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DIABETIC GANGRENE.

BY

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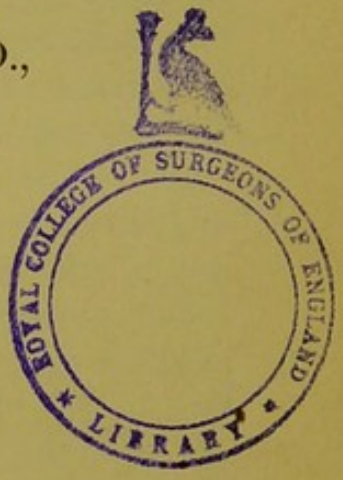

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DIABETIC GANGRENE.

By WILLIAM HUNT, M.D.,
SENIOR SURGEON TO THE PENNSYLVANIA HOSPITAL.

[Read November 28, 1888]

My young friend, Dr. Charles B. Penrose, who, at the time, I did not know was one of our directors, told me not long ago that he had a case of gangrene in a negro which puzzled him and he gave me a few of the points. I said "that man has sugar diabetes; test his urine." A few days after he crossed the street to tell me that the man's urine was full of sugar. "Yes," said I, unwarily, "I have seen and had under care quite a number of cases." "Then," was the reply, "you'll read a paper on it before the County Medical Society, on the 28th of November," and straightway he whipped out his pencil and put me down as engaged for that night. Resistance was useless, and I promised to open the subject for discussion to-night with a record of my experience, and as much more as I might choose to add. I kept no close notes of my cases, which I think is rather an advantage for my hearers, as it saves them from listening to much tedious detail, and such detail is not the object of the present discourse. Of course, it was necessary to take a glance at the literature of the subject. This is vast as to diabetes, and as to gangrene in general but meagre, and in some respects surprising as to diabetic gangrene. There are about twenty pages of the great *Index-Catalogue of the Library of the Surgeon-General's Office*, which is double-columned as you all know, given to each of the subjects of gangrene and diabetes. You have to search sharply for anything associating the two. The French seem to have the best of it up to 1868. There are but two monographs catalogued, one by Giron, Paris, 1881, and one by Peyrot, a student, 1878, who reports, I think, thirty-nine cases; these are not in the College of Physicians' Library. Then ten isolated cases are reported in the French journals from 1856 to 1868; most of these are in *L'Union Médicale*. I will give a brief summary of these cases, most of the reporters of which think they have hold of something very rare

and interesting, and you will not wonder at this when you hear more of this literature.

1st. A case of phlegmon and gangrene of the anterior and external region of the right knee. Free incisions were made. The patient was discovered to have intermittent diabetes. There was recovery from the local lesion.

2d. A patient known to be diabetic had his right toe to slough; it was detached with scissors. From this he recovered slowly. He was placed on strict antidiabetic treatment, but was careless and the whole foot became gangrenous. There was great abdominal pain, and necrosis of the gastric mucous membrane was diagnosed; death speedily followed; no autopsy.

3d. A diabetic of sixty years of age is reported, who died from extensive gangrene of the thigh and back.

4th. A doctor, aged sixty-five, fell down from an attack of cerebral congestion; never sick before. Diabetes was discovered. This was on the 21st of the month; on the 25th great mortification took place involving the cellular tissue deeply, followed by death.

5th. A man had a leg amputated for what was thought to be senile gangrene. He recovered slowly from this, then the other leg was attacked, first at the toes. He was found to be a diabetic.

6th. Another diabetic is mentioned with spontaneous sphacelus of the right toe.

7th. A colonel with his right foot gangrenous died of diabetes. Other cases are here and there mentioned with spots of gangrene.

8th. A man of seventy, after great pain, had gangrene, first in left toes, then in right. The disease was thought to be senile, but he was found to be a diabetic. The absence of ammoniacal changes is noted in this case, and the question is raised whether the urine of diabetics undergoes these changes.

