Diabetes : its cause and permanent cure from the standpoint of experience and scientific investigation / by Emil Schnée.

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Publication/Creation

London : H.K. Lewis, 1889.

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George R Murray.

DIABETES

ITS CAUSE AND PERMANENT CURE

DIABETES

ITS CAUSE AND PERMANENT CURE

FROM THE STANDPOINT OF EXPERIENCE AND SCIENTIFIC INVESTIGATION.

BY

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TRANSLATED FROM THE GERMAN BY

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ENGLISH EDITION REVISED AND ENLARGED BY THE AUTHOR.

LONDON

H. K. LEWIS, 136 GOWER STREET

1889

MOTTO

"Alterius non sit, qui suus esse potest."

PARACELSUS.

To His Highness

PRINCE

HERMANN

OF

SACHSEN - WEIMAR - EISENACH

WITH HIS GRACIOUS PERMISSION

THIS WORK IS DEDICATED BY

THE AUTHOR.

PREFACE.

THE author of one of the most important scientific treatises on Diabetes, which has hitherto been declared incurable, is Prof. F. T. Frerichs, one of my former teachers. His work (Berlin, 1884), the result of exact, scientific observations, and the fruit of forty years of study, must be regarded as of great authoritative value. Nevertheless, at the close of his work, he feels compelled to acknowledge that, with our present knowledge of diabetes, we are still unable to explain the essential nature of this disease. Baffled, he exclaims: "For a long time perhaps the enigma of this sphinx will yet remain unsolved, and many a human being will yet be carried off by it before we shall find an adequate solution of it."

I, also, have felt compelled to subscribe to Prof. Frerichs' confession, until the year 1881, when, as I believe, I succeeded in discovering the real cause of diabetes. After continuing, since that time, my observations and experiments, I am at last in a condition to lay before the profession the results of the experience I have gained in conquering diabetes. The present work, I trust, will be instrumental in directing into different channels the views that have hitherto prevailed on the nature of this disease; and it is confidently hoped it will also render this disease

more tractable in the hands of the physician than it has been hitherto.

The present work contains everything of importance that has thus far been written and found out concerning "diabetes," and also concerning "glycosuria," which is frequently confounded with it on account of the sameness of its product of excretion. The essential points, in fact, of the entire literature of both these diseases, from Celsus to Frerichs, and respectively to the present work, will be found fully treated in the following pages; and on the ground of observation and experience ranging over a period of twenty-five years, it will be demonstrated, I hope, to the satisfaction of everyone that DIABETES, not simply "glycosuria," *is curable.*

The method of cure which I follow individualizes every case; for the success of the method depends upon the time when the disease first manifested itself; upon its progress; upon the sex, age, and condition in life of the patient; further, upon the quality of his habitual food and drink, his power of resistance, the character of his mind and disposition, and upon many other contingent circumstances.

It is a source of great satisfaction to me to be thus enabled to supply to the student of medicine a safe guide through the labyrinth of this mysterious and perplexing disease; and to afford to the practical physician, whose mind is taken up by the duties of his profession, a clear insight into the true nature of Diabetes. But especially do I feel happy at being able to minister comfort to those afflicted with this

malady; to instruct them concerning their bodily condition, which has hitherto been regarded as perfectly hopeless; and to hold out to those among them who are reasonable and brave the prospect of a lasting cure.

EMIL SCHNÉE.

CARLSBAD,
SEPTEMBER 16, 1888.

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DIABETES.

I.

SUGAR IN THE HUMAN ORGANISM.

ACCORDING to the reliable investigations of C. Schmidt, Bock, Figuier, Böhm, Hoffmann (who experimented on cats, see "Archiv für experimentelle Pathologie," 8), sugar occurs constantly, and, indeed, from 0·12 to 0·33 *per cent.*, and, according to Pavy, even to 0·53 *per cent.* in the blood of every normal, healthy person. Further, in the general nutritive fluid; in the glandular substance of the liver; in the interfibrillary, so-called cement, substance of the muscles; in the cerebro-spinal liquid, etc. The chemical antecedent of this sugar is the so-called glycogen, or glycogene, which, in a healthy condition of the living human body, is stored up to a considerable amount, from 2·0 to 10·9 *per cent.*, in the liver; in a less degree, from 0·1 to 0·4 *per cent.* (as has been observed first by W. Kühne), in the muscles. Further, in the cartilage, in the white blood-corpuscles, in the stratified epithelia, in new formations, etc. (see also Ziemssen's "Handbuch der speciellen Pathologie und Therapie," Leipzig, 1876; xiii., 2, p. 187).

Amylum or starch, by the action of the saliva, is first altered into sugar; the sugar is afterwards changed into alcohol, alcohol into acetic acid, and acetic acid into carbonic acid; so that carbonic acid must be regarded as the final product of sugar. Whenever the production of carbonic acid is diminished or interfered with, the sugar which is very rapidly and in excess formed in the blood, is no longer subservient to the generation of heat in the body; for it is no longer burnt up, and ministers no longer to respiration; but it circulates in the blood as a heterogeneous substance, and is excreted by the kidneys. Such is the case in that condition of the body which, in the following pages, is denominated *glycosuria*. On account of its great diffusibility, the sugar rapidly passes through the capillaries of the blood-vessels, whence there arises a possibility of its getting into the liver through the *vena portæ*. A portion of the sugar is there changed into the above-mentioned glycogen; that is, into *amylum jecoris* (hepatine or amyloid substance), a kind of starch, which is soluble in hot water, and which, by being treated with iodine, assumes not a blue, but a brown colour. From the liver the sugar passes into the general circulation, where it combines with the white blood-corpuscles. In the organs themselves this sugar is partly made use of in the formation of glycogen; but through the action of the serum in the blood this glycogen is partly changed back into sugar.

Only this latter sugar which has been obtained

from glycogen can by combustion produce carbonic acid, and is thus able to generate heat.

The blood-sugar which has been diffused over all the organs is partly changed into glycogen through those processes, by which the tissues of the body are renovated. The liver, just like the muscles, is a receptacle of the glycogen that has been formed in it out of sugar and plasma. This glycogen, through the action of the blood-serum, is altered again into sugar, in order finally by combustion to produce carbonic acid.

If the formation of glycogen is interfered with, the sugar from the *vena portæ*, according to Luchsinger and Frerichs, passes directly into the general circulation without being changed first into glycogen. The blood then becomes flooded with sugar, and there arises *glycosuria*, or *hyperglykæmia*.

For a long time the *stomach*, and respectively the process of digestion, has been looked upon as the principal source of sugar; and, indeed, for this reason, that when a person lives on a vegetable diet the stomach changes the starch of the food into sugar (that is, into dextrose, dextrine, lactic acid, lævulose or fruit-sugar), for the use of the circulation of the blood (see Pflüger's "Archiv," etc., for 1877).

More recently the *liver*, according to Claude Bernard, has been regarded as the principal source of sugar. The function of the liver, so far as its power of forming sugar is concerned, is, indeed, placed beyond doubt at the present day.

Claude Bernard found that the venous blood of

the liver abounded in sugar, and simultaneously with Hensen (1857), although independently of him, he instituted investigations in order to find out whether the sugar is originally contained in the liver itself. For this purpose he removed from a living frog a piece of liver, minced it quickly, and in order to prevent any possible decomposition he put it into boiling water. He then ground up the piece of liver in a mortar, and made a decoction of it with a small quantity of acidulated water. The filtrate of this substance he treated with five or six times the quantity of alcohol, whence resulted a white precipitate—a substance akin to starch or amylum, and which, just like starch, possesses the property of being turned into sugar by the action of the diastatic ferments contained in all blood. The above substance Claude Bernard called *glycogen*.

Pavy describes glycogen as an "amyloid substance," *Tscherinoff* as glycophthirium, *Cantani* as storage sugar. The latter gentleman thinks that the grape-sugar (glucose) formed by the ferment circulates through the system in company with this storage sugar. This sugar, which is destitute of ferment, he says, is altogether indifferent and void of action; wherefore it is not used up, but is excreted at last with the urine. It used to be supposed that the substances entering into the composition of glycogen —that is hydrates of carbon, namely, grape-sugar, cane-sugar, lævulose, inuline, sugar of milk, galactose, etc.—are turned into glycogen *directly*, by the reception of water, by division, by synthesis, or any other

complicated unknown chemical process (see Bunyus' and Schmiedeberg's "Nachweise").

The property of forming glycogen possessed by the liver is inherent in the normal function of the liver-cells. It seems exceedingly plausible that, while departing from these cells, the glycogen is constantly being changed into sugar in the venous blood of the liver. A ferment is required for this purpose, namely, the so-called diastase—a substance generated, *e.g.*, out of the albuminous ingredients (vegetable fibrine) of grains of corn when they germinate. This substance, which belongs to the albuminates, is difficult to isolate. It is soluble in water, and possesses the property of changing starch into dextrine and grape-sugar.

Claude Bernard already demonstrated how diastase—the ferment which is productive of sugar—originates from albuminous bodies, but he did not succeed in isolating it. *J. Wortmann* only ("Zeitschrift für Physiol. Chemie," 1882, p. 287) was able actually to isolate the diastatic ferments coming from bacteria, by which raw, undissolved, as well as dissolved, starch, and likewise boiled starch, are changed into glucose.

A pure ferment may be obtained, and thus may be isolated; or, more precisely, a solution of it may be obtained, by crushing newly germinated barley, stirring it up with water, and pressing out the liquid. This liquid is afterwards heated to 75° C. in order to separate the albumen from it. Alcohol throws down from this liquid the diastase in the form of a flaky,

colourless precipitate, which by and by thickens and dries up into a kind of gum-like mass. It scarcely requires to be noted here that the employment of barley in the production of beer is due altogether to the formation of diastase and to its action, as a ferment, upon the starch of the barley.

According to Claude Bernard, the processes which take place in the liver are to be explained thus: that the substances producing glycogen by the action of a ferment are changed in the cells of the liver into glycogen, and that, through the reciprocal action of the blood by which these cells are bathed, the glycogen is altered into grape-sugar.

Pavy assumed a negative position in respect to the new theory of Claude Bernard, so far as the sugar-forming function of the liver is concerned. He maintains that the ferment of the liver-sugar is contained in the blood, and he calls the formation of sugar a post-mortal process. He also supposes that the glycogen of the liver serves a different purpose, and is utilized, perhaps, in the formation of fat. On p. 64 of his "Croonian Lecture," (London, 1878), he certainly expresses a different opinion, and thus contradicts his former idea.

Because most albuminates are altered in the stomach into peptones, *peptone* also has been regarded by some as a source of sugar.

The former Carlsbad physician, *Dr. Zimmer*, in contradiction to Claude Bernard and to those who believe that the liver is the sole source of diabetes, agrees with *Nasse*, who holds that the glycogen of

the liver is also consumed by muscular action (see Pflüger's "Archiv," etc., xxiv., 41, and "Biologisches Centralblatt," 1884, iii., p. 251). For Zimmer is of the opinion that the muscles, too, have a share in the production of diabetes, both as regards the supply of sugar and its decomposition. This view was set forth already by *Brücke* (see "Vorlesungen über Physiologie," second edition, Vienna, 1875, p. 323), who quotes *Sigmund Weiss*, according to whom the glycogen of the muscles is not subject to any considerable fluctuations, while the glycogen of the liver is used up completely as soon as the food of animals is deprived of its supply of hydrates of carbon. (The literature on the above subject has been collected by Barfurth in the "Archiv für Mikroskopische Anatomie," Vol. xxv., p. 397.)

The muscle, when at rest, stores up glycogen in its tissue in order to change it into sugar when in a state of activity. This sugar in a healthy organism is assimilated *totally*, but in a diseased organism only *partially*. If this process of combustion by muscular action does not take place, and if the liver is no longer able to store up the glycogen which is constantly being conveyed into it, the consequence is that, after the consumption of amylaceous substances, that is, of food containing starch, such as bread, potatoes, etc., the blood is surcharged with sugar, and *sugar passes into the urine.*

According to *Külz*, sugar is beginning to be excreted by a diabetic patient within half-an-hour to an hour after he has partaken of bread; within two

or three hours the excretion of sugar reaches its climax, and in five to six hours it ceases. *Külz* found that when a patient partakes of bread, sugar is rapidly being formed in the intestinal canal by a ferment which is generated there; that it speedily reaches the liver, which is unable to retain it, whence it passes into the circulation, so that it is possible for urine free from sugar to become charged with it after the lapse of half-an-hour. According to *v. Mering*, the sugar in the ductus thoracicus does not come from the liver, but arises from the saccharine contents of the lymph. This, theory, however, does not exclude the idea that the liver is a storehouse of sugar.

Ebstein, on the one hand, considers it possible that the sugar which has passed from the intestinal canal into the vena portæ should be excreted by the urine, and, on the other hand, he inclines to the belief that considering the speedy alteration of the sugar, in consequence of a disturbance in the formation of carbonic acid, the excretion of sugar through the urine ought to begin with a diabetic patient already half-an-hour after he has partaken of bread.

When a diabetic patient was fed with cane-sugar *Weiss* found 2,369 times more sugar than he did when he was nourished with fibrine and fat, while, on the other hand, the quantity of glycogen in the musculus-pectoralis increased much more by a diet of fibrine (see experiment 3) than it did by a diet of food rich in hydrates of carbon. On the strength of

this *Zimmer* supposes that the muscles, by themselves, produce sugar from albuminates in a large quantity, that they secrete it from the albuminates and store it up in the form of glycogen, while the liver is not able to do this. Zimmer maintains that the muscles from albuminates purvey to the blood six times more sugar than the liver; wherefore he holds that the source of the severer forms of diabetes is to be sought for in the muscles.

Meissner, Ritter, Seegen incline to Pavy's view, since they are unable to explain the alteration caused in the amylum of the liver.

Pavy, Dock, Salomon, Tscherinoff, Luchsinger, Weiss ("Zur Statistik des Glykogens im Thierkörper," in "Sitzungsberichte der Wiener Akademie der Wiss.," Bd. 64) were unable to demonstrate the genesis of sugar according to Claude's doctrine, as this had been proved experimentally by Ebstein. My idea has always been that *the sugar is the product of a process of alteration which is constantly going on, during life, in the cells of the living body.*

The only thing which the above gentlemen were able to demonstrate was that when a person fasts the amount of sugar is diminished; but that this amount increases at the same rate in which food is purveyed to the body more copiously, no matter whether it contain hydrates of carbon or albumen. They were able to prove only that the purveyance of sugar to the blood could be increased also from the intestinal canal through the lacteals, or

through the liver ; further, from the muscles, and, finally, from the milk-glands, by virtue of the sugar of milk which is generated therein, and which from thence passes into the blood.

In respect to the origin of the sugar in the blood, as well as in respect to its purpose, consumption, and the use it serves, all inquirers—even those who have proceeded according to the strictly scientific method—*have dealt merely in guesses and hypotheses.* By many who have laboured in this direction it was thus supposed that the oxidation, that is, the consumption, does not take place in the blood, but in the tissues ; consequently, that *a priori* not the alteration of the substance (*Stoffumsatz*), but the contents of the living cell are influenced by the oxygen (see Wolffberg in "Zeitschrift für Biologie," Vol. xii., 2, p. 290).

Ebstein's experiments about the origin and consumption of sugar (see his work entitled, "Die Zuckerharnruhr" or Diabetes, 1887), on account of the final settlement by his experiments of the pathogeny of Diabetes mellitus, are deserving of the greatest praise. They command the highest theoretical and practical interest of the profession, and when these experiments are verified—which I believe they are already—they cannot fail to influence largely the therapeutics of the future. By these experiments the process is demonstrated according to which the sugar is formed. They teach us further that sugar is formed in a larger quantity after death than during life ; which fact, however, does

not by any means invalidate the fact of the formation of sugar in the liver during lifetime.

The ground of the abnormal formation of sugar in diabetic patients, according to this inquirer, is a *relatively insufficient formation of carbonic acid in the tissues,* which subject will be treated at greater length below.

Ebstein demonstrated *ad oculos* the influence exerted by weak acids, especially carbonic acid, upon the sugar-forming ferments which are contained chiefly in the tissues, organs, and secretions of certain glands in the animal organism.

For this purpose he employed the method of v. Wittich, according to which the respective organs or tissues are first minced most minutely; afterwards they are digested for 24 hours in alcohol; then they are dried in the air and ground in a mortar. The pulverized mass which is obtained by this means is then sifted through gauze in order to keep back the connective tissue; and the mass itself is afterwards digested with glycerine, etc.

In the course of his experiments Ebstein showed that carbonic acid exerts a neutralizing influence on the action of the sugar-forming secretions of the glands, and upon the diastatic ferments which are generated from the organs and tissues of the animal organism. *Ebstein's investigations, consequently, have definitely disclosed the secret of that process, according to which sugar is formed in the organism.*

At the outset we have to start with the proposition that the diastatic or sugar-forming ferments

are diffused largely through the entire animal organism.

By placing minced portions of organs in floating amylum, *Lépine* proved the presence of diastatic ferments (see "Bericht über die Verhandlungen der K. Sächsischen Gesellschaft d. Wiss. zu Leipzig," Vol. xxii., 1870, p. 324). This inquirer, by that means, demonstrated the existence of diastatic ferments in the blood, the mucous membrane of the stomach and intestines, the liver, gall, kidneys, the mucous membrane of the bladder, the brain, muscles, etc. *Tiegl* and *P. Ploss* in like manner (see "Pflüger's Archiv," etc., vii.) discovered these ferments in the blood, as well as in all animal organs and tissues, etc.

Now, inasmuch as the diastatic ferments are most widely diffused in the organs and tissues of the living animal body, and inasmuch as carbonic acid also is produced everywhere in these organs and tissues, according to Ebstein, it may also be taken for granted that *wherever glycogen occurs in the living organism it is under the influence of sugar-forming ferments, the action of which is regulated by carbonic acid.* The production of carbonic acid, however, is at an end when the change of substance (*Stoffwechsel*) and the circulation of the blood in the liver cease. At the same time also the influence of the carbonic acid upon the protoplasm of the tissue of the liver ceases. The action of the sugar-forming ferment is henceforth no longer regulated by the carbonic acid; the glycogen of the liver, conse-

quently, is deprived of the protecting influence of this acid, and there is no longer anything to prevent its being turned into more simply constituted and more easily diffused hydrates of carbon, such as grape-sugar, etc.

Ebstein proves that wherever there is a sufficient quantity of diastatic ferments, but an insufficient development of carbonic acid, whereby the action of these ferments is checked, the glycogen which exists in the tissues of the organs is more quickly and more abundantly turned into easily diffusible hydrates of carbon, especially into sugar, than is the case in a normally constituted body.

The forty-two experimental investigations of Ebstein (*Op. citat.*, pp. 20-92), which bear witness of his untiring industry, are full of interest, and not even his opponents will seek to detract from their importance. Their object is (1) to explain the influence exerted upon the sugar-forming ferments by diluted acids, especially carbonic acid, and further by a shaking movement compared with a state of rest; (2) to demonstrate the effect of the above-mentioned acids, and also of a shaking movement upon the secretions of the glands wherein are contained diastatic ferments; and (3) to show how a freshly-made pulp of liver behaves under the influence of the various above-mentioned contingent circumstances.

From his experiments Ebstein draws the conclusion (pp. 108-115) that the carbonic acid checks the action of the diastatic ferments, by which the less diffusible, more composite hydrates of carbon are

altered into more easily diffusible and more simply constituted hydrates of carbon. He then answers the following cardinal question, namely: What physiological and pathological phenomena of life may be explained by the checking influence which is exerted by the carbonic acid upon the diastatic ferments?

The swift alteration of glycogen in a liver taken from a living animal he explains thus:—As soon as the change of substance (*Stoffwechsel*), as well as the circulation of the blood, cease in the liver, there is an end also to the generation in it of carbonic acid. As soon as the regulating influence of the carbonic acid upon the diastatic ferment of the liver ceases, the glycogen of the liver can be easily altered into sugar.

Through the influence of the carbonic acid the action of the diastatic ferments is checked and paralyzed. So long as the carbonic acid exerts its regulating, restraining influence, there does not ensue any superabundant, excessive formation of sugar—no over-production. The body is in a state of health.

v. Wittich quotes Woroschiloff's statement, according to which glycogen, the chief emporiums of which are situated in the liver and in the muscles, is an invariable constituent of all animal tissues, subject to continual fluctuations, and conditioned or qualified by the energy of the chemical change of substance (*Stoffwechsel*).

Pflüger ("Archiv," ii., 1869, No. 129) and

Bogâljubow bear witness to the abundance of carbonic acid in the liver, whereby the possibility of its action, as pointed out by Ebstein, is confirmed.

Thus far the practitioner had to content himself with the supposition that sugar, which must be regarded as the product of a chemical alteration more or less independent of the food of the body—which product is possibly made use of in the formation of fat by that process of metamorphosis or chemical change which is constantly going on in the cells that are bathed by the current of the animal juices—serves the purposes of life in general, and is utilized in the economy of the human body so long as it does not exist in excess.

Fortunately the observations made by Senator (see "Handbuch der Allgemeinen Ernährungsstörungen," p. 213) need no longer to apply at the present day; for this author, who judges objectively, says in a general way, "Everyone may suit himself, whether he considers the one or the other hypothesis as more probable." For every thinking physician, since the time that Ebstein made his demonstrations, is bound to admit in the biological processes, and especially in diabetes mellitus, the action of carbonic acid in checking and regulating the ferments—and not the action of those acids, *e.g.*, lactic acid, which are generated in the protoplasm of the tissues and organs: for all the acids that might possibly be taken into consideration here are completely neutralized in the tissues, while carbonic acid, on the contrary, is present in a sufficient quantity, both in the form

of a bicarbonate and also in a reabsorbed condition, in order by its presence to exercise an effect.

My view, based on experience, according to which the ætiological tendency towards diabetes is to be sought for in a luetic (*i.e.*, venereal) constitution by inheritance, acquires a scientific foundation through Ebstein's demonstrations. The pathogenetic conception of diabetes henceforth has left the stage of Claude Bernard, and has entered into an altogether new phase.

It becomes plain, at the same time, why the curative method proposed by myself is able to effect a lasting cure of diabetes, which fact borders on the miraculous; for my method, for the first time, pursues a distinct aim, whereby the protoplasm is renewed or regenerated.

II.

SUGAR IN THE URINE.

(The Distinction between Glycosuria and Diabetes.)

IN the urine of a healthy person there is no sugar. The secretion of sugar by the urine, consequently, is not a physiological act.

Although Brücke, who has been controverted by Wiederhold, Leconte, and Friedländer, maintains that all normal urine does contain sugar, and although Worm-Müller (in Pflüger's "Archiv," etc., for 1884 and 1885) declares that accidental, transitory glycosuria is caused also in healthy persons after they have partaken in large quantities of various kinds of sugar, there is, nevertheless, no doubt that the secretion of sugar by the urine is always a pathological phenomenon, and not a normal process of life.

As soon as a higher percentage of sugar than 0·3 *per cent.* is formed in the blood, the urine at once secretes sugar. A morbid, pathological condition of the body is indicated thereby. This condition may be transitory, as, for instance, (1) in the case of healthy women during the last months of their pregnancy, as in the case communicated by Bennewitz in Hufeland's "Journal" (1865, 61, p. 114),

where a woman from her fourth pregnancy, during each successive pregnancy, suffered from glycosuria during the *last months* (thus regularly for six months), and afterwards recovered; or (2) during the period when a suckling babe is weaned; or (3) when the breasts begin to swell at an incipient mastitis, in consequence of the milk retreating into the system, and so forth (see Blot in "Gaz. Hebdom.," 1856, No. 41; also Lehmann in his "Lehrbuch der phys. Chemie," i., p. 270; Kirsten in "Monatsschr. für Geburtsk.," 1857; Iwanoff in "Beiträge zur Frage über die Glycosurie," etc., Dorpat, 1881; Abells in the "Wiener med. Wochenschriften," 1874, who discovered sugar in the urine of twenty pregnant and of twenty suckling women; Hempel in "Archiv für Gynäkologie," iii., p. 312).

The sugar of milk which is formed by the glands of the breast seems here to be absorbed by the blood, to increase its percentage of sugar, and produce glycosuria.

Sugar also may appear transiently as the symptom of a disease and disappear again. This is an important distinctive feature, for such is never the case with diabetes. Vogel also (in "Handbuch für spez. Pathol. u. Ther.," by Virchow, Vol. vi., Section 2), as well as Pavy ("On the Nature and Treatment of Diabetes," London, 1869), declare that sugar sometimes appears in the urine apart from all the other symptoms of diabetes mellitus.

This transient condition I designate as "accidental, transient glycosuria or mellituria," should it

even not disappear for several months, as in the case of the pregnant woman reported by Bennewitz, or even for years, as in the case of certain fat persons.

But if the secretion of sugar by the inheritance of a morbid constitution assumes a lasting form—on which subject I shall treat at large below—if, therefore, this secretion is a symptom of that terrible bodily condition which results in organic destruction, and which no physician thus far has been able to heal, I denominate the constant, "incurable" glycosuria resulting thence DIABETES.

Glycosuria and diabetes, which in outward appearance do not differ much, have thus far very often been confounded, even by the most exact inquirers, but more especially by the physicians residing at Spas and by practical physicians generally; and not unfrequently they have been under the impression that they had cured diabetes, while in reality they had only stopped "glycosuria" by removing the causes through which this illness had been called into existence.

III.

HOW DOES GLYCOSURIA ARISE?

ACCIDENTAL glycosuria may arise from a great number of causes—(*a*) from a change in the blood and in the circulation; (*b*) from an injury suffered by certain portions of the nervous system; (*c*) from disturbances of the digestion and certain other illnesses; (*d*) from an obstruction in the action of the nerves, from disturbances of the respiration, etc.

(a) Changes in the blood and in the circulation.—Claude Bernard, Bumm, Sauvage, Willis, etc., have shown that an excessive use of alcohol alone, particularly in the stage of delirium tremens, results in glycosuria; likewise breathing for several hours an atmosphere charged with oxide of carbon (according to Bernard); further, an inhalation of chloroform, etc.

Experiments made on animals have resulted in the formation of sugar after the administration of poisons or poisonous gases; after poisoning with strychnine; after injection of nitrate of amyl (see Hoffmann's experiment on dogs in "Archiv für Anatomie u. Physiologie," 1872); after the introduction of a solution of one *per cent.* of carbonate, phosphate, or sulphate of sodium administered with gum arabic (see Küntzel, "Beiträge zur Lehre von der Melli-

turie," Berlin, 1872); after subcutaneous injections of nitrate of benzole administered to rabbits, and an introduction of the same substance into the mouth of dogs (see Ewald, "Centralblatt f. d. med. Wissensch.," 1875, No. 52); after methylate of delphinine (Külz's and Beschop's experiment); after doses of hydrate of chloral administered to dogs (see Teltz, Ritter, Eckhard, etc.); after the injection of lactic acid into the stomach of rabbits; after poisoning dogs with phosphorus; after the administration of orthonitro-phenylpropriolic acid (Hoppe-Seyler's experiment); after injection of ether and spirits of ammonia into the portal system (Dr. Harley); after swallowing curare (Bernard), when, after a lapse of 20 minutes already, sweat, saliva, and sugar were caused; further, after swallowing decomposed prussic acid, concentrated sulphuric acid, and heavy doses of mercury (Selkowski's experiment); further, after the injection of considerable doses of morphium (Bock and Hoffmann's "Experimentalstudien über Diabetes," 1874), or of a solution of one *per cent.* of common salt (see Bock and Hoffmann, "Ueber eine neue Entstehung von Melliturie" in "Arch. für Anat. u. Physiologie," 1871); again, after an injection of a solution of one *per cent.* of carbonate, acetate, and succinate of sodium (experiments of Külz; see "Beiträge zur Hydrämie und Melliturie" in Eckhardt's "Beiträge," etc., Vol. vi., 1871); finally, more recently, after phloridzine (C_{21} H_{24} O_{10}), which exists in the bark of the roots of apple trees

and cherry trees, had been introduced into the stomach of dogs or rabbits by v. Mering, which resulted in the formation of 15 *per cent.* of sugar in the urine.

(b) Injuries suffered by certain portions of the nervous system.—Sugar has also been formed in animals after portions of their nervous system had been injured; *e.g.*, by puncture, that is, the so-called sugar-puncture (piqûre) made by C. Bernard into the fourth ventricle at the extremity of the calamus scriptorius, etc. Sometimes polyuria only arose; which may be caused also by cutting the two nervi splanchnici, as well as by stimulating the great sympathetic nerve.

Pavy discovered sugar in the urine after an injury of the vertebral plexus of the great sympathetic nerve, as well as after injuring or removing the cervical ganglion; Schiff, after destroying the spinal cord in front of, as well as behind, the origin of the bronchial nerves; Eckhardt found it in dogs in which the hinder lobe of the vermis, in the cerebellum, had been injured.

