is less severe and slower. The peculiarities of antimony are not apparent from investigations arranged on animals, so that we must depend entirely on human provings for these.

The metabolic actions of antimony seem to be similar to those of arsenic, still the scanty findings available at present are contradictory. Chittenden and Blake[409] found by prolonged feeding of Sb_2O_3 in pigeons an increase of weight and a large fatty liver, in rabbits a decrease of weight. In a dog with a fixed normal diet they found no essential alteration of the protein metabolism by the use of Sb_2O_3. On the contrary Gäthgens[410] found in a hungry dog to whom tartar emetic was given, a considerable increase in nitrogen excretion and a slighter one of sulphur and phosphorus so that an increase of protein transformation of about 30% was assumed.

The glycogen of the liver under antimony very markedly diminishes and may vanish completely.[411] As with phosphorus and arsenic the CO_2 content of the blood falls, obviously here the result of an acidosis from disturbance of the carbohydrate and protein metabolism.[412]

In the blood at first appears a leucopenia and eosinophilia[413]

and then a leucocytosis follows.[414] The reports regarding the red blood cells are indefinite, Kolle and his co-workers observing[415] after chronic poisoning in mice a marked decrease of the erythrocytes and poikilocytosis, which recalls the action of atoxyl. Mayerhofer[416] found the coagulability of the blood markedly reduced. The blood pressure sinks gradually and continually and in chronic poisoning one finds also a slight reduction. This fall is not simply the result of cardiac weakness, because by aortic compression and under helleborein there still occurs an increase of pressure.[417] The fall in blood pressure is the result of vascular paralysis primarily in the abdominal capillaries. In acute poisonings there is cardiac standstill in diastole.

A stimulation of respiration in acute poisoning from tartar emetic has been traced by Grimm[418] to an immediate action on the respiratory center.

The typical vomiting which appears not only with tartar emetic but also from other antimony preparations also occurs after intravenous introduction whereby the vomitus contains antimony. According to Hermann[419] the vomiting is not the result of an immediate central action because greater doses are necessary for its production intravenously than by mouth. The vomiting is regarded as released reflexly from the gastric wall and indeed by the antimony that has been excreted also after intravenous administration. According to the investigation of Weiss and Hatcher[420] on cats the vomiting movements appear after intravenous injection and even after removal of the entire gastro-intestinal tract. According to them the action probably proceeds over the vagus (whose sensory nucleus is essentially concerned with the act of vomiting), and to a lesser degree over the sympathetic. These authors hold it as probable that by intravenous injection the heart comes into consideration as the site of origin for the vomiting reflex and from there, as well as from the stomach and duodenum for the most part over the vagus and only to a slight extent over the sympathetic, the centripetal stimulus for vomiting passes.

An influence on the vegetative system is also suggested by the observation of the angioneurotic manifestations in the antimony therapy of multiple sclerosis.[421]

Apart from these central and vegetative actions, antimony has no essential significance for the central nervous system. With fatal antimony poisoning the reflexes are lost and even if the vessels are ligated before the intoxication. Accordingly the

disturbance does not arise from the spinal cord.[422] On the other hand Michiels[423] found no alteration of reflex excitability. According to Soloweitschyk[424] the irritability of the nervous system persists after cardiac standstill. In the beginning of the intoxication an irritant state of the medulla is observed, then the reflex excitability is diminished. But the voluntary movements may persist. The irritability of the motor nerves and voluntary muscles is also maintained.

Occasionally the remark is found that antimony aggravates pulmonary tuberculosis, but that with small doses the therapy of lung tuberculosis can be assisted in that it acts as a "tonic" on the total organism.

ANTIMONIUM TARTARICUM

Provings of Antimon. tartar. are found:

1. Stapf: *Arch. f. d. hom. Heilk.*, Bd. 3, H. 2, p. 146, 1824.

2. Mayerhofer: *Heller's Arch. f. physiol. u. path. Chem. u. Mikr.*, 3 Jg., p. 111, 1846.

3. Nobiling: *Ztschr. f. Biol.*, Bd. 4, p. 40, 1868 (see above).

4. Ackermann: *Ztschr. f. ration. Med. von Henle u. Pfeiffer*, Bd. 2, p. 241.

5. Boeker: *Beitr. z. Heilk.*, Bd. 2, p. 324, 1849.

6. Molin: *Des spécifiques en médicine*, Paris, 1847.

All antimony compounds unfold their chief action on the mucous membranes, particularly of the gastro-intestinal canal, the respiratory passages and on the skin. But in use the preparations are differentiated by elective organ trends.

RESPIRATORY ORGANS

With tartar emetic, antimon. tartaricum, the emetic action of large doses is not guiding but the milder action which stamped the agent as an expectorant even in antiquity. This old empirical use became discred-

ited only because of unsuitable doses. While the aim with larger doses proceeded on the basis of increasing and relieving the scanty and tenacious sputum of bronchitis, the homoeopathic use is much more extensive in massive collection of mucus which is difficult to evacuate. In bronchitis, bronchiolitis, bronchopneumonia and threatening pulmonary oedema, the cardinal symptoms of tartar emetic *loud, rough rales in the air passages* has been proven ever again. The chest seems to refill constantly with foamy mucus. At the beginning the patient can evacuate some tenacious light, white mucus by retching, but finally he is unable to do so, an asphyxial state impends and signs of collapse with cold clammy sweat, white ala nasae and hippocratic facies (entirely as with arsenic) is noted. Antimon. tartar. is especially suitable for small children and old people with recurrent bronchitis, in whom tracheal rales and dyspnoea, finally sleepiness through the excess of carbon dioxide, dullness, lassitude and sweats appear. The increasing weakness expresses itself in the type of cough: attacks of coughing decrease slowly in duration and severity with increasing weakness; the cough alternates with yawning. In emphysema attended by bronchial asthma, tartar emetic competes with arsenic. "Cannot lie down because of dyspnoea" is a symptom common to both. The old patient must sit up; there is a great desire for fresh air even though the skin is cool as a result of the impaired circulation. The child wants to be carried upright; they are anxious and peevish because everything bothers them; they will not be touched, etc. Owing to the defective power of reaction the fever in antimon. tartar. patients generally is not high; chilliness prevails.

Cardiovascular symptoms appear early in antimon. tartar. in exactly the same way as in arsenic. But in

this field antimon. tartar. holds practical preference over arsenic when the cardiac stasis is combined with stasis in the pulmonic circulation and also when the failure of the heart is associated with the previously described severe disturbances of the respiratory organs. From antimon. tartar. D 3 at times one sees an astonishing change appear in these extremely severe pictures of disease. It is assumed that the action occurs reflexly through the vagus; and if it is precisely antimon. tartar., which so favorably influences this syndrome of the respiratory passages and heart, then the potassium fraction is not without importance.

STOMACH-INTESTINE

Likewise the arsenic-like gastro-intestinal symptoms offer scarcely independent symptoms for antimon. tartar. However nausea, also retching and more rarely vomiting, often accompanies the antimon. tartar. picture. The broncho-pneumonia of drunkards is considered a special indication on this account. The vomiting which occurs in antimon. tartar. is accomplished only with great effort and relieves in so far as it assists the evacuation of tenacious mucus but it leaves profound exhaustion behind. An uncertain modality attributed to antimon. crudum is: desire for acids and fruits, but still aggravation from acids. In this respect the gastro-intestinal symptoms without pulmonary or bronchial symptoms give preference to either arsenic or antimon. crudum and the selection is made easier through definite symptoms and yields better results.

SKIN

Likewise the pustular, variola-like skin affections scarcely have an independent therapeutic significance. Old homoeopathists, the Swedish Liedbeck for example,

however, have extolled antimon. tartar. in smallpox, in varioloid and varicella. In chronic skin maladies antimon. crudum more often comes into question.

MUSCLES

The lassitude in the extremities which has also been observed in the provings with antimon. tartar. and the muscle pains and stiffness throughout the entire musculature, but particularly in the back which are noted as untoward actions in the intravenous injection of antimonial preparations give some support to the indications for antimon. tartar. in rheumatic affections, particularly in the back and arms, in lumbago with marked aggravation from each movement. For this special localization perhaps the potassium fraction is also not without significance. A general connection with rheumatic gouty maladies will also be encountered in antimon. crudum.

MIND

The mental symptoms and the headache of antimon. tartar. have in and of themselves nothing characteristic, except the previously mentioned peevishness of children. Anxiety, restlessness, melancholia, fear of being alone, are similar to arsenic and can be utilized just as the final stupefaction, only as accompanying manifestations of the severe diseases for which antimon. tartar. is suitable. Besides the general dullness the headaches are said to be predominantly localized in the frontal region and of a contractive type.

SUMMARY

Chief Trends:

1. Respiratory passages:

Bronchitis, bronchiolitis, bronchopneumonia (espe-

cially of small children and old people), stasis in the lungs.

Mucous rales in the trachea with difficulty in expectoration.

Dullness, malaise, cold sweat.

Alternation of coughing with yawning.

Precordial pressure, cardiac palpitation, dyspnoea, cyanosis, failure of the right heart.

Bronchial asthma, emphysema.

2. Stomach-intestine:

Action similar to arsenic.

Nausea, retching, frequent accompanying manifestations.

Vomiting very exhausting, but alleviates through evacuation of mucus.

Desire for acids but aggravation from them (better for ant. crud.).

3. Skin:

Pustular eruptions (variola, varioloid).

4. Rheumatic muscle pains:

Lumbago worse from movement.

Guiding Symptoms and Modalities:

Mucous rales in the air passages.

Desire for fresh air.

Peevishness in children against being held, etc.

Better from erect position.

Worse from movement (muscle pains).

DOSE

In threatening cases the D 3 is often helpful. I have not seen injuries from it. Otherwise the D 6 is most often employed, although the high potencies have also been recommended.

ANTIMONIUM CRUDUM

Provings of Antimonium crudum are found:

Hahnemann: *Chr. Krkhtn.*, 2 Aufl., Bd. 2, p. 190, 1835.

Of the antimony preparations the sulphur compound, Sb_2S_3, in which antimony usually appears in nature and for this reason bears the name antimon. crudum, practically considered, has the organ trends for the gastro-intestinal canal and the skin. Indeed symptoms in the respiratory tract are also observed but they are less expressive than in other antimony preparations.

STOMACH-INTESTINE

In gastritis and gastro-enteritis antimon. crudum has as a leading symptom a *thickly coated white tongue* which looks as if painted. Vesicles on the tongue and wrinkled angles of the mouth can be further indications. The taste is pappy (the metallic constrictive taste on oral administration is locally conditioned). There is nausea from all foods, constant qualmishness with a feeling of an overloaded stomach; violent retching leads finally to the vomiting of the gastric contents, then of fluids tasting of the food eaten and of tenacious mucus or bile. Severe thirst with dryness of the lips is present, but water, even in small amounts, will be vomited. The vomiting does not relieve but only exhausts the patient. Burning and crampy pains in the gastric region appear in attacks, pressure on the epigastrium aggravates. *Sour wine is particularly aggravating, also vinegar and sour fruits,* however, there is still a desire for acid foods. Cold bathing and washing are also said to aggravate.

The same modalities are decisive for the diarrhoea: many urgent, thin stools with tenesmus and finally ex-

haustion. Considerable admixture of mucus in the stool refers to the proctitis. *Aethiops antimonialis*, a mixture of antimon. crudum and mercuric sulphide, HgS, has been recommended by A. Stiegele in membranous colitis and ulcerative colitis.[425] The outpouring of mucus from the anus can also make antimon. crudum suitable in the hemorrhoids of old people with morning diarrhoea. The heat of the sun aggravates the acute intestinal manifestations. This has given occasion for its use in the summer diarrhoeas of children. In nursing, milk is vomited in a curdled state. Antimon. crudum moreover has a chronic intestinal symptom: *diarrhoea alternating with constipation*, particularly in old people. Likewise the variable stool which can consist of fluid with solid particles is given as characteristic.

GENERAL ACTIONS

The headache and mental symptoms in antimon. crudum are associated with the gastro-intestinal disturbances. The headaches are mostly in the frontal region, also unilateral, and the aggravation from the direct rays of the sun, from cold water and from washing may be mentioned here. Of the mental symptoms the irritable fretful peevish behavior of children, and here also in gastro-intestinal disturbances, are to be stressed; the child will not rest, not mind or even look. In the adult the absence of desire for work is worthy of mention as an indication. Sleepiness during the day and after eating characterizes the sluggish malaise. The modalities mentioned also hold for the general state.

The rheumatic muscle and joint complaints of antimony, soreness and stiffness will be found in this remedy in association with gastric disturbances and are

said to alternate with the gastro-intestinal symptoms and to be aggravated by the same external states (overeating, acids, cold baths, radiant heat). That a gouty disposition and manifestation of antimon. crudum actually prevails is doubtful. Even less well founded is the report that antimon. crudum is a remedy for obesity. This report "becoming obese" is taken over in the Hahnemann protocol from Kunkel v. Löwenstern. It may be that a similar increase of weight occurs from antimony as from long continued small doses of arsenic —although in acute and chronic intoxications, only emaciation is otherwise reported, so that such a constitutional indication must still be established by practical observations in order to awaken trust.

Among the symptoms in the respiratory passages which are given especial mention, the cough on entrance into a warm room is not based on the provings.

SKIN

On the skin the acute pustular eruptions of the antimonials are even less suited for antimon. crudum than chronic alterations: rhagades at the muco-cutaneous borders and itching eczema, but especially thickening on the epidermis, wart-like, callous, horny formations, particularly on the soles of the feet which makes walking painful. The similarity with the hyperkeratosis of chronic arsenic poisoning is obvious here. Likewise the growth of nails is disturbed, the nails grow long slowly, are split and discolored. Furthermore antimon. crudum will be seen as a suitable remedy for urticaria which is dependent upon gastro-intestinal disturbances.

SUMMARY

Chief Trends:

1. Stomach-intestine.
Gastritis, gastro-enteritis.

Thickly coated white tongue.

Aggravation from acids but desire for them; from cold baths and washing; from radiant heat.

Mucous outpouring in proctitis and hemorrhoids.

Summer diarrhoea in children; vomiting of milk.

Chronic: diarrhoea alternating with constipation.

Stool: liquid with small solid particles.

Headaches and mental symptoms dependent upon gastro-intestinal phenomena.

Children: fretful, peevish; adults: lack of will power, sleepy, relaxed.

Soreness and stiffness of the muscles, likewise dependent upon gastro-intestinal phenomena or alternating with them.

(Obesity doubtful.)

2. Skin.

Rhagades at muco-cutaneous borders.

Itching eczema. Urticaria from gastro-intestinal disturbances.

Thickening of epidermis, especially soles of feet, painful gait.

Disturbances of nail growth.

Modalities:

Worse from overeating, from acids, wine, cold water, radiant heat.

DOSE

The usual potencies are 3-6 (trituration).

ANTIMONIUM SULFURATUM AURANTIACUM

Provings of antim. sulf. aur. are found:

1. Mayerhofer: *Heller's Arch. f. physiol. u. path. Chem. u. Mikr.*, Bd. 3, p. 356, 1846.

2. Boecker: *Beitr. z. Heilk.*, Bd. 2, p. 93.

3. Neidhard: *Hahn. Monthly,* Bd. 16, p. 649.

Antim. sulfur. aurant. has entirely similar symptoms from the stomach and skin as the other antimonials, but is used almost exclusively for diseases of the respiratory passages. The manifestations are similar to those of antimon. tartar., only of a more chronic and less severe type; they also involve the upper respiratory tract more. Obviously the antimony in the more stabile Sb_2S_5 comes into action with greater difficulty. Outside of the collection of tenacious mucus in the bronchi with oppressed respiration (worse night) the larynx and the naso-pharyngeal space shows more involvement; much mucus collects there and the sense of smell is impaired.

OTHER ANTIMONY PREPARATIONS

Antimon. arsenicosum was briefly proven by Isnard[126] but its use is largely empirical in outspoken emphysema with marked dyspnoea and cough and abundant production of mucus, in hypostatic pneumonia (as antimon. tartar.), moreover, in exudative pleurisy.

Aethiops antimonialis, outside of the above mentioned indication of A. Stiegele, has an empiric reputation in scrofula, particularly the severe scrofulous ophthalmias, D 2-D 15 (aethiops mineralis does not contain antimony but is a trituration of mercury with sulphur with partial combination). It is also empirically employed in scrofula.

DOSE

The lower potencies (triturations) of antimon. sulfur. aurant. and ant. arsen. are common, but of the latter, not below the third.

BISMUTH

The name bismuth is derived from "Wisemut," originating from the idiom of mountain folk, according to Paracelsus, "since it blooms as a beautiful meadow on which all types of colored flowers stand." Probably it is the "marcasita" of the middle ages. Even in the 15th century Basilius Valentinus mentions it as a metallic substance. It appears sporadically in nature, usually being found in common with arsenic, also as bismuth oxide (Bi_2O_3) and bismuth sulphide (Bi_2S_3).

Chemically bismuth stands very near to antimony, corresponding to its position in the periodic system but still bismuth has definitely the properties of a heavy metal and thereby approximates the heavy metals in its actions. In the nitric acid salt, $Bi(NO_3)_3$, bismuth appears as a trivalent cation. This salt breaks down in water to the basic bismuth nitrate, bismut. subnitricum (formerly called magesterium Bismuti). This white powder, insoluble in water, does not have a perfectly constant formula but in any case it contains bismuth in the bismuthyl form (BiO), perhaps also bismuthyl hydrate (BiO)OH.

Bismuth subnitrate is the most common preparation in pharmacology. The bismuthyl salt may be compared best to the antimonyl salt, antimonium tartaricum. But the bismuth salt like most heavy metals is much less susceptible to absorption. The poorly or insoluble bismuth salts may be considered as not ab-

sorbed by the unbroken skin or mucous membrane. Moreover it is probably taken up from granulating wounds and catarrhally inflamed mucous membranes. On the other hand fresh wounds transform these compounds into soluble forms and induce manifestations of poisoning.

ABSORPTION AND POISONING

One may well assume that a minimal absorption may occur from the intact mucous membrane, similarly as with other heavy metals, for example, iron. The absorption is assisted if, from the start, the size of the particles is diminished by trituration. Only one need not expect the severe toxic manifestations from a few milligrams. But it is worthy of note that recently bismuth subnitrate has been relinquished in the treatment of gastric ulcer because of the possible manifestations of intoxication and bismuth carbonate recommended in its place.

After the introduction of large amounts bismuth is found in the liver, spleen, kidneys, intestinal wall, salivary glands and bones. Excretion occurs in the urine, faeces, saliva, intestinal glands and milk. Thereby the channels of excretion through the intestinal glands, saliva, and urine are noteworthy for explanation of the toxic actions observed.

In animal investigations (in the dog) the manifestations of acute poisoning from intravenous administration: vomiting, barking, twitching and death.[457] With more chronic intoxication, vomiting, loss of appetite, diarrhoea with tenesmus; the temperature falls to 34°, increasing weakness, there is reduced sensitivity, twitching of the facial muscles, fall of blood pressure and it cannot be raised by splanchnic stimulation or artificial asphyxiation; tetanic spasms, disturbances of coordination and increasing paralysis are frequently observed.

The milder states of intoxication in man consist of lassitude, loss of appetite, tendency to vomit. The

bowels are somewhat constipated. Furthermore develop: burning in the throat, persistent vomiting, thirst and diarrhoea, then intermittence of the pulse, cyanosis, dyspnoea, etc. Moreover a state appears which closely recalls that of mercury: purulent oral inflammation, ulceration of the mucous membranes, loosening of the teeth, formation of a dark area on the margin of the gums; after healing, the scars of the ulcers show often a black base; the oral mucous membrane is loosened, marked salivation appears, the salivary glands swell and swallowing is impaired.[428] Likewise intestinal catarrh and nephritis (or much more nephroses since it is especially the tubular apparatus which is involved) are entirely the same as with mercury poisoning.

Anatomico-pathologically are found: the large intestine is colored black and contains necrotic foci; stomach and intestine, macroscopically, a relatively normal appearance but they may also show severe hemorrhagic ulcerated appearance. In the large intestinal mucosa are found many bismuth containing leucocytes. (According to Kobert bismuth penetrates the white and red blood corpuscles and leads to their destruction and haemosiderin deposit in the liver and spleen). Moreover the liver shows hyperemia and parenchymatous inflammation, slight fatty degenerative infiltration. The liver glycogen diminishes from the use of bismuth.[429] There is slight fatty infiltration in the heart; the kidneys show parenchymatous alterations and deposits of calcium carbonate and phosphate.[430]

ANIMAL INVESTIGATIONS

Animal experimentation up to the present has contributed very little to the clarification of the intermediate processes in bismuth poisoning. The most important findings are the following: action on the erythrocytes: in dogs following the subcutaneous injection of bismuth there is a transient slight decrease in the red cell count and the hemoglobin value. In the urine a few erythrocytes, which does not explain the decrease. In spite of larger doses of bismuth which cause a loss of weight, no fur-

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drawn from the reports of Hermann, Hartmann, Langhammar. Even Hahnemann considered the proving as unsuitable but it has not been enriched in the interval. Hahnemann calls his preparation bismuth oxide but according to the preparation cited it is bismuth subnitrate. But apparently in his preparation the bismuthyl hydrate (BiO)OH or $Bi(OH)_3$ are probably constant admixtures to bismuth subnitrate and even increased in that the second washing of bismuth subnitrate precipitate was performed with water containing some drops of potassium (perhaps potassium hydroxide?).

Apart from these reports of Hahnemann on the actions on healthy humans, those cited by Wibmer[137] may be included. The difference between the preparations employed is not made distinct, so that one can discuss the symptoms without hesitation under bismuth subnitrate which is not a uniform preparation.

If one proceeds according to diagnosis then the homoeopathic indications in general agree with those known to school therapy, gastralgia, gastritis, gastric ulcer, more rarely diarrhoea and ulceration of the intestinal processes. If one closely studies the now known, but still the ever necessary symptoms, then the agreement with antimony is striking. But in the center with bismuth subnitrate stands severe *gastric pains*: pressure as if from a weight, burning, cramp-like pain. *The pains go through to the vertebra and pressure on the vertebra necessitates bending over which relieves* (ulcer on the posterior wall?). But these signs do not arise out of the provings but are differential characteristics obtained and proven clinically. Nausea and spasmodic vomiting appear soon after eating; there is a desire for cold drinks; they relieve temporarily but then vomiting soon follows (as soon as the stomach becomes full or as soon as they enter the stomach),

entirely the same as in arsenic, phosphorus and antimony. The tongue is coated white, the taste metallic or sweet as in antimony. However foul eructations are reported.

The mercury-like actions in more prolonged intoxications, the oral and large intestine inflammation as well as the nephrosis have not obtained special therapeutic application up to the present. Salivation and oral inflammation were also observed in the provers. The diarrhoea is said to be painless, accompanied by marked thirst, frequent urination and vomiting. Cardio-vascular symptoms are also not entirely lacking in the intoxication, and are similar to arsenic and antimony only they have no clinical significance for bismuth outside of the old indication "cholera" in which bismuth played a great role in the previous century.[438] A pinching, pressing pain in the region of the diaphragm and extending diagonally across the chest is probably associated with meteorism. In the provings the pinching, pressing pains and rumbling in the abdomen signify flatulence.

Headache and facial neuralgia alternating with gastric pain is reported with bismuth entirely as with antimony. The cutting or pressing headache is said to pass especially from the right frontal region to the occiput. Neuralgic, pinching facial and tooth pains are said to be worse from eating, better from cold, as long as cold water is held in the mouth.

The mental behavior is like antimony. Anxiety from being alone is present chiefly in the acute gastro-intestinal disturbances. Otherwise dissatisfaction and many complaints about the condition are cited as characteristic for the mental picture.

SUMMARY

Chief Trend: Stomach:

Gastric pain cramp-like, pressing, penetrating toward the back, necessitating bending over.

Nausea and spasmodic vomiting, worse from eating, temporary improvement from cold water; fluids are soon vomited again.

White tongue.

Alternation of headache and neuralgia with gastric pain. Dental neuralgia relieved by cold water in the mouth.

Disposition:

Anxious, discontented.

DOSE

The lower potencies up to the 6th are customary. I have observed favorable effects from these.

6. THE BOR-ALUMINIUM GROUP III

Of Group III of the periodic system only boron and aluminium have medicinal significance. Both are lithophilic elements. Both are positive trivalent.

Group III cannot be designated as the earthy metal group because the initial member, boron, has essentially non-metallic properties. As happens so often the lightest element of the group takes an exceptional position chemically. The great gap which seems to exist between the elements boron and aluminium becomes smaller when one considers the similar behavior of some of their compounds. And in the effects which their oxygen compounds unfold in conjunction with the living organism, the group relationship becomes still more distinct. However the boron compounds are much milder compounds than the aluminium compounds. Likewise the protein precipitation by aluminium is even less reversible than that of boron. This relationship is evident to some extent in the familiar local uses of boric acid and the acetate of aluminium. As an antiseptic boric acid is even milder than the solution of the always weaker aluminium acetate. In the double sulphate salts, alum, aluminium has distinct general astringent actions on the tissues. Likewise the total action of boron compounds (as borax) is essentially milder than those of aluminium (for example, aluminium oxide), but the similarity of their trends of action is unmistakable.

ALUMINIUM

The aluminium preparation which comes chiefly under consideration for us is aluminium oxide, Al_2O_3, which is designated in the materia medica as alumina. However alum, the double sulphate salt of potassium and aluminium ($KAl(SO_4)_2 + 12\ H_2O$) is employed under the name of alumen and more rarely aluminium metallicum. The effects of alumina and alumen are so similar that we will discuss the simpler and better proven Al_2O_3 and mention the peculiarities of alumen only incidentally.

The trivalent element Al is an earthy metal and stands at the transition from the earthy alkalies to the heavy metals.

APPEARANCE AND SIGNIFICANCE IN PLANTS AND ANIMALS

Aluminium in the form of complex silicates forms over 7% of the earth's crust. In clay and loamy soils it is even more abundant. Many plants take it from the soil. The lower plants as mosses (lycopodium) and ferns are richest in aluminium. The hygrophytes with considerable water exchange contain more aluminium than the xerophytes in which the water maintenance and transpiration is difficult. According to Stoklasa[439] aluminium wanders through the membrane and prevents the exit of biogenic elements from the cell. Thereby the cells cannot be plasmolysed. Aluminium

in the plant cell membrane increases the swelling of the cellulose very markedly, the intake of water makes easy and limits or prevents the incorporation of metals as iron and manganese, perhaps, also calcium and potassium. In the plant aluminium is also an important regulator of membrane permeability for water and ions. In the animal body it is present in large amounts only in the lower forms, such as medusa, otherwise only in traces. Since it is ingested with the plant foods, this speaks against the absorption of aluminium from the intestine. Actually resorption effects of aluminium from the intact intestinal wall are denied. The toxic actions described of the salts are provoked either by intravenous injection or are local in nature. Aluminium coagulates protein, but the precipitation under some conditions is reversible. Thus water plants whose protoplasm is coagulated by aluminium can grow again when they are placed in their original medium.

With this property is associated the employment of aluminium as a mild corrosive, astringent and mild antiseptic, which is generally known and commonly used. One need only think of aluminium acetate, Liqu. alumin. acetat. Apart from the protein precipitation, for the stronger corrosive action of burnt alum (in which the water of crystallization is driven out by heat) its hydroscopic effect comes into consideration. In the school in any case alum is employed in a weak solution in diarrhoea, and here just as on other mucous membrane catarrhs by virtue of a direct local action. Moreover aluminium is also present in the related Neutralon employed in acid dyspepsias. Even in his Apothecaries' Lexicon Hahnemann mentioned that alum earth seems to be a suitable remedy in the gastric weakness provoked by acids and in diarrhoea due to

relaxation of the alimentary tract. Moreover in small doses alum produces gastric irritation and vomiting, larger amounts leading to fatal gastro-enteritis.

INTOXICATIONS AND ANIMAL INVESTIGATION

In a case of poisoning Ricquet[440] observed severe difficulty in swallowing, tormenting thirst, vomiting of blood, and constipation; moreover twitching of the muscles, spasms, anxiety, finally accelerated and irregular pulse, rapid respiration, repeated attacks of fainting, collapse type of temperature and finally death.[441] In addition to these manifestations, Kramolik[442] saw albuminuria, hematuria, and casts.

P. Siem[443] first studied the actions of aluminium by injecting double aluminium salts in frogs and mammals, thereby avoiding the gastro-intestinal canal. After injection of sodium-aluminium lactate in frogs (lethal dose 0.02-0.03) he observed at first severe restlessness and then hour-long rest in a normal position; thereafter the movements became uncertain and lethargic, the animal lay flat on the abdomen, reflex irritability was diminished and finally fell to zero. Then paralysis of respiration appeared and finally cardiac standstill in diastole. Nerves and muscles still react after death.—Siem injected the citrate and tartrates of sodium-aluminium in small continuous doses (lethal dose about 0.15 pro. kg.) of about 0.25-0.3 Al_2O_3 into dogs, cats and rabbits. During a trial continued for a week nothing is noted at first; after 344 days loss of appetite, constipation, decrease in weight, lassitude, inertia, and vomiting appeared. The apathy continually increased; trembling and convulsive twitching appeared; the animal was almost completely devoid of sensation. The tongue could not be moved and there was a flow of saliva. The temperature was very low. The death occurred at times with special phenomena, at times with clonic spasms consequent to respiratory disturbances. Autopsy shows: hyperemia of the gastric and intestinal mucosa with single small ulcers, the large intestine is normal; the liver shows fatty degeneration; there is parenchymatous swelling in the kidney.

Of particular interest for us is that Siem believed he saw the picture of a chronic bulbar paralysis in the symptoms. Outside of the influence on the columns of the spinal cord and the medulla, in respect to the homoeopathic drug picture there is the delayed appearance of the action (in spite of massive doses) and also the constipation. The symptom of flow of saliva perhaps is to be considered as the secondary result of a paralysis of the tongue.

The results of Döllken[444] differ from those of Siem in some respects, above all in that he found smaller doses fatal, rabbits dying suddenly 12-25 days after single doses of 0.015 g. pro. kg. aluminium-sodium tartrate. Again worthy of note is the long delay of stimulus. In injections of 5 mg. pro. kg. subcutaneously there was a loss of weight after 6-8 days and after 14-35 days death without particular manifestations. In cats after subcutaneous injections of 2-5 mg. Al_2O_3 pro. kg., twice daily Döllken saw: after some days decrease of weight, loss of appetite, soon also decreased movements of the tongue and dragging of the posterior extremities; if the injections were stopped then, the animal recovered; if they were again injected then depression, salivation, stiffness of the extremities appeared, then twitching in these and pendulum movements of posterior half of the body; the tongue was always hardly moved; there was huskiness, increasing dullness and clonic spasms. Later the irritation phenomena ceased, the animal showed spastic paralysis and fibrillary twitching so that spontaneous progression was impossible. From the beginning there was constipation as a rule, the stools contained mucus or blood. With increasing intoxication sensitivity diminished, the anterior musculature showed tonic or clonic spasms, the posterior were paralyzed. 2-3 days before death the blood pressure is very low, the vagi hardly can be stimulated. Death may occur in convulsions or may be gradual. Dogs react like cats. The microscopic investigation of the central nervous system is reported by Döllken: constantly a turbidity of the pia over the convexity of the brain, often venous hyperemia of the brain and spinal cord. Neither systematic degeneration of the cord nor any myelitic foci to

any extent were found in any case. In the white substance of the brain no alterations, relatively little in that of the cord. In the spinal cord slight column degeneration at the decussation of the pyramidal tracts, in the cervical cord somewhat more marked degeneration in the lateral and posterior columns, in the thoracic cord only very little, in the lumbar cord marked degeneration of the posterior columns, particularly in those parts which lie in the medium aspects of the anterior root zone and corresponding to the column of Goll, the nerve roots of the V, VII, XII were more than half degenerated, IX, X, XI contained degenerated fibres; anterior and posterior roots of the cervical enlargement of the cord largely degenerated, brachial plexuses hardly at all; anterior and posterior roots of the lumbar enlargement in part markedly degenerated, ganglia cells are at times markedly degenerated, glassy, granular, destroyed and show nuclear degeneration.

Also deviating from the observation of Siem are the clonic spasms early in the intoxication, also after previous paretic symptoms. Moreover reference may be made to the more exact description of the psychic depressions with increasing dullness: while Siem speaks only of apathy, Döllken saw psychic depression, then increasing stupefaction.

QUESTION OF LIABILITY TO DAMAGE HEALTH

In studies on healthy men with large amounts of aluminium salts given by mouth nothing essential is observed outside of a delay and hardening of the stool, as by Wibmer[445] after taking a dram of alum in 2 days; in him a mild diarrhoea present was stopped and soon recurred after discontinuance of the alum. With the appearance of cooking utensils, soldier's canteens, etc., made from metallic aluminium, the question of injury to health from aluminium salts which go into solution was studied. Plagge[446] found no disturbances of sensation in two soldiers. Ohlmüller and Heise[447] permitted

2 physicians of 26 and 35 years of age respectively to take 1 gram of aluminium tartrate from the 22nd of February to the 26th of March. In the two was noted a mild constipation which expressed itself less through a temporal change in the faecal evacuation than in its firmness. The manifestations diminished each time on the 3rd day after omitting the administration of the salt and did not reappear after the study was ended. Since tartaric acid has a purgative action, this manifestation was ascribed to aluminium by the authors. Other disturbances of nutrition and of general well being even from 30 grams of aluminium tartrate were not observed. One sees that also in studies, with massive doses it also makes a difference who observes.

Recently the question of the harmful effects which aluminium cooking utensils could have on human beings has been subject to animated discussion. A universal injury to all men is indeed not asserted by those who know the action of chronic administration of aluminium from the homoeopathic materia medica and nothing is contributed to this question when one testing or another is negative. For this reason the positive proving reports are designated as the exceptional manifestation of an idiosyncrasy. The sensitivity of man for aluminium is certainly graded differently. There need not be exactly a hypersensitivity present if aluminium symptoms come into evidence. There are also factors in respect to the effective material, the duration, the physical and chemical form, entirely apart from the quantity and the site of application.

ALUMINA

When one sees that the homoeopathic symptomatology of alumina corresponds in a striking manner to the

experimentally determined actions in animals, then they cannot pass over the conception that these (indeed temporally too early) results of proving on the healthy are due to the subdivided state of the investigated material.

Provings of alumina are found:

1. Hahnemann: *Chr. Krkhten,* II Aufl., Bd. 2, p. 33.

Of alumen:

1. Wibmer: Wirk. d. Arzneimittel u. Gifte, vol. I, p. 114, 1832-1842.
2. C. N. Hottenroth: Diss. Leipzig, 1838 (1-2 scruples).
3. Barthez: *Recueil de Mem. de Med. de Chir. et de Pharm. mil.,* Bd. 38, p. 195, 1835 (½-3 drachms).
4. Woodward: *Med. Era.,* Jan. 1885, and *Journ. de la soc. gall. de med. hom.,* Bd. 3, H. 6 (D 1).
5. Hering: Mat. Med., Bd. 1, 1873 (7 provers with 3 and 12 C dilution).
6. Hering: *Neues Arch. f. hom. Heilk.,* Bd. 1, H. 1, 1846.

The trends of alumina go to the *central nervous system,* in connection with it, to *the trophic supply of the skin and mucous membranes* and moreover and furthermore to *mucous membrane catarrhs.*

Aluminium belongs to the electropositive elements even if the cation character is only weakly expressed in its compounds. The sensitivity towards cold and change of weather which we have associated with the positive change is also present in alumina, even if not so prominently as in the elements of the first and second groups of the periodic system. In particular dry cold weather, the transition from dry weather aggravate, damp at times is said to improve. Deficient per-

sonal warmth is expressed in the desire for warmth and warm clothing. There is a desire for open air. In the easy chilling still to be mentioned and the tendency to catarrhs of the mucous membranes we must think of this manner of reaction.

A second general characteristic is its chronic, slow but deep action. We have already noticed in the animal experiments a striking delay in the response. From the chief action, namely, on the depression or interruption of the stimulus transmitting centers, this becomes comprehensible. Because such paralysis are seen (for example also in lead) particularly in the action with very chronic effects.

CENTRAL NERVOUS SYSTEM

The chief trend on the cerebrospinal nervous system can be summarized in the phrase, *disturbances of co-ordination.* The mental personality, in particular the sphere of intellectual ideas and judgment is disturbed or broken in its associative capacities and similar interruptions are characteristic in the reflex centers of the spinal cord and medulla.

The disturbance and confusion of the sphere of comprehension, the ability to form ideas and decisions is characterized through the *restraint of imagination.* On this basis arises the impulse for murder, for example, at the sight of a knife, of blood, etc. The consciousness of reality is disturbed, things seem unreal, indeed, the consciousness is finally confused concerning the identity of the patient's own personality. "When he sees or states something, he has the feeling as though another person had said or seen it, or as though he was placed in another person and could see only then." He is not entirely certain whether he is still himself. He cannot

follow a chain of thoughts, cannot draw a conclusion, makes mistakes in speaking, in writing, uses words which he does not intend to say. He is forgetful, is indisposed for any occupation. In this confusion it is understandable that he fears that he will lose his mind. The patient is completely enveloped by fears, unpleasant thoughts that something evil will befall him. He is hasty, the time passes too slow for him. By his mental state his disposition is weighed down and encumbered. Only when his mental state is somewhat better and his mind is also improved, he will rest. All is dependent upon the tormenting depression and confusion of thoughts through impulsively developing ideas. The confusion and depression is worse mornings on awakening. This is understandable because the delayed realization of actuality on awakening is to some extent still in the field of normality.

The *vertigo* of alumina can indeed be psychogenic as it often accompanies the state described, as well as conditioned through interruption of the reflex paths. Objects rotate, he stumbles as if drunk, worse in early morning, on bending and walking. For the coordination vertigo the appearance of Romberg's phenomena on closing the eyes and in the dark speaks correspondingly. Moreover vertigo appears in a proving (Schreter): vertigo as if the eyes were closed. Alumina is especially suitable for old fragile people with vertigo. In the vertigo stiffness of the neck is noted. It also states: drawing in the neck during sleep, the neck muscles draw the head back during sleep.

There follow a series of *motor paretic symptoms*: from a sensation of paralysis to actual weakness up to paralysis is reported of almost all the voluntary muscles, although in the provings only the early phases are

apparent: difficulty in moving the arms, must take a slow tottering gait as after a severe illness, must make slow movements, all muscles as if paralyzed, paralysis of one side of the body, or of the lower extremity, difficulty in swallowing, paretic state of the esophagus, squeezing sensation down to the stomach on swallowing each bite, the material seems to steadily go down; paretic weakness of the larynx, loss of voice, huskiness, weak voice, a singer or reader can only use the voice a short time then it fails; with this occurs a peculiar tickling in the larynx; also the movement of the chest is weak, sensation of heaviness on the chest which is increased by talking; weakness and paralysis of the eyelids, eye muscle disturbances, double vision, squinting of both eyes, cloudy vision as if in a fog.

Still more often a paresis and weakness of the rectum and bladder occurs in alumina; there is a *constipation on account of the inability to evacuate a stool of normal consistence.* The rectum thereby may contain enormous accumulations. Likewise soft stools are evacuated with difficulty, and when they are passed there is the sensation as if some were still retained. This paretic state of the rectum appears particularly in pregnant women who otherwise do not suffer particularly from constipation, moreover in very small children who must strain excessively even from a soft stool. But in the persistent constipation a very hard, lumpy stool may be present and by this the occurrence of fissures is favored.

The bladder weakness is very similar: on account of the inability to empty the bladder, micturition proceeds slowly, the urine flows slowly, the stream is interrupted when the patient stands, many times it is voided only in drops; likewise retention with involun-

tary dribbling, ischuria paradoxica appears. Characteristic is the symptom: must go to stool in order to void.

A related symptom is the evacuation of prostatic fluid at stool. Furthermore weakness up to paralysis of the male sexual functions, decrease or loss of libido, impotence, nocturnal seminal emissions and painful erections.

Let us now complete the picture from the side of the centripetal nerves. There are many *paraesthesias*: feeling of crawling on the skin of the face or other places, feeling of tension, a peculiar sensation on the face or on other uncovered areas as from dried egg or spider web (as borax!). These sensations are so disturbing that the patient seeks to rub the part constantly. The extremities go to sleep on sitting or from light pressure; a numbness of the heels develops on standing, pain in the soles of the feet on stepping as if they were too soft and swollen, a band sensation on the body or about a part, the prover cannot hold objects (observed with alumen), sticking and burning in the back and a pain as though a hot iron had been pressed through the lowest vertebra, drawing and beating pains in the back like electric shocks through the body, contractions of the extremities, lancinating pains. All these symptoms are more or less common in the course of posterior columns degeneration in tabes. If one considers the disturbances in coordination and the motor paretic phenomena, it is not surprising that since v. Boenninghausen, alumina is held as the chief remedy in tabes. Naturally expectations should not be placed too high and it is not surprising if later authors saw no results in completely developed tabes. I saw a strikingly favorable result in undoubted tabes some years ago.

The *cerebro-spinal stimulus conduction* is *retarded* in alumina, the prick of a needle will be felt with delay, and all senses are reduced in this way; impressions reach consciousness only slowly and this proceeds up to a dullness and inertia of understanding. Here again the above described mental status is included.

TROPHIC DISTURBANCES

A series of symptoms in the skin and mucous membranes from alumina can be perceived as *trophic disturbances*. It is well known that this appears usually with partial injuries of sensory nerves (not so much with smooth section). Whether or not one assumes special trophic nerve fibers in any case there is an irritation of the sensory paths as seems to occur in degenerations, usually combined with an impairment of power of resistance of the tissue, which leads to dystrophies particularly in the skin. One thinks of the irritative phenomena of the posterior nerve roots in tabes dorsalis with tendency of the skin to become ulcerated with preceding cornification (mal perforant) or the thickening of the skin with malformation, hyperkeratosis, ulceration in syringomyelia. The slighter grade of lowered resistance of the skin of a neurogenic type expresses itself in defective elasticity of the skin, dryness, desquamation, vesicular formation, glassiness and brittleness of the nails, falling of hair. This type of nutritive disturbance of the skin, according to all appearances of a neurogenic type, is described in alumina. The senile alterations in the skin show a similar picture to this nutritional disturbance. Alumina adapts itself particularly for withered, emaciated, decrepit persons. The skin is dry, withered, of sluggish reaction, does not perspire, becomes hot and itches from too

many coverings but does not sweat; the action of cold is much suppressed, moreover fissures appear readily, thickening, hardenings, vesicles and ulcers occur; especially observed are cracking and ulcerations on the tip of the nose; above all an itching, worse from the warmth of bed is characteristic in that no eruption appears; the patient scratches until the part bleeds and then has relief. The same happens in pruritus senilis. The skin is dry, rough, wrinkled and itching. The hair and eyelashes become dry and fall out; the nails brittle and broken. The appearance of ulcers with a hard base is favored. Therein alumina has found use in cancroid and lupus.

MUCOUS MEMBRANES

The disturbances of the mucous membranes are for the most part to be compared with those of the skin. The mucous membranes are dry and covered with tenacious deposits or crusts; thus in the nose where the crusts are offensive, the picture of a chronic atrophic catarrh occurs. It is the same in the posterior nasal or pharyngeal space where dryness, burning, tenacious mucus and crusts, stitches as from splinters on swallowing, stitches towards the ears on swallowing, suggest the chronic retro-nasal and pharyngeal catarrh. A sensation as if the uvula were too long or as if a membrane hung down from the soft palate which compels constant clearing the throat is noted in particular. There is constant difficulty with the throat and the easy chilling signifies an ever-recurring exacerbation. The headache of alumina, dullness and constriction, better on lying down depend partly on the constipation, partly on the chronic catarrhs.

The hoarseness of singers and speakers with tickling

in the larynx has been mentioned above because it gives more the impression of a weakness of the innervation of the vocal cords. Chronic, dry hacking cough and tormenting attacks of coughing in the morning with the ultimate evacuation of a little tenacious mucus can appear in a chronic pharyngitis as well as laryngitis. The dryness of the mucous membrane is characteristic. As on the nose, ulcerative processes may also occur at times in the pharynx and result in yellow brown, offensive secretions and bleeding; the slowly appearing tissue alterations are said to make the tonsils stony hard. Lupus and scirrhous carcinoma are also added as clinical indications for the mucous membranes. The internal and external use of alum in tongue and uterus carcinoma is ancient.[448]

On the eyelids the symptoms suggest a chronic granular conjunctivitis and blepharitis: dryness, lids as if stuck to the eyeball, itching, agglutination of the eyelids, photophobia, itching, burning, falling out of eyelashes; thickening of the mucous membrane and ectropium as resultant manifestations.

On the mucous membranes of the female genital organs a tenacious, acrid egg white-like or yellow leucorrhoea is worthy of note. It is persistent and so copious that it runs out upon the thighs. Aphthous ulcers in the vagina, ulcerated and hardened os uteri, indeed even scirrhus of the portio form the chief indications. Noack[449] recalls that Hufeland warned against the continuous use of alum in excessive menstruation and metorrhagia because it brings about induration and scirrhous uteri. Indurations of the breasts are also cited for alumina and alumen.

The menses are scanty but exhausting, bodily and mentally. Kent recommends alumina in women at

about 40 with a pain in the pelvis and a bearing down sensation consequent to relaxed ligaments; likewise in delicate women with gonorrhoea who are improved by palliative measures but show recurrences.

Similarly the recommendation in male chronic gonorrhoea has been maintained since the first proving (Hartlaub) up to Kent and thereby the painless discharge of small drops of material remaining yellow, not the usual milky-white discharge, should be associated with ulceration of the urethra.

For completeness there are some reports on the digestive organs. Gastric complaints with nausea and sour stomach, aggravated by potatoes, is an oft-repeated symptom. One must naturally remember however that it came from the prover Nenning whose reports, according to Hahnemann, should always be taken only with care. But the modality *"aggravation from eating potatoes"* seems to have been clinically proven. Perhaps the dryness of the mucous membranes and the difficulty in swallowing are responsible for it. Furthermore aversion to meat and smoking, desire for indigestible things as chalk, charcoal, etc., is reported. The *aggravation from stimulants* obviously refers to the nervous symptoms. Otherwise the gastric and intestinal symptoms, except the functional weakness of the rectum, are scarcely characteristic. Clinically gastric and intestinal ulcer as well as enterocolitis are reported.

Since antiquity alum has been used as an antidote in lead poisoning, and thus alumina is also held as suitable to prevent sensitivity to lead. According to the general manner of action, and particularly according to the type of constipation the homoeopathic adaptability is easy to understand, particularly since alumina is chiefly mentioned in colic (better from warmth) with retraction in the umbilical region.

SUMMARY

Cold sensitive remedy.

Acts slowly and on chronic processes, must be given a long time.

Chief Trends:

1. Central nervous system:

Psychic: disturbances in the sphere of ideas and judgment, compulsive ideas and impulsive acts, confusion up to disturbance of the ego.

Disturbances of coordination, paralysis, paraesthesias.

Trophic disturbances in the skin and mucous membrane up to ulcerative processes and indurations.

2. Chronic catarrhs of the mucous membranes (with dryness).

Leading Symptoms and Modalities:

Early morning aggravation for the psychic and spinal cord symptoms as well as for the symptoms of chronic catarrh.

Aggravation from dry cold weather.

Aggravation from eating potatoes.

Persistent constipation, even soft stools evacuated with great difficulty, must use great effort in order to void.

DOSE

Potencies from D 4 to C 30 are usual. According to my own experience I must hold D 30 as active. The slow unfolding of the action is to be noted.

ALUMEN

Aluminium potassium sulphate, $AlK(SO_4)_3$, in its action corresponds entirely to alumina. As special

symptoms are cited: a pressing pain on the vertex, better from firm pressure on the place and from frequently changed cold applications; furthermore, cardiac palpitation when lying on the right side. The vertigo in alumen is present when lying on the back, and is accompanied by weakness at the pit of the stomach, better on opening the eyes and by turning on the right side.

In the catarrhs the yellow bland secretions (from eyes, vagina, urethra) are stressed, which is perhaps traceable to the potassium sulphate fraction. This also holds for the chest catarrhs of old people with abundant tenacious morning expectoration and great weakness of the chest so that the mucus is difficult to raise, occasionally spitting of blood as well as asthma. The yellow secretion of chronic gonorrhoea is understandable better as a potassium sulphate action rather than of alum. Furthermore very painful ulcerated hemorrhoids and in general intestinal bleeding (in clots in typhoid) are ascribed to alumen. Widening of the veins appears more marked than in alumina. Likewise more is said of inflammatory and ulcerated processes in the mouth. Finally according to the provings swooning-like sensation of faintness, nausea, gastric pain with bending double, deathly pallor, blue lips, cold sensation and subsequent great weakness especially in the back belong to the picture of alumen observed with the 6th and 12th potency. A rare sensation in the vertebra in alumina "as though hot iron was thrust through the lowest vertebra" appears similarly in the report in alumen: "as though cold water was poured down the spinal column."

BORON

Of the trivalent element boron which belongs to the group with aluminium, in homoeopathic practice only borax, the sodium salt of tetraboric acid, $Na_2B_4O_7 + 10\ H_2O$, is in use. Boric acid, H_3BO_3, a very weak acid because it dissociates according to the equilibrium $H_3BO_3 = H_2BO_3 + H$, has been proven with large doses by Biswanger[150] but actually its actions are known only from accidental poisonings.

DAMAGES AND INTOXICATIONS

As a mild antiseptic for washing and instillations boric acid is widely used. That it is not harmless may be seen from the fatal poisonings when large amounts of boric acid are retained in the body cavities. Exact investigations of Rost, Rubner and Forster[151] have shown that daily doses of 0.5-1.0 impaired the utilization of food (the weight and nitrogen content of the faeces increase) and the destruction of food substances increases, particularly the burning of fat. Moreover excretion from the intestinal epithelium is increased. With continuous introduction of 3 grams daily in healthy persons after 5-12 days there is a considerable loss of weight which according to Rubner can be traced to increased loss of fat and water. Boric acid is only slowly excreted and in kidney patients a definite injury may be expected. On the basis of these investigations

boric acid is prohibited as a food preservative in our country, but not in many other lands.

Apart from the actions mentioned boric acid solution on longer use causes gastro-intestinal irritation, pain in the epigastrium, vomiting and diarrhoea and skin eruptions. Biswanger observed moreover increased urinary urgency with increased amounts of urine and pain in the region of the ureter. He proved several boric acid alkalies among them borax with the intention of showing the non-effectiveness of small doses but even on himself after pustules some time progressing in a circinate manner appeared on the right thigh, an impetigo figurata, which finally extended over the entire extremity and passed to the left leg. The eruption lasted 8 months and healed leaving a residual of dark red spots, 2 months later the boric acid containing remedies were discontinued.

In occasional acute boric acid poisonings[452] loss of appetite, weakness, increased temperature, pallor, collapse, apathy, headache, vertigo, ear noises, nausea, sweating on the abdomen and at times vomiting of greenish masses are observed. The tongue is dry and coated. In addition to boric acid the urine contains protein. In a fatal case after retention of the irrigation fluid in the pleural cavity[453] there was an extensive erythema with subsequent pearl shaped vesicles.

In other cases[454] salivation, gastric pains, feeling of chilliness and heat, hematuria, bladder spasm, sleeplessness from preceding headache, delirium, hallucinations, disturbances of vision and speech, collapse and skin eruptions (erythema, urticaria, papules, petechia) were observed.

Cases of poisoning after the introduction of tampons of dry boric acid in the vagina are reported.[455] The

symptoms were: sensation of formication on the hands and feet, later on the face; mental gloominess, marked nervous depression; burning of the skin with hard swelling; all movements were painful. The patients were cold, sensation of icy coldness in the vagina, a calm collapse. Finally a case with multiform erythema of the trunk which extended to the arms and a painful swelling of the upper lids with conjunctivitis and photophobia was observed.

Rabbits die from 4 grams of boric acid in 17 hours with acceleration of the pulse and respiration, gastro-enteritis, lassitude, dogs with paralysis of the nervous and muscle systems.[456]

According to Jaksch[457] after the employment of boric acid solutions one sees spasms on the musculature which are not rarely followed by a paretic-like weakness. Furthermore he speaks of a hemorrhagic diathesis, hemorrhages into the skin and serous cavities. Poulsson mentions a dark discoloration of the gums resembling a lead line. Animal experimentation shows that increasing central paralysis may be the cause of death.

Apart from the acute actions in the form of gastro-enteritis and more rarely nephritis also diverse skin manifestations, nutritional disturbances with emaciation appear, and the most diverse nerve actions so far as one can form a picture of boric acid poisoning from the incomplete material available up to present.

In general the same actions are ascribed to *borax*. From antiquity borax has had the reputation of promoting menstruation and causing abortion. Today this action is in general denied.

The excretion of borax occurs through the saliva, milk, urine according to Lewin. The excretion through the milk is worthy of note in respect to action upon the mammary glands and the influence upon nurslings, moreover from the fact that borax in a concentration of 0.01-0.04% makes the coagulation of casein difficult.

After the internal use of borax in epilepsy in two personal cases Gowers[458] observed in whom the treatment was continued 8 months and two years respectively a psoriasis-like eruption on the trunk and extremities. At most the eruption differed from psoriasis only through slighter thickness of the scales.

I have made this observation the point of departure for the supportive treatment of psoriasis with daily washing with borax and am satisfied with the results obtained.

CURRENT USES

In the school borax as well as boric acid finds use at present only as a mild local antiseptic, in particular in the dermatomycosis (herpes tonsurans, favus, and especially thrush) and in aphthous stomatitis. The last indication concurs in a striking way with an important homoeopathic one.

Recently the ancient treatment of epilepsy has been again renewed with boron preparations. In order to avoid the untoward effects of large doses, tartarus boraxatus (1-6 g pro die according to the age) is suggested.[459]

BORAX

Provings of borax are found:

1. *Annalen der Hom. Klin. von Hartlaub. u. Trinks*, Bd. 3, p. 309, 1832.

2. Hahnemann: Chr. Krkhten, 2 Aufl., 1836.

3. Binswanger: Pharm. Würdigung der Borsäure, etc. München, 1847.

4. *Ztschr. d. V. d. h. Aerzte. Oesterr. Wien.*, Bd. 2, 9H, p. 217, 1858.

5. Woodward: *U. S. Med. Invest.*, vol. 8, p. 495 (the

last however with the medicinal use of D 1 trituration in catarrhal fever. Thereby symptoms from the uterus and vagina were observed).

In borax one must remember that we are confronted with a sodium salt of boric acid. In the effect picture both components come into evidence.

NERVOUS SYSTEM

In the psychic actions two outstanding sodium characteristics again appear, the hypersensitivity towards unexpected noises and alarm and the aggravation from mental labor. Thinking is difficult, indeed, and even causes nausea in the borax patient. The aggravation from cold wet weather, though not outstanding, designates it as a "cold" remedy. Otherwise borax more than natr. carb. has an anxiety and nervous excitability which according to Kent often lasts until 11 in the evening and then should cease with the beginning of sleep. Likewise the poor humour, indolence, dissatisfaction with the bowels are said to be prominent. The patient dreads the time at which he must change from one activity to another; is easily terrified. Anxiety, excitation and vertigo are mixed with descent and swinging movements. Going down stairs causes vertigo, confusion and headache; the baby shows an anxious expression, grasps and cries when it is put down, carried down stairs or swung. This *aggravation from downward motion* holds as the leading symptom of the borax picture. We have in this lability of coordination an accord with the chief trend of the group neighbor aluminium and indeed can ascribe it to the boron constituent, particularly since disturbances of the central nervous system especially with vertigo are repeatedly reported in boric acid poisonings.

Epilepsy is considered an indication also in homeopathy. The symptoms cited give some indication of what cases are suitable for borax. In single cases I have given 0.5 g doses 2-3 times daily and have seen some success. With finer indications one should make an attempt with the lower potencies.

TROPHIC AND NUTRITIONAL DISTURBANCES OF NURSLINGS

In connection with this another symptom in common with aluminium must be mentioned: the *spider web sensation* which is perceived as if a spider web were on the face. A certain basis for parasthesias are found in the toxicologic material on boric acid. Also in the second effect trend, trophic skin and mucous membrane alterations borax is to be compared with alumina. However borax strikes less deep; in place of the ulcers of alumina there are aphtha. Then in borax the sodium fraction conveys an accent to the mucous membranes of the digestive canal and thereby general nutritional disturbances especially in nurslings. The emaciation from poor utilization of the food with increased loss of intestinal epithelia has been mentioned above as a result of the prolonged use of boric acid. In small children for whom boric acid is especially suitable a marasmatic state is present: the face is pale or earthy colored, the entire skin pale, livid, and wrinkled, the child is relaxed and emaciated, cannot digest the food, vomits and has diarrhoea. Characteristic is an aphthous state, the mouth is sore, bleeds easily, the aphthae extend apparently throughout the entire intestinal canal and indeed are said to be responsible for complaints on other mucous membranes. In any case here we are confronted by trophic mucous membrane dis-

turbances. The mouth of the nursling is so sore that it cannot nurse. They retch, cough and vomit sour mucous and have abundant light yellow slimy stools; slimy masses "like cooked starch" are passed without stool. To this is added that borax also influences the milk secretion of the mother; the milk is too thick, tastes badly and coagulates rapidly. The child has an aversion to milk which causes diarrhoea. If here one recalls the trend of action in impairing the coagulation of milk outside of the body and that borax is excreted through the milk, such an action can be understood and moreover the merit of borax medication for the nursling through the lactating mother. Likewise another mammary gland symptom may be mentioned here: on nursing the mother has a pain in the breast from which the child is not nursing, or painful sensation in the breast when it is empty. In lactating young mothers, if the secretion of milk does not cease, the use of borax solution externally gives results. It is in the sense that the clinical indication "galactorrhoea" is meant.

FEMALE SEXUAL ORGANS

The functional, trophic and sensory connections between the mammary glands and the female genitalia can perhaps cover the bridge to borax effects on the female sexual organs. The long maintained view that borax in large doses is an emmenagogue and abortifacient has not been entirely imagination. In the homoeopathic school borax has always been held as an important remedy in sterility. Thereby a characteristic menstrual disturbance is present: *dysmenorrhoea membranacea,* severe labor-like pains before and during the flow as though the uterus had been pushed out of place

or sticking pains as if from a knife, the pains ending with the extrusion of the membrane. To this is added an egg-white-like or starch paste-like leucorrhoea with a sensation as though warm water were running down the leg or an acrid leucorrhoea appears for two weeks between the periods. The menses are too early and profuse. Nausea with faintness is observed in women and also belongs here. The libido is reduced. If such a general state, together with the borax mental disposition and nausea occurs in sterile women, then the indication in sterility can be founded on several grounds even if we cannot explain the deeper connections of all these manifestations. Moreover a sensation of enlargement and sticking pain in the clitoris reported.

OTHER MUCOUS MEMBRANE AND SKIN SYMPTOMS

The most important symptom on the urinary organs: the child cries each time before or at the beginning of urination; also a feeling of soreness in the urethra on urinating and afterwards (especially on contact). The urine is hot. The painfulness of urination was traced by Kent to an aphthous state of the mucous membrane. Moreover unsuccessful attempts at urination with (or from) cutting pain in the urethra is noted; furthermore acrid offensive urine.

Chronic catarrhal states of the nose and eye-lids are described as for alumina. The chronic granular conjunctivitis here is said to be associated with inward turning of the eyelashes (trichiasis) and entropion. The chronic catarrhal state shows thick, greenish mucus and crusts, ulcerated nasal folds and easy bleeding.

On the skin are vesicular, itching eruptions, but also, as we have seen above, psoriasis-like manifestations. The report "erysipelas" remains unexplained, and is

doubtful. The skin in borax is said to be unhealthy; the hair mats easily.

Without connection stands: cough with expectoration of mouldy odor and taste, mouldy smelling breath; sticking, right sided cutting pains, high in the chest; dyspnoea on climbing stairs. Hoarseness from sudden chilling is said to be relieved for some time by dissolving a pea-sized piece of borax in the mouth.

SUMMARY

Chief Trends:

1. Nervous system.

Anxiety, excitation, vertigo (epilepsy).

Sensitive to sudden noises.

Aggravation from downward motion.

Paraesthesia (spider web sensation) and trophic disturbances (aphtha).

