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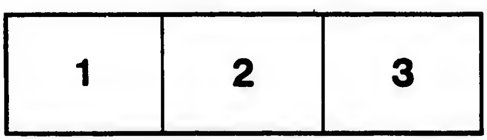
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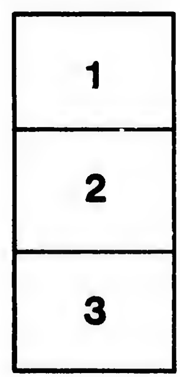
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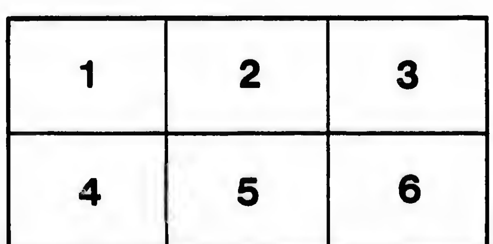
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On the Development of Physiological Chemistry and its Significance for Medicine.

An Address delivered at the Celebration of the Opening of the New Institute for Physiological Chemistry of the Imperial University of Strassburg, February 18, 1884.

BY

Professor FELIX HOPPE-SEYLER.

Translated by

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PHYSIOLOGICAL CHEMISTRY

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AN ADDRESS DELIVERED AT THE CELEBRATION OF THE OPENING OF THE NEW INSTITUTE FOR PHYSIOLOGICAL CHEMISTRY OF THE IMPERIAL UNIVERSITY OF STRASSBURG, FEBRUARY 18, 1884.*

By Professor FELIX HOPPE-SEYLER.

Translated by T. WESLEY MILLS, M. A., M. D.,

DEMONSTRATOR OF PHYSIOLOGY, MC GILL UNIVERSITY, MONTREAL, CANADA.

The mere opening of another large and elegant structure in connection with Strassburg University can in itself have no great interest, as of these there are already so many. This is, however, the first building erected by a German university for the investigation and teaching of the science of physiological chemistry. Allow me, then, to

* Any views of Professor Hoppe-Seyler's on the relations of physiological chemistry must attract attention in every quarter of the world. This translation has been undertaken in the hope of bringing the matter of his recent address within reach of a larger number. While the first few pages have been rendered freely and somewhat condensed, a closely literal translation has been given of the remaining ones, owing to the importance, originality, and extreme interest, alike to biologists, chemists, and physicians, of the opinions they contain. The admiration and gratitude of the pupil have rendered the task pleasant.—The Translator.

give the objects for which this building has been erected, afterward a short sketch of the history of physiological chemistry, and finally to indicate what the plan and arrangements of the structure itself are. For hundreds of years have able physicians zealously interested themselves with the chemical investigation of the composition of the organs of the human body and its life-processes, the knowledge of which seemed of great value in determining the causes, course, and treatment of disease. Previous to the discovery of oxygen by Priestley and Scheele, and to the time when the penetrating Lavoisier, with experiments of previously unknown accuracy, gave chemistry a surer foundation, very little came out of this investigation. Especially such discoveries as that of the composition of water, of carbon dioxide, and of other important compounds of a simple kind, are to be noted in this connection. It would be wholly wrong to suppose that the brilliant discoveries of the last quarter of the eighteenth century were the results of this period alone; in fact, the way had been already prepared, and other important discoveries made. Among others, the numerous and valuable discoveries of Scheele, the accurate measurings and weighings of Lavoisier, and his proposed antiphlogistic theory, gave alike an invaluable foundation for the science of chemistry, and also a point of observation for its organization.

Already these beginnings of scientific chemistry had shown themselves fruitful for physiology. The investigations of Scheele, Lavoisier, and Van Ingen-Housz on the respiration of animals, sprouting seeds, green plants, etc., gave physiology a deep insight into the chemical relations of organisms to the surrounding atmosphere. Scientific chemistry and physiological chemistry have here alike a common origin. But, though by Scheele and many others, especially French chemists, many important substances of the animal and plant world were brought to light, yet organic chemistry, and with it physiology, remained far in the rear of the advancing knowledge of inorganic substances. The limitation of the attention to the inorganic part of chemistry was authorized, inasmuch as it was to furnish that knowledge which for all time would remain a certain basis.