Schiff insists in his declaration that he had pointed out the effect of an injury to the nervous centre before Bernard, and he maintains that Bernard's puncture causes a kind of paralytic hyperæmia of the bowels and liver, from which results a stagnation of the blood whereby the ferment which brings about the formation of sugar is developed. A common effect of perhaps the whole of the above experiments is a flooding of the liver with blood. That such an

effect is produced by Pavy's injection of blood is beyond doubt; that curare and nitrate of amyl react in a similar manner may be likewise assumed with certainty from their well-known physiological effects. The direct mechanical stimulations of the liver, as well as the introduction of stimulating substances into the vena portæ or into the intestinal canal, may result, or rather must result, likewise in a hyperæmia of the liver. Whether an injury of the nerves be caused by stimulation or by paralysis, in either case the enlargement of the vessels of the portal system which has been directly observed, after divers nerves had been cut, may be explained.

With respect to the so-called animal diabetes, experiments made upon animals are very instructive; still in animals *glycosuria* only can be caused, NOT *diabetes*. Their so-called diabetes ceases as soon as the effect of the injections has passed away.

Külz and others have always observed in animals that had been operated upon that, as soon as the forcible interference was stopped, their urine in a short time became normal again.

Zimmer's idea is that in animals poisoned by arsenic, antimony, or phosphorus, mellituria is caused by an incomplete transformation of the sugar in the muscles, and he opposes the proposition that glycogen in formed in the liver from the sugar contained in the food. His opinion is that the active muscles, along the whole course of the general circulation, constitute those organs which are able to bring about a transformation of the sugar of the

food speedily and in a considerable quantity, and are thus able to destroy it at once. The consumption of hydrates of carbon in the muscles, according to him, is very considerable, for while they are at rest they use up their own supply of glycogen, and, besides, when exerted very much they consume the entire mass of glycogen in the liver.

According to Zimmer, every kind of glycosuria is caused in the organs of motion. I share his opinion so far as to maintain that by the action of the muscles there is started the change of substance (*Stoffwechsel*); and, further, that the muscles burn up the glycogen furnished to them by the current of blood, and that they secrete it through the organs of secretion. Zimmer thinks (see his work on "Muskeldiabetes," p. 17) that a diminished consumption of glycogen in the muscles, together with a too speedy and copious absorption of sugar from the intestinal canal, causes the lighter form of diabetes; yet this is a mistake, because in that case all healthy persons also would be exposed to this same lighter form of diabetes. *Yet on no account can this be demonstrated and established.*

(c) Disturbances of the digestion, and certain other illnesses.—Glycosuria arises in cholera, after the secretion of the urine has been suppressed or diminished; it also regularly follows albuminuria.

Sugar generally attends anthrax, until the anthrax is healed. Marchal de Calvi (see "Medical Times," ii., 1854) supposes erroneously that glycosuria is the cause of anthrax, when yet the reverse is

everywhere the case, for when the anthrax is healed the accidental glycosuria disappears. The case is quite different when anthrax occurs in "diabetes," which is a connate, constitutional, inherited inclination to glycosuria. Anthrax, then, according to my own numerous observations, is actually a consequence of the severer form of persistent glycosuria. The latter form of glycosuria continues even after the anthrax has been healed, which is one of the proofs of the existence of genuine diabetes. I refer the reader on this subject to Griesinger's observations in his "Studien" (p. 358 *et. seq.*, and p. 413), also to Hertzka's communication in his work entitled "Die Zuckerharnruhr" (p. 102, etc., etc.).

Frerichs mentions a case where glycosuria was developed into diabetes by diphtheritis. What a host of diabetic patients there would be if every case of diphtheritis were to lead to diabetes! That glycosuria which is incident upon diphtheritis will certainly lead to diabetes whenever diphtheritis attacks a patient who by inheritance is predisposed to diabetes. Such a case, however, is as rare, or, if you please, it occurs as frequently, as diabetes itself occurs under the same conditions.

Glycosuria in a transient form, until the disease which it attends has been healed, has also been proved in typhoid fever (see Seiffert's report); further, in meningitis cerebro-spinalis (Sherrit); in scarlet fever (Zinn's report); in measles (Bordier); in abdōminal dropsy; *in the fever attending suppuration after vaccination* (Prévost).

In malaria, according to Verneuil ("Bull. de l'Académ.," 1881), and according to Bourdel (1882), glycosuria (*glycosurie palustre*) is caused during the fever-stage. It has likewise repeatedly been demonstrated in catarrh of the stomach, especially in gouty subjects; also in a closure of the vena portæ; in a hardening of the pancreas; in diseases of the liver, etc.

(d) Obstruction in the action of the nerves, and disturbances of the respiration.—Glycosuria finally has been caused by a disturbance of the action of the nerves, as well as by disturbances of the respiration and circulation, whereby the kidneys become congested, and sugar is transmitted from the blood into the urine.

As sugar is liable to be formed in the urine by all kinds of physical and psychical excitements, such as anger, wrath, bodily and mental overwork, sexual excesses, etc. (see "Arch. Génér.," 1862, ii., p. 265), it is even more especially generated by all local, mechanical stimulations of the nerves; by neuralgia and injuries of the sciatic nerve; by stimulations of branches of the nervus trigeminus (*e.g.*, in dental operations); further, after neuralgia of the occiput; after trauma; after severe concussions of the brain (G. Fischer, in "Arch. Gén.," 1862, reports seventeen cases of injuries of the head accompanied by transient, accidental glycosuria); in injuries of the brain; and, finally, after a sprain of the cervical vertebræ; likewise after blows inflicted on the dorsal vertebræ. In a few cases, also, glycosuria arose in

affections of the ear; from running ears, headache, vertigo, sickness, fainting-fits, etc.

Since all of the above cases of glycosuria have been caused by forcible interferences with the health of the subject, or arose in cases of illness; and since they have occurred only as symptoms and as the results of such definite interferences and illnesses, there applies to this particular, curable, and—as it may be called—accidental form of glycosuria what has been declared erroneously of "diabetes" in the "Transactions of the Medical Congress" for 1886 (p. 177):—"This pathological condition is no illness, but a symptom, just as is the case with fever or icterus. The most diverse ætiological causes are at work in producing it [*i.e.*, glycosuria, as I suggest], and the secretion of sugar is only to be regarded as a symptom," etc.

Wherever, indeed, there is no hereditary predisposition, accidental glycosuria only, not diabetes, will arise from such merely accidental causes. Glycosuria becomes chronic, or, according to the prevailing idea, it becomes "incurable," and thus manifests itself as "diabetes," only in persons who are hereditarily predisposed for it.

A. Vulpian (in "Leçons sur l'appareil vasomoteur," Paris, 1875) is decidedly wrong in making the following general declaration:—"Glycosuria is only a symptom of that malady which is known as diabetes, a malady which physiology has thus far been unable to produce. Glycosuria, in the form in which we have just determined it, lasts for one, two, and some-

times for five, six, seven, and even eight days; after that time has elapsed it disappears, and it is not possible to prolong its duration."

All those cases of diabetes, therefore, where the patients otherwise feel well, and where, by the use of the Carlsbad waters, or by the help of a rational physician, they are restored to health, I think ought to be classed under "glycosuria," and not under "diabetes."

Lasting mellituria, which, according to Seegen ("Diab. Mell.," 1878, p. 16), ought never to be made light of, is called "diabetes."

Gäthgens', Pettenkofer's, and Voit's idea is that whenever the sugar contained in the chyle or lymph, in spite of the burning up of albuminates, is not sufficiently destroyed, the secretion of carbonic acid is diminished, and sugar makes its appearance in the urine.

The experiments of Ebstein confirm this. Hyperglykæmia, as a consequence, is avoided whenever the carbonic acid which is formed in the tissues of the organism is sufficient to protect against a speedy transformation the glycogen, which, free from nitrogen, is separated from the albuminates.

Through this fundamental principle, which Ebstein discovered experimentally (see *Op. citat.*, p. 128 *et seq.*), this inquirer was brought into the immediate presence of the pathogenesy of glycosuria. He is, therefore, quite justified in declaring that essentially this malady consists in an insufficient formation of carbonic acid in the tissues, the consequence of

which is that the glycogen stored up in the organism is not protected against the attacks of the diastatic ferment to the same extent as it is in a normally constituted organism. The equilibrium between the formation and the consumption of sugar in the tissues is thereby disturbed, wherefore the unconsumed sugar, by virtue of its great diffusibility, passes into the current of the juices of the body, the result of which is hyperglykæmia.

A SUMMING UP.—First of all Ebstein demonstrated experimentally the cause of glycosuria; that is, of the excessive formation of sugar. He teaches that in a healthy condition of the body the material which is used up in the tissues, and by which the supply of carbonic acid, necessary for regulation, is kept up, is fully replaced by the food. A sufficient amount of substances containing nitrogen (*i.e.*, albuminates), and also of substances free from nitrogen (*i.e.*, hydrates of carbon and fats) which are conveyed into the body by the food, is deposited in the organs and tissues in order to replace the consumed material. For a time this stored-up material, during an insufficient supply of food, is able to act as a medium capable of forming in the tissues the carbonic acid necessary for the maintenance of life. A decrease in weight at last becomes apparent; in which case only an excessively large amount of fuel is able to furnish the quantity of carbonic acid required for the continuance of life. This carbonic acid is the agent by which the diastatic ferments of the organism are

checked in their action. If, therefore, the quantity of carbonic acid generated, compared with the available amount of glycogen and diastatic ferment, is too small, its protecting influence will not suffice. A greater amount of glycogen, therefore, than is the case where there is a sufficient quantity of carbonic acid, will then be exposed to the vigorous action of the sugar-forming ferment, and be transformed into sugar. This sugar, which is formed in the tissues from glycogen, becomes diffused easily and quickly throughout the juices of the body—so far as it is not used up, that is, oxidized into carbonic acid in those parts of the body where it was originally formed. In a normal condition of the body there is evidently an equilibrium in the tissues between the formation and the consumption of sugar. The percentage of sugar in the blood in healthy persons is essentially the same at all times ; only occasionally, under well-defined conditions, there is an increase in the percentage of sugar in the blood of healthy persons. The case is altogether different if the consumption of the sugar in the tissues of the organism is either too limited, or its formation too excessive.

In either case there arises a hyperglykæmia, the duration of which corresponds exactly with the duration of its cause. Here, therefore, we have a scientific explanation of the origin of accidental glycosuria.

IV.

THE CHARACTERISTIC FEATURES OF DIABETES MELLITUS.

As in the case of accidental "glycosuria," so also in the case of "diabetes" under certain well-defined conditions, there exists a continued lasting secretion of grape-sugar through the kidneys, which is mostly combined with disturbances in the entire organism, resulting, without any doubt whatsoever, in the death of the patient. Such a complex of symptoms is defined by pathology as *diabetes mellitus*.

There is an essential marked difference between diabetes and simple glycosuria or melliturıa. The former is connate, inherited, and presents itself as a chronic disease, which has hitherto been supposed to be *incurable*. In this disease, as is also the case with curable glycosuria, there is an excessive percentage of sugar in the blood, from 0·22 to 0·44 *per cent.*, and this sugar is not consumed in the system. Glycosuria is transient; diabetes constitutional. Glycosuria is caused transiently by all those hurtful agencies which have been enumerated in the preceding chapter; but diabetes is never caused in that way—that is, provided a person is not hereditarily predisposed for diabetes. *Herein lies the great mystery, never before discovered by anyone, of the*

cause of "diabetes;" and here, according to my conviction, hereditary lues on the part of one of the parents, grand-parents, or great-grand-parents of the patient, has to be taken into consideration. A transmission of lues through vaccination also is not excluded.

The diabetic predisposition begins to show itself when the blood—as is the case also in glycosuria—contains such a percentage of sugar as to be compelled to excrete some portion of it into the urine.

During many years, and even in ripe old age, a person may be diabetic in a latent state without knowing it. Only when there is a change wrought in the production of carbonic acid, and when in consequence of it there is an excessive formation of sugar—an over-production; only when under such circumstances the percentage of sugar in the blood increases, and nature is no longer able to consume it, latent diabetes becomes *active;* and then within a longer or shorter period through accidental causes, but mostly through the *coma diabeticum,* death ensues.

Diabetes, consequently—as already stated—is not a symptom like glycosuria, but it is a well-defined, primary, independent, chronic form of disease, the existence of which is based on a connate, false disposition, or a wrong composition of the protoplasm. In its active stage this disease produces deeply-seated, serious, complicated disturbances in the change of substance (*Stoffwechsel*), and in the

course of time causes a consumption of the physical as well as of the psychical forces.

A characteristic feature of diabetes is its freedom from fever. Sometimes, even, it pursues its course attended by an abnormally low temperature, while cases of accidental glycosuria are mostly attended by a transient fever. Whenever, therefore, diabetes is accompanied by fever, this fever is caused by a second, adscititious illness, of which the patient suffers at the same time.

Again, *diabetes is not infectious or contagious.* The blood of diabetic patients has been inoculated into animals without any injurious effects.

From Rollo to Bouchardat the cause of diabetes was sought for in gastro-intestinal disturbances—in a faulty digestion, which cause could no longer be upheld as our knowledge of the digestive organs increased.

Bouchardat, indeed, supposed that the normal gastric juice stops the secretion of sugar, but that a ferment favourable to the formation of sugar arises from a diseased stomach. McGregor also was of the opinion that a diseased stomach furnishes the ætiological element of the disease, until Cl. Bernard pointed out the liver as the organ in which the sugar is formed.

Basing himself on the effect of certain poisons, after the administration of which, as well as after a division of the great sympathetic nerve, the blood-vessels are enlarged, allowing the blood to pass through without first becoming arterialized, the

vivisector Pavy believed that diabetes was due to a [paralytic] enlargement of the vessels in the liver.

Seegen traced the cause of diabetes to a morbid transformation of the glycogen of the liver—to an abnormal transformation of substance, which in most cases arises from a disturbance in the province of the nerve-centres. "There is no mellituria," he says, "which is not injurious, even as there is no tuberculosis which is not dangerous" (p. 18). More than one-third of Seegen's patients also suffered of adiposis. He is of opinion that fatness predisposes to diabetes, and he considered adiposis a precursor of the formation of sugar.

Dickinson also supposed that diabetes arose from a disturbance in the functions of the liver, which instead of glycogen prepared sugar out of albuminous food. All changes and disturbances within the nervous system, according to him, cause an abnormal state of the circulation.

Zimmer searches for the cause of the disease not only in the liver, but also in the muscles, which at first sounds strangely, since an increase of sugar in the blood through the action of the muscles can only be imagined in connection with, and in dependence upon, the liver.

Claude Bernard maintains that a deeper disturbance lies at the bottom of diabetes than at that of glycosuria and glykæmia, the nature of which "deeper disturbance" he thinks will continue to remain unknown to us so long as that complex of physiological processes which we comprise under the

terms "assimilation" and "change of substance" (*Stoffwechsel*) is not made clear to us in all its particulars by physiological investigations.

Cl. Bernard's view called forth an entire school, according to which the formation of sugar is a normal bodily function, which idea is contested by the opposite view of Pavy, Schiff, Ritter, etc., according to whom the above is not the case, but the formation of sugar is explained as a post-mortal process.

Every inquirer before and after the rise of the above school started a theory of his own. According to Lecorché (see "Considération sur le diabète sucré," in "Gaz. hebdomad.," 1873) the true nature of diabetes consists in a non-assimilation of the proteinous substances, which manifests itself by the enormous daily secretion of urea.

Vocke supposes that the true nature of diabetes consists in a kind of paralytic infirmity interfering with the formation of glycogen in the liver and the oxidation of the blood-sugar, wherefore our first and essential object should be to increase the activity of the nerves.

The profession began to be exercised by the fact that in the presence of the wealth of data furnished by the rising sciences of experimental chemistry and experimental physiology, which applied themselves by preference to the investigation of diabetes, no one has as yet been able to solve the riddle of this "sphinx," as Frerichs calls it.

V. Pettenkofer and v. Voit, in the case of diabetic

patients, find a more extensive transformation of substance (*Stoffumsatz*) than in healthy persons, coupled with a diminished reception of oxygen. The cause of this greater consumption of material, and of the decrease in the reception of oxygen, they declare, is that the tissues of diabetic patients are ready to decompose, as is proved by the furunculosis of which they suffer; further, by the spontaneous gangrene of the extremities, the softening of the lungs, the shrinking of the pancreas, the loosening of the teeth and caries of the same, the loss of hair, etc.

The real cause of all the above symptoms which are exhibited by diabetic patients, namely, *the hereditary transmission of lues,* they did not discover.

In battling with diabetes, the primary thing that has to be attacked is not the formation of sugar, but the faulty composition of the protoplasm, and its inability to produce carbonic acid.

The postulate, therefore, of my theory, which I have tested practically ever since 1881, is the renovation of the entire protoplasm of the body. In this theory I start with the following proposition laid down by v. Pettenkofer and v. Voit:—"An understanding of that alteration in the normal processes of decomposition, that is, of that disturbance in the assimilation which is caused by diabetes, can be obtained only by a study of the general processes carried on in the body, such as respiration and decomposition generally, and not by a minute examination of organs torn from their context, that

is, from the series which they form with other organs of the body."

The method of cure followed by myself is based on a thorough study of those general processes which are constantly carried on in the organism. My aim is an improvement in, and a transformation of, the protoplasm. *My entire secret* consists in restoring the equilibrium—the balance in the "change of substance" (*in dem Stoffwechsel*), which was aimed at by v. Pettenkofer and v. Voit. These gentlemen, indeed, have defined the essential nature of diabetes as consisting in a diminished reception of oxygen and an increased transformation of substance (*Stoffumsatz*), while I consider these physiological conditions as of *secondary* importance, and attack at once the fundamental cause which resides in the protoplasm. The disturbance in the assimilation of the food, which they, in conjunction with Seegen (see *Op. citat.*, p. 33), have assumed is indeed only a consequence of a wrongly-formed protoplasm, and of an insufficient formation of carbonic acid. Hence the lowering of the temperature in diabetic patients.

A cardinal symptom of diabetes which v. Pettenkofer and v. Voit met with in all their investigations is a decomposition or a resolution of the albumen: *increased resolution of albumen.*

Ebstein also assumes, from the pathogenetic standpoint, that glycosuria and an increased decomposition of albumen are brought about in the organs and tissues of diabetic persons under a similar con-

dition, namely, under the influence of an insufficient development of carbonic acid.

Ebstein proves experimentally the insufficient formation of carbonic acid; but he raises difficulties against his theory, which is based on a defective production of carbonic acid, by asserting that a diabetic patient possesses a greater amount of diastatic ferments than a healthy person. The equilibrium in such a case could be re-established only by an increase in the formation of carbonic acid. The normal quantity of carbonic acid required by a healthy person would thus be insufficient in the case of a diabetic person.

That portion of Ebstein's theory, however, is fully proved where he declares that an excessive formation of sugar ensues whenever the glycogen which is stored up in the tissues, on account of an insufficient formation of carbonic acid, is not protected in a normal manner against the influence of the diastatic ferments (which are likewise in the tissues); a lasting disturbance in such a case being caused in the equilibrium between the formation and the consumption of sugar, so that that portion of the sugar which is not used up, by virtue of its great diffusibility, passes speedily into the circulation of the vital juices. According to this theory the copious transmission of sugar into the urine is due to an insufficient formation of carbonic acid in the tissues. This same theory also requires that a diminished production of carbonic acid, in its character as a symptom of diabetes mellitus, must be regarded as a

primary disturbance, while a decreased reception of oxygen would be only a *secondary* disturbance. By this means light at last is thrown on the lower temperature of the body which prevails with diabetic patients.

By means of Ebstein's experiments we are able to obtain the only rational explanation of the generation of sugar in an organism where diabetes has been fully developed. Although his experiments do not explain fully and exhaustively the pathogenesy of this disease, they nevertheless became at once of the greatest consequence as soon as it was shown by my experience that those symptoms which he laid down experimentally, are identical with the symptoms of *hereditary lues.*

I was somewhat surprised by Hoffmann's definition of diabetes at the Medical Congress held at Wiesbaden in 1886, where—certainly in agreement with inquirers of the stamp of Landrieux and Iscovesco (see "Progrès Médic." of June 27th, 1885, No. 26), who declared that glycosuria of long standing is "diabetes," while a short transient glycosuria ought to be called an "abortive diabetes"—he said: "If a boundary line is to be drawn between glycosuria and diabetes, the decisive criterion can be furnished only by a shorter or longer continuance of the disease." By way of disproval, we need to refer here only to the diabetes of pregnant women, according to Bennewitz's observations, to which reference has been made above. Hoffmann continued: "It is very plain that we still lack some fundamental symptom to aid us in drawing a distinction."

Such a fundamental symptom is hereditary lues, which, as shall be proved more at large below, serves as an organic basis to diabetes. Wherefore I am justified in giving for the first time the following definition of diabetes, drawing a sharp distinction between it and glycosuria: *Glycosuria must be looked upon by therapeutics as something accidental or symptomatic; but diabetes as something essential, as a state of the human organism corrupted by inheritance; as a predisposition, consequently, for a constant, destructive mellituria, combined with an increased decomposition of albumen.*

It is not correct to maintain that alimentary glycosuria, according to circumstances, may become the cause of diabetes; certainly not of what I understand by diabetes.

Glycosuria, when it lasts long, under unfavourable circumstances may, no doubt, lead to consumption; in like manner a large accumulation of glycogen, just like diabetes, under peculiar circumstances, may lead to acute intoxication. *Nevertheless, glycosuria is not on that account diabetes;* nor does it become identical with this disease, because certain practitioners define glycosuria as a "neurogenous" form of diabetes. I am acquainted with only one kind of diabetes; and this one kind of diabetes I treat as a hereditary, connate disease. Only thus unity can be obtained in our conception, and hence unity as a basis to start from.

I shall direct the attention of my readers here only to one fact, namely, that the diabetes of many

fat persons—according to Pfeiffer they constitute 33 *per cent.* of all cases of diabetes—is frequently a merely accidental glycosuria caused by an excess of sugar, which by the use of the Carlsbad waters can certainly be diminished, nay, even healed.

The author of a popular treatise on diabetes, which has recently appeared, is not on a par with the present state of medical science, where he maintains that the whole of the sugar originates from the blood; and where he declares, without any limitation whatever, that all those persons suffer from the sugar disease, or are "diabetic," whose urine has been proved to contain sugar.

There are diabetic persons who, to the end of their life, use up all the sugar secreted; so that an excessive accumulation of sugar becomes noticeable only at a certain time of rest, when the action of the muscles ceases, and when the production of carbonic acid becomes deficient; as, for instance, in cases of illness, such as cholera, small-pox, typhoid fever, scarlet fever, syphilis, gout, a diseased state of the pancreas and liver, or, again, after catching a cold, or getting wet. Diabetes is never caused by any infectious disease, although wherever there exists a hereditary predisposition for diabetes any disease may become the occasion of the development of this hereditary malady. If a patient, during the continuance of active diabetes, becomes infected by any acute disease, such as typhoid fever or pneumonia, his condition mostly becomes critical. For the same reason also tuberculosis,

wounds, etc., mostly cause the death of a diabetic patient.

Experiments were made with healthy and diabetic persons, where both partook of the same amylaceous food; thus, Gäthgens, for instance, partook of the same nutriment as a diabetic patient (see Gäthgens, "Ueber den Stoffwechsel eines Diabetikers," Dorpat, 1866; also his report in Kühne's "Medic. Centralblatt," Berlin, 1887; Vol. v., p. 147). Portions of the liver of living persons were removed in order to test its percentage of sugar, and in order to use this percentage afterwards for a comparison; which procedure, however, was condemned by Ebstein as unbecoming (*Op. citat.*, pp. 150 and 188). Conclusions also were drawn as to the gradual cessation of the formation of glycogen in the liver; and as to a direct conveyance of sugar from the bowels through the blood of the vena portæ into the general circulation. But has any inquirer, before Ebstein, ever been able to throw light on the procedures in the protoplasm of the liver-cells, etc.? According to Luchsinger, the sugar passes into the blood unchanged, as soon as the liver-cells lose their power of action, that is, so far as the formation of glycogen is concerned.

This idea is favourable to that maintained by English physicians, according to whom marasmus is the most frequent cause of diabetes; for marasmus cannot help diminishing the power of action of the liver-cells.

In his work on Diabetes, Ebstein enters upon

the standpoint which I announced at Wiesbaden in 1886. He starts with the idea that the quantity of carbonic acid formed in the tissues of a diabetic person is too small, compared with the carbon-holding substances there, which require to be oxidized. He regards a diabetic person, most significantly, as an individual who, on account of the defective constitution of the protoplasm of his tissues, is unable, out of the same given quantity of carbon-containing fuel, to produce the same amount of carbonic acid as a healthy person. He shows that carbonic acid possesses the property of checking the action of the diastatic ferments in the tissues and organs, and the ability of regulating the transformation of the glycogen, which is stored up nearly everywhere in the organism. He shows, further, that the carbonic acid is able to change certain albuminates —the globuline—from a liquid into a solid state, and that by an addition of oxygen these same substances are again changed back from the solid into the liquid condition.

Ebstein starts with the investigations of Voit and Pettenkofer, according to whom a diabetic person decomposes more albumen than a healthy person, and also destroys more fat ; and yet under the same circumstances absorbs less oxygen, and yields less carbonic acid than a healthy person. On the basis of these investigations he sought to prove, by experiments based on an examination of the entire change of substance (*Stoffumsatz*), that the protoplasm of a diabetic person is unable to form as much

carbonic acid out of a given amount of carbon-containing fuel as the tissue of a healthy person. He looks upon the secretion of sugar in diabetes as the result and the effect of a diseased state of almost the entire protoplasm of most tissues and organs; since nearly everywhere, where the juices circulate in the living organism, and where the substance of it undergoes change—hence where there is respiration, and where carbonic acid is formed in the protoplasm—there also diastatic ferments and glycogen are present.

In view of the great bulk and the extensive volume of the liver and the muscles, Ebstein regards these organs as those parts of the body which are affected most, and are most concerned in the various stages of diabetes; yet he does not consider the profession justified, at the present state of science, to speak of a special liver-diabetes, or muscle-diabetes.

After thus disclosing to us, by his theoretical investigations, the cause of the formation of sugar, on the ground of a defective development of carbonic acid, which is surely the real cause of the fatal anomaly in the change of substance witnessed in diabetes, Ebstein only needed to go a little farther, and discover the cause why, in the case of some individuals, at certain times, the development of carbonic acid in the protoplasm is thus interfered with, and why it is not in the case of others. He stood nearer than anyone before him to the head of that source whence alone the answer to these questions could come. According to his theory he was bound

to say:—So long as the formation of carbonic acid is able to regulate or govern the diastatic ferment the predisposition for diabetes remains latent; but as soon as, through any cause whatsoever, the formation of carbonic acid is interfered with, the fatal predisposition for diabetes is ushered actively into the foreground, by allowing the sugar-forming ferment to display its energy in an excessive manner. Under such circumstances the protoplasm becomes defective; it loses the power of forming carbonic acid in a normal manner; sugar is formed, and the patient becomes consigned to death.

Ebstein, as just mentioned, was very near drawing this inference. The fact that I have succeeded in tracing the fundamental cause of diabetes to a hereditary luetic disposition, lets a flood of light into the chaotic darkness of diabetes. A new epoch in the therapeutics of diabetes has no doubt been inaugurated with this discovery.

V.

CLASSIFICATION OF DIABETES MELLITUS.

FROM a therapeutic point of view it is totally valueless to assume various forms of diabetes; still, in the interest of science, and in that of the history of literature, it seems worth while to inquire into this subject.

About 1680, Ettmüller drew a distinction between *diabetes verus,* in which liquids pass unchanged through the body and are excreted, and *diabetes spurius,* in which the solid ingredients of the body become liquefied, wherefore the quantity of the urine exceeds then the quantity of the liquid imbibed.

Afterwards a *diabetes chylosus* was spoken of, in which it was supposed that the chyle was secreted in conjunction with the urine; whence the sweet taste of the latter.

In the beginning of the last century Sauvage called a particular species of this disease *diabetes anglicus,* a characteristic feature of which was a sweet, sacchariferous urine. Another distinct species he called *diabetes legitimus Aretaei,* in which the volume of the excretion was larger than that of the liquid imbibed.

He distinguished besides the following five forms of this disease: *Diabetes hystericus; diabetes arti-*

ficialis, which ought rather to be called transient glycosuria, since it was caused by tying the vessels of the spleen; *diabetes a vino,* caused by high-life, an abuse of spirituous liquors, and by partaking of young, sweet wine; *diabetes arthriticus; diabetes febricosus.*

Only towards the end of the last century the percentage of sugar in the urine was employed as a principle of classification by Cullen and P. Frank, who distinguished between *diabetes mellitus* or *verus,* and false diabetes or *diabetes insipidus* or *spurius.* The latter species Ewald treated as *azoturia*, after Ettmüller's example.

The disease was called *diabetes mellitus* when grape-sugar was contained in the urine. But when a large quantity of urine only was passed, without any sugar, they called it *diabetes insipidus;* this latter disease, consequently, is identical with *polyuria.*

When the urine contained sugar, but its quantity was not in excess of that excreted by a healthy person, Peter Frank denominated that species *diabetes decipiens.* He described it thus: Urine scanty, but sweet ("Spez. Path. u. Therap.," übersetzt v. Schernheim, 1840, i., p. 360). This species, as Ch. Bouchard expresses it, is diabetes without polyuria. Brücke does not regard *diabetes insipidus* as a definite disease; neither does he regard *diabetes mellitus* without polyuria as diabetes.