9th. A case of complete destruction of the plantar aponeurosis by gangrene in a diabetic is reported with recovery from that lesion.

10th. A man of fifty-five, cut his corn—gangrene followed and diabetes was present; he died. He had before this no symptoms of diabetes—in fact, was never sick. He went through troublesome family affairs, which he felt deeply, some time before.

These patients where the sex is given were males. Mental troubles are more than once given as a cause. Intermittence in the appearance of sugar is noted in two cases. In fact, in one of them, the interne tells his chief, that he (the chief) had made a mistake. The interne had examined the urine when sugar was absent, but it returned in full. The majority of these cases were in the better walks of life. But the work worthy of a higher dignity of title than a monograph is by Marchal (de Calvi), Paris, 1864: *Recherches sur les Accidents Diabétiques et Essai d'une Théorie Général du Diabéte.* Some of his cases are among those quoted above.

Marchal claims to be, and with some force, an original discoverer. He places 1852 as the dividing line between the periods when, in the

first, gangrene occurring during the progress of diabetes was regarded by all as a simple coincidence, and the second, when gangrene occurring among diabetics it is the result of inflammatory conditions dependent on the disease and due to the irritation of the peculiar products of it, which are thrown into the blood and tissues. This last is the so-called discovery, as I understand it, and there is some discussion as to priority, for Hodgkin of London, about the same time, as we shall see, took the same view. Marchal was, of course, criticised by his own people, one of whom was Charcot. The cases, facts, and comments are divided into two series, those published before the discovery, and those published after it. The collection is really remarkable, both as to number and as to character of cases, and especially so when contrasted with German, English, and American reports and literature on the subject up to that time. Marchal's book has reports of one hundred and thirty-three cases of all sorts of what I may call extra lesions occurring during the progress of diabetes, collected both before and after the discovery. In the notice of three cases of Carmichael, Adams, and Marsh in the series before the discovery, these remarks occur: "The mention of these cases does not give place to any general deduction. The question to know is, whether there exists a necessary relation between gangrene and diabetes, a question which appears to have been totally lost from view." Of the 133 cases, gangrene *per se* occurred in 57. The seats of it were, in the lower extremities 35, lungs 7, hand 3, pleura 2, shoulder 1, nucha (not ordinary carbuncle) 2, nose 1 (necrosis), plantar aponeurosis 2, ribs (necrosis) 1, forearm 1, back 1, gangrenous plaques 1—although the latter are reported in several other cases. I shall not pretend to particularize these cases; I refer any one interested to Marchal's book. My purpose is to show that gangrene in diabetes is something more than a coincidence. The extraordinary case No. xxxix., almost of itself sustains the position. A man of fifty-eight years, came under observation. The case is given in detail and is thus summed up by Marchal. "Thus in the space of six years from 1850 to 1856, the patient was attacked successively with first, a necrosis of the first phalanx of the second toe, which was amputated; second, with a sphacelus of the whole foot and inferior part of the leg of the same limb, which was also amputated; third, with a skin gangrene of the other leg which gave place to a callous ulcer; fourth, with a gangrenous inflammation of the base of the great toe, which left a deep and intractable ulcer; fifth, with a sphacelus of the first four toes, which were also amputated." Through all this melancholy history

no suspicion of diabetes was raised until attention having been called to the case through Marchal's labors, the urine was examined and the man was found to be a positive diabetic, and he was proved to have been one for years. Other multiple cases are reported. This by no means exhausts the French literature. Verneuil, Nélaton, Lizé, Peter, Charcot, Demarquay, Peirot, Chauvel, and others have done their share in the observation of cases and in elucidating the subject. I will now take a short notice of German, English, and American work in this line.