In the second decade of our century chemistry again began to grow and to be the food of physiology. Organic chemistry remained as yet almost identical with animal and plant chemistry. The labors of Chevreul on the fats, of Prout, Tiedemann, and Gmelin on digestion, of Prevost and Dumas on the composition of the blood and the formation of urea, which belong to this period, wonderfully enriched our knowledge of life-processes. In 1828 Wöhler accomplished the synthetic formation of urea from cyanic acid, previously discovered by him, and ammonia. *For the first time, here was a substance, which had been previously known only as a normal product of the processes of life, formed out of its inorganic elements.*

Soon after, Berzelius and Liebig greatly increased the existing knowledge of organic substances. A theoretical war of thirty years' duration sprang up, but it proved fruitful in investigation, especially of the organic realm. Organic synthesis, together with the explanation of theoretical points; the rearrangement of groups on physical and chemical grounds; the mechanical theory of gases and vapors, which first gave a foundation for the estimation of the relative weight of molecules and the number of the atoms contained therein; the relation of atoms in molecules; and the theory of organic chemistry in its essentials, founded on the affinities of the carbon atoms—offering many points difficult of solution and still controverted—all was the fruit of this period.

It would be difficult to enumerate all the chemists to whom this progress was due, but the names of Laurent and Kekulé are the foremost. It could justly be said, as Lothar Meyer said in 1864, that already for a long period the controversy over the systematic arrangement of chemistry had ended. In consequence of this controversy, however, physiological chemistry had in general been overlooked, though Liebig was not one of those who neglected it. From 1830 till old age, though engaged in almost every controversy of the time, he labored to advance it. He had himself worked out excellent methods of determination, and had made investigations into the constitution of flesh; and his keen insight gave to his pupils correct methods of research for the accomplishment of decided results. The pregnant ideas of his writings prompted numerous valuable researches. His investigations of the relation of food to life-processes and to muscle-work are especially noteworthy. They have directly or indirectly led to researches of wide application to agriculture, medicine, and hygiene, and especially in the last ten years. Though the hypothesis *relating to the formation of fat within the organs from albuminous matters* has proved erroneous, the results of the work of this period in their practical worth remain uncontroverted.

Important advances were made in other directions. Ferments acting on diastase and starch were discovered in the saliva, and afterward in the pancreatic secretion. Schwann extracted pepsin from the mucous membrane of the dead stomach with dilute hydrochloric acid; and the action of this artificial digestive fluid on albumin was ascertained. C. Bernard subsequently discovered the emulsifying action of the pancreatic juice on fat, and the remarkable formation and changes of carbohydrates in the animal body, especially in the liver, as dependent on the method of feeding; and various other influences were recognized. The composition and conditions of secretion of the various digestive fluids in their main outlines were ascertained. With new and excellent methods and apparatus, and by very numerous and varied researches, was the interchange of gases in the respiration of animals of different classes, under varying conditions of nutrition and many other circumstances, investigated by Regnault and Reiset.

New substances were found in the organs of men and animals in health and disease. With the noted researches of Liebig on flesh may be ranked the labors of Strecker on the biliary acids; of Strecker and Scherer on xanthin, hypoxanthin, and guanin; of Frerichs and Städeler on leucin, tyrosin, etc.

The investigation of the composition of the blood in health and disease was at this period the subject of numerous researches in Germany and France. C. Schmidt's research "On the Characteristics of Epidemic Cholera" deserves special mention. Nor have these researches remained without fruit, though the over-zealous opposition of the Prague-Vienna school against bloodletting had an injurious influence, which has not yet been wholly removed.

Of enormous value for physiology was the discovery of Magnus that from the blood, when subjected to a good vacuum, together with carbon dioxide and a little nitrogen, oxygen also was given off, and, in fact, more from arterial than from venous blood. Few then anticipated, with Johannes Müller, the enormous consequences of Magnus's discovery, and, in fact, able chemists were at once ready to controvert it.

The researches of Schönbein on the peculiarities of oxygen in different conditions; the formation of ozone, hydrogen superoxide, etc., did not receive generally the attention they deserved. Liebig fully understood their value.