When the grape-sugar disappears, and the urine

instead exhibits inosite, which is incapable of fermentation; when, therefore, there is simply a case of *inosituria,* while all the remaining symptoms of diabetes continue (as was shown by Vohl in 1858), that condition is called *diabetes inositus.* In cases where a great deal of water was conveyed into the system Strauss discovered inosite also in the urine of healthy persons. Külz is of the opinion that a consumption of upwards of seven pints of any liquid beyond the usual allowance promotes the formation of inosite. A distinction used to be made between *brain-diabetes, liver-diabetes,* and *stomach-diabetes,* thus between neurogenous, hepatogenous, and gastrogenous diabetes. Diabetes was called neurogenous, or brain-diabetes, when nervous symptoms predominated, such as weakness, ill-humour, itching of the skin, headache, disturbances in the sense of vision; but it was called liver and stomach-diabetes when combined with adiposis, furunculosis, albuminuria, gout, irregularities in the digestion. In brain-diabetes a stimulation of the vagus nerve in the brain was assumed; in the other forms a stimulation of the same nerve in the stomach. In the former case diabetes was supposed to be caused by a reflex-excitation of the secretion of sugar; in the latter case by the digestion of hydrates of carbon. In the former case lean persons, thinkers, persons labouring with their brains were attacked by the disease; in the latter case fat persons, etc. Griesinger drew a distinction between transient and chronic diabetes.

Redard (in "Revue de Chirurg.," 1866) reports a number of cases of "ephemeral" glycosuria, to which he opposes the "severe" illness bearing the same name.

Senator (*Op. citat.*, p. 216) explains the origin of diabetes in a twofold manner. It is caused by disturbances of the nerve-tracks within the province of the alimentary canal and the liver, which arise either from any point of these tracks, or else are produced by local causes, by which these organs are affected immediately. In this way are explained the following forms of the disease: A form of diabetes (*neurogenous*) which originates primarily in the nervous system, and another (*gastro-enterogenous* and *hepatogenous*) which originates primarily in the intestinal canal or in the liver.

The "severe" form of diabetes Lecorché calls the *idiopathic*. Dickinson uses the same term in order to indicate the condition under which the disease originates in the affected organ itself. Seegen also distinguishes between *idiopathic* and *symptomatic* diabetes, and herein lays great stress on the circumstance whether the secretion of the sugar is only scanty, and whether it occurs only after partaking of a certain kind of food, and thus is merely temporary; or whether the affection is constant and independent of the food of the patient. Again, Seegen distinguishes between two other forms of diabetes, according to the source whence the glycogen is introduced into the system:—

(*a*) A form of diabetes, in which only that glyco-

gen which has been produced of hydrates of carbon is transformed into sugar.

(*b*) Another form, in which the glycogen which has been formed from albuminates by division (*Spaltung*) is likewise transformed into sugar.

In the former species of diabetes sugar is excreted only when hydrates of carbon are introduced into the system; in the latter species sugar is formed even if a patient lives altogether on a meat-diet.

Seegen distinguishes further (*Op. citat.*, p. 66) between adipose and slim diabetic patients. The former show sugar in their urine only when they feed on sugar or starch, while the latter produce sugar even if they live exclusively on a meat-diet.

Traube (see Virchow's "Archiv," etc., iv., 1852, p. 109) regards the above forms as different stages of diabetes. He thinks that in the first stage of diabetes, in which the cessation of sugar is caused by an abstinence from hydrates of carbon, the sugar is derived immediately from the food, while in the second stage, in which such is not the case (or only in a limited measure), the sugar is derived immediately from that prepared by the liver. Here we have glycosuria and genuine diabetes! Seegen, it is true, admits that the second form presents itself at once in the severe cases of the disease, without passing first through the milder form, and Pavy declares that the formation of sugar is not a physiological process. Hoffmann adopts the neurogenous form, and also that presented by adipose patients, and repudiates a pancreatic form of the disease.

He tries to present an image of the neurogenous form of the disease by noting the changes in the medulla oblongata or pons of forty persons who died of diabetes, whose heads were dissected, and to these cases he adds forty other cases in which the active form of the disease had set in soon after an injury to the head.

Additional classifications were forced on the profession by the experiments of Cl. Bernard, who was of the opinion that he had discovered the real cause of diabetes mellitus in the floor of the fourth ventricle of the brain, although in the animals on which he operated he was able to produce only glycosuria, and not diabetes. Compare Holst (in the " Petersb. Med. W.," 1880), who arrives at a number of forms presented by diabetes ; and also Pawlinoff (in Virchow's "Archiv," etc., 64), who speaks of muscle-diabetes; likewise Zimmer, who endeavours to make out a hepatogenous, a muscular, and a mixed diabetes. The profession was thus led into error, just as it had been by those observers who in a one-sided way declared diabetes mellitus to be either an affection of the stomach or the bowels, or, again, an affection of the liver ; in which assertion they based themselves on the idea that the liver in a normal condition produces the glycogen which, when a change occurs in the innervation of the liver, or when this organ undergoes organic alterations, is carried as a matter of course into the blood and is excreted thence into the urine. Other new classifications of diabetes which originated with the vivisectors are the follow-

ing : The "manacle-diabetes" (*Fesselungsdiabetes ;* see Böhm's and Hoffmann's experiments on cats) ; "diabetes by stimulation" (*Reizungsdiabetes*, which Eckhard caused by stimulating or exciting the vermis of the cerebellum) ; "strychnine-diabetes" (see Schiff's experiments on frogs) ; "curare-diabetes" (Cl. Bernard) ; "oxide of carbon diabetes" (Cl. Bernard) ; "salt-water diabetes" (Bock and Hoffmann), etc. In connection with these experiments it may be objected that the animals operated upon were affected with glycosuria, but NOT WITH DIABETES.

Artificial diabetes (*i.e.*, transient glycosuria), according to Schiff, may extend over several days, while ordinarily it lasts only a few hours (Külz) ; yet this artificial glycosuria is *no analogue of human diabetes.* Kahler, therefore, says correctly ("Die dauernde Polyurie," etc., Prague, 1886), "A phenomenon extending over a short time, in matters pathological, is not by any means the correlative of a phenomenon which is permanent, lasting. There is a much greater probability that such transient phenomena are caused by reflex action, or reflex stoppage (*Hemmung*) ; and this circumstance alone forbids us to assume a definite connection between any injured part in the system and an outward symptom of disease."

As a leading type of *diabetes alternans*, Cl. Bernard (in "Leçons de Physiologie," Paris, 1855) points us to that form of diabetes which ensues after attacks of gout or rheumatism.

Since diabetes, as I am endeavouring to prove, is caused by hereditary lues, and since this illness, whenever it becomes active, presupposes a diseased state of the protoplasm of the whole body, from the anatomico-ætiological standpoint I feel bound to protest, with Ebstein (*Op. citat.*, p. 180), against the classification of diabetes into brain-diabetes, liver-diabetes, pancreatic-diabetes, and muscle-diabetes. To mention here only one thing: Hoffmann, at the Medical Congress held in Wiesbaden (see "Verhandlungen," etc., of 1886), among 60 cases which he had collected, found only 10 where he was able to apply the symptomatology of the so-called pancreatic-diabetes.

Again, the severest affections of the liver very often take their course without being attended in the least either by glycosuria or diabetes.

Since the time when Th. Willis reported the case of a woman who, in the morning only, secreted a quantity of urine far in excess of the liquid which she had imbibed, the profession spoke of an *intermittent diabetes.*

Seegen says (*Op. citat.*, p. 44): "In a few individual cases diabetes seems to have arisen as a consequence of intermittent fever. A definite connection can be proved only in one case. In this case there was an intermittent secretion of sugar, and according to the observation of the physician in charge, Dr. Lenzberg, who instituted a lengthy and exact examination, sugar showed itself in a moderate quantity only after a paroxysm of fever had been

passed through, or after it ought to have taken place according to typical laws. The intimate connection between the intermittent fever and the secretion of sugar became more evident by the effect exercised by sulphate of quinine, which had the power of completely stopping the periodically recurring secretion of sugar. This secretion, however, made its appearance again as soon as the remedy was discontinued. In another case the patient stated that, after a journey to Holland, he suffered for two years of a periodically recurring intermittent fever. The attacks, he says, always took place during two or three consecutive nights, after which time they stopped again. The patient dates the first symptoms of diabetes from that time; but only after a lapse of years a serious form of diabetes developed itself. In two cases, before the diabetes showed itself, the patient had suffered of an obstinate attack of intermittent fever in the South of Hungary. The following case is most interesting:—A patient, 58 years old, had suffered much of intermittent fever. The fever stopped; but after some time he was troubled by the most violent headache, and, indeed, at exactly the same time when the fever usually had made its appearance. A disproportionate state of weakness remained after the attacks; when the urine was analyzed it was found to contain a considerable quantity of sugar."

Bourdel ("De la glycosurie éphémère dans les fièvres palustres," in "Union Médicale," 1872) frequently observed a secretion of sugar during the

paroxysms of intermittent fever. He says that he discovered sugar in 32 out of 40 cases of highly-developed malarious cachexy.

Senator (*Op. citat.*, p. 228) pointed out that cases like the above occur mostly in connection with malarious diseases, in which sugar is found periodically in the urine, with or without any typical attack of fever. He continues: "Those typical secretions of sugar, however, which occur in connection with intermittent fever, and which, Bourdel says, he has observed, do not present the characteristic features of diabetes mellitus, but they are mere instances of transient glycosuria; wherefore they must not be put into the same category with real diabetes."

Frerichs draws the following distinctions :—

I. *Mild and severe forms.* A form, according to him, is *mild* or *light* if the secretion of sugar depends upon the character of the food. He calls it *severe* if the nature of the food exercises but little influence, and if the urine preserves its saccharine quality even if the patient lives on a pure meat-diet.

II. *Diabetes with polyuria*—the most frequent form; and diabetes without polyuria (*Diabetes decipiens*).

III. *Diabetes as a consequence of brain-diseases :*

(*a*) Organic diseases of the brain.

(*b*) Disturbances of a mental kind.

(*c*) Mental excitements.

(*d*) Injuries to the head.

(*e*) Reflex forms arising from a stimulation of peripheral nerves (of the vagus nerve, of the trigeminus nerve, and of the sciatic nerve).

IV. *Diabetes in consequence of infectious diseases* (cholera, diphtheria, small-pox, typhoid fever, scarlet fever, measles).

V. *Diabetes as the consequence of a chill.*

VI. *Diabetes as the consequence of a constitutional illness* (syphilis, gout, adiposis).

VII. *Diabetes coupled with an affection of the pancreas.*

VIII. *Diabetes coupled with a liver-disease.*

IX. *Diabetes of children and aged people.*

X. *Intermittent diabetes*, where the secretion of sugar frequently ceases; but where it shows itself anew after a disregard of the rules of diet.

Bouchardat, Harley, Pavy, Tommasi, Rosenstein, and others, like Frerichs and Seegen, distinguish between *mild* and *severe* cases of diabetes. This same classification was accepted by Traube, Bence Jones, Dickinson, and others, but they limited it to two stages of the same disease; while Hertzka more recently amplified this classification, and presented it thus: (*a*) a severe form, capable of improvement; (*b*) a severe form, which is absolutely unfavourable; (*c*) a mild form; and (*d*) a still milder form.

Vocke assumes "stages" in the disease. The *first* stage presents the following symptoms:— Fatigue, losing flesh, polyuria, hunger, thirst, dryness of the skin, itching of the skin, eruptions, boils,

inflammation, gangrene, etc. In the *second* stage, according to him, the patient really begins to look ill and suffering. The symptoms of the first stage become intensified, both as regards the disturbances in the action of the nerves and the assimilation of the food. The weakness increases; the patient begins to cough; thirst and polyuria increase. The second stage is quickly run through, and terminates in coma.

More recently, not acetone and diacetic acid, but oxy-butyric acid ($C_4 H_8 O_3$) which, under the effect of polarized light, turns towards the left, has been put down as the final product of the decomposition of sugar, since it has been shown by experiments made on animals that oxy-butyric acid diminishes the alkaline reaction of the blood, and produces coma and paralysis. Vocke calls those cases *severe and incurable* in which all the sugar which has been introduced into the system is found in the urine within the space of an hour.

Bouchard ("Maladies par ralentissement de la nutrition," Paris, 1855) defines every case of diabetes, irrespective of the reception of food, as *severe* or *serious* where the patient, within 24 hours, secretes more than 50 grammes of sugar; and he defines every case as *mild* where the patient secretes less than 50 grammes of sugar during the 24 hours.

Ebstein distinguishes an alimentary form of diabetes, and a protoplasmatic form; thus he discriminates between the mild, curable glycosuria and genuine diabetes. That glycosuria which manifests itself sometimes in a healthy person, after he has

partaken of sugar, he calls *physiological* glycosuria; but the glycosuria which shows itself in diabetes mellitus he designates as *pathological* glycosuria. Between alimentary glycosuria and diabetes mellitus he finds a sensible, graduated difference, but not a difference in principle. Herein I have to oppose Ebstein, and, indeed, on grounds belonging to the ætiology and pathogeny of diabetes.

I recognize only one cause of diabetes, namely, hereditary lues.

On this ground it is wrong to speak of a "mild," or of a "milder" form of diabetes; for, according to the present mode of treating the disease, the victims of diabetes—whether more slowly or more quickly, it does not matter—are irresistibly, and without any hope of being saved, drawn towards the gates of death. *There are* NO *mild, only* SERIOUS *cases of diabetes.*

Whenever diabetes became active, even at the slightest manifestation of that illness, my teacher Frerichs always became serious, and I never heard him, in ordinary conversation, describe a pronounced form of active diabetes as being "mild."

There is no need, however, to alter the existing terminology. It suffices to regard the many forms of diabetes as *the effects of hereditary lues.* If the profession still insists on introducing glycosuria as a form of diabetes, it may be denominated a spurious, "mild" diabetes; but to diabetes itself, as characterized by myself, in all its forms, there applies only the epithet *severe* and *serious,* and it ought to be described as "real, *active* diabetes."

VI.

THE ÆTIOLOGY OF DIABETES MELLITUS.

FRERICHS makes a statement to this effect, that one-tenth of his patients inherited diabetes from diabetic parents. About the remaining nine-tenths he is silent; but six-tenths, or more, out of these nine-tenths, if I am correct in my computation, were afflicted only with glycosuria.

In many cases he proved a hereditary transmission from distant, and yet at the same time directly related, members of one family; for instance, supposing an uncle and a nephew to be afflicted by this disease, he inferred from this that the grandfather or grandmother, and eventually the great-grandfather or great-grandmother, were the original sources of diabetes.

This constitutes the basis, on the strength of which, after a lengthy examination extending over twenty years, I was led to make the following important discovery:—

Diabetes is a hereditary, constitutional disease; and the ætiological element of this disease is lues contracted by some ancestor!

After I had discovered this truth in 1881, and in

accordance with it had originated a method of cure which combined various curative agencies, and after I had improved this method from year to year, I have at last succeeded in curing radically the most difficult cases of diabetes; that is, I have succeeded in healing them in such a manner, that my patients, after recovering from their illness, remained thoroughly healthy, and were not compelled to return and undergo a second treatment, except under exceptional circumstances.

Seventy-one cases of real diabetes were treated by me, partly in Carlsbad and partly in Nice, from 1881 to the end of 1884. From among these there were radically cured

53 PATIENTS, as follows :—

36 men,	aged	from	21-64 years,
8 women,	,,	,,	19-32 years,
5 virgins,	,,	,,	17-23 years,
4 children,	,,	,,	9-13 years.

Ten among the remaining patients were dismissed improved, and they might have recovered by undergoing a second treatment, and obeying the dietetic rules which were prescribed; while eight of them died in the course of that time, on account of the disease having progressed too far; and thus on account of some new complications having arisen.

I shall be prepared to report concerning the patients who were treated by myself during the years 1885, 1886, and 1887, as soon as I shall be in a condition to express a positive opinion as to the

lasting character of their cure. Their number is as follows :—

In the year 1885, 24 cases of *real* diabetes.
" " " 1886, 54 " " " "
" " " 1887, 87 " " " "

Those theories which claim for diabetes a hepatogenous or a myotic (muscular) origin fall to the ground in the face of the fact that *all real diabetes is hereditary, and is caused by a degeneracy of the protoplasm.* The same applies to most of what is said, for instance by Frerichs, concerning "the more immediate causes" of diabetes. The more "immediate causes" which he enumerates apply only to glycosuria; and they produce diabetes only where there is a hereditary predisposition for it.

The marasmus of old age is never a cause of diabetes, as is supposed by Zimmer on the basis of some English statistical tables; although any latent diabetes becomes developed regularly by the marasmus of old age.

Frerichs is likewise in error where he supposes that diabetes is caused by a reflex action of the nervus trigeminus and the sciatic nerve.

At the Medical Congress which was held at Wiesbaden stress was justly laid on the following sentiment :—"If every case of trauma—of a severe bodily injury—of intense fright, of heightened nervousness; and, again, if every sorrow, every misfortune which befalls a family, were productive of diabetes, fully one-half of humanity would be diabetic."

Senator observes justly (*Op. citat.*, p. 125) that trauma is only a mediate cause of the disease, since in consequence of it there is developed a more intense change of structure, etc., within the province of those nerve-centres which regulate the formation of sugar. The source of these affections, he thinks, is the medulla oblongata or its immediate neighbourhood; or, again, if the real cause of the disease is placed at a greater distance, he thinks the area of the fourth ventricle, as may be plainly shown, has some share in its production; or, again, disturbances in the assimilation of the food or in the circulation may be caused from this area, etc.

Is not the following case reported by Frerichs (*Op. citat.*, p. 187) a case of glycosuria? He says that a speculator, after meeting with some severe losses of money, became affected with diabetes, but that after three weeks already he had lost every vestige of sugar!

Distinguished medical inquirers have already been on the road leading to my discovery, only they did not go far enough; they were not prepared to draw the necessary conclusions from their premises; they did not direct their inquiries to some definite point, and afterwards test their theory by practice. Again, they were one-sided; they drew conclusions from diabetes concerning diabetes, from effect concerning effect; and they did not trace diabetes as an effect to hereditary lues as its cause.

Rondelet already observed diabetes in a father and his daughter; *Morton* in a father and a son, and

in four brothers and sisters, all of whom were carried off by the disease.

Isenflam stated a case where eight children of healthy parents after reaching their eighth year died of diabetes.

Marsh reports ("Dublin Quarterly Journal of Medicine," 1854, xvii., 17) the case of a family where diabetes was hereditarily transmitted through four generations.

Langiewicz (Breslau) mentions a diabetic patient, seven of whose nearest blood-relations were *epileptic*.

Griesinger treated a patient who had suffered of epilepsy in childhood, and all of whose brothers and sisters were *epileptic*.

Similar reports were made by *Clarke*, *Eulenburg*, *Westphal*, *Pavy*, *Ebstein*, and *Müller*.

Among 140 cases *Seegen* noted eight cases where both parents were diabetic, but ten cases where the brothers and sisters of the patient were afflicted with diabetes. In one case the father of the patient suffered of diabetes insipidus. In four cases both parents and several of the brothers and sisters had died of diabetes. Seegen treated a young Englishman who in the course of time died of diabetes; his younger sister had died of the same disease, and his father came to Carlsbad in the following year, likewise afflicted with diabetes. In one case Seegen witnessed *two sisters* dying of diabetes. Unfortunately he did not inquire whether any of the relatives or ancestors of his diabetic patients had been *luetic*, although he arrived at a conclusion

which confirms our present position, namely, that *a hereditary disposition for diabetes must be assumed, even in such cases where either the father or the mother suffered of an affection of the brain.* Seegen treated a brother and sister who suffered of diabetes, both of whom were of a highly nervous temperament, and whose father and grandfather had suddenly died of an apoplectic stroke. In two cases the mothers of patients died insane. In one case the brother of a patient was an idiot, and all her children suffered from brain disease. In another case the father was insane; the patient himself suffered much from headache, and he noticed an early loss of memory. In one case a brother and a sister committed suicide in a fit of melancholia.

A SUMMING UP.—In 140 cases Seegen proved 20 times the hereditary nature of diabetes, and thus in one-seventh of the entire number. If we add to this all those cases where there existed a hereditary cerebral affection, and if we take into consideration that only in the most recent times the connection between affections of the brain and diabetes has been recognized; further, that only most recently a distinction has been drawn between real diabetes and the so-called milder and more frequent form of this disease, and that most probably many persons have hitherto died of diabetes, the cause of whose death remained unknown, the numbers given above acquire a much greater statistical importance, and bear an imposing testimony in favour of the theory advanced by myself.

Among 104 cases, from 1868-1874, *R. Schmitz* proved in a most definite manner the *hereditary character of diabetes;* for in one case the grandfather had been diabetic, in another case the grandfather and the father, in six cases the father, in six cases the mother, together with the brothers and sisters, in eight cases the brothers and sisters. In these cases, also, he witnessed the manifestation of diabetes in consequence of hurtful agencies (nervous shocks).

Hertzka infers a connection between the diabetes of a patient 40 years old and the *anthrax* of which an uncle was suffering. In this connection he expresses the same idea which already *Blau* had uttered (who "was forced" to admit and teach the doctrine of a "diabetic predisposition," see Schmidt's "Jahrbücher," etc., 1875, p. 205), namely, that it was possible for a predisposition for diabetes to be handed down by inheritance without this disposition becoming active in the immediate progenitor. A case communicated by himself was to prove the fact that the disposition for diabetes is *de facto* hereditary. In the case of a female patient 24 years old, sugar had been discovered in the urine already in her fifteenth year. Two of her brothers and sisters died of diabetes, another brother perished of phthisis, and the remaining brothers and sisters suffered of catarrh of the lungs, and discharged blood while coughing.

In quoting this testimony of Hertzka, I am quite pleased to quote also the following question which he

propounded, and which speaks in favour of my doctrine: "In the face of such facts, are we not bound to accept that the slumbering germ of the disease was transmitted by inheritance, and are we not compelled thus to assume a predisposition for the disease in the progenitor?" My answer is: most undoubtedly must we assume such a hereditary predisposition.

Senator relates that four children of a Polish Jew perished of diabetes in the Polyclinical Institute of the University at Berlin.

According to the same authority (*Op. citat.*, p. 260) a hereditary tendency has also repeatedly been proved in the case of diabetes insipidus.

Lecorché accepts a hereditary predisposition in the so-called cerebral diabetes.

Lacombe reports the case of a family where the mother, one daughter, and three sons, as well as the mother's brother and his children, fell a prey to diabetes.

Other cases where two or more blood-relations suffered from diabetes insipidus are communicated in the "American Journal of Medicine" of 1858, p. 379.

Trousseau mentions the case of a female patient, aged 19 years, whose grandfather had suffered from diabetes mellitus.

Charcot ("Maladies des Vieillards," Paris, 1874) furnishes the information that persons who *descend from a gouty family* are sometimes affected by diabetes mellitus.

Redon shows in 32 cases where children suffered from diabetes that their parents were affected with scrofula, gout, mental diseases, etc. The mother, aunts, and other relatives of a girl 15 years old, who died of diabetes, were all affected by diabetes.

Reith reports the case of a woman, 24 years old, whose father and brother suffered from the same disease.

It was lately pointed out that diabetes occurs with persons of a *neuropathic* and *psychopathic disposition.*

Zimmer reports 85 cases, out of which nine could be traced to a hereditary predisposition. He also mentions several diseases which he regards as causes of diabetes, but which, on the basis of my inquiries and experience, are competent to produce diabetes only where there is a hereditary predisposition for this disease. He relates the case of a patient, 55 years old, whose father died of *apoplexy*, while his mother perished from consumption. The latent diabetes of this person became immediately active through trauma—an injury (the fall from a horse).

What a striking example for our proposition, namely, for the presence of *hereditary lues*, which is the cause of *apoplexy*, as well as of *diabetes*, and which requires a mere outward contingency, in order at once to become developed, and to be stirred into activity!

Senator writes (*Op. citat.*, p. 121): "In a by no means inconsiderable number of cases of diabetes,

inheritance can be proved to have acted as a predisposing element. These cases consist partly of such where several brothers and sisters, nay, where all children of certain parents have suffered from this disease; partly of such where one of the parents, or one of the grand-parents, was diabetic, and transmitted this predisposition to his descendants. It seems even that such cases are by no means very rare; nay, that they occur much more frequently than the profession *has been inclined to admit, even to within a comparatively short time.* For *lately*, since more attention has been paid to this matter, reports concerning the hereditary character of diabetes are becoming more and more numerous."

Ebstein, who proves that only a fraction of fat persons become diabetic, is of the opinion that there must exist a particular predisposition for diabetes, so that this disease may be developed in company with adiposis. On p. 168 of his work he puts forth the proposition *which I had proved by facts at Wiesbaden in* 1886, namely, that *apart from a definite, morbific predisposition, which is connate, and which very frequently is transmitted by inheritance*, no uric gout, and no diabetes mellitus, are developed. Ebstein declares verbally, on p. 180, "All the facts before us *force us to the belief* that the development of diabetes requires *a definite bodily tendency, an individual predisposition, which in almost all cases may be regarded as connate, and not rarely may be considered as the result of inheritance.*"

This connate predisposition, first characterized

by myself as hereditary lues, is naturally common to all the organs and all the tissues in which the change of substance (*Stoffewechsel*) is constantly going on. Ebstein thus corroborates my discovery; although by my discovery it is proved that diabetes descends from hereditary *lues*, and NOT from diabetes, as is supposed by all those who suspect its hereditary character.

The above weighty proofs and expressions can scarcely avoid creating some confidence in the truth of my proposition that diabetes is derived by inheritance from luetic ancestors; but any doubts that may still linger in the minds of the profession cannot help being removed by the success which has attended my method of treatment. The additional words of Frerichs and Senator will now be appreciated in their full force: "*Cases of diabetes occur also among the more* DISTANT *relations of persons afflicted with this disease.*"

VII.

DIAGNOSIS OF DIABETES MELLITUS.

PATIENTS afflicted with diabetes usually consult their medical adviser only when they are compelled to do so by an increase in their desire to urinate; when there is a constant dryness in the mouth; when they experience a general feeling of lassitude and weakness; when their skin itches; when they are affected by furunculosis, and when carbuncles are beginning to be formed; when their sense of vision is debilitated; when there is a tearing sensation in their limbs, as though caused by rheumatism; when there are abnormal sensations in the muscles, especially in those of the loins and of the lower extremities; and especially when there is a striking decrease in weight.

The first attention of the physician must be directed to the condition of the urine, which is most important for the purposes of diagnosis, since the two cardinal symptoms of diabetes are (1) glycosuria, and (2) an increased decomposition of albuminates.

Urine of this kind usually has no settlement, and in proportion to the increase of active diabetes it is generally as clear as water; or it is of a pale colour; or again it exhibits a greenish yellow tint, or one which has a greenish tinge. Ordinarily its reac-

tion is sour, and its odour is fruity, chloroform-like, aromatic—reminding one of damp hay—and sweetish ; which is due to the presence in it of alcohol and acetone.

The specific gravity rises from 1·010 to 1·060 ; yea, according to Bouchardat, even to 1·074.

ALBUMEN.—Albumen was discovered by Latham and Erasmus Darwin in the urine of diabetic patients at a time when a relaxation of the kidneys was still supposed to be the cause of diabetes. Their results were confirmed by a treatment of the urine with nitric acid, as taught by Haller-Hammerstein ; but of course only in those cases where there was albuminuria at the same time.

My experience has taught me that it is not at all essential for the urine in diabetes to contain albumen. In case there is any, it has to be removed, before testing it for sugar.

The sugar in the urine is grape-sugar (dextrose, glucose). Its presence can be proved by its power of reduction, its property of fermenting, and by its rotating the plane of polarization of a ray of light to the right, which peculiarity justifies the name "dextrose," as well as that of its preceding stage, which is called "dextrine."

The best known, and most approved methods for establishing the presence of grape-sugar, are the following :—

I. (1) *The test by tasting.*—The ancient physicians were obliged to resort to the sense of taste.

In order to escape this disgusting test, they after-

wards tried whether the urine left any spots on white linen; or whether on cloth there was left a floury dust of the kind which is noticed in vessels where water is evaporated, or as appears sometimes on cabbage or rose-leaves, or on plums, etc.

A simple method for proving the presence of sugar is by evaporating the urine. If the residue is soluble in water or alcohol the urine contains sugar.

(2) *Moore's sugar-test by caustic potash.*—Pour some urine into a test-tube; add some liquid caustic potash; heat the mixture (while constantly shaking it) to the boiling point. The heated portion of the liquid turns brown if there is any sugar present. The darker the colour the greater the quantity of sugar contained in the urine.

(3) *Trommer's sugar-test by a solution of sulphate of copper.*—This test is more sensitive than the preceding one. Urine, free from albumen, is made alkaline in a test tube by the addition of one-fourth of its volume of liquid caustic potash or caustic soda. Add in drops a concentrated (1 : 5) solution of sulphate of copper. One drop more may be added than is dissolved. On shaking the mixture a fraction of the sulphate of copper is turned into a clear, blue liquid, if there is any sugar in the urine. The upper part of the liquid is now heated, almost to the boiling point. A reddish-yellow or brownish-red zone is noticed then even before the boiling point; this zone soon permeates the whole urine and yields a precipitate of cuprous oxide. N.B.—Before pro-

ceeding with this, and all other tests, dark urine is made colourless by filtering it through pulverized animal charcoal, or by adding one-ninth part of acetate of lead. The animal charcoal requires to be purified first of all reducing substances by treating it with muriatic acid, and afterwards washing it with water.