The great *Index-Catalogue* I referred to is dated 1882, and in going twice over those thirty-seven double-columned pages devoted to diabetes and to gangrene, I found no monograph on diabetic gangrene in German. There is one case of it reported by W. Roser of Marbourg, and an article by him upon it in the *Medicinische Wochenschrift*, Berlin, of January 1, 1880. Billroth, in his *Surgery*, merely mentions diabetes mellitus as a possible complication of gangrene. Hodgkin read a paper before the Harveian Society, session of 1852–53 (*Journal of the American Medical Association*, 1854, p. 915), and, aside from this, there is no notice of an English article or case in the index. I may have missed them, but I thought I looked sharply, else how did I find the French ones? There is one Italian case reported.

The Marbourg professor (Roser) grasps the situation thoroughly. He says: "When an otherwise healthy appearing man has a gangrenous or ulcerous disturbance, for example, on the foot or hand, when one can think of no infecting cause, when all irrigations with carbolic acid, etc., are in vain, it *is high time to think of diabetes.*"

He attributes the past failures of diagnosis and consequently of proper treatment to three causes: First, to the fixed, classic, and preconceived notions as to diabetes, viz., that an otherwise well-looking and well-nourished person cannot have it; that the usual symptoms, thirst, emaciation, etc., must be present; so to say, a cachexia. (These points I can practically confirm as well taken.)

And what are we to think of this?

"Second. In gangrenous destructive processes *now*, one takes it for granted that a rotting, generating, chink-fungus (literal, Spaltpilz) has got in from without and is the cause of all the trouble, and one is obstinately striving to stop or make impossible the vegetation of this chink-fungus and to control the advancing sepsis by still more obstinate applications of carbolic acid [he quotes carbolic acid as the type of the germicides, for he has u, s, w in some places], and so long as

one remains in this blind thought, he naturally seeks for no other etiology.

"Third. Even when the diabetes is discovered, the doubt is set up whether it has anything to do with the gangrenous destruction, and then it is still more strongly doubted whether a treatment appropriate to the case, both constitutional and local, can mend matters where there is a high grade of diabetes." Cases are then given, some of which are taken from Marchal. A plausible explanation of some cases of otherwise unaccountable sloughing after operations is suggested in the possible presence of diabetes. I came across some such cases. Roser supports Marchal's axiom, "One must always think of diabetes and examine the urine, when one has to deal with obstinate and repeated cases of furuncle, anthrax, diffuse phlegmon, gangrene or sphacelus, and the like affections." (This is all I shall translate, for I find there is a longer abstract from this article of Roser's in the *Chicago Medical Gazette*, 1880, vol. i.)

Since Roser's paper the Germans have paid more attention to the subject. I find in the *Annual of the Universal Medical Sciences*, vol. i. 1888 (a book which brings our literary knowledge of a subject fairly up to the present day), that in the *Centralblatt für Chirurgie* König "points out" what this article shows has been long ago known, that diabetic patients are subject to a low grade of inflammation; and he issues the dictum, "that in all cases of spontaneous gangrene the urine should be examined for sugar, and in surgical complications of diabetes the first and most persistent treatment should be anti-diabetic." In the article upon surgical diseases in the *Annual*, collated by Dr. Christopher Johnston, of Baltimore, an interesting case of diffuse gangrenous phlegmon in a diabetic is reported, and after some remarks and extracts as to the causes of the various gangrenes, this rather heavy quotation closes a paragraph: "The differential diagnosis is simplified since antisepsis has detached gangrenous septicæmia from the morbid coexistences which complicated its symptomatic category."

English and American literature on diabetic gangrene amounts to almost nothing. After Hodgkin's paper, 1852, the affection seems also to have been totally lost from view, and no one appears to have taken any especial interest in the subject. Hodgkin is the one with whom the question of priority was raised with Marchal. He reports several cases, one that of a young man who, after venesection for diabetes, developed an acute pneumonia. He died, and gangrenous softening was found surrounding tubercle. Another case, in an

elderly gentleman, with symptoms of the same kind; no post-mortem. Two more with gangrenous feet. Then follows this important remark: "Reflecting upon the evident tendency of diabetes to impair the vitality of the tissues, I could not but attribute it, not to accident, but to an essential connection between the disease and the function of nutrition."