To the casual observer, looking from a distance, nothing very striking in the development of physiological chemistry may seem to have occurred in the last twenty or twenty-five years. It has, however, been in good fortune. The general advance of chemistry, especially since 1850, and in particular the improved methods of gas analysis due to Bunsen—the improvement in apparatus, spectrum analysis, etc.—have all contributed to the advance of physiological chemistry.

The publication in the second half of the fifth decade of this century of Virchow's "Cellular Pathology," together with the researches of Max Schultze on the structure of animal cells, which soon followed, though of no direct bearing on physiological chemistry, yet afforded new points of view. The researches of Pasteur and his pupils and opponents, from the beginning of the sixth decade onward, have had a notable influence on physiological chemistry.

These researches, though as yet abounding in obscurities and uncertainties, have still given results of the highest value for the technique and for medicine.

The treatment of wounds to the exclusion of infection, the relation of sepsis to operative surgery, and the discovery of micro-organisms of definite character in the blood in certain diseases, are of a value well recognized. There is no limited region of natural science which at the present time attracts zealous investigators in so great numbers as the microscopic determination of the conditions of life and propagation of these micro-organisms. Botanists, chemists, physiologists, normal and pathological anatomists, surgeons, pathologists, and hygienists contend in the race in this realm of investigation.

Difficult is it to separate the chaff from the wheat. Owing to the extreme minuteness of these organisms, their anatomical investigation and certain separation are very difficult. But the difficulty is greatly increased, owing to the power many of them possess, according to the conditions under which they are found, of developing into entirely different forms, and at the same time occasioning entirely different chemical processes, according as the chemical and physical conditions surrounding them vary.

Physiological chemistry partakes of a far greater share of difficulty than the microscopic investigation, which, apart from the method, now much used, of impregnation with coloring matters (which also leads to manifold deception), without simultaneous chemical investigation with sufficient certainty, can not make great advances. This investigation, as I shall soon have occasion to illustrate, brings great gain to physiology itself.

I must abstain from giving you a complete outline of the advances physiological chemistry has made with reference to the composition of the organs and fluids of the human body, and the processes taking place in them, effected in the last two decades. Allow me to sketch the manner in which, in the most recent period, the science has advanced.

With great [illegible]ence, and not without success, the processes of the digestion of all the most important constituents of food in the alimentary canal, with the sole exception of the part played by the bile (which, indeed, does not seem essential, and which is wanting in invertebrates), have been studied, and it has been ascertained that these processes in all their phases may be carried on outside the organism, and the products of their action isolated and investigated. Medicine and hygiene in this case, as well as physiology, have become possessed of treasures of knowledge the practical value of which already abundantly appears, but *far short of the extent to which it must appear in the diagnosis and treatment of diseases of the alimentary tract especially.*

Our knowledge of the composition of the blood and its changes under the influence of certain physiological processes has been essentially advanced in the line referred to;

and the chemical functions of the red corpuscles in respiration, especially the influence of the coloring matter in reference to the absorption of oxygen from the air in the lungs, its transportation to the cells of the organs, and their proximate causes, are so well known that, in a given case, it is merely a question of reckoning to determine the total quantity of oxygen appropriated in a given period by definite extents of surface, etc.

With reference to the life-processes within organs, such as muscles and glands, the passage of the free, indifferent oxygen of the air into these organs has been demonstrated with certainty. The chemical structure of numerous substances already known which arise in the organism has been determined, and their formation by synthesis accomplished; others have been discovered and to some extent artificially formed, and many general laws in regard to their formation and behavior with reference to the peculiarities of their chemical structure discovered, and, above all, the interesting formation and processes of change of the aromatic bodies in their characteristic combinations with sulphuric acid, glycocoll, glycuronic acid, and cystin.

By the last-mentioned investigation have the methods and results of the new theoretical chemistry become of great value for physiology, while interesting new material for chemistry has appeared.

Even with more and more clearness during the course of these investigations has the fact become recognized that the substances which form the organs, out of which they build themselves up and are regenerated, belong to a class which may be included under the term *onhydrides*, and which have the common property that, under treatment with alkalies and acids, many of them also, through ferments, can be changed or split up with the addition of the elements of water, thereby, as it is said, becoming hydrates.