2. Nutritional disturbances of nurslings; sore aphthous mouth, marasmus.

Vomiting of acid mucus, light yellow slimy diarrhoea.

Child cries before and during urination (aphthae?).

Aversion to mother's milk.

(Nursing pain in the empty breast of the mother; galactorrhoea.)

Dysmenorrhoea membranacea, sterility, egg white like leucorrhoea.

Leading Symptom:

Aggravation from downward motion. Aphthae.

DOSE

The remedy has found little employment so that the best dose has not been definitely determined. The D 3 is usually employed.

7. THE CARBON GROUP IV

From group IV only the first two elements, carbon, carbonicum, C, and silicium, Si, are drawn into the circle of our consideration. These two tetravalent amphoteric elements appear in nature as powerful opponents; carbon as the point of departure and pillar of the entire organic world, silicium as the inorganic crust of the solid earth shell down to a depth of 1100 km. If carbon once appears in the oxygen compound CO_2, in the circulation of life then it unfolds the infinitely great number of carbon compounds, beyond human comprehension, by virtue of carbon having the capacity of self-combination in series and rings and through the innumerable and easily convertible compounds particularly with H and O. In contrast to the unlimited alterations in shape, the oxygen compound of silicium, SiO_2, stands as a rigid inorganic principle.

Thus at first glance the cleft between these two neighbors seems unbridgeable. If however one draws carbon into comparison only in so far as appears in the life of the organism or after its return from the circulation of life into an elementary form, then obviously the chemically inert "coal" (if we employ this embracing name here apart from the various physical structures and the almost constant admixture of other substances) then it is on an even plane with silicium. Both are almost chemically inert. Both come into consideration for reciprocal action with the organism

by forces of the same type, surface powers which become effective through physical subdivision, the colloidal state. Physical structure differentiates the actions of these charge carrying molecular aggregates more than does the nuclear charge differences of the elements formed.

On this account the medicinal relationship of silicic acid to carbon comes much more distinctly in evidence, the nearer the latter approaches the pure elementary and at the same time mostly inorganic form. Among the common medicinal substances graphites fulfill these presumptions the nearest. Therefore we shall open the carbon series with it after we have first learned silicium in the oxygen compound as a drug.

SILICIUM

Silicium in the form of silicic acid salts next to oxygen is the most extensive element of the lithosphere, and it is fundamentally the chief constituent of the earth crust. Bunge[460] gives a picture of the struggle of carbonic acid with silicic acid for predominance in the building of the earth crust. Silicium appears as silicates in the plant and animal organisms. It will concern us only in this form or as the anhydride of silicic acid, silicium dioxide, SiO_2.

The colloidal nature of pure silicic acid seems to have been known to Paracelsus because he states in the book "De natura rerum": "the life of quartz and flint stones is a mucilaginous material."

APPEARANCE AND SIGNIFICANCE IN PLANTS AND ANIMALS

The content in silicic acid seems to decrease in the series of organisms from the lower plants to the higher

animals. In the plants it appears as a supportive substance. It is abundant in alga, equisetum, polygonum, and grasses; in bamboo it is enriched in the so-called sections in the region of the nodes. Even today it plays a great role as a drug in the Orient.

Herbivorous animals are also richly supplied with silicic acid. In sheep and swine formation of silicate stones may occur. Also in animals silicic acid always passes into the supportive substance, it forms the shells in some, and in birds the ashes of the feathers have an especially high content. In man silicic acid appears most strongly in the connective tissues, in the skin and its appendages, nails and hair. The regular total content in the human body however is small, about 0.001%.

That silicic acid appears in the urine (average 0.1 gram per day) suggests an actual silicate metabolism. Moreover it is also excreted through the large bowel after absorption. In the excretion from the large intestine of a man whose natural feces were passed through an artificial fistula in the small intestine the ash amounted to 3.15% determined as SiO_2.[461] The loss of SiO_2 with skin desquamation, nails and hair, makes some additions necessary.

Even in plants the role of silicic acid is probably not exhausted with the supportive function. As a hydrophile colloid silicic acid can retain water in varying amounts, indeed amounting to multiples of its own weight. It may be remembered that the plants growing on stony soils are able to create a considerable water reserve through this property of silicic acid. The increased absorption from a silicate rich soil also proves a defense against drying.

In the human organism apparently the function of silicic acid is supporting and structure giving, because

it is found most abundantly in the particularly resistant tissues. Thus silicic acid in the organism forms a counterpole to the supportive function of calcium which prevails in part in the carbonic acid, the close neighbor of silicic acid.

Silicic anhydride, SiO_2 is chemically very inert, being attacked only by the fluoride ion. The essential silicate functions are physical in type. SiO_2 is a colloid of complicated structure, is highly molecular, is difficult to break down, and also physically difficult to attack. It is never in true solution but only colloidally dispersed. Actual salts of silicic acid occur only in solid form, and they are peculiarly complex compounds of the metal oxide with SiO_2; for example Na_2SiO_3 is decomposed in water to NaOH and SiO_2.

SiO_2 is a negative colloid, as most body colloids which however arise from carbon. With this may be associated the extensive independence of silicic acid in contrast to carbon colloids. Through its physical structure and chemical stability silicic acid can assert itself in the organism and in contrast to the organic colloids, it is not susceptible to splitting. To a certain extent they are a counterpole of the organic. They are found especially where the chemical metabolism is low or has ceased. Thus silicic acid will be taken up and transported as a foreign body by the phagocytes and will be found for the most part in the hair and nails in solid form, otherwise it is precipitated chiefly in the connective tissue of the body and always where the organic metabolism is at a minimum. One finds the ever present SiO_2 in traces in all tissues and excretions; since it is present in dust it can be removed only with difficulty in analysis. The marked silicic acid content of the bronchial glands of millers who inhale much

SiO_2 with flour dust, shows transportation via the lymphatic ways.

An especial enrichment of silicic acid in the pancreas has been asserted.[402] The pancreas is said to be a site of storage of silicic acid. But from the analysis of these authors themselves, the amount of silicic acid in the pancreas is not greater than that found in other organs. Hugo Schulz[403] has definitely contradicted the above assertion through numerous analysis.

STIMULATION OF FIBROBLASTS

Kobert[404] would conclude from quantitative studies on healthy and tuberculous lungs[405] that silicic acid participates in the healing of tuberculous foci, and that deficient silicic acid prevents healing. But a survey of numerous quantitative studies of French and German authors shows[406] that this deficiency theory is not maintainable. If silicic acid is used in the tuberculous lung, then it is not as a nutritive substance but as an excitor of connective tissue growth. For this the experimental investigations of Kahle and Rossle[407] are of great significance. They found that the administration of silicic acid preparations, 0.5-2.0 g. daily, in experimentally produced tuberculosis of guinea pigs, in and around the tubercle formation a new connective tissue, distinct encapsulation and gradual scarring of the tuberculous tissue; it occurred entirely in the manner of scarring in tuberculous foci in man. With 0.5 g. (per os) the connective tissue is of loose fibres, with 2.0 grams in solid fibres. Rossle recognizes in sick guinea pigs even on the 5th day of treatment with silicium a suddenly awakened fibroplastic activity of the tubercle. Likewise after silicic acid treatment in experimental animals with tuberculous livers, an actual cirrhosis with new formation of the billiary passages develops. New growth is also observed in the tuberculous spleen connective tissue. Outside of Rossle, Gye and Purdy[408] demonstrated a fibrous inflammation of the liver, spleen and kidney with small doses of colloidal silicic acid.

With this the possibility of excitation of fibroplastic activity in the animal tissues is accomplished and with such a relatively crude basis of manner of action of a

medicinal substance, one can hardly make a transition to the human organism. According to Rossle's report[169] silicium has a great significance for the defense against destructive tuberculosis and porcelain workers who inhale the fine dust of silicates, if they become tuberculous, have for the most part the fibrous form of disease. And this fibroid-indurative form is more favorable than the exudative-ulcerative form as is well known.

One may present the following conception of the effectiveness of silicic acid on connective tissue formation in the lung. In crushed stone workers the fragments of stone are in a crude and hardly dispersed state. They reach the lungs and in their transportation to the lymph glands produce relatively crude scars with subsequent connective tissue growth, the so-called chalicosis pulmonum. How greatly this gives the first occasion for the outbreak of pulmonary tuberculosis is known and easy to understand. The same behavior occurs with the finer silicic acid-rich dust which millers inhale in large amounts. Also by the copious ingestion of slightly dispersed silicic acid they are not protected against pulmonary tuberculosis. But it is otherwise with the medicinal administration of silicic acid. The Glashäger mineral springs, which were preferred by Kobert, contain silicic acid in a dilution of 5:1,000,000. Here one can imagine much better that the particles of silicic acid are sufficiently small in order to provoke scarring only in single cells with which they come in contact, that is, on the whole, in the cells which have the capacity to stimulate fibroplastic activity. How fine we must represent the colloidal process in actuality we shall still see in discussing the actions of silicic acid on the blood cells. From the discussion up to the present we may also conclude that silicic acid in cases of

tuberculosis, where a stimulation of the fibroplastic activity of the cells seems necessary, should serve as a medicinal supportive agent for the self healing but that the chief factor outside of the correct selection of the remedy, is the selection of the right degree of division since from too slight a grade of dispersion more harm than good may be expected.

USE IN PULMONARY TUBERCULOSIS

Since most of the therapeutic trials with silicic acid, outside of homoeopathy, have been arranged in pulmonary tuberculosis, the results should be mentioned here briefly. The trial was carried out by the Kobert school, particularly by Kühn.[470] He employed in part the Glashäger mineral spring, partly a tea from the silicic acid-rich plants and indeed Equisetum minor, polygonum aviculare, galeopsis ochroleuca. The therapy was continued over a long time. But since a complete series of physical-dietetic measures were employed simultaneously and on the other side medicinal measures were used, at most only a general impression can be gained from these studies on the addition of silicic acid tea to the other methods of treatment; but these seemed favorable in pulmonary tuberculosis, especially at the beginning of the disease. Naturally it does not awaken much confidence when Kühn did not venture to remove other medicinal therapy even if only experimentally. Indefinite impressions from the use of teas of plants strong in silicic acid were available from the centuries-old use of plants as tuberculosis teas as well as under other names in folk medicine. From an employment on a general diagnosis one cannot expect much more than uncertain impressions.

COLLOID ACTIONS ON SERUM AND CELLS

The experiments with colloidal silicic acid on serum and cells has brought many explanations for the possibility of action of finely divided silicic acid.

Investigations with sodium silicate[171] have shown that in a dilution of 1:1000 it precipitates proteins and agglutinates red blood cells. In this respect colloidal silicic acid agglutinates red blood cells in a dilution which corresponds to the 7 decimal potency of silicic acid. The other conditions such as the presence of electrolytes have the same influence as with organic agglutinins.[172] Hemo-agglutination occurs most rapidly with the medium concentrations, in higher concentrations it is slowed. It is activated similarly as organic agglutinins by warming, the agglutinating action will be removed by prolonged standing in a 1% sodium chloride solution containing silicic acid, more rapidly through moderate warming or brief boiling, whereby with sufficient dilution of the fluid no noteworthy alterations are shown. With the hemo-agglutination by silicic acid, an easy destructibility of the red blood cells is also shown, for example, even with mild warming with a 1% salt solution a certain amount of hemoglobin is given off and the same occurs with shaking. Now silicic acid does not indifferently agglutinate all cells. It has a certain grade of specificity even if the immunohemolysins will not, for example, agglutinate the typhoid bacillus. On the other hand it acts agglutinating and paralyzing in still smaller concentrations on spermatozoa. After red blood cells are agglutinated by silicic acid, the addition of a very dilute lecithin solution causes hemolysis and the outpouring of hemoglobin. (In strong concentrations lecithin alone will produce hemolysis.) Thereby a greater amount of silicic acid than the necessary one will delay or prevent hemolysis. We see also for this biochemic action as so often a definite optimum is present and is a sign of a colloid reaction. At the same time this is ever again proof that it requires a definite dose which does not pass beyond a certain amount in order to obtain definite biologic results. The hemolysis which results in rabbit blood cells from agglutination by silicic acid also occurs by the addition of fresh rabbit serum; but not or in a slighter

degree if the serum has been previously heated for a short time to 60°. The action of the serum addition (that is, complement) can be suppressed or depressed in silicic acid hemolysis by the same agent as in the other cell dissolving action of sera. Landsteiner represents the hemolysis as an alteration in the lipoid part of the blood cells (or the lipoid-protein compounds) forming the pre-condition so that through the intermediation of silicic acid more lecithin or complement will be absorbed by the blood cells. Lecithin solution alone with silicic acid solution forms a very slow falling precipitate which rapidly unites into flocculates when a 1% mixture of sodium chloride is added. As Siegfried has found, silicic acid also produces a precipitation in the blood *serum*. This precipitation will be depressed by an excess of the blood serum, similar to the precipitating effect of precipitins.

v. Dungern and Coca[473] also found that a moderate concentration of silicic acid represented the optimal condition for the hemolytic action. Not only with an increase in the silicic acid but also in increase of the blood serum the hemolysis decreases. The same happens from the addition of certain salts, as magnesium, calcium and barium chloride. Since silicic acid also unites with substances of the blood serum, it may be assumed that in the mixture with the complement containing serum, part of the silicic acid and part of the complement in the serum will become inactive. This has been confirmed in that it makes a difference in the hemolysis whether one adds the silicic acid first to the blood cells or adds the serum previously. The hemolysis will naturally be promoted by the previous addition to the blood cells. Now while the blood cells are undoubtedly made much more sensitive to complement and lecithin through silicic acid, v. Dungern and Coca found that in contrast to other substances, they become more resistant to soap solution. The alteration of the state of the blood cells by silicic acid must therefore be a particular one.

Seligmann[471] found that the reaction playing between two colloids or between one colloid and a salt can lead to flocculation and even if this is not visible. Hailer[475] showed that 1-5% poured into guinea pig serum bound the complement entirely or in part so that the addition of sensitized blood was either not at all or only incompletely dissolved. On the contrary a coagu-

lating ferment from a rennet solution was not adsorbed by silicic acid. Accordingly ferments behave otherwise than the complement of the serum. Rennet will be bound just as little by silicic acid as a specific precipitate as occurs in the reaction between antigen and immune body. Silicic acid also behaves entirely as a specific precipitate in the reaction between antigens and immune bodies. For the different behavior of complement and rennet ferment in the two cases, different adsorption coefficients of the two substances are made responsible, as occurs in other cases. The difference of specificity between the precipitate formation of antigen and immune body on the one side and an inorganic colloid will not rest thereon. It is merely shown that also in this specific action, a decisive weight is to be placed on colloidal flocculation. Landsteiner and Bock[476] found that the silicic acid of a so-called hemolytic system could appear in place of specific immune bodies, of hemolysins and that such a non-specific hemolytic system could be used as a test object in the Wassermann test for syphilis. But now Landsteiner employed the active serum of the patient, also his immune body and his complement and also his own blood cells as a test object. From this it proceeds that the silicic acid in the human blood works hemolytically. But this method differs from the usual arrangement in the Wassermann test because in it guinea pig serum is employed as complement and sheep blood corpuscles tend to be employed as an indicator. Liebers[477] found also the usual arrangement of the hemolytic system in which the specific hemolysin was replaced by silicic acid could not be used. Hemolysis did not appear in either negative or positive sera. In the contest around the complement of the guinea pig serum, even in the usual test arrangement the combination of the luetic liver extract and the luetic immune body, in the complement binding endeavor the silicic acid was the victor. In his studies Liebers found that silicic acid did not produce hemolysis in all kinds of blood, for example not in sheep and horse blood, but on the other hand in rabbit and swine blood. Also in the testing of various types of sera, that is complements, one of which had been sensitized by a specific immune body (hemolysis), the other by silicic acid, he found an extensive parallelism in the action of specific bodies and the silicic acid. The fact that different types of blood cells absorb

silicic acid differently is explained by Liebers as due to different surface tensions, for which the different chemical compositions of single types of blood can be made responsible. Furthermore other types of investigations make it seem probable that the various grades of alkalescence of the blood corpuscles may play a role. Silicic acid alone acts agglutinating on the red blood cells according to Liebers but does not affect hemolysis. Older silicic acid solutions which have become slightly turbid and which therefore have a slighter grade of dispersity are less useful for showing the hemolytic effects but still produce marked agglutination. With this agrees the fact that smaller amount of silicic acid of a higher grade of dispersity provides the most favorable chance for the hemolysis. Here also we again see how the grade of dispersion of the silicic acid is of striking importance for the type of biochemic action. In agreement with the earlier findings of v. Dungern and Coca, Nathan[473] later found that sheep blood by a treatment with silicic acid has increased resistance against the hemolytic actions of saponins, indeed it becomes more sensitive for certain materials but insensitive for others.

Alteration of the colloidal state nowadays is made responsible for the process of hemolysis, and complement formation. According to Sachs[470] complement activation is effected by an alteration of the state of the serum globulin, which need not exceed a certain step. Also according to him the complement effect in the presence of red blood cells will be released by a physical influence on the complement containing serum in the sense of a decreased dispersity of the globulin. Sachs ascribed to the physical state of the serum respectively its globulins, a very special significance for pathology and therapy. The complicated relations which exist on the introduction of colloidal silicic acid into the blood depend upon the already many times cited simultaneous action of the blood cells and the serum constituents. Sachs expresses this as follows: "It is striking that non-specific substances (such as silicic acid) which are suitable for intermediating in complement action can also act anti-complementary. It simply amounts to the question whether the agents concerned are simultaneously mixed with blood cells and complement or whether the complement is mixed and then the blood added. In the first case the hemolysis appears and in the

last case not, and indeed also when one has sought to intermediate through specific amboceptors." Likewise sodium silicate cannot convert a non-hemolytic system into a hemolytic one. New pipettes which are used to measure a negative serum make this positive.[480]

From all this we may conclude that the negative colloidal silicic acid can unfold a series of biologic actions on the body colloids and a very small amount but a very fine division is optimal for this. In these states of physical alteration silicic acid furthermore possesses some selective property, a certain grade of specificity which is dependent on the one side on the type of body colloid and on the other side by the dispersion and time sequence of the addition of the SiO_2.

LEUCOCYTIC ACTIONS

Likewise a series of observations are available on the action of silicic acid on the white blood cells.

G. Zickgraf[481] found generally an increase in the white blood cells after the oral administration of silicic acid. In the tuberculous the Glashäger springs are said to improve the neutrophilic blood picture in the sense of a relative increase in the polynuclears. But the studies were not sufficient. From the tables the leucocyte increase in the mineral water patients is not evident in comparison with others.

S. Schwarz[482] proceeds more exactly under the stimulation of the work arising from Kobert. At least he considers the definite variations in the number of leucocytes throughout the day. Through blood counts repeated 4 times a day at 2-hour intervals the number of white cells was determined systematically for 3 days. On the 4th, 5th, and 6th days the patients received ¾ liter, in some case 1½ liters Glashäger spring water, that is, 40-80 mg. silicic acid while the blood counts on these days were continued in the same way. In other patients who received no or pure spring water control counts were made. From the records and graphic representations it may be concluded that in a vast majority the Glashäger water cases showed a hyper-leu-

cocytosis during the days the water was administered. Unfortunately no observations were made in respect to after effect. The increase amounted in three cases from 0% of the original maximum, in 10 cases up to 40%, in 10 cases 200% of the original maximum. In some cases at first a slight hypoleucocytosis was observed exactly as has been demonstrated with nucleic acid by other investigators.

The increase of leucocytes by drinking Glashäger water was also confirmed by Helwig[453] in the healthy. In some cases a fall was also observed by him soon after beginning the ingestion, that is a hypoleucocytosis or a negative phase. Also an improvement in the sense of a nuclear maturation can be confirmed by Helwig on the basis of the blood pictures. Furthermore according to size, shape and coloring his blood pictures show that after the drink cure is begun there is a sudden new formation of small but very well differentiated leucocytes which gradually become replaced by normally colored and shaped active cells. Furthermore Helwig tested the opsonic index of Wright and found after the administration of Glashäger water in the healthy, a positive opsonic index of 2.4.

Helwig then studied the influence of silicic acid on the leucocytes and the opsonic index in a more detailed manner by animal experiment. As a preliminary investigation he determined the hemolytic dose of sodium silicate (Merck) in 1-2 mg. in 1 ccm. of a 0.9% sodium chloride solution in 0.5 grams of defibrinated blood. The ingestion of bacteria in the leucocytes was studied by a simple method wherein apparently he did not separate the white cells from the red. Next the rectal injection of Glashäger water or pure sodium silicate in rabbits showed a distinct special influence on the grade of phagocytosis. The bacterial ingestion was about 80-143.5% higher than the normal. The total dose of silicic acid in Glashäger water amounted to 3 mg. twice in 24 hours. If the double dose, 6 mg. of sodium silicium was rectally injected then the special silicic acid influence increased from 80 to 143.5%. On the other hand further increase of the dose evoked no increase but more a diminution of bacterial ingestion. Here also a distinct optimum is observed. When one thinks that it involves healthy rabbits, the dose in 48 hours, and particularly rectal injection, by which part of the grade of dispersity would be lost, then one can

designate the dose as small, since distinct effect differences are shown within the third decimal potency. Helwig himself remarks that *smallest and small doses seem to act more markedly exciting on the ingestion by the leucocytes than do the next corresponding larger amount.* The microscopic picture corresponds to the grade of phagocytosis in so far that in the lower grade the leucocytes and bacteria were scattered, in high, leucocytes and bacteria were always more markedly clumped. Here too, one must think of the agglutinating action of silicic acid. Likewise the subcutaneous and intravenous injection of pure silicic acid solution gave a distinct optimum which lay within the 4th decimal potency. In doses within the 3rd decimal potency the grade of phagocytosis was indeed distinctly lessened in comparison to the normal. The third decimal potency of sodium silicium indeed acted hemolytically in 0.5 ccm. of blood.

Furthermore Helwig studied 8 animals in which he had artificially suppressed phagocytosis with opsonogen, that is, with a vaccine made from dead staphylococcus cultures. He also used the negative phase developing after such an imitated infection which was still distinct, according to his studies, 24 hours after subcutaneous injection. This negative phase is a well known phenomenon as the primary effect after infections and after some time will release increased phagocytosis. Now in this phase intravenously injected silicic acid solutions 18 hours before withdrawal cause a distinct increase of the opsonic index. And indeed this increase is proportional to the doses of silicic acid employed which varied from 0.00005-0.01 pro ccm. Whether this increase of action with increasing dose which far exceeded the hemolytic dose in other studies will be confirmed, is not determined as yet. But in no case does it mean that the same proportionality lies at the basis of therapeutic trials in actual infections. Because such a negative phase of infection never comes to treatment as it lies in the incubation period. In obvious disease the patient is in the positive phase also before increased phagocytosis and in order to stimulate this we need certainly not more but less than the amount necessary for the increase in phagocytosis in the normal animal. Much more we should be warned sufficiently through the existence of an optimum of action in order to summate the equally directed

stimulus in the sick organism. But in any case one must select a dose smaller than the 4 decimal potency in order to expect a favorable result.

Finally Helwig made chemotactic studies. Thereby cork protected glass capillaries containing vaccines were introduced under the skin in accordance with Hamburger's method. Also in these studies a distinctly more marked leucocytic infiltration occurred under silicic acid than without it. A relative leucocytosis and eosinophilia after administration of silicic acid has been reported many times.[481]

Whatever significance one attaches to the leucocytic increase and the increase in degree of phagocytosis, it is clear that within certain limits they signify defense and protection for the organism and indeed exactly against the pus-producing bacteria. With this also stands that this defense can be supported through suitable silicic acid.

NON-SPECIFIC IRRITANT THERAPY

After the therapy of silicic acid was based first on a quantitative balance in SiO_2 metabolism, later it was incorporated into non-specific irritant therapy. The appearance of fever and disturbance of general well being which one notices after parenteral introduction of colloidal silicic acid, for example, in the tuberculous who are capable of reacting with labile heat control and the hyperleucocytosis with neutrophilia[485] are certainly non-specific irritant actions; but it is exactly the specific which interests us. For this reason nothing is gained for explanation when Zimmer[486] also brings the oral administration of silicic acid under the general conception of non-specific irritant therapy. The production of general and focal reactions in rheumatic-arthritic processes is in general bound to parenteral administration, but it seems that it is obtained with

certain organic silicic acid preparations orally. It is certain that the silicic acid actions will be determined by the sensitivity of the patient and his lability and furthermore by the form of division of the preparation. Not only absorption depends upon the fact that small amounts are administered in finely divided form but the size of the particle is decisive in oral administration. The increase of temperature appearing in dogs and man after a few milligrams of SiO_2 in a highly dispersed colloidal form does not appear with less dispersed silicic acid preparations.[487]

Silicic acid irritant therapy has been employed at times in typhoid.[488] Here an excitation of a leucocytosis in the presence of leucopenia was guiding. The typhoid bacilli have, as we have seen, only a slight affinity for silicic acid and the opposing influence of the white blood cell picture (whereby in this respect the negative phase is to be considered as a hypoleucocytosis), also cannot give a very good basis for this therapy.

SUBSTITUTION THERAPY WITH SILICIC ACID

The hypothesis of transmineralization, of the balance of a mineral deficit, is given in general for the silicic acid therapy of pulmonary tuberculosis. But in the rare indications of some therapeutists, in arteriosclerosis this explanation has been included in the absence of a better one. Kühn[489] obtained a favorable impression from the intravenous administration of sodium silicate, particularly in aortic and coronary sclerosis, at least in respect to the subjective symptoms. In old men the silicic acid in all the tissues is supposed to be diminished and the calcium to be increased (according to H. Schulz). Consequently silicic acid ther-

apy is conceived as substitution therapy. But it was not adopted and the subsequent addition of iodine to his preparation, najosil, by Kühn is not exactly designed to explain the question. Even more uncertain in regard to the basis and in the results has been the occasional use of sodium silicate injections in asthma and diabetes.

From the viewpoint of a silicium deficiency, silicic acid has also been employed internally in skin diseases, outside of homoeopathy. For the external use in the form of Aqua silicata in decubitus and other ulcers the adsorption capacity and the cell proliferation propensity of colloidal silicic acid must be taken into consideration. P. G. Unna[490] recommended the oral use of sodium silicate in pemphigus chronicus and foliaceus. Luithlen[491] treated senile itching and eczema which developed on thin, dry and desquamating old persons' skin, moreover lichen and psoriasis as well as angiospastic skin manifestations ("dead hand") successfully with small intravenous doses of sodium silicate. Results have also been obtained in scleroderma. Loss of elasticity consequent to impoverishment of the skin in silicic acid is said to be removed by the medication.

CARCINOMA AND SARCOMA

Here and there again emerges the treatment of cancer with silicic acid.[492] Best known is Zeller's[493] internal use of sodium and potassium silicate (nakasilicium = pot. silic., sod. silic. aa 20.0, Sacch. lact. 60.0, ¼ gram three times daily is taken in cancer), and in external tumors his arsenic-cinnabar paste (Acid. arsenic. 2.0, Hydrarg. ox. rubr. 6.0, Carbo. anim. 2.0) in addition. A favorable influence from pure silicic acid

therapy in single cases is not dismissed. But to decide on these rare suitable cases out of the great number without closer reports offers an almost insurmountable difficulty. Netrolitzky[494] has again employed an impoverishment of the tissue in silicic acid in cancer as an explanation. On the other side the decrease of silicic acid in senile tissue has been shown. The old reports that the silicic acid content of the pancreas may be increased in carcinoma[495] are scarcely of significance since the theory of Kunkel and Kall[496] that the pancreas is the site of storage of silicic acid has been proven untenable. One might better consider that silicic acid stimulates the fibroplastic activity and thereby under certain conditions can favorably influence epithelial cell growths. Still more significant seems the fact that by the injection of infusorial silica an outpouring into the peritoneal cavity of guinea pigs can be produced with peculiar granulomatous swellings which are composed almost exclusively of giant cells with numerous hyperchromatic nuclei.[497] Likewise Schirokogoroff[498] by injection of the same substance into the portal vein and pleural cavity of rabbits produced multiple tumors after 1-8 months on the peritoneum and pleura which had a similarity to giant cell sarcoma. Since the formation of giant cells in carcinomatous tissue is considered as one type of healing process[499] silicic acid might introduce or perhaps favor the healing process in carcinoma in this way. We might further consider that many compounds of the related carbon are likewise tumor producing and on the other side also have a reputation in cancer. That results with these agents appear only rarely, lies in the nature of malignancy itself and the difficulty in obtaining indications for a definite remedy.

In the treatment of cancer this also holds for homoeopathy. The indefiniteness and limitations of the other silicic acid therapy of the school will be decidedly overcome in homoeopathy by means of studies on the healthy. The effects of silicic acid and its utilization will then show entirely new enlightenment and arrangement. The large number of artificial silicic acid preparations (siliquid, silistren, *etc.*) which are brought out by the pharmaceutical industry cannot outweigh the knowledge of the peculiar type of action of a simple substance.

A DRUG PROVING

As an example of a drug proving of silicic acid that occasioned by H. Schulz and published by Bootz[500] may be repeated here in summary. It has the advantage that the prover did not know the substance but still it agrees well with the earlier homoeopathic provings which are richer in details.

In a first series of trials Bootz described a study with 8 young men with pure silicic acid. This was taken daily for 4-6 weeks in an amount increasing from 1 to 4 knife points. The observation was continued two weeks after the discontinuing medication. In a second series which goes back 15 years, the silicic acid in one case was given in a trituration with milk sugar in the ratio of 1:10, in 4 cases in a ratio of 1:1000; in the first case for one week daily two knife points, then for 2 weeks daily 4 (in total 3.5 grams were given) and in the other 4 cases in irregular increase for a few weeks daily 4, then 8 or more which made for the total experimental period about 0.1 gram of silicic acid. In a third series 4 men were given a 0.01% solution of silicic acid in water, so-called aqua silicata, and indeed for 4 weeks, weekly increasing from 20-50 drops. Thus in general 0.0075 grams was used, that is, less than a centigram of silicic acid. A period of at least one week of subsequent observation was followed. It should be stressed that in this last series of studies

with the 4th decimal potency the actions were in no way distinct as they were with the studies with the original substance. On the other hand the symptoms in the proving with the potentized silicic acid are more definite. But in general all studies show a great similarity in the symptomatic picture.

On the skin acne appeared several times, especially on the face, forehead, neck and on the back; in 4 of 17 cases furuncles with indeterminate borders and hard infiltration of the vicinity. Then in two cases (with the administration of the original substance) a peculiar papular exanthem with sharply limited red elevations was preceded by several more days of severe itching. Such itching was observed in two cases in the 3rd series but without anything appearing externally. The secretion of sweat was strikingly increased in five instances, especially on the feet, and the sweat smelled sour. In four cases there was soreness of the feet and desquamation of the skin between the toes and the fingers, once initially moist and then desquamating rhagades in otherwise unhealthy skin and a tendency to suppuration. Once an old scar became thickened and painful. Twice bunion-like structures appeared, one other time an old bunion loosened without effort. Five times there was marked desquamation of the scalp as well as marked falling out of the head hair and beard. Once the finger nails became painful and seemed to grow more rapidly.

Silicic acid provoked considerable symptoms also in the bones, muscles and joints. At first great fatigue, lassitude over the entire body, especially heaviness, lassitude and tension in the legs, rapid fatigability of the same on only slight exertion. The movements in the legs were more difficult and stiff, especially in the knee and there appeared the sensation as if the legs could not bear the weight of the body, as though the leg, and here the lower leg was temporarily completely lame, would crumple. Running and jumping were impossible. Still more frequently observed were dull deep seated pains in the leg, drawing or sticking pains in the knees and hip joints but at times also in the shoulders, the bones or joints of the arms. The intensity of these pains was variable. Sometimes it was reported that pressure did not aggravate the pain and that it was better from movement. But in two reports exceptions are

found, that is, aggravation from pressure and relief from motion.

Reports on symptoms in the domain of the nervous system are practically never absent in the three series of studies. The fatigue and relaxation have already been mentioned for the muscles and particularly in the first there was great fatigue, lassitude and desire for sleep, and in the two other series they also appeared in the majority of provers. To this was added aversion for physical work, inability to concentrate the thoughts. Once at the same time occurred a highly increased nervous irritability and in others restless sleep. Practically all reports mentioned headache. They are expressed as dullness and a sensation of pressure increasing up to pain. The headache was now more diffuse, now unilateral (right sided) now limited to single spots, and often began in the occiput. In two provers attacks of vertigo were reported, and once trembling of the hands and uncertainty on movement. Once burning and pains in the eyes was reported, once injection of the conjunctiva bulbi and palpebrarum, and once rapid fatigue of accommodation.

In spite of definite counts of the pulse rate the vascular system did not show many symptoms. In three cases there was a slight increase in the pulse rate, in one case a later decline in the frequency. At another time the increase of pulse was only on one day and was associated with respiratory acceleration and internal unrest, at another time cardiac palpitation appeared with a simultaneous feeling of oppression. Sensation of oppression in the chest was reported 4 times and in one other case sudden palpitation and also internal anxiety once. On the respiratory system no symptoms were observed on the whole.

On the other hand in 16 of 17 cases symptoms in the digestive organs were in good agreement. In the one case in the second series where they did not appear, the protocol is very insufficient and the administration of the drug very irregular. Many times the picture was of such a nature that at first marked collections of gas occurred in the intestine with flatulence; there was colic and gurgling in the abdomen, at times very severe cutting pains with urgency for stool. The stools were irregular, often constipated, at times painful and then also after normal stools, suddenly soft, light yellow and diarrhoeic.

The urgency to stool was often without result, only flatus being evacuated. Tormenting tenesmus and the sensation as though the stool would be large although it was actually small and frequent.

On the urinary organs only the ingestion of the pure acid produced symptoms, 2 times polyuria, whereby once the act of urination was accompanied by burning pain in the glans; three times the urine was scanty, concentrated and in two cases smelled intensely urinous.

SILICEA

Provings of Silicea are found:

1. Hahnemann; *Chr. Kranh.*, Bd. 3, p. 208, 1828.
2. Knorre: *Allg. hom. Ztg.*, Bd. 6, p. 37, 1835.
3. Ruoff: *Hygea,* Bd. 8, p. 1, 97, 193, and 330, 1838.
4. Becker: *Hygea,* Bd. 22, p. 401, 1847 (Aqua silicata).
5. Hencke: *Allg. hom. Ztg.*, Bd. 55, p. 135, 1857.
6. Sorge: *Ztschr. d. Berl. V. hom. Aerzte,* Bd. 12, p. 267, 1893.
7. Bootz: *In. Diss.*, Greifswald, 1903.

A summary of the indications of Schüssler is found in *Allg. hom. Ztg.*, Bd. 98, p. 172, 1879.

In homoeopathy silicea belongs to the polycrests which have a prolonged action. On the one side as a chief agent for the support of defense functions against external injuries, particularly chronic infections, silicea is suitable; on the other side to fundamentally alter the internal metabolic and energy exchange. We shall first consider the "outer" actions because they are more accessible to observation and easier to comprehend.

SUPPURATION AND FISTULA

Silicea acts on suppurations of all types, *acute as well as chronic.* The purulent processes in the organ-

ism for which it is suited are those which reveal *a lessened tendency to scar formation.* Therefore silicea is employed less at the beginning or at the height of a suppuration and more at the end of acute processes when they are prolonged and in chronic processes. In particular it is preferred after hepar sulf. calcar. Lersch[501] reports: In Upland silicea is a folk remedy against suppuration in general, but particularly against furunculosis, in which, according to Söderberg, one gives a knife point covered with powdered flint stone. From the capacity of silicic acid to stimulate leucocytosis this indication finds explanation. And that healing by it can be perfected or accelerated is due to the stimulation of fibroplastic activity, the promotion of granulations and scarring. For this reason silicea is also a chief remedy in fistula and by suppuration promotes the removal of foreign bodies and sequestra. The suppurations of a suitable character or fistulas may arise from a susceptible tissue or organ, this making no difference in regard to the utility of the remedy; they may be provoked by bacteria of various types, staphylococcus, streptococcus or tubercle bacillus. As the organism exerts itself against all actually with the same indeterminate defense agents, among others phagocytosis and indeterminate opsonins, thus by promotion of this defense power the bacterial actions of the most diverse types can be made harmless. In particular there should be mentioned bone suppurations, old fractures, whether in long or short bones or joints, the inner ear, the mastoid process, the hip joint, the vertebra or the teeth with swelling of the cheek and toothache, which is worse at night and from cold; furthermore benign and malignant suppurations, ulcers on the skin, particularly those announcing their age and

defective healing power through their stench; recurrent, indurated styes as well as ulcers of the nails; moreover suppurations in the lymph glands and in the breast, inflamed nipples; for *fistula*, silicea, as said above, is a chief remedy. Here lachrymal fistula as well as those of the rectum and others come into consideration; here as well as elsewhere there is the thin, acrid, offensive secretion, the hard borders which are sensitive to contact; chronicity and defective tendency to healing. Ulcera cruris tending to go into the depths with these characteristics experience improvement by excitation of granulation from the external application of aqua silicata and the internal use of silicate medication.

Subacute and chronic suppuration of the mucous membranes and the deeper lying organs also not rarely offer a phase adapted for silicea; for example, when the tonsils undergo prolonged suppuration, and the purulent materials are difficult to evacuate or are discharged incompletely. Soreness and sticking as from a needle in the throat on swallowing are subjective indications from the provings. A sensation as if there was a hair on the tongue has been cited as a symptom ever since the first provings and shows a striking agreement with the other great inflammatory remedy, hepar sulphur calcareum. In chronic purulent pyelitis or prostatitis, silicea is at times indicated. In old ulcerative processes of the cervix the already mentioned acrid, excoriating leucorrhoea irritates the vulva in silicea cases. On the respiratory passages a purulent, offensive profuse expectoration with purulent bronchitis, bronchiectasis or prolonged pneumonias suggests that silicea is to be considered as an agent of reaction and interpolated remedy.

The old clinical report: mucus pulmonary tuberculosis in stone cutters, millers, in old people is worthy of mention in respect to the etiologic connections to such "pituitous" lung processes from silicic acid containing dust.

TUBERCULOSIS AND SCROFULOSIS

In tuberculosis of the lungs difficulty exists in determining the suitable case and the adapted stage from the organ symptoms. Sensation of soreness in the chest, occasionally sticking in the chest going through to the back, deep hollow cough with bloody expectoration or cough with vomiting of mucus or the previously mentioned foetid-purulent expectoration, shortness of breath when lying on the back, or cough on exertion, profuse acid smelling night sweats, are too little differential signs and the aggravation from drinking cold liquids is also present in other remedies (for example, phosphorus) and characteristic of them, so that the aggravation of the cough and shortness of breath at night seems the surest. Moreover in reference to this modality one might think of pressure from swollen bronchial glands in silicea. And it is exactly these in the first but also often in the chronic stage of tuberculosis with the lymphogenous metastasis when adenitis and peritonitis appears and which have the tendency to scar by proliferative processes, where one may expect a favorable result from silicea; it is similar in chronic mesenteric lymph gland tuberculosis of emaciated children with swollen abdomen.

The glandular swellings and indurations in silicea are slightly painful and merely itching of the overlying skin signifies the development of a chronic inflammation. Together with the skin manifestations and a

chilly or easily chilled constitution the glandular swellings give the general outline for the indications in scrofula. The skin is "sickly," unhealthy; it has a lowered power of resistance. At first there is itching over the entire body without a visible eruption, then the skin irritation progresses to erythema and red nodular patches, vesicles and pustules and eczematous eruptions appear. The itching is worse at night, but also from cold and contact, as in general with silicea, warmth relieves. Nose, throat and ear symptoms may accompany the scrofulous state: persistent occlusion and dryness of the nose, alternating with flowing coryza with acrid excoriating discharge and ulcers in the nose; occlusion of the ears with explosive sounds and difficulty in hearing which indicates the participation of the eustachian tube. But again the average pathognomonic symptoms are not able to say in which cases and phases of scrofula silicea is suitable but the totality of the constitution and the modalities gives the decision. Silicea is especially suitable in thin, pale, "anemic" children (not pasty as in calc. carb.) with swollen abdomen and weak musculature; thereby a certain hypersensitivity against external influences, particularly cold, drafts and contact is present (the last in any case in contrast to calc. carb.). Ricketic symptoms are also mentioned for silicea: difficulty learning to walk, retarded labored gait, weakness of the joints, enlargement of the head with open fontanelles, evening head sweating, great muscular weakness. But these clinical indications give less occasion for the use of silicea in florid rickets; rather they indicate a further source of depressed development in the constitutional picture as it, differing in calc. carb., corresponds to

silicea. In such children occasionally an enuresis nocturna may be present.

SKIN AND CONNECTIVE TISSUES

But the action of silicea on the skin is in no way limited to typical scrofulous manifestations. Acne and furuncles appear but here the agents of the sulphur group are superior. The behavior of the sweat is typical for silicea: it is offensive or acid smelling, appears especially profuse on the feet making the toes sore, the skin between the toes and fingers desquamates but there may also be suppuration or vesicles on the fingers, toes and heels; severe itching on the soles or burning in the tips of the fingers announces the eruption. But silicea is most valuable for *the results of suppressed foot sweats.* Not only the persistent annoying coldness of the feet but also diverse disturbances involving the entire body can be correctly traced to this. This sweat will obviously again reappear after the administration of silicea and the equivalent, perhaps recurrent catarrh or asthma, disappears.

The close connection between silicic acid and the skin and its appendages particularly the connective tissue parts, its capacity to stimulate fibroplastic processes makes still another series of indications, necessarily infrequent, understandable. Influences on the keratinization of the skin are observed in the provings in the bunions and painful hard callosity on the soles deserves a trial with silicea. The new excitation of old scars, known from the provings, leads to its employment in excessive granulations as keloids. Even the complaints from old scars in the internal organs after operations or other trauma at times have shown striking improvement after silicea. But also connec-

tive tissue tumors, fibroma, lipoma and enchondroma and moreover elephantiasis-like states of the subcutaneous connective tissue in conjunction with phlegmasia alba dolens, indeed, even hydrocele are cited as clinical indications, in which naturally one will proceed without excessive expectation in silicea. The appearance of ganglia on the hands which has been observed three times from silicea is peculiar.[502] The report: funnel shaped retracted nipples recalls that silicea is to be considered in malignant tumors. After the above discussion one ought not to restrain trying a remedy so little toxic in sarcoma, particularly since Stauffer has reported a result from it.

Silicea is often mentioned as a remedy in turbidity of the lens. Therein it is to be recalled that silicic acid is found in the lens and this hydrophilic colloid will not be without significance for its state. That in the cataract of Indians, more silicic acid is found than in those of America[503] has been attributed by Kobert to the vegetarian diet followed in India. In the provings one can find many reports such as fiery spots and black spots before the eyes, short attacks of blindness which might make one think that silicea also plays a role in the vitreous humor.

The appendages of the skin are disturbed in their growth with silicea; the hair falls out easily, the nails are brittle, contain white spots, pulverize on cutting.

DIGESTION AND METABOLISM

In the silicea picture the persistent failure of the mesenchymal defense system with its fixed and movable cells of the lymphatic apparatus and the skin functions is again reflected. From this alone a marked

involvement of the general state in the sense of defective vitality or indeed a chronic illness can be understood. But in addition there is a failure of *metabolism*, predominantly in its assimilative phase, in the utilization of the energy introduced by the food. Digestion is slowed. The tonus of the gastro-intestinal canal and at the same time of the abdominal wall is reduced. Gas collects in the abdomen; the abdomen is distended and tense; colic and gurgling in the abdomen, worse from pressure and better from heat. The stool remains in the large intestine for a long time. In persistent constipation the symptom of weakness of expulsion is characteristic: *the stool occurs only with great effort and then returns to the rectum;* it is delayed, laboriously evacuated with much pressure and in hard dry masses. To this may be added pain from a fissure, or burning from anal eczema. More rarely diarrhoea with tenesmus appears consequent to the decomposition of the long retained stool which then may exert a sudden marked stimulus to the intestinal mucous membrane. However the type of constipation described prevails. As a special indication holds: before and during the menses, the sphincter is sensitive; naturally the provings give no special basis for this. As the result of the impaired digestion and resorption there is aversion to flesh and cooked foods; milk is also borne badly and in nursing mothers milk may be vomited. In general anorexia exists, yet often great thirst and occasionally ravenous hunger may also be encountered. Slow digestion causes a series of disturbances in the stomach although naturally not characteristic of silicea: pressure pain after eating, fullness, eructations, sour stomach, even nausea and vomiting.

The great desire for sleep after eating is striking and a sign of the strong general occupation with digestion.

GENERAL SYMPTOMS

The nutritional energy is also deficient and thus the silicea type has "deficient body warmth"; he needs artificial warmth; all his complaints are relieved by warmth. This also holds for the very characteristic *headache*. It passes from the neck over the vertex to the forehead, often unilaterally and is aggravated by wind and drafts and *relieved by warm coverings*. General chilliness may accompany the headache. Mental effort readily provokes it. It may also involve a periodic migraine (especially over the right eye) with nausea, sensation of faintness and dimming of vision; here also the improvement from warmth is decisive. In Schüssler's reports are found "headache with small nodules of the size of a pea on the scalp." Obviously indurative headache is meant by this. That silicea has a connection to connective tissue swelling in the scalp, is comprehensible; the improvement from warmth will also guide the choice here.

The defective vitality furnishes many other signs of lessened capacity for nerve performance. On near-sight the visual pictures swim before the eyes. Vertigo is not rare, especially in the morning and on looking back and is said to increase from back of neck to vertex, at times being associated with nausea and with a tendency to fall forward or to the left. Indeed epilepsy has been included in the effect domain of silicea on the recommendation of v. Bönninghausen, an indication which is also found in the writings of Paracelsists. The aura is said to arise from the solar plexus. If one may assume that old scar processes in the men-

inges play a role, then one may attack silicea with greater confidence.

The reduced capacity for performance and reduction in power of resistance expresses itself in many partly body, partly nervous-psychic *general symptoms*: heaviness and paretic malaise of the extremities, trembling from slight exertion, diverse sensations up to pains, proceeding particularly from the vertebrae, excessive reaction to external impressions, especially sudden noises and contact, cardiac palpitation and pulsation from alarm and exertion. The profound exhaustion from bodily and mental effort is expressed by inability to concentrate the thoughts and impaired power of attention. Through this, the mental attitude becomes depressed, irritable, anxious and confidence is lost. Coitus also aggravates the symptoms of nervous exhaustion. On the one side the desire for sleep during the day exists and then again restlessness and anxiety which disturbs the night sleep and causes restlessness from alarming, frightening dreams. In an animated fashion Kent pictures that silicic acid supports the nervous system and psyche just as it gives stability and support as to plants.

CONSTITUTIONAL TYPES

With this the constitutional type of silicea is carried to the side of lymphatic trend which results from a poor ability in the mesenchymal defense system to react to infections. Moreover, on the other side the failure of the skin and intestinal functions deeply affects the energy and metabolic exchange which has general and chronic results in the entire psycho-somatic impulse and frequently on the reciprocal relation between the excretory processes and the manifestations

of internal illness, as is characteristic for the "psoric" remedies. The conception of carbo-nitrogenous constitution covers this only imperfectly. Because the failure in silicea lies more in the assimilative phase than in the dissimilative. Indeed Paracelsus regarded silicic acid as a remedy in stone diseases and in the herbivorous silicic acid causes the formation of stone in the urinary passages; likewise silicic acid containing plants are often prized in folk medicine as teas for stone and gravel; the promotion of diuresis which is also observed in the provings may have a share in this. However in homoeopathic use the rheumatic-lithemic trend lies in the background although reference is made to the gouty-neuritic symptoms (for example, old facial neuralgias) by many.

One can hardly study the merit of the homoeopathic method of investigating the medicinal powers of material and the usefulness created by opening up the substance, in a better way than by this very common material, whose great healing actions after the correct application have been confirmed and can be again confirmed easily by experience.

SUMMARY

Slow, persistent action.

Chief Trends:

1. Mesenchymal defense system (fixed and movable cells).

Stimulation of leucocytosis, demarcating inflammation and fibroplastic activity.

Purulent processes with defective tendency to scarring.

Fistula of all types; also tuberculous.

Thin, acrid offensive secretions. Ulcers with hard sensitive borders. Chronic suppuration also of mucous membranes (for example, tonsillar abscess, pyelitis, cervical erosions, purulent bronchial and lung affections).

Also pulmonary tuberculosis in not very advanced stages. Chronic glandular swellings (also of bronchial and mesenteric glands). Scrofulous skin and mucous membrane manifestations. Marantic children, emaciated with swollen abdomen; also after rickets; head sweating.

Acne, furunculosis.

Intertriginous, offensive sweats; desquamation and pustules between fingers and toes.

Foot sweat and chronic maladies after suppressed foot sweat.

Disturbances of hair and nail growth.

Painful indurated formations (on the soles), keloids; also internal scars.

Fibroma, lipoma, enchondroma, ganglion; hydrocele.

Scirrhus, sarcoma.

Cataract.

2. Metabolic disturbances in the assimilative phase with its results.

Inactivity of stomach and intestine. Aversion especially for cooked foods and flesh.

Constipation with weakness of expulsion (stool returns to rectum).

Deficiency in body warmth and vitality.

Headache better from warmth.

Asthenopia; vertigo on looking back, from bending over; epilepsy, nocturnal attacks.

Bodily and mental exhaustion.

Irritable, depressed, anxious, frightened, irritable restlessness.

Constitution:

Lymphatic scrofulous children with nutritional disturbances and chronic infections (chilly, thin, pale, swollen abdomen). Adults: results of failure of skin and glandular functions; chilly defective vitality; "psoric" reciprocal relation between suppressed skin functions (foot sweats, fistula) and chronic internal maladies (lithemic, carbo-nitrogenous fraction, retention processes less expressed).

Modalities and Leading Symptoms:

Better from warmth (also the headache).

Worse from wind, cold.

Worse at night (deep inflammatory processes, sweats).

Worse new moon (epilepsy).

Worse from bodily and mental effort.

Offensive secretions from ulcers and offensive sweats.

Result of suppressed foot sweat or occlusion of fistula.

Sensitive to contact and sudden noises.

Constipation with failure of extrusion of stool.

DOSE

The 6, 12, 15, 30 D. potencies have proven themselves adaptable to the chronicity of the process and the local or constitutional conditions. One may see striking results many times from the 30th potency given at infrequent intervals.

With silicea are included two naturally appearing

silicate stones which have not been proven upon the healthy but have been used empirically.

Lapis Albus is essentially calcium silico-fluoricum. The preparation arises from the region of the Gasteiner springs. It was introduced by v. Grauvogl because he associated the spring water and the stones from which it arises with the endemic goiter and cretinism. Actually Lapis albus has proven useful in hard goiters in the middle and high potencies. Here one will recall the same use of calcium fluoricum. Otherwise the clinical indications of lapis albus are the same as for silicea, particularly bone caries and glandular swellings. In myoma and uterine carcinoma as well as epithelioma and other scirrhous tumors will lapis be preferred to pure silicic acid many times.

Heckla lava, the lava of the Icelandic volcano is a silicate of calcium, magnesium, and aluminium and contains at the same time iron oxide. This preparation was introduced by Wilkinson[504] because he observed massive exostosis of the jaw in sheep grazing in the region of Mt. Heckla and also a failure of milk in animals grazing in this region. Heckla lava has been given with good results in diverse bone diseases, and has also been employed in sarcoma, moreover in glandular swellings such as silicea.

CARBON

How far the carbon preparations should be discussed under the mineral drugs is more a question of convenience than of factual justification. Even the chemical limits between inorganic and organic compounds are subjected to a certain amount of arbitrariness. However we shall consider also undoubted compounds of "organic" chemistry under the mineral drugs because the "minerals" here are substances contrasted to those obtained from plants and animals. But even the substances which arise from plants or animals or those which can be obtained from them, can be suitably discussed with the mineral substances when they have little or none of the properties of the plant or animal organisms, for example wood charcoal, animal charcoal, petroleum, salicylic acid. The selection among the almost innumerable number of carbon preparations must be made dependent upon their significance as drugs or knowledge of their medicinal powers. After considering the individual substances in detail, a review will be made as to the selection of the agent and its suitability and medicinal value from natural associations.

GRAPHITES

Graphites, as it appears in nature is almost pure carbon. The purest type which Hahnemann employed was the English graphite which contains 96% carbon

and 4% iron. Other types are impure from various admixtures, among others at times arsenic. One must exclude such admixtures, particularly in future provings, because it is not improbable that these contaminations are responsible for many symptoms of the graphites picture.

Hahnemann reports[505] that the stimulation to the medicinal use of graphites was given by Dr. Weinhold who, while on a journey in Italy, saw workers in a mirror factory in Venice employ graphites externally for expulsion of herpes. Weinhold described his own personal results in 1812 in a paper: "Der Graphit als Heilmittel gegen die Flechten."

PHYSICAL STRUCTURE

Graphites is the hexagonal crystalline modification of carbon. The carbon atom stands at the corner of regular hexagon which is arranged in a triangular plane. The distances of these triangular planes from one another is greater than a side of the hexagon so that each carbon atom is equally removed from the three others lying in the same plane and one is further removed from the others lying in the plane above and below. (This arrangement is known from the so-called space lattice of graphite through v. Laue's x-ray analysis of crystals.)

This crystalline form is very stabile and can be brought into action again only with difficulty; chemically it is quite inert. Graphite is the stabile modification in which C is set free from the carbon compounds by strong heat. The fine structure in the plane with greater intervening spaces than exist between the carbon atoms of one plane is reflected itself in leaf-like

crystalline form of graphites as it appears in nature. By trituration the metallic grey leaflets subdivide into ever finer scales.

In contrast to so-called amorphous carbon (carbo vegetabilis and animalis), which apart from impurities, is characterized by greater subdivision and irregular superimposition of minute crystals, graphites is characterized by an even surface. On this surface one valence is free to each carbon atom (three are fixed in the same plane, the fourth is free because the next plane is too remote). According to the theory of Haber and Langmuir it is the unsaturated valence of the surface which conditions the physical compound (that is, absorption of molecules from a limited gas space or dissolved substance). This loose combination obviously contains the best conditions for exchange reactions by absorption; the inner connection of the atom of the absorbing substance will thereby not be touched at all so that it can act unlimitedly as a catalysor. The type of surface primarily differentiates the various modifications of carbon and this certainly has its share in the difference of actions on the organism. Wood and animal charcoals, for example, because of their fine division (greater surface and the great irregularity of their surface) from the start have a greater capacity for absorption than graphites. Moreover they are still further complicated partly by chemical compounds and partly by impurities. How far the material character is maintained during trituration according to the homoeopathic method cannot be determined simply through mathematical calculation of the atomic size; it depends much more on the technical possibility of subdivision.

COLLOIDAL ACTIONS

In regard to details the type of colloidal actions of graphites on the organism have not been determined with certainty by organ or cell experiment. However we can assume that colloidal graphites is able to provoke states of alteration in the biocolloids, just as silicic acid.

If even the colloids themselves have an optimum of action within a certain breadth of dispersion, then an upper limit of particle size for those within the organic substance, and here especially for their influence on the cells must be presumed for purely mechanical reasons. In the foam-like structure of gelatin, which is assumed also for protoplasm, the capillary space between the structural walls has, at most, a diameter of a few micro-microns; if an excessive pressure is not available, then for the finest actions within the cells the size of the particles must remain below this diameter of the hollow spaces. In any case the size of the particle of a colloid such as graphites, as far as it acts upon the organism, is limited above, while from below on the other hand no limit has yet been found.

Indeed one can imagine that with a certain grade of dispersity and with a certain amount of the particles, the cells will be enveloped by a foreign layer of absorption and thereby the metabolism depressed; that on the other hand by a high grade dispersity and lesser amounts the particles act directly on the cells to which, for example, graphites particles have a special affinity by virtue of their charge and their peculiar surface, and thus are able to promote or intermediate very directly (catalytically) in the gas exchange or the general metabolism. In the one case a cell damage is

found, in the other an elective cell excitation to increased function, by the same element, but in varying state of division.

Surface reactions on colloids, absorption catalysis, play a major role in the organism in carbon dioxide assimilation, respiration and fermentation. It is no accident that in carbon materials we find the chief trend of action on the gas exchange, on the fermentative process. Since O. Warburg[506] has demonstrated the preponderance of the fermentative processes over the oxidative in the cancer cell, we also understand the influence of carbon materials on carcinoma much better.

GRAPHITES DRUG PICTURE

Provings of graphites are found:

1. Hahnemann: *Chron. Krkht.,* Bd. 2, p. 147; 2 Aufl., Bd. 3, p. 291.

2. Buchner: (Eine kurze Bemerkung über eine Selbstprufüng Storks, zit., *Allg. hom. Ztg.,* Bd. 47, p. 40).

3. Piper: *Allg. hom. Ztg.,* Bd. 18, p. 125.

The monograph of H. Goullon, Jr. (Leipzig, 1872), is purely clinical and to be judged only with great caution.

According to the results of provings on the healthy the drug picture of graphites has its basis in *defective internal metabolism* which expresses itself in slowing of all functions, particularly those of the *skin* and *intestine.*

TYPE

As general symptoms we find in the provings: chilliness, easily chilling, fear of open air and drafts, coldness of the feet, in the evening offensive sweating of the feet in bed, often offensive sweating on the least

exertion, night sweats, great desire for sleep, drowsy morning sleep, anxious alarming dreams, "going to sleep" of single parts, pallor of the face. Great emaciation is also reported as well as, from the other side, a fat, pasty habitus. Moreover the last is more characteristic because in general graphites shows a greater depression of dissimilation and in approximation to charcoal more stasis in the venous circulation in comparison to silicic acid. In American literature graphites is characterized as *"fat, chilly and constipated."*

A number of other general symptoms such as constant pulsation in the entire body, aggravated by each movement, transient facial heat, rushes of heat, circumscribed burning at the vertex, sudden jerks in the heart, the rush of blood to the head are probably not from graphites itself but may be ascribed to the admixture of ferrum.

As far as the mental state is characteristic for graphites, it is a melancholic disposition: indecision, inconsolable grief with much crying, anxious unrest, fear of disaster; more rarely irritability and ill humour. The manner of psychic reaction, corresponding to the relaxed type, is sluggish. Definite headaches are not present in the general state of depression conditioned by graphites; constriction and tension in the occiput is mentioned.

FEMALE SEXUAL ORGANS

Closely connected to these general manifestations are the characteristic constitutional symptoms in women. The menses are *too late, too scanty, too pale*; added to these is the clinical indication: sterility with delayed menses. Sensation of coldness in the vagina, aversion to coitus strengthen these indications. Many complaints are worse during and after the menses, particu-

larly the constipation. The reports vary concerning the leucorrhoea of graphites: watery thin, as well as white, acrid, profuse, gushing leucorrhoea is reported. The watery, profuse and at the same time acrid leucorrhoea seems to be the most characteristic. For the explanation of this leucorrhoea there is the erosion of the cervix, because such fissuring is characteristic of graphites.

DIGESTIVE ORGANS

The disturbances in metabolism begin in the assimilative phase but more markedly involve the dissimilative. On the *gastro-intestinal canal,* the digestive symptoms are almost word for word those of silicic acid. In the middle of the intestinal actions stands the persistent constipation; just as with silicea there is reported in graphites "effort even from soft stool" though this is concerned with the transient action from large amounts. The report: undigested stool soon after eating one may well ascribe to the admixture of iron. In constipation the evacuation results after great effort, then it appears in *single lumps covered with mucus.* Defective assimilation, poor gas exchange, predominance of retention processes express themselves as follows: abdominal distension after eating, so that the hypochondria are sensitive to the pressure of clothes; aversion to cooked foods, hot drinks and meats, against salty and sweet foods; fullness in the abdomen, accumulation of gas, excessive emission of offensive flatus, pressure in the abdomen. Similarly as with silicea there may be at times excessive hunger and marked thirst. Morning nausea and vomiting, however, is an exception. Burning in the stomach which necessitates eating is reported; it may be that this symptom is to be traced to the admixture of iron or arsenic. Nocturnal

cramp-like gastric pain accompanied by dyspnoea is also said to be relieved by eating and by the drinking of warm milk. In this respect graphites is to be considered in pyloric and duodenal ulcer. Perhaps it acts on the cicatricial formations. The taste in the mouth is reported as bitter or acid, by another as foul; in any case it is not characteristic.