After this I found no monograph on the subject, nor no particular reports of cases in our language. They must exist, but I got tired looking for them, and at any rate I proved them to be rare. I searched some works on general surgery, including text-books, and allow me to say in passing, that I do not allude to them in the spirit of carping criticism, but to show how this important matter has attracted such small attention. I also may have overlooked something, but here is the result. In only one of these books do the words *diabetic gangrene* occur in the index. This is in Ashhurst's *International Encyclopedia of Surgery*. They refer to six lines given to the subject by Professor E. M. Moore in his article on "Gangrene and Gangrenous Diseases." Even the great *Index-Catalogue*, with much more insignificant headings about gangrene, has no heading *diabetic gangrene*. The subject is not noticed in any way by Ashhurst, Agnew in his first edition, or by Bryant. Agnew speaks of traumatic diabetes in injuries of the head, and Erichsen gives a case of a severe blow upon the back of the head followed by concussion and the rapid development of diabetes, but makes no mention of diabetic gangrene in his early editions, but has quite an extended notice of it in his last one. Agnew, whose attention of late years has been drawn to the subject through meeting with cases of it, writes about it in his second edition (vol. i. p. 192). Prof. S. W. Gross (late editions) gives us a short notice under the head of chronic gangrene, which he says "is occasionally associated with, if not directly dependent upon, organic disease of the kidneys, especially that form of it which is attended with saccharine diabetes." And he refers to the elaborate observations of Marchal and Verneuil. Holmes Coote, in Packard's edition of *Holmes's Surgery*, in his fine essay on gangrene, does not notice it in any way, nor does his reviser, Dr. P. S. Connor.

So much for the surgeons. Pavy, 1862, makes no mention of gangrene; to be sure, his researches were mostly in different directions, although he alludes to other complications. Squire in a short essay is equally silent. Dr. Tyson, our acknowledged expert in urinary matters, says: "Gangrene of various parts of the body is another of this class of symptoms; it is sometimes spontaneous, but

more frequently is immediatcly caused by some trifling injury, which under other circumstances would be without result. It has been known to start from a blister. The mode of origin makes it unnecessary to seek *any further immediate cause*, such as inflammation, degeneration, obliteration of arteries, etc. Beginning most frequently in those parts of the body most remote from the centre of the circulation, as the toes, its progress and appearances are like those of senile gangrene." Tyson also gives two passing notices to gangrene in his later article on diabetes in Pepper's *System of Medicine* (pp. 205 and 210), and also in Sajous' *Annual*, where he quotes from a French authority a case of gangrene of the penis in a diabetic. His remark that the gangrene is *more frequently* caused by some trifling injury is not sustained by the histories of the reported cases. It is doubtless *started* in some, as we have seen, by such an incident, the place simply being determined by the injury. The differences from senile gangrene are also mostly well marked.

W. Roberts has quite a paragraph on diabetic gangrene in his work on *Urinary and Renal Diseases* (4th ed., 1885). He quotes Marchal, Hodgkin, and others. Niemeyer mentions it only as a possible complication. Fagge gives it four lines, and confines it to *one* of the lower limbs. We have seen how it may be multiple, and simultaneously or successively attack different parts of the body in the same person. Watson, quoting Garrad, mentions gangrene. Flint and Aitken speak of it as a possible complication of diabetes.

Whilst writing this, Schmidt's *Jahrbücher*, No. x. for 1888, comes to hand, bringing us up to October of this year. In it there is the latest general article on diabetes mellitus, a review, twenty-eight pages in length, by Dr. Louis Blau, Berlin. The paper opens with a list of seventy-four different articles on the subject from 1886 to date. Among the Americans mentioned are J. M. Da Costa and L. K. Baldwin. This catalogue gives the same experience as the *Index* of the Library at Washington. Only three articles refer to diabetic gangrene, one by König, "A Revision of the Knowledge as to Capital Operations (Amputations) during the Progress of Diabetic Gangrene," and two cases (both French) of diabetic gangrene of the external genitals are reported.