These anhydrides show mostly in striking chemical affinities, swell in water or dissolve generally with difficulty in it; they withstand the action of the atmospheric oxygen, and, so far as it can yet be made out, have very large molecules.

Animals and plants are, as regards these substances in general, not different, though certain substances, as albuminous matters, fats, and inosit, appear in both; others, as cellulose, starch, cane-sugar, tannic acid, and malic acid, only in plants; others, again, as glycogen, less in plants than in animals; finally, certain substances, as gelatin, urea, and creatin, are formed only in animals.

The line of demarkation which it was once thought could be drawn in regard to chemical structure and life-processes between plants and animals has been, in consequence of recent investigations, more and more obliterated.

The discovery of inosit, glycogen, and allantoin in plants; the establishment of closer relations between the caffeine and theobromine of plants and the xanthin and guanin of animals, especially the presence, without exception, of globulin substance, lecithin, cholesterin, nuclein, and potassium in all cells formed under normal or pathological conditions so far as yet investigated, whether in man or in the highest or lowest animals and plants—all these considerations must bring us to the conviction *that definite fundamental chemical formations and changes are common to all living beings, and that the life-processes common to them all, especially their growth through formation of their own substance and their propagation without limit under conditions peculiar to them, must be formed in the presence of those chemical constituents; that also in the further processes of change, often appearing so different in the different classes, orders, and families of animals and plants, many processes can take place according to a conformable fundamental type; and that finally in the life-processes of man these parallels* *are again found, whose simplest manifestation we, perhaps, follow with the least difficulty in the lowest organisms.*

We are thus brought to a definite unity in the original chemical structure and processes of living existence, a point which the microscopico-anatomical investigation of the morphological development has already reached. The chemical characters are, however, much more within our ken than the microscopic, since the latter take cognizance of the simplest forms of existence, as plastic, variable, or irregularly formed little masses.

When the chemical components of the cells or the protoplasm, or any formed organ of animals or plants, is spoken of, it is, of course, to be observed that we yet have no right to speak of the constituents of living cells, but only of the products of their chemical decomposition. A series of observations of different kinds points in the direction of the conclusion that the change which simple protoplasm, as well as complicated organs, undergoes on the entrance into the death state, arises from the chemical addition of water. If the water essential for all life-processes be removed, life is indeed suspended, but death does not, in consequence of this alone, follow. Plants, insects, amphibians (e. g., tritons), and frogs can for a long period remain hard frozen; their life is thereby fully suspended; after being slowly thawed out, the organs take on again all their life-functions. The noses, ears, hands, and feet of men act similarly when frozen by a degree of cold not too intense. But such frozen organs die at once if thawed out too quickly, inasmuch as the melting ice-crystals injure the cells in juxtaposition to them. Carefully dried seeds of plants—e. g., peas—can be kept heated for hours at 100° C. without their vitality disappearing. They sprout, after cooling, when placed in water or moist earth just as quickly as undried and unheated peas, and develop to perfectly healthy plants. If the seeds are not carefully and fully dried before the heating, they perish under 60 °C. If now, from these and many other experiences, it is to be concluded that the death of protoplasm arises from assumption of water, then must it be assumed *that the forms of living protoplasm conduct themselves in respect to the substances found in the dead forms of the same as anhydrides do to their hydrides or decomposition products*, unless some further insight into this matter is forthcoming.

In the most recent times different hypotheses bearing on the chemical structure and peculiarities of living protoplasms have been published; they do not, however, taken together, agree with the known facts. Their mechanical and chemical behavior, so far as they have as yet been investigated, force us to the supposition that *one and the same protoplasm, according to the influences which from without are brought to bear upon it, may form [darstellen] two entirely different bodies*—different in chemical structure and in action on other organic substances which come into relation with the same, and also in attraction for water.

The protoplasms further effect chemical changes through which, on the one hand, fermentative decompositions, and, on the other, anhydrides, are formed. Both processes stand in such decided opposition to each other that they can not proceed at the same time from one and the same substance. In the plants and animals of higher organization we can ascribe to one cell the one function, and to another the other. In the lowest unicellular organisms this is not possible: in these, both processes must go on in the same protoplasm; they form albuminous substances, fats, glycogen, or cellulose, and such like, and also break up these substances.