(4) *Böttcher's test by basic nitrate of suboxide of bismuth.*—Saturate the urine with soda; add a small quantity of the basic nitrate of suboxide of bismuth, and then boil the whole. If any sugar is present the liquid itself, or its precipitate, will turn black.

(5) *The sugar-test of Nielander or Almén.*—Mix two grammes of basic nitrate of bismuth with four grammes of Rochelle salts and 100 grammes of a solution of eight *per cent.* of caustic soda; add ten times as much urine, and boil the whole. The mixture turns black if sugar is present.

(6) *Seegen's sugar-test.*—He filters the urine twice or three times through animal charcoal until it is perfectly colourless. He then washes the coal on the filter with some distilled water. This water he employs for the tests of Trommer or Fehling. Through it, as well as through any equally weak solution of sugar in water, there is produced a beautiful deposit of cuprous oxide along the inner surface of the test-tube. If the urine contains 0·05 *per cent.* of sugar, the reaction caused by the water used for washing the charcoal is always very characteristic. The second and third waters employed in the washing process cause an equally energetic reaction.

(7) *The sugar-test of Fehling.*—The method of Fehling, the so-called method of "titration," is described in every text-book of chemistry. It consists in an alkaline solution of Rochelle salts, with a certain quantity of sulphate of copper. The solution of Rochelle salts is made in one vessel, that of the sulphate of copper in another. Pour three-parts of the first solution into one part of the second; by shaking the mixture you obtain the so-called solution of Fehling. One part of this solution is now heated to the boiling point with one part of the urine. Before the boiling point is reached, a reddish-yellow zone of cuprous oxide is produced; if only a very small quantity of sugar is contained in the urine, a reddish-yellow precipitate is thrown down after a while.

(8) *The sugar-test of Worm-Müller.*—Worm-Müller, in Christiania, perfected the method of Fehling. In order to determine small quantities of sugar, he titrates the urine with the liquid of Knapp, before and after its being treated with yeast. He takes 2·5 *per cent.* of a solution of sulphate of copper, and a solution of Rochelle salts—ten parts of double tartrate of sodium and potassium in 100 parts of a solution of four *per cent.* of caustic soda (four parts of liquid caustic soda in 100 parts of water). He now fills the first test-tube with five ccm. of urine; the second tube with 2·5 ccm. of an alkaline solution of Rochelle salts, and 1·5 ccm. of a solution of sulphate of copper; whereupon he heats both tubes to the boiling point. Both tubes

are now allowed to cool down to 70 or 60° C. He then slowly pours the reacting liquid into the urine; and if much sugar is contained in it, it *immediately* assumes the colour of cuprous oxide. But if the percentage of sugar is small (under 0·1) the colour develops only very gradually, generally in five to ten minutes.

Sugar, to the amount of 0·25 *per cent.*, can be traced by this test. The precipitate in this latter case does not exhibit a reddish-yellow, but a dirty yellowish-green colour.

If there is no precipitate, the test is repeated with from 2½ to 4 ccm. of a strengthened solution of sulphate of copper.

Worm-Müller (in Pflüger's "Archiv," etc., Vol. xxxvi.) proves that healthy persons, after partaking of large quantities of cane or milk-sugar, secrete through the urine a fraction of this same sugar; but they *never pass grape-sugar.* He also discovered that healthy persons, different from diabetic persons, after partaking of starch, do not pass any grape-sugar by the urine. In order, therefore, to prove definitely the existence of diabetes, he gets all who wish their urine to be examined to eat food containing starch before their examination.

(9) *The sugar-test of J. Rosenbach.*—After satisfying yourself of the reducing effect of a certain quantity of urine upon a definite quantity of Fehling's solution (add one ccm. of urine to one ccm. of Fehling's solution, when an incomplete reduction below 0·5 *per cent.* still proves the existence of sugar), boil

a small quantity of urine after adding to it one or two drops of tartaric acid, which prevents the precipitation of phosphates. The boiled urine, after it has cooled off, is distributed into two test-tubes; in one of the tubes the urine is mixed with a little pressed yeast, after which it is placed near a warm stove. If after a few hours the same quantity of liquid is taken out of each of the tubes, to have it tested by an equal quantity of Fehling's solution, it will be found that one of the liquids, as before, exerts a positive effect, and thus has a reducing power; while the second liquid, according to the degree in which the sugar had been decomposed, exerts a negative effect, or, at all events, manifests a much feebler, reducing power. By comparing the two test-tubes, it is easy to discover the difference. An unprofessional examiner even can discover by this method whether a diminution in the reduction of Fehling's solution caused by the urine is due to the presence of sugar or not. The test is not vitiated by the presence of albumen.

(10) *Dr. Ed. Stütz's reagent capsules.*—The test for sugar and albumen has lately been much facilitated by the introduction of easily portable reagent capsules. With the aid of these gelatinous capsules, which contain the requisite quantity of the most approved reagents, every practitioner can make his tests for sugar or albumen on the spot with the most satisfactory results. Concerning the use of these capsules, which are exported by the firm of "MARTIN WALLACH'S Successors," in Cassel,

Germany, we read in the circular issued to the profession by *Dr. Ed. Stütz*, apothecary in Jena, as follows :—

"I. *Reagent-capsules for Albumen.*—The idea of providing practitioners with an easily portable reagent for albumen in the form of gelatine capsules, filled with a mixture which, even at the ordinary temperature, should produce a reaction, we owe to Professor Fürbringer. The discovery of a suitable reagent was left to the undersigned, who at the same time undertook to carry out the invention in a practical shape. Particulars may be found in Prof. Fürbringer's essay in the 'Deutsche medicin. Wochenschrift,' No. 27, 1885.

"The reagent consists of a mixture of chloride of mercury and sodium, with citric acid. The precipitate obtained from urine containing albumen is albuminate of mercury.

"DIRECTIONS FOR USE.—A capsule, both ends of which are cut off close, is dropped into a test-tube about half-full of urine (any other small vessel of clear glass will answer). More than half a table-spoonful of urine should never be taken. Close the mouth of the tube with the thumb, shake the contents thoroughly, then tilt the tube so that the glutinous envelope can sink down to the mouth, where it adheres; then let the liquid run slowly back into the lower part of the test-tube. When the bubbles caused by the reaction have disappeared an opinion can be formed as to the result. According to Fürbringer only a *pronounced clouding*, occurring

a few minutes after, can be held as proving the presence of albumen. Opalescent traces, even if coming from a slight quantity of albumen, are not worth the practitioner's consideration.

"Concentrated urines, containing much uric acid, should be diluted with an equal quantity of water before testing. Urate sediment should be warmed, the urine being somewhat diluted with water for this purpose. Entirely fresh alkaline urines, even if clouded by phosphates, require no preparation.

"II. *Reagent-capsules for Sugar.*—It was the endeavour of the undersigned to apply Fürbringer's idea likewise to the sugar-test, and in this connection to extend the test to its quantitative determination. This endeavour was so far successful that he was enabled to prepare the approved reagents (solutions of bismuth and copper) in a form which insures their preservation in gelatine envelopes, the composition of which by repeated trials has been found best for the purpose intended.

"The copper reagent-capsules are especially designed for cases where the patient is bed-ridden; the white bismuth capsules for consultations and observation.

"For determining the *quantity* of sugar the following articles are required: Specially prepared capsules, filled with an exactly-weighed portion of the salt of copper; likewise a dropping-tube provided with a hollow rubber globe, which, upon light pressure, when held vertically, permits a drop weighing five centigr. to escape; and also a graduated measuring-

tube for diluting urines containing much sugar with several volumes of water, since without such a dilution no accurate result can be obtained in such cases. The dropping-glass and measuring-tube should be rinsed before being used with the liquid which is to be tested or diluted.

"DIRECTIONS FOR USE.—(*a*) *The white bismuth capsules.*—Empty a capsule, as directed for the albumen test, into a test-tube containing about two teaspoonfuls of urine. After removing the envelope with a knife-point heat the liquid over a low flame, letting it boil several minutes. Where a blackening of the liquid or of the precipitate (by the protoxide of bismuth) does *not* occur sugar is not present.

"Urine containing albumen cannot be tested for sugar with thebismuth reagent.

"(*b*) *The blue copper reagent-capsules.*—Proceed as above, only that the contents of the capsule must be dissolved in 20—30 drops of water, not in urine. Heat this solution nearly to the boiling point (if more convenient over the chimney of a kerosene lamp, or by plunging the test-tube into hot water); then let five or six small drops of urine fall rapidly into the test-tube, held obliquely so that the urine runs down its inner side. The presence of sugar is indicated if within a minute (during which time a fusion of the strata is to be avoided) there appears between the strata, even with the light shining upon it, a distinct zone of a yellowish red colour, resulting from the formation of cuprous oxide.

"(*c*) *The quantitative sugar reagent.*—After shaking up well and opening the cover of a capsule pour its contents into a test-tube; add about 3 cc. of water, heat the liquid to the boiling point, at which point it is to be kept while the urine is added, drop by drop, so long as the blue colour of the reagent remains, which can be observed by holding the test-tube against the light. It must be borne in mind that the precipitation of the cuprous oxide becomes easier the nearer the point of total precipitation approaches. Therefore, as soon as the particles of the cuprous oxide betray any inclination to sink, the heating process may be suspended until the liquid, which is in the process of clearing, has been examined for a remaining bluish tinge.

20 drops of 0·5% urine reduce contents of one capsule.
10 ,, ,, 1% ,, ,, ,, ,, ,, ,,
5 ,, ,, 2% ,, ,, ,, ,, ,, ,,
2 ,, ,, 5% ,, ,, ,, ,, ,, ,,
1 drop ,, 10% ,, reduces ,, ,, ,, ,,

"In general terms the percentage of sugar is calculated by dividing the number of drops employed by 10.

"The *quantitative* reagents are accompanied by a portable glass for the waistcoat pocket; the *qualitative* sugar reagents are furnished besides with a sample of pure grape-sugar."

In another circular Dr. Stütz gives the following caution in respect to the *qualitative* sugar-reagents:—

"Darkly coloured, concentrated urines, when treated with bismuth, sometimes yield a reaction, even if there is no sugar contained in them. The precipitate in such a case is of a grey colour. No notice should be taken of such a greyish sediment, for even should it be partly due to a trace of sugar the practitioner will be quite justified in disregarding it, because by other means also it will be impossible for him to prove the presence of such small quantities of sugar. If the urine contains 0·1 *per cent.* of sugar the precipitate is coloured black; a larger *per cent.* of sugar causes at the same time a dark-brown or even a black colour in the liquid overhead. Should this test produce a black colour, and should the copper-test also furnish a corroborating result, the presence of sugar is absolutely certain."

If a difficulty should be experienced in emptying any of the gelatine-capsules Dr. Stütz suggests the following expedient:—

"Rinse a suitable test-tube either with water or urine, and insert the capsule, which has been cut at both ends, into the neck of the tube. After a short time it will adhere there so firmly that after introducing the requisite quantity of urine, by gently rolling the liquid against the capsule, it will empty its contents without any difficulty, and without the gelatinous case getting into the liquid. The case is afterwards removed with a knife."

II. *The quantitative determination of sugar by the test of fermentation*:—

(*a*) The long arm of a so-called fermenting tube

is filled with urine and with a piece of pressed yeast of the size of a pea, which has been well washed. The tube is filled so that no air remains in it. For 24—48 hours the tube is left in a place, the temperature of which is from 70° to 90° Fahrenheit. Gas is now developed, which gas, if any sugar has been present, is carbonic acid. The open arm is now filled with liquid caustic potash, whereupon the opening is closed and the liquid shaken. If the gas disappears the urine contains sugar, which, through the process of fermentation, has been decomposed into carbonic acid and water.

This test yields a reliable result, and is not very complicated.

(*b.*) The following method is a little different. Filter half a litre (a little less than half a pint) of urine; determine its specific gravity; mix with it one *per cent.* of well-washed brewer's yeast which has been dried in the air; cover it lightly, and expose it for one or two days to the heat of a stove (from 70°—90° Fahrenheit). Determine again the specific gravity of the urine at the first temperature. Multiply now the difference in number with 219, and divide the product by 1,000, in which case the difference of 0·001 corresponds to a percentage of sugar amounting to 0·219 *per cent.* The yeast which has been precipitated, the transparency of the urine, the disappearance of foam, and, again, the fact that the fermented urine, when subjected to the copper test, is unable to reduce the sulphate of copper, all this shows that the fermentation has been accomplished.

In order to test the purity of the yeast repeat the experiment with normal urine or with water.

III. *The test of polarization.*—The examination of the urine by means of the polarizing apparatus of Soleil-Ventzke, or by that of Mitscherlich, or, again, by that of Wild, can be executed easily and quickly; for, if any grape-sugar is present in the urine, the plane of the polarized beam of light is rotated to the right, while fruit-sugar (lævulose), as is well known, rotates it to the left. According to the greater or less amount of rotation caused by the greater or less amount of sugar, the lines of graduation in the apparatus indicate a greater or less percentage of sugar. The optic test, it is true, does not always tally with the chemical analysis.

A popular description of the apparatus of polarization, intelligible to all, is furnished by Bernstein.

Additional methods for determining sugar have been recommended by others, *e.g.*, by Pavy, Knapp, Vogel. The latter gentleman draws his inferences as to the percentage of sugar from the lighter or darker colour of the test by caustic potash. Canary-yellow, according to him, corresponds to 2 *per cent.* of sugar, the colour of dark Jamaica rum to 5 *per cent.*, a dark blackish brown colour to 10 *per cent.*, etc.

The amount of sugar.—The quantity of sugar in the urine, according to the food, mental excitement, movement of the body, etc., differs from one-half to 8 *per cent.*; according to Ségalas and Lehmann it reaches even 14 *per cent.*, and a still higher per-

centage. Such a high quantity I have never observed myself, and I have to take it for granted, provided there is no cause for doubting the accuracy of the observation.

The daily amount of sugar by weight may reach 500 grammes and beyond, although the average weight is from 200—300 grammes. The highest quantity of sugar secreted, as observed by Seegen, amounted to 600 grammes *per* day.

In addition to the secretion of sugar, another element of importance in the diagnosis of diabetes is *the increased secretion of urine.* It increases daily from two to five, yea, to 14 litres (= from $1\frac{7}{9}$ to $4\frac{4}{9}$, yea, to $12\frac{4}{9}$ pints). Still, there are cases of diabetes in which no considerable increase in the secretion of the urine is noticed.

Urea, also, owing to the excessive consumption of meat, increases in volume from 100 to 200 *per cent.*, so that 80, and even more, grammes have been formed *per* day. Gäthgens discovered urea and uric acid in still greater quantities during the febricose state of patients. Fürbringer reports 160 grammes, and Dickinson 142 grammes.

Phosphates and sulphates increase at the same rate. Other substances also were found to increase in like manner.

In some cases, for instance, Seegen discovered phosphoric acid to the amount of 6·6 grammes *per* day. Senator found creatinine, Frerichs inosite. Others demonstrated the presence of salts of ammonia, of diacetic acid, of leucine, acetone, etc. Winogradoff, Stopczanski, and Gäthgens, on the

other hand, noticed *a diminution in the secretion of creatine.*

Sediments are mostly found only in the beginning of the active state of diabetes, namely, uric acid and oxalate of lime. The urine of polyuria, which is a later stage of the disease, as said above, is clear. Nevertheless, it becomes turbid when left standing for a considerable time, and the yeast-cells which are then formed yield whitish precipitates.

A characteristic symptom of diabetic patients, in addition to the polyuria which gradually interferes materially with the process of assimilation, is a catarrhal nephritis, coupled with a copious secretion of albumen.

The diagnosis of diabetes is more difficult, when its characteristic symptom, namely, polyuria, is wanting; when, therefore, as the profession calls it, there is a case of diabetes decipiens.

An interesting property of diabetes, for the purposes of diagnosis, is presented by the fact that a latent diabetes very often, by certain contingencies, is instantaneously made active; for instance, by a kick, a blow, a fall; further, by mental excitements; by cares, over-exertion, a reflex action of the nervus vagus or nervus trigeminus in dental or ophthalmic operations; again, by a reflex action of the sciatic nerve; by infectious diseases, such as Asiatic cholera, diphtheria, typhoid fever, small-pox, scarlet fever; by chills, or constitutional diseases, such as syphilis, gout, adiposis, disease of the pancreas, liver, etc.

There is no doubt whatever, that in all those

cases where diabetes becomes manifest under the influence of any of the above contingent causes, the disease *has previously been latent in the system.*

Diabetes, consequently, does not arise from marasmus, furunculosis, etc.; but, on the contrary, diabetes, on account of the faulty assimilation of the food, causes marasmus, furunculosis, diseases of the eyes, ears, and lungs, nephritis, etc.

Another circumstance that has to be borne in mind in the diagnosis is this, that in active diabetes the character of the food is of comparatively small import. While, therefore, in accidental glycosuria, by abstaining from certain kinds of food, the percentage of sugar is diminished, or ceases altogether, in diabetes the urine *contains sugar, even if the patient lives on meat exclusively.*

A further symptom by which diabetes may be diagnosed, is an abnormal feeling of thirst and hunger. V. Pettenkofer and v. Voit explain the excessive thirst of diabetic patients by the fact that they secrete less carbonic acid and less water than healthy persons. This thirst may be explained thus, that healthy persons burn up more sugar, *i.e.*, alter it into carbonic acid and water, which are excreted through the skin and the lungs; while the diabetic patients pass all their surplus of sugar into the urine.

Other symptoms that often strike the diagnosing physician in a person suffering from diabetes, are an abnormal greediness, a dryness of the throat and larynx, as has long ago been observed by the

laryngologist Dr. Ch. Fauvel; further, an emaciation of his whole body, and a diminution in his power of resistance.

I have noticed several exceptions to this rule in cases where active diabetes nevertheless did exist.

The pulse of diabetic patients is usually sluggish; their stool indolent; although diarrhœa, on the other hand, has also been observed.

An important symptom is the scanty secretion of saliva. The reaction of the tough saliva is *sour;* which may be explained by the growth of a certain fungus (*Soorpilz*) first mentioned by Friedreich. It grows in the cavity of the mouth, and frequently causes a disease in the gums, by which they redden; at last the teeth become loosened, and drop out without pain.

The tongue is often normal, yet frequently also it is thickened, chapped, furrowed, and reddened. The papillæ are swollen, sometimes to the size of a pin-head, and even larger, which was pointed out already by Seegen, with whom I agree on the main. He says, "On closer examination it will be found that the tongue of persons suffering from diabetes is rarely quite normal, and repeatedly I have been induced, by changes that I noticed in the tongue, to examine the urine of patients, which was then found to contain sugar. The changes I noticed are as follows: (a) the tongue, almost always, is increased in thickness; it is wider and more bulky. The edges of the tongue exhibit a fine, symmetrical indentation, and appear swollen. (b) After the changes have

proceeded further, the upper surface of the tongue exhibits a peculiar design, somewhat similar to the skin of a crocodile. This design originates from a network of fine, superficial fissures, which intertwine in a manifold manner. (c) These fissures sometimes penetrate more deeply into the tongue; sometimes they do so to the depth of $\frac{1}{2}'''$, and they cross the tongue in all directions. A deep fissure sometimes passes through the middle of the tongue, while smaller fissures extend sidewards and transversely. These fissures, however, are by no means bloody, nor are they ulcerated; but they are sensitive on coming into contact with sour and sharp articles of food. As an illustration of the looks of such a fissured tongue, and also as an illustration of its origin, I may point to a lump of clay which, when it begins to dry up, contracts and is full of cracks. (d) Individual papillæ and groups of papillæ are very much enlarged; they protrude in the form of islands, like red spots. I observed some papillæ, of the size of moderate pin-heads. In one case the papillæ along the edge of the tongue were very much enlarged; the whole edge was unequal; it consisted of excrescences and inlets, and the individual enlarged papillæ had the appearance of condylomes on top of them. (e) While the normal tongue always makes an impression on the eye as well as on the touching finger, as though it were not always symmetrical; and again while it rather looks and feels like artists' pencils closely pressed against one another (papillæ filiformes), on the tongue of a

person suffering from diabetes entire portions of this pencil-like structure seem to be wanting. These portions are smooth, shining, bluish-red; and while the normal tongue is often more or less covered, the above portions are entirely free of any deposit. These spots, which sometimes occupy only a small portion, of the size of 1 ccm., often increase in size, and fill the entire half of the tongue. Such places often have a peculiar smell, like raw meat. In these portions, again, you meet with dense, white, dimly shining places. The histiological significance of these alterations is not yet clear to me. At first it seems as if these portions were deprived of epithelium; yet the above white places seem rather to indicate a luxuriance of epithelium. In some cases, also, there are ulcers of the size of lentils or peas, which are very painful.

"The changes described under the head of (e) remind one of those syphilitic affections of the tongue which are described under the name of psoriasis linguæ and keratosis. Yet in the first place they are not entirely analogous to them; and, secondly, I have repeatedly seen them in persons where a syphilitic origin could be definitely denied." [?]

Again, it ought to be mentioned here that the breath of diabetic patients has an *aromatic odour*, like their urine; it smells like apples which have been sliced, or like rotten apples, and like damp hay; or again like fruit in process of fermentation. The cause of this phenomenon seems to be a dimi-

nution in the reception of oxygen, and a decrease in the giving out of carbonic acid.

The skin of such persons is frequently rough and brittle; it scales off like bran; it has folds, and is mostly dry. Usually it feels cool, and exhibits a low degree of warmth; although patients with good lungs, who have been debilitated very much, sometimes are able to give out a considerable quantity of perspiration, which, according to some (Forster, Vogel, Fürbringer, Griesinger, Hebra), likewise contains sugar; others (*e.g.*, Frerichs, Külz in *Op. citat.*, p. 68) found the perspiration free from sugar.

According to Reich and Liebermeister the skin and lungs of diabetic patients exhale about one-third of the amount of water evaporated by healthy persons. The activity of the skin I sometimes found reduced to zero.

Since I regard diabetes as predestined in a certain sense, that is, as transmitted by lues from ancestors, in contradistinction from the physicians of the new as well as of the old school, in my diagnosis, I direct my chief attention to the suppressed activity of the skin.

Every patient whom I suspect of diabetes I ask to undress, and I first of all endeavour to examine his skin—an element of diagnosis on which heretofore no physician has laid much stress.

Marks of hereditary lues, and therefore of importance to me, are the so-called beauty-spots, warts, deposits of pigment, rank growths of epithelium, white spots on the finger-nails, gouty deposits

in the joints of the fingers and toes, especially in those of the big toe; further, barky epithelial growths in the feet, etc.

An unsafe symptom, and yet one which ought still to be taken into consideration, is a vivid itching of the skin. Another suspicious symptom is the formation of fungi, caused by the sugar in the urine, whereby an inflammation is produced in the male genitals; and with women an insufferable itching (pruritus pudendi) in their genital organs (the large labia of the pudendum), which itching may be overcome by cleanliness. One single drop of sacchariferous urine which has dried up at the orifice of the urethra may cause there an itching and burning sensation, with inflammation. In consequence of this there arises sometimes with men balanitis (gonorrhea of the gland), phimosis, paraphimosis, psoriasis in the upper parts of the thigh, on either side of the testicles; and with women a wearisome eczema (eczème glycosurique) or prurigo of the labia, etc. (See Winckel's article in the "Zeitschrift für praktische Medizin," 1876).

Often boils and carbuncles seem to form themselves by preference on the labia of the pudendum; again, phlegmonous inflammations, gangrene, diseases of the lungs.

A local cure in such cases by well-known remedies is impossible; for so long as the fundamental cause is not removed, a mere palliative treatment can effect nothing.

Fits of ill-humour, loss of memory, convulsive

movements in the muscles, sciatica (according to Berger, in "Breslauer ärztliche Zeitschrift," 1883), neuralgias (which Drasche, in "Wien med. Zeitschrift," 1882, regards as the consequences of a toxical effect of sugar on the peripheral nerves), may eventually raise a suspicion of the existence of diabetes.

In advanced cases of this disease the power of vision decreases, even as to lead to the formation of cataract, and to the production of other ophthalmic troubles. It also gives rise to mental diseases, sclerosis of the vessels, carcinomas in the pancreas, rectum, breasts, and liver, œdemas of the feet, face, etc. Sexual languor, also, heightened into impotence, sometimes serves to indicate the presence of the disease. With women there occur disturbances in the menses.

So long as there are no inflammatory complications, there is no fever. On the contrary, the temperature of the body, as mentioned above, frequently is below the normal warmth, namely, between 34° and 36·5°, which observation was already made by Vogel and Dickinson. The pulse at the same time is mostly big and hard, since the arteries are overfilled.

It is an interesting feature that in proportion to the progress of the disease, hydrates of carbon, without being utilized, *i.e.*, without being decomposed into carbonic acid and hydrogen, appear remarkably soon in the urine in the form of sugar; and that the albuminates, even in an exclusively

animal diet, are not able to re-establish the equilibrium in the organism, so that the patient loses in weight.

The fundamental cause of the illness sometimes also causes at first a general rheumatism of the joints and muscles, etc.

In children diabetes frequently manifests itself—a thing often overlooked—by a wetting of the bed. Sucking babes that lose flesh ought to have their urine examined.

A valuable help in the diagnosis is furnished by the fact that the deteriorated organism of a diabetic patient gradually loses the power of reproduction and assimilation, so that, for instance, wounds which ordinarily close in a very short time require a proportionably long time to heal; they incline towards suppuration, form chronic ulcers, etc.

VIII.

THE PROGRESSION, PROGNOSIS, COMPLICATIONS, AND TERMINATION OF DIABETES.

After diabetes has entered upon its active stage, it mostly runs its course without fever, and assumes either an acute or a chronic character.

Until within the most recent times diabetes has been declared incurable. Seegen (*Op. citat.*, p. 125) says that among nearly 400 cases of diabetes in his own practice he has *never witnessed a case of perfect cure.* He grants, however, that by abstinence from amylaceous food it is possible for diabetic persons to preserve themselves for years in a state of health, and that the body acquires a tolerance for a certain quantity of sugar, and gradually accommodates itself to the sugar. Senator (*Op. citat.*, pp. 137, 231) speaks of a cure extending over several years as being only a conditional, *imperfect cure.* The same term he applies to the transition of diabetes mellitus [?] into diabetes insipidus, when followed by a cure. Compare, also, the case which was observed by Plagge (see Virchow's "Archiv," etc., xiii., p. 93). Vocke, therefore, exclaims (*Op. citat.*, p. 84), "*Real diabetes is equivalent to death.*"

The *prognosis*, namely, how long it is possible to preserve life after diabetes has become active, depends: (*a*) upon the tolerance of the system for amylaceous food; (*b*) upon the consistency of the patient in following the dietetic prescriptions; (*c*) upon the physical or moral disposition of the patient, since a patient of a cheerful temperament will progress more favourably than a hypochondriac; (*d*) upon the age, etc.

The duration of active diabetes differs very much in the various stages of life.

In children it mostly leads precipitously to death. In my own practice, up to the year 1881, I often saw diabetes acutus and acutissimus cause death in children, already in the short space of from four to eight weeks. Becquerel even communicates the case of a boy nine years old, who died six days after he had been seized with diabetes.

Adult persons who, by a rational life, that is, by an appropriate physical and bodily diet, as well as by the use of the Carlsbad waters in Carlsbad itself, know how to regulate the consumption of glycogen and to prevent an over-production of sugar, often enjoy a tolerable degree of health for years after the active form of diabetes has manifested itself. Nevertheless, according to my own plentiful experience, they are not able to prolong their sad existence much beyond six years, although in a few individual cases such patients have been kept alive for upwards of seven or eight years. Cases of longer duration I have always considered

as examples of simple glycosuria, which I was competent to heal even by the old-fashioned method of treatment before 1881.

Not unfrequently I have come across communications from even distinguished inquirers, such as Bence Jones, Lebert, Dickinson, by whom we are informed that in *mild* cases of diabetes the course of the disease has been observed for upwards of 20 years. Doubts arise in my mind whether such communications are really not due to a mistake on the part of the inquirers, who have confounded accidental glycosuria with constitutional diabetes. In the course of my large practice, which has extended over many years, I have not become acquainted with a single case of genuine diabetes the duration of which was longer than eight years, although I am acquainted with cases of accidental glycosuria (especially among well-to-do, corpulent persons who lead a rational life) which have lasted for 20 years.

Sometimes the disease seems to be at a standstill. The abnormal thirst, the greediness for food, and the increased secretion of urine stop. The loss of flesh and the feeling of lassitude disappear. The physician who allows himself to be deceived calls it a cure, when all at once the enemy reappears, more threatening than ever, and this time he will not allow himself to be driven away again.

Unless one of the usual complications, such as pulmonary consumption (owing to a defective assimilation of the food), or carbuncle, gangrene,

etc., cause death, it mostly ensues unsuspectedly, instantaneously, without any outward cause; or, again, it results in consequence of over-exertion, mental excitement, catarrh of the stomach. It occurs then with apoplexy, attended with attacks of paralysis, loss of consciousness, and, indeed, it is caused by a peculiar complex of nervous disturbances and brain symptoms, which are comprised under the general term of "coma diabeticum," the terror of all medical practitioners.