The stasis in the gastro-intestinal canal in graphites involves the portal circulation more than with silicea but not to the extent of charcoal. Large hemorrhoids appear with soreness so that sitting is hardly possible; to this may be added *burning fissures* between the hemorrhoids which we have already learned are typical of graphites. The external application of graphites D 1 prepared with an ointment base may support the action. Itching eruptions about the anus likewise belong to the skin actions of the remedy.

SKIN

Graphites acts especially prominently on *the skin and its appendages.* We are not closely informed on the connection of the skin manifestations to the defective general metabolism and the depression of intestinal functions; and we know just as little about why the functional disturbances localize with preference in the skin. One may conjecture here as with silicic acid that foreign colloidal particles which escape from the gastro-intestinal canal are removed through the activities of the skin. The chemically inert though purest form of carbon has a special affinity for this mode of excretion. The skin manifestations of graphites are considerably dryer and less purulent than with silicea.

Most characteristic in graphites is *the persistent dryness of the skin* and lack of moisture, *tendency to rhagades and unhealthiness of the skin.* Outside of

fissured dry eczema moist crusted eruptions also appear with preference on the flexors of the extremities or behind the ears, moreover on the sites of transition from skin to mucous membranes and the vicinity of the genitalia. The secretion should be honey-like, coagulated, acrid and offensive; the *itching* is worse from heat and the warmth of the bed. (Here the similarity to sulphur which is the outstanding mobilizer in retention processes is distinct.) The nasal orifices are particularly involved, so that the nares are sore, fissured, crusted, ulcerated and the nose is swollen; its secretion is offensive, purulent, crusted. The usefulness of graphites for the avoidance of recurrent erysipelas is explained by the favorable action on rhagades. Likewise the localization on the border of the lids in the form of a blepharitis is frequent and the lid borders are thickly covered with crusts; also cited are: scabby eruption on the chin and about the mouth, soreness of the nipples with vesicles thereon, soreness between the fingers and the toes, itching on the hairy scalp, moist, scabby eruption on the scalp, the hair falls out also on the side of the head; the hair is stiff and brittle; the nails on the fingers and toes are thickened, distorted and split.

From the predominantly dry character of the skin symptoms of graphites, one will not neglect this remedy in psoriasis. Goullon sees a special indication for graphites in the herpetic-like eruption.

SCROFULA

The skin manifestations described suggest that graphites, like silicea, must be taken into consideration as a remedy in scrofula, particularly since it is a remedy with a prolonged effect and has outstanding suitability for the chronic case. Hahnemann, indeed, counts

it among his "antipsoric" remedies. In addition also to graphites is ascribed the tendency to swelling and hardening of the glands, many symptoms in the eyes and ears as well as in the upper air passages, these providing many similarities to the symptoms of scrofula; inflammation of the sclera with burning, sore readily bleeding angles of the lids, photophobia; inflammation from inwardly growing eyelashes, trichiasis, moreover offensive discharge from the ear which smells like herring brine, either from the middle ear catarrh or an eczema of the external auditory passages; dryness of the nose, itching in the larynx. In this respect one must state that while graphites as well as silicea is to be counted to the outstanding remedies for scrofula, still it is suitable only for definite phases. The selection is primarily according to the constitutional viewpoint as well as from the type and localization of the skin manifestations.

CONNECTIVE TISSUE ACTION

The action of graphites on scar tissue is extolled. It is said to soften old scars and remove pain and inflammation in old scars. We find a similar influence also in silicea. In ulcera cruris graphites again is indicated by the hard borders and the thin, acrid, offensive secretion; it bleeds readily and has a thin, sanginous discharge. Styes, chalazea, sebaceous tumors, fibroma, and scirrhus, as well as hydrocele have likewise been cited as indications. In tendon contraction, Dupuytren's contracture, graphites may be tried. In the connective tissue action must also be included the employment in otosclerosis, with *difficulty in hearing which is better in noise and from riding*, with various

types of ear noises and dryness of the inner auditory passages.

According to all reports graphites belongs to the chronic metabolic remedies which, like sulphur and silicea, are directed preferably toward the skin and digestive functions. They can be subordinated with reservations, to the carbonitrogenous constitution.

SUMMARY

Chronic remedy.

Constitution:

Fat, chilly, constipated, pale, pasty, inert, depressed. All functions impaired.

Chief Trends:

1. Skin.

Dry, unhealthy, itching, worse from the warmth of bed. Rhagades, fissured eczema. Moist crusted eruptions with honey-like, tenacious, acrid, offensive, secretions.

Predominant sites: flexor surface of joints, behind the ears, muco-cutaneous junctions (recurrent erysipelas!), region of genitalia, hair and nails.

Scars and connective tissue action: keloid, swellings; otosclerosis: hearing better in noise and on riding.

2. Gastro-intestinal canal.

Persistent constipation. Hard faeces covered with mucus.

Abdominal plethora. Aversion to cooked foods, meats (also to salty and sweet foods).

Occasionally ravenous hunger; burning and cramp in the stomach, relieved by eating.

Hemorrhoids with fissures and anal eczema.

3. Female sexual functions.

Delayed, scanty, pale menses. Sterility.

Leucorrhoea, watery, profuse, acrid (cervical erosions).

Modalities:

Nothing universal; in general worse from cold. Worse at the time of the menses, particularly the constipation.

Itching worse at night, in the warmth of the bed.

Many gastric complaints improved by eating, others aggravated (abdominal plethora).

DOSE

The 6, 12, and 30 D potencies are usually employed. The chronic skin processes with the suitable constitution are suited for testing the higher potencies.

PETROLEUM

Crude petroleum is a natural product of the earth, arising probably through the slow destruction of fossil rests of animals and plants. Chemically it is a mixture of carbon compounds of the alipathic series or paraffin series (which are derived from methane, CH_4) and some aromatic or cyclic carbon compounds (derived from the benzol ring C_6H_6) and other compounds. The composition of petroleum is therefore different according to the source. The petroleum from Galicia, Transylvania and Roumania is medicinally employed, that is, a petroleum containing few constituents of the low boiling point. The part used begins to boil at 90°. With this the petroleum ether (boiling point between 50-60°) and the characteristic benzine (boiling point between 70-90°) is excluded. On the other side the substances boiling at over 300°, the solid fractions of

petroleum at ordinary temperature, vaseline and paraffin are omitted. However many injuries to paraffin workers, of which we shall still speak, are ascribed to those constituents which appear in the common fuel petroleum. On the other side the paraffin cancer may be placed at the side of tar cancer. Paraffin and tar stand very close, only the points of departure for these products are different: in paraffin, the crude petroleum; in tar, the coal.

We cannot expect a uniform chemical composition in the natural mixture "petroleum" but merely an approximate control through the specific gravity and the boiling point. Hahnemann[507] described a method by which one can purify it from admixed bituminous elements (from the "flüchtigen Gewachsolen" as he states) by mixing with alcohol and filtration as is done with rock oil. Preliminary purification by sulphuric acid was also known to him.

The modern method of preparation of the potencies no longer corresponds to the original prescription of Hahnemann because he made dilutions to the 1:1 million, that is C 3, with sugar of milk and only subsequent potencies with dilute alcohol. On the other hand both the pharmacopoeias, Gruner as well as Schwabe, use only liquid dilutions from the beginning.

POISONINGS

Apart from intentional provings upon the healthy we have knowledge of the actions of petroleum only from the usual occupational poisonings. Exact experimental animal investigations have scarcely been performed with petroleum.

The chief organ affinities of petroleum are similar to those of the simple carbon substances (for example, graphites), on the skin and the gastro-intestinal canal.

To this is added, in petroleum, a particularly marked influence on the sensorium, indeed on the cortical centers. This cerebral action according to Lewin,[508] who made personal observations in the petroleum districts of Pennsylvania, is due chiefly to the readily volatile, that is, low boiling carburetted hydrogen which is generally inhaled in the gaseous form. The gastric form of intoxication and the skin manifestations according to Lewin are to be ascribed to the heavier constituents with higher boiling points. The residue of crude petroleum which is no longer present in the medicinally employed petroleum acts most severely and rapidly on the skin. In the paraffin fraction it even amounts to malignant tumors.

SKIN

The skin affections from both external as well as internal introduction according to Lewin consist of acne-like, thick, hard nodules with inflammatory surroundings; moreover, inflammatory infiltrations as furuncles and diffuse inflammation resembling erysipelas. Burning and itching are constant symptoms. Lewin places the point of origin in the sebaceous glands and hair follicles, respectively the perifollicular tissue. He places the petroleum affections, the so-called oil itch, at the side of those which occur in refinement of oils, tars, asphalts, etc.; the skin glands are occluded and thereby inflammation occurs.[509] Still it is to be remembered that these impure mixtures almost always contain sulphur.

The detailed picture of the skin manifestations in paraffin workers has been given by Ogston.[510] It reads:

"Eruption of nodules and vesicles on the skin involved appears very soon in those who are concerned with this occupation for the first time; the eruption lasts some weeks or months and

then generally lessens. Exceptionally in some persons the eruption does not disappear in that it takes on a chronic character and produces such an outspoken and persistent affection of the skin that the general status is disturbed thereby and makes the cessation of work necessary. The acute form of the eruption which soon appears in those who are subjected to the influence of crude paraffin, covers the hands, wrists, arms, feet and legs with light red nodules, very close together, usually largest and most numerous on the wrists or where the clothing is in close contact. *The dorsal aspect is especially involved,* the palms and the soles of the feet may be entirely free. Similar nodules appear to a slighter extent on the face, the neck and other parts of the body with which the oily stuff comes in contact. The exact examination of the skin of those affected yields the following chief characteristic of the eruption: the light red nodules, hard on contact, soft on pressure, slightly variable in size, which corresponds approximately to a barley corn, round and embrace a single hair follicle and the area immediately surrounding it is inflamed, reddened and hard. The hair is considerably elevated from the apex of the nodule and the opening of the hair follicle is considerably widened and easily visible to the unaided eye (about the size of a needle puncture in a sheet of paper). The widening extends deeply into the follicle which contains the core of the inflamed nodule and whose retention contributes to the ringlike hardening of the inflamed zone. The open orifice of the follicle shows masses of desquamated epithelia which are dry and fragile in place of fatty and tenacious. The nodule has little tendency to pass over into suppuration, and as is usual in the maggot the contents cannot be expressed, however the redness and hardness gradually lessen and after they have existed a short time, finally diminish and leave the hair follicle widened and its mouth open so wide that the retained epithelial mass is visible and indeed even more distinct through the continuous retention and accumulation of the filth. In actuality the acute form of the eruption consists in successive stages of these nodules which are to be seen in all stages of formation at the same time from complete development to regression; thereby the skin in between them shows the dark openings of the follicles which have already broken down or are in the process and the skin

still shows pliability and elasticity in contrast to the manifestations of the chronic form of the disease.

In all paraffin workers the opening and widening of the hair follicles exists to a certain extent as long as they remain at their occupation and the dark points on the skin of the hands and face immediately strike the observer. Individuals with dark color of the skin and hair are especially affected in this way while light people with blond or reddish hair are relatively unaffected. In exceptional instances single dark, hairy persons show the openings of the follicles so markedly that they are compelled to give up their occupation and seek another trade.

When the disease takes a chronic form, it shows the following characteristics: the back of the feet and toes, the hands and fingers and between the fingers, but not over the joints, shows a peculiar honeycomb appearance; thereby the skin is elevated, thickened, inelastic so that the flexion of a finger is difficult, painful or impaired. The elevated honeycomb-like places are of natural color and not inflamed (outside of areas where the acute form gives the already described appearance but consists of thickly grouped series of hair follicles with hardened cutis between and around them.

The follicles are filled with dry brittle accumulations of epithelial desquamation and so markedly that they are easily visible through the widened mouth of the follicle. The openings are sufficiently widened to be accessible to the end of the usual sound. The hairs diminish from these areas, probably atrophying from pressure of the epidermal masses, while *cracks and bleeding* fissures course through the hardened part and in occasional cases as a follicular abscess somewhat alters the picture. The joints of the fingers and toes, the palms and the soles remain uninvolved. In the chronic patient the appearance is pale, the tongue is coated and the loss of weight may be traced to the result of sleepless nights which are caused by the constant irritation and the pain in the skin of the involved extremities.

We will see that the homoeopathic reports on the skin action of the petroleum also contain burning and itching, the vesicles and the nodular eruption, furuncles and inflammatory infiltration, moreover some exact re-

ports on the total state of the skin and eczema. Intentional provings are responsible for these details.

GASTRIC FORM

In the gastric form of petroleum poisoning it is to be remembered that it involves chiefly a local irritative manifestation from oral administration. Lewin mentions: burning, thirst, vomiting, colicky pains and diarrhoea (the stools containing petroleum), icterus; then painful urination, odor of petroleum to the breath and the skin, albumin and casts in the urine. In a poisoning after rubbing it into the scalp for a young girl for the removal of lice, there appeared a severe hemorrhagic nephritis.[511] The excretion of petroleum in the urine of the intoxicated is debated by Lewin but is expressly stressed by v. Jaksch.[512]

CEREBRAL ACTION

The cerebral actions are described as dullness, headache, vertigo, then collapse, loss of consciousness, more rarely stupor, spasms, maniacal states or resembling intoxication before the appearance of unconsciousness, fainting and hallucinations, also palpitation, small accelerated pulse, gasping respiration, asphyxia, miosis or mydriasis and general weakness.

Benzine which consists of the constituents of crude petroleum with low boiling points and indeed those no longer in medicinally used petroleum, but still to some extent approximates its volatile constituents. According to Lewin on inhalation of the fumes it causes, among other things, hallucinations of hearing and vision. *"A patient saw various shaped animals and small men or it seemed* to him that the entire room was filled with waving silk *threads which flickered here and there."* This report is repeated because of the similarity with some hallucinatory symptoms which are found in the drug picture of petroleum.

In the numerous cases of petroleum intoxication reported in the literature are found many manifestations outside of those described, for example, paraesthesias, neuralgias, tremor, bronchitis, pneumonia but with the varying type and purity of the preparation not much can be determined from these isolated reports. In homoeopathic literature is a detailed instance of poisoning described by J. O. Müller[513] in which vertigo and headache, moist itching eczema on the posterior scalp, furuncles, phlegmons, ear discharge, subjective auditory sensations and bronchitis stood in the foreground. A chronic poisoning with the appearance of patches of vitiligo[514] of interest in regard to the isolated report in the homoeopathic drug picture is: brown and yellow patches on the skin.

PETROLEUM DRUG PICTURE

Provings:

1. Hahnemann: *Chron. Krank.*, Bd. 3, p. 5, 1828; 2 Aufl., Bd. 4, p. 479, 1838.

2. Benson: *Trans. Hom. Med. Soc., St. of N. Y.*, p. 297, 1868, according to the *Allg. Hom. Ztg.*, Bd. 82, p. 80 (this describes only the headache and gastro-intestinal disturbances after 10 drops of D 1).

SKIN SYMPTOMS

Petroleum stands very near to graphites in the *skin action.* This consists of the well-known unhealthiness of the skin, the smallest injuries suppurating and the suppuration extending. Itching and burning are early symptoms before the eczema appears. Scratching is said to aggravate the pain and the itching is relieved only upon the appearance of bleeding. It consists of a painful sensitivity of the skin of the entire body, even the clothing hurting the skin. The skin is *rough and*

cracked, especially at the ends of the fingers. Eczema of the hands is said to be characterized especially by *an aggravation in winter*, and to heal in summer. This winter aggravation is not apparent from the provings, where only freezing of the hands is mentioned. It may be assumed that this modality entered the picture through observation of patients.

Apart from this chronic fissured eczema which may give occasion for secondary infections, furuncles, etc., a less chronic form of vesicular and nodular eruptions appears on the most diverse parts of the body, preferably behind the ears, on the hairy scalp with falling out of hair, on the scrotum and about the anus with fissures, to which is added itching, burning and weeping, worse at night and from scratching.

If one carries over the reported experiences from paraffin workers, then the dorsal aspects of the feet and hands are preferred while the palms and soles remain free. This indicates an affinity for the glands of the hair follicle. To this may be added that petroleum preparations are employed externally against the falling of hair. Judged by the provings the sweat glands are not so markedly involved, still offensive sweat, particularly from the axilla is an indication. The ulcers have sticking pains. In bunions there is burning and sticking "as though they would become ulcerated." The external and internal use in frost bites finds support in *the sensation of cold* "as though the ball of the great toe was frozen," in burning and coldness in single parts, in the winter aggravation and from cold, in respect to skin inflammation.

The blepharitis is a particular localization of the eczema. Here it may be said that petroleum involves the inner angle, graphites more the outer angle of the lids. The connection here to the hair follicle glands is

also obvious. From the Hahnemannian proving is the symptom: "Inflammatory swelling of the right inner angle of the lid as in the development of a lachrymal fistula, a swelling so large that the right side of the nose was dry for several days" has given the occasion for lachrymal sac suppuration and fistula. In the ear are noises as if from water, rushing as from wind, or ringing as from the pealing of bells and frequent knocking with difficulty in hearing; however petroleum is less used in otosclerosis than graphites; petroleum comes in consideration more in a chronic catarrh of the Eustachian tube.

GASTRO-INTESTINAL SYMPTOMS

The *gastro-intestinal complaints* of acute petroleum poisoning are difficult to evaluate because of their indefiniteness and local nature. If one looks carefully into the provings on the healthy, then symptoms recur which are always encountered in the carbon-silicea group: aversion to fat, meat, cooked foods, odor to the breath, bitter, acid, or foul taste in the mouth, white coated tongue, flatulence, dullness and vertigo after eating. The ever-recurring *nausea* is stressed more strongly than in the other agents of this group, and indeed is associated with the greater central nervous system influence of petroleum, which will be mentioned later. The chief symptom of petroleum that the *gastric complaints* (painful spasm and burning) necessitate eating and are *relieved by eating* also appears in the symptoms of graphites, but does not have the same importance there. Emptiness in the stomach, ravenous hunger also at night, temporarily relieved by eating and persistent nausea, moreover, the type of *diarrhoea which is only in the morning and persists for many days*, with frequent urging, appearance of hunger sensa-

tion soon after eating, probably stands in close connection with the characteristic syndrome which seems to arise from the vegetative centers. With this belong the symptoms: *vertigo, worse from riding and passive* motion, with collection of water in the mouth, pallor, chilliness and cold sweat, cardiac palpitation, faintness, *profound heaviness and pressure in the occiput.* If one adds to these the constant nausea, weak, empty, cold sensation in the abdomen, cold sensation "as if from a cold stone in the cardiac region," then the indication "seasickness" becomes understandable. Nausea and vomiting on riding should also suggest petroleum during pregnancy.

The watery daily diarrhoea with offensive flatus (also evacuation of mucus) accompanied by abdominal pain, moreover aggravation from farinaceous foods, naturally suggests a fermentative dyspepsia and likewise from the non-homoeopathic side, petroleum is taken into consideration as an intestinal antiseptic.[515] Less than with the other medicinal substances of the carbon-silicea group is the defective assimilation with its chronic effects, with stress upon the constipation and weakness of expulsion although weakness of the rectum is also observed. This peculiar deviation, a shifting of the action toward the side of nervous regulation is probably to be ascribed to the volatile constituents of petroleum.

SENSORIUM AND PSYCHE

If we presume the syndrome similar to that of seasickness is due to a central action of the special volatile constituents of petroleum, then this will be emphasized by single psychic symptoms: forgetfulness, confusion, absent mindedness with the particular: "loses his way on streets well known to him." Then the sensory de-

ception of reduplication of the extremities and "believes there are people beside him who are not actually present" and "the entire air is filled with peculiar forms." The last hallucination was a striking similarity with that reported by Lewin from benzine. The occasional observation that wine and smoking causes extraordinary intoxication also shows a cortical influence. The mental state can be characterized in the following manner: grief and fear act strongly and disadvantageously: excited over details, cannot calm himself, easily offended, easily aroused. The inability to disregard irritating matters, the indecision and dissatisfaction creates a depressive hypochondriacal state.

RARER INDICATIONS

The symptoms on the respiratory organs, urine and sexual organs have little characteristic in petroleum which would necessitate the recounting. Likewise the occasionally observed hemorrhagic nephritis in petroleum intoxication has obtained no therapeutic significance. Rheumatic drawing and stiffness in the back and the extremities, crackling and easy dislocation of the joints (particularly the lower jaw which Stauffer cites as an indication for the disposition to luxation), aggravation of many pains before and during storms and from cold have given occasion for perceiving a chronic rheumatic agent in petroleum. However one finds similar symptoms in all chronic remedies, of which petroleum is one, and certainly the clinical significance of petroleum does not lie in this field.

SUMMARY

Chief Trends:

Skin: itching, burning; scratching aggravates. Unhealthy skin; chronic raw and fissured eczema; worse

in winter, tips of fingers and dorsal aspects. Subacute: vesicles and nodules (relation to hair follicles). Preferred sites: behind the ears, on the hairy scalp, scrotum, anus, blepharitis. Offensive sweat, particularly in the axilla, frostbite.

Eye: Blepharitis and lachrymal sac suppuration.

Ear: Difficulty in hearing and ear noises (from tubal catarrh?).

Gastro-intestinal: Aversion to fat, meat and cooked foods. Constant nausea. Gastric spasm and burning necessitate eating; eating transiently relieves. Empty sensation, ravenous hunger; hunger soon after stool. Diarrhoea only during day with cutting abdominal pain, frequent urging (worse from vegetables).

Sensorium: vertigo (worse from riding) with symptoms like collapse (collection of water in mouth, pallor, chilliness, cold sweat). Occipital pain, heavy as lead; cold sensation in the abdomen (and in the cardiac region), seasickness.

Psyche: Confused, absent minded (loses the way).

Sense delusions: reduplication of parts; peculiar forms in the air. Long maintained action of anger and fear, easily excited over details, depressive hypochondriacal.

Modalities:

Aggravation through riding, in winter, perhaps before and after storms.

Improvement from eating.

DOSE

It is most commonly prescribed in the D 6, the one with which I have had experience. Still it is prescribed in the third and has been recommended in the 30th decimal dilution.

WOOD AND ANIMAL CHARCOAL

Wood charcoal is obtained by the dry distillation of wood. In his provings Hahnemann[516] employed that from birch, others have used copper beech. The product (caput mortuum) of the dry distillation of the wood consists for the most part of carbon, but it also contains ash constituents, among which potassium carbonate is the most important. In general we may attribute the actions of carbo vegetablis to the carbon.

According to Hahnemann's prescription animal charcoal is prepared from beef leather; later it was prepared from flesh or bones and in modern medicine blood charcoal is preferred. Indeed the admixtures vary according to the original material.

Animal charcoal shows physico-chemically and biologico-therapeutically extensive similarity with wood charcoal. For this reason it is sufficient to merely mention some differences.

ADSORPTION ACTION

In the original form animal charcoal is porous, more finely divided than wood charcoal. Therefore it has a different adsorption coefficient for various materials. According to L. Jaque and E. Zunz[517] animal charcoal adsorbs diphtheria toxin and antitoxin strongly while neither is adsorbed by wood charcoal. They found also that the adsorption of diphtheria toxin in the organism is reversible, but in the test tube irreversible. Serum protein can prevent the adsorption of diphtheria toxin and antitoxin by animal charcoal. In the organism the relations from the concurrence of several adsorbents around an absorpt are different than in a test tube. As a crude adsorption agent in dysentery animal charcoal is often preferred.

Even Pliny mentioned the use of wood charcoal in carbuncles. The employment of wood charcoal in old ulcers for the removal of odor, as a lavage for the

offensive odor of the mouth, or the removal of odor from the stool in spring diarrhoea was common before Hahnemann. In addition to this adsorptive action of wood charcoal, Hahnemann knew still a chemical action and contrasted it with a "dynamic," which first appeared by trituration with sugar of milk in one part to a million. Today we would include the actions entirely under the physical. The fine state of division of wood charcoal permits its extensive use in industry as an adsorbent.

At glowing heat amorphous carbon withdraws the oxygen from most oxides and therefore is a good reduction agent in chemistry. On the other side carbon can act as an oxygen carrier and through the delivery of adsorbed oxygen can produce oxidation.

The crude adsorption action has, as said above, been long known and therapeutically utilized many times. It has not, as Poulssen[518] believes, been displaced by the modern treatment of wounds, because for example in a filthy carcinoma charcoal is to be preferred even today over the modern disinfectants. Likewise the use in tooth powders is supposed to be disadvantageous, according to Poulssen, because the sharp particles penetrate and tattoo the gum. In this respect I can say from personal experience with the finely divided linden charcoal that such a bluish discoloration of the gum margin is to be feared at most when the gum has been previously loose.

Adsorption therapy has been reintroduced in recent times by Lichtwitz[519] and a number of works have appeared on the absorption of poisons by charcoal.[520] Even in 1830 the apothecary Thouery took one gram of strychnine (10 times the fatal dose) with 15 grams of charcoal powder and remained well. Sabbatini[521]

avoided the poisonous action of strychnine by an intravenous injection of six times as much colloidal carbon. Like other colloids charcoal is employed in excessive acid secretion in the stomach as well as fermentative processes. Lichtwitz employed it for obesity. In the adsorption of bacteria charcoal has been found far superior to other adsorbents. In infectious intestinal catarrhs, in particular dysentery, the use of wood or animal charcoal (of bolus alba) is now very extensive.

THEORY OF BIOLOGIC COLLOID ACTIONS

The adsorptive action of unpotentized wood charcoal is employed in suitable cases, particularly in filthy ulcers. But of great significance for us are the finer actions which wood charcoal unfolds in the organism only in the higher grades of dispersion. In principle they rest indeed on the same physical properties as in colloidal charcoal. But as with all colloids an optimal action is possible only at great dispersion, because it occurs only (perhaps at the 5-6 decimal potency) when the size of the particle has been attained that can be compared to the size of dissolved particles or the cell colloids. We know particularly well the action of the globulin of the serum. Through absorption it will be brought into a crude state of dispersion and flocculated, that is, brought near to flocculation. This signifies the exclusion of the so-called complement, that constituent or much more state of normal serum which plays an essential role in the occurrence of immunity, in the defense from bacteria and foreign protein. This would also indicate that the power of resistance of the blood serum is reduced when the carbon particles have reached a sufficiently small size to go into reciprocal

action with the serum. But if the serum defense power ("complement") is brought against the protein poison ("antigen"), then a complement binder such as colloidal carbon is in a position to serve as a complement linkage and intermediator. But to do this the colloidal carbon particles, either by their size or number, must appear as an activator. For the promotion of defense the greater dispersion and a moderate number of particles at the suitable time will be desirable. These theoretic reflections would hang in the air if we did not have factual knowledge of the corresponding and related silicic acid. For the understanding of the septic tendency in the drug picture of wood and animal charcoal these basic ideas of the mechanism of action may be taken over.

One can represent the influence of colloidal carbon on the cell colloids in a similar manner. With the size of the particles which again may be compared to the 5-6 potency, they will occlude the membrane pores of the healthy cell, prevent gas exchange, depress and alter the diffusion of ions in a definite way. This comes under consideration primarily in the red blood cells. A defective oxidation of the blood and organ cells will result and surcharge of the blood with the metabolic end product carbon dioxide cause the blood to become venous. One can also think of this important action of colloidal carbon as occurring in that the cell membrane, perhaps the red blood cell, is finely coagulated through adsorption, which prevents the normal metabolic exchange. Now it is exactly the ratio of the carbon dioxide in the blood which offers the best proof for the fact that with small doses the reverse occurs as from large doses. With excessive carbon dioxide pressure the blood becomes decidedly and finally permanently

incapable of metabolic exchange, and suffocation is the final result. On the other side it is exactly a moderate amount of carbon dioxide in the blood which is the physical stimulus to the red blood cells to increased function, to more animated movement and increased gas exchange. The activity of smaller amounts and smaller fragments of carbon than those which provoke defective oxidation in the healthy can be considered directly as the stimulus which the finest and diffusible carbon particles in the cells effect on cell function, or thereby take the intermediation of the slight increase of carbon dioxide into consideration or both act as a stimulus at the same time—but in any case there is no difficulty in comprehending the stimulating action of smallest doses of carbo vegetablis in morbid venous states.

CONNECTION TO CARCINOMA

A similar alteration of the metabolism in the epithelial cells, depression of the oxidative and predominance of the fermentative process, must be taken into consideration in the development of carcinoma from many types of carbon substances. The same has already been shown for the related silicic acid. In the now rare but common 150 years ago, chimney sweeps cancer, which usually involved the scrotum and extended to the testes, but still showed little disposition to extensive metastasis, the constant injury by soot was in any case an important condition. Even if trauma and traces of arsenic in the soot might have cooperated still the experiences on industrial and experimental tar, paraffin, and aniline cancer show that the products of coal distillation favor the development of cancer. And it is indeed no accident that these same impure carbon

products ever recur in antiquity in the external and internal treatment of cancer. Wood and animal charcoal have not only proven themselves in respect to deodorizing adsorption action in sloughing ulcers, but from the internal use of animal charcoal, noteworthy results were obtained over 100 years ago in carcinoma of the uterus.[522] For the further explanation reference should be made to the studies of W. M. Sykow and A. Sticker[523] who have observed depression of growth of carcinoma and sarcoma cells from these carbon materials. Homoeopathic experience in any case has steadily treasured plant and animal charcoal as a worthwhile cancer remedy.

CARBO VEGETABLIS DRUG PICTURE

Provings:

1. Hahnemann: *Reine A.M.L.*, 2 Aufl., Bd. 6, p. 120, and *Chr. Krankh.*, 1 Aufl., Bd. 4, p. 1.

2. C. Wesselhoeft, *Trans. of Amer. Inst. of Hom.*, p. 198, 1877.

METABOLIC WEAKNESS AND VENOUS STATE

The characteristic in the drug picture of carbo vegetabilis is *the metabolic depression with particular stress on the defective oxidation and tendency to venous stasis.* Thereby even the wood charcoal itself is a product of incomplete combustion. A connection between the direct property and the indirect actions is clear here.

Out of the metabolic weakness the following *general symptoms* are derived: great fatigue, often up to faintness; early in bed or on beginning to walk the extremities go to sleep readily; general lassitude of the extremities soon after arising from bed, rapid sinking of

the power. The faint-like weakness in which the patient is cold, with pale or blue skin, almost pulseless, indeed is covered with a cold sweat and even the breath is cool and associated with the desire to obtain air, is the extreme expression of the frailty which occurs in carbo vegetabilis. Such a *collapse* often leads to the choice in the course of acute diseases (in the older therapies usually called asiatic cholera), still often in emaciated, cachectic, particularly in old people, when incomplete recovery follows some preceding disease. In general all complaints in carbo vegetablis show a tendency to chronicity. The special action on the co-existing cardiac weakness in carbo vegetablis is perhaps to be attributed to the admixture of kali carb. The symptoms of weakness from any exertion even from arising in bed indicates what a deep disturbance in metabolism is present.

The combination with venous stasis gives symptoms such as chilliness and coldness of the body, thirst during the chill, full puffy face, blue skin, cold knees, especially at night on awakening, *coldness from the knees downward,* cramps in the soles of the feet, pallor of the face, sluggishness, slowness in everything, slow thinking, weakness of memory, sudden failure of memory being characteristic. During the day there exists great sleepiness, at night consequent to bodily unrest sleep occurs late; insomnia or alarming dreams. Offensive sweating of the feet as it appears in other carbon compounds and silicea. The head is full and heavy, headache from heat; pressing and dullness occur in the occiput, moreover a spasmodic tension in the head which is sensitive to external pressure for example from the hat, the eyes ache from efforts to see, dark spots move before the eyes. Likewise there is vertigo

from the least movement of the head or it may occur after sleeping. Anxiety and restlessness prevail in the disposition, particularly evenings (aversion to dark) and there is marked irritability.

Further signs of the depressed gas exchange and the venous state of the body are: *tendency to relaxed veins*, varices *passive, dark, thin, prolonged bleeding and involvement of the tissues on slight cause.* Such people are easily chilled. Burning at various places in the skin indicates the beginning of the venous state. As a result of the varices the patient wishes to sit with the legs elevated. Bleeding occurs readily and there are foul ulcers with burning pain and abundant foul pus. The ulcera cruris are usually flat with bluish surroundings; frostbite may also be suitable for the remedy. Bluish hemorrhoids appear, pain, itch, burn or bleed and with every stool there is bleeding or itching and burning; evacuation of sticky acrid moisture, particularly at night. Varices also appear on the vulva and provoke itching and burning as well as soreness and aphthous ulceration. From a similar alteration from venous stasis in the internal sexual organs perhaps arises the thick, yellow-green offensive corrosive leucorrhoea, as far as it is not conditioned by carcinomatous ulcerated surfaces. Menses in general appear too early, are too copious and last too long, the menstrual flow is pale and at times the blood spots the parts from one period to another in a way resembling carcinoma. Burning in the back or in the hands and soles of the feet during the menses, weakness and relaxation of the lower abdominal organs are further indications. Often persistent daily nose-bleed with pale face is present and may be associated with varicose alterations. The gums also bleed readily, are sensitive and loose. As with so

many remedies, one finds here also reports on alveolar pyorrhoea for whose avoidance the external application of finely powdered linden charcoal is worthy of mention. The tongue is sensitive, and especially noteworthy are *aphthous sites on the glossal mucous membrane.*

SEPTIC-GANGRENOUS STATES AND CANCER

The slight vitality of the organism and the slowed circulation prepare the soil for bacterial action and self intoxication. *Septic and gangrenous trends* in the drug picture refer to the defective defense power in the blood. The secretions are all offensive. The ulcers, for example the varicose, are unhealthy, and there is burning pain. In inflammations, phlegmons, which take on a gangrenous or septic form, in ulcers with marginal gangrene, carbo vegetablis comes into consideration, as well as in senile gangrene which begins in the toes. In many less stormy cases of sepsis carbo vegetablis comes to mind. Ecchymoses and bleeding from the mucous membranes are in this group. Also severe inflammations of the parotid and metastasis to the testes are reported. To these belong the malignant tissue injuries which may involve other glands, for example the breast, and show a tendency to ulceration. More frequently however wood or animal charcoal is considered in cancer of the digestive passages while in uterine carcinoma the related creosote accomplishes more.

CARDIAC SYNDROME

The tendency to collapse explains the persistent palpitation with alarming fright about the heart, the rapid, thready, intermittent pulse and dyspnoea. Symptoms as burning in the chest, pressure, oppression, heaviness

and soreness in the chest, fullness of chest, labored and short breathing, rales, refer to the stasis in the respiratory organs. Asthma of old people with cyanotic skin is regarded as a good indication. Throughout carbo vegetablis is a *passive hyperemia of the respiratory organs* which often goes gradually and insidiously from the nose to the larynx and bronchi, especially in old people. The persistent hoarseness is aggravated by speaking and at night. The cough of chronic bronchitis with or without emphysema or lung stasis is spasmodic, in single cases dry in spite of audible rales in the lungs, but often a slimy purulent sputum is evacuated; foul expectoration and breath indicate the progressive suppurative process. With the spasmodic cough the sputum may be bloody and a sensation of weakness and burning develops in the chest, the painful stitches going to the head. In general the cough is worse at evening and in bed, from cold, from evening air, after eating and talking. Chilling, bronchitic and asthmatic states appear especially in *damp warm weather*. This is comprehensible because humid weather particularly embarrasses gas exchange and for this reason the general modality has special significance for carbo vegetablis. Desire for open air stands in accord with this. Because of the spasmodic cough in which nausea and vomiting can occur, carbo vegetabilis is also recommended in whooping cough. That carbo vegetabilis is an important remedy in cough and dyspnoea of cardiac origin is probably due to the admixture and participation of kali carbonicum.

DIGESTIVE ORGANS

Of the symptoms from the *digestive canal* we have on the externally visible exit and entrance lesions,

aphthous oral ulceration and hemorrhoids, which have already been mentioned. The abundant development of gas is associated with the venous stasis in the intestine. *The abdomen is distended and tense.* One half to one hour after eating the stomach is full of gas, tense like a drum, each article of food is converted into gas, the hypochondrial region is sensitive where the clothes touch. The gaseous collection produces a burning, pressing gastric spasm with great sensitivity in the pit of the stomach, moreover, sticking or sore pains in the hypochondria and the picture of retention of gas and decomposition of gas can be combined with a considerable grade of dyspnoea. The crampy pain radiates into the chest, the burning in the stomach extends to the back and along the vertebral column; recumbency aggravates the flatulence. Characteristic is *the relief from eructation and emission of flatus.* Likewise other complaints than merely those of the stomach and intestine are thereby relieved. In the abdominal plethora characteristic for carbo vegetablis in which the increased gas tension of the venous blood contributes to the increased collection of gas conditioned by the sluggish digestive process, there is excessive flatulence with offensive foul flatus. Such conditions develop especially readily after prolonged rich living; in particular the evil results of banqueting fit well into the general picture of excessive venosity; dull morning headache, white or yellow brown coated tongue, morning nausea, vomiting and gastric weakness, burning in the stomach, offensive rancid eructations, disgust for meat; *aggravation from fat,* which causes rancid eructations, increased flatulence and acid eructations after eating, particularly after the use of milk, desire for acids. The simplest diet causes distress, flatulence naturally being outstand-

ing. The typical symptoms which indicate complete depression of the normal digestive activity can also indicate carbo vegetabilis even if it has other causes; even if it involves a persistent state of this kind and a carcinoma of the gastro-intestinal canal is present, carbo vegetabilis comes into consideration. Alcohol in any form is said to be borne badly in the typical state of carbo vegetabilis, particularly provoking rush of blood to the head. One gastric symptom seems especially noteworthy in carbo vegetabilis, namely: *rising of fluid from the stomach into the mouth.* In the atonic stomach it does good service. A feeling of sinking in the stomach, which is relieved by eating belongs here. The atony of the intestine makes itself obvious in constipation, difficult stool with strong urging or thin slimy stool; the last is excoriating and foul, and may be comprehended as resulting from the decomposition of the intestinal content and the influence of abnormal split products due to the impaired digestion. The discharge of acrid, sticky moisture from the rectum has been mentioned in discussing the hemorrhoids. But the symptom also refers to other affections of the rectum, namely carcinoma, just as the discharge of blood. For carcinoma of the rectum there is also the characteristic frequent, involuntary putrified stools with subsequent burning.

RARE INDICATIONS

On the urinary and male sexual organs carbo vegetabilis has no characteristic symptoms. In skin eruptions it comes much less into consideration than the related drugs. Itching and moisture on the scrotum and thigh and similar skin affections are the suitable trends of action here. It is much less applicable in

otosclerosis than graphite; deficiency of cerumen, occlusion of the ears, ringing and noises in the ears have also been reported from it.

GENERAL CHARACTERISTICS

By way of repetition the character of the pains is *burning*. But at the same time general or partial sensation of cold is characteristic. The pains in carbo vegetabilis are dependent mostly upon venous stasis and inflammation and often are associated with anxiety particularly at night.

The type of patient suitable for carbo vegetabilis is determined by the weakness with defective oxidation and venous stasis. Old, decrepit people, weakened by disease, are particularly susceptible to its action. The tendency to "decomposition of the blood," of the transition of inflammation into foul septic and gangrenous forms, reflect themselves in the general report: all secretions are offensive and acrid. The failure in the venous part of the circulation readily leads to faintness, weakness and collapse. The drug picture is a subform and type of the carbo-nitrogenous constitution in itself.

SUMMARY

Chief Trends:

1. Depression of oxidative metabolism. Venous stasis, faint-like weakness, cyanosis, collapse.

(Marked desire for fresh air. Aggravation from damp warm weather.)

Chilliness, cold from the knees down.

Relaxed veins (relief from elevation of the legs). Chronic ulcera cruris.

Tendency to passive dark bleeding.

Oral aphtha. Alveolar pyorrhoea.

Transition to septic and gangrenous states.

Carcinoma and malignant parotid metastasis.

2. Stasis catarrh of the respiratory passages, worse at evening and from speaking. Dry cough with rales in the chest, attacks of spasmodic coughing; putrefactive processes, foul sputum and breath. Asthma and dyspnoea of old people with cyanosis.

3. Abdominal plethora. Complaints of meteorism. Improvement from eructation and discharge of flatus.

Atony of stomach and intestine.

Dyspepsia with putrefactive processes. Eructation of water into the mouth. Aggravation from fat. Intolerance of alcohol. Hemorrhoids, carcinoma.

Type:

Carbo-nitrogenous. Venous.

Chronic stasis in old decrepit people.

Psychic: nocturnal anxiety; slow.

Leading Symptoms:

Burning pain; internal burning but external coldness (especially from knee downward).

Faintness.

Desire for fresh air.

Acrid offensive secretions.

Eructation of water into the mouth.

Aphthae on the tongue.

Modalities:

Aggravation in damp air.

Aggravation in evening and at night.

Aggravation from fat (and alcohol).

Relief from eructations and emission of flatus.
Relief from elevation of the legs.

DOSE

Carbo vegetabilis has proven itself in the D 6 and D 30.

CARBO ANIMALIS

Provings:

1. Hahnemann: *Reine A.M.L.*, 2 Aufl., Bd. 6, p. 161, and *Chron. Krankh.*, 1 Aufl., Bd. 4, p. 68.

2. Weise: *Rust's Magazine*, Bd. 22, I, p. 198, 1826.

The greater effectiveness of carbo animalis on the *lymph glands* is stressed fairly uniformly. Hard painful glandular swellings in which suppuration impends are said to be favorably influenced, also venereal buboes. In ulcus molle, carbo animalis promotes healing after too early incision. In tumors of glandular organs, tumors of the parotid and testes and mammary gland and uterine carcinoma, it has been emphasized as well as plant charcoal. The cachexia and the marked reduction of vitality makes carbo animalis even more suitable for the senile marasmus than carbo vegetabilis.

Carbo animalis is also preferred in the states of weakness which are dependent upon lactation as well as great exhaustion after the menses.

A report: copper colored eruption (especially on the face) has given occasion for the use of carbo animalis in syphilis.

Single differentiating symptoms still require confirmation, for example, the report of a special sensitivity to open air, which indeed would be opposite to that of carbo vegetabilis. A feeling of looseness of the brain especially in the suffocating cough, is also cited for

carbo animalis. Opposite to the burning in the stomach and chest of carbo vegetabilis, *a sensation of coldness in the stomach and chest* is said to prevail in carbo animalis. The digestive weakness with complaints from almost every food is stressed more strongly in carbo animalis than in carbo vegetabilis, as well as the feeling of emptiness and sinking in the stomach (particularly in lactating women) which is not relieved by eating.

The tendency of decomposition of the blood, the transition from inflammation to the septic form is not less in carbo animalis than in carbo vegetabilis. Here also the discharges are offensive. Moreover it is particularly in the purulent gangrenous lung processes that carbo animalis, like carbo vegetabilis, is recommended: when there is green, purulent, offensive expectoration and especially with carbo animalis, cavities associated with sensations of coldness in the chest. In other respects the burning pain is often repeated in carbo animalis. As a detail for carbo animalis, there is also the clinical report; sticking pains, which can be traced to a pleuritis.

DOSE

Carbo animalis is also employed in the 6th and 30th potency.

KREOSOTE

According to its chemical composition and medicinal actions, kreosote stands between wood charcoal and carbolic acid, the simple phenol. It is a mixture of various phenols, a product of the distillation of beechwood tar and indeed the fraction which distills over between 200-220°. It is predominantly composed of polyphenols, that is, benzol derivatives with several

OH groups. Its chief constituent, guaiacol, is the methyl ester of dioxybenzol (also a diphenol). Other constituents are cresol and creosol, also methylated phenols.

MANNER OF ACTION, INDICATIONS AND CONTRA-INDICATIONS

Like all phenols this mixture has a markedly irritating up to destructive cell action through protein coagulation. Its antiseptic property approximates that of phenol, the corrosive action is less. Since the introduction of kreosote into the therapy of tuberculosis by Reichenbach[524] in 1830, it has long been erroneously considered as an internal antiseptic. In this respect it is indeed impossible, without manifestations of severe poisoning to obtain the concentration of kreosote or guaiacol in the organism which is necessary to depress the growth of tubercle bacilli or indeed to kill them. At the same time guaiacol is rapidly split in the body, made harmless through conjugation with sulphuric acid, and excreted as ethyl sulphuric acid. In animal experiments all of the many kreosote and guaiacol preparations with which the market is flooded, have shown themselves inactive in experimental tuberculosis. If still a favorable action in tuberculosis is observed from kreosote or guaiacol, such as the improvement of appetite and the state of nutrition, lessening of cough and expectoration, at times also the reduction of fever and the night sweats, then this can be explained only as an indirect action on the economy of the organism. Since kreosote is also excreted in small amounts through the respiratory passages, for it is easy to note in the odor of the exhaled air, one may presume a mucous membrane stimulus as an intermediate factor. Through

this the accompanying bronchitis and the mixed infection could be favorably influenced. At times kreosote and guaiacol have been employed in putrid bronchitis. On the other hand the late stage of tuberculosis with greater destruction and tendency to hemorrhage is held as a contra-indication, a distinct proof that the dose selected is too strong for these cases. On the other hand it is exactly in homoeopathy when the destructive processes in the respiratory passages are present, the late stages of phthisis with fever, night sweats and cachexia, which are considered suitable for kreosote. On the whole the clinical indications and the contra-indications and the so-called untoward actions in kreosote, as always are very instructive. On the one side it can, as many related benzol compounds (for example salicylic acid), reduce the fever even by application to the skin; but the chill can be followed by very high fever. On the one side there is the stimulation of gastric function which can be compared to the bitters, on the other one sees the impairment of gastric function from prolonged use and therefore sought aid in guaiacol compounds which are not split in the stomach, but only gradually destroyed in the intestine, entirely overlooking the acute irritative manifestation in the gastro-intestinal canal as burning, pains in the epigastrium nausea and vomiting and diarrhoea. All this divergence of action is solved when one takes consideration of the quantity, the repetition of the dose and the sensitivity of the patient.

Even from the local application of kreosote in carious teeth, there readily arises inflammation of the surrounding tissue, indeed a severe stomatitis. It is exactly in dental pains from caries with inflammation of the neighboring tissue that the homoeopathic use of kreo-

sote has often proven itself. The increase of menstrual bleeding which makes necessary the discontinuance of the drug during the menstrual period, finds the opposite as a homoeopathic indication, as a tendency to hemorrhage. States of excitation with palpitation, vertigo, feeling of intoxication and headache are on the one side "untoward" actions, on the other side supporting therapeutic indications.

The role of tar products in the development of cancer has already been discussed. On the other side the external use of kreosote in malignant ulcers has been extolled from time to time ever since 1834.[525] The cancer treatment of E. Salzborn has guaiacol valerianate as the chief constituent and is given twice a week in milligram to centigram doses.[526] In homoeopathy kreosote has always been an important remedy in carcinoma.

The excretion of sugar in the urine is not found in the symptoms of intoxication or untoward actions. However in homoeopathy kreosote is held as one of the best remedies in diabetes. We should recall that adrenalin just as guaiacol, is a pyrocatechin derivative and, as is well known, has a prominent role in sugar metabolism; moreover its artificial introduction produces hyperglycemia and glycosuria.

KREOSOTE DRUG PICTURE

Provings are found:

1. Reichenbach: *Das Kreosote in chem., phys. und med. Bezeihung*, 2 Aufl. Leipzig, 1835.

2. Syrbius: *Allg. Hom. Ztg.*, Bd. 12, p. 33, 1837.

3. Wahle: *Arch. f. Hom.*, Bd. 16, H. 2, S. 152, 1837.

4. Wichorn: *Ztschr. d. Ver. d. Hom. A. Österreichs*, Bd. 2, S. 24, 1857.

CHARACTER OF ACTION

Kreosote differs from wood charcoal chiefly in the more marked inflammatory manifestations on the mucous membranes and skin while the venous status is minimized in the picture. *The tendency to putrid inflammations and ulcers, to malignant degenerations, to bleeding, the transition to cachexia* stands in the center. *The discharges* are *foul and acrid, indeed corrosive.* Therein the stronger inflammatory stimulus (exactly as with carbolic acid) comes into expression. The reduction of power of resistance in the tissues expresses itself much more in the symptoms similar to disturbed nutrition, as in *diabetes.* And even if sugar excretion in the urine is not observed in kreosote, still disturbances in the skin and mucous membranes are induced which are similar in their results on tissue nutrition as the metabolism of diabetes, and valuable indications may be had in this field.

SKIN

The irritative manifestations on the skin and mucous membranes can run through all stages; on the skin from itching and burning to vesicles and pustules; the skin becomes unhealthy, its nutrition is bad, it tends to ulcerate and becomes gangrenous. The itching is especially severe at evening and may provide occasion for the use of kreosote in pruritis senilis; even more frequently the remedy is successful in pruritis vulvae, particularly on a diabetic basis. Here the irritation appears from the acrid discharge. Carbuncles and gangrene in diabetics (besides arsenic) likewise suggest kreosote. The tendency to bleeding in injured, non-resistant tissue is expressed in the bleeding from small wounds.

DIGESTIVE ORGANS

In *the digestive canal* the inflammatory tissue injuries begin in the mouth. The teeth rapidly become carious. When the inflammation proceeds from there and produces severe toothache, kreosote in the D 3 and D 6 often proves useful. The gums are sore, spongy, and bleed readily; salivation is increased. A bitter taste prevails. Nausea, retching, and *vomiting* of undigested food several hours after eating or the regurgitation of sweetish water in the morning suggest kreosote much more than the other irritants of mucous membranes. Here also belongs reflex vomiting from other organ maladies or in pregnancy, but still, more frequently the severe inflammations of the gastric mucous membrane form important indications. Ulcerative processes with bloody vomitus, particularly of a malignant nature, can be at least improved by kreosote. The gastric pains are severe, burning, constrictive but a nagging fasting pain in the morning with vomiting is also observed and this diminishes after eating. Food remains in the stomach long after eating and causes pressure. This refers to gastroectasia consequent to narrowing in the duodenum where kreosote as well as carbo vegetablis brings improvement. The abdomen is distended, acrid, very offensive also bloody diarrhoea as well as persistent constipation is reported; moreover large painful hemorrhoids. Much pain in the rectum and tendency to bleeding permits one to think of carcinoma, though the rectum less than the stomach and much less than the uterus is the preferred site of kreosote. Severe gastro-enteritis with atrophic, marasmatic children with dental disturbances, and rapid decay of the teeth are given as clinical indications.

FEMALE SEXUAL ORGANS

Most frequently kreosote is used *in putrid and malignant ulcerative processes in the female genital organs*, particularly carcinoma of the portio. *A foul, yellow or flesh-like (bloody) acrid leucorrhoea* which corrodes the external parts is suggestive here. It makes the clothing stiff, indicating the high protein content. Foul lochia can also give occasion for the drug in puerperal fever. Burning and corrosive itching on the vulva, between the labia and the thigh, worse on urination, with swelling of the parts seem partly dependent upon the leucorrhoea and partly intrinsic. Itching of the vulva, in the vagina and the anus are good indications in diabetes. The menses appear too early, last too long, are dark, often acrid and offensive. The bleeding is intermittent, ceases on walking or sitting and reappears on lying. Itching in the vagina can increase the libido sexualis. Intermittent bleeding appears after coitus. Before and during the menses, difficulty in hearing and ear noises are reported. Downward pressing backache and sacral pain and great feeling of weakness accompany the uterine maladies.

RESPIRATORY ORGANS

Of the irritative manifestations on the *respiratory organs* the progressive destructive processes are the chief indications for kreosote. *Abundant, purulent sputum after each cough* may lead to the choice of kreosote in bronchitis foetida, bronchiectasis, lung gangrene, persistent lung inflammation after grippe, also in cavernous tuberculosis with hemoptysis and night sweats. In the chest much burning, pain and oppression is felt, pressure on the sternum with respiratory embarrassment.

Hoarseness appears, but carbo vegetabilis is then more frequently in place.

MORE RARELY USED ACTIONS

In severe poisonings the urine is diminished in quantity and colored brown. Nephritis and hemoglobinuria occur. However these end effects do not suggest a preferential trend, much less a stimulative state and one susceptible to improvement by kreosote. In the provings a frequent and particularly very sudden urge to urinate is recorded and the urine is often very copious and colorless, or offensive and cloudy. In the enuresis of children in the first sleep, kreosote is recommended. The polyuria is only a very weak support for the connection to diabetes. The similarity here lies much more in the type of nutritional disturbance in the tissue.

It should still be mentioned that kreosote is recommended for the beginning cataract in diabetes. A number of symptoms of cloudy vision are observed in the provings. But whether they arise from the refractive medium of the eye or are associated with the frequent vertigo of acute kreosote action is not determined.

Vertigo with congestion, pulsation, stupefaction and confusion of thought, depression, great sensitivity of the mind with tendency to cry, hopeless despondency, nervous excitability before the menses, are the first signs in acute poisoning of the sensorium and psyche but are of subordinate significance in the selection of the drug. The dissatisfied and contradictory behavior which is mentioned particularly for children, finds no support in the provings.

GENERAL

General exhaustion with trembling and failure of the legs, chilliness, weak, slow pulse, pale yellow appearance

or hectic redness are the expressions of the severe state of disease for which kreosote is suited.

Universal modalities are not known for kreosote. The aggravation from rest, particularly from sitting, refers to the back and sacral pains, but the improvement from lying and the aggravation from movement and walking is observed. One can generalize just as little on the aggravation in the open air and from the cold and the improvement from warmth.

SUMMARY

General:

Severe alterations of the blood and tissue. "Decomposition." Tendency to bleeding, to foul, acrid and corrosive secretions. Putrid inflammations and ulcers. Carcinoma. Diabetic tissue injuries. Cachexia; yellow appearance in chronic deep seated maladies.

Chief Trends:

Skin and mucous membranes.

Skin: severe itching, burning; vesicles and pustules. Poorly nourished unhealthy skin, marked bleeding from small wounds, tendency in ulceration and gangrene. Pruritus senilis. Pruritus vulvae. Diabetes!

Digestive canal: toothache from caries. Nausea, vomiting of undigested food several hours after eating or regurgitation of sweetish water (organic even malignant alterations or reflexly from other organs).

Old cases of gastric or duodenal ulcer in enfeebled persons.

Gastro-enteritis with nutritional disturbances in children with poor development of teeth.

Female sexual organs: foul, yellow or flesh-like, watery, acrid, corrosive leucorrhoea. Marked inflam-

matory irritation of the external parts. Putrid ulcers and carcinoma of the portio.

Menses too early, too copious, too prolonged, dark, acrid, offensive; intermittent, flow particularly on lying. Intermittent bleeding after coitus. Back and sacral pain with downward pressing in uterine maladies.

Respiratory passages: Copious, purulent sputum. Progressive destructive processes; foetid bronchitis, bronchiectasis, lung gangrene, tuberculosis.

DOSE

It has been recommended in the D 3 up to the D 30 and higher. I have observed good effects from the D 6.

OTHER TAR PRODUCTS

Pix liquida, a product of dry distillation of various conifera, is not proven. Its action on the skin from external application is generally known. The skin inflammations are associated with marked itching and burning, yet on the other side, wood tar through the phenol contained in it, also markedly relieves itching. With prolonged external use there is an inflammation of the hair follicles. Internal use proceeds as the external, in chronic eczema with marked itching, particularly on the backs of the hands, psoriasis and particularly acne.

The internal use for muco-purulent sputum from chronic bronchitis still occurs in many places. As with kreosote the sputum is offensive and here also suggests a destructive process. Moreover rough râles and a pain near the origin of the third rib cartilage on the left side, may be correctly related with the left bronchus.

Wood tar also provokes irritative manifestations in the urinary passages and has been employed at times

in cystitis. The explanation through a disinfectant effect is not sufficient. The dose is usually in the low potencies.

Ichthyol, a distillation product of bituminous deposits with fossil fish inclusions, is obtained in Tyrol and contains 10% sulphur. This tar product is also unproven. Outside of the indications also mentioned for pix liquida there is a connection described for rheumatic-gouty affections, which may well be traced to the sulphur fraction.

Naphthalin $C_{10}H_8$ is composed of two benzol rings joined together and is a constituent of bituminous tar. It is also unproven. But its actions are known to some extent from many poisonings when it has been taken in excess for intestinal parasites (hookworm, oxyuris), or when de-mothing tablets are accidentally eaten by children. Also the continual inhalation of the vapor or dust can give occasion for poisoning. Peculiar alterations develop in the eyes by the external or internal influence, particularly chorio-retinitis and turbidity of the lens (naphthalin cataract). Naphthalin has been recommended in cataract, among others by Tischner. In dermatology beta-naphthol, an OH compound of naphthalin, also a phenol, is used in parasitic skin diseases, acne, psoriasis, pruritus and prurigo. Likewise the inhalation of naphthalin can provoke itching and exanthemata, still it is used therapeutically in skin inflammations. The severe toxic manifestations are nephritis, hemoglobinuria and methemoglobinuria, icterus, swelling of the spleen, clouding of the mind, loss of consciousness, finally spasms and death. Inflammation of the bladder and the urethra, particularly at the orifice of the urethra are noted. But all these trends of action in homoeopathy have hardly been utilized up to the

present. On the other hand asthma, hay fever and whooping cough are the chief indications of the remedy: spasmodic sneezing, spasmodic asthma and dry spasmodic cough in children and old people with emphysema. Usually the lower potencies (1-3 triturations) are recommended but D 12 is suggested by Cartier in bronchitis with spasmodic cough and tenacious sputum.

ACIDUM CARBOLICUM (PHENOL)

The simple phenol, C_6H_5OH, is indeed not an organic acid but like all OH compounds of the aromatic series has a much stronger acid character than the alcohols (OH compounds) of the aliphatic series. Therefore the name carbolic acid is not entirely wrong. Phenol appears in the destruction of living substances. Thus it occurs also in wood tar among other homologous phenols. It develops in the animal body as a decomposition product of proteins in the intestine, and after absorption (particularly after conversion into the polyphenol hydrochinone) is bound to sulphuric acid and glucuronic acid, made harmless, and is excreted in the urine. In general the benzol ring is not split in the organism as the open, aliphatic series.

TOXIC ACTIONS

In contrast to the mixture of phenols and phenol derivatives of kreosote, pure phenol possesses a marked capacity for penetration into the cells. Thereby not the antiseptic property but the corrosive action is increased. And since the resorption occurs rapidly, in phenol there soon appears central nervous system effects. A natural mixture of the less strongly split plant products as kreosote, on the other hand acts more steadily on the receptive organs. But this is an advan-

tage for securing persistent therapeutic actions. We encounter here the same regularity which has such great significance for the relation of the entire plant to its "pure" constituents (alkaloids, glucosides, etc.) in therapeutics.

Even in the corrosive action on the skin, the property of rapid penetration of phenol is revealed in the anesthesia which follows the initial burning pain and proceeds into a dry gangrene as it occurs in the prolonged influence from an application.

After absorption of large amounts of phenol the intoxication soon involves the nervous system with loss of consciousness, sensory and motor paralysis, collapse followed by death. Convulsions may occur. The milder poisoning causes a stupefaction like intoxication, vertigo, headache, often ear noises, fainting, vomiting. Gastro-enteritis, at times icterus, irregular respiration with small pulse may follow. In acute cases the body temperature falls considerably with cyanosis, cold sweat, and collapse, while, on the other side, in prolonged poisonings there is the so-called septic fever, indeed consequent to the cell destruction. The excreted phenol sulphuric acids, in particular the transformation product, hydrochinone sulphate, makes the urine brown-green to black, so-called carboluria. If the pairing with sulphuric acid and the absorbed phenol does not keep pace, then nephritis results.

THE DRUG PICTURE

Intoxications with acidum carbolicum are very numerous. Intentional provings are found:

1. Hoyne: Carbolic acid, Chicago, 1869 (see *Journ. of the Hom. Mat. Med.*, vol. 5, p. 329, 1872. *Allg. hom. Ztg.*, Bd. 68, p. 166 ff.

2. Price: *Amer. Hom. Observer.*, Bd. 8, p. 148.

3. Lilienthal: *Trans. of N. Y. State Hom. Soc.*, vol. 8, p. 232, 1870.

4. Haeseler: *Hahn. Monthly*, vol. 5, p. 166, 1869.

5. Danion: *Recherches sur l'acide phenique*, Strasbourg, 1869.

6. Mitchell: *Amer. Journ. of Hom. Mat. Med.* N.S. vol. 1, p. 354 (use in carious teeth).

7. Hale: *New Remedies*, 4 Aufl., vol. 1, p. 151, 1875 (1 and 6 are found here).

8. Norton: *Public. of Mass. Hom. Soc.*, vol. 4, p. 285 (of phenol vapors).

9. Williamson: *Trans. of Penns. State Hom. Soc.*, vol. 1, p. 180, 1870 (phenol vapors).

10. Declat: *Traite de l'acide phenique*, Paris, 1854.

GENERAL

Acidum carbolicum stands very near to kreosote in its actions. However it acts more acutely, reaches *the central nervous system more rapidly* and seems to condition *vasomotor-trophic disturbances* more strongly and centrally. But for these reasons the field of action is narrower than that of kreosote. Acidum carbolicum is therefore infrequently employed.