Blau gives credit to König for confirming the frequent tendency to inflammations giving rise to gangrenous processes in diabetics. This (the gangrene) may appear to be spontaneous, but it calls for an examination of the urine if that has not been made.

He as well as König is a firm believer in these inflammatory gan

grenous affections being dependent upon specific microbes, as do other incidents of diabetes. The easy passage into gangrene is favored by the less resisting power of the tissues than when in health, and, also, it may be, the presence of arterial sclerosis.

The diabetic is at a disadvantage with the sound man, in that there is a greater tendency in him to take up the microbes in his tissues and into their fluids, as these offer a better nourishing nest for the microbes. Compare König's with Roser's views. Roser ridicules the chink-fungi as the producers of the gangrene *in situ* and from without. And, agreeing with this, König gives them a nidus within from which to operate. This is but a repetition of what I long ago stated in an address before the Academy of Surgery in this city.

The reason that a sick man is at a disadvantage as compared with the well man is that the former is a harbor for the products of disease (molecular necrosis). These products are the food of the bacilli, and where the food is, *there* they go. They do not differ in this from all other organized creatures from man to microbe. How far they are the *causes* of disease is the business of the mycologist to find out. But little as yet has been established as a *certainty*, and, therefore, it is all the more incumbent, in practice, to guard against their possible presence and specific power. König thinks that capital amputations had better be let alone so long as the urine is rich in sugar. He also says there are cases in which the surgeon must be the judge. It may be worse to refrain from amputation, and thus let the patient contend with two serious conditions, the disease and the gangrene.

Thus you see that up to this time but little has been added to our real knowledge of diabetic gangrene since 1852, the days of Marchal and Hodgkin. The disease was there, the theories were there, the cautions and advice and treatment. All were present but the bacillus, and he was lurking in the dark. The surprising thing is that, as in the expression already quoted, the interesting and important subject should have twice "been almost totally lost from view."

After reading the review in *Schmidt*, I got the number of the *Centralblatt* which contains König's paper and read it. I have already taken most of the important parts from the reviewer. König has evidently gone over some of the same historical ground that I have done. He gives the French great credit for their researches and papers and reports. He quotes one of the latest French observers, P. Redard, upon "De la glykosurie ephèmère dans les affections chirurgical" (*Revue de Chirurgie*, 1886, No. 8 and No. 9, S). He reports two most interesting cases, one aged seventy, and one forty,

occurring in 1886, both having diabetic gangrene and atheromatous arteries. He amputated a thigh in each case, under strict antisepsis. Both recovered rapidly, and there was a remarkable diminution of the sugar in both, and at times it wholly disappeared. He argues to himself in this quaint way: "During the past year I took the knife in hand, for I said to myself, 'if thou continuest to treat the case in this way (the expectant), the old man, upon whom his family depends, will surely go to the ground; to be sure, he may also go to the ground after the amputation, but possibly he may live if antisepsis is strictly carried out.'" And live he did. He then issues his dictum, a process of which our friends abroad seem to be very fond: "When in diabetic gangrene, in spite of antidiabetic treatment constitutionally and antiseptic treatment locally, the general diabetic symptoms and the local phlegmonous appearances do not disappear or ameliorate, and a further perseverance in the treatment simply increases the danger for the patient, then a radical operation, in order to try to save the patient's life, must be performed. These operations will, as a rule, be amputations."

We will now leave the history and literature of diabetic gangrene and take up the records of experience with a few practitioners here at home.