The cause of death in diabetes is often marasmus, exhaustion of the nervous centres, exhaustion of the heart, which brings about paralysis of the heart; and this on the other hand presupposes a wasting away, and a degeneracy of the muscle of the heart. Coma also ensues in the so-called diabetes insipidus, if the patient does not pass away before by some intercurrent disease, or an affection of the brain or spinal marrow.

Prout, who proved the injurious effect of fatiguing marches on the nerve-life, was the first who made mention of the complex of symptoms in coma diabeticum. Notable physicians, such as Griesinger, Dusch, Hilton-Fagge, Taylor, but especially Kussmaul, have noted and described similar observations. Frerichs also devotes a considerable portion of his monograph on diabetes to a proof of the fact that most cases of this illness terminate in coma, in sudden death, which is certainly a discouraging sign for practical therapeutists.

But of what use to the practical physician would

be this great number of instances showing in what manner death overtakes those who are afflicted with diabetes, if the discovery and the prevention of the cause of this mysterious termination of human life were to be regarded as impossible?

That portion of his material which Frerichs gathered from experience for the purposes of theory and instruction, and which has a bearing upon the subject before us, he divides into three groups. Group I. embraces those persons suffering from diabetes who all at once, perhaps after having made an exertion, are seized with a general weakness, and who pass away in a few hours with cold extremities, a small, sinking pulse, loss of consciousness, and somnolence in consequence of paralysis of the heart. Group II. comprises those cases which run their course in from one to five days, and with whom the preliminary stage may be diagnosed thus: General weakness, gastric disturbances, sickness, vomiting, sluggish stools, pharyngitis, phlegmons of limited extent with inclination towards gangrene, bronchitis, pains in the head, chest, and abdomen, a feeling of anxiety, dyspnœa, accelerated breath with or without cyanosis, a weak pulse, a sinking of the temperature, until somnolence and coma intervene. Group III. includes those cases where diabetic patients, without dyspnœa and with no feeling of anxiety, with a moderate tension of the radial arteries, and with their bodily strength in a comparatively good condition, are seized with headache, a feeling of

intoxication, and somnolence, out of which they never awake. Frerichs explains the "coma diabeticum" by an alteration in the nervous centres, brought about by a change in, and a thickening of, the blood owing to an increase in the percentage of sugar; further, by uræmia, embolisms of fat, acetonæmia, as well as by a disturbance in the secretions. Petters, Kaulich, Cantani, and others suggest a chloroform-like effect of, and poisoning by, acetone. Griesinger assumes an accelerated formation of lactic acid; Ebstein supposes uræmia; Lœb a gradual paralysis of the vagus nerve; Taylor, Starr and Hamilton suggest embolisms of fat, intoxication by carbonic acid, etc.

I am of the opinion that in most cases nephritis is caused by the exciting, stimulating substances contained in the blood of diabetic patients; that in consequence of the inflammation of the kidneys there is a diminution in the excretion of the excrementitious matters of the blood through the urine; and that in conjunction with the suppression of the activity of the skin, there is produced at last through this cause that blood-poisoning, that uræmia, and, indeed, that self-intoxication which results in the coma diabeticum, which manifests itself by a kind of delirium, intoxication, and giddiness. Such is my opinion, although Senator (*Op. citat.*, p. 171) thinks that the symptoms of coma do not correspond to an intoxication by uræmia. Again, although he seems rather inclined, in conjunction with Petters (who, however,

was opposed by Frerichs), to regard the presence in the blood of acetone as the cause of those peculiar symptoms, the experiments made by Prof. Dr. Brieger in Berlin are certainly contradictory to this assumption. Stadelmann (see "Archiv für exper. Path. u. Pharm.," xvii., p. 443) suspects an intoxication by an acid, probably by crotonic acid.

Anyone who adopts my theory of self-poisoning will regard with suspicion all attempts at combatting the "coma diabeticum." What possible and impossible things have not been recommended and done in order to overcome this coma! One medical practitioner thought the existing dyspnœa ought to be relieved; another that the action of the heart ought to be stimulated by appropriate remedies; still another that the secretion of the urine ought to be increased; while a fourth maintained that the excrementitious matters that have accumulated in the blood ought to be diminished. It is a great pity that none of these gentlemen have been able to point out the remedy by which the desired result is to be attained.

Some of them, and among them the great clinical authority, Kussmaul, proposed a physiological solution of common salt, a transfusion of blood, an intravenous injection of a solution of bicarbonate of sodium, saline and stimulant aperients; again, they advised a return to a mixed diet, lavements, rubbings of the body with lukewarm water, in order to prevent a recurrence of the attack. But have their sugges-

tions and proposals been crowned with success in practice?

There is only one means by which coma can be prevented; and this one means is combatting its efficient cause, namely, *hereditary lues.*

Here I wish to point out that already Seegen in his work on Diabetes (p. 65) suspected a hereditary diabetic tendency in cases where either the father or mother have suffered from affections of the brain; and, further, that Senator, like Seegen before him, assumed a connection of diabetes with diseases of the central nervous system, especially with epilepsy and mental diseases.

I am able, at this day, to furnish an incontestable proof of this connection; nay, I am able to declare that there exists a primal consanguinity among all these diseases.

At all events therapeutics are aided but little by inquiries into the character of the anatomical substratum of this disease, the changes caused in the nerves, etc. But the declarations of Formad, Veraguth, Schottelius (see Virchow's "Archiv," etc., 1882), with regard to the state of the body favourable for the development of diabetes are simply surprising; for the first regards the disposition of the lymphatic vessels, the second that of the alveolar epithelia, and the last the configuration of the bronchia, as that anatomical element which predisposes for diabetes.

Finally, I wish to extend Cornillaus' idea—who

teaches the connection of diabetes with *gout and rheumatism*—so far as to define all these diseases as branches of one and the same root; and I herewith declare that in all those cases where it has been possible for a morbid condition of the structure of the protoplasm to be reformed and regenerated, such a condition has most assuredly been healed by myself, and will be healed by myself again in the future.

IX.

THE SO-CALLED CURES OF DIABETES THAT HAVE HITHERTO BEEN MADE ARE ILLUSIONS.

BETWEEN 1861 and 1881 I have met in my practice with many (over 200) cases of so-called "neurogenous diabetes" (glycosuria), and of diabetes of corpulent persons, which cases, according to my present system of classification, are to be classed simply under the head of accidental glycosuria. Such cases also I have frequently encountered afterwards; and I have cured them. Other practitioners have effected similar cures, without, on that score, being able to declare that they have actually healed genuine diabetes.

Numberless cases of accidental glycosuria may be stopped almost without the aid of drugs, simply by a combination of an appropriate mental and bodily diet, which shall be explained below. The cure will be speedier if the warm, alkaline waters of Carlsbad, etc., are applied.

Claude Bernard says (in "Leçons sur le Diabète," 1877, p. 70): "While diabetes was formerly considered a rare, but always deadly, disease, it is now, in most cases, considered less serious and capable of being healed."

But Zimmer justly complains that with all that has been done by Bernard, the therapeutics of diabetes have not been advanced by him in the least, and that the profession is still where it was when Rollo determined upon his empirical treatment of the disease, namely, upon a diet of meat and fat. In making the above declaration Bernard had evidently in his mind only accidental glycosuria.

Frerichs enumerates some few cases where diabetes has been healed. Such cases, according to his declaration, are cases of diabetes after neuralgia, after paralysis, after apoplexy, after mental excitements, after cholera, after gout, etc.

It is hard for me to contradict my former teacher; nevertheless, in accordance with the facts of my experience, I am compelled to believe that he also mistook *accidental* glycosuria for diabetes. Let us examine his so-called cures:—

He maintains that in eight weeks Lady v. B., who was 58 years old, after using the Carlsbad waters and by being placed afterwards under the influence of kreosote, was cured of an attack of diabetes *brought on by an ophthalmic operation.* [Accidental glycosuria!]

Castellan Hänel, 60 years old, who, in consequence of an extensive *carbuncle in the neck*, became *diabetic*, is said to have been radically cured by the Carlsbad waters in eight weeks. [Accidental glycosuria!]

The corpulent Mr. J. W., 70 years old, is said to have been relieved of all his troubles at Carlsbad,

and to have been thoroughly healed of diabetes. [Accidental glycosuria !]

The *apoplectic* landed proprietor, Barth, whom *I am inclined to regard as truly diabetic*, was freed from sugar after three years, but he died of an effusion of blood in the brain [arterio-sclerosis. Can this be called a cure ?]

The Cabinet-minister v. G. was cured after three years ; but he *died of an effusion of the blood in the brain* [arterio-sclerosis. Was that a cure ?]

A diabetic professor lost his sugar, but he DIED after a few months of *marasmus, by a quickly growing cancerous swelling.* [Was that a cure ?]

Diabetes *after cholera* was healed. [Accidental glycosuria !]

Patient No. 8, who suffered from diabetes after mental excitement, did not exhibit any more sugar, but *he remained* ILL *of catarrh in the stomach.*

Case No. 9 RETAINED *catarrh of the bladder.*

Bookseller Sch. (case No. 10) did not die of coma ; but, after attempts had been made for 20 years to cure him, he *died of inflammation of the lungs !* [Does this prove a cure ?]

In case No. 11 the sugar disappeared after two years, but "*cataract was fully developed.*"

Lady v. St., from P., who was plethoric and corpulent, was healed ; but *she* DIED *of nephritis and dropsy,* which are regular consequences of diabetes, and which prove the existence of active diabetes.

In summing up the cases quoted by Frerichs, *he has not,* in my opinion, *cured a single case of true*

diabetes. Feeling the insufficiency of his own method of cure, he exclaims, "Alas! the termination of diabetes by a cure is very rare indeed!"

In the course of his monograph Frerichs states that sometimes diabetes mellitus gives way to another disease, of which the patients die, *e.g.*, nephritis, arterio-sclerosis, diabetes insipidus, etc. But he forgets altogether that these so-called "succedaneous diseases" lie in the very current of diabetes mellitus, and that in the end it matters little what direction the enemy takes, since his victim, without any hope of escape, remains in his clutches for all that. Thus, for instance, a lady, 56 years old, dies of marasmus, although, according to his account, diabetes mellitus had already been succeeded by diabetes insipidus. Another patient he dismissed as cured, whose diabetes, I suspect, was simply accidental glycosuria.

I am inclined to apply to Frerichs and to others who declare that they have cured true diabetes the following language of Senator which he used in respect to Morton: "Morton's statements that he healed completely his three patients makes it doubtful whether they really suffered of diabetes mellitus."

This opinion of Senator is significant as expressing his view in respect to the general curability of diabetes, which is also doubted by Seegen, who says (*Op. citat.*, p. 124), "Of the 140 cases of diabetes which I had occasion to observe I have not seen *a single case which was completely* healed."

Frerichs was often in doubt whether he had before him a case of real diabetes or merely a case of accidental glycosuria. It is possible that where he claims to have effected a cure of diabetes he had in his mind only what I would call glycosuria. The following circumstance seems to prove this, for he closes his monograph with an enumeration of those cases where diabetes resulted in death, and where he uses the words of Senator (*Op. citat.*, p. 230) :— "*The usual termination is death;* death by pulmonary consumption (34 times); by marasmus (18 times); by pneumonia (seven times); by nephritis (eight times); by paralysis of the brain (twice); by effusion of blood (once); by softening of the brain (twice); by meningitis cerebro-spinalis (three times); by formation of carbuncles (seven times); by coma (seven times); by other complications (nine times; among which were six cases of carcinoma).

What a shocking confession of those authorities who have written on diabetes!

Let us rejoice that we are able nowadays to proclaim: DIABETES MELLITUS IS CURABLE!

X.

THE OCCURRENCE OF DIABETES; MORTALITY AND THE RESULTS OF POST-MORTEM EXAMINATIONS.

THE possibility was suggested that the occurrence of diabetes in certain places and localities (*e.g.*, in Ceylon) was due to the influences of the climate. There would be a meaning in such a suggestion if it were possible to trace the history of the disease and to observe its development; and if those places could be determined where luetic or venereal diseases, the consequences of which are manifesting themselves in the present generation, were once prevalent.

From 1861-1870 no less than 6,494 persons died in England and Wales of diabetes. It is interesting to note that 1,194 of these cases were reported of persons from 55 to 65 years old, and only 830 cases of persons from 65 to 75 years of age.

Among 104 diabetic patients Schmitz reports 38 cases of persons whose age ranges between 50 and 60 years.

Among 165 diabetic patients Griesinger found that the age of the majority, namely, 91, was between 20 and 40 years. Only two persons among the 165 were seventy years old; while Schmitz counted four among his 104 cases.

Seegen, among whose 140 diabetic patients there were 100 men and 40 women, compiled the following table: — From 1st-10th year=0; from 11th-20th year=5; from 21st-30th year=40; from 31st-40th year=21; from 41st-50th year=33; from 51st-60th year=43; from 61st-70th year=14; from 71st-80th year=1.

My own experience and my own notes confirm these communications, and I might multiply them if it were of consequence. According to my notes also active diabetes occurs most frequently in persons between the 35th and 55th year of their life.

It would be interesting to know what circumstances conspired in keeping the diabetes of some of the above patients latent until they had reached such a high old age?—provided their medical advisers did not mistake transitory, accidental glycosuria for diabetes—why, therefore, the sugar in their case was used up without being conveyed into the urine? Or, better still: Why the production of carbonic acid proved sufficient to check the formation of sugar in their case, and to make it normal?

If Senator (*Op. citat.*, p. 122) is of the opinion that diabetes frequently begins in early years, and continues into high old age; in my opinion accidental glycosuria only can be meant by him.

In order to find out the causes of diabetes, Frerichs also subjected no less than 400 cases to a careful examination. In his list there were five diabetic patients between the 1st and the 10th year;

29 between the 11th and 20th year; and thus in succession in every additional space of ten years, 42, 71, 101, 105, 42 and 5 persons; so that according to Frerichs' observations the highest percentage occurs between the 40th and 60th years of human life. Two-thirds of his patients were male, and one-third female patients.

Among Frerichs' 400 diabetic patients, 102 belonged to the Semitic race. Seegen found 36 Israelites among 140 diabetic persons; thus 25 *per cent.*, just like Frerichs. Zimmer noticed 22 *per cent.* of Israelites; and Hertzka 50 *per cent.*—that is, among 86 diabetic patients there were 40 Jews. He believed that this was due to the Jews frequently marrying elderly wives.

My opinion is, that on the one hand, Jewish patients prefer to be treated by physicians of their own religious persuasion, many of whom practice medicine in the convenient Carlsbad. But another reason why relatively more Jews than Christians (according to Seegen the former constitute 10 *per cent.* of all the frequenters of Carlsbad) prefer the costly experiment of regaining their health at Carlsbad to a treatment at home or at a hospital, must be sought for in the fact that the Jews are generally better provided with pecuniary means. Moreover, the Jews are usually more anxious about their health, and this anxiety with them has frequently become intensified. The same is the case with ladies, only, from a sense of economy or from attachment to their families, they often prefer to await death at

home rather than to suffer from nostalgia in a distant watering place.

In order to furnish an anatomical foundation of the disease, some physicians have carefully noted the condition which the bodies of persons who died of diabetes exhibited in *post-mortem* examinations.

Seegen carefully examined the records of the *post-mortem* examinations at the general hospital (*Allgemeine Krankenhaus*) in Vienna from 1838 to 1870. He found 30 reports of the anatomical condition of such bodies. *Not a single case could he find where a change had been undergone by any organ.*

Richardson, on the contrary, mentions a tumour of the size of a bean in the brain of a diabetic patient, caused by brain disease. Seegen also mentions such a tumour of the size of a nut. Some dissectors found an alteration in the pancreas (*e.g.*, Recklinghausen, Fles, Hartsen). Others, again, in several cases, found the kidneys morbidly altered; also in most cases the lungs. Diseases of the stomach and bowels also have been mentioned; these diseases were probably the result of a change in the assimilation of the food.

Frerichs shows in five cases that the local affections of the nervous system have "mostly" been confined to the medulla oblongata, the pons Varolii, and the cerebellum; and that they "rarely" extended into the hemispheres. In syphilitic affections of the coatings and vessels of the brain the case is the same. Six times he found new growths; as was shown also by Rosenthal, Recklinghausen, Mosler, Perotow,

Lionville, Reimer, Weichselbaum, Dombling, and others.

The spinal marrow he found altered in one case only. The smaller vessels of the medulla oblongata were much enlarged.

In half of the cases he found the lungs and the air passages diseased [tuberculosis]; inflammation of the lungs in these cases had frequently caused death.

The heart appeared to him mostly small and affected by atrophy; not unfrequently he found a development of chronic arteritis.

The stomach sometimes was unaffected, and sometimes it was enlarged. The liver and spleen were mostly normal, only now and then they were abnormal as regards size.

Twenty-eight times the pancreas was normal; 12 times it was *abnormally affected by atrophy.* The kidneys often appeared normal; in some special cases he found them small and pale, or large and abounding with blood. Still Frerichs considered himself obliged to assume a glycogenous degeneracy of the small canals of the kidneys, whereby they lost their power of resistance as a constant, anatomical product. [A succedaneous stage of diabetes?]

Frerichs enumerates 58 cases of *post-mortem* examinations which I have studied carefully. Of what great therapeutical value are they? Alas! he has been as little able by these cases to demonstrate the organic changes and causes of diabetes as their anatomical foundation.

The declaration that a tumour of the size of a hazel-nut in the hinder convolution of the right temporal lobe; and, again, that a tumour of the size of a pea in the cerebellum actually serve as an anatomical foundation to diabetes, ought to be opposed most strenuously; for wherever there is no hereditary lues, such tumours will always run their course apart from diabetes, yea, even without any accidental glycosuria. In spite of the most scrupulously exact *post-mortem* examinations of the bodies of persons who died of diabetes, surprisingly few bodies were found in which the changes in the brain, so far as their anatomical localities are concerned, were of such a kind that I would dare to derive from them the cause of diabetes. In by far the greater number of the bodies of persons who died of diabetes, where changes in the brain have been proved, these changes, without doubt, have to be looked upon *rather as consequences of diabetes than as the causes of the disease.*

Serious objections also may be raised against other theories raised on the ground of *post-mortem* examinations. Thus the severest kind of diseases of the lungs have been observed, in which the reception of oxygen was greatly disturbed (dyspnœa), and yet not even the slightest secretion of sugar in the urine was noticed.

The derivation of diabetes from diseases of the stomach and liver can be refuted in like manner; for in the most serious affections of the stomach and liver the urine is often free from sugar. On the

other hand, again, in severe cases of diabetes the stomach, as well as the liver, have been found perfectly normal.

After communicating the sum of his 58 *post-mortem* examinations, Frerichs confesses that he is not able to give an account of the processes that take place in the protoplasm of the liver-cells. His learned disciple, G. Salomon, knows as little concerning these processes, as other mortals have found out since his time. Ebstein only is on the right track.

Thus far it has not been possible to prove in a single case that diabetes depends upon any alteration in any particular organ. How many physicians since the time of Celsus have looked for the cause of diabetes among the consequences of this malady! How many have looked for organical causes, for a visible anatomical substratum, for gross anatomical changes without discovering anything whatever except purely accidental complications or secondary affections, like phthisis, which were consequences of diabetes.

Some interest in the subject and patience are required in order to wade through the heaps of barren and prolix dissertations and papers on the subject of diabetes; and to consider and digest all the unripe, ripe, and over-ripe lucubrations of practical and unpractical physicians, medical candidates, and theorizing medical lecturers on this same subject. Most authors have battled against the devastating waves of this disease at the mouth of the river, and not at the distant fountain-head.

XI.

TREATMENT OF DIABETES (THERAPEUTICS).

THE steps in advance that have successively been made in the art of healing have ever exhibited the same kind of progression which we also notice in the advancing course of human nature, as well as in the world of outward phenomena around us.

The secret of a rational method of healing is the maintenance of the change of substance (*Stoffwechsel*) in agreement with nature. The object of this method is, to direct into normal channels the disturbed transformation necessarily undergone by the bodily fluids, and to correct the wrongly constituted protoplasm which has become incompetent to perform its functions, so as to prevent diseases, or to remove them.

A rational practitioner, therefore, will direct his attention first of all to the entire system of the organs engaged in carrying out the change of substance, namely, (*a*) to those organs which are receptive of substance, *i.e.*, which prepare the blood, namely, the digestive organs and those which minister to respiration; (*b*) to those which distribute the substance, namely, the heart and the vessels which are put in charge of the circulation; (*c*) to those organs which

excrete substance and purge the blood, which organs include the lungs (also mentioned under *a*), further, the liver, the spleen, the secretive organs of the urinary apparatus, the bowels, and the outer skin.

The material operated upon by the change of substance (*Stoffwechsel*) has to pass through sundry processes of transformation before it is rendered fit to serve in the building up, and in the maintenance of, the bodily organism. Through the action of the saliva upon the food which is masticated in the mouth it is first prepared for reception in the stomach.

The soluble ingredients (*e.g.*, the sugar) are dissolved, and the insoluble starch is changed into dextrine and grape-sugar. Through the chemically dissolving action of the secretions of the stomach (stomachic mucus and gastric juice, which juice consists chiefly of free muriatic acid and a ferment called pepsine) the food is rendered fit to be properly digested, and the continued transformation of starch into sugar which was commenced by the saliva is accomplished.

Before the chyme (the pulp of food) passes from the stomach into the intestinal canal it has to pass through the supervision of the pylorus, which, in a normal condition, does not suffer any undigested food to leave the stomach. A new digestion ensues in the intestinal canal. The chyme is there exposed to the action of the intestinal juice, which consists of the bile that enters into the duodenum, and also of the pancreatic juice. The acid reaction of the

chyme is changed thereby into an alkaline one. The starch which has hitherto remained unchanged is altered by the pancreatic juice into sugar, etc., and the undissolved albuminates are altered into peptones. The latter substances, the formation of which was started already in the stomach through the action of pepsine, are easily diffused through animal membranes.

Additional transformations take place through the action of the intestinal juice, *e.g.*, the transformation of cane-sugar into grape-sugar. The fermentation of butyric acid and of alcohol likewise takes place there.

The so-called chyle is extracted from the chyme and transferred into the blood by the absorbing lymphatics and by the glands and intestinal villi, which consist of least ducts (about four millions of them).

All depends upon this chyle and upon the formation of the blood, the quality of which is determined by that of the chyle; for the blood has to furnish the material for the maintenance of the change of substance and for the building up of the organism, wherefore this chyle may be styled the dissolved, liquid, organism of the human body.

The excretion of useless material is carried on by various organs. The lungs excrete in great abundance altered sugar, namely, carbonic acid and water, while renovating at the same time the venous blood by conveying oxygen to it, and also by imparting to it the faculty of assimilation and the possibility of building up the organism, vindicating thereby

for the work of respiration the highest mission in the continuance of life. The intestines cast out the useless residuum of the food. The urinary organs dispatch the residuum of the albuminous and fibrous ingredients out of the body, while the skin excretes the sebaceous and other matters which when condensed appear in the form of perspiration.

A glance upon these processes which are carried out in the daily change of substance (*Stoffwechsel*) shows that all the organs in the body can exist only when the requisite ingredients of the blood are duly commingled in it, and when there is a normal formation of protoplasm as its natural result.

Good curative results, therefore, can be obtained by a physician only when in the case of a hereditary, faulty protoplasm he does not undertake any *merely symptomatic cures,* but regards *the peculiar assimilation of the food by the body as the chief cause of the progression of a disease.* A disturbance in the change of substance (*Stoffwechsel*), as Blumberg and Steinbacher justly observe, is the root of most diseases, and, therefore, a faulty formation of the protoplasm.

Healing, in the modern sense, means maintaining in a normal condition the change of substance, regulating that change when it is disturbed and directing it again into its proper channels.

This is the fundamental principle of my therapeutics in all specific diseases, and particularly in dealing with diabetes.

Like nature's practitioners (Steinbacher, Priessnitz,

Schroth, and others), by exciting in the system new activities, and, indeed, by employing in a rational way all those factors or agencies which are indicated by the pathogeny of a disease, I endeavour to eliminate from the human system the elements by which the change of substance is disturbed.

Although our art of healing, even in the most recent times, has not been able to heal *a single* case of diabetes, since hereditary or connate defects in the protoplasm cannot be removed by a mere application of medicinal remedies (see Ebstein in *Op. citat.*, p. 193); nevertheless, by its symptomatic, empirical method of treatment it has limited in an essential degree the deadly nature of diabetes, and it has at least mitigated the symptoms of the disease.

The best results are obtained, and will be obtained in the future, by a proper combination of hygienic, dietetic, and remedial agencies.

Scientific attempts, based on definite principles, to combat diabetes by dietetic agencies have only been made since the close of the last century.

J. Rollo in his memorable treatise "On Diabetes Mellitus" (London, 1797) was the first who recommended a dietetic treatment of diabetes as a therapeutic remedy. His recommendation has gained the approval of the profession even to the present day.

Rollo prescribed almost exclusively animal food and fats, and especially rancid fats, which he rendered more effective by alkaline and calcareous substances.

Wm. Prout, in his work entitled "On the Nature and Treatment of the Diseases of the Stomach and the Urinary Organs" (translated from the English by Krupp, Leipzig, 1843), likewise recommends fats, because they increase the secretion of saliva, and diminish thirst. Butter he calls the most agreeable form of fat.

Nourishing food, difficult to digest, such as fish, tripe, the mouth of oxen, etc., was recommended for combatting diabetes by Alexander v. Tralles.

Many practitioners after him prescribed fats, and justly so; for they are burnt up into carbonic acid and water, and thus protect the glycogen and the albuminates in the system, and, consequently, diminish the sensation of hunger and thirst in diabetic patients, and counteract autophagy—the process of consuming one's own self.

Whoever withholds fats from diabetic patients commits a blunder, since patients by eating fat neither become fat themselves, nor is their blood-supply diminished (see Ebstein, *Op citat.*, p. 199).

An exclusive meat-diet, carried out consistently, may become fatal, as is proved by the so-called Banting-cures. Voit says (in "Physiol. des allg. Stoffwechsels," Leipzig, 1881) that in such a treatment the most abundant supply of albuminates does not suffice to preserve the body in a proper albuminized condition.

Following the precedent of Rollo, other physicians, such as Bouchardat, Dickinson, v. Düring, Cantani, Seegen, Naunyn, Voit, Pavy, Boucheron, Bence

Jones, M. Traube, and others, prepared dietetic instructions for diabetic patients. These we shall examine below.

Ebstein, in giving his noteworthy advice to resort only to dietetic treatment, starts from the position that in a normal condition of the body, under the influence of diastatic ferments, only so much of the glycogen stored up in the body is altered into species of dextrine and sugar as is oxidized completely into carbonic acid and water; while in diabetic persons the amount of carbonic acid formed in the protoplasm no longer suffices to regulate the diastatic ferments, which therefore exert in them a more powerful effect. Glycogen, consequently, being no longer protected is transformed into easily diffusible species of sugar, which quickly pass into the liquid portions of the body, where they produce hyperglykæmia, and generate what is known as constant glycosuria.

The defective protoplasm has to be made normal again. Can the medical practitioner effect this?

My answer is, YES, if he aims at altering the disposition of the protoplasm, and at regenerating the protoplasm and the entire blood; if he makes up for the considerable loss of organic substances in a natural manner, and if in addition to the medicinal agencies, wherever they are indicated, he prescribes as a *conditio sine qua non,* a hygienic treatment, as well as a careful mental and bodily diet.

In respect to mental diet, Franciscus Place, in his inaugural dissertation, "Concerning the true cause

of Diabetes" (1784), uses the following language which still holds true at the present time, "Frustra remedia exhibentur, nisi adsit placida illa mentis tranquillitas, animi illa serenitas, quæ non modo remediorum efficaciam auget, sed ipsa remedii præstantissimi instar vitia corporis medetur." These words, in an English translation, read as follows, "It is vain to apply medicines, unless a patient possesses that tranquillity of the soul, that serenity of the mind, which not only heighten the effect of the medicines, but which, like the most potent remedy, even heal the infirmities of the body."

The object of mental diet is to avoid rigorously all physical excitement, all fatiguing mental work, all care and all troubles, since it has been proved that all kinds of mental excitement increase the amount of sugar in the urine. Some propose to conceal from the diabetic patient his condition; but on psychological grounds I must protest against such a course.

Under the head of mental diet also comes placing a diabetic patient, if possible, under the influence of a pleasant, home-like, new climate, and among cheerful people, not worried by care. Thus an inhabitant of the North, where often the summer is nothing else than a winter painted green, ought during winter-time to be transferred to the sunny, lively Riviera, which exerts an exhilarating effect on the mind, as well as upon the heart.

In summer, during the time which is generally devoted to the care of the health, a diabetic patient

ought to select as a place of abode a watering-place containing warm, alkaline springs, like Carlsbad. As a central intermediate station between Carlsbad and the Riviera, and *vice versâ*, and also for an after-cure I would recommend the superbly situated Hotel Belle Vue au Lac, in the mild and cheerful Zürich, where there is a prospect that the patient will find all those appliances which are required for the treatment suggested by myself.