In acidum carbolicum septico-putrid and gangrenous processes on the tissues are also the most frequent substrate, the acrid secretions are corrosive and at the same time offensive; but these processes lead sooner to trembling, sensation of numbness, mental confusion, chills, cold and clammy *sweats*, and manifestations of collapse.

Pains in the most diverse nerve fields, in particular in the right supraorbital, appear and disappear suddenly; numbness, cold, loss of sensation are the warn-

ings of the trophic disturbances. Disinclination to perform any mental work proceeds into stupefaction and confusion. *Headache as if from a tense elastic band around the head,* particularly in the forehead and *an acute olfactory sense* have some value as special symptoms.

ORGAN SYMPTOMS

Outside of paresthesias and anesthesias on the skin there are all stages from itching to vesicles and pustular eruptions to necrosis, decubitus and gangrene, as in kreosote, those on a diabetic basis find the most frequent use. From the necrotic processes in the throat comes the clinical recommendation of phenol in malignant scarlet fever and even more in septic diphtheria when the widespread membrane extends to the nose and mouth, there is a strong odor and symptoms of collapse indicate the malignant course. From the stomach and intestine come the same inflammatory, ulcerative and carcinomatous processes as were mentioned under kreosote. Morning vomiting as well as nausea have led to the recommendation in hyperemesis gravidarum and still more, because of the regurgitation, stupefaction and confusion, to the morning vomiting of drunkards. Desire for alcohol and tobacco are cited but they are not found in the provings, and from smoking aggravation as well as improvement is observed. Much is said of the fermentative processes, accumulation of gas in the stomach and intestine. The emissions here too are said to be offensive. Ulcerative processes in the intestine with fever have also given occasion for the use of acidum carbolicum in typhoid and dysentery with a malignant course. In carcinoma of the gastro-intestinal canal and of the uterus phenol, from a practical stand-

point, is inferior to kreosote. The leucorrhoea is also characterized just as in kreosote. In puerperal fever a foul discharge, vomiting and meteorism should make one think of carbolic acid.

Frequent copious micturition has also been cited as an indication for acidum carbolicum in diabetes. The nephritis which appears in carbolic acid poisoning is scarcely suitable as a therapeutic indication. Inflammatory destructive processes in the urinary passages require considerable doses of acidum carbolicum for effectiveness. Even from this one may conclude that it is less suitable than, for example, the related benzoic acid. And if, from the provings, stiffness and diverse pains in the muscles and joints suggest a certain rheumatic component in carbolic acid effects, then these are far less important than in the benzoic and salicylic acid actions.

SUMMARY

Chief Trends:

Septic-gangrenous processes, acrid, corrosive, offensive discharge.

Participation of the central nervous system, particularly the vasomotor-trophic centers.

Paraesthesias, anesthesia; states of confusion; collapse. Frequent neuralgias, coming and going suddenly.

Headache as from a band around the head. Acute olfaction.

Skin: itching, necrosis, gangrene.

Throat: malignant diphtheria with extensive membranes.

Gastro-intestinal: ulcers (also typhoid and dysentery) carcinoma.

Vomiting of pregnancy. Gastritis of drunkards. Uterus: Ulcerative processes with foul leucorrhoea. Puerperal fever.

DOSE

It is given in potencies from D 3 to D 30.

ACIDUM SALICYLICUM

Salicylic acid, o-oxy-benzoic acid with its numerous derived preparations (aspirin, diplosal, salol, salipyrin, etc.) is one of the most commonly used drugs in the world today. Compounds of salicylic acid appear in various plants, for example, types of willows (salix), gaultheria procumbens, spiraea ulmaria. Indeed the very ancient use of such plants, particularly as fever remedies depends upon this constituent; however the chemically simple and synthetically prepared substance should be mentioned here because of its close relation to phenol and benzoic acid and the carbon compounds discussed.

Salicylic acid was prepared by Piria in 1838 from the glucoside salicin of the willow (salix alba). Chemical synthesis was obtained by Kolbe and Lautemann[527] and with this was given the basis for the scientific and industrial attempt then instituted to explain salicylic acid (indeed first by Stricker[528] as a specific for acute rheumatic fever. This opinion long remained unconsidered.

THEORY OF SALICYLATE ACTION

It is worthy of note to remark that Ehrlich[529] considered the action of salicylates in rheumatism had an antiseptic basis, were "specific," that is, "etiotropic." His three prerequisites for the recognition of chemotherapeutic-etiotropic action: 1, strong depressant or

destructive action on the excitor in a test tube; 2, relative harmlessness for the host; 3, antiseptic action in the organism are indeed, even the second (relative harmlessness), not proven for salicylic acid in rheumatism, and even if placed in analogy with the streptococci, at least highly improbable; all findings speak against this conception.

If the non-discovery of the excitor of polyarthritis rheumatica makes direct proof of the etiotropic action impossible, then at least the probability of bacterial depression or destruction should be proven to hold for salicylic acid. But the bactericidal properties of salicylic acid and even if its salts are much less evident outside the organism than of carbolic acid; in weak solutions of salicylic acid, molds develop for example. The percentages for the depression of bacterial growth of solutions of salicylic acid move around 0.1%, for sodium salicylate 0.4%. On the other side after the administration of 13 grams of salicylic acid according to Scott, Thoburn and Hanzlik[630] there is an average concentration in the normal blood of 0.0265% and 0.021% of patients with polyarthritis which comes very near the theoretically considered 0.02%. (Moreover the greatest concentration of salicylic acid occurs in the blood.) Accordingly the concentration of salicylic acid would never be attained in the organism which has been found necessary for the depression, not to mention the death of the bacteria.

Thereby it is also to be considered that a stronger antiseptic salicylic acid could be liberated at the site of action from its salts. But this is not the case. The oral and in massive doses administered salicylic acid is converted into the sodium salt by the alkali of the intestinal fluids; it is taken up in this form and must circulate as such at the chemical reaction of the blood. Now Binz[631] has presented the theory that in polyarthritis the strong carbon dioxide tension of the blood and other body fluids (joint effusions!) would be in a position to liberate salicylic acid from its salts and has introduced some support for it.

Newer investigations by Hanzlik[632] which considered the H-ion concentration of the blood show the untenability of the CO_2 tension theory. The liberation of salicylic acid requires a much higher acidity than that which is obtainable in the living

blood. Actually the salicylate containing joint fluid in patients with rheumatic fever shows no free salicylic acid according to Scott, Thoburn and Hanzlik[533]

A way out of the dilemma into which the hypothesis of an etiotropic action of salicylic acid in rheumatic fever has been harmed by experimental investigation is opened through the findings of Bondi and Jacoby.[534] They seem to speak for a certain organotrophy of salicylic acid for inflamed joints, because the joints of rabbits which were infected by staphylococci contained more salicylic acid than those of normal rabbits. Such an enrichment of salicylic acid salts in the inflamed tissues would be explained without further trouble from its greater blood supply, because according to Bondi and Jacoby the blood has the greatest relative amount of salicylic acid. But now newer investigations[535] have brought definitely opposite results, naturally in arthritis which can be experimentally produced in rabbits by the local application of oil of mustard and croton oil. Finally it is proven by Scott, Thoburn and Hanzlik[536] in patients with rheumatic fever that the salicylate content of the joint fluid is less than in the blood. Thereby the greater affinity of salicylic acid for the inflamed joint cannot be maintained.

MANNER OF ACTION IN RHEUMATISM

In what relation now from a clinical viewpoint does the specificity of salicylic acid stand in acute rheumatic fever? The prompt lowering of the temperature with the outbreak of sweating and the diminution of inflammatory manifestations in the joints, particularly the pains, is so striking with great doses, that indeed one might well think of a specificity. Recently R. Sicard[537] has shown from personal observations as well as those of others that the joint manifestations and the fever are not rarely entirely refractory from the start against the salicylic acid therapy. Moreover it is striking that under the use of salicylic acid in maximal doses, the return of joint symptoms is frequent, and further that cardiac involvement is not avoided nor in any way favorably influenced.[538] But since the cardiac mani-

festations of the infectious disease, polyarthritis rheumatica are characteristic, indeed according to many authors an essential part, this must create doubt of the specificity of salicylate salts. Against a specificity in the sense of a one sided selectivity also speaks the fact that other agents which do not contain the salicyl group (particularly atophan with its chinolin group) have the same antipyretic and analgesic action in joint rheumatism, indeed, Hanzlik, Scott and Gauchat[539] have shown that the same or almost equal results can be obtained in rheumatic fever by a combination of analgesic and antipyretics of the type of morphine and quinine, where there is not the least relationship to the salicylate group. But on the other side salicylic acid effect is not limited to acute rheumatism but the analgesic and antipyretic actions are used just as much in many other states of disease. So there is no basis for seeing in salicylic acid more than a pure symptomatic agent as it is not able to remove the several symptomatic characteristics in this disease. In addition to the antipyresis and analgesia, there is also the lessening of joint swelling. One may designate the *action* in rheumatism also as a *polysymptomatic* one so that in this case salicylic acid is a syndrome remedy.

The mechanism of salicylic acid action on the symptoms of joint rheumatism has been explained only to a small extent through numerous studies. In regard to the antipyresis, salicylic acid in the usual small and large doses widens the peripheral vessels, in particular those of the skin, probably through an action on the central nervous system, at the same time with an increase of sweat. Increased heat radiation occurs and in the febrile it is particularly great. While increased heat radiation is hardly evident in the healthy, it is distinctly evident in the labile heat regulation in fever. The production of heat does not seem to be influenced at least by the doses employed clinically. It is established that there is an increase of nitrogen,

uric acid, phosphate and sulphate excretion under large doses of salicylic acid.

There is also a lowering of uric acid content of the blood with increased amounts in the urine.[540] After discontinuance of salicylates the uric acid in the blood again increases and the quantity in the urine diminishes.[541]

Moreover with doses of salicylic acid under 2 grams, variable output of uric acid in the urine is found.[542]

On the other side, very large doses in rats also cause a diminution of nitrogen excretion in consequence to the nephritis which develops.

The influence on water excretion behaves correspondingly. With moderate doses the diuresis is increased; in animals the renal volume increases through widening of the vessels and there is only a transient decrease in the output of urine[543]; with doses under 2 grams according to Willy[542] there is no increase in output. With large doses, clinically maximal, of sodium salicylate the amount of urine is decreased and albuminuria appears (and eventually casts) in the urine.[541] In animals nephritis has been found histologically[545] and also in the human at autopsy.[546]

The increase of protein conversion under large doses of salicylic acid permits *an increase in heat production* to be assumed and this is present also according to experiments by Isenschmid.[547] But for the antipyresis, it is decisive that under the conditions of the already febrile increased metabolic, the heat radiation predominates.

Formerly one perceived a close natural connection between the acute rheumatic fever and the uric acid content of the blood and made the increased excretion of uric acid responsible for the favorable influence of salicylic acid. If this hypothesis is not clinically verified in gout, then it is to be doubted in an acute infectious disease as acute rheumatism.

It is exactly the detailed investigations on the N-metabolism under salicylates which have led to the conception that salicylic acid lowers the permeability of the kidney for uric acid and it has often been assumed that the increased permeability of the kidney

for other residual products and also the hypothetical toxin of the excitor of joint rheumatism existed. With this there would be in addition to the marked excretion through sweat, a further excretion through the kidney, two ways of canalization, but still no "created" defense of the organism, as one might say.

The actions on the heart and circulation known up to the present cannot contribute much to the explanation of the antipyretic action.

Sensitive persons react to small doses of salicylic acid with acceleration of the pulse and sensations in the cardiac region.

How much the disposition contributes to the action of salicylic acid can be perceived from the existence of a (so-called paradox) increase in temperature which is independent of the dose of the drug. Lewin states[548]: "It is evident ½-1 hour after the ingestion and is usually introduced by a chilliness which may last over an hour. Following this is a marked sensation of heat and the body temperature itself rises to 41° C. The fever may remain at this height up to two days and then spontaneously diminishes. In these cases there is, what was striking to me because it is usually so common, only a fairly moderate secretion of sweat."

Since the heat production is almost constantly increased by salicylic acid, perhaps the last observation of deficient sweating explains the fever. Moreover it is noteworthy, that besides the antipyresis by "canalization," a stimulative action is also possible under certain conditions, in which an action of much smaller doses in the febrile state might occur in the sense of the simile rule.

The reduction of inflammatory manifestations in the joints according to all appearances is not a local phenomenon which lessens or prevents oedema through al-

teration of vessel permeability. The action seems to occur rather through a central reduction of the circulation and also to a certain extent independent of the mechanism of antipyresis. Artificially chemically induced oedema is neither prevented nor improved by sodium salicylate.[549]

On the other side Starkenstein[600] has depressed the chemosis of mustard oil in rabbits and the dionine chemosis in patients with salicylates (even if more slowly than by atophan) however without consideration of the influence of reduction of circulation and alteration of blood pressure.

The analgesic action in rheumatic fever finally may be ascribed partly to the lessening of inflammatory afflux into the joints, but this may also have a central origin, since the action has found numerous application in non-inflammatory pains. Whether the action occurs directly on the cerebral pain centers or via a detour over the vasomotor nerves, is still not known.

RESULTS OF SALICYLATE THERAPY

If now the bacteriotropic action of salicylic acid in joint rheumatism is denied and a polysymptomatic effect recognized, then it is by no means determined whether the known action of clinically maximal doses on fever, swelling, and mobility of joints is curative, favorable in the sense of an accelerated recovery and avoidance of complications (as the cardiac affections), or a lessened incidence of fatality. These questions can be clinically-statistically investigated and further studied accordingly from the side of theoretic plausibility, which is based on experimental results.

The question of the avoidance or improvement of cardiac affections in joint rheumatism by salicylic acid in the usual doses is answered decidedly in the negative. An unfavorable influence of salicylic acid on the fre-

quency and severity of heart affections is proposed by one series of observers, denied by another.

The possibility of cardiac damage in any case is not to be entirely dismissed. States of collapse with cyanosis and comatose dyspnoea are observed from large doses. In animals there is a transient increase from smaller doses, falling of the blood pressure and finally diastolic standstill.

The influence of the duration of the disease is difficult to determine. If the fever was a definite point of departure then the question would certainly be decided in favor of the usual salicylate therapy. But it depends largely upon the subjective view of the physician when he considers a patient with joint rheumatism cured. According to Hanzlik, Scott and Gauchat[551] 8 patients under salicylic acid had an average duration of disease (from 6-38 days), 9 days shorter than patients who received no salicylate. J. L. Miller[552] showed in a statistical study on 1907 cases with and 1600 cases without salicylates that the average duration of the hospitalization in patients with salicylic acid was the same as without it. He comes to the conclusion that treatment with salicylic acid in no way favorably influences the duration of disease and the tendency to recurrences and that a complete refractory situation against salicylates is frequent. Poynton and Paine,[553] R. Miller,[554] and Zadek[555] decide similarly that neither the involvement of other joints, nor recurrences, nor heart complications are prevented by salicylate therapy and that reappearance is just as frequent in the treated as in the non-treated.

In another statistical investigation by Hanzlik[556] 18% were not improved by sodium salicylate in large therapeutic doses or were incompletely improved, and that in the improved repetition of the salicylates was frequently necessary because of recurrence of the symptoms.

Swift, Miller and Boots[557] sought to obtain an objective criterion for the influence of salicylates from the white cell counts. At times during the treatment with salicylic acid the white count fell to normal, with discontinuance of salicylates the number rose again, to 4,000 or more over the original state, a sign that the infection again existed. If one has in the leucocyte count a suitable criterion for a decision on the course of the disease with and without salicylate, then insufficient use of it has been made to decide the question here. In any case theoretically the immediate reduction of leucocytosis through the usual doses of salicylic acid speaks against an increase in the defense of the organism in the fight against an unknown cause, much more for a weakening (entirely in contrast to the manner of action of non-specific irritant bodies which have been found curative in about 40% of the cases according to American authors). In the sense of a decrease of the intrinsic possibility of defense through large doses of salicylates also speaks the experimental studies in animals. Swift[558] found in rabbits who had received streptococcus viridans (living and in vaccine form) and washed sheep erythrocytes, a reduction in the antibodies, agglutinins, and hemolysin formation and the complement fixation under large doses of salicylates in contrast to control animals.

From animal experiments proceed even more significantly the results of experimentally produced arthritis in rabbits. Salicylic acid proves useless for the avoidance of arthritis from the injection of hemolytic streptococci.[559] In the arthritis from various types of streptococci, the animals die more frequently under salicylate treatment than the controls which had no salicylates.[560] Swift and Boots[561] obtained the same result with non-hemolytic streptococci. The animals which received salicylic acid before and during the infection died earlier than those without salicylic acid. It remains undetermined whether the view of the authors is correct, namely that the cause is a summation of the renal damage through the bacteria and salicylate. Of interest was the finding on the severity of the joint inflammation. Approximately one half the joint inflammations (from streptococci of slight virulence) in the animals with salicylates were of a mild type, while the inflammation in the controls was severe. But nevertheless 36% of the animals treated with salicylates died while only 8% of the controls.

The apparent local improvement also stood opposed to the unfavorable course of the general disease.

Accordingly the theory of etiotropy and increased intrinsic resistance by salicylic acid does not obtain in its characteristic domain in the acute rheumatic fever, whereas one is confronted by the confirmed experience that in innumerable cases, salicylic acid can bring some of the cardinal symptoms of rheumatic fever to disappearance. The chief action of salicylic acid on the vasomotor and heat center and the central reduction of pain in general have a palliative value. Moreover a canalization especially through the sweat and kidneys in the sense of an alleviation of the healing endeavor is to be considered. But it is doubtful how far the organism is weakened in the active fight against the infectious excitor. These reflections hold for the great doses of salicylates (8-12 grams pro die). This does not exclude in any way that in single cases of rheumatic fever salicylic acid can be more than a palliative and that in single cases it may give permanent results. In the sense of a derived irritant therapy according to the symptoms, as homoeotherapy is, such results are to be expected when the effect picture of salicylic acid presents a similar picture. And this is actually the case. But the confirmation would first be brought when small doses (stimulant doses) yield a good result in these cases. This expectation must be realized still more when benzoic acid which is closely related to salicylic acid, is found often to be suitable in joint rheumatism in accordance with homoeopathic use. If an agent like benzoic acid, in provings on the healthy, produces many expressions in the human organism such as symptoms which are similar to those of joint rheumatism, small doses of it have been proven useful,

so it is certainly not a palliative agent suppressing single symptoms, that is, it is directed not *against* the healing endeavors of the organism but conforms with them. With the provings of salicylic acid available up to the present this trend of action has not been sufficiently tested and even less investigated. That salicylic acid often produces sweats in the healthy and also high fever in those disposed, also occasionally springing pains in the joints with aggravation from movement and contact, moreover an urticaria related to that of rheumatism (I recall here that the arthritis in joint rheumatism has been considered as an allergic manifestation by Bauer[562] speaks for the possibility of a specificity in the homoeopathic sense. Between the extremes the specificity for the joint rheumatism (which can exist only in etiotropic action on the excitor) and the non-symptomatic symptom suppression, homoeopathy sees a specificity in the sense that the medicinal agent can be adapted to especially suitable single cases by comparison of the symptoms.

OTHER ACTIONS AND USES

The chief trend of salicylic acid on the nervous centers is also revealed in the well-known so-called untoward actions: pains in the head, vertigo, ear noises and difficulty in hearing, nausea and vomiting.

In regard to the obviously vasomotor headaches, it is to be recalled that Wiechowski[563] found widening of the peripheral and contraction of the intracranial vessels in animals with sodium salicylate. Probably this is connected with the palliative action of salicylate preparations in headache.

Nausea and vomiting are centrally conditioned, because with the intravenous injection of sodium salicylate vomiting occurs, indeed, sooner than after an oral administration.[564]

On the basis of animal investigations the ear symptoms have

been traced to hyperemia and hemorrhage into the inner ear, according to the investigations of Haike,[565] however the alterations in the N. acousticus and Ganglion vestibulare and spirale are also to be recalled. However in spite of these findings an influx of blood with vascular over filling in the sensitive inner ear is not excluded.[566]

The observations on the eyes also speak for a marked vasomotor influence, in which a series of subjective and objective salicylate symptoms have been observed. A narrowing of the retinal vessels has been reported.[567] Also in dogs after subcutaneous injection of large amounts of salicylate a decrease in visual capacity has been found, narrowing of the visual field and pallor of the optic nerve.

On the skin erythema, vesicular eruptions, and especially urticaria are often observed as untoward symptoms, more rarely a purpura. In sensitive people receiving aspirin a partial oedema may appear which however can be ascribed more to the acetyl component. Formerly salicylate solutions were used in itching eruptions, urticaria, eczema and pruritus. The external use of salicylic acid for the solution of cornified epithelium and for the suppression of foot sweat is generally known. From poisonous internal doses (13.3 grams of sod. sal.) one has seen besides stupefaction and muscle twitching also a suppression of the sweat secretion.[568] On the other side the production of sweating by moderate doses is known.

Similarly animal experimentation has shown the increase of salivary and biliary secretion, on the contrary complete failure of these from larger doses.[569] In large doses salicylic acid (as well as benzoic acid) markedly increases the excretion of indican in the urine.[570] This is probably connected with a one sided influence on the intestinal flora.

The usual mass use of salicyl preparations in fevers of all types chilling, grippe, rheumatism, pleuritis, pneumonia, sciatica and other forms of neuritis, headaches, migraine is found no better than in joint rheumatism but the pure symptomatic palliative effect is obvious. The limits and disadvantages of such treatment need not be discussed here nor misused by a badly informed public.

DRUG PICTURE OF ACIDUM SALICYLICUM

Our knowledge of the actions of salicylic acid is based for the most part on the so-called untoward effects. The provings on the healthy are insufficient. They are:

1. Lewi: *Hirschel's Ztschr. f. hom. Klin.*, Bd. 20, p. 106, 1875.
2. Chase: *N.E. Med. Gaz.*, Bd. 12, p. 564.
3. Cushing: *Trans. Mass. Hom. Soc.*, 1878/79.
4. North: *Practitioner*, Bd. 23, p. 184.

CHIEF TRENDS

The chief action of salicylic acid proceeds on the nerve centers. Vertigo, ear noises, difficulty in hearing, often accompanied by nausea, give the practically important indication in Meniere's syndrome.

Generally there is a feeling of weakness, dullness of the head; headaches appear paroxysmally or remain constant, in the frontal region or over the entire head, tearing, pressive, throbbing or as a boring pain in the temples. The vertigo is rotatory with a tendency to fall to the left. Headache and vertigo are *worse from motion.* Uncertainty in the movements, leaning the body to one side, striking against objects, trembling of the hands occur. The difficulty in hearing is accompanied by ear noises of all kinds. Also flickering, weak vision, transient blindness, squinting, mydriasis or miosis is observed in the eyes. Psychical disturbances go from poor memory to maniacal states with delirium, hallucinations and illusions.

Nausea and vomiting can appear even after proportionately small doses and may last for several days; the vomitus may be blood streaked. In severe salicylate poisoning it often amounts to hemorrhage; from

the uterus (therefore in massive doses it has been used as an emmenagogue and abortifacient), from the nose, from the mouth, esophagus, stomach, intestine, and as hematuria. However no use has been made of all these symptoms homoeopathically. The reports on inflammation of the throat and the use in diphtheria arises from the proving of Lewi[571] and can scarcely be associated with one dose of the 1 C trituration. Offensive eructations, distension in the stomach and intestine with colicky pains, offensive diarrhoea have led to the occasional use in dyspeptic flatulence. Here the increased excretion of indican from salicylic acid is to be remembered. The gastro-intestinal symptoms also have a great similarity with those of phenol.

The undoubted action in many rheumatoid inflammatory processes is given through the already mentioned pains in the joints, which leap from one place to another, through profuse sweats which relieve, but generally weaken and through the connection to the heat center; the aggravation from movement, contact, from cold and at night, the relief from the application of warmth, in particular heat, may assist to some extent in determining suitable cases. However these signs scarcely characteristic in themselves have been partly derived from patients. Involuntary twitching and trembling appear in the muscles. With regard to the biphasic action on the secretion of sweat and the frequent use against foot sweat is the report "results of suppressed foot sweat" also to be noted for the rheumatic patient.

SUMMARY

Chief Trends:

Vasomotor syndrome. Sensorium.

Meniere's syndrome.
Joint rheumatism.

Modalities: (uncertain)

Worse from contact, motion, cold, at night.
(Results of suppressed foot sweat.)
Better from warm applications, dry heat.

DOSE

In Menière's syndrome it has proven useful in many cases in the D 3 trituration.

ACIDUM BENZOICUM

Benzoic acid is a constituent of many plants and is obtained by distillation from the resin of types of styrax. In the urine of herbivorous animals, glycocoll (amino-acetic-acid, $H_2N.CH_2.COOH$) is bound with it to form hippuric acid ($C_6H_5.CO.CH_2.COOH$). (There is a similar pairing for salicylic acid in the form of salicyluric acid.) Not all the benzoic acid is paired with glycocoll and excreted as hippuric acid, but the greatest part is in men. Glycocoll is apparently only gradually liberated. Thus it is possible that benzoic acid unfolds its special influence in "rheumatic" processes in the supportive tissue on this part of the protein metabolism.

Exactly as from salicylic acid the nitrogen excretion in the urine is increased by large doses of benzoic acid. In animals the urinary output[672] and the bile excretion[673] is increased. In the antiseptic action it behaves about the same as salicylic acid. Of the mixed bacteria of the faeces, the colon group are influenced more than the coccus forms by it. The indicanuria signifies an alteration of the bacterial flora, and has been demonstrated from benzoic acid as well as salicylic acid.[674]

The transition from amounts of benzoic acid which are apparently born without symptoms to very severe poisoning has

been found extremely variable in dogs.[575] This is probably connected with the amount of available glycocoll.

If the detoxifying glycocoll pairing is not sufficient then the toxic symptoms are noted particularly in the nervous centers, in animal investigations in the form of spasms, ataxia and finally paralysis. After washing out an ovarian cyst with more that 100 g of sodium benzoate, a maniacal confusion has been seen.[576] 1-2.5 g of benzoic acid or sodium benzoate in 4-5 daily periods in 12 healthy persons produced nausea, vomiting, headache, feeling of sweating, burning in the esophagus, often also a sensation of hunger and digestive disturbances.[577] Nausea and vomiting, the latter revealing blood, is centrally conditioned as with salicylic acid because both are observed after parenteral use.

Inhalations of benzoic acid are still employed at times for the improvement of expectoration in bronchitis, and in the '70s it was much used in tuberculosis on the recommendation of Rokitanski.

Stockmann[578] found that benzoic acid was effective in rheumatism but somewhat less than salicylic acid. The same untoward effects are reported for benzoic acid as for salicylic acid.

ACIDUM BENZOICUM DRUG PICTURE

The provings are compiled in:

Hering: *Amerikanische Arzneiprufungen,* vol. I, p. 703, 1857.

RHEUMATIC-ARTHRITIC CHIEF TREND

In homoeopathy benzoic acid is considered as a remedy for the rheumatic-uric acid diathesis.

As the chief symptom it has *the sharp odor of the urine,* like the urine of horses, as it states; offensive, sharp, penetrating, intensely "urinous" odor and indeed immediately on voiding. This is moreover an indication of an abnormal protein split product, which hip-

puric acid is to be considered in man, when it appears in large amounts. The urine is concentrated, dark brown or deep red. The desire for frequent voiding is present.

In patients with the uric acid diathesis, with the tendency to true gout as well as to rheumatism, the amount and salt content of the urine is subjected to great variations. At the times of small output and light urine with relatively low specific gravity the patient has the most bodily and in particular rheumatic complaints. If then an outpouring of salts follows, particularly of uric acid, with an increased amount of urine, an amelioration of all symptoms occurs. The relation between the excretion and the complaints is characteristic for benzoic acid, when the sharp odor of the urine is present.

In children the uric acid diathesis may reveal itself early in the penetrating "urinous" odor and in these cases acidum benzoicum can also come under consideration for enuresis nocturna.

In the provings a series of symptoms in the joints and extremities have been observed: tearing and sticking pains and occasionally swelling (so that the ring would be too narrow for the finger), particularly severe pain *in the Achilles tendon near the heel*, occasionally the feeling of dryness and clicking in the knee joint. The wandering of the pains from above below and from right to left is a further characteristic; but the most important is always the character of the urine.

Moreover for the utility in acute rheumatism speaks a number of mild febrile symptoms in the proving protocols: sweat, internal heat (after preceding external coldness), with marked palpitation (with now fast, now non-accelerated, hard, beating pulse), pulsation in the arteries of the temples (sounds as whizzing in

the ears), pain and sensation of weakness in the cardiac region. Obviously benzoic acid is not a remedy for rheumatism in general but only for rare cases, which one can recognize best through the peculiar acrid odor of the urine. Moreover it seems that in the cases suitable for benzoic acid the sweats do not relieve. Use of wine is said to aggravate, likewise movement and cold.

ACCOMPANYING SYMPTOMS

More frequently than in acute rheumatism, benzoic acid is employed in subacute and chronic rheumatism and indeed in arthritis deformans. In addition to the condition of the urine there is also the psychic state, the sleep and the headache. Periods of specially deep, stuporous sleep alternate with sleep disturbed by excitement and a tendency to dwell upon unpleasant things.

Moreover the frequent omission of words in writing is striking. Dullness of the head and dull headache in all parts of the head, especially in the occiput, occur with lassitude, malaise and loss of appetite, and in conjunction with rheumatic pains and deficient urinary output, after chilling and coming over night with change in the weather, recur periodically, are worse at rest and often accompanied by gastric pain, nausea, regurgitation, and cold hands. It involves a headache on the soil of arthritism. Vertigo with a tendency to fall to one side is also observed, on the other hand ear noises seem to be rarer than in salicylic acid. However benzoic acid is also recommended in Meniere's syndrome.

Likewise a series of inflammatory states of the tongue, throat, tonsils, or in the stomach are associated with rheumatic manifestations. They are said to appear in place of suddenly diminishing joint pains, with lessening of the urine, which then becomes high colored

and of strong smell. The manifestations are: soreness of the tongue, acute inflammation of the tonsils and the throat (burning and scratching pains in the throat have also been observed after the inhalation of 2-5% sodium benzoate solution); loss of appetite, white slimy coated tongue, eructations and gastric pressure with bitter taste, nausea and bitter or salty vomiting from all foods. Watery diarrhoea, especially in children, when it is accompanied by the urinary symptoms discussed. The stools are usually foul and white as soap water, at times putrid and bloody.

"Dull pain in the renal region" with the characteristic urine has led to the use of benzoic acid in *renal colic, renal gravel*; moreover in bladder catarrh in which the great urge to void occurs as a further indication.

The cardiac symptom "pain in the cardiac region, severe palpitation, worse at night, sensation of weakness in the precordium, morbid unrest in the chest, heart beat intermits" has also drawn benzoic acid into the domain of rheumatism alternating with cardiac affections.

It is always characteristic of benzoic acid when the pains wander from one place to another, when they vanish from the joints and extremities, then involve internal organs and reversely when the symptoms reappear in the joints with the improvement of the cardiac complaints, and when the urine periodically alters in regard to its amount, color, specific gravity and odor in relation to the general symptoms of sleep, psyche, headache, and the urine is striking through its odor.

In conjunction with the rheumatic diathesis it should also be mentioned that benzoic acid has been success-

ful in several cases of ganglion on the wrist, internally D 6, and externally 0.2 Acid. benz, ad 30.0 glycerin cerate.[579]

The use of benzoic acid as an "expectorant" is obviously taken over from the formerly frequent use in school medicine. The itching and burning in the throat especially from inhalation promotes the cough and expectoration, therefore the use in bronchitides and asthma, but which has however become more or less relinquished. In homoeopathy this trend of action has not won any great significance, yet there is cited an asthmatic state in reciprocation with rheumatism.

The skin symptoms of benzoic acid are regarded strikingly less in homoeopathy, just as with salicylic acid. They are noted in the provings on the healthy as itching and red patches, but as untoward actions in the form of maculo-papular eruptions and diffuse, itching erythemas with red flat nodules at the border.

SUMMARY

Chief Trend:

Rheumatic-gouty diathesis.

Change of joint pains; alternation with general complaints, with cardiac or urinary symptoms. Variable state of the urine.

Offensive urine "like horse's urine." Pyelitis with lithiasis.

(Throat inflammations, cardiac complaints and gastro-intestinal catarrh in association or alternation with rheumatic complaints.)

Guiding Symptoms:

Offensive urine.

Alternation of complaints.

Pain in the Achilles tendon.

Modalities:

Worse from the use of wine; from cold and change of weather; from movement (but headache worse at rest).

DOSE

The potencies from D 1-D 6 are usual.

ACIDUM PICRINICUM

Picric acid is a strong acid in watery solution and in its salts. As a protein precipitating agent it is well known from the use of Esbach's reagent. The absorption of picric acid occurs from the skin, mucous membranes and wound surfaces, which become inflamed on prolonged contact with the remedy; the excretion occurs principally through the urine which is colored an orange yellow, red and by standing in the air to brown black by reduction to the poisonous picramic acid. During the war the picric acid, widely used in the preparation of explosives, was also taken to produce pseudo-icterus since 0.3-1 grams color the mucous membranes, skin and sclera yellow. This has nothing to do with the liver and bile passages.

Upon the coagulation of protein depends the employment of dilute solutions or ointments with picric acid in burns of the first or second degree. However resorptive actions can appear here. Poisoning with large doses produces nephritis, strangury and even anuria. Whether a destruction of the blood occurs with picric acid is doubtful; in any case according to Lewin, methemoglobin cannot be found in the blood, though it is typical for nitrobenzol (= mirbaneol and dinitrobenzol which is used in the preparation of roburite). After the absorption of picric acid erythema or eczemiform eruptions develop on the skin. The occasional inflammations on the conjunctiva, the

mucous membranes of the nose and the digestive canal have nothing typical. After single large doses there appears slowing of the pulse, with prolonged toxic action and intermittent fever.

The important nervous manifestations are mentioned only in general in toxicology; heaviness of the head, headache, vertigo, delirium, prostration, more rarely spasms and many times a sciatica.

PROVINGS

The nerve actions of picric acid were first recognized through the intentional provings on the healthy and were first utilized there. The provings are:

1. Parisel: *De l'acide picrique,* These, Paris, 1868.
2. Couch: *N. Y. J. of Hom.,* vol. 2, p. 149, 1874.
3. Jones: *Allen's Encyclopedia,* vol. VI, p. 519.

DRUG PICTURE

One may be doubtful whether this remedy stands nearer the nitrates such as glonoin or the phenol derivatives such as benzoic acid and salicylic acid. But the medicinal trend in acidum picrinicum goes strongly to the central nervous system so that the similarity with salicylate actions on certain nerve centers seems to justify the inclusion in this direction. A glonoin-like headache indeed appears with picric acid nevertheless the vascular action is subordinate to those on the nerve centers of the spinal cord, the medulla, the cerebellum and cerebrum.

The chief field for acidum picrinicum is *the severe nervous exhaustion,* so severe that it permits one to think of a transition to organic alterations of the central nervous system. Mental work, reading and writing decidedly exhaust, thinking can no longer be concentrated. It can proceed to a complete loss of energy

and mental power. Headaches "up to bursting" begin in the occiput and extend foreward to the eyes; they are relieved by tightly binding the head and are worse from movement, from any effort, from dazzling light, from summer heat, in warm rooms, better in the fresh air and on lying down.

But the pains also extend over the neck to the back along the vertebral column and here the syndrome is characteristic and one which played a great role in older medicine as *"spinal irritation"*: a burning and sensation of heat along the vertebra with extreme paralytic-like weakness in the back and in the legs, numbness and sensations of tenseness in various places, particularly in the legs and feet. It is hard to keep the feet warm. Also in partial hyperirritability syndromes as writer's cramp, picric acid has been employed with good result. After exhausting diseases and mental over-exertion, but particularly in sexual hyperexcitability and states of weakness this picture of a severe neurasthenia is a good indication for acidum picrinicum. Vertigo and ear noises recall those of salicylic and benzoic acid.

The spinal cord centers for the sexual functions are especially involved; *sexual weakness* with seminal emissions, spermatorrhoea, states of irritation and priapism from organic spinal cord diseases and finally impotence; in women, pruritis vulvae before the menses. A clinical connection exists to prostatic hypertrophy and for this purpose ferrum picrinicum is usually employed. Dribbling urination and nocturnal urgency are the symptoms. Perhaps the action is to be placed in a series with that on the kidney and urinary passage in general, because in addition to nephritis, strangury is also observed in poisoning. In subacute nephritis with

many renal elements and scanty, dark urine one may use picric acid when the exhaustion is particularly outstanding.

In organic nervous diseases as facial paralysis and paralysis agitans, *zincum picrinicum* is preferred, in prostatic hypertrophy *ferrum picrinicum*.

SUMMARY

Indications:

Severe nervous states of exhaustion with "spinal irritation" and states of sexual hyperexcitability; transition to organic disturbances. Nephritis; prostatic hypertrophy.

Modalities:

Worse from mental effort, from sun's heat, better in cold air. Headache better from firmly binding the head.

DOSE

The usual dose is the D 6.

ACIDUM HYDROCYANICUM

Hydrocyanic acid, HCN, is known as a poison of rapid action. And still it occurs physiologically fairly often in the plants of different families, usually Rosacea, and particularly in the form of so-called cyanogenous glycosides, for example as amygdalin. In cherries, plums, peaches, apricots, in phaseolus lunata and linum usitatissimum, the content has not obtained medicinal significance, in bitter almonds only a little, but in prunus laurocerasus, crataegus oxyacantha, sambucus nigra, the hydrocyanic acid probably participates in the medicinal effect. The cyanogen containing glucosides in plant metabolism are sugar reserves;

through ferments as emulsin which appears in the same plants, the sugar is liberated (for example from amygdalin, hydrocyanic acid, oil of bitter almonds and sugar develops). Moreover these glucosides are probably steps in the formation of amino acids in the plants. (The CN_2 stands very near to oxalic acid; it is its nitrile and develops from ammonium oxalate by heating with dehydrating agents.) In animals, hydrocyanic acid appears in the glands of certain centipedes. So far as it develops in the metabolism of man, it is detoxified through compounds with sulphur as the thiocyanates (CNS).

POISONING

The almost lightning-like course of poisoning with HCN or KCN (from which HCN is easily liberated by CO_2) shows the extraordinary capacity for penetration in the organism to the vital centers, the respiratory center becoming paralyzed. But the symptoms also diminish just as rapidly as they occur, when the excretion of HCN occurs sufficiently rapidly, and here chiefly through the respiratory passages. In slower poisoning with smaller doses the respiratory and vasomotor center is first stimulated, respiration deepened, cardiac activity slowed, the blood pressure rises, then follows sudden falling of the blood pressure, and respiration ceases; the cardiac action remains unaltered for a relatively long time. In addition the action proceeds on the cell respiration, the respiratory ferments unable to exert their catalytic activity, the oxygen of the blood cannot be taken by the cells, and the blood remains arterial. According to O. Warburg the iron-containing respiration ferment is poisoned; it is changed into a complex iron compound which is unsuitable for surface catalysis.

The first signs of inhalation of hydrocyanic acid are irritative manifestations in the throat and larynx, burning in the tongue, redness of the mucous membranes, then restlessness and anxiety, headache, nausea and a desire to vomit. Slowing of the pulse and respiration with oppression and constriction of the cardiac region and in the throat, dyspnoea and convulsive breathing (short inspiration and long exhalation) pass over into tonic-clonic spasms which can increase up to tetanus and loss of consciousness. Then suddenly the asphyxial stage sets in with falling of blood pressure and ends in respiratory paralysis. After recovery from the poisoning at times there is a persistent weakness in the muscles and the heart.

The alkali cyanides act because of the hydrocyanic acid set free in the stomach, although more gradually according to the amount of HCN liberated. Moreover local corrosive actions occur from the strongly alkaline salts.

HALOGEN SIMILARITY

Chemically the CN compound behaves entirely like a halogen. The first affinity for the mucous membranes of the upper respiratory passages is entirely similar to that of iodine. Formerly the hydrocyanic acid-containing preparations as aqua amygdalarum amararum were used for the relief of cough, although now they are regarded chiefly as correctives. Heavy metal compounds as cyanide of mercury, $Hg(CN)_2$, are used in homoeopathy much like the corresponding iodine compounds. Hydrocyanic acid itself however through its rapid capacity for penetration even to the nerve centers shows much of the character of carbon compounds so that its consideration at this place seems logical.

PROVINGS

Outside of numerous descriptions of poisoning, intentional provings of hydrocyanic acid are found:

1. Jörg: *Materialien zu einer künft. Heilmitell.*, Leipzig, Bd. 1, S. 82, u. 118, 1825.
2. Hartlaub u. Trinks: *Reine A.M.L.*, Bd. 1, S. 127.
3. Preyer: *Die Blausäure*, Bonn. 1870.

DRUG PICTURE

According to its severe and sudden method of action acidum hydrocyanicum is a remedy for attacks. *Convulsive states* of a general type, as epileptic, tetanic, and uremic are said to experience transient improvement of the attack from the remedy. But since the epilepsy which has a lightning-like seizure is described as the type suitable for the drug and acidum hydrocyanicum comes into consideration only for the attack and nothing known of a lasting effect on the disease, this use must be rare. The spasm should involve particularly the neck, facial and the jaw muscles.

Acidum hydrocyanicum is more successful in partial *spasms* which precede paralysis or are associated with it. As with other remedies with spasms such as cuprum, the symptom "drinks roll audibly through the esophagus" refers to spasm of the esophagus. In spasm of the diaphragm acidum hydrocyanicum in the D 6 has proven useful. The initial symptom of scratching in the throat and the larynx provoking dry spasmodic tickling cough has been relieved by acidum hydrocyanicum, in the tuberculous form as well as others. Sensation of *constriction* in the throat or in the chest and spasm in the respiratory passages, laryngismus and spasmodic cough, with the most severe dyspnoea and

cyanosis, precordial anxiety and ice cold skin are the signs of impending respiratory and vasomotor paralysis in which acidum hydrocyanicum is one of the most important remedies for the moment. The remedy is also recommended in cholera when vomiting and diarrhoea cease and collapse appears. Sudden weakness belongs to the picture in general. The mental state is anxious as long as confusion or loss of consciousness does not prevail. The headaches are severe and numbing. If, immediately after an apoplexy, the vital centers of the medulla are threatened, one should think of acidum hydrocyanicum. Involuntary stools and urine often appear in the HCN poisoning.

A sensation of warmth, nausea and vomiting which relieves is reported of the stomach; moreover (without point of departure from the provings) a feeling of emptiness in the epigastrium and pain in the empty stomach. The occasional use of HCN containing remedies in nausea and vomiting, gastric pain is traced back to the local anesthetizing action of HCN. Still even in this field the vagal spasm underlies the special influence of acidum hydrocyanicum.

SUMMARY

Rapid and short acting agent.

Chief Trends:

Convulsive states, epileptic, uremic, tetanic attacks (palliative).

Spasm of esophagus, "drinks roll audibly through the esophagus"; diaphragmatic spasm, sensation of constriction. Scratching in the throat with spasmodic cough. Laryngismus.

Transition or collapse. Precordial anxiety. Cyanosis and icy coldness.

DOSE

The D 6 is the common preparation.

ACIDUM OXALICUM

Oxalic acid COOH.COOH (or sorrel acid because it is found in large amounts in the wood sorrel, oxalis acetosella) occurs as the calcium salt in many green plants, for example, sorrel, rhubarb and spinach. The absorption from the plants depends upon how much calcium is simultaneously present in the intestine. Because calcium oxalate is not absorbed from the intestine. The greatest part is destroyed by intestinal bacteria and burned to CO_2 and H_2O. But there are also bacteria in the intestine which can form oxalates from the foods (bacterium oxalatigenum). The fungus, aspergillus niger, can form oxalic acid out of carbohydrates. While oxalic acid in the test tube is easily burned by oxidizing materials, it cannot be split and burned in intermediate metabolism. In the human urine it appears normally in amounts of 15-20 mg. But it need not be precipitated in the form of the well-known crystals of the sediment as calcium oxalate but may also be dissolved. This depends upon the colloidal state of the urine. A small amount of oxalic acid will also be formed endogenously in the animal body and indeed probably in the splitting of glycocoll[sso] from connective tissue. By feeding limes the oxalic acid in the urine can be increased.

The formation of oxalate concretions in the urinary passages depends upon many other physical and chemical conditions outside of the quantity of oxalic acid

introduced with the plants. The indestructible calcium salt causes no peculiar toxic manifestations but only an irritation of the urinary passages which is associated with an oxaluria.

POISONING

As is generally known most poisonings occur from potassium oxalate, COOK.COOH. The corrosive action on the gastro-intestinal canal is not different from that of the mineral acids. The prolonged vomiting may be bloody, the diarrhoea also; esophageal distress and radiating pains in the epigastrium are accompanied by precordial anxiety, slowing of the pulse, dyspnoea, twitching of the muscles, lassitude and vertigo. In other cases the resorptive toxic effects appear very rapidly into the foreground; fainting, loss of consciousness and collapse; in longer delayed poisoning there is crawling and numbness in the extremities and headache. Urinary complaints and strangury are associated with the excretion of oxalates, but pain in the kidney region, nephritis with oliguria or anuria, hemoglobinuria and other severe results also occur. In these cases the kidneys are infarcted by oxalate concretions.

Poisoning with oxalic acid and its salts is often explained as a calcium precipitation or deprivation exactly as the poisoning with other calcium precipitating acids, for example the related citric acid. The arrest of coagulation of the blood by alkali oxalates and citrates through removal of calcium ions is known and indeed used for many investigations (for example, the sedimentation velocity). In the severe poisonings the muscle contractions, the cardiac damage, perhaps also the nerve actions, signify simply a calcium precipitation process.[581] And for the flooding with large

amounts of oxalic acid, the calcium salt for chemical combination is a useful antidote. But whether the less severe disturbances from smaller doses occur by withdrawal of calcium is still not certain. A product which develops physiologically in the protein splitting of supportive substance may also have immediate actions on the metabolism of this supportive tissue.

PROVINGS

The provings of oxalic acid are found:

1. Reil: *Hom. Vierteljahrsschr.*, Bd. 2, p. 305, 1851.
2. Hering: *Ameriken Arzneiprufungen,* S. 525, 1857 (here also the earlier ones).

DRUG PICTURE

The local irritative manifestations on the gastrointestinal canal and urinary passages give fewer therapeutic indications than the symptoms reported from the nervous system.

Here first are the *neuralgias.* They appear paroxysmally in circumscribed small places or as cutting pains through the arms and from the back over the thigh. Many paraesthesias, crawling, numbness, prickling, coldness occurs in the back or in the extremities, likewise itching. On the skin are patches of marbled livid appearance. Hands and feet are cold as if dead; coldness runs along the back. There is also a great feeling of weakness as if the back was too weak to support the body. The feeling of crushing in the testicular and spermatic cord neuralgias is particularly stressed. Oxalic acid is also to be considered for organic diseases of the cord and a modality which holds not only for the neuralgias but also for the cardiac and urinary symptoms obtains here: the psychic influence predominates

over all irritative symptoms; *all complaints are aggravated by thinking about them;* attentiveness to complaints. Moreover in general movement aggravates. The pains are often considered as rheumatic and the connection of oxalic acid to protein metabolism of the supportive substance permits this possibility to remain open.

The severe cardiac symptoms of poisoning have their predecessor in *severe palpitation which is worse at night on lying down.* When thinking about the heart, the pulse intermits. A connection with rheumatism is thereby not particularly probable. Sudden stitch in the cardiac region interrupting breathing, in view of the other characteristics of the remedy, need give no occasion for including organic diseases of the heart, pleura or lungs in its field of action.

In the stomach burning pains and sensitiveness to contact, in the abdomen pains and burning in small areas are noted. The diarrhoea is said to be produced by coffee; neither the diarrhoea with colic about the umbilicus nor the tormenting vomiting of poisoning gives any special point of departure for the selection of acidum oxalicum. The headaches are said to be worse before and during the stool (afterwards better?). The use of wine aggravates the headaches. Strawberries are apparently not tolerated.

The irritative manifestations in the urinary passages have led to therapeutic use when the urgency and pressure of urination is renewed by thinking about it.

SUMMARY

Chief Trend:

Neuralgia, paroxysmally at circumscribed places. Paraesthesias. Cutting pains. Weakness of back. Spermatic cord neuralgia.

Modalities:

All complaints worse thinking about them. Worse from movement.

Palpitation on lying down.

(Diarrhoea worse from coffee. Headache worse from the use of wine, worse before and during stool.)

DOSE

This rarely used remedy is recommended usually in the D 6 but also in D 12 and D 30.

Cerium oxalicum, the oxalate of the only rare earth which has been therapeutically used to the present, is not proven but in the lower triturations has been recommended in hyperemesis gravidarum and other forms of reflex vomiting and cough. The action does not seem to be very useful.

ACIDUM CITRICUM

Citric acid, $CH_2.COOH\text{-}C(OH)COOH\text{-}CH_2.COOH$, produces experimentally very similar intoxications to those of oxalic acid and which are also traced back to calcium precipitation; however in man the poisoning from internal administration is very rare. The corrosive action is not particularly great.

The action of the juice of citrus fruits in scurvy cannot be ascribed to the citric acid but only the vitamine content. But on the other side a case of scurvy has been reported from the excessive use of citrons for the prevention of yellow fever.[582] The tendency to bleeding is increased by the excessive use of juice of citrus fruits. The reduction or prevention of coagulation of the blood by sodium citrate is generally known. In those who are sensitive, citric acid can produce vomiting and headache.

Citric acid itself is not proven. So only the external use of citrus juices for the pain of carcinoma of the tongue and the internal lay use in chronic rheumatism, dropsy and menstruatio nimia need be mentioned.

ACIDUM TARTARICUM

Tartaric acid, $CH(OH).COOH\text{-}CH(OH).COOH$ which appears in many fruits, especially in grapes, produces inflammation and irritation of the digestive passages with burning as if from fire and drawing pain in the soles of the feet particularly near the heel after the ingestion in large amounts.[583] Outside of the neutralization in poisoning with alkalies, tartaric acid is not used therapeutically. Also in homoeopathy, neither it nor the potassium salt, cream of tartar, has obtained significance.

ACIDUM LACTICUM

Lactic acid, $CH_3.CH(OH).COOH$, oxypropionic acid, develops from sugar through fermentation. It is found in many foods (sour milk, sauerkraut, cucumbers) and is formed in the stomach during fermentative processes. There is a dextro- and laevo-rotatory form as well as the racemic mixture of both. The dextro-rotatory form develops in working muscle from the fermentative splitting of glycogen and with phosphoric acid plays an important regulating role in the production of muscle contraction (see p. 454). Moreover lactic acid can also form during protein splitting.

Lactic acid is locally employed as a corrosive agent when abnormal tissue (new growth, tuberculous ulcers) are to be electively attacked. Healthy cells are more resistant to this acid; however the corrosion is painful for some time.

Fermented lactic acid in foods, particularly the various types of curdled milks (yoghurt, kefir, koumyss), play a great role in dietetics. Although overrated for a long time, still they possess much that is correct for, in many cases, an alteration of the intestinal flora is favored through these lactic acid containing preparations. In a similar sense dilute lactic acid is employed for betterment of the bacterial flora and for changing the reaction (toward the acid side) in vaginal douches.

Fifty to sixty years ago lactic acid in large doses was extolled in diabetes and skimmed, easily soured milk was recommended as a suitable drink for diabetics (J. Leeser). The important physiologic role of lactic acid opened, similar to phosphoric acid, the prospect that in the future this treatment would be grounded more exactly. In homoeopathy diabetes has been the chief indication for acidum lacticum in a potentized form.

From the use of large doses (60-100 drops per day) of 10-15% lactic acid in two diabetics, Foster[584] saw pain, swelling, redness of many joints with copious sweating and fever, aggravation of the pain on movement, and on repetition of the medication these symptoms recurred, that is, a syndrome conformable to rheumatic fever. Thus the frequent pains in the muscles and joints and along the N. ischiadicus are conceived as rheumatic.

PROVINGS

Provings of acid. lact. are found:
T. F. Allen: *N. Y. Journ. of Hom.*, Bd. 1, p. 337.

INDICATIONS

Diabetes and acute rheumatic affections are the main field of application for acidum lacticum. When both

indications appear together, perhaps in a diabetic sciatica, then one may attack with this remedy.

Signs of diabetes are the frequent and increased urinary output, particularly at night, which appeared repeatedly in the provings; attempts to retain the urine causes pain; thirst only once in a non-characteristic way; the mouth is dry and there is a constant desire to swallow.

The rheumatic inflammations are characterized by the copious sweats and by aggravation from movement. Profuse, non-offensive foot sweats was noted in a prover. Sharp pains in the cardiac region with cardiac palpitation refers to the involvement of the heart in the rheumatic affections. Many pains involve the chest muscles. Red patches on the skin and in one prover with the 30th potency on the lower third of the leg on the anterior surface, with burning and improvement from cold or sudden transition from cold to warm, has led to the indication in peliosis rheumatica which Stauffer has confirmed.

Nausea and acid, hot, acrid, sharply burning eructations and constant necessity to eructate, thickly coated white-yellow tongue has given occasion for the use in *acid dyspepsia.* The nausea occurs particularly in the morning, and is often relieved by vomiting. Tobacco smoking aggravates the eructations associated with regurgitation of tenacious mucus which must be constantly swallowed. Morning nausea in sensitive women and morning vomiting of drunkards and smokers seem to be suitable indications. Diarrhoea (once reported as foamy) with sudden urgency refers to the abnormal fermentation.

Dryness, burning, and sensation of soreness in the larynx and failure of the voice was evident in a proving with the D 15.[585] A special suitability of lactic acid

for laryngitis and indeed of tuberculous origin can hardly be drawn from this.

SUMMARY

Chief Trends:

Diabetes.

Rheumatic inflammation. Joint, muscle. (Cardiac involvement?) Sciatica? Peliosis rheumatica.

Dyspepsia acida. Morning nausea.

Modalities:

Worse from moving.

Nausea and acid eructations, worse in the morning, from smoking; at times better from eating.

DOSE

Acidum lacticum is recommended in the 3, 6, and 30th potency. Most provings have employed the 30th. In diabetes the high potencies are said to be most active.

ACIDUM ACETICUM

Acetic acid, $CH_3.COOH$, appears in a few plants. In the distillation of wood it is obtained in the tar in addition to other lower fatty acids, as the impure "wood vinegar." The development from alcohol (oxidation) by fermentation has been known since antiquity.

Vinegar as a condiment is completely burned to CO_2 and H_2O in metabolism. How far this is the case with large amounts is uncertain. In the dilute form (2-4%) it stimulates the secretion of saliva and gastric juice. In concentrated form acetic acid is a corrosive agent like the mineral acids. The use of vinegar as a skin stimulant, as well as for the production of reaction sweat and for the alleviation of excessive sweating, moreover bleeding is common in folk medicine.

The results of acute poisoning with corrosion has nothing characteristic. In chronic excessive use or the industrial inhalation of acetic vapors, there is a gastric catarrh with coated tongue, feotor ex ore, acid eructations, emaciation, loss of strength, weak pulse, pallor and anemia. Colicky pains and diarrhoea are rare. In rare cases bleeding occurs. After injection into new growths, pallor, cyanosis, and increased temperature and a central vasomotor action is seen.

PROVINGS

Provings of acid. acet. are found:

1. Melion: *Roth's Materia Medica*, Bd. 3, p. 15.
2. Catell: *Brit. Journ. of Hom.*, Bd. 11, p. 338.
3. Berridge: *Monthly Hom. Rev.*, vol. 15, p. 397.

INDICATIONS

Acetic acid is rarely employed. *Emaciation, increasing pallor, oedema,* profuse sweats, great fatigue and the above mentioned gastric disturbances are the chief symptoms.

General oedema and the "skin pale as wax" is cited in Orfila's toxicology for acetic acid; oedema in the extremities has been noted in other instances. One must think of the end stage of cachexia. An influence of acetic acid on the peripheral vessels is also known from the action in bleeding.

Severe thirst, increase of the urine, and emaciation has led to the recommendation of this acid in diabetes, but this has rarely been followed. (The diuretic action of potassium acetate is a salt effect of massive doses.)

Gastric catarrh and diarrhoea in acetic acid have nothing characteristic but are merely occasional indica-

tions in association with emaciation, cachexia and oedemas, perhaps in atrophic children.

SUMMARY

Used rarely in emaciation, pallor, oedema, cachexia with accompanying gastro-intestinal catarrh.

Diabetes (doubtful).

DOSE

It is usually employed in potencies from D 3-D 6. Experiences are insufficient.

ACIDUM FORMICICUM

Formic acid, H.COOH, is found free in the anal secretions of ants. The tincture prepared from formica rufa is proven,[586] from the pure formic acid by injections of D 3 and D 4 also proven by Scheidegger, and the tincture and lower potencies internally by Stauffer. The symptoms have been joined to those of formica rufa.

The external application of "formic spirits" in rheumatic processes is laic. The internal use of acidum formicicum in rheumatism of the muscles and joints and states of weakness occurs rarely in homoeopathy. On the contrary the subcutaneous and intravenous injections of potentized formic acid (D 6, D 12, D 30, and D 200) has found very extensive employment by A. Reuter[587] in conjunction with Krull; it is given at long intervals and in the most diverse diseases on the soil of arthritism and the exudative diathesis. In arthritis, asthma, beginning tuberculosis, chronic skin maladies, chronic nephritis, etc., results have been reported from this derived parenteral irritant therapy.

With internal administration the action is slow, uncertain and limited.

A GLANCE OVER THE CARBON COMPOUNDS

Carbon stands at that remarkable place in the periodic system which seems to be the pivot of the balance in relation to the other elements. But this need not lead to a consideration of the element C as an enduring resting point but rather a rotation point about which the shifting equilibrium of the elements plays (from the H^+ or the O^- side). Carbon is the pole which lies diametrically opposite to the fixed, stabile elements of the noble gas series (likewise the steadiers of the balance), when one considers the periodic system pictorially as a spiral arrangement on a cylinder surface. The longer the arms of the "balance" through the deposit of new elements on both sides, the more living the play of the balance or to leave the illustration: there develops from the point of departure C that unending series of new configurations, from whence (materially considered!) finally the living form is born, blooms, or whatever word may be used to symbolically designate it since a mechanistic expression is unsuitable.

This place of a new addition in the natural structures also signifies for our consideration, the material reciprocal actions with the living man, a new exit and at the same time a crossing. The carbon compounds which we include with the mineral medicinal substances build a bridge, at whose other end stands the plant and animal medicinal substances.

The selection which is involved here in the transition structures of the carbon compounds was primarily guided by practical considerations. The substances whose actions are best known as extensive and which

are employed most often have precedence. For homoeopathic materia medica this signifies a preference for those remedies in which a greater extent of action has been demonstrated through provings on the healthy. It happens now that the chemically impure mixtures of substances which stand very close to the formations of nature (outside of the relatively pure natural coal graphite mixtures as petroleum, wood and animal charcoal, creosote) stand in the first place; that on the other hand the chemically exactly defined and artificially prepared carbon compounds play a much more decisive role, indeed only a small number have been considered here. This leads to a problem, which ever again arises in the organic materials: with the chemical uniformity of carbon compounds the action on man will also be more uniform, one sided and limited. The intensity in given directions may be increased. All the artificial measures for the synthesis of such preparations indeed serve for the purpose of increasing definite properties one sidedly. But thereby the diversity of qualities of actions are lost. However it is exactly these which we would have and seek in medicinal substances when they are to be adapted according to the action similarity of morbid manifestations. The most "impure" natural products prove more suitable there because (through their colloidal state or their colloidal admixtures) the passage through the organism is slowed, ramified and hence more symptoms are unfolded in the organism. In the chemical constructions and variations on the other hand it is exactly one sidedness which is sought, the exclusion always to smaller fields until finally limitation to an outstanding symptom and uttermost freedom from "untoward" actions is the ideal. So the chemical drug construction leads, so far as it seeks its goal in the

human organism and is directed not against foreign organism dwelling in it, logically to a treatment of symptoms. This artifice still compares poorly in spite of all elaboration with nature and the natural structures.