I think any fair-minded person would say that, if we can develop so much in such a limited range of inquiry and in such a short time, and then ask himself what might be found out by further inquiry, not only among ourselves but throughout the country, diabetic gangrene is certainly something more than a mere coincidence of the disease diabetes. I sent out a small number of inquiries to physicians and surgeons in our city, selecting those whom I thought would know most about the matter, and also made personal inquiries of some. The questions were: 1. How many cases of diabetic gangrene have come under your notice or treatment? 2. What was the social standing of the patients—wealthy, medium, poor, hospital, or private—their ages and sex? The next question would appear to be rather a side issue, but it was made, in passing, to ascertain whether what is almost universally stated about diabetes is legendary, or is the result of carefully collated observation; it also bears upon gangrene of the pulmonary organs—it is: 3. How many of *all* of your diabetics had consumption, or died with it, and was there anything like gangrene of the lungs?

I received thirty answers, including myself; of these, seven had seen no gangrene. They were Tyson, Longstreth, A. V. Meigs,

Hutchinson, Packard, Sinkler, Keen. Twenty-five reported 64 cases, viz.: T. G. Morton 13, Da Costa 5, Hunt 5, Agnew 6, J. C. Wilson 3, S. Solis Cohen 3 (two of them in consultation with other practitioners), Dr. Brush 4 (one case intermittent). D. F. Woods, J. H. Brinton, S. W. Gross, E. L. Duer, Murray Cheston, W. A. Edwards, J. W. Hearn, 2 each. John Ashhurst, Jr., Elwood Wilson, L. K. Baldwin, W. Osler, James Darrach, A. Fricke, W. F. Atlee, C. B. Penrose, J. H. Musser, W. B. Hopkins, T. K. Morton, 1 case each.

I was as particular as possible to eliminate double reporting; for example, cases seen in consultation, thus, D. Brinton saw one with Dr. Mitchell and myself; it is reported as one of my cases. Dr. C. B. Penrose is entitled to one more than above given, which one, as you have heard, was the cause of this paper, but it went into the hospital and so it appears in Dr. Morton's record. Dr. Weir Mitchell has seen several cases, I know, but having just returned from abroad he had no time to give a verified statement.

I was also particular that the cases should be known by actual examination and record to be diabetic. Thus, Dr. Morton at first answered me that he had seen twenty or twenty-five cases, not knowing my object. I have no doubt that he has seen that number, for he and I have had our attention drawn to this matter for years, but he actually verified the thirteen in his list. Dr. T. R. Neilson was certain he had two cases to report from the Episcopal Hospital, but he found no record of sugar, so I rejected them. I mention these facts to illustrate the care that has been taken.

The ages, where given, were: 1 between 30 and 40; 2 between 40 and 50; 11, 50 and 60; 12, 60 and 70; 10, 70 and 80; 2, 80 and 90. One exceptional case of Morton's, a diabetic aged nineteen, in whom gangrenous sloughing took place after a needle operation for cataract, is down, and one of S. Solis Cohen's cases was a young female. Of the sexes given, 24 were females and 25 males. Of social standing, where given, 16 were wealthy, 23 medium, 9 poor, and of these 6 were in hospital. Dr. Brush reports a most interesting case of a female diabetic aged forty, a lunatic. She had large ecchymoses on her limbs which became gangrenous; she died. The autopsy revealed a gumma the size of a large pea in the floor of the fourth ventricle. The seats of gangrene, where reported, are: Lower extremities—below the knee 37, thigh and buttock 2; nucha (not ordinary carbuncle) 2, external genitals in female 1, lungs 3, fingers 3, back 1 eyes 1.

Had I allowed myself to include ordinary carbuncles and boils in

the gangrenes, to which class they belong, the list would have been greatly increased.

We will now take up the third question: How many diabetics have consumption or die of it? Is it a legend?

Marchal says he has known of but few diabetics to die of consumption, but he is rather inclined to adopt the general view.

A pamphlet published at Oxford in 1745, called "A Mechanical Inquiry into the Nature, Causes, Seat, and Cure of Diabetes, with an Explication of the most remarkable Symptoms," says, if the patient be "too far advanced by a neglect of proper remedies, the person so affected in reality dies of *a* consumption."