A warm climate is recommended to patients suffering from diabetes also on this ground, that a warm climate, as has already been observed by Dancel (in "De l'influence des voyages sur l'homme et sur les malades," Paris, 1858), stimulates the secretion of the perspiration, and relieves the kidneys.

Movement. Muscular activity.—The plan of life prescribed for diabetic patients requires first of all regular exercise in open, fresh, good air. While formerly (*e.g.*, by Rollo) the patient was forbidden to take any exercise at all, on the ground of its being injurious, ever.since the time of Trousseau, who prescribed daily exercise and muscular exertion, especially for corpulent persons, muscular activity has been introduced as affording great assistance in the therapeutic treatment of diabetes. As to the rest, Trousseau regards diabetes simply as an indisposition, and not as a disease. Bouchardat also (see "Supplément à l'Annuaire de Thérapeutique," etc., Paris, 1846, p. 217), whose diabetic patient while doing rustic work in summer bore amylaceous food

very well, is in favour of regular exercise. The necessary muscular activity for such persons is obtained by light work in the garden, by playing at billiards and skittles, by using dumb-bells, fencing, rowing, splitting wood, taking gymnastic exercise, by walking moderately uphill, by hunting, and particularly also by riding on horseback.

Külz made the influence of muscular labour in five persons the subject of careful investigation, and he showed that bodily exertion is indeed able to control the formation of sugar, although he was also obliged to confess that in some individual cases muscular labour had an indifferent effect, nay, acted even injuriously.

O. Nasse ("Berl. Centralblatt," 1884, p. 250) deems it very probable that the muscles destroy the sugar which has made its way into the blood, *i.e.*, that they use it for forming carbonic acid.

According to Ebstein, the decrease in the formation of sugar during muscular activity, and its increase during a state of rest, is due to an increased formation of carbonic acid during muscular action, and to a decrease in its formation during a state of muscular rest.

K. Zimmer, formerly a consulting physician in Carlsbad, is of the opinion that in all cases of hepatogenous diabetes the real cause of the disease is attacked by muscular exertion; yea, he is convinced that cautious, consistent muscular movements which are extended to all the large muscular groups, in conjunction with a plentiful meat diet,

are able to heal many cases of hepatogenous diabetes, or, at least, that by them the patient is kept for a longer time in a condition in which he is able to act. He further declares that the effect of muscular exertion is more lasting than that of a diet according to Rollo.

Cantani endorses these views.

Those who are opposed to exercise and muscular action in diabetes, object that it is immaterial whether the sugar is secreted through the kidneys, or whether it is burned up during exercise, and during muscular labour, etc. Nevertheless, if you consider that during muscular exertion the rush of blood is led away from the liver, as well as from all abdominal organs, and is directed towards the muscles; that the sugar therefore is conveyed then into the muscles in order to be utilized there for the production of heat; if you take into consideration therefore that through exercise there is brought about a consumption of glycogen and a production of carbonic acid and heat; and, further, that the muscles are strengthened by this means, and that the change of substance and the transformation of substance is promoted thereby, whence there arises an improvement in the whole condition of the body, you must needs hold in high estimation a means of bodily culture whereby the change or alteration in the composition of the body is promoted.

V. Mering reports, on the basis of observation, that the secretion of sugar was stopped for some time by increased bodily exertion. His patient was

allowed to turn the wheel of a machine by which soda-water siphons were filled, of which work he was very fond. After one hour and a half already he was free from sugar, and, indeed, at a time when he lived altogether on a meat diet.

This statement, however, is counterbalanced by a case reported by H. Oppenheim, in Pflüger's "Archiv," etc., for 1881. He states that a woman was visibly reduced in health by pumping water every day, and that the secretion of sugar was not influenced at all by her exercise. [Who knows, however, what kind of food this poor woman was obliged to live upon, and whether she performed this severe labour willingly *or unwillingly!*]

In every particular case you have to individualize: This fundamental rule must never be lost out of sight, least of all in diabetes. What is easy for persons of a strong constitution, persons of a weak constitution will not be able to bear. What is advisable for young men and the male sex generally, is not necessarily so for old men and the female sex.

In medicine you must guard against working by rote, and against applying one general rule to all things and all persons. Zimmer's examples also prove this. In 14 cases he demonstrated the great use of muscular exertion, while in his remaining cases he is obliged to confess the reverse, so that he felt bound to advise a CAUTIOUS and SYSTEMATIC *training of muscular activity.*

It is very important to remember this, for with

patients whose constitution has run down, you cannot be circumspect and systematic enough. One single exertion may cause their *sudden* death by coma diabeticum.

Care of the Skin.—An additional most important element of bodily diet is an intelligent care of the skin. The skin is cared for by the patient washing his whole body quickly every day with lukewarm water. If the accommodations at home are limited, the patient should undress and stand in a small wooden tub, the bottom of which is covered with warm water, so that the feet are kept warm. In winter the room must be heated. A basin filled with lukewarm water, into which some rectified alcohol or some French brandy has been poured, is placed on a chair close to the tub. With a large sponge the patient now washes himself from top to toe. He then quickly rubs and dries himself with a rough towel, and dresses himself in a woollen or cashmere shirt, and in drawers, stockings, and a suit of clothes of the same material. Linen is prohibited. Woollen garments have been recommended already by Prout in 1843, and Bouchardat in 1846.

After the patient has dressed himself, there comes the important cleansing of the cavity of the mouth and of the teeth. For this purpose it is best to use a solution of chlorate of potassium (this salt dissolves in water in the proportion of 1·19); one or two spoonfuls of which solution may be put into one pint of water. By using this preparation a diseased state of the gums as well as of the tongue

is avoided. Adding to the above mixture a solution of thymol in alcohol I have also found useful.

For almost all patients, especially for those who have a dry skin, I prescribe Irish, Roman, Russian, or Turkish baths, as well as a combination of baths according to a special method; for every one according to his own individuality; BUT I NEVER ALLOW ANY ONE TO BATHE IN A BATH TUB.

The prescribed baths have this effect that they revive and discharge the sebaceous glands and the sweat glands which deposit their secretion on the surface of the body. This secretion combines there with the dust particles floating in the atmosphere, and condenses into a stratum whereby the respiration of the skin is checked. The above baths, therefore, are of a sanitary as well as of an æsthetic importance for the diabetic patient.

In patients whose skin had been entirely neglected, and whose nerve-life, in consequence, was very much depressed, I have employed with great advantage—partly also in connection with electricity and galvanism—my regenerative method, which is a modification of the method prescribed by Steinbacher, Priessnitz, and Schroth. The nervous system is strengthened by its application; the sexual potency is revived; the enfeebled digestive organs are strengthened, etc. The incitative action of the above-named baths improves not only the state of the skin, but the whole vascular system also is benefited thereby. The circulation of the blood becomes more animated, and the change of substance more

energetic. By the Russian bath the fluids of the body press more towards the skin, whereby the interior organs are relieved, and a compulsory excretion through the skin is brought about. The heightened stimulation of the cutaneous nerves is continued towards the brain and spinal marrow, and by reflex action it operates upon all the organs which are capable of being incited; as a matter of course, also, it operates upon all the diseased parts. A regulating effect is thus exercised upon the conditions whereby the state of the equilibrium of the body is influenced, and by an improvement in the quality of the protoplasm other accidental diseases are prevented. The bath recommended by myself is similar to the Hamám of the Turks, to the warm baths of the Greeks, or also to the baths of the Romans. It is a combination of agreeable influences by which health is promoted. It is an essential means for improving the condition of the body.

In the Turkish bath I get the patients first of all to transpire in a dry, hot air, the temperature of which towards the close is raised to 160° Fahrenheit, in order to compel the body to give out an excretion. This is followed by a lukewarm douche or shower-bath; whereupon the body is soaped and shampooed until every vestige of the dead and withered superficial stratum of the epidermis is removed, together with every trace of grease, dirt, and dust, and until the sallow, yellow, and withered colour of the skin is succeeded by a healthy, rosy colour.

From the Turkish bath the patient passes into the Russian vapour-bath, the temperature of which must not exceed 100° Fahrenheit. By breathing its watery vapours the activity of the lungs is stimulated, and the excretion through the skin is promoted. After a shorter stay in this bath the skin is cooled off by a lukewarm, but *never by a cold shower.* At last the patient is allowed to have a secondary perspiration on a couch, and according to the measure of his strength is allowed to rest for upwards of one hour. After the reaction has set in, which often takes place only after the twelfth bath, the feeling of thirst peculiar to a diabetic patient begins to cease. About an hour before entering into the bath the patient ought to drink a cup of beef-tea. All feeling of lassitude will then disappear.

Drawing deep breath. Quality of the air.— Of great importance for a diabetic patient is learning and practising the art of breathing correctly. In order that the lungs may be properly ventilated, it is especially necessary that our ladies who wear corsets should be trained to breathe in a rational manner, for instance, as is prescribed and realized by Dettweiler's method of taking a deep breath.

The air, in order to be suitable for a diabetic patient, must first of all be free of all substances injurious to the health. A chief requisite is an abundance of ozone. The percentage of ozone in the air can easily be determined by the ozonometer of Lender, which consists of strips of paper painted with a paste of starch containing iodide of potassium.

These strips are exposed for some time to the influence of the air, by the action of which, according to the quantity of ozone which is present in it, they are turned more or less blue. The scale of the shades of colour enables you to determine the degree of the intensity of the blue colour. Ozone refreshes the nerves and the blood; it is subservient to the oxydation of the blood, since the blood corpuscles possess the property of imbibing ozone as well as common oxygen.

If diabetes is attended by an insufficient oxydation of the blood-sugar, an increased absorption of oxygen and ozone must be of the greatest importance to those who are suffering from this disease. Unfortunately, the experiments which have thus far been made were limited to the inhalation of artificially-prepared oxygen; and since these experiments, apparently, did not result in much good, they were not followed up. Artificially-prepared oxygen, however, is only a make-shift. A stay in the sunny air of the country is worth much more than all artificial supplies. Such a change of air ought never to be undervalued, especially not in the case of town-patients, if even, as was shown by Buchheim, only 1 *per cent.* of additional oxygen is imbibed by the system.

What result may be obtained by living in a pure air (of course in combination with a carefully-guarded mode of life, and a most scrupulously observed method of cure) we can see from the example of Dr. Vocke, which is worthy of being

followed. He relates of himself: "After an exhausting medical practice in Berlin, which extended over 25 years, I was attacked by diabetes. At first I thought that I might conquer the disease by giving up my town-practice and commencing another in a neighbouring village, where I might breathe the country air. Whether the fault lay in the mental excitement which is inseparable from all medical practice, and which is so very injurious to diabetic patients, or whether the morphium injections which I used at the time were at fault; in short, within two years, on account of increasing feebleness, I was compelled to give up my medical practice altogether. I now removed to my villa in the forest of Friedrichshagen, and transformed its spacious balcony into a kind of dwelling and sleeping-room by covering it with a marquee of sail-cloth. During the seven summer months, from April 1 to November 1, I lived there during the day and at night; thus breathing the air, rich in ozone, not only for six, but for twenty-four hours daily. In the winter I walked in the woods from four to six hours, and at night I slept with an open window. The same treatment I repeated during the second year; and, in the third summer, at last I accomplished my cure by staying for six months at the seaside on the Baltic coast. The sugar disappeared already during the first months, and on account of the polyuria which remained yet for a very long time I utilized the remainder of the time in confirming this result, for the presence of polyuria made me doubt of the radicalness of my cure."

Alas, there are only too many patients who are unable to lead such an idyllic life as Dr. Vocke was able to do! With the feebler of my patients I employ the pneumatic apparatuses of Geigel, Meyer, and Waldenburg in order to regulate the gymnastic of their lungs, and to administer it to them in proper doses. I thereby expel the residual air in their lungs, supply oxygen to them, and strengthen their pectoral muscles.

By a methodic climbing of hills also, according to Oertel's prescription, I teach my patients to take deep breath. For this purpose I find the air-breathing-stations (*Terrain Kurorte*) Carlsbad, Nice, and especially Monaco, of great use.

Dwelling-rooms.—The sleeping-room of a diabetic patient in winter ought to be towards the south or south-west, in summer, towards the east. It ought always to be furnished with a hygrometer in order, if necessary, to have water evaporated. High situations ought to be selected, and the suite of rooms ought to be thoroughly ventilated. Apparatuses for ventilation are recommended. The air-passage through the stove or fire-side ought never to be blocked up. The windows ought to be left open as long as possible. A window in the room next to that in which the patient sleeps, the door of which should be left open, ought always to remain open in summer, even at night.

The temperature of the dwelling-rooms in winter ought never to be below 56° Fahrenheit (16° C.).

Considering the temperature of all northern countries during winter, a stay in the Riviera di

Ponente during winter is recommended to the diabetic patient; but not a stay in Cairo or Alexandria, where the air is so dry that the hydromania of the patient is only increased. Since the year 1882 I have succeeded in curing diabetes radically during winter-time in the Riviera, altogether in the same way as I have been able to do at Carlsbad during summer; a result which I could scarcely have attained in other places on account of the changes in the temperature and the prevailing cold of winter. Besides, as Fleckles also has mentioned with commendation, the warm climate of the Riviera enables a patient to breathe freely and in great abundance an open and pure air, rich in ozone; for in the middle of winter he is able to sit there for hours in the open air, while listening to public exhilarating concerts, or he is able to undertake long walks through forests and fields, in orange and olive groves. Even in January and February he can go about without an overcoat, and is not compelled, after a long walk, to take refuge in the oppressive, hot and smoky rooms of a restaurant.

Massage.—In many cases, following the example of Reibmayr (see his "Technik der Massage des Unterleibs"), I have declared in favour of his method of rubbing, namely, in favour of massage. Massage constitutes an important factor in my method of treating diabetes. My method, however, differs from the usual practice of massage in this respect—that in rubbing I do not employ a greasy substance, but a preparation of mercury; ordinarily

I prescribe a mild solution of corrosive sublimate in alcohol with an addition of vaseline. I employ the massage daily once, between breakfast and dinner ; only exceptionally I allow a patient to be rubbed before breakfast.

Heynsius von Hart in Amsterdam already recognized the value and use of massage. The influence of a mechanical treatment of living tissues by kneading, pressing, and beating is indeed of great therapeutic value. The conditions under which the change of substance (*Stoffwechsel*) is brought about are most favourably influenced by such a treatment. An improvement is effected in the assimilation of the food by the muscles, and the muscular apparatus of the body is rendered more fit to do its work. Again, the circulation of the blood is promoted thereby, and the products of the change of substance are separated and excreted. The volume of the body of a diabetic person is seen to increase visibly under the treatment of massage.

Finkler in Bonn inquired, in 13 cases, whether the change of substance (*Stoffwechsel*) in a person afflicted with diabetes underwent any alteration by the mechanical treatment of the muscles of the body by massage. He found that a considerable influence was exerted thereby upon the secretion of sugar, and the general well-being of the body. The influence upon the secretion of sugar, within 24 hours, amounted to an average reduction of 400 to 120 grammes ; the muscular energy became invigorated ; the weight of the body increased ; the thirst

decreased ; and the patient began to perspire. Yea, in one case the secretion of sugar ceased for three months. All these results were obtained with a mixed diet, the patients drank water, and no change was made in the use of hydrates of carbon.

In company with Dr. Brockhaus, of Godesberg, Finkler tried the influence of massage also upon the muscles in cases of paresis, hysteria, etc.

Electro-magnetic influences.—Zabludowsky noticed remarkable changes in the muscular tone of the body in consequence of electric and magnetic reactions. Likewise Clemens, who after an electric shock of the liver, combined with a faradization of the entire muscular system, saw changes taking place in the formation of sugar.

I also have repeatedly tried the wholesome influences of electric and magnetic reactions. Under their influence the volume of the muscles and their vigour increased, their sensitive properties were enhanced, and the physical as well as the psychical well-being of the patients was improved.

In regard to *sexual intercourse*, many practitioners when dealing with diabetes forbid what during the progression of the illness need not be forbidden at all, since it ceases of its own accord.

Although I am of the opinion that in the first stage of the disease, and also afterwards, transgressions in this line are followed by serious consequences, so that a rational abstinence ought to be recommended ; still my method of nourishment and the principle which underlies my method of cure

are able to prevent the injurious consequences of a moderate intercourse. This moderate intercourse I deem admissible in the interest of the building up of the substance of the body, and in that of the regular circulation of the juices.

Food and nourishment.—The fact that the excretion of the sugar into the urine ensues but a short time after a patient has partaken of *hydrates of carbon*, induced the profession many years ago to prohibit them, and to subject the selection of food for a diabetic patient, in every particular case, to the greatest care.

Unfortunately, not much harmony has prevailed in this respect among the physicians in modern times.

Although, on the whole, they have assented to Rollo's view, namely, that in order to avoid the formation of sugar all amylaceous substances, as well as all hydrates of carbon, such as grape-sugar, fruit-sugar, cane-sugar, sugar of milk, etc., ought to be forbidden, and albuminous food to be recommended; and that only a few green vegetables, as being less injurious, ought to be allowed; still in practice the physicians very often follow very divergent courses.

Some demand most rigorously a most copious supply of animal food; while others (Cantani, Fleckles, v. Düring, Ewald, etc.) advocate a most painful theory of fasting; and, at variance with the former, not only forbid an excess of food, but with the view of reducing the quantity of sugar, sacrifice

even the proper nourishment of the body. I will only mention here Naunyn, who, in accordance with the principles of Cantani, demands the strictest meat-diet.

I consider it useful to present here the essential parts of the dietetic instructions of the leading authorities in the field of diabetes, in order to enable the reader to form a judgment as to what is common to all, and what the various authorities have borrowed from each other; likewise, in order that the question may be answered whether any progress can be noticed at all in the matter of diet for the use of diabetic patients.

Rollo's Diet.—He allowed for breakfast: 1⅓ pints of milk mixed with ½ of a pint of lime-water, together with some bread and butter.

For dinner: Tender meat, sausages prepared of blood and fat.

For supper: The same.

Beverage: Water with sulphate of ammonium.

Bouchardat's Diet.—In the place of milk he orders cream, all kinds of meat, from 150-200 grammes of fat *per* day, and those vegetables which contain only a small quantity of starch, such as spinach, artichokes, cabbage, lettuce, asparagus, beans; peaches, strawberries. In the place of ordinary bread he recommends gluten-bread. Men he allows to drink daily from 1-1½ pints of claret or Burgundy. He thinks that by the quantity of alcohol contained in the wines he is able to replace amylaceous food.

Dickinson's Diet.—He allows all kinds of meat, including pickled and smoked meats, soups without flour and spices, sauces without sugar; further, oil, lard, butter, cream, green vegetables, such as cauliflower, spinach, rape-cole (*Kohlrabi*), Brussels sprouts, French beans, asparagus, lettuce, radishes, nuts, almonds, as well as the almond-bread prescribed by Pavy.

Beverages allowed: Water, tea, coffee, cocoa, brandy, rum, claret, Burgundy, chablis, hock, and Moselle wines, some good beer [to which exception was made].

He forbids: Sugar, honey, bread, milk puddings, carrots, beets, onions, rhubarb, cucumbers, milk, whey, chocolate, champagne, sweet wines, etc.

Pavy's Diet.—He allows all kinds of meat and fish, the liver excepted. Soups not prepared of plants; cheese, eggs, butter, cream. Further, green vegetables, such as spinach, cucumbers, lettuce, radishes, and celery [which is forbidden by Dickinson]. He permits blanc mange prepared of cream and the white of eggs. Instead of bread he prescribes almond-bread.

Beverages allowed: Tea, coffee, soda-water [to which exception was taken], wines and spirituous drinks, not sweetened, bitter ale.

He forbids: Sugar, rice, sago, vermicelli, potatoes, all fruits and puddings. He allows milk in a small quantity. [See the ideas of others on this subject below.]

Cantani's Diet.—Whether a patient is fat or lean,

for all meals he only allows the *meat* and the *fat* of all vertebrata. Even the viscera, the liver excepted, he permits to be eaten. Meat and fishes he allows cooked in any fashion. Spices, sugar, and flour must not be used in their preparation. He forbids butter [in a most unjustifiable way] on account of the traces of sugar of milk which it contains. [They amount to $\frac{1}{2}$ *per cent.*, which amount is surpassed by the hydrates of carbon contained in the meat.] In the place of butter he permits sweet oil.

Patients whose digestion is weak he advises to eat fats in a pancreatic state, that is, he soaks them for three hours with the fresh pancreas minced of calves, lambs, oxen, or goats, and afterwards has them roasted before the fire.

As a beverage he prescribes water (in exceptional cases mixed *per* day with 10-30 grammes of rectified spirits of wine), sometimes a little coffee, tea, etc. He forbids milk, butter, cheese, oranges, peaches, and other fruit, as well as all green vegetables; further, puddings, sweet drinks, etc. He allows salt to be used in preparing the food, yet sparingly.

Cantani continues his exclusive diet of fats in mild cases of diabetes during two or three months; in severe cases from six to nine months. After he has stopped the formation of sugar in mild cases he gradually returns to the former diet.

Eggs he allows only in exceptional cases.

Pavy's almond-bread is the only bread which he allows in the place of real bread.

Seegen's Diet.—He allows meat and fish *in any*

quantity; jelly, aspic, eggs, caviar, cream, butter, cheese, bacon.

Among vegetables he permits: Spinach, lettuce, endive, cucumbers, asparagus, water-cresses, artichokes, mushrooms, nuts.

In moderate quantities he allows: Cauliflower, carrots, turnips, savoy, French beans, berries, oranges, almonds.

He forbids absolutely: Farinaceous food of every kind; in some special cases bread may be allowed. He also forbids sugar, potatoes, rice, sago, semelina, beans, peas and lentils, green peas, cole-rape, sweet fruits, grapes, etc.

Beverages, in any quantity, he permits: Water, carbonized waters [to which exception was taken], tea, coffee, clarets, Rhine wines, Moselle wines, Austrian and Hungarian table-wines. In short, all wines which are not sweet and which do not contain an excessive amount of alcohol.

In moderate quantities he permits: Milk, brandy, bitter ale; milk of almonds not sweetened; lemonade not sweetened.

Beverages forbidden: Champagne, sweet beers, must, cider, liqueurs, fruit-juices, ice-cream and water-ices, cocoa, chocolate, wine prepared of fruits.

v. Düring's Diet.—Düring's diet differs from other diets by his admitting many hydrates of carbon. For early breakfast he permits: Milk, containing some unsugared coffee, with stale wheat-bread; alternately rice-soup and porridge without butter.

For second breakfast: Wheat-bread with butter, a boiled egg with a glass of good claret in water; or alternately a cup of rice-soup, or semelina-soup with or without milk.

For dinner: Soup of cereals, 250 grammes of meat without fat, together with stewed dried apples, prunes, or cherries. Among vegetables, which are not to be prepared with soup or fat, but simply boiled in salt water, he permits: Carrots, cauliflower, French beans, cabbage, asparagus.

For dessert: Fresh fruit, such as apples, cherries, with a glass of claret in water.

For supper: Rice-soup or semelina-soup without butter; sometimes milk may be added.

Beverage: Ice-water, water, etc.

Senator's Diet.—He permits: Meat of mammalia and birds; further, oysters, mussels, craw-fish, fish. Again, meagre cheese, eggs, salad, cucumbers, water-cresses, spinach, asparagus, all kinds of cabbages, scorzonera, radishes, carrots, truffles, butter, bacon, oil, sour or acidulous fruit, etc.

He forbids: Grapes, cane-sugar, honey, farinaceous food, such as bread, etc.; further, potatoes, leguminous plants, rice, maize, semelina, sago, chestnuts, etc.

Frerichs' regimen.—He requires an avoidance of amylaceous food; a shunning of hydrates of carbon. But he allows a small quantity of bread. As a condiment for meat and fish he generally uses

green vegetables and other vegetable substances free from starch. Only once Frerichs noticed a favourable result from the use of milk; more frequently he saw bad results. Especially while using the milk cure of Donkin he noticed an increase in the secretion of urine and sugar. He prefers, as a beverage, good, thoroughly fermented beer, which contains but little sugar; also claret in moderate quantities, only the sugary Spanish and Hungarian wines he prohibits most strenuously. He permits a moderate use of unadulterated brandy. (See Frerichs, *Op. citat.*, p. 261.)

Ebstein's Menu.—(See Ebstein, *Op. citat.*, p. 204.)

Early breakfast: One cup of coffee or black tea, without milk and without sugar. Eat with it from 30 to 50 grammes toasted white bread, or respectively brown bread richly buttered (from 20 to 30 grammes of butter). Add to this, if required, the yolk of one egg, a little fat ham, or some German sausage (*Mettwurst*).

Second breakfast: It is best to do without such a meal; but, if required, let it constitute a part of the first breakfast; or else take one cup of broth with the yolk of one egg.

Dinner: Broth with yolk of egg, or the marrow of marrow-bones, or with both. The marrow-bone is boiled for half an hour, so that the marrow may be served in a solid form. Some peptone may be added to the broth. Meat: Roasted, boiled, or stewed; either beef, pork, mutton, veal, fowl, or venison.

Fat meat is preferred. Gravies are to be prepared with the yolks of eggs or cream in the place of flour. For a change, eat fish cooked with butter. The amount of meat to be eaten at dinner is upwards of 180 grammes of meat, apart from the bones, together with one of the vegetables mentioned below, prepared richly with fat. Persons who do not like fat meat will perhaps eat richly-prepared vegetables. Every case should be individualized! Let the food be well salted and spiced. Some purée of leguminous plants, prepared with fat. Salads dressed with vinegar and oil, or sour cream. After dinner, or in the afternoon, one cup of coffee or of black tea.

Supper: One cup of tea or bouillon, some roast meat, ham or cheese, or one egg, or fish, caviar, from 30-50 grammes of bread with 20-30 grammes of butter.

Small quantities of apples, pears, etc. (*i.e.,* fruit with kernels) are allowed.

Among alcoholic liquors Ebstein forbids absolutely the use of beer. He permits about half a bottle of wine. The use of spirits he limits. Milk-cures he condemns on the ground of their being modified abstinence treatments. He tries the patient whether he assimilates milk, in which case he allows moderate doses of good milk, especially of cream. The character of the food which he prescribes depends upon the age and the individuality of the patient. Spare persons he treats to greater quantities of fat than fat persons.

Conclusions drawn from all the dietetic instructions of acknowledged authorities and experienced practitioners:

The specialists from whom we have just now quoted agree in recommending the following course of diet:—

(*a*) All kinds of meat, with the exception of the liver, which contains sugar, also all kinds of fowl, all fishes, oysters, likewise butter and other kinds of fat.

(*b*) Among vegetables they permit spinach and the like, salads, water-cresses, mushrooms, cabbage, green asparagus, nuts, prunes, etc.

(*c*) The beverages permitted, it seems, are seltzer-water with brandy, koumiss, genuine hocks when light, cream with raw eggs, coffee without milk, etc.

Absolutely forbidden articles are: Farinaceous food, potatoes, rice, leguminous plants, sweet sugary wines, etc.

König systematized all articles of food and all beverages in the following work: "Prozentige Zusammensetzung und Nährgehaltwerth der menschlichen Nahrungsmittel, etc. Graphisch dargestellt." Berlin, 1882.

A similar classification is contained in my pamphlet: "Hygieine und Diät" (Geneva, Pfeiffer).

Particular information on the subject is contained in Ebstein's meritorious treatise on the articles of food for man, entitled: "Das diätetische Regimen beim Diabetes mellitus" (a reprint from the "Deutsch-ärztl. Vereinsblatt," May, 1883).

Bread: Since bread contains much starch various substitutes have been proposed in the place of it.

The *gluten-bread* prescribed by Dr. Budde in Copenhagen, as prepared in the bakery of Rasmussen and Heegard in the same town, is most worthy of recommendation, since it contains only two *per cent.* of starch. (By washing the flour nearly the whole of the starch is removed, so that only the albuminate of the grain, the gluten, remains.)

The gluten-bread of Dr. Budde is preferable to the breads of Henry and Bouchardat (who first proposed gluten-bread in 1840); further, to the bran-bread of Prout, to the breads introduced at Neuenahr, to the wheat-bread of Dahmens, to the expensive almond-bread of Pavy, as well as to the inuline-bread of Külz. The only bread that comes near it in point of excellency is the gluten-bread recommended by Fürbringer ("Arch. für Klin. Med.," xxi., 1878, p. 503), which is prepared in the establishment of "Bassermann, Herschel, and Dieffenbacher," in Mannheim, and is free from any farinaceous admixture. In Carlsbad are sold so-called "Diabetes-brödchen" (diabetic biscuits) which sometimes bear the name of a Carlsbad physician. They are certainly to be preferred to the ordinary bread.

My former teacher, v. Frerichs, and also Fleckles, etc., permit small quantities of bread. In my practice, before 1881, I also permitted small quantities of bread in order to meet the feeling of disappointment in patients, and I have always found

that the psychical gain richly counter-balanced the bodily harm caused by eating bread.

Milk: Rollo expressed doubts about the use of milk. Pavy shares this doubt, and a great number of able specialists have rejected milk on the ground of its forming glycogen. Seegen also expressed himself against milk; he allows it only sparingly because it contains from 4—5 *per cent.* of sugar. Frerichs decided against the use of milk. Ebstein also condemns milk-cures, although he likewise advises careful trials in order to see whether milk agrees with a patient, in which case he allows small portions. My experience also, respecting the use of milk, has been most unsatisfactory, wherefore I only allow cream.