Thus is explained that here the homoeopathic materia medica can neglect a number of positively effective drug preparations without harm. So far as it possesses a valuable nucleus (also chemically considered), these recur in the plant or animal products. In this natural association its drug value can be evaluated better. This holds also for single substances already briefly mentioned, for example, formic acid.

If we would follow the chemical construction plan with the carbon compound beginning with methane in the one, with benzol in the other series, then we could hardly find a way out of the labyrinth of the medicinally unused or unuseable preparations. Our knowledge of the relation of actions with the chemical structure is much too superficial and fragmentary to serve as a guiding thread. The infinite laborious fruitless attempts to obtain or to increase definite actions through chemical construction leads at every step to unexplainable surprises. Addition or subtraction of an accessory group or shifting in the arrangement of the groups in similarly composed compounds (isomers) may lose the effect. An explanation is not possible because we do not know the receptive grouping of the cell chemistry sufficiently well. A completion of the testing of all carbon compounds is unattainable. So far the chief weight has been placed upon details because the gaps between the results are so great and frequent that the greater associations can no longer be seen. On the contary if one has ascertained the actions of a series of

important drugs from the group of carbon compounds in the uttermost breadth, then the mutual trends and the deviations will be at least visible, even if not explainable.

In the series of carbon preparations selected here for practical reasons this was distinct. Graphites with its elementary carbon properties still permits considerable group affinity to silicic acid and very extensive constitutional effects to be recognized. Petroleum with its mixture of higher carburetted hydrogens, particularly from the paraffin series, still has very similar skin affinities, but less connection to metabolism, less constitutional involvement but shows an increase in the sensory actions by virtue of its volatile content. Wood and animal charcoal in all their similarities with graphites stress the note of depressed gas exchange and increase of fermentative processes. And the line from carbo vegetablis and animalis to kreosote corresponds, perhaps, with that from graphites to petroleum. In the mixture of phenols, kreosote, the extent of action has already narrowed; it is less "constitutional" than carbo, but has the septico-malignant side more intensely as well as the necrotizing. With pure phenol the action becomes still more one sided and proceeds very rapidly to the vasomotor-trophic centers. The trend remains standard also after the entrance of the carboxyl group, COOH, in phenol, also in salicylic acid. But however this substitution (of COOH) seems to add a peripheral affinity for the supportive tissue which seems to proceed from the agreement with benzoic acid which has the COOH group on the simple benzol ring. The same also holds for the divalent phenol from the paraffin series, oxalic acid. And this affinity becomes milder in the weak acids of the paraffin series up to formic acid.

In the last the medicinal intensity, at least with oral administration is much weaker because in contrast to the cyclic acids and oxalic acid, it is more rapidly subjected to oxidative splitting. The nitrogen containing acids, picric and hydrocyanic stand between as outspoken central nervous system poisons with a tendency to paralysis. Here the influence of the organically bound nitrogen becomes obvious; this plays a very essential role in plant and animal poisons.

Finally a complete evaluation of these substances from the crossing would be possible only by a survey from the other end of the bridge, from the plant and animal medicinal substances.

8. THE ADDITIONAL GROUP (HEAVY METALS)

Concerning the additional group of the periodic system and the relation of the elements in it in respect to a general survey, the necessary things have already been said (see p. 113ff.). When we designate this class of elements with the term heavy metals, this signifies a characterization a potiori. Because transitions to the light metals of the type of aluminium exist in this group. On the other hand the heavy metals are not limited to the additional group but also appear in the related chief groups (for example, bismuth from whence there is an unclear transition over antimony and arsenic to the non-metals). A universal agreement on the conception of metal is scarcely possible so that it is not feasible to define the heavy metals sharply. The chemical criterion that the metal appear as a cation, the oxides and the metals should be base forming, proves unsuitable because undoubted metals form no bases and others form acids as well as bases. Difficult solubility is also insufficient as a criterion. The conduction capacity for an electro-magnetic stream is best adapted for characterization because it is associated with a special electron structure. But also this obtains only for the solid and fluid states of these materials; in the gaseous forms, the "metallic" state diminishes; also too crude for our purpose is the characterization by properties such as impermeability, sheen, etc. In solid state the metals are

class I conductors. According to modern conceptions this signifies the presence of freely movable negative electrons within the interspaces of the atoms. These electrons are carriers of electrical conduction; conduction occurs in that the electrons transmit their movement pressure to one another in the same direction (toward the positive pole). Another physical characteristic of metallic elements is that they consist of free atoms which are positively charged (therefore in many typical metal compounds, the appearance of the metal as a cation). The heavy metals are further characterized by their high atomic weight and small atom volume in contrast to the alkali—earthly alkali—and light metals. The heavy metal tendency increases in single chief groups with the atomic weight.

It should also be constantly held in mind that flowing transitions from all sides occur from the metallic state or the metallic or heavy metal tendency. But here we use the designation heavy metal for the type of elements as they belong predominantly to the additional group.

Their physico-chemical mutual nature also conditions a series of common trends in the behavior to the organism. They are poorly soluble and therefore poorly absorbed from the unbroken mucous membrane, with the exception of mercury, which, under the usual conditions, is the only liquid metal. Only from mercury and from a few metal vapors (also removal from the metallic state) are there typical acute intoxications from the intact skin and mucous membranes. The heavy metals precipitate protein irreversibly but mercury albuminate again finds its best conditions for solubility in an excess of protein and salt. Moreover the defense of the uninjured organism fails easiest with lead, but here the

persistent absorption of the smallest amounts first brings about a typical chronic metal poisoning. When the metals appear in their ionic forms, as salt solutions (or chromium for example as an acid) in reciprocal action with the organism, the dissociation of the compound, the reaction intensity of the liberated fraction (the acid) decides, whether and how far the local injury conditions the abnormal absorption and the acute poisonous action. These then are comparable to parenteral introduction. Likewise the valence of the metals (for example ferrous or ferric compounds) is important for absorbability.

In most cases the participation of the nervous system will be seen in an intoxication with a heavy metal. These affinities come predominantly to expression if the heavy metal is introduced into the organism in a finely divided form and over a long period, as in the provings on the healthy. Most heavy metals are therefore chronic nerve remedies, iron with its well demonstrated physiological function forming an important exception. The heavy metals appear particularly arranged for this affinity for the nervous system. They are outstanding conductors for electro-magnetic currents; their structure remains unaltered in this conduction (so far as the electron impulse is not altered by the excessive production of heat), therefore they are not destroyed by the conduction. The nervous system is a conducting and connecting system with insulating arrangements that certainly can be placed into activity by electromagnetic energy (light!) and this energy transmission, though perhaps of another type, is still comparable to the well-known electro-magnetic waves. One might advantageously represent in this way how the heavy metals as energy carriers find their receptors in the first line in

the nervous system. And now finally must the phenomena be founded, indeed whether it is designated according to ordinal number as affinity, electromagnetically as resonance, in structure, whether it depends upon atom or electron groups, which has something in common in the type and ordinal number of the energy carrier and receiver, so that it may occur. The transference catalysis (comp. p. 115), which we have already discussed as an essential effect mechanism of colloidal heavy metals, is indeed nothing more than the continuation of equal processes up to the dimensions which are available for the experiments of today.

From this chief trend of heavy metals in the organism there are single deviations in the single effect pictures of the materials of the group. In some the affinity for the nervous system appears much in the background. In mercury it comes to appearance only in chronic poisoning, in chromium (as the chromic acid ion) the acid action is directed toward the peripheral parts. With iron there is the physiologically fixed position, as the transference catalysor in cell respiration and this gives the effect picture more a constitutional character than heavy metals have otherwise.

So in spite of the narrow neighboring connections of the elements there is a great diversity of the effect pictures, a diversity not only in their symptomatic ramifications but also individually different in their origin and trend.

IRON

The element with an ordinal number 26 must be characterized by an extraordinary stability of its nucleus. Its abundance in the earth favors this. Although geologically it is peculiar to the interior of the earth as the chief constituent of the siderosphere and the chalkosphere, its appearance in the lithosphere is very significant, so that in its compounds it amounts to 4.2% of the solid earth crust.

Even in the earth iron acts as an oxygen carrier, ferrous oxide, as it is liberated in the destruction of certain stones and is oxidized to ferric oxide. If now this comes in contact with decomposing organic substances then it oxidizes the carbon compounds to carbon dioxide and from ferric oxide, ferrous oxide is again formed (Bunge). In experiments animal charcoal which adsorbs molecular oxygen, O_2, cannot oxidize organic compounds without the presence of iron.

PHYSIOLOGIC ROLE OF IRON

The *catalytic* capacity of iron as transferer of *active* oxygen to the organic constituents of cells which are not able to react directly with molecular oxygen depends upon the easy change in the valence of iron. This ability to alter valence is indeed one characteristic of the elements of the additional group. In regular sequence the divalent (ferro) iron reacts with O_2, changing into the trivalent (ferri) iron and this reacts

with the organic substances with liberation of oxygen. Molecular oxygen, O_2, is thereby activated to atoms carrying electricity. The catalytic action is limited only to definite forms of iron, as they are present in protein compounds in the cells as respiratory ferments (according to Warburg). If this form of cell iron is altered by reaction with a poison as HCN (ferment poison, anticatalysator), then the catalytic capacity of the iron compound ceases.

The body iron belongs for the most part to the red blood cells and in them is bound to the hemoglobin. This role of easy absorption of oxygen to oxyhemoglobin and the yielding of it according to the partial pressure of the milieu is universally known. Iron is bound to the coloring material (hemin, that is the HCl ester of haematin) in the red blood corpuscles, and this is chemically closely related to the green coloring material of the higher plants, chlorophyll. Now it is worthy of note that chlorophyll also needs iron for its formation. If iron is lacking in the nutrition of the green plants, then they become "chlorotic," that is, they show a deficiency in chlorophyll. However iron is not a constituent of chlorophyll. But an intermediate reaction with iron is obviously necessary in its formation. According to one conception[588] iron inactivates calcium in favor of magnesium which is known to be the essential constituent of chlorophyll. Accordingly one might also consider for hemoglobin that iron is not merely passive as a coloring substance but is actively necessary for its formation. The form of iron for this task can be variable.

For illustration of the amounts involved of iron metabolism, the report of Warburg may serve: the cell iron in the tissues of higher animals contributes a few

tenths of a milligram per gram of cell substance (that is, about the D 4). The physiological iron requirement per day in adults is about 1-10 mg.

It was long held that absorption of iron which was present in the natural foods could not occur because at first it seemed as though a quantitatively complete excretion through the intestine followed. But since experience has shown clearly the effectiveness on blood formation, an attempt has been made to find a suitable explanation. Finally it was demonstrated that soon after the administration of iron chloride, it could be found microscopically in the intestinal mucosa and chemically in the lymph of the thoracic duct and the absorption from the intestine was demonstrated. The iron was absorbed in an ionized form. It is worthy of note that the capacity of absorption of the intestinal wall for iron is very rapidly paralyzed.[589] Lewin cites the old report that absorption occurs with a 1% iron citrate solution introduced into the stomach, but in a 4% it does not. There also exists an optimal concentration for absorption.

From the intestine the iron passes to the liver and is deposited in it, further in the spleen and bone marrow and is available for the body cells. To this is added the iron arising from the destruction of the erythrocytes, which again becomes useable iron. This reserve iron is stored chiefly by the reticuloendothelial system. The excretion of the finally used iron occurs largely from the lower bowel, only a small part going through the kidney. Thus may there be the appearance after the marked use of iron as though the iron introduced was quantitatively (as one formerly believed without absorption) excreted again through the intestine. The use of iron in metabolism is constant and in the state of hunger the excretion does not cease. The use is also regular and therefore the excretion through the kidneys is largely independent of the introduction of iron. With increased blood destruction as in pernicious anemia, the excretion of iron in the urine is considerably increased.

Since excretion does not cease with deficient introduction, one might conjecture that the iron excreted is in another used state than that introduced, because otherwise there would be complete retention and reutilization of the iron by the organism. In fact the normal and pathologic iron metabolism is, perhaps, one of the best examples of how little the quantitative conception states about the actions and how outstanding the chemical and here the physical form is.

SIGNIFICANCE OF THE CHEMICAL AND PHYSICAL FORM

It has long been known[590] that the inorganic iron salts are distinguished from the organic preparations in that they also possess the capacity for promoting the formation of hemoglobin in the growing animals by a iron rich diet. Moreover if sufficient the iron is offered as a building material of hemoglobin through the organic compounds, the inorganic iron compounds alone have a stimulating influence of the new formation of hemoglobin. This activity is also associated with the ion form and the strongly ionized (divalent) ferro-compounds prove much more active than the (trivalent) ferri- compounds. Moreover it has also been proven in the test-tube that the iron of the healthy animal or a man dead from an acute disease accelerates certain chemical reactions catalytically, while the iron from the liver of a patient dead of pernicious anemia does not have this catalytic property.[591] It is not known whether the activity here is joined to a definite chemical compound or to the physical structure of iron.

Starkenstein and Weden[592] see the difference exclusively in the manner of chemical combination. Simple ferri-compounds which have been introduced into the organism from without are always inactive according to their report. They will be

taken up by the spleen—and indeed only by this—in unaltered form, stored and then again excreted; on the other side reduced to the inactive ferrous iron in the liver, this is the hemoglobin building stone, but not available for the catalytic process. Active ferro iron is also dissociated in the organism and it circulates long in the organism and is introduced from the blood into all organs outside of the spleen. It is oxidized to the ferri form in the blood, in which the iron is bound complexly in the anion. This differs however fundamentally from the directly introduced ferri-compound, in so far as they remain unaltered for a long time in the blood. The activity of this ferri iron, which enters the cell, consists of its biologic O_2 yield, whereby it is reduced to the catalytically inactive ferro iron. This inactive divalent iron is deposited in the liver and can then (as it is converted there into the ferri form) serve as a building stone. Ferro and ferri forms on introduction into the organism act in entirely different ways, the organs possessing a selective capacity for the different forms. If Starkenstein ascribed no pharmacologic actions to the simple ferri-compounds but only local toxic actions, because they precipitate proteins, then this holds only for large amounts introduced by injection. And also with the deposit of simple ferri-compounds in the spleen and its subsequent excretion is not ultimate proof of its medicinal inactivity, since all ferri iron need not take this way. Experience contradicts such an assertion.

But how important the physical state of iron is for the therapeutic purpose is shown by Baudisch and Welo.[593] They proceed from the well-known fact that where mineral springs appear on the surface they have very special effects and that the healing power of the fresh mineral water gradually diminishes and disappears. In many springs can this old folk experience be explained scientifically by the proof of radio-activity. But the difference between fresh and old mineral water is seen in springs without known radio-activity, and most strikingly in the iron containing waters. Only the iron water freshly appearing from the earth shows catalytic properties. Chemical differences cannot be made responsible for this.

One knows chemical parallels; only freshly precipitated ferrous bicarbonate is able to activate the oxygen of the air so that oxidizable compounds present at the same time are oxidized. Brief existence without the presence of air makes ferrous bicarbonate inactive, although it takes up oxygen avidly on subsequent access of air, but is not activated. Such "active" properties of chemical substances in the statu nascendi are indeed known of many other substances. But this capacity is only very transient in preparations in the test tube. In the natural mineral springs the active or better activated state is more prolonged (some hours). And finally from the benzidine test on the blood the presence of H_2O_2 is well known, so that something is contained in the blood (namely its iron compounds) which is colored by perioxidase action, that is, oxygen activation of H_2O_2 which colors benzidine blue.

As Baudisch and Bass have shown, even light is able to accelerate the aging of mineral water and thereby it must be concerned with an involvement of the ferrous bicarbonate, while on the other hand potassium ferrocyanide solution is converted from its catalytically inactive state into an active form by radiation with sun light.

That also without alteration of the chemical composition, the physical form of an iron compound as iron oxide is decisive for the properties, one knows from magnetism. Baudisch and Welo proved with iron oxide, Fe_2O_3, that the artificially prepared magnetite, $FeO.Fe_2O_3$ would oxidize in an oxygen stream by heating. At 300° there develops a strongly magnetic red powder, Fe_2O_3 which on heating to 550° goes over without external alteration into an almost non-magnetic Fe_2O_3. Through x-ray interference photography it is shown that the magnetic Fe_2O_3 has a cubic structure while the more highly heated Fe_2O_3 has a rhomboid structure. Only the magnetic cubic Fe_2O_3 is active iron while the non-magnetic rhomboid iron is biologically inactive.

The arrangement of atoms in space is also decisive for the magnetic as well as the catalytic properties. Through the various arrangements of atoms the surface powers depending upon the free valences will be altered and only in the active form is a partial reaction with oxygen possible. The formation of such active surfaces

of a simple iron compound is compared by Baudisch and Welo with enzymatic or serologic processes. The activation of mineral compounds through sunlight is the simplest example of the formation of an inorganic vitamin. If now one adds to this effect of light on the arrangement of molecules and atoms still the physical photo-effect which also involves a reformation of the electron structure, then an entire world of structural alterations with whose appearance entirely new properties are bound is opened in chemistry even of the simplest inorganic compounds under the influence of radiant energy.

Bickel and his pupils have found that active iron as iron oxide preparations, so-called siderac, like the fresh Stahl spring, also has biologic actions on the red blood cells, growth and metabolism which are absent in inactive iron oxide and the older Stahl spring water. But the promotion of blood building can only be demonstrated in the previously disturbed equilibrium of anemic children. The lability in iron metabolism forms a pre-condition for such proof and this condition, the iron sensitivity of the side of the organism, has often been referred to by us. A transient increase in the hemoglobin formation has however been found by Abderhalden in the growing normal animal. However even during growth a definite although naturally slight lability may be presumed. The favorable action already demonstrated by Abderhalden on the growth of young animals by the introduction of inorganic iron salts can also be ascribed to active iron in a higher degree than to the inactive. Moreover an influence on the nitrogen balance of the growing animal[594] will also be found only from the active forms of iron.

TRANSFERENCE OF AND ACTIVATION OF OXYGEN

The physiologic role of iron in hemoglobin is not limited to the acceptance, transport and delivery of oxygen. Likewise the taking up of CO_2 in the body capillaries and the release in the lung capillaries is facilitated by the iron containing hemoglobin, moreover hemoglobin participates in the buffering of the blood. Not only as an ampholyte as all protein bodies—that is, in the

property of being a weak acid and a weak base at the same time—does the buffer action exist, but also especially in that the oxyhemoglobin is relatively acid and reduced hemoglobin is relatively alkaline. The preponderance of reduced hemoglobin in the venous capillaries also signifies a tendency to alkalinity. By this the streaming in of CO_2 into the blood will be facilitated without the acid-base equilibrium in the blood varying markedly. After yielding CO_2 the alkalinity developing will be buffered by the formation of oxyhemoglobin.

The general function of iron in the respiratory ferment of the cells has become known through the work of Warburg. The respiratory ferment is an organic iron containing pigment standing very close to haemin. It has the task of oxidizing the hydrogen rich carbohydrate fraction remaining after fermentative splitting. Whether this occurs through the activation of hydrogen from the organic compound, as Wieland asserts, or through activation of O_2 (to atomic oxygen), as Warburg believes, is immaterial for the effect. It is also assumed now that the activation of hydrogen as well as oxygen occurs. The cells, outside of the O_2 activating respiratory ferment of Warburg, also contain hydrogen acceptors (as Kelin's cytochrome), which with the help of suitable ferments (dehydrases) can activate the H of the organic compounds and react with the molecular O_2.

Likewise the other catalysors belonging to the mechanism of cell oxidation are haemins: the peroxydase, the peroxide (as H_2O_2) activator, that is, liberate the atomic oxygen from it and the catalase, H_2O_2 being decomposed into H_2O and O and thereby an excess of H_2O_2 made harmless.

The red blood cells in this respect contain no respiratory ferment, hemoglobin not being a respiratory ferment in the sense of an activation of O_2 but only a carrier of it.

Both the oxygen carrying capacity of hemoglobin as well as the respiratory ferment of cell respiration can be poisoned through anticatalysors like HCN. It occurs through a transformation of iron in a complex compound with CN which thereby becomes inactivated. Exactly like hemoglobin, the respiratory ferment can be poisoned by carbon monoxide. Warburg was able to again detoxify this combination of carbon monoxide and the respiratory ferment by radiation, and indeed

with various strengths according to the wave lengths of the light. The corresponding facilitation of dissociation of CO-hemoglobin by ultra-violet rays was previously known.[605]

METABOLISM, BLOOD FORMATION, GROWTH

Up to a certain degree the oxidative action can be augmented by increased introduction of iron: at least metabolic investigations with animal diets of iron rich food shows an essentially higher O_2 use than the normal animal. A markedly increased new formation of blood also occurs but an increased destruction maintains the equilibrium so that the normal number of red blood cells is maintained. Distinct actions of iron are apparent only with a previously disturbed equilibrium.

A physiologic role of iron in growth is made probable through the combination of functional iron in the cell nucleus in the nucleo-albumins. Likewise with a continuous iron free diet, animals of the second generation are retarded in growth and the aplasia of the thymus observed may be connected with this.

In the age of sexual maturity the influence on the generative organs stands in the foreground and this is made distinct in the human by the disturbance of iron metabolism in chlorosis.

IRON AND CHLOROSIS

The classical field of standard iron therapy, *chlorosis*, today has more historical and theoretic interest than practical interest because this disease has become very rare. One cannot escape the impression that this malady of the female puberal period has been markedly influenced in the last few decades by suitable foods and clothing (access of the activating sunlight).

If the decrease in the red blood cells and even more in the hemoglobin has once occurred, then the food

iron in its organic combination proves inactive, even though it provides the necessary building material. Iron therapy is concerned with an "active" iron or one which can easily be made active. For this, ionized iron seems best adapted from the start. But for the dose, the physical state is obviously important. For the same which is accomplished by a dose of several grams per day is achieved by drink cures in the Stahl springs in which not even 0.1 gram is introduced in a day. Even this amount is essentially more than the physiologic requirement.

In chlorosis one is not concerned simply with a deficiency in iron. This may be concluded from the fact that in the chlorotic much more iron is found in the urine before the administration of iron than at the time of administration and improvement. The failure in chlorosis lies in the incapacity to bring the iron into hemoglobin formation and to promote the new formation of blood in the bone marrow, so that active iron is necessary for blood formation. In the anemias after loss of blood the situation is different. Here the organism has the capacity to obtain active iron from inactive. On this account after the exhaustion of deposits in the liver, spleen and bone marrow, iron in any form is correct, and an iron rich diet is sufficient. Indeed in the anemias from blood loss feeding of liver, kidney, and blood improves the new formation of blood better than iron. Pure iron preparations often prove inactive, less pure act very well, likewise from the addition of vegetables or their ashes. It is also probable that in the simple anemias from blood loss an intermediate reaction is necessary for the conversion of pure iron into a form capable of combination. One assumes that traces of copper complete this catalytic activation.

In endogenous chlorosis the situation for the utilization of iron in the formation of hemoglobin is still much more complicated. Because here the disturbance of iron metabolism lies distinctly in the opposed inter-relationship with the hormones of the female sexual organs. The incretion of the corpora lutea regulates the periodic process of maturation, the transformation of the uterine mucosa and menstruation. In this periodic process obviously special demands are made upon the iron metabolism. One might well imagine that in the process, the need for active iron is especially great. For this reason disturbances in iron economy or iron utilization are manifested earliest in this event. Thus on the one hand the defective adaptation in sexual maturity is a precondition for chlorosis, on the other chlorosis makes itself distinctly obvious in the disturbances of the corpora lutea which regulate menstruation. The periods are very irregular, often missing, conception does not occur in the severe chlorotic and defective sexual sensation is frequent. If pregnancy should occur then in general it is curative.

In chlorosis, then, it is necessary to activate the disturbed iron content, to improve the utilization of iron. Large amounts of iron are not needed for this, in case sufficient regard is taken for the chemical and particularly for the physical form. As stimulative therapy with small doses the iron therapy of chlorosis would still not be homoeopathic. It would be only if the excessive or too long continued introduction of the iron stimulus in the healthy provoked symptoms similar to those of chlorosis. And this is to a vast extent the case as we shall see from the results of drug provings. We should not be surprised particularly in this respect if we have liberated ourselves from the much too narrow

consideration of quantity. The disturbances in the drug proving with iron show that the usual cell functions for the utilization of iron are no longer sufficient and they are signs of a relative over-demand in an artificially induced situation. In chlorosis the otherwise normal demand for functional iron in the red blood cells is already excessive. In both cases the regulatory attempt of the organism can cause entirely similar manifestations. If in the same period a sufficient supply of oxygen is to be obtained by the tissues in the presence of decreased amounts of hemoglobin then the velocity of the stream must be accelerated in the vessels. Actually in chlorosis the gas exchange is not reduced, but the circulation velocity is increased and therefore many symptoms of excited circulation with irregular blood distribution. Other less important vital events as maturation and menstruation will become irregular or entirely neglected.

If on the other side the previously normal iron containing cell begins to fail under the continuous stimulus of iron, then this signifies that the limits of possible functional increase have been surpassed, and the reduction of function may be avoided by a blockade of active iron. Actually in certain concentrations the ferrous salts are able to transform oxyhemoglobin into the functionally incapacitated methemoglobin.

The solution of the apparent paradox also lies in that the regulation of iron economy by the cells constantly using it, employs the same trends and ways if the physiologic breadth of iron utilization is not exceeded on any side. Thus iron therapy can be used in many cases where there is an excess of iron in the body but its utilization fails. There the symptoms similar to "iron disease" will appear and the therapeutic stimulus of

active iron help to overcome the blockade in iron economy. Likewise in chlorosis there is finally no deficiency in material, but only inability to utilize it.

The employment of iron in the school occurs essentially in respect to chlorosis and the secondary anemias. In the other states of weakness one depends upon its so-called roborant and tonic action. The explanation as a stimulant to oxidation in the cells is still necessary. In drug attempts the improvement of the general well being is observed as a *primary* action.

TOXIC ACTIONS, UNTOWARD ACTIONS, CONTRA-INDICATIONS

The local protein precipitating, astringent or corrosive action of soluble iron salts in large amounts can be overlooked since they are not characteristic of iron but common to all heavy metal salts. The use of iron chloride for the arrest of non-arterial bleeding may be merely mentioned. But in regard to the tendency to bleeding in the drug picture of iron it is noteworthy that the ferrous salts in vitro as well as in vivo can reduce the coagulability of the blood while the protein precipitating ferric salts precipitate and dissolve the red blood cells. Of slight interest for us are the manifestations or intoxication from intravenous administrations: soluble, non-protein precipitating iron compounds (as ferrous salts) prove extremely toxic in animals when introduced directly into the blood. In frogs there is an initial increase in reflex excitability, then motor paralysis consequent to depression of the central nervous system; in mammals lowering of the blood pressure and *inflammatory manifestations in the stomach and intestine with diarrhoea.* Nothing similar is observed in man although the amounts of iron introduced in any

form into the digestive canal probably are not too small. It can only be that the iron is for the most part made harmless in the intestine and only a little is absorbed. After the oral administration of massive doses, inky taste, dark discoloration of the teeth (by iron sulphide or iron tannate), injury to the teeth, gastric pain and a series of dyspeptic symptoms as offensive eructations, nausea, vomiting, moreover persistent constipation and colic are observed as so-called untoward actions.

With the undoubted favorable action of iron preparation in many cases of chlorosis many believe that numerous unpleasant untoward actions must be anticipated. Recently very large doses of ferrum reductum have been recommended in refractory cases of anemia. Lewin[596] places the blame for certain untoward effects on too great dosage and refers to that fact that on older times the *special effectiveness of smallest doses of iron was stressed.* Also worthy of note is a further remark by him: there are individuals who react to the smallest doses of any iron preparation with *congestions.* "Other well nourished people after longer use have an unpleasant orgiastic state. Many hysterical and anemic people, even children, show an *unexplainable intolerance* towards certain iron preparations." Moreover "in *the febrile patient the body warmth and febrile symptoms will be increased by iron.*" Apart from this, previously present digestive disturbances show an aggravation or some other type of unpleasant untoward action which is apparently associated with an abnormally increased absorption of iron from the intestine. Lewin also refers to the characteristic experiences of other observers on the aggravation of disease by iron: with an existing tendency to atheroma of

the vessels, plethora, in certain forms of gout; moreover the acceleration of a beginning tuberculosis under the picture of chlorosis in young girls by iron; the contra-indication in patients who have previously had tuberculosis, in whom the skin is fine, transparent and the veins are visible as blue violet structures. The inhalation of powder, vaporized liq. ferri sesquichlorat after hemoptysis can readily excite renewed bleeding. A deeper significance lies at the basis of most of these aggravations and contra-indications than merely signs of a special sensitivity to iron.

RADEMACHER'S USE

Rademacher made extensive use of iron usually in the form of ferrum aceticum. For him iron was one of the three universal remedies, that is, agents which acted on the entire organism. In his method arranged for testing which involved the experiences from case to case with special consideration for the epidemic factor, some few indefinite diagnostic or symptomatic signs for the selection of iron can be unraveled. One indication should be the alkaline reaction of the urine. Many times Rademacher employed iron in febrile diseases, in scarlet fever, in acute rheumatism, pleuropneumonia, recurrent sore throats, but also in skin and mucous membrane hemorrhages, menstrual disturbances and sciatica. A leading motive outside of the scant indication of Rademacher on the state of the urine cannot be found.

PROVINGS

His follower Löffler has published (in the Ztschr. für Erfahrungsheilkunst, Bd. 1, 1847, H. 2, p. 62, and H. 3, p. 39), an investigation on himself and 5 (unfortunately

exclusively male provers) with liquor ferri acetici containing 8% iron. Increasing doses of this, on an average of 2-3 grams daily (about 0.15-0.25 grams of iron), were taken for 2-4 weeks. The studies were directed primarily toward the blood, and for this reason before and after a bleeding of 120g was done. The findings of the characteristic elements correspond to the state of the existing technique of blood investigation and naturally are not conclusive. A more marked color of the blood cells and a darker color of the blood was constant in 5 provers after the use of iron (in the sixth the behavior was different but he was not healthy; a spongy state of the gums and a tendency to bleeding was removed after the use of iron and his previously dark red blood became much lighter afterwards).

The slowing of the pulse which stands in opposition to other reports from earlier or later times was most striking. (For example Lewin states: Even after very small amounts the increase in cardiac activity can be significant. Perhaps in the investigation of Loeffler, the preceding bleeding played a role.) Moreover the pulse tension increased under the use of iron.

In agreement with all other reports stands the observation of congestion to the head, relieved by quiet, lying down and sleep, not relieved by cooling; a sensation of heaviness, pressure and excessive fullness in the head.

In the first period of use of iron in small doses there was an increase in strength, later, on the contrary, a general fatigue, a feeling of weakness, of heaviness and lassitude in the extremities of aversion to bodily or mental activity, lassitude, and overpowering tendency to sleep. Moreover an increase of appetite up to ravenous hunger was observed; however soon there was

an unpleasant sensation in the gastric region and considerable digestive disturbances were noted; at first a feeling of increased warmth in the gastric region and with large doses a sense of constriction in the mouth and esophagus, annoying pressure in the abdomen, distension and colic in the epigastric region; with doses over 20 drops colic-like pains, nausea, eructations and tendency to vomiting. The gastric region was sensitive to external pressure and the tongue became coated white. The disturbances which in themselves were not long maintained were relieved or minimized by bodily movement after the onset. Apart from the green-black discoloration appearing in the stools (formation of iron sulphide) which was observed from the doses of iron, which were not small, it was noted that the stools became drier, more solid and heavier, at times with urgency for stool, with large doses the consistency of thin paste.

In five of the six provers there was observed a tickling sensation in the urethra and increased urgency to urinate. In one prover it amounted to a tenesmus vesicae to which a tenesmus recti was added. The nervous (neuralgiac as Löffler expresses it) nature of these events becomes obvious in that they appeared only during the day, were increased when the urge was yielded to and disappeared as soon as the urge was conquered by walking. An increased secretion of mucus in the urine was observed only twice.

Also the provings of Hahnemann (Reine Arzneimittlehre, 3 Aufl., Bd. II, S. 119, 1833) was arranged for the most part with ferrum aceticum, only a few symptoms arising from ferrum metallicum.

Ferrum aceticum was also proven in the 15, 9, and

3 C potencies by Alb (*Ztschr. d. Vereins d. hom. Aerzte Oesterreichs,* Bd. II, S. 213, 1857).

Ferrum phosphoricum was proven by Morgan (*Amer. Journ. of Hom. Mat. Med.,* Bd. IX, p. 308, 1876), and Moffat (*New Amer. Journ. of Hom.,* vol. 37, p. 218).

Ferrum iodatum by F. Müller (*Allg. hom. Ztg.,* Bd. 50, S. 97, 107, 115, 1855) and Boissiere (*Gaz. med. de Paris,* 1842, p. 830).

From these provings as well as other actions known from the untoward effects, the drug picture of iron is derived as it is presented in the following. An exact proving of *metallic* iron is very desirable for the improvement of our knowledge on the pure effects of iron.

FERRUM METALLICUM AND FERRUM ACETICUM CONSTITUTIONAL TYPE

With a substance necessary to life as iron which appears bound to the nucleus in all cells, which participates essentially in growth, regeneration, metabolism and securing of energy and blood formation, we may expect it to be a constitutional remedy in a narrow sense. The *constitutional type* of iron may be described as follows: a thin, graceful, irritable person, usually feminine, with *irritable circulation,* delicate transparent skin and widened veins. In ferrum aceticum there is excessively rapid growth, pallor, easy exhaustion in children. Ferrum metallicum is used more often as a remedy for the female puberal period. There exists a tendency to rushes of blood in which the face changes from pallor to a fiery red on the slightest occasions, thereby the mucous membranes are pale, the extremities, especially the legs are cold and the feet swell easily; tendency to bleeding, particularly from the nose and lung, in conjunction with congestion to the head-

ache or chest, palpitation or superficial breathing; danger of transition into chronic tuberculous processes; great lassitude and weakness even up to fainting repeatedly necessitate lying down, the irritability of the circulation and the symptoms dependent upon it are *better from prolonged moving around.* Heat and cold in general have little influence, in spite of chilliness in the ordinarily cold extremities, rushes with sudden sensation of warmth to the head and the febrile state. Many complaints are *worse at night and on sitting,* the nocturnal restlessness occasions the moving around, but the weakness ever compels lying down. From the irritability in the evening which may lead to an increase of temperature, sleeping is impaired, and restlessness and sweating may appear. The congestive, pressing, hammering, beating and pulsating headache, especially in the front and temples is relieved at times by lying down, but also by walking about in the fresh air (perhaps also by counter-pressure); cough, bending, in general sudden movement, moreover alarm aggravates the headache. Application of cold does not relieve it (in contrast to the hyperemic congestion of Belladonna which is also aggravated by lying down). The headaches of ferrum tend to recur periodically.

Perhaps the constitution in its change between the irritability in the circulation and the change into weakness, is to be designated best according to the division of v. Grauvogl as the *oxygenoid.* The attendant hyperesthesia is indeed not particularly stressed (it exists chiefly toward noises) and the further signs of v. Grauvogl, the aggravation before rain and storm and the improvement after the appearance of them have not been noted particularly in the picture of iron. But that the type described is particularly susceptible to the in-

fluence of oxygen, permits the best characterization of its nature. Iron as an activator of oxygen and the oxidation process in metabolism physiologically is standard for this constitution. (Also in the syndrome of anemia more oxygen is used than corresponds to the functional capacity of the organism, namely the blood.)

Thus the drug picture of iron in many trends goes to the *anemic chlorotic picture of disease.* Moreover it is also striking that the too long continued use of iron again aggravates the condition. Outside of the signs already mentioned there are: a vertigo with suffusion of the face, swishing in the head, ear noises, sensations of faintness, worse on looking downward, on looking at flowing water.

FEMALE SEXUAL FUNCTIONS

In conjunction with the chlorotic syndrome stands the functional disturbances of the female sexual organs in the picture of iron. Most characteristic are the *intermittent menses* or the amenorrhoea and the delayed menstruation with anemia, moreover irregular menorrhagia with marked excitability of the circulation, fiery red face, ear noises, copious discharge of now fluid, now clotted blood with labor-like pains in the pelvis and the abdomen, an increased nocturnal bleeding. Also to be mentioned is the marked appearance of varices and of acne during the period. The menses are exhausting and accompanied by considerable headache. A catarrh of the mucous membrane with watery or milky leucorrhoea occurs. Anesthesia during coitus and the decided sensation of pain in the os uteri externum is the indication for iron as a remedy for *sterility.*

CIRCULATION

The excitability of the circulation is quite irregular. Cardiac palpitation and palpitation in the pit of the abdomen readily occur from nervous causes. The pulse varies markedly in the frequency as well as the tension. The congestion to the head and the chest, the irregularity of blood distribution have been mentioned. The rushes to the chest lead to oppression "with desire to breathe deeply, or to respiratory action with almost invisible movement of the chest and great expansion of the nasal orifices on expiration," that is, a superficial respiration. The respiratory limitation corresponds to a pseudo-plethora which is relieved by moving about. All these symptoms are worse while resting quietly. Thus the following report is also to be understood: "nocturnal oppression at the pit of the stomach, worse on rest and lessened by mental or bodily occupation." Stitches in the chest occur occasionally.

RESPIRATORY PASSAGES

A sudden congestion of the respiratory mucous membrane lies at the basis of the dry cough with bloody expectoration. The tendency to pulmonary bleeding, considered in school medicine as a contra-indication, is exactly an indication of homoeopathic suitability and dosage under certain conditions. A prover in Löffler's experiment reports: "in the morning on awaking a painful sensation in the larynx with cough and rasping, which increased up to pressure in it but which diminished towards noon and a similar sensation under the upper third of the sternum. On hawking and coughing pale, tenacious but blood stained sputum was expectorated which was often repeated up to 4 in the after-

noon. In Hahnemann's protocols bloody expectoration is reported many times.

DIGESTIVE ORGANS

The symptoms of iron on the digestive canal are best known as untoward actions in the usual treatment of chlorosis and also from the so-called Stahl baths. Thereby it is not sharply separated as to what belongs to the chlorosis and what to the iron, since the dyspeptic symptoms may be so similar: after eating many eructations of the food eaten or a taste as from rotten eggs; the food lies in the stomach for a long time and is rejected in the middle of the night; the appetite is very fickle and irregular, now ravenous hunger, now anorexia and there is an aversion to meat and particularly marked gastric pressure after eating meat; desire for stimulants such as brandy; pressure in the stomach after all foods. After the oral administration of larger doses, the stools are green-black and there is constipation; after injection of iron preparations into the circulation diarrhoea may occur. The exact proving has brought out a type of *vegetative diarrhoea*: watery or undigested painless stools, soon after or during eating or at night. (These stools, called "lienteric" by the older physicians, are similar to those reported for china which is related in other respects as well). The colic and tenesmus and the hard dry stools from the Löffler proving are much less characteristic indications.

URINARY PASSAGES

On the contrary deserving of greater esteem from this proving is the old observation of irritation in the urethra up to the neck of the bladder with frequent tormenting urge to urinate. Associated with the Hahne-

mannian symptom: "involuntary urination, preferably during the day" one comes to the use of iron preparations (for example ferrum phosphoricum) *in irritative states of the neck of the bladder in anemic women*, particularly during pregnancy, in whom small amounts of urine are voided involuntarily on walking, but not on sitting or lying. The use of ferrum picrinicum in prostatic hypertrophy is to be ascribed to the picric acid fraction.

RHEUMATIC PAINS

Finally there is a trend of iron action which should not be neglected even though its comprehension in the total picture still offers great difficulties: the rheumatic-neuralgic. Here especially are the sticking and tearing pains in the *shoulder girdle*, apparently in ferrum aceticum more in the right, in ferrum metallicum more in the left. They impair the movements of the arm. They are often ascribed to insufficient clothing or deficient covers, and are relieved by external warmth. A similar tearing-sticking pain also goes from the hip joint into the leg," the hip is painful as if bruised, on touching, the patient cannot come on account of the pain which prevents walking; it is worse in the evening after lying down, he must arise and move about in order to lessen the pain up to midnight"; thus the description of Hahnemann reads. Cramps in the calves appear, worse at rest and at night. The extremities can hardly be kept at rest and during rest there is the necessity of moving them. This symptom awakens an impression of local stasis in the large muscles, which may be considered less as of arthritic origin than of defective distribution of the blood and depression of the circulation

and the metabolic exchange in the muscle apparatus, though it is assigned to the large joints.

The nocturnal aggravation can be indicative. For the neuralgia in the teeth, relieved by cold water, worse at night, one finds no suggestion in the provings, but they are frequently observed in the untoward actions of iron.

Empirically iron is recommended in the cachexia of quinine and malaria.

The drug picture of iron must hold in essentials, at least for the present, for ferrum metallicum as well as ferrum aceticum, since the available provings do not permit a separation. Moreover at present no separation can be made for the oxide of iron or ferrous carbonate. Practically the simplest agent, the potentized metal, will always be preferred unless there is a special indication for a definite compound.

FERRUM PHOSPHORICUM

As ferrum phosphoricum today one uses ferric phosphate, $Fe(PO_4)$. Whether ferrous phosphate, $Fe(HPO_4)$, was present in the proving of Morgan, it is difficult to say.

SCHÜSSLER'S CONCEPTION

When Schüssler included ferrum phosphor. in his therapy in 1874, he did not actually include it on the basis of provings with this substance but on the idea, based on nothing, that iron was present in the organism and particularly in the muscle tissues, in this compound as a building and functional agent. He took over that which was known in homoeopathy of the action of iron, for his remedy, naturally as always with him under extremely simple, unprovable theoretic conceptions.

Many symptoms of iron seemed to signify hyperemia to him. Since there were dependent upon the tension of the vessels and ferrum phosphoricum was a constituent of the musculature, also of the vessel musculature, thus he explained this substance as the functional agent for tension of the vessel; in great doses it can relax the tension of the vessel and therefore create hyperemia, in small doses on the other hand the relaxed muscle fibres are returned to normal tension.

INFLAMMATION AND FEVER

In spite of the untenable nature of this conception, the fact remains that ferrum phosphoricum more than the other iron preparations, has practically proven itself as a remedy for *inflammation and fever*. It has already been stressed that through iron not only "febrile states" but even fever may be produced in sensitive persons, moreover that Rademacher often used iron in the febrile diseases. In the proving with ferrum phosphoricum in the D 2, heat and dryness of the face and the palms of the hands, later of the neck and upper chest is noted. (Provings with ferrum iodatum have yielded febrile symptoms more distinctly). Schüssler took ferrum phosphoricum into consideration in all the states which belong to belladonna in the homoeopathic domain. In the first stage of febrile diseases ferrum phosphoricum is used much more in homoeopathy on the basis of experience than on observations from the provings when the sensitive, anemic, easily exhausted ferrum type which tends to have congestion is present, when chilling or rheumatic causes are present. The nocturnal aggravation and the sensitivity to contact and alarm are general ferrum indications but do not differentiate from belladonna. The reported aggrava-

tion *worse from movement*, which stands in opposition to the other improvement through prolonged motion, concerns the rheumatic symptoms. The *shoulder region* is again the preferred site; the right side seems to be more markedly involved. But quite generally ferrum phosphoricum has frequently proven itself in acute as well as subacute febrile joint rheumatism. The improvement from cold applications refers to the congestive headache, in any case not to the rheumatic pains, because in the provings it was expressly stated that these were improved by warm applications and covers. The fever following chilliness from the respiratory passage involvement can increase up to the first stage of a pneumonia and here the tendency to bleeding is of value as an indication of ferrum: expectoration of almost pure blood. Moreover ferrum phosphoricum is particularly advocated in *acute otitis* in the first stage which it develops from a catarrh of the Eustachian tube, either as the first remedy or when belladonna fails.

Finally the already mentioned weakness of the sphincter vesicae in anemia with involuntary urination on walking is an indication, more of ferrum phosphoricum than for other iron preparations.

FERRUM IODATUM

There is a special proving of ferro-iodide, FeI_2. However, it is not frequently used, though it is best in those cases in which one desires an iodine action in a ferrum type, for example, in goiter. The proving with the pure substance and up to the 3rd trituration also has many iodine symptoms from the mucous membranes of the upper respiratory system, moreover irritative states of the urinary passages and the rectum; moreover there is the already mentioned fever (pulse increase and

febrile sensation, without actual temperature measurements). In scrofulous and tuberculous affections with fever a combination of the two remedies so erethristic as iron and iodine are, in any case, ought to be done with caution.

FERRUM MURIATICUM

Ferrum muriaticum up to the present has not been subjected to a special proving. Today usually ferric chloride, $FeCl_3$, is understood by it. It is indicated like ferrum aceticum in pains in the right shoulder. H. Schulz considers the chloride as especially suitable for bleeding and it has also been employed externally as a styptic.

FERRUM SULPHURICUM

Ferrum sulfuricum, $FeSO_4$, has a purely empirical recommendation in Basedow's disease with anemia as well as the other ferrum characteristics. The painless watery diarrhoea also seems to belong to these.

FERRUM ARSENICOSUM

Ferrum arsenicosum, ferriarsenite, is not proven. It is used as an arsenic preparation in the same sense as chininum arsenicosum: in anemic, weak children without appetite, in splenic and liver enlargement, severe blood diseases, malarial cachexia, occasionally also in nephritis.

FERRUM BROMATUM

There is a brief proving with the D 6 potency but it is scarcely used. The recommendation in spermatorrhoea in weak anemic people with depression is purely clinical. The sole prover reported a feeling of

numbness in the scalp, pressure and heaviness in the head and eyes, dryness in the nose and mouth, improved by the onset of sneezing, diarrhoea with bloody mucus and tenesmus and feeling of intestinal prolapse; moreover sticky mucoid, excoriating leucorrhoea and an unpleasant sensation of heaviness and sinking in the uterus.[597]

FERRUM PICRINICUM

Ferrum picrinicum is occasionally employed in states of exhaustion and difficulty in hearing in which the picric acid fraction participates; more often in prostatic hypertrophy. The recommendation is purely clinical.

SUMMARY

Constitution:

Oxygenoid: weak anemic persons with transparent skin in which widened veins appear, with congestions, but cold extremities, tendency to fever and bleeding, pseudo-plethora, tendency to tuberculosis and hyperesthesia (against noise), easily excitable and rapidly exhausted. Rapid growth.

Endocrine associations: Ovarian dysfunction (corpora lutea); thymus?

Chief Trends of Action:

1. Chlorosis and secondary anemia with irregular circulation, intermittent menstruation, or other irregularities of the menses (amenorrhoea but also too early and severe flow). Sterility, sensitivity of the os uteri externum, anesthesia of the vagina.

Congestive headache and vertigo, nose bleed, febrile state, congestion to head, palpitation and oppression, hemoptysis.

2. Digestive disturbances.

Lienteric and nocturnal diarrhoea, nocturnal vomiting. Aversion to meat. Very variable appetite.

3. Urinary organs.

Frequent urge and impaired continence.

4. Rheumatic-neuralgiac complaints, especially in the deltoid.

Leading Symptoms:

Worse at night and on sitting and lying, but again the need for lying: during and after eating; periodic.

Comparison:

China (in quinine cachexia as a curative agent). Special preparations, see above.

DOSE

Usually the iron preparations are recommended in the D 6, though many cases of anemia seem to react only to material doses. Ferrum phosphoricum is often given in the D 12 as well as the D 6 and I have seen results from D 3 in the bladder weakness described.

COBALT

Cobalt which is usually associated with its neighbors, iron and nickel, is less well known and used in its medicinal actions, and in school therapy, not at all. At most solutions of cobalt nitrate have been recommended as an antidote in HCN poisoning. But in view of the rapidity of action of HCN it is hardly conceivable that there can be a formation of the insoluble cobalt cyanide.

After the introduction of any cobalt salt the inflammation of the stomach is said to occur. Moreover Lewin reports nephritic alterations after the chronic subcutaneous introduction of cobalt. The urine is said to be colored darkly by cobalt. Occasionally one finds spasms and central paralysis noted in cobalt poisoning in animals.

The Schneeberger bronchial cancer in workers in the cobalt industry in any case has no relation directly to cobalt but is probably to be ascribed to admixture of arsenic and even radium.

Cobalt was proven by Hering and Lippe (1850 and 1851) on the healthy.[598]

Of the 314 symptoms reported there, only a few have been confirmed by clinical use, so that the sphere of action of cobalt is almost completely dark. Practice has not yet yielded any selection. The best acknowledged symptom is a *pain in the back*, in the lumbar and sacral region, which is worse on sitting, better on

standing, walking around and lying down; moreover weakness in the knees, trembling in the extremities, also pains in the legs on sitting. These symptoms are said to be associated with frequent seminal emissions and deficient erection and impotence has been reported.

Headache worse on bending over, accompanies the sexual-neurasthenic state, likewise the sleep is disturbed by virtue of sensual dreams. Toothache with the feeling as if the "teeth were too long" is also stressed and pains in the region of the liver and spleen (similar as with manganese), itching from the warmth of the bed, white coated tongue.

A summarized picture for clinical use which would be furnished by comparison with the related remedies, cannot be given at present.

NICKEL

The close kinship of nickel with iron and cobalt is revealed in the frequently repeated meaning and also in the common natural appearance. Nickel also approaches copper in a further (horizontal) relationship and is separated from it with difficulty in the earth.

In modern chemistry nickel sponge is employed (similarly as palladium) as a catalytic carrier of active hydrogen. From nickel vessels nickel is dissolved by plant acids, vinegar, also lactic acid, in noticeable amounts on heating and cooking acid containing foods. Therefore many foods become colored in nickel vessels, for example milk becomes bluish. These small amounts are considered as harmless because the intestine poorly absorbs nickel.

For the usual standards of toxicology this consideration of non-toxicity in any case is correct (as also with other metals which go into solution in slight amounts when foods are cooked, for example, aluminium). But whether the chronic introduction of such traces may not still be injurious, although they do not produce severe toxic symptoms and therefore are not easily recognized, is still not a determined fact. Naturally here also a special sensitivity of individuals comes into prominence.

Theoretic discussion in this respect and in this question of hygiene do not lead any farther and a nickelophobia is just as untenable as an aluminophobia. Only

when such metal salts have produced injuries in special individuals and after removal of the presumed cause the disturbances again gradually diminish, would one be able to decide this question. For the validity of such a presumption naturally the better knowledge of the chronic action of such metal salts, as they are present or are strived for in homoeopathy must be obtained. With nickel this knowledge is still lacking as we shall now see.

TOXIC ACTIONS

The local corrosive action of the nickel salts scarcely enters our problem. Likewise the acute poisonings are not able to give us much help. That one can produce vomiting, diarrhoea and marasmus in dogs, with larger doses nausea and vertigo in man, contains nothing characteristic; nor does that smaller amounts given subcutaneously in man cause vomiting and in animals aid; outside of the intestinal symptoms, central nerve disturbances as trembling, twitching, stupor, paralysis are observed. In the chronic feeding of a nickel salts to dogs, outside of vomiting and diarrhoea, there is also lowering of body temperature, weakness and impaired cardiac work. Nickel is found enriched in the liver (analogous to Cu and Fe; the liver is probably an important site of storage of all heavy metals).

The nodular and vesicular eczema on the hands and forearms of workers who are concerned with nickel plating of objects is apparently not to be ascribed to nickel alone, but much more to the participation of alkalies in co-existing skin injuries. There is no doubt in regard to the local corrosive action, for example, of nickel sulphate.

PROVING

A single proving of nickel arises from Nenning. Hering believed that the nickel was not free from cobalt[599] and states that it is exactly the extensive similarity of the results obtained by Nenning with nickel with his own with cobalt which speaks against the usually conceded doubtful merit of observations by Nenning. Nenning's proving is found in Hartlaub and Trinks, Annalen de hom. Heilkunst, Bd. 3, p. 353.

SYMPTOMATIC PICTURE

With nickel the crude material of the results of proving are still too slight and the selection by practical use is still insufficient to delineate a sharp effect picture. As indications for practice are *periodically (14 days) recurring migraine* which begins on the left (eventually passing over to the right, so severe that the patient cries out, worse 10-11 in the morning, diminishing toward evening) (similarly as platinum which has the migraine more on the right); for nickel sulphate, the periodic neuralgia on a malarial basis also has a similarity with the iron indication for old malaria.

A survey over the symptom register of nickel, which is still insufficiently studied, permits even now a close connection to the effect picture of iron with the modification that in nickel, as is always true of non-physiologic metals, the central nervous actions are more strongly stressed.

The erethism of the vascular system is characterized by symptoms as sensation of heat in the entire body, always more warm than cold sensation, great unrest and heat at night, heat, heaviness and fullness in the head (forehead) with vertigo, pressure on the vertex,

as if from a hand or as from a nail, with improvement in the open air. The periodic 14-day headache is a precision from practical use. An asthenopia (eyes very weak, particularly evening, lachrymation on use) is brought into association with it and a peculiar symptom of macropsia: enlargement of remote objects (in contrast to the micropsia of platinum).

To these symptoms which all can be ascribed to altered vessel tension are added the usual dyspeptic symptoms: nausea, pressure in the stomach, tendency to constipation or faeces evacuated only with great effort even though they are not hard, of diarrhoea after drinking milk. A special note is sounded by the symptom: gastric distress as from emptiness but still no appetite.

Various disturbances of the menses are reported: too late and too early and intermittent, thereby weak. They induce great weakness. Of the leucorrhoea it states, that it is watery and appears especially after urination.

The throat symptoms recall to some extent those of manganese: huskiness and a dry cough from tickling in the throat, roughness in the throat which is relieved by coughing. The throat pains are said to be characterized by the fact that the involved side is very sensitive to touch. A severe cough may necessitate sitting up and holding the head with the hands.

All these symptoms offer an uncertain selection for therapeutic attempts in the future. The characterization of Hering that the drug is useful for mental workers with periodic headaches who are also weak, asthenopic, who have a weak digestion, who are constipated, who find themselves worse in the morning on awakening, can only be suggestive.

OSMIUM

According to the available insufficient reports osmium seems to have an entirely different action sphere than the other platinum earths with which it appears in common in nature. This is perhaps to be traced to the fact that the symptoms described particularly on the respiratory passages, skin and eyes are not of the metal, but erroneously from the so-called osmic acid, OsO_4. In a finely divided state, osmium oxidizes rapidly in the air to this step. The symptoms of osmium oxide are mixed with those of the metals in homoeopathic literature, for the metal never occurs without the oxide.

Even at ordinary temperature osmium oxide is volatile and develops severe penetrating odoriferous, dangerously irritating vapors. According to Lewin the conjunctiva and air passages are especially severely inflamed up to an asthmatic state and dyspnoea: but also bloody diarrhoea and a squamous skin eruption appears. After several months' occupation with osmium there were headaches, sleeplessness, nausea, albuminuria, dyspnoea, attacks of chilliness and finally inflammation of the lungs. In the now discarded injection of osmic acid salts into tumors or nerves in neuralgia, an inflammation of the skin occurs which may progress to gangrene.

These studies arise on the basis of special tissue affinities which have developed from microchemical staining

methods (fat with osmic acid-containing Flemming's solution and nerve demonstration) and are known to the physician.

In homoeopathic literature there is a translation of a long experimental work with osmic acid on animals and men by Branell[600] from the Latin by Bojanus who added two short provings on himself and also mentions a proving by Stockes.[601]

From these studies the homoeopathic osmium picture is abstracted. In actuality they refer not to the metal but to the volatile oxide, because the osmium triturations in the studies of Stockes certainly represent the oxide.

The severe inflammation on the conjunctiva, nose, larynx, air passages and bronchial mucous membranes, moreover the itching eczema and the odorous axillary sweat (resembling vinegar?) (the urine is said to smell like violets and the eructations like radishes!) are the local irritative manifestations which are less useful for homoeopathic indications.

The color and light manifestations around objects and the cloudiness of the vision occasioned Norton to seek in osmium a remedy for glaucoma. Otherwise the frequent headache, especially bandlike, and falling out of hair are stressed. A characteristic useful picture of osmium is not available.

IRIDIUM

Our knowledge of iridium actions rests on so small a basis that practically we take no notice of it.

A single prover, Tafel,[602] gave a few symptoms, of which a numb sensation in the ears and also in other parts of the body and cramp-like contraction of the calves and in the middle of the sole of the foot, recalls a kinship with platinum. Otherwise Labouches[603] has made a number of clinical reports (anemia and states of weakness in rapidly growing children and old people) but it needs no further discussion at present.

PALLADIUM

In homoeopathy one hears in general that palladium is extremely similar to platinum in action. In general the association between the ovarian and mental symptoms perceived as the characteristic and the practically useful.

It is however possible that the older observations are to be ascribed to impurity of the preparation; because in nature palladium is usually found in association with platinum. However it is also probable that the close chemical relationship lies at the basis of the pharmacodynamic similarity.

From palladium by suitable preparation and use one may expect great actions; at least if one thinks of its strong catalytic properties. It is an acceptor for loosely bound hydrogen and through this can act oxidizing, but on the other side it may liberate a very active hydrogen and thereby act reducing. By virtue of this chemical property colloidal palladium oxide, $Pd(OH)_2$ has been recommended as "Leptynol" for obesity. Otherwise as far as I know palladium is unknown and unused in school therapy.

The first drug proving with palladium was arranged by Hering[604] in 1850 on 12 provers. These are, apart from the provings with high potencies by McFarland (High Potency Provings) which are not available to me, the only ones which have become known. But in them there is nothing of a connection of palladium to

the right ovary and as good as nothing of the mental symptoms so that the clinical reports of Skinner and Lippe seem to be more valuable. *Pain in the right ovarian region better from pressure,* and a platinum-like but still somewhat different *mental state,* holds as the leading palladium symptom. This mental state is described as a great sensitiveness to praise, for applause and flattery and easily wounded pride; believe themselves easily rebuffed; in company easily irritated and excited, afterwards the ovarian pains are aggravated, the disposition depressed and tearful. The irritability is evident from the caustic expressions.

Of the many headaches are stressed: headache from one ear going through to the other over the vertex. Also a sensation as though the brain was shakened and a pressure sensation on the vertex is reported. Moreover great lassitude, aversion for bodily labor, improvement of complaints after sleep is reported.

On the female sexual organs the sensation of sinking and downward pressure has given occasion for the use in uterine prolapse (as with platinum); pains in the right ovary with downward pressure, heavy sensation in the pelvis, frequent urination with swelling in the right ovary. The feeling of downward pressure is said to be relieved by rubbing.

The frequent change of sensations among which is the sensation of numbness in the arms (similar as platinum), the aggravation by mental occupation, company, etc., makes the neurotic character of many symptoms plausible. To my knowledge there is no confirmation clinically for the above mentioned organic indications on the female sexual organs.

PLATINUM

Platinum is never employed in its pure form in school medicine. It is considered as non-toxic and inactive. Platinum was formerly recommended against syphilis. It produces externally, irritation of the skin with the formation of fine vesicles which may become so sensitive that opening a flask of a platinum preparation (for example platinum oxide nitrate) produced an erysipelas like redness of the face with itching and heat in the skin. Platinum chloride (0.25:180.0) internally produces salivation, nausea, mild icterus, headache, increase in the urinary output,[605] in greater amounts also burning in the mouth, colicky pain, bloody stool; in rabbits and dogs paralysis of the extremities.

Such general toxic symptoms of platinum salts say little about the peculiarity of platinum action. In this respect we may presume from physico-chemical facts that platinum can become very active after proper preparation. In fine division the metal is extensively used for oxidation and reduction catalysis. Colloidal platinum acts as a ferment.[606] It effects a splitting of ethyl butyrate and also its synthesis from ethyl alcohol and butyric acid and acts accelerating on the reaction like lipase.[607] It also accelerates the oxidation of alcohol to vinegar (like acetum bacteria) (Bredig). Platinum accelerates the decomposition of H_2O_2 as catalase. The velocity of the catalytic effect of platinum is proportional to the surface of the metal. Dilutions

which correspond to the D 8 prove distinctly active catalytically. The reaction accelerating catalytic action of platinum is depressed by extraordinary small quantities of HCN according to Loewenhart and Kastle[608] because HCN forms an insoluble coating on the metal particles. Through this the intermediate reactions necessary for catalysis are made impossible.