Here are the answers to the third question. Dr. Tyson has notes of 55 cases in private practice since 1884. Of these, 18 have died, 4 *of consumption.*

Dr. Longstreth says a very large proportion die of pulmonary complications *called* consumption.

Dr. A. V. Meigs has notes of 5 deaths from diabetes, none from consumption, nor does he know of any consumption in those diabetics who have passed into other hands, nor, as I understand, of any in his father's practice. Dr. James H. Hutchinson remembers 1 diabetic who died of consumption. Dr. Packard remembers none. Dr. J. Ashhurst, Jr., does not remember a consumptive. Dr. Sinkler: none of his few cases died of consumption. Dr. Da Costa does not remember a case of gangrene of the lungs, but has seen a sufficient number die of phthisis as to believe in the generally held opinion. Dr. Agnew has seen no consumption, one of gangrene of the lungs. Dr. Elwood Wilson does not remember a death from consumption.

Dr. J. C. Wilson cannot answer as to consumption, thinks it not so common as supposed; has seen one case of gangrene of lungs. Dr. D. F. Woods has had no consumption deaths. Dr. L. K. Baldwin, one case complicated with consumption. Dr. Osler, two died of consumption, one of gangrene of lungs. Dr. Darrach, no consumption. Dr. S. W. Gross, none; Dr. Keen, none; Dr. Albert Fricke, none; Dr. J. H. Brinton, none; Dr. Hearn, none; Dr. Hunt remembers one poor woman in the hospital who was said to have consumption with diabetes. Dr. Brush, one phthisis death, and reports one lady of seventy-one, three of whose family had consumption; she escaped it. Dr. F. G. Morton, one; Dr. W. A. Edwards, none; Dr. Murray Cheston, six cases, no consumption; Dr. W. F. Atlee, none; Dr. T. S. K. Morton, none; Dr. Musser says he knows the cause of death in nine cases—none of phthisis.

Thus among all the diabetics noted by the practitioners mentioned, and we do not know how many are included, but certainly the 55 of Tyson, the 64 of my collection, the 9 of Musser, and 16 non-gangrenous ones specified by 7 others, in all 144, we find but 11 deaths from phthisis. And yet Dr. Thomas S. K. Morton, in an essay on diabetes, has somewhere picked up a statement, from an authority whose name he has missed, that 43 per cent. of diabetics are killed by phthisis sooner or later. Roberts, 1885, says that one-half of them die with cough, catarrh, phthisis, and other lung complications, when prolonged to the third year, and Aiken quoting him, evidently in mistake, says to first year. Dr. George B. Wood says, "In the great majority of cases the patients die of phthisis." Drs. Da Costa and Longstreth, whose opinions are entitled to great weight, make general statements in their answers; Dr. Longstreth cautiously stating it is *called* consumption. From a conversation with Dr. W. Pepper, who gives no return, he adopts the consumption view, and Dr. J. Cheston Morris coincides.

S. Solis Cohen says: "I cannot find accurate statistics as to consumption. Think at least one-third of the cases that I have seen died of pulmonary affections." Griesinger, quoted by Niemeyer, says "one-half of the cases die of phthisis." Watson says, "some think phthisis universal in diabetes, but it is not so." Flint, quoting Ogle, reports fourteen cases, with deaths from scrofulous or tubercular disease in seven of them. Niemeyer says "that pulmonary tuberculosis hastens the fatal issue." What one of latest authority, C. Hilton Fagge (1886), says, is important. "Diabetes is frequent cause of *a* phthisis" (almost the 1745 expression), which is peculiarly pneumonic in character. Its relation to ordinary pulmonic disease is still doubtful," and after giving certain facts he says, "hence it supports very strongly the opinion that the pulmonary affection in the disease is not of a tubercular origin." He kept notes of the diabetic deaths in Guy's Hospital and in twenty years out of 40 such deaths, 17 died of phthisis. You will notice how indefinite and general some of the statements above given are, without figures to sustain them. Blau, in his review in the late number of *Schmidt's Jahrbuch*, already quoted as to gangrene under the head of "diseases of the lungs in diabetics," says, in substance, "that the question whether so-called diabetic phthisis is the same as ordinary tubercular disease of the lungs is only to be settled by the proved presence in both of the same bacillus." Authorities, Inmérman, Rütimeyer, von Merkel, and von Leyden, are quoted as having observed absolute differences between the two diseases both