Nevertheless, there are left a considerable number of physicians who do not unconditionally reject the use of milk, even in the face of authorities like Seegen, Frerichs, Rollo, etc. Th. Wille maintains that he has healed diabetes by a milk-cure consistently carried out. The Englishman Donkin, who allows even the use of skimmed milk, makes a similar statement; he was opposed by Frerichs. Cantani recommends lactic acid as of great service in diabetes. Hoffmann allows milk *after* a patient by abstaining from hydrates of sugar has lost his sugar, and when he is about to return to his usual diet. [He allows it, consequently, after the "glycosuria" has been healed?] Hertzka, who is in favour of a copious consumption of fat, and recommends a meat-diet, allows milk "when it agrees with a

patient." He does not dread the hydrates of carbon so much, but is rather of the opinion that nervous symptoms, and even the diabetic coma, are connected with, and partly caused by a purely animal diet. Dr. Vocke, who is himself a diabetic subject, declares unreservedly that sour milk makes up his supper, both during summer and winter. He whips the sour milk until it becomes liquid and then drinks it out of a cup like sweet milk, for, says he, "cold liquids are not enjoyed when eaten with a spoon."

Senator, who permits pieces of ice and milk for quenching the thirst, pronounces against a wholesale arrangement of a system of diet suitable for all diabetic patients.

Finkler agrees with him. In five severe cases of diabetes he allowed his patients to partake of bread and potatoes, to drink beer and wine, but, on the other hand, he fed them richly with meat and eggs. Here, however, it must be mentioned that he paralyzed the influence of the food by the massage, and therefore succeeded in diminishing the secretion of sugar. With one of his patients who used the ordinary diet, the secretion of sugar became reduced in 100 days from 700 to 200 grammes. The quantity of the urine also grew less. The thirst diminished, the perspiration returned, the bodily weight increased, and the general well-being of the patient improved visibly.

Finkler approaches more nearly than any one else to the standpoint occupied by myself in respect to a rational treatment of diabetes. For he also opposes

the draconic severity of the abstinence-cures, although he is ignorant of the premises from which I started in the elaboration of my theory, and also is not aware of the object which I seek to realize.

Jänicke ("Arch. für Klin. Med.," Vol. xxx.) and Block (*Ibid.*, Vol. xxv.) declare most emphatically against a one-sided meat-diet, which causes many patients to run down quickly in their health, while an ordinary mixed diet preserves, at least, their former, valuable cheerfulness.

Cl. Bernard also, as well as Boussingault, condemn a diabetic diet which is carried to an extreme; for they do not consider the doctrine of digestion sufficiently advanced to enable us to determine scientifically the influence of food on a diabetic patient.

Unfortunately, the profession, even down to the most recent period, has aimed only at suppressing the secretion of sugar, without considering that it matters much less whether the sugar is formed than whether the sugar is assimilated and consumed in a regular manner; for only by this means can the protoplasm be regenerated and the overproduction of sugar be checked in a lasting manner.

Hertzka is quite right where he exclaims: "Of what use is it for a diabetic patient if through a course of diet the secretion of sugar is stopped, but if, at the same time, his system has been reduced, and he has altogether run down in health? Tests of the urine, showing the decrease of sugar, are not decisive, in my opinion. I do not worry myself about the fact whether the urine contains a few

tenths of sugar more or less. My first question is always: 'How does the patient feel? What is the state of his mind?'"

Although Hertzka's question does not contribute anything to the cure, nor to any improvement in the condition of a patient, his standpoint, nevertheless, is correct, and, indeed, so much the more since it is a known fact that the increase of sugar is in exact proportion to the increase of food. In this connection I should like to direct the reader to the proofs furnished by Külz (in "Arch. für experim. Pathol.," etc., 1876, p. 141), whose patient on five successive days was fed with caseine at the following rate: (*a*), 200 grammes; (*b*), 240; (*c*), 300; (*d*), 500; (*e*), 240. He secreted sugar in the following proportions: (*a*), 66 grammes; (*b*), 65·7; (*c*), 96·7; (*d*), 126·9; (*e*), 86·6 grammes.

My own Dietetic Regimen for Diabetic Patients:

My own ideas concerning an appropriate diet for diabetic patients have undergone a considerable change since I recognized the real character and cause of diabetes; for since then I have been led to look upon the so-called injurious effects of certain kinds of food simply as accidental causes, and I have also learned by experience what a great mistake it is when physicians, like Seegen, among all the manifold symptoms by which diabetes is characterized, single out the formation of sugar as the only cause of this malady. Taking all this into consideration, I have been induced to favour freedom

in the choice of the articles of food, that is, a freedom based on the temperate use of food, and which is determined by the individual condition of the patient. The only thing on which I lay stress is eating slowly, and masticating the food well. In the place of an ABSTINENCE-CURE I prescribe a NOURISHMENT-CURE, which results in the proper assimilation of the food; for my object is to produce A CHANGE IN THE BODILY CONSTITUTION AND TO REGENERATE THE ORGANISM.

For my dietetic regimen I therefore laid down the following rules: Articles of food which have an immediately strengthening and nourishing effect, and which are free from any particular acids, are to be allowed; further, wines which have a quiescent effect, and do not heat the system—for which purpose I prescribe a claret which contains but little sugar, and light Moselle wines. As to the rest I permit my patients to select easy digestible animal and vegetable articles of food which are free from starch.

As a preparation for my treatment, that is up to the time when the real treatment begins, I insist upon the diabetic patient, according to his bodily condition, observing the following dietetic rules: (one of the objects to be attained is breaking the habit of a second breakfast, so as not to disturb the process of digestion too often.)

BREAKFAST.—200 grammes of beef-tea, with as many grammes of beef-broth, and 50 grammes of gluten-bread with fresh butter; or else use the

chrome-bread introduced several years ago by myself (bichromate of potassium 0·05, distilled water 20·0, mixed with two pounds of dough used for white bread); of this bread patients are very fond. Tea or coffee without milk (in the place of milk use cream and eggs), unsweetened with sugar (in the place of sugar use *saccharine*).

The above chemical substance prepared, in 1879, by Dr. Fehlberg, of New York, out of the products of coal-tar, which on account of its similarity to sugar is called *saccharine*, dissolves easily in alcohol and ether, and also in hot water, tea, coffee. It is 280 times sweeter than the common sugar, and possesses the property of leaving the body without being decomposed, and of appearing again in the urine in the form of saccharine. It does not interfere with the digestion, nor does it exert any injurious effect on the organism. Besides, it possesses slight anti-fermentative properties. At present it is offered for sale in easily soluble tablets prepared with carbonate of sodium.

DINNER.—Oysters, snails, mussels, crawfish, lobster, crabs; dishes prepared of eggs without any flour; fish, fried or stewed with butter, served with a sauce made of eggs (caper-sauce or lemon-sauce). Meat of all kinds, which must either be roasted or stewed. Beef-tea and stewed vegetables prepared with soup and butter, such as spinach, sorrel, French beans, scorzonera, cauliflower, Brussels sprouts, savoy, and fresh mushrooms. Salads: Watercresses, lettuce, endive, dressed with oil and

citric acid, for a change. Radishes, cucumbers pickled in salt-water, but not in vinegar.

Blanc-mange, prepared of the white of eggs beaten up and flavoured with vanilla, lemon, raspberries, or whortle-berries (bilberries), and sweetened with saccharine.

For DESSERT, only a *few* nuts and almonds are allowed, since they dry up the mucous membranes too much. The patient also may eat one apple, not sweet; also all kinds of cheese.

When the bowels are constipated the patient may partake of sour milk as a dietetic remedy.

The SUPPER ought to consist of the very same ingredients as the dinner, only the dishes ought to be fewer in number.

With most patients I prescribe the exact quantity of food.

For DRINKING I allow good spring water, not too cold. When the thirst is excessive I administer light, warm tea with a lemon-slice.

For the meals, or, still better, *immediately after* the meals, I allow old claret, if it is unadulterated. It is preferable to other wines, since it contains only 0·2 *per cent.* of sugar, and also contains more tannin, and is less acid than wines of the hock kind.

After every meal the patient has to remain passive from 30 to 60 minutes. It is best for him to sit during this period in an easy chair.

ARTICLES TO BE AVOIDED: Sugar, and dishes prepared with sugar, also farinaceous dishes, and

gravies prepared with flour and the like. I also forbid: asparagus, parsnip, all leguminous plants, potatoes, chestnuts, and sweet fruits.

ABSOLUTELY PROHIBITED are all kinds of soda water and sweet beverages.

SMOKING must be reduced in quantity, or is to be abstained from altogether. According to circumstances I allow from one to two light, good cigars. The orders as to smoking change according to the development of the disease.

MEDICINES AGAINST DIABETES.

The application of medicines is determined by the object which it is sought to realize. Medicines are prescribed differently where the object to be attained is simply to suppress symptoms and their consequences, from what is the case—as in my own practice—where the physician attacks the very fundamental cause of a disease.

A countless number of medicines and remedies (without mentioning bleeding, which was still advocated by Prout) have been proposed, and in the course of time have again been abandoned. Rubricating and enumerating them results in a total condemnation of the therapeutics of diabetes so far as the application of medicines is concerned, for thus far *not a single specific medicinal remedy against diabetes has been discovered.*

Emetics and purgatives have been employed in order to regulate the action of the stomach; rennet,

acids, and alkaline salts in order to replace the digestive fluids; oxygen, chlorine, etc., in order to promote the combustion of the sugar; narcotics in order to react on the nervous system; alcohol and lactic acid in order to replace the sugar, etc.

In order to handle more conveniently the vast number of medicines which have been tried, I propose to classify them: (*a*) into specifics and (*b*) into such as are calculated to improve the tone of the system.

(*a*) *Specifics.*

Among these, narcotics have hitherto occupied the first rank, to which, however, I take exception.

The chief remedy has been *opium*, which was recommended by Rollo, as well as by Jos. Frank, and which was strongly advised by M. Gregor, in 1837, on the ground of its diminishing the secretion of the sugar. It was also recommended by Kratschmer ("Wiener acad. Sitzungsber.," Vol. lxv., Vienna, 1872); further, by Fürbringer, while the practitioner Dickinson declared that he reaped more harm than good by prescribing opium! In small doses, opium sometimes reduces the feeling of thirst and hunger, since it diminishes the secretion of the urine, interferes with the excretion of sugar, and causes a patient to put up more readily with the monotony of the diabetic diet; it also preserves the weight of the body. Frerichs, like myself, pronounced against the derivative use of *morphium* which had been successfully employed by others

(*e.g.*, by Kretschy, "Wiener Med. Zeitschrift," 1873, Nos. 3 and 4), and also against the use of *codein*, which Smith and Pavy preferred among the alkaloids of opium, and which they prescribed three times *per* day in doses from one to four grammes (even as other narcotics have also been prescribed, *e.g.*, belladonna, cannabis, calabar, and ergotine—an ingredient of secale cornutum, together with bromide of potassium, strychnine, quinine, etc.). Frerichs administered opium up to 2·04 *per* day. But, like Seegen and others, he had to make the unpleasant experience that the body soon gets accustomed to opium, so that in the course of time a diminished influence, or none at all, is obtained from it.

Besides opium, only a few other specifics exert a decided influence upon the symptoms of diabetes, and either one or the other of these medicines—but only in very definite, individual cases, and solely with the view of counteracting such symptoms, I include in that combination of curative agencies which makes up my method of treatment.

The modern practitioners have applied the anti-zymotic remedy, *salicylic acid*. Frerichs recommends it as worthy of being tried. Hoffmann finds it effective in "recent cases" [probably in glycosuria], and he orders from five to ten grammes daily. In prolonged cases [hence in active diabetes?] he finds its effect injurious.

Salicylate of sodium (from eight to ten grammes *per* day) was first prescribed by Ebstein, afterwards by Kamen, Fürbringer, Petters, Hoffmann, etc. The

latter gentleman maintains that by means of it he cured three-sevenths of all his cases [?].

Ebstein maintains that salicylic acid has a decided effect upon diabetes, and Hoffmann is of the opinion that of all the medicines employed against diabetes mellitus, it possesses more than any other the character of a specific.

In recent cases the sodium preparation of salicylic acid is almost exclusively employed (from five to ten grammes *per* day). Fürbringer is of the opinion that in the most obstinate form of diabetes, when no medicine seems to be able to act any more, the salicylate of sodium, as well as *phenol*, by reducing the elimination of nitrogen, are able to bring about a favourable turn.

Ebstein and J. R. Müller have first employed successfully *phenol* (carbolic acid) in diabetes mellitus. Nevertheless, Ebstein, who at first claimed that opium, phenol, and salicyline were the chief remedies which exert a specific influence upon diabetes, was obliged to acknowledge afterwards that he did not estimate their practical importance very highly, although by means of them you are able to exert an influence upon some of the complications of diabetes, for instance, upon neuralgia. The aim of his therapeutics is now to increase in the tissues the formation of carbonic acid, which is too scanty in comparison with the food introduced into the system; and indeed (*a*) indirectly *through a diet*, which will supply the appropriate material for this purpose; and (*b*) by stimulating the development of carbonic

acid in the protoplasm of the tissues and in the organs of the body by intensifying the activity of the muscles. He asks here whether by an increased introduction of *carbonic acid* (by the drinking of carbonated waters) we are not really able to compensate for a relatively insufficient development of that gas in the tissues? This question, however, does not seem at all indicated, for practical experience in many cases has deemed it necessary to reject the use of carbonated waters.

Habershon employed carbolic acid as early as 1870; Ebstein and Jos. Müller have used it after him. Both found that the sugar disappeared in the same degree in which the introduction of food was reduced.

Felizet more recently maintains that by an application of *bromide of potassium* he has stopped the irritation of the medulla oblongata, which he regards as the cause of diabetes.

Forster combined *chloride of iron* with bromide of potassium. Clemens declares ("Allg. mediz. Centr. Blatt.," 1882) that by *bromide of arsenic* he cured radically severe cases of diabetes [?]

Laube administered daily $\frac{1}{3}$ gramme of *arsenic* (solut. Fowl. 30 gutt.). Likewise Külz and Lehmann. Lecorché also used it; he showed by his experiments that in the animal on which he operated the glycogen of the liver was diminished in quantity. Kretschy, however, says that he was not successful in the administration of arsenic.

Frick experimented with *secale cornutum;* Hunt

with *ergotine.* Other substances that have been employed are as follows: copaiba, benzoic acid, and benzoate of sodium; tincture of iodine by Seegen, chloral by Eckhard, eucalyptole by Carlatti, potassium permanganate by Masoin.

Cantani considered *lactic acid* as a substitute for sugar for the purposes of respiration. He administered from 5—10 grammes of acid. lact. purum, and 250—300 grammes of aromatic water after the meals. By this means he intended to remove the sugar from the urine. I did not notice any beneficial result from their use; neither could I become convinced of the beneficial result of *glycerine* which was applied by Schultzen (see "Berl. klin. Wochenschrift," 1872), and more recently by Holst, Petersburg; other physicians also, *e.g.*, Blumenthal, J. Mayer, Külz, Ziemssen, Kussmaul, either obtained no effect from it, or a merely negative one.

Moleschott reports that he successfully used *iodoform.*

Yeast also was prescribed by some. Kussmaul obtained a favourable result by injecting diastase into the blood.

Leyden reports (in "Berl. klin. Wochenschrift," 1877) that *pilocarpine* injections exercise a stimulating effect upon the nerves by which the vessels are enlarged; just as, for instance, the drinking of water heated to 140—160° F. produces an increase in the action of the heart and an increase in the temperature (see Glax, "Mittheil. in Sitz. Ber. d. Akad. d. Wissenschaft." 1877). Cantani, indeed, after the

use of pilocarpine, no longer discovered any sugar in the transpiration of the skin. v. Hoffer also employed sub-cutaneous injections of pilocarpine at intervals of 10 days, thus five injections in 50 days, of a solution of two *per cent.* of the alkaloid. It exerted such an effect on polyuria that the daily amount of urine decreased 5,900 Cc., and the secretion of sugar diminished from 564 to 224 grammes *per* day.

I have employed experimentally this last medicine, as well as all those that have been enumerated above; I prescribed it internally, and as a palliative medicine it has exercised a remarkable effect.

Finally, I introduced into my combination-method with extraordinary effect both *chromate of potassium* and preparations of *mercury*, and, indeed, internally, as well as externally in the massage, as these remedies seemed to be indicated by the case in question.

Internally I employ the *corros. sublimate-albuminate,* prepared according to Bamberger's well-known prescription; but I never employ it subcutaneously. I also prescribe *chrome-water* after the carbonic acid has escaped from it, which remedy has been tested in cases of *lues* by Günze in Dresden, and the curative effect of which has been confirmed by myself.

(*b*) *Strengthening Remedies.*

Under the above head the following remedies have acquired some distinction: *Preparations of iron*, *quinine* in small doses (Blumenthal administered daily from 0·4—2 gr. of muriate of quinine);

cod-liver oil, recommended especially by Buchheim and Senator, and lastly, *alkaline salts*.

ALKALINE SALTS. CARLSBAD.—Although in some special cases the *sodium bicarbonate*, which was frequently employed by myself, has proved very effective, the hot alkaline waters of Carlsbad in particular, which were recommended already by Hufeland, have produced most wonderful effects, especially in cases of glycosuria; while the waters of Vichy, Neuenahr (which Vocke recommends on account of the absence of Glauber-salts), Vals, and other alkaline springs containing carbonic acid, only promote the thirst and the secretion of urine, and increase the dryness in the mouth. During winter Seegen prescribed daily one bottle of Celestin or Grande grille of Vichy. Schmitz sings the praises of Neuenahr as furnishing a specific remedy against diabetes (see "Four cases of diabetes cured" [?], in "Berl. klin. Wochenschrift," 1873).

The Carlsbad waters certainly do not exercise any specific effect on genuine diabetes, but their effects upon the conditions of the blood-circulation in the liver, upon the raising of the tone of the whole system, upon the transformation of constitutional states and complications, upon increasing the tolerance for amylaceous substances, etc., are so much the more striking. In thousands and thousands of cases they have caused the sugar to disappear from the urine, and have healed glycosuria. Statistical proofs of the efficiency and significance of the Carlsbad waters have been furnished by Anger, Senator, Seegen,

Griesinger, L. Fleckles, F. Fleckles, Hoppe-Seyler, Emil Pfeiffer (in "Balneol. Studien," Wiesbaden, 1880), Hlawacek, Külz, Loignard, and others.

Carlsbad certainly brings relief also to those afflicted with diabetes, if, in addition to the "sprudel," rich in alkalies, there are applied the requisite medicines and a rational method of cure.

The use of the Carlsbad waters has thus far not been able to cure diabetes radically! But it has justly been considered as a matter of importance that Carlsbad is able to stop temporarily the feeling of thirst, the greedy hunger, and polyuria, and further that it increases the tolerance of the system for hydrates of carbon, and has prolonged life for years.

Senator, Külz, Riess, and others prescribed Carlsbad waters for their patients in hospitals, but they did not meet with any success! Most assuredly they would fail to do so. For those efficient, collateral elements by which the action of the waters in Carlsbad itself is supported, namely, a cheerful state of mind, relieved of cares and freed from anxiety—further, muscular action by climbing the forest-clad hills of Carlsbad, with leisurely walks on its sunny heights—cannot be administered in the hospitals at the same time with the waters.

Since I claim "hereditary lues" as the ætiological element of diabetes, *the use of the hot Carlsbad waters, regulated for individual cases, is of especial value as one of the factors in my therapeutical system.*

PAQUELIN. Where there are complications with albuminuria I have obtained most favourable results

by a simultaneous cauterization of the back with this instrument.

A SUMMARY. After numberless experiments, by combining a hygienic treatment with a careful bodily and mental diet; by thus utilizing and uniting in one system the various agencies detailed in the present chapter, and by applying the few approved medicines, I have succeeded in bringing about a transformation of the defective protoplasm, and in effecting a *lasting cure* of diabetes.

I am now enabled to prognosticate with certainty: Such a case of *genuine diabetes is curable*, while another case, on account of the advanced state of the sclerotic processes, is indeed capable of being ameliorated, but not of being radically cured, because the protoplasm is no longer capable of being reconstructed.

In bringing the present monograph to a close I shall confine myself to a report of the first *twelve cases* of diabetes in which I have applied my method of cure, and by which I have demonstrated the curability of diabetes.

I selected by preference cases which date from the first period when my efforts of curing diabetes became successful, namely, from the year 1881. My object has been to show that the disease which was cured then has not reappeared during the ensuing six, and respectively seven years. I hope at some future time to be able to communicate an account of a great number of additional cures in a strictly scientific treatise on the Therapeutics of Diabetes.

XII.

A FEW STRIKING AND SIGNIFICANT ACCOUNTS OF CASES OF DIABETES FROM THE YEAR 1881.

The first twelve cases of diabetes cured from among a great number of cases successfully treated by myself.

(1) *Marie H.*, 13 years old, from New York, arrived in Carlsbad on May 13, 1881, in company with her father. The patient was somewhat emaciated; her countenance had an intelligent expression. Her person was not yet developed.

The *skin* was very well taken care of, but very dry. The complexion of the face and of the whole body being pale, its lymphatic habit exhibited considerable *deposits of pigment*, and in various parts of the body and of the lower extremities *epithelial growths* of the size of lentils, in groups of ten or twelve, were scattered; there were also warts of the size of lentils, and even of peas. The *hair* was of a dark-brown colour and bristly; the *nails* of the two great toes were much thickened and out of shape. So-called white lucky spots were on the nails of the hands, the results of disturbances in the assimilation of the food, of the kind very frequently met with in youth and even as late as the thirtieth year.

The *lymphatic glands* on both sides of the cervical vertebræ, as well as the *inguinal lymphatic glands* were swollen; the former felt as though hardened. Several of the *teeth* were carious.

The left side of *the surface of the tongue* had deep indentations; while the right side was normal. It was reported that she had been a healthy child, but had a difficulty in teething. From her seventh year she attended school, was diligent in her studies, and had a quick apprehension.

In January of the present year (1881) she was overtaken by a cold shower, and came home from school wetted through. Soon after, she complained of headache, and especially of pains in the occiput; she lost her appetite, but in a few days she became ravenously hungry and her thirst increased.

The physician who was consulted kept the young patient for a few days in bed in order to observe her, and on analyzing her urine he found that while its specific gravity was 1·036, it contained 4·2 *per cent.* of sugar.

The well-known diet and a corresponding treatment were prescribed; and as her condition was only temporarily relieved during the ensuing weeks, it was resolved to send her to Carlsbad.

After gathering all the above information I felt compelled to examine the father as well, who complained of all kinds of troubles of the digestive organs. I learned from him that he was a captain in the navy; that while a midshipman, when 18 years of age, and ONE YEAR BEFORE HIS MARRIAGE,

HE WAS LUETIC ; that he was pronounced cured by the doctors, and that only then he resolved to marry. The mother, he said, was perfectly healthy.

21st May.—While undergoing the well-known diet, the urine of 24 hours amounted to 2,100 ccm. ; it was nearly of the colour of water ; its specific gravity was 1·038 ; and it contained 4·6 *per cent.* of sugar.

22nd May.—The treatment began, consisting of the drinking of Carlsbad water and the taking of baths, together with the internal remedies mentioned above, and the massage of the whole body. The thermometer, which was applied between six and seven o'clock in the mornings and evenings, constantly exhibited the following minute fluctuations: 36·2—36·5—36·7° C.

The intelligent father himself examined the urine daily, most accurately. He was also very expert in the use of the apparatus for polarization.

On July 28th the patient left Carlsbad with the instruction to continue the prescribed diet and the internal treatment, together with the massage and the baths, until November. From that date I permitted her at intervals to return to the ordinary diet, but the Turkish baths, which I had ordered, were to be continued.

From time to time I received the gratifying news that the sugar had not reappeared and that Miss Marie H. was enjoying the best health.

She married in the month of May of 1886.

(2) *Lady v. S.*, aged 28 years, of a delicate constitution, daughter of a landed proprietor in

Northern Germany, who had been in the army, and *who had died in his 62nd year of diabetes.* She reported that in her youth, when she was 16 years of age, she, and also an elder sister, suffered from green sickness.

When 20 years of age she married, and quickly in succession bare six children. After the birth of the fifth child already, in 1879, she did not feel quite well; her stomach was frequently out of sorts. In the year 1880, in the third week after the birth of her last healthy child, she was suddenly seized with a ravenous hunger and a violent thirst, coupled with dryness of the mouth.

Her *teeth*, which had hitherto been perfectly healthy, became sensitive during mastication, and the two upper incisors came out without pain.

After she had become emaciated her urine showed 7 *per cent.* of sugar.

When an examination was made on July 24th, 1881, her *skin* appeared dry; *epithelial growths* were here and there over the whole body; there were strongly developed varices on each of the lower thighs, especially on the right side; all the *toe-nails* were deformed, without being thickened; the *lungs* and *heart* were healthy; the right lobe of the liver was enlarged. The quantity of urine passed during 24 hours was from $4\frac{1}{2}$—9 pints; its specific gravity was 1·038, and it contained 6·4 *per cent.* of sugar.

The treatment lasted until the end of September, with interruptions during the menses. On September

26th the quantity of the urine was reduced to 1,500 ccm., and the sugar had reached zero.

The hygienic treatment and the diet were continued until December. On Christmas eve she was able to try farinaceous food with milk, after she had been allowed to eat bread and fruit (an apple) since September. The urine remained normal. *The patient has remained healthy to the present day!*

(3) On July 3rd, 1881, *General N.*, from Russia, presented himself. He was 59 years of age, of a herculean stature, and had scarcely any hair left on his head. He reported that he had enjoyed good health while a young officer, until in the Caucasus, where he was stationed, he was repeatedly attacked by intermittent fever.

After he had been removed from the Caucasus to Odessa, and thence to Warsaw, he recovered his health, but he often complained of headache. When 36 years of age he married. He is the father of three children who are all very scrofulous.

His father frequently suffered of tetter, and he died of tuberculosis when 42 years of age; as a young man he had been twice treated for venereal disorders.

The body of the patient, which was somewhat emaciated, exhibited a very *dry skin. Epithelial growths* in the form of jagged, little warts were on the neck, abdomen, upper thigh; and on either side of the vertebral column there were dark red spots of the size of pin-heads to the size of a pea; *deposits of pigment* were here and there, and the *nails* of the

big toes were much thickened. On either side of the scrotum there was prurigo, and in the palm of both hands psoriasis.

Three years previously five healthy teeth had fallen out without pains. The *surface of the tongue* exhibited deep indentations; the mouth great dryness.

The patient had always enjoyed a good appetite; for about the space of a year he had experienced a violent thirst, and on examination a percentage of 5·6 of sugar was discovered. The remedies which were applied (bromide of potassium, Vichy-water, opium) had only a temporary effect.

Lungs and heart healthy, *stomach* extended, *liver* and *spleen* enlarged. Frequent constipation alternated with diarrhœa. The percentage of sugar was 5·3; during 24 hours there were secreted 6½ pints of urine.

A treatment at Carlsbad for three months, with the aid of the proper medicines, massage, and Russian baths produced a *complete cure. The patient is enjoying good health at the present day.*

(4) *Anna B.*, 9 years old, was brought to me by her healthy mother. I was informed that since March, 1881, the child had fallen off very much; that she was tired, complained always of fatigue, drank much, and constantly craved to eat. All this was attributed to the quick growth of the child, until at last the physician proved the existence of diabetes mellitus.

The father had led a very irregular life, and was treated, among other things, for condylomes of the rectum.

I saw the child for the first time on July 16th. I was struck by the strongly developed head of the very emaciated young patient.

The prevailing tendency of the body was scrofulous, the skin dry and cracked, the complexion dark; there were very many scars of furunculous ulcers which the child had passed through; the nails of the hands and feet were deformed and brittle.

An iritis which the child had gone through had left a synechia in the right eye. The *teeth* were carious, the *gums* bulged out, the *tongue* was normal, and there was an odour of acetone.

The body was bloated, and there was an accelerated action of the heart, but the respiration was normal. The temperature indicated 36·4°; the urine which was passed during 24 hours amounted to 1,800 ccm.; it was very pale, and its specific gravity was 1·040. The percentage of sugar was 5·4.

After the use of the Carlsbad waters for two months, in conjunction with Russian baths and wet sheet packings, together with the medicines specified above, and massage, as explained in the last chapter, there resulted a complete cure; the use of the medicines and a dietetic treatment were continued for six months. *The patient has remained healthy to the present day.*

(5) *Lieutenant R.* passed successfully through the

Franco-Germanic war of 1870-1871 ; only he contracted a chronic catarrh of the stomach and bowels.

For several years he suffered of this illness, until at last there was added to it a fistula of the rectum. The fistula was operated upon and healed, whereupon the patient underwent a regular treatment with the view of being freed of his catarrhal affection.

The medical man who treated him noticed some furunculous ulcers on his back and along his legs, which the patient informed him he had been troubled with for several months.

The patient, who complained of great thirst, but who had a craving for food only at intervals, was very much emaciated, and in a low state of health. After his urine had been examined it was found that he had 6 *per cent.* of sugar, when the usual remedies against this illness were employed. He got alternately better and worse, until at last he presented himself before me in Carlsbad in the month of August, 1881.