PROVINGS

Provings on the healthy are found:

1. Gross and Stapf: *Arch. f.d. hom. Heilkunst*, Nd. 1, p. 122, 1822.

2. A brief imperfect proving of larger doses of platinum chloride and platinum sodium chloride. Höfer (*Gaz. méd. de Paris*, Nr. 48, ref. in *Allg. hom. Ztg.* Bd. 19, p. 374, 1840).

DRUG PICTURE

It may be due to the insufficient proving with various amounts or more probably in the type of the metal that functional actions on the side of the nervous system predominate and the sexual organs are stressed. The most characteristic is the strongly *increased excitability of the nervous system with tendency to paroxysms*. One will involuntarily recall the reaction accelerating action of colloidal platinum. In the tense state it comes to *sudden reverses* which give rise to an impression of hysteria. On the peripheral nerves *neuralgias, paraesthesias and anesthesias* come into evidence. Then a paralytic-like weariness follows. The abnormal increase of tenseness extends further to the *sexual organs* and indeed particularly to the female. Here according to all evidence a close reciprocal relation between the nervous-psychic state of tenseness and

the female sexual organs is outstanding in platinum. Daily observations show the high grade dependence of the nervous equilibrium (disposition, neuralgias!) on the function of the female organs. The interrelationship through the endocrine organs is probable and in this form the old hypothesis of hysteria as a malady of the sexual organs could easily become restored.

MENTAL SYMPTOMS

The mental state of the platinum picture remarkably recalls that of hysteria; we find the *suddenly varying disposition, from elation to depression, from laughing to crying*; fear of demons, of losing the mind or of dying, worse in the evening, great influence of anger and fright. It seems noteworthy for the *haughty nature* of platinum that all persons and objects seem very small. It is to be considered that this smallness, this micropsia is functional and neurotic and not due to disturbance of accommodation or convergence. And indeed the association of superiority, of pride, a peculiarity so often found in the "hysterical" transformation will be found a flight from the feeling of inferiority. Platinum likewise is employed in the outspoken grandiose ideas of the manic state. Moreover common to the picture of platinum and hysteria is: *the physical symptoms diminish when the mental symptoms appear and reverse.*

NERVOUS SYMPTOMS

The increase of irritability in platinum, as in hysteria may go on to *paroxysms, to clonic-tonic spasms, to crying out, dyspnoea, etc.*, joined with characteristic sexual erethism which one finds expressed by preference

in positions and attitudes taken. The increased erotic trend also comes to expression in dreams.

Platinum also has a series of sensations in the peripheral nerve fields which seem to stand in transition from the psychic neurotic to the peripheral nerves. The increase of nerve irritability *increases and decreases gradually*, the *pains* of platinum having this characteristic-like stannum. The *pains* frequently are followed by *numb sensations*, a sign of excess over a certain stimulus threshold. The peripheral nerve actions are said to go on to trophoneurotic effects on the fingers and toes and platinum has even been recommended for caries of the bones of the feet. The platinum picture is rich in pains and they give an impression of hysteria. Sensations of tension and numbness prevail: sensation of numbness or superficial coldness appears in spots, constriction and numbness of the head and in the scalp as if tensed rigidly, similarly in the neck, worse evenings and on sitting; sensitivity from cold, numbness and crawling in the eyes, ears and in an entire half of the face as well as in the feet on sitting, also tensive cramp-like constrictive pains as from a firm band around the extremities. But this sensation of constriction also comes in the neck, in the epigastrium and in the chest where it embarrasses breathing. Another characteristic sensation is that of a plug, particularly in the headache, with painful pressure from within. The headache can be associated with trembling and twitching of the eyelids and flickering before the eyes; it is worse at rest and in the evening also in a warm room, better in the open air. The slow increase and decrease may also be suggestive here. Moreover the plug sensation is also noted in the chest and abdomen. A feeling of weakness prevails in the back, sacrum and the extremities and

may become quite severe. Trembling or rigidity of the muscles may be present.

ORGAN ACTIONS

The organ actions of platinum in the first line involve the sexual organs. A sexual erethism exists. The *excessive sexual libido* which is said to be present in the male is not so characteristic as for the female sexual functions; indeed in general platinum in its entire character is adapted for the female sex to a special degree. The excessive irritation of the sexual organs conditions the sensual itching of the genitals, at times associated with anxiety and cardiac palpitation: there is a tendency to onanism and the excitement may increase up to *nymphomania*. Thereby a painful sensitivity of the parts may be present, likewise vaginismus. The marked flow of blood to the parts is expressed in the pressing and drawing toward the sacrum and also in a pressing downward and the feeling as if the menses would appear. Platinum is also extolled in actual descent of the uterus. An irritated state of the ovary which is designated as ovarian neuralgia is often associated with a migraine in the frontal region. Corresponding to the marked excitation, the periods are *too early and too profuse* (not too long). The blood is said to be dark and clotted. Cramps occur at the appearance of the menses at times; during them there are many pressing pains. Less definite as a point of departure, theoretically as well as practically is the reported hardening of the uterus which has led to employment in myoma.

On *the digestive organs* there is an aversion to food because of sadness, then again ravenous hunger and rapid eating, loud eructations, persistent nausea with

anxiety and trembling. Obviously all these stand decidedly under the influence of the psyche. Formication in the anus, a shuddering of the entire body after stool also reflects the nervous component. A constipation with unsuccessful urging or only insufficient evacuation is said to occur on traveling. One other symptom is peculiar that the stool though soft as clay, remains adherent to the rectum. In the constipation and colic of lead poisoning platinum is an antidote.

On the *respiratory organs* and the heart occur only nervous manifestations in platinum: loss of voice and brief dry cough which is depicted as "hysterical," palpitation causing anxiety and an almost spasmodic yawning.

Dark, thin women and girls of tense fiber are said to be the *types* which are most sensitive to platinum.

SUMMARY

Chief Trends:

Central and peripheral nervous system. Hysteria. Increased nervous irritability, paroxysms. Psychically marked changes in disposition, changes between physical and psychic symptoms. Haughty nature. Neuralgias, paraesthesia, tense, numb sensations. Feeling of a plug; slow increase and decrease of pains.

Sexual Erethism:

Great sensitivity of the female genitalia. Nymphomania. Ovarian neuralgia. Menses too early and too profuse. Downward pressure.

Digestive Disturbances:

Under psychical influence: constipation on traveling. Stool remains attached to the bowel though like soft clay. (Rare: tropho-neurotic ulcers; lead colic.)

Modalities:

Worse on sitting and in the evening.
Better in the open air.
(Right side seems to be preferred.)

DOSE

As a rule the D 6 is employed.

MANGANESE

Manganese chemically is a close neighbor to iron. Corresponding with this fact in nature manganese is usually found in association with iron. The relationship is "horizontal" as so frequently occurs in the periodic system.

In plants at times manganese seems to have the role of iron as an oxygen carrier and indeed in the test tube oxidation catalysis of manganese salts is often used. Small amounts of manganese enter the human organism in grains and plants but nothing is known of a physiologic vital role of manganese in the human organism.

It is stated[609] that manganese as iron causes the number of red blood cells and the hemoglobin to increase markedly, but a lessening in the after effect, although exact investigations on this point have not been performed. Nevertheless manganese compounds have often found use in chlorosis and secondary anemias (usually with iron) on account of this iron-like action.

In the compounds where manganese appears in the basic fraction (2 and 4 valent) as well as in the acid fraction where it is 6 and 7 valent manganese determines the action, so that there is a great pharmacologic similarity in all manganese compounds. The compounds most used are manganum aceticum, $Mn(CH_3COO)_2$ which Hahnemann introduced into materia medica and potassium permanganate $KMnO_4$. But also

manganum muriaticum, $MnCl_2$, manganum carbonicum, $MnCO_3$, and the (4 valent) MnO_2 are employed in the same sense as the acetate.

The compound best known in medicine is the dark red crystalline potassium permanganate, which produces a violet red solution in water and even in a solution of 1:500,000 still gives a rose red color in water. On account of its marked power of oxidation potassium permanganate is often used as an antiseptic and deodorant. A further use occurs in morphine and phosphorus poisoning as well as an antidote in snake poisoning. A strong concentration acts locally on the mucous membranes producing marked swelling, dark discoloration and scab formation; particularly dangerous is the edema of the glottis. In poisoning there is vomiting, cyanosis, and finally cardiac paralysis. Often the difficulty in speaking is prominent. Albuminuria is also observed. On the contrary it has not been proven in manganese poisoning that manganese is excreted through the urine so that the kidney is not known to be a site excretion of the poison, though the intestine is with all heavy metals.

The experimental acute animal poisoning with compounds in which manganese makes the basic fraction as the sulphate, reveals some action on the central nervous system in the form of paralysis and tetanic spasms, so characteristic in chronic manganese poisoning. But also inflammatory alterations are found in the liver and spleen. This suggests a relation to the blood forming system.

CHRONIC POISONING

It is particularly remarkable that chronic manganese poisoning has such a great similarity in its central

nervous system symptoms to those of Parkinsonian syndromes and in a lesser grade to multiple sclerosis. The first description, on which apparently Lewin has based his report has not been forgotten in homoeopathic literature. In workers who were occupied in crushing manganese, Cowper[610] observed paralysis especially of the extremities with propulsion, moreover weakness of voice, vacant facial expression, flow of saliva especially on speaking. Even this first observer noted that though years elapsed after the removal from the work, practically no improvement occurred in the condition. Industrial manganese poisoning was described more exactly by v. Jaksch.[611]

Outside of the spastic paralysis symptoms (without Babinski), a peculiar gait and walking on the metatarsal phalangeal joint, propulsion and retropulsion, the facial mask, flow of saliva, and monotonous speech, v. Jaksch described spontaneous laughing and crying and psychic alterations. Likewise nystagmus, trembling of the tongue and extremities and limitations of the visual field (according to Lewin) are observed, moreover writing in small letters without the ability to make them larger. These represent many signs of disease of the basal ganglia as we see them after encephalitis lethargica so that one would think manganum to be the simillinum for the sequella of this disease. But neither here nor in the usual paralysis agitans have healing or improvements been reported with manganum. If one recalls that these represent severe organic injuries and also that the end state in chronic manganese poisoning does not improve, then he will not place his hopes too high in the expectations of a possible therapy in spite of the similarity. All these symp-

toms show degeneration in the central nervous system whose slight power of restitution is well known.

The process which lies between the acute poisoning and the endstage of the chronic poisoning, is to be conceived in the proving on the healthy; from this intermediate domain we shall best gain the healing indications of the remedy.

PROVINGS

The provings of manganese salts are found:

1. Hahnemann: *Reine A.M.L.*, and 2 Aufl., *Chron. Krankh.* (of mang. acet. and mang. mur.).

2. Lembke: *Neue Ztschr. f. hom. Klin.*, Bd. II, p. 28, and Bd. III, p. 4 (of mang. mur. and mang. oxid.).

3. H. C. Allen: *Amer. Hom. Observer*, Bd. III, p. 345 (of kal. permangan. with such great doses that almost only acute mucous membrane symptoms of the mouth were observed).

DRUG PICTURE

As a point of departure for the picture of manganese one may take its similarity with iron; but at the other end stands to some extent the nervous system actions which are very decisive in the heavy metals foreign to the body (as with almost all), but which we need not discuss from what has been said above. The *similarity to iron* is revealed: anemia, pale face, great fatigue and sensation of weakness, general improvement by lying (but especially as with ferrum and holding for the cough), congestion to the head, restless anxiety (also better from lying still), many headaches (as if too large and heavy) which become better in the fresh air if they have occurred inside a room and better in a room when they have occurred in the open air.

ANEMIC SYNDROME

The *disturbances of the menses* belong here: the periods come too early and frequent, but are weak; likewise intermenstrual bleeding occurs. But amenorrhoea is also reported from kali permanganatum, moreover marked pains at the period, in spite of the fact that the remedy has not been proven on healthy women. But Stauffer considers it as proven in the dysmenorrhoea of the anemic. Both forms of menstrual disturbances are found in iron. Also the accompanying digestive disturbances are similar to iron, but without special significance in manganese. Pressure burning and sensation of heat in the stomach and in the abdomen and especially in the hypochondria, acrid eructations and nausea are the signs. The relief of the abdominal pains by pressure is occasionally mentioned in the provings and by Lembke; there is also aggravation of the pressure in the stomach from external pressure.

Likewise the trend toward the liver and the spleen is to be recalled as they show patchy inflammations in acute poisoning. Lewin mentions icterus in acute poisoning. A clinical proof for the hepatic and splenic maladies as well as in the hemopoietic system is not available at present.

RESPIRATORY PASSAGES

Also the tendency to persistent catarrhs in chlorosis with the tendency to transition into tuberculosis is again found in manganese. The symptoms in the upper air passages are expressed even more distinctly with manganese than with iron. Common with iron here is the characteristic modality that *the cough is better on lying down.* Dryness, roughness and constrictive sen-

sation in the larynx, a deep cough without expectoration, on the other hand, easy expectoration in the morning without much coughing, expectoration of small yellow green clumps of mucous or bloody sputum; the catarrh is described in this way and the tendency to tuberculosis is very distinct. *These catarrhs are aggravated when the weather becomes damp and cold.* The severe mucous membrane alterations in the throat with oedema and ulceration in the local action of kali permangan. have given occasion for the use of this remedy in diphtheria.

Besides the catarrhal symptoms which involve the throat and larynx, there is still another trend of action on the larynx in manganese, that of *innervation of the vocal cords.* The weak and monotonous voice of chronic poisoning has been mentioned. Therefore the use of manganese is worthy of note not only for the catarrhal huskiness in professional speakers but also for the voice disturbances conditioned more by nervous factors. The larynx also seems to be a site of elective action for manganese and disturbances here, from nervous to tuberculous, come in the therapeutic field of manganese.

SENSE ORGANS AND NERVOUS SYSTEM

The frequently observed symptoms in the ear, sensation of occlusion and difficulty in hearing, ear noises, pains which radiate from other parts of the body, especially from the throat on speaking and swallowing, obviously stand in association with the catarrhal symptoms and are mediated through the eustachian tube. The changes in the weather are of great influence here.

Pains also go from the teeth into the ears; the toothache becomes unbearable on contact with cold.

Asthenopic complaints appear as signs of nervous exhaustion from singly directed efforts: the eyes pain from near work and from looking into a bright light.

A great sensitivity of *the skin sensory organs* is expressed in the symptom: pains in the most diverse parts of the body on touch as if they were sore.

All these nervous symptoms then pass over into many types of neuralgias of various parts of the body from altered sensation and numbness to twitching, tension, stiffness, weakness and trembling in the muscles and tendons, especially in the legs which obviously introduce the central disturbances of motion as early irritative symptoms to the central spastic paralytic manifestations of chronic manganese poisoning. The region of the *knuckles and heels* is an especially frequent site for the appearance of the pressing site.

RARE INDICATIONS

Added to the above trends of the iron-like picture of the blood injuries and the special tendency in manganese to definite involvement of the central nervous system are certain single assertions in the symptom registers which lie entirely outside of the sketch up to the present. These are the swellings over the tibia apparently inflammatory, sensitive to touch, which have been viewed as periostitis and erythema nodosa and swelling and pains in the joints with transversely changeable sites. Manganese has no other indications for the bone and joint inflammations. Itching and burning of the skin, unhealthiness and tendency to suppuration have also been cited as indications in old eczema and psoriasis but without any clinical confirmation giving the right for this.

SUMMARY

Chief Trends:

Anemic syndrome and menstrual disturbances. Catarrh: cough better from lying down. Disturbances of voice. Kali permangan. in diphtheria. Neuralgias, paraesthesia, great sensitivity of the skin, central disturbances of movement (end stage—parkinsonian syndrome).

Modalities:

Worse on change to damp, cold weather. Better from lying down.

DOSE

The dose of manganum aceticum is still very uncertain. Pot. permanganate has been recommended in the lower potencies.

CHROMIUM

The picture of chromic acid poisoning is so plastic and peculiar that one can scarcely forget it as the basis for the therapeutic indications. It is well known from many industrial poisonings (dyeing, electric chrome batteries, use of chromates in photography, chrome tanning) but also from unsuitable medical use (for corrosion, for suppression of foot sweats, in syphilis, and for the conservation of anatomic specimens). A very instructive case of chrome poisoning is cited by Riedlin.[612]

PICTURE OF INTOXICATION

The severe picture of acute poisoning shows accord with the other acid poisonings. The yellow to red yellow discoloration of the skin and mucous membrane or the vomitus from local or resorptive action indicates a special type of poison. The vomitus may be blue or greenish from the formation of chromium oxide. Vomiting, pains in the abdomen, early collapse, cramps in the calves and cyanosis is the severest, usually fatal, cholera-like picture. Thereby ulcers are found particularly in the large intestine. With a somewhat longer course an acute nephritis with hemoglobinuria or urinary retention occurs. Fever and single cerebral symptoms[613] as well as glycosuria and polyuria are also observed.[614]

More distinct lines of action and thereby better

points of departure for therapeutic indications are yielded from the chronic chromic acid poisoning. The chief trend appears on the mucous membrane of the naso-pharyngeal space and the gastro-intestinal canal and in the second line the action of the skin.

The peculiarity of the catarrhal manifestation especially in the naso-pharynx will be presented first in the homoeopathic drug picture. On the skin various eczematous papular, vesicular and pustular eruptions are observed. On the skin and mucous membranes the progressive effect leads to deep syphilis-like ulcers. One of the first signs is a painless perforation of the septum of the nose. One sees moreover that a great similarity with syphilis exists.

The chronic gastro-intestinal actions go from dyspeptic to gastro-enteric and finally to outspoken dysenteric manifestations. A longer course occurs with anemia, cachexia and finally the manifestations of a chronic nephritis. Lewin once saw at autopsy of a kali bichromicum poisoning, a nutmeg liver.

KALI BICHROMICUM

The chromic acid preparation which is employed almost exclusively in homoeopathy is kali bichromicum, K_2 $[(CrO_3)(CrO_4)]$. The homoeopathic school possesses an extensive elaboration of the remedy from the Austrian school: Arneth, Physiologischen Prufung, of the double potassium chromate.[615] In it the oldest animal investigations of Gmelin[616] cited by Wibmer[617] are introduced, moreover the animal experiments and drug proving of Drysdale (Liverpool) which introduced kali bichromicum into the homoeopathic materia medicine in 1844.[618] Likewise the Austrian provers society did not satisfy themselves with numerous provings on the

healthy but added animal experiments to those available. Thus this basic work performed in 1847 even today is not surpassed and is standard for the basis of our drug picture of kali bichromicum. Moreover the therapeutic use for decades has shaped the selection among the many symptoms and evaluated them by the test of clinical use. (The probings with high potencies of Berridge[619] are not yet evaluated.)

The animal experiments cited in the Austrian journal of homoeopathy give us the best confirmation for the crude symptoms known from toxicology. Convulsions and paralysis have been observed repeatedly in the severe intoxications of animals.

TYPE

In the industrial poisoning in the English factories it is always striking (according to Drysdale) that *fat and light haired* people are especially susceptible to kali bichromicum, which can serve as a constitutional sign. Likewise in these workers in chrome factories the modality of *aggravation* of many symptoms in *hot weather* was observed.

MUCOUS MEMBRANES: UPPER RESPIRATORY PASSAGES

Very distinctly developed, both from the intentional as well as accidental poisonings with kali bichromicum, is the chief trend on the mucous membranes of the upper respiratory passages. The *tenacious stringy mucous* is especially characteristic. The exudates at times seem to be pseudo-membranous and even purulent-bloody discharges are observed. At first the nose is the chief point of attack. Even Arneth correctly stressed that one cannot arrive at an explanation of

this affinity with the conception of a local action of chrome dust or vapors on the nasal mucous membrane, because the inflammatory manifestations also develop after the internal administration of the substance. The first stage is a coryza with considerable clear water and much sneezing, a coryza which is said to be aggravated from cold air. Moreover the watery discharge also appeared in the proving in hot weather. (In this regard the catarrhal symptoms of the upper air passages with aggravation from hot weather, which is particularly characteristic for the gastro-intestinal symptoms, seem to be the exception.)

The further course of the mucous membrane inflammation yields still better indications. Next come the most diverse sensations of dryness, tickling and burning in the nose, then pain and sensitivity of the nose, often nose bleed, outpouring of thick mucus, then, in the chronic industrial poisonings, tenacious, elastic, gummy plugs whose removal is painful. This refers to the lesion on the mucous membrane which is degenerating into the perforating ulcer of the septum. The perforation itself seems to progress fairly painlessly. Similar *circumscribed ulcers* "as if punched out" also arise in the course of inflammation of the palate and throat. Their similarity with syphilis should be stressed. The already mentioned skin and mucous membrane affections and certain pains which one refers to the bones, especially on the head and the tibia, increase the similarity. But without connection with this similarity and from the non-homoeopathic side, in France about 1850 kali bichromicum was used in secondary syphilis by Robin and in Germany as well, though today the chromate preparations in syphilis is again considered obsolete therapy. Recently again in homoeopathic lit-

erature a mercury compound of the chromate (merc. oxydulat. chromat.) has been suggested as a remedy in syphilis. It is to be considered in the cases where a differential diagnosis between mercury and kali bichromicum cannot be made and has repeatedly proven valuable to me in severe ulcerative processes of syphilis in the throat. The chronic kali bichromicum poisoning of the nose does not happen exactly as in syphilis for only the upper part of the cartilaginous septum is destroyed.

Also when ulcer formation occurs the nasal mucous membrane is persistently involved. This is signified by the loss of smell which seems to outlast the usual coryza; but the soreness of the nose is associated with an offensive odor of which the patient himself is aware. This degenerative mucous membrane symptom is the occasion for the use of kali bichromicum in *rhinitis atrophicans*, the ozena of syphilitic as well as scrofulous origin.

The coryza with a thick tenacious secretion (which is like that of hydrastis) can also cause symptoms of nasal occlusion, especially *painful pressure at the root of the nose* which can also be conditioned by involvement of the frontal sinus. Moreover the thick secretion, like that of hydrastis, may fall into the posterior pharynx. An occluding coryza in fat plump nurslings is said to be especially suitable for the remedy.

Many sensations of pain in and around the nose in the proving protocols refer to this site as one of predilection. Very similar are the inflammatory manifestations in the throat, which, with redness of the throat and soft palate, with difficulty in swallowing and oedema of the uvula may go on to the already mentioned ulcers. For the chronic catarrh, pharyngitis, the

tenacious stringy mucus is characteristic. Indeed as the initial symptom of the chronic mucous membrane affection besides the often mentioned sensation of dryness, scratching and sticking of the provings, there is the ever repeated symptom "feeling of a hair at the root of the tongue and the soft palate." It is, so far as I know, described only by one prover (Norton) as the early warning of an ulcer in the throat. In spite of the solitary nature of his report I do not see little value in such a detail but decisive in this respect is the question of whether or not it has proven a practical indication for kali bichromicum. And this seems to be the case.

Hoarseness, tickling and painfulness in the larynx and the trachea, especially in the region of the bifurcation, stitches under the sternum going to the back, irritative cough and oppression of the chest, labored breathing and chest pains are frequently observed, but particularly characteristic for the laryngitis, tracheitis and bronchitis is the repeatedly mentioned tenacious expectoration and moreover *the morning aggravation of the cough.* The pseudo-membranous deposits on the mucous membranes of the throat, the larynx and the trachea which has also been found in animals has led to the proven use of kali bichromicum in severe diphtheria. Here also the structural participation of the mucous membrane is essential.

In close connection with the inflammatory manifestations in the upper air passages stands the ocular inflammations of kali bichromicum. Here also then itching, burning, redness, swelling, lachrymation photophobia is the usual but not characteristic picture. The tenacious, yellow secretion or the pseudo-membranous deposit speaks first for a conjunctivitis in the direction of kali bichromicum. But also a torpid keratitis with

ulcer of the cornea without great pain and photophobia (indeed on the basis of the industrial poisonings) is found in the drug picture of kali bichromicum; moreover iritis with punctiform deposits in Descemet's membrane; here also the relatively slight pain with severe inflammation is guiding. However it is not apparent on what clinical observations these indications are supported.

GASTRO-INTESTINAL CANAL

If one proceeds according to the frequency of the symptoms observed under kali bichromicum, if the value of symptoms is to be statistically conceived, then the gastro-intestinal complaints must have precedence over those of the respiratory passages. But according to all experience this is not the case. That nausea and vomiting appeared in almost one half the provers is still not decisive for a special affinity of the remedy for the stomach. Because it is to be considered that this defense manifestation is something quite common, when, as it happens here, a different drug is administered in fairly massive doses. A preferential organotropy would be made probable first in that such symptoms were not only locally conditioned and rapidly transient but also appeared as persistent actions after the absorption of smaller doses. In such cases the symptoms also have finer differentiations and characteristics become evident.

The gastric disturbances of kali bichromicum show all the steps from functional disturbances to inflammation to ulcer: poor appetite, especially in the morning, thick yellow coated tongue, aversion to food, especially against meat, acid eructations or eructations of air, after eating an uneasiness in the stomach, gastric ac-

tivity seems suppressed, nausea and vomiting appear suddenly. Finally kali bichromicum is cited on the basis of pathologic-anatomic findings of a sharply circumscribed ulceration of the mucous membrane as a remedy for ulcer of the *stomach and duodenum*. For this are single observations of improvement of gastric complaints after eating included. For the gastric disturbances in the direction of kali bichromicum *the morning aggravation between 2 and 5 in the morning* (perhaps also the aggravation of the nausea on moving around) speaks, moreover the aggravation of the nausea from drinking water, though great thirst is often present. Moreover the desire for beer is stressed. This was repeatedly noted by one prover (Prof. v. Zlatarovich). However one also finds it repeatedly stressed in the materia medica that beer is not well tolerated and from this association it has said that kali bichromicum is particularly suitable for the gastritis of beer drinkers. But it was precisely the prover named who felt better after beer.[620] Riedlin[621] also reports an aggravation from beer, but he avoided it as it was "too cold."

The acute and subacute intestinal actions are, as previously mentioned, like dysentery. The brown foamy diarrhoea with tenesmus, at times bloody, shows the morning aggravation. Likewise for the enteritis the tenacious, stringy mucus like gelatin is said to be guiding and is considered an indication for kali bichromicum in mucous colitis; because of the tendency to ulcer formation under certain circumstances kali bichromicum comes under consideration in the most diverse chronic ulcerative processes. Moreover also a persistent constipation is observed in chrome workers and in the provers. It is said to be characterized by periodic recurrence and is associated with pains cutting

across the pelvis and the voiding of a brown urine. In addition to other sensations in the anus as burning and pressure, a sensation of a plug is also present.

OTHER ORGAN ACTIONS

From the frequent pains of different types in the liver region which were associated with pale clay colored stools, one has concluded that kali bichromicum has significance as a liver remedy. The above reported findings of Lewin and the newer animal investigations of Hinsdale which showed the fatty infiltration of the liver and an increase in the connective tissue support this suggestion. But clinical observation has not yet showed that this indication is sufficient to make a therapeutic indication from it. It is a mistake in the meaning of the simile rule when one would make *any* organotropic connection conclusively evident of a therapeutic action trend. In the evaluation of the total picture it appears that *the possibility* of a trend of action is not sufficient. The pathologic-anatomic findings on the organs are for this reason often entirely unsuitable for the emphasis of this value because they bear only the fixed precipitate of a functional event after the ended reciprocal play of powers.

The same also holds for the nephritis which also appears at times as a result of severe kali bichromicum poisoning. The frequently mentioned pains in the lumbar region can also support this indication. But without exact further guiding symptoms we could hardly select kali bichromicum from other renal poisons in a case of nephritis. It is certain that there are also diverse irritative manifestations in the urinary passages from kali bichromicum. Perhaps in pyelitis, cystitis, and urethritis it may lead to the secretion of

tenacious mucus. White sediment is also reported. As a special indication "the sensation as if drops remained in the posterior part of the urethra and cannot be pressed out" is perhaps useful from the proving.

On the female genitalia a tenacious yellow leucorrhoea is worthy of note; moreover irritative manifestations, itching, swelling of the external parts, like those on the male external genitalia, can lead to pustules and finally ulcers. Such a pustular and ulcer formation generally appears on the skin with kali bichromicum. The type of pustules which should heal with scarring has given occasion for the remedy in smallpox, just as the type of reactionless ulcer penetrating into the deeper parts among other symptoms has linked it to syphilis.

GENERAL SYMPTOMS

The kali bichromicum picture is rich in pains of the most diverse type which are present in the muscles, joints and bones. According to the site and character they have been considered now as rheumatic, now as syphilitic. Two properties of the pains are particularly worthy of note; first, *the sudden appearance and diminution* and rapid wandering from one part to another and, second, that they are often limited *to a small spot* so that one can cover the painful site with the end of the thumb. Both characteristics refer to neuralgias. The modalities of these pains are not fixed with certainty. Perhaps the best is aggravation from cold. In isolated instances they are relieved by motion but usually (especially at the beginning of motion) are reported as aggravated. The wandering pain, worse from cold, may be ascribed to the potassium fraction, perhaps, also the preferential site in the back (in the pelvis, sacrum and coccyx). Other modalities which

agree with those of kali carbonicum are the general early morning aggravation and the aggravation after coitus.

Then also an alternation between the gastric complaints and the wandering pains in the extremities is described as a sign of kali bichromicum on the basis of the provings.

Extraordinarily numerous in the provings are *headaches* and sensation of vertigo. In order to evaluate these reports, one must differentiate. The vertigo and many pains are associated with gastric symptoms, nausea and vomiting. Often the pains are associated with catarrhal processes in the upper respiratory passages. They were usually localized in the forehead and about the region of the nose. From all these headaches which cannot be more closely defined than secondary are separated several others resembling migraine or neuralgia. These pains again are limited to small areas, over one eye, unilateral pains about the orbit or in the frontal region which precede darkening of vision, cloudy vision, and vertigo. Here movement seems always to aggravate but the reaction to cold is not constant (once it states better in the open air, the other time worse from cold air), the time of aggravation is often in the morning but also an increase up to noon and decrease toward evening is reported. Since these modalities are not precise, the suitability of the remedy for the symptom concerned is less certain. Unilateral headaches with preceding visual disturbances are found in many drugs and differential signs are necessary. These must be introduced from other fields if one is to attack migraine with kali bichromicum. Kali bichromicum is most frequently employed in the headache associated with disorders of the frontal sinuses.

If one takes the single proving of Arneth's with the various steps of dilution, then one can read out of it that the wandering pains are evident in the highest dilutions (D 7) and here also the kali fraction comes into prominence while in the third dilution the symptoms in the upper respiratory passages stand in the foreground and in the third the gastro-intestinal symptoms begin, then in the first dilution the nose and the mouth symptoms appear in a very organic expression and thus the chromic acid fraction which differs from the potassium can always be distinctly recognized.

That severe chromic acid poisoning leads to anemic and cachetic states has already been mentioned. This is a sign that the remedy has the capacity to produce deep, subacute and chronic, general disturbances. Corresponding to this in the drug picture which has to be considered less in the end state is a great weakness. The occasional yellow discoloration of the cutaneous appendages by the colored chrome in the severe instances of poisoning naturally is not taken over into the therapeutic drug picture. This would mean to convert the meaning of the simile rule into nonsense.

SUMMARY

Type:

So far as determined at present, light haired, puffy.

Chief Trend:

Mucous membranes of the upper air passages and the gastro-intestinal canal.

Leading Symptoms:

The tenacious mucous.

The formation of pseudomembranes and circumscribed ulcers.

Pains limited to small spots.

Rapid change of the site of pain.

Alternation between gastric symptoms and rheumatic complaints.

(Doubtful desire for beer but aggravation from it.)

Modalities:

Morning aggravation throughout.

Catarrhal and rheumatic pains worse from cold, while the gastric symptoms in particular are worse in hot weather.

In general worse from movement.

DOSE

The middle potencies (about the 6 D) are preferred in general.

VANADIUM

Neither the metal vanadium itself nor its compounds have been proven on the healthy up to the present. The sodium salt of metavanadinic acid, $Na.VO_3$, in animal experiments yielded actions on the vasomotor and respiratory centers and the intracardiac ganglia. The severe toxic manifestations after injection are: motor paralysis, loss of reflex excitability, convulsions, stupor, irritation of the intestinal canal up to inflammation, lowering of body temperature, slowing of respiration and weakness of cardiac action. The blood pressure is reduced, the pulse weak, irregular, intermittent, the respiration initially accelerated, later slowed and fails[622]; from such acute poisonings one can learn as good as nothing.

In industry the salts of the lower vanadium oxide are used as catalysors of oxidation because the change in valence, oxygen is easily given off and taken up. In single invertebrate sea stars (Ascidia) vanadium plays the role of iron in the blood. Lyonnet and others report vandates, in particular ammonium metavandate, $NH_4.VO_4$, in amounts of 2-5 mgs., is a "roberans" for the improvement of the appetite, strength and weight. Accordingly the technically employed catalyzing property could also be appreciated for the excitation of metabolism.

From the exposure with vanadinic acid salts in industry, irritative states of the mucous membranes, the respiratory passages and the gastro-intestinal canal as

well as the kidney have been seen; as general effects, headaches, trembling as well as psychic disturbances.

The recommendations for vanadium preparations in homoeopathy are also merely clinical and very general; as a tonic for the stimulation of the appetite in early tuberculosis, in anorexia with states of irritation of the gastro-intestinal canal, anemia, emaciation. Moreover in homoeopathic materia medica a fortunate use has been obtained by Burnett in the indication: fatty degeneration of the liver and arteriosclerosis (with many pains in the course of the aorta, pressure in the cardiac region). Vanadium is also used in compound remedies for arteriosclerosis. The basis through the result in the case in which the diagnosis is by no means accepted without reservation does not exactly awaken confidence for such a grave indication.

COPPER

The elementary relationships of copper go in three directions: the horizontal direction to the nearby iron group on the one side, to zinc on the other, and to the vertical group relationship to silver. The sister relationships are expressed again in the frequent natural association of the iron and zinc with copper; they appear in the earth in the chalkosphere, usually in the sulphide forms, often with admixtures of arsenic and antimony.

BIOLOGIC ACTIONS

Biologically the relationship to iron is still visible in that copper in the form of haemocyanin plays the same role in the blood of crustacea and mollusks as iron in the vertebrates. Even from antiquity a connection of copper to the blood formation process has been stressed.

The agreement with zinc on the one side, with silver on the other, is found in the nervous system. Perhaps it is merely a foreign but still not absurd thought that a physical property as the particularly high conduction capacity for electricity and heat, as are peculiar to copper and silver, can be placed in relationship and compared in analogy to the especially strong tension in the nervous system. Finally must this especially great conduction capacity be grounded in the atoms and such properties must appear again in conjunction with the living organism.

Likewise that it is precisely copper and silver which show in a high degree the so-called oligodynamic actions must be founded upon similar special physical properties. The observations of Naegeli with copper have been the point of departure for these investigations. The millionth or milliard dilutions which still act lethally or exert damaging actions on lower organisms (molds, bacteria, algae) permit one to think of catalytic influences which involves an electro-magnetic charge in the vital tension. If one uses only very slight amounts of very finely divided copper or silver for the disinfection or the destruction of algae in large amounts of standing water and on the other side fairly concentrated solutions of copper sulphate for the protection against parasites in wine cellars, then one can draw the conclusion from this, that the medium has significance for the optimum necessary, that it determines the degree of liberation of effective powers, the impetus power of molecules. If we add now a simple rule based on observation that below a definite optimum of division which exists for the damage of living organs, there lies another promoting, then we easily see that the various steps of concentration for the promotion and likewise for damaging are possible and that these optima depend upon the conditions which do not involve the quality of the material. Actually with copper Richet has found several optima and minima in the concentrations for the development of lactic acid fermentation.

The lethal action of copper has been medicinally sought many times in the human organism. In tuberculosis the results of this chemotherapy are in no way striking. On the contrary copper preparations have proven themselves in the attack upon intestinal para-

sites in accordance with the ancient conception (for example cupr. oxid. nigrum, the remedy of Rademacher in taenia and ascarides).

A local corrosive action is held by copper salts in common with most heavy metal salts. They rest on the precipitation of proteins, the formation of metal albuminates. This property is used in copper sulphate on mucous membranes and formerly copper ointments were employed for the stimulation of granulation on ulcers.

COPPER POISONING

Acute poisoning with copper salts by mouth, in which copper sulphate and acetate come into consideration, show at first severe gastro-intestinal symptoms. The repugnant metallic taste of copper salts is very persistent. The vomiting which follows rapidly from copper sulphate is also therapeutically used, for example, in phosphorus poisoning it is a very suitable emetic because the copper at the same time renders the phosphorus harmless. However at present kali permanganate is preferred. The vomiting may also protect against further toxic manifestations. The vomiting occurs through the intermediation of the vagus. When this has been sectioned in animals there is no vomiting after copper sulphate. With very large doses of copper salts however a complete removal is not possible on account of the injury to the mucous membrane. Then a severe gastro-enteritis appears. To the vomiting is added salivation, burning and pain in the esophagus, severe colic like pain in the stomach and intestine, meteorism, diarrhoea with tenesmus, at times with blood. Widening of the pupils, small pulse, cold extremities can complete the picture of acute poisoning.

With a longer duration bile pigments are observed in the urine and often icterus, in the latter instance often a high grade anemia. Perhaps outside of the bleeding an accelerated destruction of the erythrocytes participates. Once[623] alterations in the red blood cells (anisocytosis, etc.) was observed. Debris of blood cells and microscopic hemorrhages have been described in all organs as autopsy findings. The trend outside of Rademacher and homoeopathy (for example by Hannon) stressed for the effectiveness of copper in chlorosis in place of iron might find some support in these toxic end damages. The biochemic connection of traces of copper which are found in the serum is not yet explained in respect to the hemopoeitic system. Deficiency of copper in the food is said to lead to anemia.[624] In hemochromatosis and certain cirrhosis of the liver one finds increase of copper.[625] One might think also of a catalytic role of copper in the new formation of blood.

In a latter phase of copper poisoning severe nervous symptoms appear in the foreground: vertigo, cramps with high grade cyanosis, especially severe cramps in the calves, trembling, paralysis, loss of consciousness. This syndrome has become the object for comparison for the homoeopathic use of copper in very acute states. The nervous effects also appear in acute animal experiment. At first fibrillary muscle contractions occur then muscle paralysis with complete loss of irritability, then cardiac weakness. It is noteworthy that a case of acute copper sulphate poisoning from an eczematous scalp, reported by Lewin, that symptoms developed after 24 hours which recalled the threatening state of cholera in the phase of asphyxia. Such pictures are seen in homoeopathic materia medica.

Even fatal copper poisonings do not run very rapidly, but death occurs only 7-10 days after the onset. Likewise in favorable cases recovery is very slow and the digestive disturbances may persist for a long time.

Lewin denies in general the possibility that so slight an admixture of copper salts which could occur by the storing of acid foods in copper vessels or through the green discoloration of conserves with copper sulphate could be injurious and seeks to interpret such poisonings in some other manner. But when one thinks that outside of the quantity, many other conditions can be decisive, then one ought not to deny in general so many reported instances of poisoning.

Likewise chronic poisoning is denied by Lewin (apart from the local discoloration of the hair and teeth and irritative manifestations in the upper respiratory passages from inhaled copper dust). But a chronic copper poisoning is described by others, for example, Roberts saw anorexia, tenesmus, tremor and fainting;[820] recovery after seven months. That usually metallic copper dust is not absorbed, because the particles are still too large is probable. But to be recalled in regard to copper salt poisoning is that the slowly progressive non-fatal intoxication still causes prolonged after-effects and also goes over into a subacute stage. The excretion of copper occurs very slowly (through the bile, stomach, intestinal glands, pancreas, kidneys, salivary glands, and apparently also through the skin glands). Absorption in greater amounts also occurs from previously damaged sites, mucous membranes and skin. The storage occurs chiefly in the liver, then in the pancreas, spleen, kidney, nervous system and muscles. Copper is ingested in small amounts with many plants, which derive copper from the soil, and therefore is quite constant in the body. But the production of resorptive symptoms through small amounts obviously presumes frequent introduction in fine division.

CUPRUM METALLICUM (AND ACETICUM)

Provings on the healthy are found:

Hahnemann, *Chronische Krankheiten*, 2 Aufl. Bd. 3, S. 212 (there also the first cupr. acet. proving of Franz: *Arch. f. hom. Heilk.* Bd. 3, S. 166 and a smaller number of symptoms of cupr. sulph. are found in Hahnemann's *Fragmenta de viribus*, etc.

A greater part of the symptoms in Hahnemann's writings are taken over from copper poisonings.

BLOOD ACTIONS

The use like iron in *chlorosis and secondary anemia* is almost as limited in homoeopathy as in older medicine. It is said that copper should be employed in chlorosis when iron has failed or after the misuse of iron. Furthermore copper has fewer symptoms of excited state of the circulation than iron. Pale cachectic appearance of the face and blue livid lips repeatedly come into expression. The provings and intoxications available in respect to the effectiveness on the red blood cells have already been mentioned.

CONSTITUTIONAL REMEDY

A considerable lack of clarity in the picture of copper arises from the fact that Grauvogl perceived copper as the chief remedy of the carbonitrogenous constitutional type. He came to this conception by mixing the Rademacherian conception with his idea of the three chronic miasms of Hahnemann. For Rademacher copper was the third of his universals, that is, remedies which were adapted for primary maladies of the entire organism. Since the two universals were given for the two other constitutional types and indeed natrium nitricum for the sycosis of Hahnemann or the hydrogenoid constitution of Grauvogl and ferrum for syphilis of Hahnemann or the oxygenoid constitution of Grauvogl, only copper remained for the psora of Hahnemann which was placed equal to the carbonitrogenous constitution.

But it by no means proceeds from what we know of copper that it especially promotes the carbon and nitrogen retention processes nor on the other side that it is

able to balance them. Likewise the theoretic explanation of Grauvogl that copper is able to effect an improvement of such processes through increased oxygen intermediation, cannot be correctly maintained. At least it is not apparent why the still more marked oxygen carrier iron would not be a remedy for the same constitutional type. On the contrary we could count copper just as well as iron to the constitutional type which is characterized by excessive oxygen influence, namely the oxygenoid. This agrees thoroughly with the entire neuropathic drug picture of copper. The sole trend in the copper picture which can be counted to the psora of Hahnemann is the clinical report that copper (just as zinc) is suitable for such maladies (in particular nervous) which can be traced back to the suppression of eruptions and secretions. And this report again goes back to Rademacher. That Hahnemann included copper among his antipsoric remedies states nothing since this finally happened to all drugs with persistent effects.

Of the trends of a carbo-nitrogenous constitution which today come near arthritism, practically nothing is found in copper. Moreover the reported aggravation in hot weather has no support from the proving protocols. (Moreover this aggravation appears in the oxygenoid constitution as well as the carbo-nitrogenous.) From the reports of Rademacher in which copper was of use under purely empirically obtained circumstances one cannot recognize in general any characteristic trends for the copper picture.

ANTISPASMODIC

The accepted action of copper arising out of the provings and poisonings as well as from use shows distinctly the chief trend on the *nervous system*. The outstanding trend is the general *state of spasms*: spasms recurring

at irregular intervals in the voluntary nerve muscle system as well as in the field of the vagus. The convulsive manifestations go from localized twitchings of single muscles up to the most severe tonic-clonic spasms.

To begin with the general spasms: the severe *epileptic attacks* particularly nocturnal, when the aura rises from the knees, spasms from the hands and feet go upward; at first the thumb flexes then finally the hand becomes spastic and then the tonic-clonic spasm becomes general. The usual piercing scream which precedes the attack suggests a spasm of the larynx and esophagus. An excited state with disconnected babbling is observed at times clinically as the precursor of an attack. The same has been reported in cases of poisoning with cuprum aceticum, where, indeed, it amounted to a maniacal state. Great restlessness and fear of death are further warnings, considerable vertigo with loss of vision (on looking upwards), confusion, a heavy head, severe paroxysmal headaches, worse from contact and pressure also belong to this picture. The tendency to severity and to malignity is also taken over from the psychic picture of epilepsy. After the attacks the exhaustion is said to be great. Sleep in copper is very deep or restless from dreams and with twitching.

The convulsions in copper do not show epileptic nature alone, but also the hystero-epilepsy, particularly before the menses; in spasmodic dysmenorrhoea and uremic spasms (there usually cuprum arsenicosum) it is recommended, when the attacks have the above described course. Also spasms from dental origin or worms in children and other states of brain irritation (hydrocephalus acutus) can give occasion for thinking of copper for the attack itself while other remedies as calcarea and chamomilla are preferred for the underlying situation. In worms one has also to think of the

lethal action of large doses of copper. Moreover the symptoms of brain irritation from suppressed eruptions (measles, scarlet fever) are to be remembered.

Partial spasms appear particularly in the field of the vagus: spasmodic constriction of the esophagus with difficulty in swallowing, "fluids roll audibly through the pharynx and esophagus," spasms may hinder speaking and particularly spasms of the bronchi with attacks of spasmodic coughing; a very severe constriction in the region of the xiphoid or a cutting transfixed pain from the xiphoid process to the vertebra (probably a spasm of the diaphragm) with failing or piping voice, "the patient must compose himself in the agony of death."

After this description the old fame of copper in *whooping cough* becomes understandable. As in all convulsions here also, the cyanosis is characteristic. Squinting, twitching, cough so that the child loses its breath or vomits spasmodically, afterwards lies down for a long time as if dead, then breathing gradually recurs again—the description of a severe copper whooping cough. Drinking cold water may abort the attack at the beginning (likewise other severe spasmodic coughs with suffocative attacks). The *nocturnal aggravation* also holds for whooping cough. Spasmodic dyspnoea, accelerated, short, labored breathing, spasmodic asthma with rales in the chest are similarly characteristic indications of copper. Great exhaustion up to attacks of fainting between the attacks of suffocation are also indications for copper.

The spasmodic character of copper extends itself to the maladies of the abdominal organs: spasmodic constriction in the stomach or abdomen, spasmodic vomiting, board-like rigidity but very sensitive abdominal wall, intermittent gastric spasm or intestinal colic of

the most severe type, tenesmus as well as constipation as well as choleriform, gushing, watery, green diarrhoeas. The picture of cholera in the convulsive state will be completed by cold, cyanosis, precordial anxiety, tendency to collapse and particularly the very suggestive cramps in the calves in copper. The comparison of copper with cholera has been previously mentioned. For Hahnemann and his contemporaries in any case copper was one of the most important remedies for cholera (besides veratrum and camphor). Fortunately we lack experience. In any case the tendency to intermittent spasms, collapse through diarrhoea is important for copper, particularly in children.

The intermittent, paroxysmal spasmodic character goes through the entire picture of copper. The spasms are general or localized, the general tonic-clonic, the local cramps in the calves tonic. Fear is mentioned as particularly giving occasion to the attacks.

SUMMARY

Chief Trends:

1. General and partial spasms in the voluntary and spasmodic states in the vegetative nervous system.
2. Connection with blood formation.

Modalities:

Worse at night, before the menses, from contact, cough from cold air.

Better from cold drinks (whooping cough; also colic, vomiting and spasmodic swallowing).

Causative factor: suppressed eruptions; fear?

DOSE

The metal has proven useful in the D 6 but also in the D 30; the salts are usually employed in the lower and middle potencies.

SILVER

Silver stands close to copper chemically and pharmacologically. The so-called oligodynamic actions were first observed by Naegeli[627] with these two metals. The contraction of the bands of chlorophyll in the plasma membrane of the alga, spirogyra, was the indicator of these actions. From many investigations which have since been concerned with this problem, it proceeds with certainty that the metallic silver in distilled water such as conductivity water goes into solution, and indeed in an amount which corresponds to the D 5 potency.[628] The oligodynamic action of apparently higher dilutions is explained in all probability that metal particles are absorbed by the glass walls and are slowly given off again into the water so that after repeated rinsing of the vessel there is still a dilution of the metal in the D 6-D 7. This shows distinctly depressing and lethal effects on bacteria.

At the time of Hahnemann only silver nitrate $AgNO_3$ was employed and it appears quite remarkable that at that time Hahnemann[629] should have seen metallic silver effects in the organism. Because the general view is expressed by Sachs[630] when he states: "Metallic silver is insoluble in the animal organism and therefore cannot serve as a medicament." A single observation such as that of White,[631] in which a patient who accidentally swallowed a silver coin which was carried for 18 months was cured of epilepsy also cannot awaken much con-

fidence on the effectiveness of metallic silver. The certainty with which Hahnemann introduced metallic silver into the drug treasury is all the more remarkable. He has obtained splendid confirmation in this respect by recent investigations.

ACTION AS COLLOID AND SALT

It has required a large series of studies[632] in order to bring proof that the actions of the colloidal metal in its chief manifestations are the same as its corresponding salts. Colloidal silver preparations constantly split off silver ions in watery solutions and the presence of these ions is decisive for the action. The hydrosols, that is, the water dissolved colloids have the same action as the salts with the same cations in suitable, usually very low doses. For a decision on the activity of a silver preparation there is also its ability to dissociate. If now, in many textbooks of materia medica silver is denied having any general toxic influence on the organism, then this obtains only in the form where one employs it as the metal. But even poisoning from absorbed silver nitrate is denied. "Resorptive silver poisoning does not occur in man, only a grey black discoloration of the skin and many internal organs develop after the year long use of silver compounds through the deposit of insoluble silver (argyria)."[633] But Lewin[634] finds an acute as well as chronic poisoning with silver. The corrosive actions from silver nitrate as it is employed externally in the usual case, are slight in the stomach because of the combination with protein and chlorine so that often no symptoms are observed from the accidental swallowing. An absorption of silver compounds certainly occurs, not only from the stomach where the silver albuminate dissolves in sodium chloride

or perhaps silver chloride may be taken up, even from the skin. According to Lewin poisonings in the human are observed when silver nitrate solutions have been used for several years as a dye for the hair. Indeed the mere fact that argyria exists proves absorption. Outside of the intestine silver is excreted through the kidneys (according to Lewin but denied by others) and what is important for the action of silver, also in the stomach after parenteral administration. Thus it is understandable that gastric manifestations can occur which are not explainable through primary local influence. The partial retention of silver in the tissues conditions argyria. The deposit is found in the skin perhaps in a reduced form, perhaps, also in the upper layers in organic combination as under the rete malpighii and cannot be removed by any measures. Lewin mentions that besides argyria at times stomatitis without salivation, gastritis, albuminuria, depression, dullness, weakness of memory, ear noises difficulty in hearing, visual weakness and spasm of the eye muscles develop. At times oedema of the lower extremities and ascites develops. In older materia medica texts[635] cachexia, emaciation and dropsy are mentioned as results of prolonged extensive use of silver nitrate. Even the Arabian physicians knew these actions of silver. T. R. Köchlin[636] states: "silver was employed by the Arabian physicians against dropsy, but can also produce a fatal dropsy."

Of acute symptoms of poisoning there are severe gastro-intestinal symptoms, vertigo, spasms, loss of consciousness, loss of sensitivity over the body and involvement of cardiac activity, widening of the pupils which do not react to light as Lewin also cites. In animals after injection of silver compounds paralysis of

the central nervous system and soon after death is observed.

STANDARD USES

The official position toward silver as a drug has appeared in a new place since the employment of colloidal silver, of collargol. Until then in school therapy only silver nitrate had significance and indeed in the first line as a strong external corrosive agent which contracted the smallest vessels and created a firm but superficial scab and at the same time worked antibacterially. On this rested its local use on the skin and mucous membranes. The sole internal use even today of silver nitrate in school therapy is in gastro-intestinal affections and in particular in chronic gastritis, gastric ulcer, less often in chronic intestinal diseases and diarrhoeas. The action on the gastric mucous membrane moreover has been viewed as similar to that on other mucous membranes as, for example, in urethritis gonorrhoica, that is, astringent to corrosive and disinfecting. But we shall still learn the gastric symptoms of absorbed silver, which lie near to a healing effect in gastric affections without one tracing these back to crude effects.

But the uses of silver nitrate are entirely neglected in nervous diseases. Formerly it was recommended epilepsy, chorea, still later in tabes and other diseases of the spinal cord. The indications in angina pectoris and cardiac irregularity were still mentioned by Vogt, furthermore the use in older times in dropsy and ulcerative cachexias, which, as we find can also be provoked through the persistent use of silver nitrate. But all these indications were obtained purely empirically, ab usu in morbis.

An entirely new field, the infectious diseases, was opened for the internal use of silver through the introduction of colloidal silver (by Crede, 1897). One now recalls that even the Macedonians treated wounds by covering them with silver discs and erysipelas was treated in some regions of Italy by the same remedy. In all types of septic affections, in particular the septicemias and even pyemia, in general in the most diverse infectious diseases collargol has been employed, in joint rheumatism and erysipelas, in pneumonia, in typhoid and paratyphoid, in appendicitis, furunculosis, phlegmons, anthrax, cerebrospinal meningitis and scarlet fever, diphtheria, dysentery, etc. The results obtained have been judged differently, indeed nothing else could be expected from a use so generalized. But two manifestations seem especially frequently observed after the employment of collargol: fall of temperature and subjective sense of well being of the patient for a few hours after the injection. But on the influence on the disease process itself, on the ultimate healing actions, decisions are always reserved. With this influence on septic or in general infectious diseases, one is not concerned with a peculiarity of colloidal silver but an action also approximated by other metal hydrosols. Only the colloidal silver is especially frequently employed.

CATALYTIC WORKING MECHANISM

It is now a question as to how the action of metal hydrosols and collargol is to be understood in septic diseases in particular. The simplest conception is that the infection producers are directly attacked through the finely divided metal. The killing of protozoa (paramecia) according to the studies of Filippi is effected even in a dilution of colloidal silver of 1:450,000 (also at least the D 5). With the various bacteria dilutions of 1:50,000-1:100,000 (also D 4-D 5) still effect complete depres-

sion of development, in case the colloidal preparation was sufficiently fine. Against molds colloidal silver is fairly indifferent. With the usual doses of collargol with intravenous injection (011-0.45 g.) the dilution in the blood corresponds to the amount effective in the test tube (about D 4).

But we know the finer process in the death or the depression of development of the microorganisms just as little in the test tube as in the organism. However there are single points of departure for the view that the influence of finely divided heavy metal on microorganisms is concerned with a catalytic process, that is a promotion of the defense reaction of the organism against the actions of bacteria purely by the presence of the metal. Schade[637] assumes such an action to be an acceleration of oxidation. Nearly all toxins are extremely sensitive to oxidation. And it is exactly the heavy metals which are suitable catalysors, which can accelerate oxidation in a great circle of reactions (group catalysors). It is to be observed that this catalytic action is not limited to colloidal silver nor to definite reactions. The inorganic ferments (according to Bredig) in general are not limited to single reactions as are the organic ferments. "Now catalysis is a function of the (silver) surface, therefore proportional to the grade of division of the silver. The finer the particles, the more intensive the capacity for catalysis" (Schade). The dispersed red solutions are more effective than the green and these again are more active than the crude grey.

In regard to the action on toxins Hamburger has shown the depression of staphylolysin by collargol as measured by its hemolytic action.[638] Fod and Agazotti[639] could not demonstrate an action of silver hydrosol on toxin in the test tube, but when it is injected immediately after the toxin into the blood stream: an intravenous injection of collargol then defends animals

against tetanus, diphtheria, and dysentery toxins in doses which are greater than 10 times the minimal lethal doses. The authors therefore conclude that the silver hydrosol activates the oxidizing ferments of the organism.

The salts are lethal on protozoa in about the same dilution and the same metal content as the colloid of the same metal. But according to investigations it seems that the influence of the colloidal metal is less on the ferments than that of the salts. It is worthy of note that small amounts of silver hydrosol activates the diastatic ferment of the liver and of the blood serum. The acceleration of autolysis, that is, the self digestion of an organ through its own enzymes, has been demonstrated with all hydrosols investigated and silver belongs to the hydrosols which promote the autolysis in minimal amounts. While normally the uric acid arising in autolysis is subjected to further destruction through a uricolytic ferment, this action will be depressed by silver hydrosol. Silver hydrosol action on autolysis can be poisoned by minimal traces of HCN and likewise in its capacity to destroy hydrogen peroxide.[640] This is also a type of catalysis and it is a support for the conception that the action on bacteria is catalytic. And what may be presumed on single micro-organisms is an acceleration of the process of oxidation which has been confirmed by the metabolism of the total organism. According to Ascoli and Izar[641] silver hydrosol, which however must be stabilized with gelatin, increases nitrogen metabolism and indeed chiefly the nuclein metabolism in that a significant increase in uric acid occurs in the urine. The stabilized silver hydrosol thereby contains amounts of silver salts which qualitatively exert analogous actions. Thus it is understandable that at the end of a very long maintained introduction of silver emaciation and cachexia can develop, as also with other chronic metal poisonings.

All these actions on microorganisms and bacteriotoxins, on normal ferments and enzymes of autolysis and on nitrogen metabolism are not peculiar to silver. Special effectiveness of silver in infectious diseases is entirely missed in our drug picture. It is not concerned with a reaction on the organism which is specially

limited to silver, but here expresses only a group affinity. And even in these non-specific actions there are quantitative relationships so that one can refer to the catalytic effectiveness of smallest amounts. How slight indeed the concentration may be in biologic actions is evident precisely with silver! Walbum[642] has seen actions of silver nitrate in artificial tar tumors of mice in concentrations which correspond to D 23.

ARGENTUM METALLICUM AND ARGENTUM NITRICUM

If we would learn the effect field of silver, whether as the metal, or as the nitrate, we must place our trust in the results of provings on the healthy. With silver we have outside of the original provings of Hahnemann[643] on 9 provers and an extensive reproving by the Austrian provers and indeed by I. O. Müller of argentum nitricum with 7 provers (and females as well)[644] and a self investigation of Huber with Arg. met.[645] In the extensive work of Müller one finds the entire history of silver and its use discussed in detail. A further proving of argentum metallicum is found in Hering.[646]

NERVOUS SYSTEM

The action on the nervous system stands out as the chief trend of silver in the organism and indeed *especially on the central*; the silver maladies have a slowly progressing deep penetrating character. The tendency to involve the nervous system seems (according to I. O. Müller) to have first been recognized by Paracelsus as his "virtus cephalica." A series of psychic and mental symptoms appear in the provings in which argentum metallicum affects the intellect alone; in argentum

nitricum it is especially the behavior which is involved. In both there is blunting of thought, weakness of memory and loss of it. All mental and head symptoms are aggravated by *mental effort*. In argentum nitricum it is expressed especially as a general trembling weakness with anxiety and mental restlessness, anxiety as if something terrible was to happen, or that death would occur or some planned undertaking would go amiss. Likewise *hastiness* is striking, tendency to impulsive acts, for example to thrust the feet through the window. Hahnemann states: anxiety which makes him move rapidly. Time goes much too slowly for the argentum nitricum patient (as with cannabis indica). There is great desire to arrive at the right time; through this diarrhoea can be provoked. With the great weakness there is great bodily unrest and nervous excitation, in isolated instances convulsions at short intervals. The nervous exhaustion is expressed in other cases in a propensity for sleep. In the anxiety there is another accompanying symptom, the tympany which embarrasses the breathing of the patient. An important symptom for argentum in general is *vertigo and lack of recollection, "a kind of intoxication,"* according to Hahnemann; in one case "semi-sleep with vertigo with a kind of convulsive shaking of the body as in epilepsy" occurred. This type of vertigo has become the homoeopathic indication for the use of silver in epilepsy, for the so-called epileptic vertigo or for epilepsy with much vertigo, particularly at night. Hahnemann did not consider the empiric fame of argentum in the usual type of epilepsy as plausible and asserted that the cures could be traced back to the copper content. In actuality copper was much more frequently employed in epilepsy than silver. Moreover among the severe mani-

festations of poisoning with silver nitrate a case is described in which the attacks closely resembled epilepsy: "complete loss of consciousness with absolute loss of sensation, convulsive movements of the upper extremities, face and trismus; eyeballs fixed and directed towards above; pupils widened and insensitive (against light?). Later deep coma with loss of sensitivity which lasted two hours and for two days recurred paroxysmally."[647] In a case of epilepsy with the other symptoms referring closely to argentum nitricum there was no doubt in my mind of a healing action. Transient blindness is also observed in the vertigo of argentum. Together with the peripheral nerve manifestations and the vertigo we perceive the indication for the use of locomotor ataxia or beginning tabes dorsalis. In particular *uncertain standing and walking*, also in the dark and after severe mental effort is cited.