It would appear that it is observation of just these lowest, simplest forms of life that enables us to form the clearest conceptions.

Beer yeast-cells in a saccharine fluid change grape-sugar into alcohol and carbon dioxide in the complete absence of free oxygen, and can continue these processes for months without either growing or multiplying themselves, when, indeed, the food-supply is abundantly present and the temperature favorable. According to certain observers, the yeast-cells do grow and multiply, but *there is no doubt that it must be admitted* that growth and multiplication are insignificant.

A portion of the same yeast-cells, brought into a saccharine fluid in the presence of oxygen, forms little or no alcohol, separates some carbon dioxide, with absorption of oxygen, grows, and, moreover, multiplies abundantly under similar conditions of temperature and nourishment.

The bacteria of decomposition [*Fäulnissbacterien*], brought into watery extracts of flesh in the presence of oxygen, decompose albuminous matters, creatin, sugar, and lactic acid into leucin, hydroparacumarsic acid, indol, skatol, ammonia, carbon dioxide, hydrogen, and sulphureted hydrogen.

They are motionless and do not multiply; however, the latter is denied by some observers.

The same bacteria, under precisely similar conditions but with oxygen present, form no hydrogen, no organic decomposition products; only carbon dioxide, water, and ammonia; *they multiply abundantly* and are in lively motion.

The formation of anhydrides, to be recognized in the growth of organisms and their multiplication, happens either only, in the main, in the presence of oxygen, or, at least, much more abundantly than without it. However, oxygen can neither of itself form anhydrides nor be the sole cause of the movements of the bacteria.

Though oxygen is of itself powerless to act as an oxi dizer in such cases, yet, in the presence of nascent hydrogen, it does possess such power; and this latter is always the case in putrefactive processes. There is an opinion, as yet very widely diffused, that these lower organisms comport themselves throughout otherwise than the higher plants and animals. Differences not a few are to be observed, but, just as these lower organisms contain the same substances in their protoplasm as the highest (globulin substance, lecithin, cholesterin, nuclein, and potassium) so do they in their chemical processes show a remarkable agreement in the fundamental types. If we suppose (and there is no fact opposing it) that also in the highest organisms indifferent oxygen in the same manner as in the lowest succeeds in oxidizing, so might the general protoplasmic phenomena in plants and animals be thus formulated:

Distinction must be made between (1) *the protoplasm incapable of stimulation, as it continues to be in the absence of oxygen, acting with a ferment-like decomposing power on albuminous matters and many other substances, and* (2) *the protoplasm capable of stimulation, of less density than the first, of greater capacity for attracting water and not inciting fermentation. In the presence of water the second is changed into the first, through addition of the elements of water in chemical combination, in consequence of the weaker or stronger shocks of the so-called stimulation, through different modes of motion—electrical, thermal, chemical, or mechanical motion. The first protoplasm is again changed into the second* BY THE PRESENCE OF OXYGEN, *since, by the decomposing action of the first protoplasm, oxygen is rendered active, and through the active oxygen the second anhydrated protoplasm arises. If, under such circumstances, substances present themselves which can be easily anhydrated, they pass over into anhydrides. The anhydride formation happens, accordingly, through the reformation of anhydride protoplasm in conse-*

quence of the influence of active oxygen on the protoplasm with ferment-like action.

It would lead too far into details to demonstrate the agreement of these hypotheses with all the results of observation on them *in the entire realm of the organic world which they include.* Let it suffice to choose from very different classes of organisms individual representatives, and demonstrate their agreement.

What I have already said of beer yeast-cells and bacteria is in unison with the hypotheses, so I will not repeat.

The muscles of men and vertebrates, through stimulation, change in density, break up glycogen, and form lactic acid; the latter is, however, in the presence of oxygen, oxidized; carbon dioxide and water are formed in the proportion the carbohydrates furnish, and in correspondence with the strength and duration of the stimulation. The change into the stimulated condition follows also in the absence of oxygen. The removal of oxygen calls into existence lasting tetanus (poisoning by hydrocyanic acid, rapid death by bleeding, hanging, etc.). On the other hand, under normal presence of oxygen, in order to maintain a stimulated condition in some measure lasting, continuous repetition of the stimulus is necessary, since the active oxygen at once forms the anhydrated protoplasm.