He was then 31 years old ; he was very emaciated, the hair on his head was very scanty, his *skin* was excessively dry ; there were many *epithelial growths* on his body and neck ; his *teeth* were carious ; his *tongue* was plowed through by deep fissures, and very dry. His urine during 24 hours amounted to $4\frac{1}{2}$ pints, and contained 6·7 *per cent.* of sugar.

The parents, brothers, and sisters of the patient were said to be healthy, but *his grandfather had suffered of dry tetter, and had died of consumption.*

The treatment of the patient lasted for four months. During that time he constantly increased in flesh; he was perfectly healed, and *up to the present time he is a railway officer in the Prussian state.*

(6) *Nicholas O.*, 34 years old, from Bavaria, a commercial traveller, middle-sized; for many years he had complained of troubles in his digestion. He was frequently compelled to interrupt his journeys by bleedings from piles, until at last he resolved to undergo an operation.

In the year 1880, after undergoing this operation, he had an anthrax on the right shoulder-blade, which healed only very slowly, and reduced him very much. After recovering from it he rejoiced at his good appetite and his desire for much beer, until at last his thirst could no longer be quenched.

At Strasburg he consulted a medical man with whom he was acquainted. He discovered 9 *per cent.* of sugar, and sent him to Neuenahr (see the "Literature" below, under the head of "Schmitz"). He left the watering-place apparently healed, in order to follow his avocation. Business exertions soon reduced him to his former condition, and he was advised to go to Carlsbad during the same year.

Mr. N. O. called on me, on August 2, 1881. He had a considerable accumulation of fat, his health had very much run down, and he soon got fatigued in walking. *He was the son of a butcher, who had inclined to apoplexy, and had died in his fifty-fourth year.* In his youth the father had been treated several times for venereal infections.

The *complexion* and *skin* of my patient were pale; he had a large mole on his upper arm. His *toes* were contracted; the *nails* of his big toes were thickened; the action of his heart was very weak, 84 beats of the pulse.

His *teeth,* which had been carious even during childhood, showed many chasms. His digestion was sluggish; the urine which he passed during twenty-four hours amounted to 3,200 ccm., and contained 5·6 *per cent.* of sugar, with traces of albumen.

After remaining under my treatment at Carlsbad to the end of September he had by that time lost the sugar and the accumulation of fat, without having diminished very much in weight. At *Nice* he remained from November to February. The usual experiments which he underwent in respect to food showed no sugar; the albumen had disappeared; the patient felt vigorous, and began to enjoy life again, for the pulsation of the heart also had become more energetic. *He has preserved his health to the present day.*

(7) *Dr. med. N.,* from the southern part of Russia, *whose father was diseased in his lungs,* and whose grandfather on his mother's side had been luetic, enjoyed very good health until his 32nd year. By over-exerting himself in his practice, which was in the country, he contracted an inflammation of the lungs in the spring of 1877. Since that time constant catarrhal affections of the bronchia took the place of his former robust state of health. After some time asthmatic affections, with thirst and a

feeling of hunger, manifested themselves; and these affections became more and more pronounced, until at last the patient began to lose flesh; 4 *per cent.* of sugar were discovered. The remedies known at that time were employed in order to combat the diabetes, but only with a slight effect.

Prof. Tscherinoff, of Moscow, advised him to go to Carlsbad. Family arrangements forbade the patient, who was very low in his bodily condition, to undertake the journey to Carlsbad before August, 1881.

The *skin* of the patient was dry, covered with many pigmental spots; *epithelial growths* were in various places of the body; the *nails* of the two big toes were thickened, and embedded much in the flesh. In the year 1878 he lost all his teeth except three of the grinders; they were perfectly sound, and could be removed without pain and without instruments.

He complained of being much troubled with piles, without any loss of blood; and of atony of the bowels, which lasted for entire days. Heart and lungs were normal.

After a treatment which lasted for six months he recovered his full health; and *at present the former patient enjoys a better state of health than he ever did before.*

(8) *Herr v. F.,* 43 years old, landed proprietor from Saxony, had been suffering of diabetes for one and a half years.

When a young man he *had been infected by a*

venereal (luetic) disease, and when upwards of 20 years old he had painful enlargements of the right tibia, so that three times he was ordered to go to Aix-la-Chapelle.

His uncle on his mother's side had died of diabetes. The mother *is gouty;* but the father, he said, was a strong, vigorous man, 70 years of age.

The patient had fallen off in flesh; he had but little hair on his head; his *skin* was dry with many *pigmental spots* on the body; the *nails* of the feet, especially those of the big toes, were much thickened and painful; the *teeth* were remarkably well preserved; the *tongue* was dry, with many fissures; there were a few *plaques;* much thirst, but no abnormal hunger; the digestion had been disturbed for many years, and he had used the most drastic cathartics.

The quantity of urine during twenty-four hours was three pints; its specific gravity 1·042; and the percentage of sugar 6·7.

A treatment of three months at Carlsbad removed all the ailments of the patient with the exception of some traces of sugar; and an after-cure of six months *restored his health completely.*

(9) *Mrs. G.*, 28 years old, from Russia, had been married for nine years; she had no children, and led a life under the happiest circumstances. Three years ago the patient suffered of violent toothache, and had four back-teeth pulled out. From that time she felt very much weakened, so that she could walk only with great difficulty; and yet to her great

astonishment her appetite and her thirst kept on increasing.

There was a remarkable increase in the secretion of the urine; diabetes was diagnosed, with one gallon of urine secreted during twenty-four hours, and 3 *per cent.* of sugar.

A treatment of eight months, of which ten weeks were spent in Carlsbad, produced *a thorough cure in the mild climate of Nice.* Meanwhile she gave birth to a healthy child, and enjoys the very best health.

Her father died early of consumption. Her grandfather is said to have been treated several times with mercury and iodide of potassium.

(10) *University student, N.,* 25 years old, a Frenchman, born in Tunis; the son of wealthy parents, both living. He has two older sisters, both *sickly and scrofulous;* and he had also a *twin-sister, who died soon after being vaccinated.* The patient himself, as a child, was sickly; he was troubled with all kinds of scrofulous affections, so that the family physician, a doctor of medicine of the famous medical school at Montpellier, advised the young student to undertake a journey around the world.

The youth overjoyed his family in France by returning to them after his journey as a stately young man. He now considered himself sufficiently prepared by his studies to be able to follow at once a mercantile pursuit. Various attacks of intermittent fever, however, by which he was overtaken in his new home at Bordeaux, induced him to visit

Nice, where I became acquainted with him. After examining the patient carefully, who had lost much flesh, it appeared that he had 6 *per cent.* of sugar. The hot, alkaline springs of Carlsbad, as well as an energetic application of my remedies, *restored him permanently to a state of health.*

(11) *John L.,* 41 years old, from Holland, the descendant of an ancient, noble family, introduced himself to me on July 29, 1881, with these words —

"For four years I am suffering from diabetes, yet, different from other diabetic persons, I have not fallen off in flesh, but I have become feeble; besides, I am no longer young. My power of vision has decreased, perhaps in consequence of my having enjoyed prohibited dishes at a wedding last year."

The patient stated that he had as much as 4 *per cent.* of sugar. *His three brothers and sisters died in earliest infancy.* His father, upwards of 70 years of age, is still hale, but *his mother died in her* 54*th year, in consequence of cancer in the breast.*

A considerable accumulation of fat adorns the patient, who weighs 14½ stone. A scanty supply of hair is on his head, while his back is covered with strongly-developed hair. The *nails* of his hands, all except the thumb of the left hand, which is almost entirely wanting, are normal; those of the feet are very thickened and deformed.

His *teeth* are preserved all except two; the tongue exhibits deep indentations. Considerable accumulation of fat about the heart; fatness of the liver. Digestion: great tendency towards diarrhœa. Alter-

nately a feeling of hunger and thirst. Result *of the ophthalmoscope*—turbidity of the crystalline lens on each side.

Quantity of urine *per* day, 6½ pints; 4·8 *per cent.* of sugar; traces of albumen. Temperature, 35·8—36° C.

A treatment of six weeks at Carlsbad, and an after-cure in the Riviera of three months, produced *a lasting cure.*

(12) *Baron F.* (the son of a Russian general), who had been luetic in his youth, and had suffered from tetter during his whole life, put himself under my treatment on October 17, 1881. *His grandfather had died of consumption.* He was educated at the law school in St. Petersburg. When a child he suffered from scrofula, which was proved by several scars (scars of the lymphatic glands) on the neck, but, thanks to the bodily training and the generous treatment he received at the above institution, he developed into a man of a herculean stature. Being intelligent and very talented, after completing his studies he entered into the civil service of his country, already when 21 years of age. When 24 years old he married, and for 10 years, until he was 34 years of age, he felt perfectly well.

A sense of duty, as well as ambition, induced him to over-exert himself in his function; his health broke down, and he passed through a severe attack of typhoid fever; after the lapse of months only he was able to undertake again the responsibilities of his public office. He dragged in the performance

of his duties. A leave of absence of twelve months restored him to a comparative state of health. He returned to St. Petersburg, and entered anew into the public service. As a special mark of distinction for his past services, and in acknowledgment of his talents, he received the appointment of an assistantship to a governor general in the far north, which entailed upon him renewed exertions. When 39 years of age he quitted his onerous duties in order to take care of himself, for an indescribable sense of lassitude had come over him. About that time his eldest son was seized with epilepsy, which worked so much upon the feelings of the father that he was seized with another attack of typhoid fever, and regained his consciousness only after a number of weeks. He now began rapidly to fall off in flesh, notwithstanding his good appetite and an ever-increasing thirst. They told him that he was nervous, until at last sugar was discovered in his urine. He was sent to Vichy, and for three years into the Caucasian mountains (Esentuki), and again, a year ago, to Neuenahr, with only a temporary improvement.

The patient was tall, had broad shoulders, was very emaciated, had a dry skin, with epithelial growths on his neck of the size of lentils. The nails of the hands were well preserved; those of the feet, and especially those of the big toes, were thickened and had imbedded themselves into the flesh; at the slightest touch they were painful. His hair was scanty; on the body and along the extremities the

hair had developed almost in the form of bristles. His teeth, all except four, had fallen out painlessly; the first tooth had come out as far back as six years ago. The tongue was full of fissures; the lungs and the heart normal. The liver and spleen were enlarged. The stomach was bloated, the digestion sluggish. For two years he had been impotent. The quantity of urine passed during 24 hours amounted to 4,700 ccm., with 8·4 *per cent.* of sugar. After he had been treated according to my method for two months the sugar showed 0. When, after an after-cure of two months, without the use of the Carlsbad waters, but with a continuance of the medicines, he returned to the ordinary diet in Russia, the sugar reappeared after 20 days to the amount of 0·3 *per cent.*

The patient resumed his diabetic diet, and in the November of 1882 rejoined me at Nice. My treatment, which affects the change of substance and the regeneration of the protoplasm, was continued till March. The patient then returned to the ordinary diet, and has remained healthy up to the present time, *i.e.*, to February 28, 1887, consequently for nearly six years, during which time he resided at Malta.

Case 12 exhibits lues in a patient whose father, as well as himself, had been born with scrofula, the consequences of hereditary lues.

XIII.

COROLLARIES IN SUPPORT OF THE THESIS OF THE PRESENT WORK.

In presenting, from among the great number of cures of diabetes which I have succeeded in effecting since 1881, the first twelve cases, I had a distinct object in view.

For, although I have still numerous interesting cases to communicate, I nevertheless considered it my duty to report, without choice, the first twelve cases where a cure had been effected; and, indeed, for this reason, that the period from 1881 to 1887, during which my patients have remained healthy, is long enough to answer definitely in an affirmative sense the question whether actually a radical, lasting cure has been effected in those cases; which, indeed, *from a therapeutical point of view, is the chief thing to be considered.*

In a certain sense, also, the above twelve cases are entitled to represent the hundreds of cures which I have been enabled to make since 1881, for they make up the first dozen of those successful cases by which I was encouraged to make renewed exertions, and to institute experiments on an extended scale. They also have imparted to me that encouragement which I needed in order by further treatment and

additional cures to perfect my system of therapeutics in all its parts, so that at last it stands before me as a fixed, accomplished fact.

It has been proved by experience that in all the above twelve cases a *radical cure* has been effected.

The lasting character of these cures was confirmed and attested by annual reports received from each of my former patients.

The whole of these twelve cases, therefore, furnish a final and striking confirmation of my two theses —

(1) *Diabetes is the result of a hereditary predisposition, namely, of hereditary lues.*

(2) DIABETES IS CURABLE!

XIV.

CONTRIBUTIONS TO THE HISTORY AND LITERATURE OF DIABETES.*

THE Roman physician *Aulus Celsus* (30 years before Christ, to 38 years after Christ) is the first who has alluded to diabetes. He may justly be called the Cicero of physicians, and he has handed down to us, in a spirited and elegant style (in his work *De artibus* of which, since the Florence edition of 1478, at least 60 editions have appeared) the entire medical knowledge and skill of the masters of the earliest medical science even to those of his own time.

In speaking of diabetes, he alludes especially to the increased secretion of urine, which causes emaciation and endangers life. The respective passage (Celsus de Medic., l. 8 rec. Daremberg, Lips. MDCCCLIX, lib. iv., c. xxvii., 2) reads verbally as follows:—"Quum urina super potionum modum etiam sine dolore profluens maciem et periculum facit, si tenuis est, opus est exercitatione et frictione, maximeque in sole, vel ad ignem: balneum rarum esse debet, neque longa in eo mora: cibus

* Also a guide to the publications which are important for obtaining an understanding of the subject of diabetes, and to which reference is made in the present work.

comprimens: vinum austerum meracum per æstatem frigidum, per hiemem egelidum, sed tantum, quantum minimum sit. Alvus quoque vel ducenda vel lacte purganda est. Si crassa urina est, vehementior esse debet et exercitatio et frictio: longior in balneo mora: cibis opus est teneris: vino eodem. In utroque morbo vitanda omnia sunt, quæ urinam movere consuerunt." In an English translation this passage reads as follows:—"If the quantity of the urine which is passed is larger than the quantity of the liquids imbibed, even if such takes place without pains, emaciation is caused, and life is endangered. If the urine is thin, motion is required, and friction, chiefly in the heat of the sun or before a fire. A bath should not often be taken, nor ought you to stay in it long. The food should be astringent: the wine rough and unmixed, in summer cold, and in winter a little warmed, but very little ought to be taken of it. The bowels also should be kept open, or purged with milk. If the urine is thick, the motion and the friction should be more energetic; you ought also to stay longer in the bath. The food must be light, and also the wine. Everything ought to be avoided which is wont to act upon the urinary organs."

The history proper of diabetes begins, therefore, with Celsus, 1,900 *years ago.*

Aretæus, a Greek physician of the eclectic school, from Cappadocia (a contemporary of Nero), was the most shining light that adorned the times of the early Roman emperors, and, next to Hippocrates, he

was renowned in antiquity as the best observer of diseases. He wrote in the Ionic dialect concerning the causes, symptoms, and cure of acute and chronic diseases. He derived the term "diabetes," which was known before his time, from διαβαίνω (a flowing through of liquids into the urine), and he considered the stomach as the seat of the disease (see the edition of Kühn., Vol. xxv., Leipzig, 1828).

The description which Aretæus gives of the disease seems so strikingly faithful that we cannot refrain from quoting it here in a free translation:— "Diabetes is a strange disease, which fortunately is not very frequent. It consists in the flesh and bones running together into urine. It is like dropsy in this respect that the cause of both is moisture and coldness; yet so that in diabetes the moisture escapes through the kidneys and bladder. The patients urinate unceasingly; the urine keeps running like a rivulet. The illness originates very slowly. Its final development is death. The emaciation increases very suddenly, so that the existence of the patient is a sad and painful one. The patients are tortured by an unquenchable thirst; they never cease drinking and urinating, and the quantity of the urine exceeds that of the liquid imbibed. There is no use either in trying to prevent the patient from urinating and from drinking; for if he abstains only a short time from drinking his mouth becomes parched, and he feels as if a consuming fire were raging in his bowels. The patient is tortured in a terrible manner by thirst. If he retains the urine

the hips, loins, and testicles begin to swell; the swelling subsides as soon as he passes the urine. When the illness begins, the mouth begins to be parched, and the saliva is white and frothy. A sensation of heat and cold extends down into the bladder as the illness progresses; and as it progresses still more there is a consuming heat in the bowels. The integuments of the abdomen become wrinkled, and the whole body wastes away. The secretion of the urine becomes more copious, and the thirst increases more and more. The illness was called diabetes, as though it were a syphon, because it converts the human body into a pipe for the transflux of liquid humours. Now, since the patient goes on drinking and urinating, while only the smallest portion of what he drinks is assimilated by the body, life naturally cannot be preserved very long, for a portion of the flesh also is excreted through the urine. The cause of the illness may be that some malignity has been left in the system by some acute malady, which afterwards is developed into this disease. It is possible also that it is caused by a poison contained in the kidneys or bladder, or by the bite of the thirst-adder or dipsas. The bite of this snake causes an almost unquenchable thirst, and in trying to satisfy it the stomach is filled with water. With some who suffer of this disease no urine passes at all, so that they finally burst."

Aretæus excels Celsus in this respect, that he dwells upon the unquenchable thirst, which is a characteristic feature of the disease. As regards

the treatment which Aretæus advises, it is as follows:

"The disease of diabetes is a kind of dropsy, only that the water in diabetes runs towards the kidneys and bladder, and is discharged in this way. In treating it your purpose must be to diminish the thirst. For drinking stimulates the desire to urinate, and by the urine many parts of the body which have become liquid are carried off; wherefore such remedies must be applied as lessen the thirst. The treatment also must have regard to the stomach; for there lies the cause of diabetes. Let the body be cleansed by the *hiera* [a sort of antidote against poisons]; make a poultice of ointment of spikenard, mastix, dates, and quinces. The juice of quinces, together with the oil of spikenard and the oil of roses, is useful for pouring over the body. The pulp of quinces also may be used as a cataplasm; wax and the ointment of spikenards may likewise be mixed with it. The juice of the acacia and of kytinus hypocystis may also be used for this purpose.

"For a beverage use water in which summer-fruits have been boiled.

"For food use milk, dishes prepared with milk, starch, pearled barley, soups. Astringent wines, especially very strong ones, are serviceable for strengthening the stomach, and for evaporating and diluting the other fluids of the body. A wine which is astringent, and at the same time cooling, is useful on account of its transforming and cooling properties; while a sweet wine, just like the blood,

increases the strength, because it generates blood. Of compound remedies, apply that of Vestinus, that of Mithridates, the juice of fruits, as well as all the other remedies, which are also useful in dropsy. The whole diet and mode of living is identical with that which ought also to be applied in dropsy."

The celebrated physician in ordinary of the young Emperor Commodus, *Claudius Galen* (born 131 A.D.), the most influential medical practitioner of antiquity (in "De loc. affect.," libr. vi., cap. iii.), is of opinion that the cause of diabetes is *a diseased state of the kidneys.*

Paracelsus (born in 1493, at Maria Einsiedeln), the reformer of the art of healing, which had been condemned to remain stationary, returned to Hippocrates' treatment of diseases in conformity with nature. He introduced the chemico-metallic medicines; he was the first author who treated syphilis systematically; and he demanded that "science among the Germans should be German." In his work "De tartaro," lib. ii., he laid down as the cause of diabetes *"an increased formation of salt, producing an irritation of the kidneys."*

The renowned Italian physician and mathematician, *Geronimo Cardano* (died 1575), who was called the wisest fool, and the most foolish wise man of his age, and whose writings are among the most important literary monuments of the sixteenth century, compiled already a table of the quantity of liquid nourishment received by the body on the one hand and of the urine which was discharged on the other.

Sylvius (1478-1555), who most earnestly recommended the dissection of dead bodies, maintains (in his "Opera med.," Amsterdam, 1680, p. 724) that diabetes originates from a *faulty condition of the blood;* which definition I write upon my own banner to-day where I speak of the defective formation of the protoplasm in persons suffering from diabetes.

Richard Mead ("Opera med.," London, 1744) supposes diabetes to be a disease of the liver, and to arise in consequence of an abnormal preparation of bile, which, however, is pathologically false. To mention only one thing—among the 64 dissections of the bodies of persons who died of diabetes, which are described by *Griesinger,* an enlargement of the liver could be demonstrated only three times.

The Englishman *Thomas Willis,* with the exception of the Indian physicians, was the first who about the year 1674 (see "Pharmaceutica rationalis Oxenofordi") discovered sugar in the urine by the sweet taste of diabetic urine; he therefore was the first who diagnosed diabetes *mellitus.* Henceforth there existed *diabetes mellitus;* and able experimenters, such as *M. Dobson* (1775, who first obtained sugar by evaporating urine), *Pool,* and especially *Th. Cowley* and others, demonstrated the existence of sugar (*i.e.*, of crumbling, crystalline sugar) beyond any shadow of doubt.

F. Howe proved the fermentation of diabetic urine.

The Englishman *John Rollo* (1797) acquired great merit by his dietetic prescriptions, recom-

mending animal food. He first recognized the injurious effects of vegetable food on the formation of sugar in the organism, and demanded a meat diet for those afflicted with diabetes. His two works entitled: "On diabetes mellitus," London, 1797; and his treatise "On diabetes mellitus, with chemical experiments by W. Cruikshank," Vienna, 1801, are still consulted at the present day.

Henceforth the attention of the profession was directed to the processes which take place during digestion. Many dissertations and articles on this subject appeared in the medical journals, as well as the following treatises:—

W. Prout, "Inquiry into the nature and the treatment of diabetes, calculus," etc., 2nd edition, London, 1825; and "On the nature and treatment of stomach and renal diseases," London, 1848, with additional editions.

Venables, "A practical treatise on diabetes," London, 1825.

Nicolas and *Gueudeville* supposed diabetes to be a "*phthisurie sucrée,*" caused by a disease of the bowels.

With the view of obtaining an understanding of the substances which contain and form sugar, and also for the purpose of inquiring into the constituents of the blood and urine, chemistry, which was then beginning to grow strong and powerful, was drawn upon for help.

Already, in 1835, the apothecary *Ambrosiani* proved the existence of sugar in the blood, without,

on that account, being able to trace the cause of the disease.

About this time (1835) *Bouchardat* returned to the standpoint of Aretæus, and declared that *the seat of the disease was in the stomach* (see his articles in the "Gaz. méd.," of 1835, No. 11; further, in the "Rev. méd.," 1839, Juin; in the "Annuaire de Thér.," 1842, pp. 46, 48; in the "Clinique europ.," of 1859, p. 58; and, finally, in the "Bull. de Thér.," p. 145, where he treats of glycosuria.)

Mialhe looked for *the seat of the disease in the blood:* in consideration of the fact that owing to an obstruction in the secretion of the skin the alkalization of the blood is diminished, and the combustion of the sugar, which is possible only in the presence of free alkalies, is interfered with, he urgently advised the use of alkalies, which is really the only remedy used by the profession up to the present time, either in the form of medicine, or in that of waters drunk at the various alkaline springs.

The French physician *Piorry,* between 1840 and 1850, ordered his patients to use as much sugar as possible in order to replace the sugar which was lost.

A new epoch in the history of diabetes was inaugurated by the Frenchman *Claude Bernard,* in so far as by the artificially produced glycosuria through his so-called celebrated sugar-puncture *(piqûre)*, and also through curare, as well as through his experiments upon the liver, with the view

of throwing light upon the formation of sugar, *he created the physiological experiment* for the purpose of ferreting out the cause of diabetes—which also is the task I have proposed to myself (see Claude Bernard's "Leçons de physiologie expérimentale," Paris, 1855, ff.; further, "Leçons sur le Diabète et la Glykogenèse animale," Paris, 1877. "Vorlesungen über den Diabetes und die thierische Zuckerbildung," translated into German by C. Posner, Berlin, 1878. Finally, see also C. Bernard's work entitled "New functions of the liver as an organ which forms sugar in man and animals," translated into German by Dr. Schwarzenbach, Würzburg, 1853).

Lehmann entered upon the physiological experiment almost at the same time as Bernard (see Lehmann, "Bericht der Gesellschaft der Wissenschaft. zu Leipzig," 1850).

Bernard, the originator of experimental diabetes, gave rise to numberless investigations from 1848 upwards, which were profitable to the physiology of the production of glycogen, as well as to the pathology of diabetes. He is of the opinion that his operations and injections cause a vasomotory irritation, and thereby a hyperæmia of the liver, which results in glycosuria. At all events he considers the glycogen of the liver as a preparatory step for the formation of sugar. Nevertheless, he still left two questions involved in darkness; namely, (*a*) the origin and use of glycogen; and (*b*) the nervous tracks by which the circulation of glycogen is determined.

The Englishman *Pavy* is of the opinion that glycogen is subservient to the formation of fat. According to him glycogen is caused by the reception of sugar and starch, which through the agency of a ferment contained in the blood is transformed into sugar. Pavy, a disciple of Bernard, differs from his master in supposing that the formation of sugar is a *post-mortal* process.

Schiff—who still recommended, in 1859, amylaceous food, lest the sugar be formed at the expense of the elements of the body—*Tommasi, Naunyn,* and others, on the basis of Bernard's investigations, instituted the most minute inquiries. The majority of the learned favoured now the idea of the origin of diabetes in the liver; while some inquirers still assumed other causes, as, for instance, atrophy, *i.e.,* a fatty degeneration of the pancreas; namely, *Skoda, Oppolzer,* and more recently *Bäumel,* who distinguishes between a fat, a lean, and a mixed form of the pancreas, and recommends artificial preparations of pancreas for the purpose of curing diabetes.

Voit and *Pettenkofer* maintain that diabetes mellitus is caused by a too scanty reception of oxygen.

Bence Jones, Leube, and others share this opinion, but especially Prof. *Cantani,* of Naples ("Diabetes mellitus," translated into German by Hahn. Berlin, 1880). This latter gentleman regards the sugar in the diabetic blood not as glucose, but as paraglucose; and he interested himself most actively in the spread of this view.

Cantani says : " Diabetes is a disease of the change of substance (*Stoffwechsel*). In this disease there is no abnormal production of sugar, either quantitatively or qualitatively ; but the sugar which has been introduced into the system, or which has been generated there in a normal manner, is not made use of for the purpose of being burned in the manner in which this is done in animal organisms, nor is it employed as a substance capable of undergoing fermentation. It remains as a foreign substance in the body, which is not utilized in the economy of the organism ; for it cannot be made use of in the processes which enter into the change of substance. Wherefore it passes through the system in the form of sugar, without undergoing a final transformation ; and it leaves the system through the urine and the other secretions."

In animals in which glycosuria was produced artificially it disappears by the injection of bicarbonate of sodium. This is explained by Cantani in this wise—that the sugar is thereby rendered capable of fermentation, and thus capable of being burned.

It was reserved for *Ebstein* to enter into the mystery of the pathogeny of diabetes mellitus, which disease is as interesting for the physiologist as it is for the pathologist. In his treatise on diabetes, which appeared only a short time ago, he has endeavoured, by a remarkable series of experiments, to present a relatively insufficient formation of carbonic acid in the tissues and organs of a person affected by diabetes, as that element which acts the part of

an instrumental cause in the production of diabetes. By demanding a correction of the defective formation of carbonic acid, he pointed out to the medical practitioners a means by which to cope with diabetes; and he directed them to a method of therapeutics, such as I practised *before him*, ever since the year 1881.

Many things worthy of notice are contained in the treatises and articles which have appeared in the present century on the subject of diabetes. Some of these works, as, for instance, those of Seegen, Frerichs, Ebstein, may even be regarded as marking an epoch in the treatment of this disease. The whole of these publications, which at the same time furnish a complete bibliography of diabetes in an alphabetical order, are as follows:—

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Zuntz, Beitrag zur Physiolog. des Diabetes. He thinks that the formation of acid is favoured in a blood which is saturated with carbonate of sodium.

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It seems to me, therefore, that it would be a most grateful task, and one fraught with good results, if the medical societies and editors of medical journals would agree among themselves as to a definite plan according to which reports and accounts of the above disease are to be made; further, as to some definite place to which such communications might be sent, and where the specialist might find them and work them up, in order afterwards to publish the result of his labours in some journal, where it would become accessible to all interested in this special subject.

In this way it would be possible to obtain a statistical ensemble of all cases of diabetes; as regards the course they have taken, and as regards their final result. Everyone would then be able to have access to the whole modern literature on this important subject; he would be able to examine it and make use of it. Every year, also, a general report ought to be made, which would enable anyone to survey the ever-increasing literature on this subject, and which literature might be found and consulted in some given library.

Griesinger, in his statistical table, mentions the time when the disease first showed itself; Dickinson notes the time of death; while others report only the time during which the patient was treated by them.

Some physicians report only those cases which have occurred at watering-places; and hence they have almost nothing to say about children. Others relate only hospital cases, etc.

It would be very desirable if authors would make their daily observations at one and the same hour. Thus Otto reckons the day from 10 o'clock to 10; Lambe, from 6 to 6; Krausold, from 7 to 7. For forming a judgment also it would be valuable to make observations before, and after, the meals.

At some future occasion I intend to give an account of those literary communications and observations that I have received already, and of any that I may receive in the future; and I shall also express myself as to the best form in which such

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