Headaches are practically never absent in silver provings; they are severe, boring, pulsating and an especially frequent site is the *left eminentia frontalis*, for example, in Müller's proving. This preference for the left side in argentum nitricum has also been demonstrated in other respects: *the left side should be strikingly weak.* At the height of an attack of hemicrania there may be vomiting of bile and in general the entire organism is involved so that the patient feels miserable and weak. At times the attacks of pains have an outspoken 24 hour periodicity, 11-12 in the morning being cited as the aggravation time for argentum metallicum while otherwise the majority of complaints of argentum nitricum show a nocturnal or early morning aggravation. A feeling of enlargement of the head is reported many times in the provings so that the entire head feels puffy and distended. *This feeling as though a part of*

the body was distended, is generally considered as more characteristic for argentum nitricum; it recurs in the tympanitic abdomen and the sensation of enlargement with pain in the ovarian region. The headache is *relieved by pressure and firm bandaging,* particularly when the sensation of enlargement is present. Cold is also said to relieve. Overuse of the eyes, particularly from close work is also said to aggravate.

A series of complaints appear in the *peripheral nerves.* Dental pains are aggravated by contact with cold water. Drawing pains in the left infraorbital region, in the lower jaw and the teeth are mentioned many times so that argentum nitricum comes into consideration for facial neuralgia. Neuralgic pains are observed especially frequently in the sternum and the ribs, in the region of the sternal junction of the fifth left rib and along the entire border of the left lower ribs. These pains are aggravated by contact. Severe, cutting, drawing, lancinating pains go through to the back, along to the sacrum and shoot like lightning through the arms and legs. Crawling as if insects were on the skin; sticking and biting in the skin, feeling of part going to sleep, complete the picture from the sensory side; the tendency to trembling and convulsions, the heaviness, fatigue and stiffness especially in the calves from the motor side. It has already been stated that the peripheral symptoms have led to use in diseases of the spinal cord, in particular tabes, but they may offer still other signs for silver.

Newer reports, particularly from the American side, that argentum metallicum has special association to the joints, bones and cartilages appear to go back to Huber's self-investigation. But when one reads through the symptoms of the proving, then there is no occasion for

such a conception as it is brought to expression in Huber's summary of his work. Even if in his report, pains as if dislocated and bruised, recur very frequently and often about the region of the joints, still these symptoms speak for the peripheral neuralgias and a participation of the bones, cartilages and joints is in no way made probable. By American and French authors (Boericke, Jousset) a contraction of the finger and partial paralysis of the forearm is cited for argentum metallicum and taken as indications for writer's cramp. Of the peripheral sensations tickling and itching as from the crawling of insects on the most diverse parts of the skin is most frequent, also in the anus, and at times itch-like stippling. This nervous itching has occasion Sellentin to employ argentum in pruritus.

MUCOUS MEMBRANE AND ORGAN ACTIONS

A splinter-like sensation is characteristic for argentum nitricum on the *mucous membranes*, particularly the throat and the urethra is stressed. This stimulus goes farther, in the mouth and throat to general dryness with a feeling of soreness and roughness, particularly in the larynx, with much hawking in consequence to tenacious, thick mucus, up to hoarseness which is increased by use of the voice. Argentum metallicum is gladly used by singers and speakers when they have an aphonia after prolonged use of the voice. Also a dry cough which arises from laughing or tickling in the larynx or from a raw spot in the suprasternal notch, with considerable sputum is repeatedly mentioned. In argentum metallicum it is said to have the appearance of boiled starch. It approximates a severe intoxication when symptoms appear from the deeper respiratory organs: dyspnoea with a sensation of suffocation and de-

sire for fresh air, worse in the horizontal position and better on moving about. We know that the respiratory symptoms in poisoning in animals take on a spasmodic picture up to paralysis of the diaphragm and respiratory standstill through paralysis of the respiratory center. The dyspnoea dependent upon meteorism in argentum is also to be recalled. Moreover a sensation of weakness is noted particularly in the left chest. If we put the symptoms from the respiratory organs together then the impression is increased that it is a nervous disturbance for which argentum is primarily adapted and that no sufficient support is present for the reports of laryngeal or pulmonary tuberculosis. The form of asthma and whooping cough coming under consideration also and indeed more often succumbs to the influence of the related copper. Great desire for fresh air and improvement on moving around are cited as indications.

The slight influence of silver on the heart, nocturnal palpitation without particular alteration of the cardiac action does not awaken much confidence in the old indication of angina pectoris. Palpitation and unrest in the cardiac region are obviously of a functional type; they are said to be aggravated by lying on the right side and improved by lying on the left side (counter pressure).

Marked inflammatory manifestations in the mouth, as burning, sore tongue, white coated tongue with swelling of the papilla, ulcers at the border of the tongue and margins of the cheeks, swelling, looseness and easy bleeding of the gums, inflammatory swelling of the soft palate and increased flow of saliva belong to the rarer manifestations. Together with the still to be mentioned emaciation they have been cited as indications in mercurial cachexia. Of the further tendency to ulcerations

in the throat, those of luetic origin should be particularly mentioned but this indication is extremely rarely employed.

The *gastric complaints* of argentum nitricum consist in severe gastralgias; a small spot between the navel and the xiphoid is very sensitive to pressure or in the stomach immediately under the short ribs there is a sticking pain like ulcer; *attacks of gastric pain* appear particularly towards midnight with nausea and tendency to vomiting which often increases up to gastric spasm, *radiates* in all directions, but particularly *towards the chest* impeding respiration and it is said to be *relieved by pressure.* Anorexia as well as ravenous hunger may occur. Likewise school therapy has employed argentum nitricum in gastralgia and in gastric ulcer but in massive doses and under the conception of an astringent action. It is not improbable that the results even in this therapy may depend upon the minimal fractions of silver succeeding in being absorbed, when the case is otherwise suitable for argentum nitricum with the close connection recognized today between vegetative gastric disturbances and the formation of ulcer it is understandable that argentum nitricum would prove itself homoeopathically in functional gastric spasm as in gastric ulcer. As the abdomen tends to meteorism, so the stomach is distended, with the sensation as though it would burst. In the gastric complaints there are frequent, tasteless eructations of air.

The evacuation of stools is accompanied by considerable flatus. The stools are diarrhoeic, at least, this is the most frequent action in the provings, and constipation is observed only in isolated instances as a late effect. The diarrhoeic stools are greenish and offensive, often (nocturnal) colicky pains precede. The diarrhoea

is *aggravated by sugar, for which a great desire exists, in spite of the fact that it is not borne well.* Moreover the aggravation of the diarrhoea by drinking seems to have been clinically proven: diarrhoea as soon as the patient drinks; fluids seem to simply run through the stomach and intestine. For the nervous character of the diarrhoea speaks its aggravation through any mental commotion. That the disease lying at the basis of the diarrhoea in argentum nitricum is dysentery, typhoid, cholera, in which the remedy was formerly used by old physicians is in any case the exception. Better is the homoeopathic indication of chronic diarrhoea in children in whom there is a desire for sugar and a great emaciation and tympany is present.

The splinter-like pain in the urethra has already been mentioned in regard to the urinary organs. According to the provings there is also marked evidence of irritation in the urinary passages, with a sensation of swelling and ulceration, burning and cutting; also after dribbling of urine. One should recall through such symptoms the external use of argentum nitricum in gonorrhoea. For homoeopathic use these symptoms are not often employed although the first stage of gonorrhoea is cited as an indication. Not in the older provings but recently cited is an acute pain in the kidney region and along the ureter. By Americans this has given occasion for the treatment of renal colic due to stone. The oldest report that silver produces dropsy has led at one time to the question of nephritis, at another to hepatic cirrhosis. In many provings there is increased diuresis, frequent and copious evacuation of pale strongly smelling urine. Argentum metallicum is said to be useful in diabetes insipidus.

Initial increased and subsequent decrease of the male sexual impulse has obtained no clinical significance. In women the sensation of enlargement in the left ovarian region has been mentioned for argentum metallicum. Otherwise there are still single manifestations of increased rush of blood toward the genitalia; now transient appearance of bleeding between the menses, feeling as though the menses would appear marked sexual excitation. But these symptoms are rarely employed and best then in connection with states of nervous excitement, anxiety and restlessness in women at the menopause. Apparently taken over from the local actions of argentum nitricum is the indication in erosion of the cervix[618] with copious, yellow, excoriating leucorrhoea and frequent bleeding from the ulcerated sites. A symptom referring to this is also: bleeding from the vagina after intercourse.

Besides the outstanding influence of silver on the nervous system we have with argentum nitricum a series of irritative manifestations on the mucous membranes and indeed exactly on those on which the external application is common in school therapy (mouth and throat, stomach, urethra, cervix uteri). To these the mucous membrane of the eye must be added. There is a severe redness and swelling of the conjunctiva with profuse, yellow, purulent, bland, secretion, the eye lashes are especially involved and the caruncula lacrimalis is swollen. The purulent granular conjunctivitis should be especially suitable for the homoeopathic use of argentum nitricum. It is also recommended in blenorrhoea.

In the affinity for the mucous membrane the nitrate fraction of silver nitrate is obvious.

TYPE

The increased nitrogen transformation gives a basis for the comprehension of the cachexia appearing after too prolonged use of silver nitrate. Thus there is a type which is particularly suitable for argentum nitricum: *wasted people with pale, grey downcast facies or children who seem strikingly old. The progressive emaciation* is an important indication in most argentum maladies which slowly progress.

SUMMARY

Chief Trends:

1. Nervous system (holds for argentum metallicum as well as argentum nitricum).

Weakness of memory, restlessness, hastiness, anxiety (argentum metallicum involves the intellect, argentum nitricum more the disposition).

Headache in the left eminentia frontalis, sensation of enlargement; better from firm bandaging.

Vertigo, epilepsy, tabes dorsalis.

Lancinating neuralgias, paraesthesias.

2. Mucous membranes (holds more for argentum nitricum).

Splinter-like pain (throat, urethra).

Hoarseness from straining the voice (argentum metallicum).

Radiating gastric spasm (gastralgia, ulcer).

Tympany.

Diarrhoea, green slimy, worse from sugar, from drinking.

Type:

Progressively emaciating. Pale, grey, wasted.

Guiding Symptoms:

Weakness of the entire left side, which is preferred in respect to symptoms.

Sensation of enlargement.

Splinter-like pain (argentum nitricum).

Desire for sugar which is badly tolerated (argentum nitricum).

Modalities:

Mental effort aggravates many complaints particularly the nervous.

Chief time of aggravation for argentum nitricum at night, for argentum metallicum morning and towards 11 A.M.

Special modalities, see above.

DOSE

Argentum metallicum and argentum nitricum are employed between the D 3 and D 30. In gastric maladies D 5 and D 6 have proven useful for me, in central nervous maladies also the D 30.

(The lower potencies up to D 4 of argentum nitricum must be prepared freshly with distilled water.)

GOLD

If one reads an old herb book, perhaps the "Hortus sanitatis" of Peter Schöpfer written in 1485, then he finds: "the virtue of gold is heat and drying in the temperament, no master reports a degree of it because its virtue exceeds all herbs, roots, spices and metals." Here we have also lying at the base, the Galenic theory of four elements and their degrees, which was useless for explanation of observations because it was purely speculatively conceived.

Then follows a series of empiric reports with the remark of the author: "The master Serapio states that to rub gold to powder and eat it, leprosy is consumed and all members of man become strong. A wound in which gold has been placed will not become foul. The great master Halyx states that gold filings strengthens the heart more than all other drugs and allows no decomposition in the body. Gold scrapings remove the trembling of the heart which prevails from the earthy moisture, called melancholia. Avicenna states that gold removes the melancholia of man and likewise evil dreams and phantasies from sleep. The wounds in which gold is placed heal without harm and no foul flesh grows therein. Those who carry gold in the mouth have good breathing. Platearius: gold helps heart trembling and removes the sadness and is good for those who speak to themselves and make phantasies. Avicenna (in the book de viribus cordis) states that gold

more than all other drugs makes the heart strong and makes good rejoicing blood."

In these empiric reports we have already the chief indications of the homoeopathic school (melancholia and cardio-vascular action) and the most recent of school medicine (lepra, bacteriocidal action) before us. Also the fine division by trituration, even if not yet in another vehicle, was obviously known as necessary for the effectiveness. Pre-scientific empiricism remains valuable so far as the above directions are correct and give the newer observations the historical background.

CHEMOTHERAPEUTIC USE

Let us now go to the current stand of experimental-clinical investigation on the action of gold. It appeared as parenteral therapy without any connection with earlier epochs of gold therapy. For a long time under theoretical conceptions, men have tried to kill the tubercle bacillus in the body by gold (and copper) or at least severely injure them. The task was to synthesize a compound of gold which had the highest possible therapeutic index, that is, a great distance between the dose injurious to the host and that which is healing (the therapeutic quotient = t:c = dosis toxica to dosis curativa).

In the original investigative field of tuberculosis (Moellgaard) the hopes set upon gold preparations (such as sanocrysin) have not been fulfilled. On the other hand in spirocheta (organ syphilis and recurrens) and streptococcus infections, gold preparations (as solganal and solganal B of Feldt, organic compounds of gold with sulphur) have proven curative in animal experiments. The exciter was destroyed. But not in the sense of a direct therapia sterilisans magna, that is, by

a direct chemical influence of the agent on the exciter, but indirectly through an increase of the defense power of the host. This mechanism has been adopted today for all other chemotherapeutics with the exception of salvarsan. For gold preparations in particular it may be concluded from this, that their depressing or even lethal influence on the exciter in a test tube requires concentrations which are much larger than are necessary for the cure of an infected animal. Also an intravital alteration of the preparation permits a strong bacteriocidal compound to be excluded. From animal investigation alone it can be seen that the healing effect which goes up to the destruction of the exciter rests upon an influence, an activation, of the natural defense process of the host.

One postulates the chief site of organismal defense in the mesenchyme, in the vascular connective tissue, in particular in the reticulo-endothelial system. This holds on the one side as the site of natural defense actions, as the formation of antibodies, on the other side the storage also of the chemotherapeutic agent. Thus it may be assumed that particularly in this system the metallic catalysors, such as gold, activate the natural defense process.

The comparison of the knowledge of gold preparations obtained from homoeopathy to the newer gold therapy is difficult because today there are almost no simple gold preparations used, but mostly organic sulphur compounds. However it is reported of the 0.1% gold chloride solution that it works exactly as good as the many organic preparations, indeed, that it is better born. Moreover it is cheap. The principle of optimal dose has not been worked out in parenteral gold therapy but nevertheless one knows that this therapy involves a stimulation of the defense function, particularly in

the reticulo-endothelial system. In spite of the therapeutic animal investigation the indications in sick mankind remain uncertain; almost all infections were occasionally found suitable for gold therapy; but the results are extremely variable without one being able to demonstrate in detail why the result or lack of result occurred.

Chronic infectious arthritis, chronic septic states, lupus erythematosis, psoriasis, multiple sclerosis, tuberculosis, lepra, vaccinia recurrens (in the treatment of progressive paralysis) and syphilis are at present the field of application of gold preparations.

For the situation of the spirochetal diseases the already mentioned animal investigations still furnish the best point of view. Since the external manifestations of syphilis at first react with an increase of inflammatory manifestations after the injection of gold preparations, there can be little doubt of the stimulating character of this treatment. But it may be questioned whether the great doses (for example 0.25-0.5 grams solganal) of organic gold preparations are optimal. If they are proven as necessary then there may be weakening of the specific stimulative action as the result of the organic gold compound. In favor of this is the fact that only 1-10 mg. of gold chloride is necessary. But the height of the dose can also lie in the slight degree of relationship of gold to syphilis in man. Only then when the *stimulative index*, that is, the relation of the stimulus dose for the exciter to the stimulus dose for the defensive function is considered, can one say anything about the degree of specificity. Because the grade of specificity and the dose optimum always stand in opposed dependence. In human tuberculosis many small doses (0.0001 grams, that is D 4) of the gold preparation have yielded favorable results. But the school

dose in general still stands under the old maxim of going up to the limit of tolerance on the basis of the still existing conception of a direct damage to the exciter.

The so-called untoward actions of the organic gold preparations show a special connection to the skin. Universal erythema with fever, measles-like and scarletiniform exanthems, isolated keratosis and desquamating infiltrating eczema and—by overdoses of the preparation called aurophos—an eruption like that of pityriasis rosea is observed. It is doubtful whether these skin manifestations are due to the gold itself or at least in part to the peculiarity of the chemical compounds, for example with sulphur. These "untoward" manifestations are so diverse that the usefulness of gold preparations in many diseases which are preferably manifested in the skin (in lupus erythematodes, leprosy, psoriasis, erythema nodosa, erythema exudativum, multiforme, erysipelas, lues II) can be considered as organotropic from the homoeopathic viewpoint. Also within school medicine the conception gains ever more basis than the exanthems provoked incidentally are exactly as important for the cure, particularly in syphilis with marked involvement of the skin. If the irritant treatment of the skin organ today is considered as an essential factor in the therapy of lues (for example by Buschke), then this is covered by the laic conception that the good appearance and the promotion of eruptions are favorable for healing.

FROM THE HISTORY OF GOLD THERAPY

The gold therapy of syphilis is by no means a production of modern medicine nor of homoeopathy. Paracelsus employed it in syphilis and leprosy. With the

decline of the alchemists and the iatrochemists, gold again diminished in therapy, obviously because the art of preparation of useful forms was lost. Indeed a remedy always becomes obsolete when the suitable form or suitable domain of use is forgotten. However gold therapy had a brief period of blossoming from 1810-1830, particularly in France. Then this old drug again fell without notice into the grave of obsolete remedies and only in most recent times was again discovered as something entirely new, according to new methods, with many new compounds and names.

In contrast to the fashion of the school at least homoeopathy has acted differently since the continuity of gold therapy has persisted there during the last 100 years. This is not to be understood as mere conservatism on the part of homoeopathic physicians but it lies grounded in the method; when the basic lines for the domain of employment in the sick have once been established on the healthy man and removed from the up and down of empiric recommendation, then the fate of a drug no longer depends upon the praising or rejecting opinions; then the domain of action can be most precisely fixed and the possibilities and the limits of agents are ensured so far that the failure in a single case is to be ascribed more to erroneous indications or errors in the dose rather than the correctness of earlier observations on the healthy and their (obtained on the basis of symptom similarity) confirmation in patients, can be drawn into doubt.

As Hahnemann introduced gold into his materia medica after a proving on himself and other pupils about 1818, the curve of the medicinal use of gold was also on the increase in the remainder of medicine. In his apothecaries lexicon of 1795 (p. 368) Hahnemann

held the medicinal powers of gold in the sense of the prevailing opinion of the time, as very slight because of its insolubility and suggested that apparent actions might be ascribed to the intentional or accidental admixture of copper. Also the apparent cardiac strengthening power of the old esteemed aurum potabile (etheral extract of gold 16:1 dissolved in aqua regia) he did not ascribe to gold.

In 1811 Chrétien[649] again brought gold into fashion especially for the treatment of syphilis although since Paracelsus and Glauber[650] it was recommended now and then for this purpose. At first Chrétien employed gold oxide (Au_2O), gold chloride ($H.AuCl_4$) and aurum muriaticum, natron (NaCl. $AuCl_3$) later he reported that finely divided gold had the same action only milder. He permitted the patient to rub the gold into his tongue with the finger and from this perlingual application (likewise this has been rediscovered anew from time to time!) saw good results. There formed a correct party that gold was *the* remedy for syphilis and they held that mercury was ineffective and dangerous.[651]

In 1825 Hahnemann[652] still mentioned nothing of the reappearance of gold therapy but cited only the Arabian and ancient authors. As he made his first attempt with finely divided gold (after an initial trial with a gold solution) (that is, before 1818), perhaps Chrétien's work was unknown to him.

When one compares purely clinically the indications for gold from the diagnosis of a century before with the homoeopathic, then there is scarcely any difference. Thereby one need not depend upon the animated gold therapeutists as Legrand, Niel, Percy, Gozzi, Destouches, who placed gold far above mercury, but in the text books of that time, such as Vogt's[653] one finds a

great number of gold indications which later again have fallen into oblivion.

The old indications in melancholia, hypochondriasis, imbecility and chronic spasms were well known and also through observations of the stimulating actions of gold on the entire nervous system, and explained particularly on the brain (Niel, Percy). But still Vogt states that there are no observations of recent times, "if one will omit Hahnemann's exaggerations."

Gold was recommended as slowly working in syphilis where mercury has already been given without result or was poorly tolerated. "It often initially increased the symptoms which it later heals" reports Vogt and he cites examples of this.

Chrétien and his followers also used gold with results in scrofula when the patient was not too old. Also in this respect gold is similar to mercury, even if not so active. With many folks carrying of gold rings in the ears is considered a defensive agent and curative remedy against scrofulosis and other maladies.

In uterine cancer, especially scirrhus (Grötzner), results have been reported with gold and this indication also has been incorporated in homoeopathy.

Furthermore in glandular tumors and indurations, even if not of a syphilitic or scrofulous nature, but particularly inflammatory induration and nodules in the tongue, then, in the various chronic maladies of the skin gold was reported as yielding results.

Also the ancient indication, mentioned even by Pliny, of gold for "dropsy" was again introduced a century ago with success, especially in hepatic cirrhosis in drinkers. Finally general "chronic" persistent inflammations, even phthisis, were reported, and this corresponds to the newest reports.

In this enumeration one misses the very ancient indication of cardiac weakness and, if one adds the homoeopathic use, the connection to the arteries, in particular to sclerotic processes. That this most important affinity for the understanding of gold action did not remain lost from the frequent use, even if it was not clinically utilized, proceeds from the numerous descriptions of that time.

The excitation of the arterial system which increases fever after excessive use, Chrétien held as a pre-condition for the healing. At first gold increases the secretions especially of the urine and sweat; on the other side Gozzi has observed suppression of the urine and sweat from the misuse of gold. Chrétien reports general erethism, inflammation of this or that organ, indeed according to the disposition, from too long continued use.

AURUM METALLICUM

The homoeopathic provings of aurum and aurum preparations are found:

1. Hahnemann: *Reine Arzneimittellehre,* Aufl. Bd. 4, *Chronische Krankheiten,* Bd. 2 (Aur. met. and aur. mur.).

2. Molin: *Bull. de la soc. med. hom. de Paris,* Bd. 1, Seit, 19, 1845 (Aur. mur. and aur. sulf.).

3. Buchner: *Neue Ztschr. f. hom. Klinik,* Bd. 4, S. 208 and Bd. 8, Nr. 24 (aur. mur.).

4. Eberle: *ibid.* (Aur. mur.).

5. Lembke: *Neue Ztschr. f. hom. Klink,* Bd. 11, S. 17 (Aur. met., aur. mur., aur. mur. natr.).

6. Hering: *Metcalf's Hom. Provings,* p. 215 (aur. met.).

7. Burnett: *Gold as a remedy in disease,* 1879 (aur. met.).

8. Robinson: *Brit. Journ. of Hom.,* vol. 25, p. 321 (aur. met.).

9. Shelton: *N.A.J. of Hom.,* vol. 34, p. 485 (aur. met.).

10. Assmann: *Deut. Ztschr. f. Hom.,* 1929, S. 245 (aur. colloid).

BLOOD VESSEL ACTION

For the comprehension of the drug picture of aurum one proceeds best from the action on *the arterial vascular system.* This is distinctly evident from all provings, also from the newest by Assmann which were performed with the 30, 15, and 6th decimal potencies. A sensation of heat with rush of blood, waves to the head, pressure sensation, heaviness, dullness and sensation of vertigo in the head, rushing and weaving in the head (as if one sat in rushing water), noises, rushing and swishing in the ears with diminution of hearing, thereby variable cold and hot sensation: sensation of cold over the entire body, later increased sensation of heat, striking waves in the blood, just as if it boiled in the arteries, facial heat with cold hands and feet; chill at evening and in bed; the leg up to the knee is cold as ice; sensation of numbness in the arms and legs, soon after awakening, more apparent on lying still. The improvement of symptoms by walking in the open air, the general aggravation by cold as well as through mental effort is easily understood on the basis of these vasomotor symptoms. To these are added the *cardiac and pulse symptoms*: severe palpitation and extraordinary dread, desire for sleep and fatigue in all extremities; at times a single very marked heart beat, oppression of the heart

which compels deep breathing which relieves (aur. mur., D 4, Buchner), sensation as though the heart ceased beating 2-3 seconds and then suddenly began with a strong beat; oppression on the chest with feeling of anxiety; irregular heart beat with anxiety and dyspnoea; severely irregular heart; in one prover with aur. colloid. D 6, immediately after ingestion, slowing of the pulse which readily became irregular, at times the beat ceased and thereby the blood pressure fell from 112 to 95, a demonstration which must be tested further.

This great unrest and irregularity in the arterial system the older observers had described as *arterial erethism* and which on the re-introduction of gold therapy led to febrile states with transient chills. It is clear that in homoeopathy gold and its salts are important agents for such reactions in the heart and vascular system which have their origin in vasomotor disturbances as well as organic factors. Particularly *arterial hypertension, the sclerosis of the coronary and cerebral vessels* are important indications. But also there is a marked influence on the secretion of urine—at first increased, but later even suppressed, which forms an indication for nephrosclerosis. In this respect aurum is, in general, more suitable for the larger arteries and those of the upper part of the body while plumbum involves the arterioles especially of the kidneys (nephrosclerosis).

In the cerebral sclerosis the still to be mentioned mental and intellectual symptoms complete the picture. If the sclerosis whether of the aorta, the coronary or the cerebral vessels, is of luetic origin, then there is even more basis for the selection of a gold preparation (perhaps aur. iodat). Alcohol and nicotine are also im-

portant etiologic moments for aurum. In particular for the damages from nicotine in the cardiac manifestations, vertigo, diplopia and aurum is to be recalled in those from alcohol and the old indication of liver cirrhosis with ascites. Not rarely the flashes in the climacterium with high blood pressure and the corresponding mental symptoms form a good field for aurum, especially when it is concerned with a pre-sclerotic stage. Naturally other remedies are often indicated in the climacteric circulatory disturbances.

TYPE

The vascular panel prevails in the aurum picture even in the type; it is the habitus apoplecticus, full blooded, corpulent man with red face, with the tendency to take everything hard, to look upon the dark side; in general people of advanced age are suitable for gold and moreover especially for those who have suffered from syphilis or mercury. A. Stiegele has characterized the type in the following manner: "the aurum patient is heavy blooded, heavy mentally and heavy in motion and habit." This does not suggest that gold is a remedy in the constitutional sense but it is determined distinctly by the organotropy to the vascular system.

SENSE ORGANS

Mixed with the vascular diseases and luetic affections are the gold indications on the *sense organs*. The differentiation from the neighboring and related mercury is not easy here. Often one will give preference more subjectively to the slowly acting aurum when the process tends to have a more chronic evolution.

On the *eyes* many symptoms refer to congestion: a

marked feeling of tension with lessening of visual power, spasmodic pressure in the orbit, sensation of pressing together, redness, burning pain and itching of the lids, a feeling in the eyes on looking as if from marked heat. Transient loss of vision, fiery spots before the eyes, blurred vision with marked tension in the eyes, veil before the eyes, double vision, have led to the use of aurum in internal diseases of the eye as glaucoma, and chorio-retinitis. An observation of darkening of the upper half of the visual field (from Hermann in Hahnemann's proving, as with most other internal ocular symptoms) has given special occasion for use in detachment of the retina. Especially in luetic eye diseases, keratitis interstitialis, iritis with severe cutting pains in and around the orbit, diplopia from cerebral lues can furnish the link with aurum. But this does not state that scrofulous eye diseases such as are aided by mercury, cannot be favorably influenced by aurum. Also the pannus of trachoma with marked development of the vessels is reported. Still all these clinical diagnostic indications must be considered with the usual reservations.

On the ears the vasomotor symptoms with the diminution of hearing have already been mentioned. The syphilitic processes are also included here whether the auditory nerve or the middle ear bones (with foetid suppuration) come under consideration. The same holds for the ozaena and the caries of the nasal bones with nocturnal pains, when mercury is without result or has been previously misused. Foul odor in the nose is a proving symptom of gold. A vasomotor early symptom may be the increased sensitivity of smell. A special site of predilection seems to be the nasal orifices and the tip of the nose. Redness and swelling of the

nose, red nodular nose, has been observed many times since Hahnemann; among others it occasioned the unbelieving student Hering to take gold trituration. A few days later he was compelled to avoid the room because he had a frightfully swollen red nose. Acne rosacea, rhinophyma, copper nose, has given occasion for the use of gold.

MUCOUS MEMBRANES, GLANDS, TUMORS

Mercury-like oral inflammations were observed more than a century ago from the gold inunctions into the tongue. Offensive breath or foul offensive odor of the mouth and saliva are present. For luetic affections of the palate gold may come into question under certain conditions. Here we recall that even Avicenna used gold against bad breath. For the luetic bone affections, so far as they are suitable for aurum, *the nocturnal aggravation* is decisive.

In any case a slighter role is played in the aurum picture in hardened lymph glands than with mercury. The tumors of the uterus, myoma and scirrhus, also ovarian tumors, are also indications borrowed from old empiric use. Redness, heat, swelling of the vulva and vagina, thick white leucorrhoea pains pressing downwards are lesser points of departure from the provings which have given occasion for the use in enlarged and prolapsed uteri and in chronic metritis.

More distinctly the affinity to the *male sexual glands* is determined by the symptoms. The rejuvenating influence of gold, cited from antiquity, refers perhaps to the increase of sexual impulse, which proceeds also from the provings. Also a psychic excitation, improvement of humor with desire for conversation and self satisfaction, greater mental mobility and desire for work,

improved power of thinking and better memory may be connected with this as the first action of gold. This general elevation and excitation also struck the auralists of the French school a century ago. As later actions in this respect are the inflammatory and degenerative alterations in the testes: painful swelling, chronic induration and finally atrophy. Also for the tuberculous inflammations of the epididymus aurum, particularly aurum iodat., is suitable. Swellings as hydrocele corresponding to ovarian enlargements may be included in the field of indications of gold.

PSYCHE

With the degenerative phase of action in the sexual glands and on the arteries one may bring into association perhaps the depressive melancholic chief action of gold in the psychic life. Moreover an immediate action on the cerebro-spinal system is not improbable. Cerebral sclerosis, lues are often combined with severe depression. Coronary sclerosis more with anxious unrest. The depressive influence of degenerative processes on the sexual glands is sufficiently well known. But it is not to be understood that *the melancholia with a tendency to suicide* of the aurum picture is only a secondary manifestation of these organ alterations. Much more the disturbances of circulation and the sexual hormones are to be brought into parallel to a certain extent in the second phase of gold action and to the melancholic phase of mental life without one being able to say what is the primary and what the secondary site of involvement. The mental weakness, the irritability, impetuosity, anxiety and restlessness in any case are often accompanying symptoms of sclerotic diseases which in themselves are suitable for gold. The gold indication

"melancholia" known since antiquity often comes to expression symptomatically in the proving picture: "he believes nothing is right in the world and therefore seeks for death on which he dwells with inner pleasure. Great increasing anxiety proceeding even to suicide, with spasmodic contraction of the lower abdomen, disgust for life, thoughts of suicide. He is downcast and seeks solitude. If one leaves him alone, he sits silently by himself, in melancholy in a corner; the slightest contradiction however brings him into violent rage, he responds at first with fight and many words but later says only a few broken words." Thus and similarly read the reports of the provings.

In any case the presence of these deep melancholic behaviors has proven an important guiding symptom in homoeopathic use. When some report that music acts as a sedative, but fear increases the irritability, perhaps it may be useful for differentiating from other remedies in melancholia. When the severe melancholic, depressive mental symptoms appear in arteriosclerosis, in luetics, after the misuse of mercury, in women at the menopause and not perhaps in the mild pulsatilla type, but accompanied with excessive irritability and tendency to suicide, one will first think of aurum.

RARE ORGAN ACTIONS

The already mentioned association with the skin, which is more expressed in the organic preparations, combined with sulphur, has given occasion in homeopathy for the use of gold outside of acne rosacea also in lupus, particularly in erythematodes, occasionally also in psoriasis.

The symptoms on the respiratory organs are not so marked as to make a special affinity of gold to them

probable. If intravenous injections have had occasional favorable results in pulmonary tuberculosis, so this can involve a less specific treatment, perhaps even protein split products which can be obtained through copper as well as other metals. In any case it is not known that the oral use of gold has proven useful in lung tuberculosis.

The gastro-intestinal symptoms in the provings of gold are even less characteristic. Therefore they have not obtained any practical significance.

SUMMARY

Chief Trends:

Mesenchyme, reticulo-endothelial system. Blood vessels, mucous membrane, skin, sexual glands, sense organs, central nervous system, and mind.

Clinical:

Cardiac and vascular diseases, vasomotor to sclerotic disturbances (coronary and cerebral sclerosis, red high blood pressure but also nephrosclerosis), lues, particularly tertiary, after the misuse of mercury (arterial disease, bone symptoms, ozaena, glandular indurations).

Internal eye diseases (chorio-retinitis, detachment of the retina).

Uterine and ovarian tumors, orchitis, melancholia.

Guiding:

Depression with tendency to suicide; loss of courage but very irritable, hypersensitive toward noise; music quiets.

Apoplectiform-plethoric type; nocturnal aggravation,

better from movement in the open air (worse from cold, from mental effort).

GOLD PREPARATIONS

Essential differences have not become distinct up to the present between the various preparations of gold. In the recently proven aurum colloidale up to the present no mental symptoms were observed. With the gold salts of which aurum muriaticum ($AuCl_3.HCl + 4 H_2O$), its sodium salt, $AuCl_3.NaCl + 2 H_2O$) and aurum sulfurat. + gold sulphide (Au_2S_3) are proven, one has attempted to accelerate the slow metal actions and to link them to definite organs. Aurum muriaticum and aurum muriaticum natron are often preferred especially in arteriosclerotic and leutic affections.

DOSE

The salts and aurum colloidale are usually given in the lower potencies up to the D 6, aurum met. especially with the presence of the mental symptoms also in D 30.

ZINC

In the periodic system of elements zinc stands in a series related to cadmium and mercury. However the relationship to mercury is not very outspoken either chemically or pharmacologically. Even if one thinks that the working range of zinc is of a much slighter extent than that of mercury, nevertheless considerable similarity in the toxic manifestations is evident and should not be dismissed, particularly the part which we know as mercurial erethism and tremor mercurialis. The complete series of nerve actions of mercury we find again in zinc, but still most of the organ symptoms which we know and especially use of mercury are either entirely misused or insignificant in zinc. On the other side zinc shows a *close horizontal relationship with copper.*

APPEARANCE

Zinc (as well as copper) is found in considerable amounts in molluscs[854] as a normal organically bound constituent. According to Javillier[855] it is also a regular constituent of plant protoplasm. In very slight concentrations in the soil it is said to promote the growth of oats and cereals.[856] Our common foods and the intestinal contents and excreta of man regularly contain zinc (as well as copper). The excretion of zinc takes place in the urine, faeces, milk, the gastro-intestinal mucosa and perhaps also through the sweat.

LOCAL ACTIONS

The soluble zinc salts, as all metal salts, precipitate protein. The zinc albuminates which form are soluble

in dilute acids, alkalies and an excess of the precipitating agent. We need not say much about the external influences of zinc salts. They act astringent or corrosive, indeed according to the acid with which the metal is bound and according to the concentration of the solution. Chloride of zinc acts most strongly corrosive. The astringent action is used externally, particularly in the mildest zinc compound, zinc oxide, in the form of a white powder or zinc ointment. Zinc sulphate was used more as an emetic formerly than today. The treatment of conjunctivitis and gonorrhoea with zinc sulphate is well known.

POISONING

After absorption, zinc compounds provoke *initially central excitation and later reduction of the reflex excitability and muscle paralysis.* The red blood cells are said to be destroyed rapidly and hemoglobin, albumin, and sugar should appear in the urine. The pathologico-anatomic findings correspond to the toxic actions since after the chronic poisoning (10-15 days) with zinc oxide in dogs can be demonstrated: anemia and fatty degeneration in the liver, kidney and pancreas, swelling and disorganization of the epithelia of the biliary passages, *anemia in the brain and spinal cord as well as atrophy and cloudy swelling of the ganglia of the anterior horn cells.* Here we can go from the acute symptoms of intoxication to the acute corrosive actions on the gastro-intestinal mucosa. However among the symptoms of a more chronic poisoning remain: *cramps in the extremities* after several days and finally after four weeks *general convulsions.*[657] Kissel[658] reports that, according to Blandlet, workers who inhale zinc vapors have spasms, apprehension, headache and vomiting. In a case of poisoning by zinc vapors on the first day a sensation

of constriction of the chest, headache and vertigo was noted, on the second day severe cough, vomiting, stiffness of the extremities, on the third day a coppery taste in the mouth, some flow of saliva, abdominal pains and an increase of vertigo so that the patient could not stand upright.[659] Whether the so-called casting fever of smelters and workers in zinc[660] is a special result of zinc has not been determined with certainty. It begins with pains especially in the back, then chills, followed by chilliness for several hours, an increase of pulse rate with a tormenting cough, a feeling of soreness in the chest, later expectoration and frontal headache, more rarely muscle twitching, salivation and vertigo. After this sweat and sleep follows. In a remarkable way the diarrhoea which is said to appear with severity soon after the smelting (gushing diarrhoea) is missing in this enumeration.

EARLIER EMPLOYMENT AS A NERVE REMEDY

Even from the crude manifestations of poisoning one can deduce that the chief trend of zinc absorbed in the organism is on the nervous system. Formerly zinc compounds were often employed purely empirically in nervous diseases, but today one considers the treatment of chorea, epilepsy, or other nerve diseases with zinc as obsolete and abandoned. However zinc oxide is still mentioned in single textbooks as a remedy for epilepsy. But in the older textbooks the nerve actions of zinc were extolled in all types of spasms, general twitching, epilepsy, chorea, spasmodic nervous affections of the chest (spasmodic asthma, spasmodic hiccough, spasmodic laughing and the like) and here the poorly soluble zinc oxide was preferred. Vogt[661] stresses that the general twitchings from mental affections, acid stomach,

the eruption of teeth, the development of puberty, suppressed skin eruptions or those disturbed in the course of evolution in the outer skin, acute as well as chronic, from worms, etc., gave the indication for zinc oxide. The cause of the convulsions for which zinc was employed should not depend upon a weakness of the nervous system but a disorder and excitation in it, especially in delicate, sensitive, youthful, full blooded and irritable individuals, particularly children and women.

Zinc found extensive use with Rademacher and his school. Rademacher[662] called zinc mineral opium, since it had great similarity to opium in its sedative power, even if it shared the vascular exciting property only to a slight extent.

For him it was an organ remedy of the brain, particularly for the sphere of thinking, but he also gave it in melancholia with a desire to sleep much, and when depression began with the symptoms of fear and evil. In diarrhoeas and "in severe brain symptoms which may accompany infectious diseases in the form of delirium or impending somnolence," particularly in erysipelas, the Rademacherian school held zinc as the healing remedy. Kissel[663] states: "Zinc is a direct curative remedy of a special type in brain affections which can be expressed in many ways, especially by delusions, desire for sleep, headache, neuralgias, spasms, diarrhoea, inflammations of the skin and mucous membranes." Moreover Rademacher gave zinc in the affections of the organs supplied by the cranial nerves thus in nervous tooth-ache and pains in the internal ear. H. Schulz mentions that the clinician Bartels gave zinc acetate in cases of the nervous insomnia which did not react to morphine. Rademacher gave zinc acetate solution, five drops, three times daily, to people who were

compelled to work after insufficient sleep. Is he following homoeopathic thoughts here? In any case he introduced personal experiences to support this by virtue of which Kissel[664] and H. Schulz[665] report: "In the morning Rademacher took a large dose of zinc oxide of 15 grains (0.9 g.) fasting. The striking symptoms resulting were the bluish redness of the face and a great desire to sleep overcame him so that he could no longer collect his thoughts. On the other side the nausea which developed prevented sleep. This state was similar to that in which one finds himself when he has become highly fatigued from exertion and is stimulated at the same time. After some time he had two liquid stools and the apparent action of zinc gradually ceased." Rademacher held it as plausible that zinc also acted curatively on the spinal cord which he concluded from the cures of neuralgia such as sciatica and lumbago. Löffler,[666] a pupil of Rademacher, employed zinc successfully in delirium tremens and here placed it at the side of opium.

ZINCUM METALLICUM

Zinc provings have been published.

1. Franz: *Stapf's Archiv. f. d. hom. Heilkunde,* Bd. 6, Heft. 2, S. 152, 1827, with 8 provers (with the C1 and C3).

2. Hahnemann: *Chr. Krankheiten,* 1 Aufl., Bd. 3, S. 254, 1828; 2 Aufl., Bd. 5, S. 428, 1839, contains the provings of 1 and increased by the results in 4 more provers.

3. Hartlaub und Trinks: *Reine Arzneimittellehre,* 2 Bd., 1838.

4. Buchner: *Hygea,* Bd. 14, S. 481, 1841, 7 provers (zinc oxide).

5. Schreter: *Neues Archiv.,* Bd. 3, 1846.

CHIEF TRENDS

H. Schulz collected the symptoms which one obtains by the proving on the healthy with small doses of zinc oxide given continuously over a period of time. It thereby appears that the drug picture is concerned not only with *the chief trend upon the nervous system* with influence on the brain, spinal cord and peripheral nerves, but also has a second trend upon the vascular system and finally shows manifestations in almost all organs. On the one side the vascular actions proceed with an increased pulse rate with attacks of palpitation, alternating showers of chills and febrile sensations, congestion to the head, on the other side, with manifestations of stasis in the venous system. It is precisely the latter which have gained some significance as homoeopathic indications and permits zinc to appear as one of the so-called venous remedies. A third trend, at the same time dependent upon the second, is the effect observed on the mucous membranes, salivary glands and skin, but it possesses slight significance. Of the organs the kidney seems to be subjected to a direct influence because nephritis is observed as the result of zinc poisoning.

NERVOUS SYSTEM

The manifestations on the nervous system are in the foreground. Zinc actions do not consist of either "depression or stimulation." The time factor and the dose are decisive in this respect. It is precisely an *interweaving of excitation and weakness,* which is characteristic. For the acute action of massive doses the above reported personal investigation of Rademacher is descriptive: great fatigue, but at the same time restlessness and excitement up to nausea. The employment in

excessive fatigue as well as in diseases which tend to manifest a desire for sleep and delirium at the same time in spite of the massive dose in the school of Rademacher is entirely homoeopathic. The symptoms of weakness, lassitude, fatigue and disturbance of sleep which zinc has in common with so many other remedies is characterized primarily by the symptoms of excitement of the cerebro-spinal nervous system. Weakness, heaviness, lassitude, dullness, inability to think, difficult comprehension, aversion to work, vertigo, waves of faintness, great sleepiness during the day (worse after eating), depressed, dreary, and melancholic disposition (worse at evening) up to lethargy and stupor—these characterize the depressive state. The indication of Rademacher: "melancholia which has to do with fear and evil" in the proving with zinc oxide by Werneck[607] has the symptom: "mental unrest as though he had committed a crime," as a mirror image. The simultaneous exciting action which in no way can be separated merely in primary and secondary action from the sedative without arbitrariness embraces trembling and twitching of single muscles or over the entire body and particularly characteristic is the *restlessness of the feet*, which is described in the provings as a severe trembling of all extremities and the urge to stretch and extend the legs. The extreme state which approaches a type of delirium is evident in the disturbances of sleep. The night sleep is unrefreshing with much twitching, dreams, and crying out; restlessness and nausea prevent sleep. *For insomnia with great unrest in the extremities*, zincum valerianicum is often preferred. As already mentioned the central irritative manifestations can increase to *convulsions*. The following symptoms obviously owe their details primarily to clinical ob-

servation: convulsive phenomena in children with pale face, when the eruption in infectious diseases (scarlet fever) does not come out or when irritative cerebral manifestations appear as from worms or teething; the child rolls the head from one side to the other or bores the head into the pillow and grinds the teeth. Thereby one thinks of an irritative state like that of hydrocephalus or meningitis. The connection of exanthems which do not develop with the cerebral irritative manifestations has good observations underlying it. Taken together with Rademacher's observations (somnolence, delirium), the actions of zinc give a noteworthy indication in encephalitis lethargica so that the employment in different potencies should be tried repeatedly. How far the old indication in chorea and epilepsy is confirmed (Hufeland extolled zinc oxide in epilepsy), particularly when the finer signs speak for zinc, has not been sufficiently elaborated. It must also be stressed on the grounds of clinical observation that the child with spasms or with the convulsive cough places the hands on the genitalia when zinc is indicated.

Headaches are present in every proving of zinc and are extraordinarily diverse. A characteristic form is *the pain at the root of the nose as though the nose was pressed back into the head.* But also pain in the occiput and at the side of the head, even severe migraine, perhaps trigeminal neuralgia, with the tendency to spasms, vomiting, unbearable nausea and dimming of vision, vertigo with the tendency to fall to the left are reported. The headaches seem to be of a congestive type evidenced by the redness of the face after large doses of zinc. It seems particularly characteristic for the brain and the head symptoms that they are *increased by the least use of wine.* The concordance of

two irritant remedies to the brain makes this plausible. This also holds for the aggravation from nux vomica which was given for the symptoms of zinc in the older provings.

To the irritant manifestations of the central nervous system we must also count the neuralgias. The pains are jerky. We learned about dental neuralgias and sciatica as Rademacherian indications. To this belongs *the left sided ovarian neuralgia with boring pain before the menses* so that the patient cannot remain at rest; *the pain is relieved by pressure and ceases as soon as the blood flows*. The symptoms of the female genitalia particularly should be accompanied by restlessness, depression, coldness, spinal irritation, restlessness of the feet. Here we are confronted by the picture of a nervous dysmenorrhoea. A spermatic cord neuralgia with painful retraction of the testes corresponds for the male organs. Furthermore a neuralgia after herpes zoster is reported. Perhaps as a symptom of old spinal irritation, in addition to burning along the spine, there is also a pain in the last thoracic or the first lumbar vertebra. This pain is worse on sitting. Moreover an increase in sexual irritability is noted.

But the cerebro-spinal zinc action goes farther. The pathologico-anatomic affinity to the anterior horn cells of the spinal cord, which was mentioned above, gives a point of departure for the basis of other symptoms. We may mention trembling in the muscles as the first irritative manifestation, crawling and numbness in the hands, calves and feet, fingers soon go to sleep, these merging into weakness, paresis and stiffness and finally to paralysis. This is noted particularly in the eyelids: eyelids heavy as paralyzed, ptosis or paralysis of the upper eyelid. A weakness or paresis of the bladder

sphincter muscle is also mentioned: voiding of urine on walking, coughing or sneezing. A spasm in the pharynx or esophagus is also mentioned, furthermore hysterical laughing from zinc oxide. Trials with zinc in diseases as bulbar paralysis, paralysis agitans and multiple sclerosis are well founded in the symptomatic picture. Naturally the employment in milder disturbances as writer's cramp is more successful.

ORGAN SYMPTOMS

With zinc there is also a spasmodic dyspnoea with a sense of constriction, which is worse after eating and which is said to be better after the expectoration appears. The bloody and blood streaked sputum in spasmodic cough is explained by the easy rupture of vessels which is frequently noted in zinc. The spasmodic symptoms can also involve the heart, a spasmodically irregular cardiac beat with impact in the heart, with single heavy beats, is reported. Moreover in the older textbooks of materia medica attacks of stenocardia are given as indications. A finer symptom "as though a cap rested on the heart" was considered by Hering[668] as an affection of the spine.

As far as nausea, vomiting and diarrhoea appear dependent upon cerebral irritation, we encounter them in the actions of zinc. The gastric symptoms: nausea which is produced or aggravated by every movement, but again, especially after the least wine, vomiting of bitter mucus, vomiting immediately after the ingestion of any food, allow one to think of the crude action of zinc sulphate on the stomach which can be considered indicated when centrally conditioned.

For the present the bladder and urethral symptoms stand to one side and have been studied less: voiding

of blood after painful urination, persistent urge to urinate, burning in the urethra, cutting pain in the orifice of the urethra, moreover frequent urge to urinate and marked pressure from the urine in the bladder. The report: "can urinate only in certain position, for example, bending back" refers to disturbances in innervation.

Most remedies which are used locally as astringents yield proving symptoms of an inflammatory nature on the mucous membranes. This also is true of zinc on the conjunctiva, especially at the inner angle of the eye. Thereby it is assumed outside of the generalized local corrosive or astringent capacity on the conjunctiva that zinc produces a certain degree of diversion "from within" in this mucous membrane reaction.

The second trend of zinc effect on the vascular system, in particular on the venous system, is of much less importance than that on the nervous system. H. Schulz ascribed a broad extent to this trend of action and explained the related and many other mucous membrane and organ actions in this way. Of more theoretic than practical interest here is the fact that the symptoms cited have a great similarity to those of mercury: among them are inflammation of the oral mucosa, salivation, bloody diarrhoea and nephritis. However all these actions are toxicologically established and only in the second or third line. If we did not have a much more directly effective remedy in mercury in stomatitis, dysentery and nephritis in the group chemically related to zinc, then perhaps these indications of zinc would play a greater role with us. In the school of Rademacher this was actually the case with dysentery. Thereby one ought not to forget that this involved

large doses as was common in the practice of Rademacher.

As homoeopathic indications from the side of the venous system there are, though not outstandingly: cramps in the calves of the legs and in the external genitals (in particular after the use of pulsatilla). Also the early appearance of frostbites or freezing of the peripheral parts, mentioned by H. Schulz, belongs here; again the tendency to bleeding is obviously the result of distended vessels; but bloody vomiting and blood in the stool is also cited.

FURTHER PREPARATIONS

Of the zinc preparations, zincum metallicum is used most often. *Zincum valerianicum* is preferred in neuralgias (particularly ovarian pains), and nervous insomnia. *Zincum aceticum* has retained the old Rademacher indications. *Zincum oxydatum* (not the most frequently used as Schulz believed) as *zincum picricinicum* and *zincum phosphoricum*, should be adapted more to the nervous sequella of sexual excesses. *Zincum cyanatum* is said to be suited especially to meningitis and other severe central nervous system diseases, *zincum sulfuricum* more in eye symptoms and, according to Löffler, to dysentery.

SUMMARY

Trends of Action:

Nervous System:

Great fatigue and weakness with excitation and motor unrest, especially in the legs. Insomnia. Trembling and twitching. Hydrocephaloid and epileptic states. Irritative brain symptoms after suppressed exanthems or excretions.

Headache over the root of the nose, pressing inward. Neuralgias. Ovarian neuralgia, nervous dysmenorrhoea; paraesthesias, paresis, weakness of sphincter.

Backache on sitting (last thoracic or first lumbar) "spinal irritation."

Mucous Membrane:

Conjunctivitis.

Stomach:

Nausea and vomiting, worse from movement, eating, and use of wine.

Urinary Passages:

States of irritation and disturbance of micturition.

Venous System:

Varices, frostbites, tendency to bleeding.

Modalities:

Worse from use of wine; after eating.

Worse from suppressed eruptions, or secretions.

Worse from sitting, at rest, at night.

Better from appearance of secretions (for example, menses).

DOSE

Zinc. metallicum is usually prescribed in the lower and middle potencies (D 2-6), but in chronic central nervous system maladies has also proven itself in the D 30. The zinc salts are generally prescribed in the lower potencies, for example, zincum valerian, D 3.

CADMIUM

Cadmium must be considered in conjunction with zinc because it stands at the transition of zinc to mercury. Likewise as the sulphate or the carbonate cadmium almost always appears in common with zinc.

The first trial with cadmium sulphate (not cadmium sulphide as most homoeopathic encyclopedias report, which is the cadmium yellow CdS) was made by Burdach[669] in Finsterwalde: "When in complete health at 10 o'clock in the morning he took about ½ grain of this preparation which had a peculiar metallic taste. At 11:00 there developed a copious collection of saliva which had to be continuously expectorated, about 12:00 there was severe retching, which recurred every 2-5 minutes and much tenacious mucus was evacuated with great effort. This state continued until severe vomiting with retching appeared and recurred about 4:00 when severe pains were felt in the region of the stomach and umbilicus with an urge to defecate. The food eaten together with much sour mucus and bile was emptied by the vomiting. Outside of some lassitude nothing further occurred on that day since the nausea and other symptoms disappeared. On the following day Burdach had some pain in the throat muscles, probably the result of retching and efforts at vomiting."

These symptoms from the oral ingestion appear exactly after copper or zinc sulphate, only the single dose

of 0.03 gram is less than for the emetic action of zinc or copper sulphate (in which decigrams are necessary). Similar symptoms were noted in two non-fatal cases of poisoning with cadmium bromide which Wheeler[670] reported, only here the pulse was hardly palpable at times (with 0.25-1 gram).

TOXICOLOGY

Apart from phenomena varying from inflammation to ulceration of the gastro-intestinal canal in animals, vertigo, vomiting, diarrhoea, slowing of the pulse and respiration, loss of strength, loss of consciousness, spasms and death are observed. According to Marmé in general the heart remains active longer than the respiration.[671] The same author reports about chronic poisoning from continuous small doses of cadmium in rats: disturbed digestion, emaciation, death; pathologico-anatomic findings are gastro-enteritis, at times subpleural ecchymosis and partial collapse of the lungs, frequent fatty degeneration of the liver and heart muscle and diffuse inflammation of the kidneys.

Schwartze and Alsberg[672] found cadmium chloride about 8-9 times as emetic as zinc sulphate in cats which should correspond approximately to the situation in man. But with the introduction in fluids the action is stronger than with solid food. Cadmium in dilute solution is more toxic than in concentrated solutions. In studies with chronic feeding in cats with doses which do not excite vomiting, outside of the anorexia, and emaciation, an *epidemic of sneezing and coughing* was observed, which did not cease until the cadmium was discontinued so that the cadmium must be considered as a predisposing factor for the disease. The storage of cadmium by the kidney, liver and spleen was demonstrated and it was found that cadmium is excreted in the urine.

In other long continued cadmium feeding experiments on growing rats[673] it was seen that food intake diminished with increasing doses of cadmium and the growth was affected in a corresponding way. Daily doses of about ½ mg. per day did not permit any cumulative effects to be observed. A double daily dose in males led to death within 50 days, in females much later (in one case not after 280 days).

Athanasiu and Langlois[674] made similar studies of chronic poisoning with cadmium in dogs. They also found digestive disturbances, emaciation, and finally death. Cadmium sulphate was about twice as toxic as zinc sulphate.

Severi[675] fed rabbits one large dose of cadmium salts. The animals showed *hypersecretion of the mucous membranes of the upper respiratory passages* and died after 5 and 11 days with severe nephritis.

Schwarz and Otto[676] found in cats after a longer introduction of smaller amounts of cadmium salts by mouth, apart from the emaciation, also a marked *secretion from the upper respiratory mucous membrane and the conjunctiva.* In the dead animals the gastric mucosa was usually reddened and swollen corresponding to the vomiting and diarrhoea of progressive poisoning. In single animals soon after the beginning of the study the hemoglobin fell as did the red cell count, the lymphocytes increased at the cost of the polymorphonuclears.

According to Koelsch,[677] Legge observed 3 cases of cadmium vapor poisoning in men with symptoms similar to those of zinc fever. Stevens[678] found considerable amounts of cadmium in the liver in chronic poisoning.

USES

Cadmium sulphate was formerly employed in eye diseases,[679] in opacity of the cornea with still active chronic inflammation, in pterygium,[680] in conjunctival inflammations like zinc sulphate. In recent times cadmium has been used in place of mercury in syphilis, but usually in combination with salvarsan and bismuth, so that no sure decision on the value of the remedy is possible.

DRUG PICTURE

In homoeopathy only cadmium sulphate, $CdSO_4$, is used. Apart from the first proving of Burdach with a single large dose, in homoeopathic literature there also exists a symptom report by Petroz.[681]

If one adds the scanty provings to the results of ani-

mal investigation then the chief trend of action seems to be upon the gastro-intestinal canal and the mucous membrane of the upper respiratory passages, in particular the nose and the ocular conjunctiva.

Nausea and vomiting of acid, black and yellow masses (with blood or bile) with great exhaustion, cold sweat, anxiety, restlessness, trembling of the lower jaw (constriction of the pharynx), icy coldness and thirst, suggest an acute picture like arsenic particularly when diarrhoea is added. But while arsenic is indicated at the beginning of an acute febrile state, it is asserted that cadmium is suitable after the cessation of fever and indeed *when the patient wishes to be left completely alone.* As far as I know there is no suggestion of this in the symptoms of the provings. Cadmium has been recommended in yellow fever. In gastric carcinoma with constant vomiting cadmium sulphate has proven palliative. A peculiar symptom is the *sensation of shuddering with gooseflesh after drinking cold water,* for which a desire exists (similar as with capsicum). Sensation of chilliness even when near a fire is a further symptom in this sense.

A second trend of cadmium sulfuricum on the nasal mucous membrane which is said to have found clinical confirmation is *ozaena.* In one or two cases personal prescriptions have yielded no convincing impression. The similarity with mercury is distinct here. The inflammation in the nose may go on to ulceration and caries of the bones with an odor like that of ulcer or cancer (compare aurum and kali bichromicum).

In chronic scrofulous inflammations of the nose and conjunctiva, cadmium perhaps deserves greater esteem but mercury is used much more commonly.

Moreover two cases of facial paresis have been re-

ported cured by cadmium sulfuricum. However in these instances one may doubt the "propter hoc." In this respect it is probable that a zinc- and mercury-like action could be worked out better in the future. In the proving are twitching, trembling and many paraesthesia (sensation of going to sleep in parts, formication and crawling, numb sensation of the nose) are noted.

SUMMARY

Until further provings have given precision to the drug picture, one can make trials with cadmium sulfuricum in *ozaena*, finally also in *scrofulous nose and eye inflammations, as a palliative in the constant vomiting of gastric carcinoma* and will take *the desire for lying entirely still and chilly sensation after drinking and even in the proximity to a fire* into consideration as a guiding symptom.

DOSE

Up to the present the middle potencies (D 4-D 6) have been employed mostly.

MERCURY

Mercury, hydrargyrum, Hg, is a chalkophilic element in the earth. Characterized by a strong affinity for sulphur, it appears predominantly as red cinnabar (HgS) in the earth and is obtained from it by roasting.

BEHAVIOR IN THE ORGANISM

It is found in traces as a foreign substance in the organism. Here also its relation to sulphur is significant. Mercury once ingested is mobilized by sulphur (hydrogen sulphide and polysulphides) and excreted. This is well known from sulphur baths. Moreover it is probable that its chemical action on the protein compounds of the organism is effected through the sulphur containing group (cystin or glutathion).

The special toxicity of this inert, that is, not easily oxidized metal, is associated with the fact that it is liquid at ordinary temperature and volatilizes easily. Without special preparation it can, under ordinary conditions, also appear in reciprocal actions with the organism and therefore easily provoke acute poisoning. But thereby the state of division is decisive. Compact masses pass through the intestine without exerting other than a mechanical action; the more finely divided the metal, the more rapid and stronger its action on the organism, other conditions remaining equal.

For the trend and the intensity of actions of mercury the chemical form is important. Apart from the tox-

icity of the molecular vapor form, free mercury ions of the salts act most directly. The more dissociable the mercury compound is the stronger the acute action at the first site of contact. This can be determined by measuring the lethal action on bacteria by the various salts.

The rapid formation of mercury albuminate precipitates expresses itself as cell and tissue fixation. The immediate, disinfecting action depends on this. Sublimate, $HgCl_2$, mercurius corrosivus kills cholera bacilli even in a dilution of 1:1,000,000 (D 6). But on the other side stimulating actions from smaller doses are known. The old investigations of H. Schulz for the support of the Arndt-Schulz rule report a stimulation of the fermentative capacity of yeast cells in a dilution of the sublimate at 1:800,000. The growth of micrococcus pyogenes will be promoted most markedly in a dilution of $10^{-6.6}$.[82]

If the dissociation of a mercury compound and the dependent diffusion velocity is important for the rapidity of action, then the duration of the effect will be influenced by the solubility of the compound given or formed. The relation of sodium chloride is particularly significant here. Angerer's sublimate pastilles contain an addition of sodium chloride so that in the solution a double salt, $HgCl_4Na_2$, is formed. By this the transient protein precipitating and bactericidal action of the pure sublimate is reduced, but the solubility is maintained longer.