In glands, in consequence of stimulation, a secretion of a watery fluid follows, which can have only chemical, not physical, causes, in that it is independent of the blood-pressure, and the fluid secreted does not contain those salts which, in all the transudations, pass over from the blood in definite proportions.

With this secretion abundant formation of carbon dioxide and of warmth takes place at the same time. Very clearly were these conditions observed in the secretions of the insect-eating plants, as so admirably described by Charles Darwin.

Mechanical phenomena of motion [*Bewegungserscheinungen*] in plants, especially the remarkable movements of the petioles of *Mimosa pudica*, are of the same nature as the secretion of water from protoplasm, in consequence of the stimulation already mentioned. That the vacuole formation in numerous protoplasms, also in the Amœba itself, arises from a similar secretion of watery solution from the protoplasm in consequence of stimulation, is highly probable. The mechanical movements of Amœba, etc., toward the point of stimulation is explicable only through these hypotheses.

Numerous and very different in kind are the observations on higher, especially warm-blooded animals, which have afforded the demonstration that with the prevention of the access of oxygen to the organs the stimulative capacity sinks, while, in consequence of this hindrance, the extent of the decomposition of tissue and of chemical interchange rises.

When a stream of blood containing oxygen is conducted through the living kidneys, the union of glycocoll and benzoic acid which takes place has been shown to be an anhydrating process. The opposite process, however—viz.: the splitting up of hippuric acid and similar compounds under addition of water in the living organs—is observed.

Presumably the last process takes place also without the presence of oxygen, and can be effected in the protoplasm incapable of stimulation.

Let these intimations suffice to indicate how in one realm of physiological chemistry—and that the largest—results unite to induce further investigation of problems becoming ever more comprehensive; *and how, further, all living beings, of form and life-phenomena the most widely* *different, appear to owe their fundamental structure to an original chemical organization, with properties common to them all.*

In the preface to his "Animal Chemistry," Liebig, in 1842, said: "The new chemistry has, with all its discoveries, furnished only insignificant service to physiology and pathology, and no one can deceive himself as to the causes of this failure who takes into consideration that all the methods introduced into the realm of inorganic chemistry, the knowledge of the behavior of the simple bodies, and the compounds that might be made in the laboratory, could be brought into no sort of relation with the living animal body and the character of its components." Since that time this has been changed; but it would be vain to reckon on a further advance in physiology from the side of the chemist when the questions of biology lie so very far away from him — questions whose answers bring for the theoretical chemist but very little profit. While theoretical chemistry and chemical technique are closely linked with one another —while the one derives great advantage from the other— the relation to physiology and to the whole of medicine is entirely different. But even the technique has found it necessary to take the solution of certain problems in hand, with what good or ill luck might follow.

For the chemical manufacture of dye-stuffs, for the sugar industry, for beer and brandy manufacture, there now exist special, and in part excellently directed, laboratories, in which for special objects these branches are practiced and partially taught. In all civilized countries there are now laboratories for the objects of agriculture. Physiological and pathological chemical laboratories have also been established, but, with very few exceptions, they have restricted means and no independence. The importance of chemistry for the development of physiology and pathology did not escape Virchow's sharp ken. He established in 1856 the first better-endowed and tolerably independent laboratory in his new pathological institute in Berlin. In Munich, through Liebig's influence, a series of diligent researches was made on food and nutrition [*Ernährung und Stoffwechsel*]. In Tübingen the laboratory for applied chemistry was restricted almost exclusively to the subject of medical chemistry. Several of the ablest physiologists, such as Brücke and Pflüger, applied themselves with lively interest to the solution of the problems of physiological chemistry, and encouraged and advanced this science.

In the Physiological Institute of the Berlin University, opened a few years ago, there is a suitable laboratory for physiological chemistry, which has already done good service alike to teaching and to science.

Though, after the example of Frerichs, several clinicists fostered physiological and pathological chemical investigation, yet in most German universities the chemistry of physiology has not received the consideration and advancement it deserves.