It is a fact of experience that mercury preparations have a more marked action on the sea coast and in sailors (Lewin). Perhaps this has its basis in the fact that mercury albuminate is soluble in an excess of protein and sodium chloride and circulates as mercury

albuminate-sodium chloride. Through the excess of sodium chloride in the tissue fluids solubility is favored and thereby the action of mercury prolonged. For the rest in a heavy metal as mercury we must ascribe to its great tendency to the formation of complex compounds. In complex poorly soluble form it is taken up, as all heavy metals chiefly by the reticulo-endothelial tissues. Moreover the duration of stay and absorption in the organism is certainly decisive for the action at sites which are remote from the place of absorption and excretion.

SIGNIFICANCE OF FORM OF COMPOUND

This is important for the choice of the mercury preparation. Univalent mercurius compounds basically are not derived from a univalent mercury ion but probably a complex combination of divalent mercury salts with a mercury atom itself, for example, $Hg.HgCl_2$ = calomel, mercurius dulcis. The slight dissociation of the so-called mercurius compounds is associated with this. They have a less acute local action but a longer stay by virtue of which they can exert other types of action than the easily dissociable pure salts. For this reason a complex compound as mercurius solubis Hahnemanni, chiefly mercurius amido nitrate, $NH_2Hg_2NO_3$, is in no way superfluous. Because of its admixture of free mercury this preparation stands very close to mercurius vivus.

If even the solubility and absorption factors of mercury establishes a guide for mercury in the organism, then this is still more evident in the compound in which mercury is employed; thus HgI_2 or $Hg(CN)_2$ approaches the halogens in its easily dissociable halogen ion in respect to a special affinity for the throat. The

organic complex compounds of mercury are prepared with the intent of lessening toxicity and they make possible a more prolonged stay than the inorganic compounds and thereby a more chronic but at the same time a different type of action of mercury; thus with novasurol and salyrgan the inflammatory irritant effect of mercury on the kidney and perhaps also on the tissues is weakened in favor of the diuresis. Formerly calomel was also employed in cardiac oedema.

Also especially distinct in mercury is the alteration of affinity, of the site of attack, in the chronic action of small doses. As with all heavy metals the action of the central nervous system then comes to expression most strongly. The excretion into the cerebrospinal fluid is thereby determining.

MANNER OF ACTION

Whether and to what extent mercury is active in the organism in ionic form and how far as soluble complex compounds is still entirely unknown. But even if it came to action in the most active ion form, the dilution in the organism at which for example therapeutic actions are observed from the usual inunction therapy, could not possibly be sufficient for disinfection, for the killing of spirochetes. Because this dilution is estimated at most as 1:1,000,000 (D 6),[683] which would be insufficient for disinfection even under the most favorable conditions of a watery solution. But in the simultaneous presence of other protein substances this cannot even be considered. Schade therefore considers that mercury acts as a catalysor or as an activator of a catalysor already present, perhaps of a ferment. If we substitute "defense ferment" instead of ferment or with still less presumption, defense mech-

anism, then we obtain the conception which is now universal for all chemotherapeutic substances, namely, that the cooperation of the organism is indispensable for their antibacterial action. The increase of defense activity lies primarily in the reticulo-endothelial system in which all poisons like mercury are stored.

Now the use of the same defense system insufficiently explains the etiotropy which must be assumed to have a certain degree of specificity between mercury and spirochetes. A non-specific action or an increased defense mechanism to the spirochetes must still be awakened by the mercury. It is certainly no accident that (similarly as with arsenic) as a catalysor mercury is able to excite the defense mechanisms exactly against those bacteria, which are especially susceptible to mercury ions in the test tube. One can explain this grade of specificity so that mercury, like an opsonin, prepares the spirochete catalytically for the attack, without destroying them by its own power. In any case mercury is a suitable intermediator between the defense mechanism of the reticulo-endothelial system (perhaps as lysins) and the spirochetes. Such catalytic intermediary reactions finally are also physico-chemical reactions, only on another plane. They also presume a physico-chemical affinity between the bacterium and the chemical poison. The property of a chemical substance to serve as such a intermediating catalysor cannot however be determined in the test tube, that is, under such infinitely simplified conditions for it also requires the conditions, the medium of the organism. To the further and more exact indications for the suitability of such materials also belongs the fact that they act on the same defense system and *with the greatest possible similarity of defense phenomena*—as signs of

the defense mechanism—as the damaging bacteria. Presumptions from this angle lead to the simile rule. And indeed in lues and mercury with great distinctiveness.

The similarity of mercury symptoms with those of lues, primarily on the skin, mucous membranes and the glands dependent upon them is notorious. But the same "way" also holds for scrofula and therefore mercury frequently comes into question here as a healing remedy.

Outside of the enrichment in definite tissues, particularly in the reticulo-endothelial system, the chief site of defense against the toxins of micro-organisms, the sites of excretion are essential for the course of mercury actions. All the sites mentioned can come into consideration for excretion. But which one will be preferred and which produce toxic manifestations after mercury enrichment, among other things depends on the preparation; thus calomel especially affects the biliary passages and the intestine, biniodide and cyanide of mercury, particularly the throat, the stormy sublimate very rapidly inflames the oral mucosa, the kidneys and the large intestine. In the more protractedly acting metallic mercury, as in inunction cures and in mixtures of metallic mercury with complex compounds, for example mercurius solublis, excretion in the saliva and sweat obtains significance. In mercurius praecipitatus ruber, HgO, the ocular mucous membranes are preferred and cinnabar, HgS, usually considered nontoxic because of its insolubility, in sufficient subdivision shows a special affinity for the eyes and their vicinity.

Another pace is set with mercury vapors, the molecular form of mercury, if it is frequently inhaled. It provokes chronic poisoning preferably in the nervous system. This depends probably on the entrance of

firm organic mercury compounds which are eliminated with relative difficulty. For it is also known that many organic mercury compounds cause early disturbances in the nervous system, for example, the methyl and ethyl compounds.

In spite of the great improbability of a direct mass action of mercury on the spirochete still the usual mercury treatment of syphilis must be extended over months and years to obtain an extensive saturation of the body with mercury up to the threshold of intoxication. In actuality it is probable that the difference from a homoeopathic mercurial treatment with the lower potencies, as is common, is not very great. Because in an inunction treatment we do not know how much of the mercury rubbed into the skin and the fraction inhaled (daily about 1 gram Hg) actually gains absorption. Moreover it may be assumed that much of the absorbed mercury is stored in an inactive form. Finally the excretory situation of mercury through the urine, bile, faeces, saliva, sweat, under certain conditions also in the milk and seminal fluid, is so variable and unpredictable that the extremely irregular curve of excretion in the urine permits no conclusions on the amount of active mercury. These relations are just as uncertain with the injection of mercury, in which one also never knows when and how much of the inactive depot becomes active and because of this uncertainty Lewin has urgently warned against the creation of such depots. If the stimulation of the defense mechanism, perhaps antibody formation, and sensitizing the microorganism was the essential, then the choice of the most easily and perfectly absorbable preparation in the state remaining most active and sufficiently frequent repetition would be most advantageous.

The field of mercury effects which come under consideration chiefly as the image of the medicinal indications are not the hyperacute local corrosive action of ionized mercury salts, nor on the other side the chronic poisonings with preference for central nervous system involvement and ultimate cachexia as they are quite common to the poorly soluble heavy metals: in mercury it is more the subacute manifestations perhaps as they are known in untoward actions in medical use and as the first manifestations of intoxication from absorbed mercury compounds; the inflammatory manifestations primarily on the mucous membranes, the skin and lymph glands, then in the periosteum, synovia and the serous membranes and finally on the kidney, particularly in the tubules with the picture of nephrosis. Only at a certain distance from here the chronic heavy metal action on the nervous system of mercury comes into the domain of indications.

MERCURY AND MERCURY COMPOUNDS

Provings of mercury preparations are found:

Of mercurius solublis:

1. Hahnemann: *Reine Arzneimittellehre,* 3 Aufl., Bd. 1, S. 348, 1830 (of mercurius solublis whose actions Hahnemann sets equal to those of pure triturated mercury. There is included a short proving of mercurius dulcis, mercurius corrosivus, furthermore reports taken from the literature on various mercury preparations).

2. Knorre: *Allg. Hom. Zeit.,* 1835, Bd. VI, S. 35 with mercurius solublis 1st trituration (eczema and glandular swelling) one prover.

3. Robinson: *Brit. Journ. of Hom.,* vol. 24, 517 (short proving of 5th potency).

4. Andrieu: *Journ. de la. Soc. Gall.*, vol. VIII, 143 (short proving of mercurius solublis D 3).

5. C. Wesselhoeft: *Trans. Amer. Inst. of Hom.*, 1886 and 1888 (with mercurius solublis in various potencies in 20 student provers which gave useless results).

Of mercurius corrosivus

1. Buchner: *Allg. hom. Zeit.*, 1897, Bd. 135, S. 92 (7 provers).

2. Masselot: *Archiv. gén de Med., sér. IV*, vol. XI, 58.

Of mercurius iodatus

Amer. Provers Union Monogr., 1866.

New Provings (After *Allen's Encyclopaedia*, vol. 6, p. 269).

Of mercurius biiodatus

1. Andrieu: *Jour. de la. Soc. Gall.*, Bd. VIII, S. 140.

2. Robinson: *Brit. Jour. of Hom.*, vol. 24, p. 517.

3. Hering: *Mat. med.*, vol. 1, 1873.

Of mercurius praecipitatus ruber

Eiselt: *Frank's Mag.*, Bd., 1. S. 772.

Of cinnabaris

1. Andrieu: *Jour. de la Soc. Gall.*, 1856, vol. VIII, S. 143.

2. Neidhard: *New Amer. Jour. of Hom.*, vol. II, Append. Nov. 1852 (after Cyclopaed. of Drug. Path. 1890, vol. 2).

For the rest unintentional intoxications with mercury compounds are so numerous that they afford a

good basis for the drug picture. The intentional provings serve only for securing of finer details.

One can characterize a universal mercury picture as that which appears as the subacute poisoning with all, but particularly the inorganic mercury compounds. It corresponds in general to the medicinal domain of mercurius solublis or mercurius vivus. From this nucleus the details and characteristics of the single preparations can be best derived.

MUCOUS MEMBRANES

The somewhat inconstant mercury preparation mercurius solublis (obtained from mercurous nitrate by ammonia) is preferred in homeopathy because Hahnemann's provings were originally made with this compound. At first all mucous membranes can be set into inflammations of various stages by mercury; predominately and most frequently the *mouth* and *throat* and then the *large intestinal mucous membrane* are affected. This obviously depends on the enrichment in the excretion of the saliva and in the faeces. The secretions appear increased and altered under mercury.

MOUTH, NOSE, EYE, EAR

Stomatitis mercurialis can appear in all grades: Lewin differentiates a stomatitis simplex, ulcerosa and gangrenosa. The symptoms in detail are: the offensive salivation, foetor ex ore, gingivitis with involvement down to the periosteum of the alveoli, the teeth become loose with nocturnal aggravation of the toothache, worse from cold and warmth; glandular swelling in the region of the mouth and throat especially the salivary glands; swollen tongue showing imprints of the teeth, thickly coated white tongue; marked thirst in spite of moist

mouth, ulcerative processes from aphtha to deep purulent or dark blue-grey coated ulcers and abscesses. All manifestations of angina are frequent in mercury poisoning and are described exactly in the provings. After belladonna mercury is most frequently prescribed in sore throat. The similarity of mercury poisoning to pharyngeal diphtheria can be very close.[684] Similar inflammatory symptoms appear in the nose, eyes and ears. A tendency to suppuration always exists. In the coryza there is yellow green, thick or copious and acrid secretion, with much sneezing (worse from sunshine) and also here the periosteum may become involved with green offensive ulcers; caries as occurs in lues, naturally did not appear in the provings but arise from poisonings. The nose is also externally inflamed and swollen. Sensations in the region of the root of the nose refer to inflammation of the frontal sinus.

The inflamed *eyes*, blepharitis, and conjunctivitis with copious acrid secretion are very sensitive to light and flames (conjunctivitis of stokers!). For blenorrhoea mercurius praecipitatus ruber is preferred. Also keratitis, not only the parenchymatosa luetica, but also scrofulous and ulcerative forms tending to hypopyon, episcleritis and moreover iritis are important indications for mercury. The nocturnal aggravation, in the warmth from fire or light, may be guiding. The fixed points from the provings as cloudy vision and dark spots before the eyes are naturally unsuitable. The inflammation of the ears involves the external auditory passages and the middle ear. The earache is worse at night in bed, the secretions are again offensive, thick and yellow. Tubal catarrh with deafness may also require mercury.

INTESTINE

A further elective trend is the *large intestine.* Leading here for the employment of mercury are: the dysenteric, bloody, mucous, or green acrid stools with marked tenesmus and the "never get done" sensation (no relief from stool) with nocturnal aggravation, chilliness, anxiety and nausea, and cutting pains; the acrid stools make the anus very sensitive and sore; noteworthy results can be obtained in oxyuris with mercurius solublis D 3. The white-grey stool which was also observed in the proving belongs to the disturbances of biliary secretion; together with icterus and enlarged sensitive liver they frequently indicate mercurius dulcis in inflammations of the bile passages and in duodenal catarrh. The patient should not be able to lie upon the right side.

There are also a number of symptoms from other parts of the gastro-intestinal canal but they are not characteristic for mercury. The alterations of taste (salty, sweet, foul, metallic, slimy, dirty, tasteless) are associated with the processes in the mouth. Gastric manifestations may be associated with aphtha, foetor ex ore, thirst with a moist mouth when mercury is indicated. Non-characteristic and therefore less used are the symptoms from the deeper respiratory passages. An exhausting, dry, nocturnal cough with stitches in the chest on sneezing or coughing may be mentioned.

URINARY AND SEXUAL ORGANS

On the other hand the inflammations of the *urogenital system* offer frequent indications. The nephrotic albuminuria (especially for mercurius corrosivus) has already been mentioned. The initially increased amount of urine with later diminution is a renal effect. Fre-

quent urge to urinate, voiding of turbid urine with burning, cutting and sticking refers to the cystopyelitis, the greenish secretion from the urethra with inflammatory swelling of the urethral orifice and the glands to *gonorrhoea*, an important and proven indication. Correspondingly on the female organs the greenish and muco-purulent leucorrhoea with itching, burning, inflammation of the vagina and vulva find a healing remedy in mercury in cases of gonorrhoeal as well as other genesis. Also in adnexal diseases, not only of gonorrhoeal origin, are frequently suitable for mercury, particularly mercurius iodatus. The inflammatory manifestations on the external genitalia with vesicles and ulcers, bartholinitis, balanitis should also be mentioned here. To this may be added the repeatedly observed inflammation of the inguinal glands in the provings though they are less well known from the poisonings and observations of untoward actions. Hard and soft chancre, just as non-specific inflammations and buboes are homoeopathic indications for mercury. The participation of the lymph glands is always an important indication for mercury, also scrofula when, for example, the glands swell after each exposure to cold.

SKIN AND LYMPHATIC SYSTEM

Less observed in crude poisonings than in the untoward actions are the *skin manifestations* which according to Lewin can take on all forms from erythema and urticaria to eczema and severe dermatitis. That papular exanthems also appear is to be noted especially in respect to secondary lues. The skin manifestations of mercury are often associated with fever. The eczemas are most important as indications: "eczema mercuriale," marked itching pustular eruption, small vesi-

cles with turbid milky secretion, especially on the head with falling out of hair, and on the face, stinking yellow crusts, marked purulent secretion; painful deep, bloody fissures and cracks on the fingers, desquamation of skin around the finger nails. In general the skin and also the eruptions of mercury are moist or weeping, the eruption goes from vesicles to pustules, to small suppurative nodules; it is the picture of severe itching "fatty itch," as it was formerly called. But dry itching eczema which burns after scratching also appears in the mercury picture; this itching is worse from the warmth of the bed.

Even early it was noted that mercury acted intensively on men with "succulent" skin (Lewin). Therein *lymphatism* comes to expression with its broad lymph spaces and sluggish lymph stream. Likewise mercury is said to be better adapted to light haired individuals. If one adds the glandular swellings with the tendency to suppuration, furthermore all manifestations as eczema which appears easily after chilling and cold baths, and, as Lewin also cites, that there is a sensitivity to cold and dampness, then the picture of *scrofula* is completed from this side. Also in the inflammation of the sebaceous glands, the inflammatory acne I have often found mercurius solublis of value. When mercury is employed in ulcers it is in those with offensive acrid suppuration and undermined borders, indications which other agents also have as marked or stronger.

In regard to the question of mercury excretion through the milk the report of the materia medica notes: poor milk which the nursling refuses. A useful sign for mercury is pain and swelling in the breasts as signs of inflammation before suppuration. This first

stage of inflammation of glandular tissue is, in general, the most suitable for the use of mercury.

JOINTS AND SYNOVIA

Mercury is also excreted through the sweat and increases and alters it as all secretions and excretions. The sweat of mercury is offensive, oily, clammy, increased at night and brings no relief in the disturbances of well being nor in the local inflammatory pains. These good indications from the sweat are utilizable most frequently in acute and subacute rheumatic fever. The joint affection in the picture of mercury is naturally a subordinate trend of action but in acute rheumatism which is also metastatic and mostly from a sore throat, it is one of the elective sites of mercurial action.

But a transition to the mucous membrane inflammation locally is also not rare in mercury. This we saw above in the mouth and nose inflammation. Periodontitis is one of the surest indications for mercurius solublis (D 6) when heat as well as cold aggravate and the pain is worse at night. The *nocturnal aggravation* is characteristic in all of the pains arising in the bones and therein lies another similarity to the luetic bone pains. Also in the headaches of mercury, which consist chiefly in tension, pressing together and sensation of a band, one may consider a participation of the periosteum or the Galea aponeurotica as a cause primarily on account of the nocturnal aggravation.

NERVOUS SYSTEM AND GENERAL SYMPTOMS

The actions on the nervous system are rarely observed in acute or subacute poisoning with mercury, but are peculiar to the chronic intoxication. Therapeutic indications are occasionally given by the so-

called mercurial erethisms. The chronic actions express themselves as follows: insomnia, psychic irritability, restlessness, anxiety, ill humor, anger, depression, disconsolateness; exaltation finally replaced by depression, weakening of memory, judgment and will power diminish, responses are slow, disturbances of movement vary from tremor, stuttering, trembling of the tongue, vertigo to forced movements with propulsion and finally to clonic convulsions, which are chorieform or epileptic. The similarity with paralysis agitans will often justify a trial with mercury in this difficult malady. End actions of mercury poisoning, such as complete psychosis and blindness or hallucinations, with a picture that is similar to delirium tremens are just as little therapeutic indications as the cachexia mercurialis and the alterations of the blood and bone marrow. However exhaustion, emaciation, pale face are frequently accompanying manifestations. The report of Stock that a series of nervous complaints originated from amalgam fillings of the teeth cannot be accepted by the demonstration that small traces of mercury are constantly found in the urine. The improvement of well being after the removal of such fillings however is frequently observed. Finally neuralgias and circumscribed paraesthesias and anesthesias are known from poisonings and in respect to therapy the nocturnal aggravation with other indications may guide the choice to mercury.

SUMMARY

Chief Trends:

Skin, mucous membranes.

Especially mouth and large intestine, then urinary passages.

Increase and alteration of all secretions.

Lymphatic system (glands); impending suppuration.
Joint surfaces and periosteum.
Nervous system (erethism, chronic action).

Clinical:

Scrofula, eczema, acne.
Syphilis II, ulcus molle.
Gonorrhoea.
Mouth and nasal inflammation with involvement of periosteum (periodontitis).
Angina, diphtheria.
Large intestine inflammations (dysentery).
Infectious jaundice (especially mercurius dulcis).
Nephrosis (esp. mercurius corrosivus).
Metastatic joint inflammations: polyarthritis.
Adnexal diseases (esp. mercurius iodatus).

Constitutional:

Lymphatism (light haired?).

Modalities and Leading Symptoms:

The nocturnal aggravation in the warmth of bed is the most general.

Neither cold nor heat is well tolerated, cold and damp weather and drafts often make the complaints acute.

The offensive, clammy sweat characteristically brings no relief.

The aggravation from fire and light refers to the eyes.

The aggravation from lying on the right side refers to the biliary passages (and perhaps to the dry cough with stitches in the chest).

Thirst with moist mouth and swollen thickly coated but moist tongue.

MOST COMMON PREPARATIONS

Mercur. vivus= Hg.
Mercur. praec. ruber= HgO.
Mer. dulcis= HgCl— calomel.
Mercur. corrosivus= $HgCl_2$.
Mercur. iodat. flav= HgI.
Mercur. biiodat rub.= HgI_2.
Mercur. cyant= $Hg(CN)_2$.
Mercur. solub. Hahn= $NH_2Hg_2NO_3 + Hg + Hg_2O$ (mercuroamidonitrate + Hg = mercurooxide).
Cinnabaris = HgS.

Mercurius corrosivus was preferred even by Hahnemann in severe dysentery (Spring dysentery). This preparation as well as the iodide (more frequently) is employed. Also in colitis and the participation of the peritoneum from the appendix or adnexa. Moreover mercurius corrosivus is the most marked renal preparation. The calcium infarct in sublimate poisoning is an anatomical end-product. Mercurius corrosivus is a most active preparation in which the inflammatory processes and ulceration extend rapidly and take on a phagedenic character.

Mercurius cyanatus is preferred particularly in diphtheria, in severe forms with great prostration and cyanosis. H. Schulz has dedicated a special monograph to this disease. But mercurius biiodatus also performs good service.

Mercurius iodatus and biiodatus increase the affinity of the mercury for the throat. Mercurius biiodatus is the more acute of the two; diphtheria, glandular swellings in sore throat with high fever are special clinical signs. Mercurius iodatus has subacute glandular swellings also post nasal catarrh; thick, dirty yellow coated

base of the tongue. It has also proven useful in pelvic peritonitis.

Mercurius dulcis, the mildest preparation, is preferred for children. Duodenal and biliary affections are the chief trends.

Cinnabaris will be found useful in painful affections of the eye and in this region (orbit, sinusitis); pressure on the root of the nose; easily bleeding warts, condyloma about the genitalia and fiery red ulcers.

DOSE

Mercurius solublis D 6 has proven valuable with me but in very acute inflammations the D 3 is better. The action of D 30 in the nervous affections remains uncertain. The other mercury salts in general are used in the lower and middle potencies, for example mercurius corrosivus in lues in D 3-D 4.

THALLIUM

Thallium discovered in 1861 spectroanalytically by Crookes has great kinship, chemically and pharmacologically, with lead, which immediately follows it in the periodic system. In its salts (the chloride, sulphate, nitrate, carbonate, and acetate) it appears chiefly univalent, although one should expect from its relationship to the additional series IIIa, a preponderant trivalence. But the valences in the additional series are usually diverse and varying. Especially interesting would be a proving of the water soluble carbonate, Tl_2CO_3, which has been little studied up to the present.

The similarity with lead shows itself first in the fact that thallium also causes a glandular degeneration of the red blood cells.[685] An eosinophilia and lymphocytosis has also been demonstrated in man. In dogs the manifestations of poisoning are: disturbances of coordination, trembling of the head, paralysis, disturbances of respiration, coma; furthermore especially rapid falling of hair, diarrhoea, lachrymation and albuminuria.[686] Curzi[687] reported increase of blood pressure in animals. The particularly noteworthy falling of hair was also observed in men, first as an unpleasant untoward action when thallium salts were employed in tuberculosis as an antihydrotic. Buschke has experimentally induced falling of hair in various animals with minimal scarcely demonstrable doses of thallium and

also employed thallium salts for epilation in man by internal medication.

Since thallium-containing depilatories have been employed in large numbers, the reports of the untoward actions of thallium have increased. They agree with the actions which have been cited in the homoeopathic materia medica texts[688] of thallium and its salts. The older reports arise from Lamy: Gaz. des Hôp., 1863, p. 104 and Journ. de Chimie, 1863, vol. IX, p. 721, and Marmé (according to Raue's Ann. Records of Hom. Lit. 1870, p. 21).

One can present the gastro-intestinal syndrome first: nausea, vomiting, loss of appetite, abdominal pains with retraction of the abdomen, colic and diarrhoea, which soon passes into persistent constipation. Later disturbances appear in the nervous system: numb sensation in the feet, acroparaesthesia, reduced tactile sense but extraordinarily increased sensitivity to touch, especially of the lower extremities, painfulness of the muscles and joints, lancinating pains and weakness in the legs (depending upon multiple neuritis) trembling, incoordinated movement of a choreiform nature, visual disturbances from a retro-bulbar neuritis up to amaurosis, decrease in the psychic function up to dementia. To this may be added the vegetative-trophic disturbances: complete falling of hair at the vertex; moreover conjunctivitis with marked secretion of mucus, blepharitis, acute suppurative dermatitis of the face and salivation. The night sweats of the tuberculous are said to be relieved.

Thallium poisoning leads to marked emaciation and general weakness, finally also to cardiac, hepatic and renal degenerations.

The therapeutic use of thallium according to the

simile rule is still unusual. It is said to have relieved the severe lancinating pains of tabes. A further testing of the action which resembles lead would be of great interest in view of the characteristic symptoms.

LEAD

From the middle age analogy of lead to Saturn the designation of lead poisoning as saturnism still persists. Today the nature of lead and its position in the history of the material world has become significant in another respect. Lead is the inactive end-product of radio-active disintegration of uranium and thorium. The transformation of the elements by destruction of their nuclear structure finds a halting point in the ancient common heavy metal, lead.

In the course of regressive transformation of element with the highest ordinal numbers and atomic weights in lead for the first time one encounters the new problem of the riddle of "material element" which is only partly solved. It is shown that the chemical identity of a substance as lead, which shows an identity in all respects to other substances, does not depend upon physical uniformity. Moreover that which always seems to appear as the same lead is a combination of various types of lead (up to the present 14 are known) which have their developmental histories according to structural and physical properties. Although possessing the same ordinal number, also determined in material relations by the same nuclear charge, they have various atomic weights. They are called isotopes, that is, belonging to the same place in the periodic system in spite of different atomic weights. The atomic weight of naturally appearing lead is the arithmetical mean

of the atomic weight of these lead isotopes. All chemically pure lead still carries traces of its cosmic history in the composition of its isotopes.

Lead still possesses to some extent the physical forces out of which it arose or from whose point of departure it was; on the other side it also retains the inertia of a residue after the transformation of highest energies. When old physicians, particularly iatrochemists, employed lead preparations against cancer, perhaps there may have been some admixture of radioactive substances in the preparation of such lead. The insidious way in which lead leads to cachexia makes a comparison to cancer cachexia seem likely.

Later, perhaps a century ago, out of the obvious lead actions its drying, solidifying, contracting capacity were separated purely by assumption and it was recommended for states which seemed opposed to the normal by virtue of excessive secretion and dilatation. The still current external use of lead water fomentations, ointments and plasters on discharging wounds and mucous membranes depends on the formation of a fine protein precipitate. For ages the internal use of lead preparations has been maintained, as a hemostatic, especially in pulmonary bleeding, but today as in general the internal use of lead has become completely abandoned.

POISONING

With such extensive and common actions after absorption of lead at first it seems remarkable that so few experiences on its healing properties have been gained and retained. But it is comprehensible when one reflects how great a role the time factor has played in the appearance of the effects of the absorption of lead.

Acute poisonings in lead are of slight significance. They require large amounts and then show almost only gastro-intestinal symptoms: salivation, bad taste, nausea, vomiting of masses of mucus, gastric cramps, and finally collapse with cold sweat, often Cheyne-Stokes breathing and convulsions.

However lead poisoning so thoroughly important practically requires very frequent, small, finely divided amounts of lead and a long time for its development. Poisoning may long remain latent and then come into evidence when the external occasion has long since disappeared. Also the very slow excretion of metal which is moved with difficulty from the body, is even slower than the intake, scarcely furnishes an explanation for the situation. The accumulation purely to the amounts up to toxic doses according to all evidence does not correspond to the actual situation. According to animal experiments it involves less[688a] a retention and accumulation of the toxic substance and much more a summation of slightly damaging after-effects. Also the frequent repetition of minimal insults by the smallest amounts of lead, but over a long period, leads finally to demonstrable organ injuries. The comparison with the constant dropping which wears away the stone, not through force but the frequent recurrence, seems especially likely. It symbolizes only one mechanism which we utilize so well in provings on the healthy and also advantageously many times in the therapeutic dosage. That the effect with such a procedure also is entirely different than with a single massive dose is emphasized with particular clarity in the example of lead poisoning. Because never in acute animal and human attempts with inorganic lead were similar acute pictures of lead intoxication obtained as those

which are known from chronic intoxication. Particularly the late results in the nervous system appear exclusively in the chronic poisoning. With organic lead compounds (triethyl lead) however one can also experimentally produce nerve symptoms. This suggests that the nerve affinity of the chronic acting inorganic lead occur through a gradual transformation into an organic (lipoid soluble) compound. This behavior in lead is entirely similar to that in mercury.

Chronic lead poisoning seems at first to fulfill all the requirements which one can expect from a drug proving to and to make unnecessary intentionally arranged investigations in view of the large amount of observation material. But the descriptions of poisoning usually begin with symptoms which already represent the existence of definite organ injuries. These organ involvements are very good therapeutic signposts but the initial symptoms in sensitive people are (as expressions of the active defense) still more valuable for this. And this gap must be filled in as far as possible by intentional investigation in man. Lead obviously offers special difficulties, because its harmful effects remain latent for a long time and then suddenly manifest themselves. Even if the available provings on the healthy[689] supplement and make a little precise, still a disproportion remains between the repeatedly demonstrated and extensive organ damages produced by lead and the present utility of these apparently so significant indications. But up to the present the significance lies more in the pathologic anatomic alterations than in the observation of subjective details and the very important modalities. Nevertheless that is what can be utilized homoeotherapeutically in the available observation material and usage indicates that this is considerable in com-

parison to the otherwise complete neglect of lead as an internal remedy.

Since the great trend of the lead picture can be designated distinctly as a chronic poisoning, we can use it as a guide and need only to discuss the therapeutic evaluation and to add the available details where they are known.

PLUMBUM METALLICUM

It is certain that lead is a *chronic remedy* of persistent, often only late action. Its suitability for chronic diseases is not excluded by the fact that it can produce acute symptoms of intoxication and can also produce sudden improvements.

The earliest objective signs involve the blood. The basophilic stippling of the red blood cells early shows an injury to the red cells which subsequently can lead to *anemia and a wan, yellow grey,* subicteric lead pallor; moreover an outspoken icterus can occur. The hemolytic action is obvious. Hematoporphyrinuria can be considered as a further sign of blood destruction by lead (with pathologic formation of this pigment in the liver). In this respect liver damage from the plumbum absorbed (in Kupfer's star cells and the capillary endothelium) is probable. *Lassitude, decrease of appetite, emaciation, wrinkled wan skin* complete the cachectic picture. But the pale yellow appearance also depends partly on the vasoconstrictive action of lead.

Even in the early stage *constipation with abdominal pains up to colic* is present. The well known lead line, a precipitate of lead sulphide has merely diagnostic significance. Psychic disturbances likewise appear early: slowed comprehension and failure of memory, "cannot find the right word," depression and anxiety (fear of

being murdered). The state resembles that of cerebral sclerosis. Also in the later stages, after cerebral hemorrhage with hemiplegia has occurred, plumbum belongs to the remedies which deserve some confidence, for one finds many parallels with the symptoms of lead poisoning, especially in the sequela of central paralysis. The later symptoms of severe brain injury, the picture of so-called encephalopathia saturnina with mania, delirium, hallucinations, and illusions, eclamptic and epileptiform attacks, coma, give the parallel to general paresis, delirium tremens, epileptic insanity, etc., but are no longer useful therapeutically.

CHIEF TRENDS

In manifest lead poisoning two *chief trends* of action can be differentiated: on the *blood vessels* and the *nervous system.* But the two systems are intermingled so that it is often difficult to determine the initial point of the toxic action. A majority of the symptoms can be traced back to vascular actions. They vary from angiospasm and ischemia to severe injuries of the vessel intima, endarteritis, and sclerosis. The *increase of blood pressure* is also conditioned by extensive vessel spasm.

VESSELS

Even more frequently than the already mentioned cerebral vascular action is the injury to the kidney by lead; as the result of the ischemia there is a chronic nephritis with degeneration of the parenchyma or a nephrosclerosis in consequence to an endarteritis. If other etiological causes have induced these two morbid states, which merge into each other, then the prolonged use of lead which acts very similarly is recommended

in the middle or high potencies, in order to save what may be saved.

SMOOTH MUSCULATURE

Even in the spastic contracture of the intestine which is designated as lead colic, one can be in doubt whether it is to be traced more to the spasm of the mesenteric vessels or to direct excitation of the smooth muscle through the vagus. This syndrome also gives frequent therapeutic indications for lead in the event of *colic and constipation.* The attacks are *spasmodic, radiating,* mostly below the umbilicus, *with rigid retraction of the abdominal muscles;* they are *relieved by pressure* so that the patient bends double at one time but at another he has the desire to stretch. The "thready pulse" during the attack shows the marked participation of the vessels. *Persistent spastic constipation* can also appear with or before the colic and may be an indication for lead by itself. The anus is spastically contracted and retracted, if *stools* are passed they consist of *hard, black balls.* There is a *spasmodic urgency to stools,* but *even flatus is retained.* The intestinal paresis can produce severe signs of intestinal obstruction, of intussusception, still one would not pursue medical therapy in such parallel states but seek to relieve the mechanical cause. But if it involves a dyspraxia intestinalis arteriosclerotica, this true image of lead action, then plumbum is to be esteemed as a remedy with better prospects of success.

Oesophageal and gastric spasms are more rare than the intestinal. The picture resembles the tabetic crisis and the similarity with tabes extends in many other directions as we shall see (arthralgias, nerve actions).

The crampy pains with retraction of the abdomen can

also direct attention to plumbum in dysmenorrhoea. Thereby the bleeding may be immoderately severe or amenorrhoea may exist. The tendency to abortion in lead poisoning is very great, even in wives whose husbands have lead poisoning. How far the degenerative alterations in the reproductive glands and the parotitis, the trophic actions, originates in the vessels or immediately through vegetative nerves, must be left undecided. Impotence, testicular swelling and atrophy can scarcely be therapeutic indications for lead. Irritative phenomena in the external genitals as cremasteric spasm, sensation of constriction in the testes or hyperesthesia and spasm of the vagina (vaginismus) are more inviting for therapy, even though there is rarely opportunity for it.

NERVOUS SYSTEM

The disturbances in the central and peripheral nervous system are so diverse according to site and degree that all types of irritative and paralytic states appear when there is opportunity. Whether the endarteritic processes, at times ischemic, or the small hemorrhages lie at the basis of a direct injury of the nerve tissue by lead—after preliminary transformation into an organic lipoid soluble compound—cannot be decided at present. Lead action has special sites of appearance. Among the cranial nerves the optic nerve is one. It may occur as a transient blindness after previous disturbances of consciousness or as the gradual development of an optic neuritis ending in atrophy of the optic nerve. Here also the similarity with tabes is observed. A neuroretinitis in conjunction with the other suitable symptoms of the basic malady can lead to a useful employment of lead.

From the spinal cord nerves the extensor paralysis of the hands are known best. Their origin of departure probably depends on an injury to the grey substance of the anterior horn of the spinal cord. But the perfected paralysis is not the comparative picture for the therapeutic indications of lead with the prospect of success, but rather the transient sensory, trophic and motor irritative manifestations; thus severe neuralgias with local hyperesthesias and anesthesias. The *skin* in spots is very *sensitive to contact and cold air*. Numbness, twitching, lightning-like pains indicate the neuritis. Cramps in groups of muscles, for example, in the calves appear; they are *worse at night and on movement, but are temporarily relieved by pressure*. The tearing and boring pains of so-called lead arthralgia come paroxysmally like lead colic, and may alternate with it. The pains may be so severe that they force the patient into cramped positions. Trembling and muscle weakness introduce the motor paralysis which soon leads to atrophy. Lead is to be considered as a remedy in the *occupational cramps*, moreover, in the chronic neuritis of mixed nerves, for example, in chronic sciatica.

The numerous spinal cord injuries of lead poisoning have a great similarity at one time with tabes, at another with amyotrophic lateral sclerosis, again with bulbar paralysis. But one cannot expect the stimulative reaction from lead to have much room for play and prospect of results in these diseases. According to personal experience it seems that at most the course of progressive muscle atrophy can be favorably influenced by lead.

Lead gout whose origin is still very dark, has great

similarity with arthritis urica, but therapeutic deductions can hardly be drawn from this at present.

Only the most common of the lead injuries are mentioned above. Lead poisoning can imitate many severe pictures of disease so remarkably that at first it seems peculiar why the therapeutic domain of lead is proportionately small from the standpoint of the simile rule. But this is understandable when one recalls how many degenerative, severe or irreparable disease processes appear in the picture of lead poisoning.

SUMMARY

Slowly acting remedy.

General Disturbances:

Malaise, emaciation, wan, yellow, dry, withered skin —cachexia.

Depression and impairment of comprehension and memory.

Chief Trends of Action:

1. Blood vessels:

Angiospasms, endarteritis up to sclerosis. Chronic nephritis and nephrosclerosis.

Cerebral sclerosis and hemiplegia.

Dyspraxia intestinalis arteriosclerotica.

2. Participation of smooth muscles of organs.

Persistent spastic constipation with colic, better by pressure.

Dysmenorrhoea with colic-like picture.

3. Nervous system:

States of irritation up to paralysis and atrophy.

Cranial nerves: particularly neuritis optica, neuroretinitis.

Spinal nerves: especially extensor paralysis of the hands.

Anaesthesias and hyperaesthesias.

Sensitivity of skin zones to contact and cold air.

Neuralgia, muscle spasm, worse at night and from movement; better from pressure.

Chronic neuritides. (Similarity with degenerative system diseases of the spinal cord often great but not useful.)

Progressive muscle atrophy.

Modalities:

Worse from contact, from movement, at night.

Better from counterpressure.

PREPARATIONS

Outside of plumbum metallicum, plumbum aceticum and plumbum iodatum are in use.

Plumbum aceticum will be preferred in painful cramps in paralyzed extremities.

Plumbum iodatum in arteriosclerosis, spinal cord diseases (lancinating pains) and inflammatory breast tumors.

DOSE

Plumbum met. is used in D 6 and D 30, the salts in the lower and middle potencies.

TIN

In its chemical properties tin is in no way so uniform a metal as it might seem according to its usual physical state. There is also a non-metallic amorphous form of tin, a grey powder. By a prolonged stay in the cold, under 18° this non-metallic form develops out of the metallic crystalline. In the cold, tin objects gradually succumb to the so-called "zinnpest," which depends upon this transformation and again changes regresses by heating.

In the periodic system tin immediately precedes antimony. It stands on a similar step in regard to its metallic character which is very preponderant but also gives space for a non-metallic modification.

Therefore it is to be considered that the horizontal kinship to antimony which is expressed structurally, that is, in nuclear relationship, also is not without significance for the similarity of properties. Because in the following outspoken metal step, to lead, we likewise have a distinct approximation to bismuth in physico-chemical relation. This decrease of essential difference in horizontally related elements is again noted in the additional series of the 4, 5, 6th periods (and is demonstrated in a still higher degree in the compression of 15 rare earthy metals in the 6th period).

In stannum-antimony and plumbum-bismuth we can determine the approximation conditioned by a shifting of 10 elements in the horizontal series (or periods)

but also demonstrate it between the elements of an additional series (IVa) and a chief group (V). At the same time the mutuality of the additional group IVa (the carbon and silicicum series) as also the relation of additional to chief groups, is very loose; among other things this refers merely to the occurrence of equal valences. The chemical group relationship also is only suggestive and for this the physical nuclear relationship comes more strongly into appearance.

For the comprehension of the pharmacologic actions of tin this approximation to antimony is worthy of note. I recall here that nowhere else in the heavy metals is there the outspoken affinity to the bronchi and lungs as with stannum which makes it comparable to antimony.

TOXICOLOGY

Toxicological interest up to the present has been largely limited to the question whether tin, as tin vessels, food containers with tin plate, that is iron with tin coating, or tin foil, passes into the food and is injurious to health. Even if decomposition of foods has often been cited as the cause of the injuries reported, still the possibility of a poisoning by tin salts is not excluded, particularly when strong acid foods form soluble tin salts. In animals such salts cause vomiting, diarrhoea, weakness of the movements, muscle trembling, twitching and death through asphyxiation.[690] The intravenous injection of chloride of tin, $SnCl_2$ and $SnCl_4$, in animals causes the usual spasms, dyspnoea, paralysis, from which not much can be concluded. In the longer feeding of animals with tin preparations there are gastric disturbances, emaciation and disturbances of motility as well as ataxia.[691]

After poisoning with tin chloride, stannous chloride, $SnCl_2$, metallic taste, constrictive sensation in the throat, vomiting, pains in the epigastrium, diarrhoea and prolonged colic occur in man. After the consumption of salt with bread from a moist tin container (compound of chlorine and tin) there develops: chilliness with heat, frontal headache, and pains in the distended, pressure sensitive gastric region, coating of the tongue, salivation associated with a foetid odor, grey discoloration of the gums and ulcers along the border of the tongue.[692]

The gastro-enteric manifestations are to be conceived as local actions from a corrosive substance such as tin chloride is. Frontal headache and febrile disturbances are better considered as resorptive actions. According to Lewin[693] in its administration for epilepsy, as soon as the dose reaches more than 0.01 g. after each ingestion of tin chloride causes mild febrile attacks. In many epileptics the attacks at first increase somewhat, then subsequently diminish. Such untoward actions were considered necessary for a favorable effect.

USE

Tin filings were once recommended by Monro, Fothergill and Richter. Tin oxide, SnO, was often recommended in ancient times for many types of spasms, hysterical states, nerve pains, and also cachexias with ulcerations. Antihecticum Poterii or bezoardicum joviale (Jupiter = stannum) is an old preparation from antimony, perhaps iron and tin which was extolled as diaphoretic, antispasmodic, depressant to profuse secretions and in tuberculosis for the removal of the profuse colliquative sweats. That tin was present in this remedy for tuberculosis in addition to antimony, is not without interest for us. In Hahnemann's time tin was

used only as a remedy for tapeworms. Hahnemann[694] turned against the conception that tin filings acted purely mechanically on the worms. On the whole he did not consider tin a good remedy for worms since the tapeworm was not killed but perhaps only stupefied. But older physicians also used a water which was boiled in tin vessels for a long time and an action against tapeworms and intestinal parasites was ascribed to it. At present one no longer finds any therapeutic use of tin in the school, or not even the chloride as an external corrosive.

STANNUM METALLICUM

Provings with pure tin are found in Hahnemann: Reine Arzneimittelehre. 2 Aufl. Bd. VI. Other isolated observations concern the chloride. Stannum iodatum, SnI_4, is not proven.

TYPE

Nervous and bodily weakness, relaxation of the muscles and tendons, give the accent to the entire stannum picture. The type is a weak patient with pale face, dark circles around the eyes, sunken eyes, of depressed irritable disposition, who tires when speaking or listening to others, has great aversion to undertaking any work; the legs and knees fail and tremble. Walking upstairs is particularly difficult; they must often sit or lie down; they fall into a chair in place of slowly sitting down. The extremities tremble and are heavy. In spite of the exhaustion a certain unrest occasions them to attempt movements. The voice and chest are particularly weak: weak, failing voice, weakness and hollow sensation in the chest.

There is also a weak and empty epigastric sensation

which is not relieved by eating; the urge to stool is without result because of the weakness in the abdomen and rectum (expulsive weakness); weakness up to faintness when defecating and urinating. In relaxed and weakened women the uterus is fallen or displaced.

Palpitation or cardiac anxiety appears on the least effort, for example, in conferring on the order of house work. The vertigo, trembling, depression and anxiety, are worse before the period, better after the appearance of the bleeding. It is concerned with an *asthenic type with relaxed fiber, with emaciation and tendency to enteroptosis.* On the general state of constant weakness and sensation of exhaustion is added the depicted depressive-hypochondriacal frame of mind described and the special symptoms in the nervous system and the vegetative organs.

The sensation of fatigue in the head as from overwork runs the gamut up to heaviness, pressing and drawing pains in the occiput and forehead, worse from bending, sharp cutting pains in the temples and about the eyes, supra- and infra-orbital neuralgias or even migraine. The pains are characterized chiefly by the modality: *slow increase up to an acme then slow decrease,* in the second line all pains are characterized by *relief from pressure.* Also for the neuralgias in other places, for example, in the trapezius over the shoulder and in colic, this modality holds and refers to stannum.

The old reports that tin is a remedy for spasms, particularly of an epileptic type, furthermore for the complaints of worms or dentition, have been taken over into the homoeopathic materia medica. The inclusion of tin under the antispasmodics besides cuprum and zincum in the older literature can hardly exist with right.

RESPIRATORY PASSAGES

Among the organs tin has a special trend on the respiratory passages. In the throat it excites a tenacious, thick, grey or grey-green mucus, which produces nausea on attempts to remove it. The sensation of weakness on speaking or singing, with the sensation of emptiness and loss of power in the chest, failing voice and hoarseness is expressed in the provings and has been mentioned. The hoarseness will be only temporarily improved by single coughs (perhaps with expulsion of sputum). Loss of power of expiration seems to speak particularly for tin in the complaints of singers.

Besides the loss of power and emptiness in the chest tensive sticking and a knife-like pain, sore sensation internally, oppression and constriction of the chest, a constant desire to cough and exhausting attacks of coughing are repeatedly observed. The irritation seems to proceed from the trachea, to lie beneath the upper part of the sternum and is aggravated by speaking, laughing, singing (and from warm drinks). The collection of much mucus, internal sensation of gasping, snoring, and rales, *greenish sputum* of offensive *sweet* taste (or yellow sputum with foul taste or bloody sputum) are the signs which have led to the use of stannum in chronic bronchitis with abundant decomposed sputum, but particularly in *bronchiectasis and phthisis*. In tuberculosis the downcast mental state is increased, naturally with the prevailing depressed disposition which is not common in tuberculosis. The tendency to hectic fever with chills about 10 in the morning, evening heat and thirst, profuse night sweats (of musty odor?), especially towards 4-5 in the morning, massive collection of mucopurulent sputum in the throat, espe-

cially in the second and third stages of tuberculosis. Often from purely clinical reflections stannum iodatum —which has not been proven—is given preference. Hahnemann introduces a citation from Stahl that tin excites decomposition and consumption, while single older authors found tin curative in tuberculosis. He may also have referred to the old antihecticum Poterii.

GASTRO-INTESTINAL

The gastro-intestinal disturbances can be subordinated well to two clinical trends. The already mentioned sensation of weakness and emptiness in the stomach and abdomen (also after eating), the frequent unsuccessful urging to stool, loss of power of evacuation, exhaustion, and prolapse after stool refer to *enteroptosis.* Many of the proving symptoms read as though the digestive disturbances might depend upon a relaxation of the abdominal organs and wall; increased appetite and hunger without feeling of satiety, many eructations and nausea, cutting and pressure in the abdomen, especially about the umbilicus, crampy gastric and abdominal pains, better from pressure. (The report: retching and vomiting from smelling foods is not to be found in the available proving symptoms.) The gastric cramps and colics are, outside of the relief from pressure, also characterized by the slow increase and decrease.

Hunger and empty sensation, accumulations of saliva in the mouth and the crampy pain about the umbilicus on the other side give the appearance of a symptomatic justification for the old use of tin in worms, particularly when taken in conjunction to the pallor of the face and the hollowness of the eyes.

Geischlöger[695] saw bloody vomiting after intolerable

gastric pressure from finely granulated tin, which he gave for tapeworm. On the other side Alston saw bloody vomiting stopped by tin just as a miracle. This homoeopathia involuntaria in hematemesis apparently stands as an isolated experience.

FEMALE SEXUAL ORGANS

Concerning the female sexual organs the complaints associated with the prolapse or displacement and the aggravation before the menses have already been mentioned. A glassy-mucoid leucorrhoea is another observation of the provings.

SUMMARY

Type:

Asthenic, relaxed fiber. Weak, relaxed, pale, emaciated; depressed, fatigued, trembling, failure of the extremities. Weakness of the voice and chest. Hectic. Enteroptosis.

Organ Affinities:

Respiratory Organs:

Chronic bronchitis with considerable decomposed sputum, bronchiectasis, phthisis II-III with hectic fever (green yellow eventually sweet copious sputum).

Gastro-intestinal:

Digestive disturbances with enteroptosis, colic with the characteristic modality; complaints from worms is doubtful.

Sexual Organs:

Displacement or retroversion of uterus (glassy leucorrhoea?).

Modalities:

Pains slowly increase and slowly decrease. Improvement from pressure. Symptoms of weakness worse on climbing stairs, worse from speaking, especially the chest symptoms. Must move around from the restlessness but soon exhaustion compels lying down.

DOSE

The most common dose is the D 6 (trituration).

Appendix

THE RADIO-ACTIVE ELEMENTS

With the increase of nuclear charge the qualitative differences between elements following one another in the (horizontal) periods becomes ever less. The difference of nuclear charges between 91 and 92 is absolutely the same as, for example, between 6 and 7 (C and N) but relatively considerably less. And this makes itself obvious in the heaviest elements of the periodic system in the remarkable approximation of the properties, which depend upon the differences in nuclear charge.

These radioactive elements beyond lead (84-92) pass into one another. Through radiation with alpha particles which are helium atoms with 2 positive charges, an element develops which stands two places lower in the periodic system. Through radiation with beta particles an element can be built which stands one place higher, particularly when the emitted beta particles attach themselves to the atom nucleus and not to the atom shell. Because a beta particle is an electron with a negative charge.

The material property whose constancy otherwise produces the nature of a chemical element is also variable in the elements of this series. (That it must involve an uninterrupted series can be ascertained by simply rolling the first table (p. 71) together and looking from above down.) So here the chemical property

of an element as a constant unit falls entirely behind the physical variability. The radiation with which this alteration is associated, is decisive for the action of this substance. (Besides the types of rays mentioned there is also the gamma ray, a special short wave length ultra violet light as x-ray.) Opposed to these physical actions the chemical characteristics of these inconstant elements are insignificant. Indeed radium in its chemical compounds is still recognizable as a member of the earthy alkali group, but this is entirely incidental in respect to its chief property, particularly for its actions on organisms.

Now since the radiation of these materials is something autonomous, distinct from the chemical properties, so will the radioactive materials be placed correctly outside of the *drug* materia medica which concerns itself only with chemical actions (that is actions for which the material element is the ultimate unit). And if we consider the display of energy of all substances ultimately as radiant, nevertheless in the "chemically" acting substances there is such a radiation which is associated uniformly with unalterable materials, elements. Even if the difference between "physical" and "chemical" theoretically increasingly diminishes, practically this separation must be maintained.

Radiant therapy is a large promising field. When we pass over the limits to this field, so this can occur only in so far as the homoeopathic method has taken the initiative. It is not far. The extensive approximation of many results of radiant investigation to the general conceptions of homoeopathy cannot be discussed extensively here, even though it would be very enlightening in theoretical respects. I recall simply the optimal action of intermittent quanta (that is, final units

of radiating energy); phenomena of latency and sensitization in radiation with small doses; on the irritant action of slight doses (inflammation and promotion of growth), on the contrary cell destruction from large doses (whereby hypertrophic processes can appear at the border of necrosis); in the production and possible healing of malignant tumors and naevi by radium as well as x-ray; in hyperleucocytosis which is produced by injection or inhalation of radium emanation;[696] on the other hand the leucopenia, indeed aplastic aleukemia (and anemia) in radium and x-ray injuries, an action which is utilized palliatively in leukemia. These are pure results which correspond to the use of drugs according to the homoeopathic method.

But at this place only scanty observations which have been determined from the internal use of radium and uranium salts are discussed.

RADIUM BROMATUM

Soon after the discovery of radium (1897), the first proving of radium bromide, $RaBr_2$, was published.[697] Another proving was published by Dieffenbach.[698] Clarke proved with the 30 centismal potency, Dieffenbach with the 6, 12, 30 decimal potency.

According to these provings the actions of potentized internally administered radium salts proceed in the same major trends as radium and x-ray radiation, as well as those known from external and internal use of radium emanations. (Emanation, however, belongs to the inert noble gases but here a physical action is involved.)

Inflammatory and trophic disturbances on the skin and the joints, as well as growth anomalies of epithelia are the principal working domains of radium bromide.

The first manifestation of the radiant injury to the

skin is itching and burning, dermatitis; moreover, psoriasis-like and eczematous patches were also observed in the provings. The skin becomes thickened and easily excoriated on scratching. On the other hand, in one prover an eczema, fissuring, desquamating wart-like formation diminished with the D 6 during the proving. Clarke also observed the diminution of small naevi. Since the capillary widening is a well known frequent result of intensive radiation, a connection to naevus seems likely for naevus vasculosus and radium bromide (see also Acid. Fluoricum). The increased formation of pigment by radiant action should also be considered for naevi pigmentosi.

Also in dermatitis and even burns caused by radium and x-rays favorable actions have been repeatedly seen from high potencies of radium bromide.[699] Eczema, acne rosacea, psoriasis and horny thickenings likewise are said to be cured. In radium bromide the itching is always worse at night in bed, scratching relieves and washing aggravates, the skin is very sensitive to shaving; bathing in hot water relieves.

The conjunctiva and nasal mucosa were involved in the inflammation. There was a foreign body sensation in the eyes, the nose was dry and itching; dryness in the larynx and trachea provoked a spasmodic tickling cough. The symptom was better in the fresh air. The mouth was also dry; dryness and rawness in the throat ("as from pepper") caused thirst for cold water which relieved. A sensation of warmth in the esophagus and the stomach preceded digestive disturbances: empty sensation, ravenous hunger but rapid satiety, anorexia, aversion to sweets and tobacco, nausea, distension of the stomach and abdomen relieved by eructations and stools, colicky pains better from bending double, con-

stipation alternating with diarrhoea. However these and still other mucous membrane symptoms have not been utilized therapeutically up to the present, nor has the nephritis which was also observed in the proving.

On the contrary the use of radio-active waters in baths and drinking cures in the rheumatic-arthritic complaints,[700] particularly in chronic joint rheumatism, has obtained a strong support from the provings in the sense of the simile rule. Severe pains were repeatedly observed and in almost all muscles and joints; they were dull or sharp, better from continued motion (when beginning motion now better, now worse), better from pressure and from hot baths.

The general well being was disturbed in a similar way as is known from the use of radium emanation: general discomfort, headache, vertigo, weakness, waves of faintness and palpitation are the initial symptoms; sallow complexion and emaciation follow. The vertigo and headaches are better in the fresh air.

The modern radiant therapy for goiter has been employed for a long time by E. Schlegel in the form of radioactive applications (uranothor).

In general radium bromatum is not often used in homoeopathic potencies. But the use of radium emanation and irritant radiation is fundamentally the same and has the same indications. How far the details from the provings, above all the modalities, make an improvement of the clinical indications possible must be taught by further experience.

SUMMARY

Chief Trends:

Inflammatory and trophic disturbances in the skin and joints. Epithelial growth anomalies.

Skin: Itching, burning, dermatitis, eczema, psoriasis, acne rosacea, naevi. Necrotic processes, malignant ulcers, x-ray and radium burns.

(Mucous membranes: dryness of upper air passages. Dyspeptic disturbances.)

Joints and muscles: rheumatic-arthritic complaints.

General well being: headache, vertigo, weakness, emaciation.

Modalities:

Worse at night from the warmth of bed, from cold washing (skin).

Better from hot bath.

Better in fresh air.

Better from continuous (worse with beginning) motion.

Better from pressure.

DOSE

The potencies from D 12-C 30 have been recommended.

URANIUM NITRICUM

Uranium nitrate, uranylnitrate, $(UO_2)(NO_3)_2$ in which uranium appears in the form of a complex oxide as a divalent base is often used for biologic studies on plants because of its relative accessibility from uranium deposits (for example in Joachimstal). Here also the stimulating action of small doses (about D 5-7) on the germination of seeds, on the photo-synthesis of carbon dioxide, on the absorption and assimilation of biogenic elements and the development of plants is shown exactly as with beta and gamma rays; on the other hand with larger doses a depression or injury to all these

biologic processes appears.[701] Weak concentrations of uranium are beneficial, however, only in the presence of light, in the dark and only in the stronger concentrations it is depressing and toxic.

Up to the present the picture of uranium nitricum action has been constantly influenced by the impressions arising from the old investigations of Leconte.[702] In these much sugar was found in the urine 3-4 days after the administration. After subcutaneous injections the same finding is noted.[703] Albuminuria is always present and mucous, phosphate and chloride excretion increased. Dropsy and glycosuria was also found in uranium poisoning by Fleckseder.[704]

In the intentional provings on man,[705] however, no sugar and only a trace of protein was found. Indeed the frequency and amount of urine was increased; on the other hand with large doses in the after-effect and as a toxic action in animals the amount of urine is diminished. Albuminuria and glycosuria accordingly seem to appear only in severe intoxications. It involves a *renal diabetes*.[706] There is no special thirst or hunger in the provings. Thirstiness appeared only once after larger doses. Therefore the use of uranium nitrate in diabetes has weak support from an experimental standpoint and constantly repeated therapeutic attempts have not provided convincing results; in personal studies the result was constantly negative.

The gastric symptoms give much better indications for *ulcer*. With the third potency nagging pain and a sensation of emptiness in the epigastric region, worse on an empty stomach occurred. Eating relieves the gastric pain as well as the headache. Eructations are tasteless or putrid. With larger doses (0.03-0.12 g., Köck) constant nausea and vomiting stood in the fore-

ground. In animals inflammation and ulceration in the region of the pylorus have been found repeatedly. There are only isolated clinical confirmations for uranium nitricum in ulcer.[707]

The remaining symptoms of proving are so isolated and little tested that no therapeutic recommendations can be based on them.

CONCLUSION

Let us cast a glance back over the doctrine of the mineral medicinal substances!

We have considered only a part of the elements existing in the cosmos and a still smaller part of their compounds. The gaps in our knowledge regarding the use of many substances for curative purposes are still great. But the refinement of experimental methodology which homoeopathy brings to therapeutics shows, however, that many substances can be estimated in an entirely new, different and much broader extent as internal remedies and at the same time gives the factual material some finish. In both respects it can certainly be shaped better by others and in the future.

But on the whole it is necessary in medicine to remain with these structures already so complicated such as atoms, ions, molecules. In this respect the scientific analysis has arrived at elementary quantities of radiant energy. For the introduction of healing energy into the sick organism practically, or at least in all theoretic explanations, should we not go back to radiant energy? Certainly both, as far as we are able at present.

Our description is arranged theoretically on a basis of radiant energy. But if it involves comprehension of the material elements in their individuality, not only for reasons of mental economy, but we are actually compelled to go to a unity of higher order, to atoms, because the number and structure of charges, the next

higher unity, in actuality cannot be advanced as long as we do not know the organization for each single type of atom, to say nothing of the government. And in the same way we cannot dispense with the other chemical organization units for the difference between the chemical and physical action often disappears.

Likewise we practically encounter radiation at the beginning and at the end of this part of the materia medica: in potassium incidentally although we are unable to explain satisfactorily its display of energy in the organism through beta radiation; in uranium and radium on the other hand the emission of radiant energy is the prevailing, the most comprehensible property and therefore to some extent is available for explanation and use of the actions. Precisely here because the radiation gains independence from special material, we must also assign its actions on the organism as a special field, prospectively rich, outside of the doctrine of materia medica.

It is very tempting in the flow of thoughts to disregard the infinite diversity of natural things, to run down or up to some final mutual feature, the ultimate unity of energy attainable, the radiation quanta, to bring it into accord with the energetics of the living. But the actuality, action on the given thing, must keep its individuality; we conceive it not on a mutual basis but only in the characteristic of that structure; we must grasp the points where they are known to us and are controllable, if we are to work with them.

The regard for natural things as they are and act individually, as their actions are differentiated in detail, need never be lost. Only the laborious and true determination of actuality can yield the conception

of things in the world that we discover behind the resonance of electromagnetic oscillations, the affinities of substances, the adaptation of the living to each concordance in nature, which comes out of the common ground between the formations of various steps and acts.

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