It can be said in praise of the physicians of all times, and not in small numbers of those of the last ten years, that they, with much attention for the objects of the diagnosis and treatment of disease, sought to apply what science and the technique supplied. Astonishing must it be then, that the great majority of the physicians in the most recent times felt coldly enough over the advance of chemistry in general—much more so than was the case at an earlier period, and that within my recollection—while a small minority kept their eyes fixed on it with great interest.

One or another will perhaps say that these advances may be of really great significance for the science of medicine, but of little applicability to the practice of medicine. With regard to numerous results of the anatomical and physico-physiological investigations, and such as have been spoken of above by myself, bearing on the chemical behavior of living cells in general, it is not to be expected that they should have a direct bearing on practice. But quite different is it with very many results of the most recent investigations of physiological chemistry. So can I not understand how at the present day a physician can recognize, follow in their course, and suitably treat, diseases of the stomach and alimentary canal, of the blood formation and decomposition, of the liver, kidneys, and urinary passages, and the different forms of poisoning—how he can suitably regulate the diet in these and in constitutional diseases—without the knowledge of the methods of physiological chemistry and of its decisions on questions offering themselves for solution, and without practical training in their application.

Is it possible we must conclude that there is an overburdening of the medical student while following out the curriculum, and that this is the cause of the insufficient attention in general paid to the chemical problems of medicine?

I am far from denying an overburdening; it exists, in fact, in high degree, and the lengthening of the term of study (one semester) now in force does not suffice to obviate it. This overburdening, however, is not the only cause, nor is it distributed uniformly over the different departments of study.

The principal cause of this unsymmetrical distribution lies in the form which the medical curriculum has taken in the last ten years. The really valuable results in the great field of normal and pathological investigation which have been achieved through the improved microscopes of the last four decades; the triumphant victory won by the microscope for pathology in the direction of pathological anatomy over the earlier prevailing but insufficiently grounded philosophical physiology; the insight into the significance of the lowest fungi, also achieved through the microscope—have in medicine lent to the anatomical method of demonstration and investigation undue weight, which, at first useful in explanation of obscurities, became gradually more and more pressing, even crushing, on the remaining branches of the medical curriculum.

The skeptical fanaticism of the injudicious champions of the Vienna school, which sought to rob the physician of all belief in tradition, has also in its after-working exerted a paralyzing influence on chemical and therapeutical efforts. Amid this sea of doubts the anatomical facts appeared to be the only thing that remained firm. On this was joined the transformed but very meager pathology. For independent clinicists this state of things could not suffice; the sterility ensuing through this sovereignty of morphology could not remain hidden from the penetrating. Many clung with lively interest to the means which the researches on nutrition [*Stoffwechsel*] furnished for the solution of clinical problems. But insight into the hidden springs and processes of life remained veiled. That they are chemical processes we know right well, but their solution requires the most painstaking work. We trust well to the certain fundamentals of chemical investigation; but only slowly, and contending against the most diverse hindrances, can we penetrate into the fine machinery which in healthy and in diseased beings determines life [*das Leben ausmacht*]. On other than chemical paths do we not advance. Who will deny that?

We should not object that pathological investigation and not the physician's practice has to do with this. Every observing physician must admit that in this relation there exists no difference.

The commercial physician [*der ärztliche Geschäftsmann*] alone can content himself with mere patterns; for the true physician every genuine case does and must furnish a special study.

A short time ago one of the most active clinicists,* Leube, raised a warning voice against the underestimation of chemistry for medicine. *That to it the future of the science of medicine belongs can with certainty be discerned.*

After what has been said, there remains no doubt as to the aims which the erection of this spacious new structure leads us to strive to achieve. It shall be a place for the practice and study of physiological chemistry in every direction bearing on medical science The great value which in recent times, certainly rightly, is attributed to hygiene and the very numerous necessary relations which this realm of investigation and teaching have in common with physiological chemistry, cause it the more fitly to appear that, for its practical study, space and arrangement should be made in this institute, as in great part the subjects not wholly microscopic or technical belong also to physiological chemistry, and so can never be better managed than in an institute set apart for the latter science. To avoid collision in instruction, separate rooms for work in physiological chemistry and in hygiene are provided.

* W. Leube, "On the Significance of Chemistry in Medicine," Berlin, 1884.