from examinations of sputa and also by post-mortem. A case is given in which during life the patient had all the symptoms of tubercular phthisis. Except that bacilli were not found in the sputum, and at the autopsy the appearances were totally different from those found in that disease, and these appearances are noted in the text. The bacillus tuberculosis was nowhere found. A case having almost the same post-mortem appearances as this one is reported by Da Costa, in the *Philadelphia Medical and Surgical Reporter*, vol. i. page 8, January, 1887. The bacillus, as in the preceding case, was absent.

This record, considering the large number of consumptives in communities like ours, would seem to show that the cases in point *are consumptives with supervening diabetes, and not diabetics with supervening consumption.* I leave the question for wiser heads to determine. Diabetics die, as my inquiries and experience confirm, with coma, œdema of the lungs, and exhaustion.

I said I would not trouble you with the minute particulars of my own cases. To do it, would not add to the general knowledge of the subject, but I will sum them up and relate, I think, some interesting points. I have 9 cases to speak of, 5 of whom were gangrenous, and 3 rapidly advancing toward it when death overtook them. One was peculiar and unverified; all are dead; one was in medium circumstances, all the others decidedly wealthy. The ages ranged from 50 to 93, 4 of them being above 70; 5 were women, 4 men. In none of them was the classical emaciation present at any time. The disease was intermittent in two. The urine in one of these cases would range as low as 1010 specific gravity, with slight traces of sugar, and then advance to 1030–1035 with evidence of abundance of it. I took a specimen of this low gravity urine to Dr. Casper Wister, of the Mutual Life Insurance Company of New York. He tested it himself and was much surprised, and concluded not to accept statements of "no sugar" founded upon specific gravity alone. Another case also ranged from low to high at varying times, but not so marked as the first.

This teaches us not to be too sure in saying, as we all often do, "there's no use looking for sugar in that," when the gravity is 1020 and under. Austin Flint, Jr., reports a diabetic case with the gravity of 1011½. The seats of the gangrene in five of my cases were, foot and leg below knee 3, thigh and buttock 1, nucha (not ordinary carbuncle) 1.

Gangrenes, as a rule, are generally of the soft or humid kind. This, however, depends much upon the part involved. Where the tissues are succulent, the gangrene will be also of that character;

where they are composed mostly of skin, tendon, and bone, they will approach the senile gangrenes in appearance. The remark made by Holmes Coote is also applicable. He, speaking of the terms used in the descriptions of gangrene in general, as dry, moist, etc., says, "when death of a part takes place rapidly, the vessels still contain blood and the usual fluids, and the mortified parts are moist and soft. When, on the other hand, the death is slower, there is usually a deficiency of the supply of blood; the vessels become empty and the part hardens and withers." There is this distinctive difference between the diabetic and the senile gangrenes according to my observation. The former rarely or never present the clear-cut line of demarcation between the dead and living parts that is characteristic of the latter. This fact, with a want of the decided dryness and shrivelling of the senile variety, should suggest the diabetic form, but in any case the urine should be examined.

I have this interesting observation to make about one patient:

a lady, aged ninety-three years, who did not have gangrene. This past summer she was in more than usual good health. I know positively she had no diabetes until shortly before her death; not only from the want of rational symptoms, but also from recent examining of the urine. I went with her to Newport in June, and left her there. In passing through Newport in the latter part of July, I saw her; she was perfectly well, and her delight was to drive twice a day. I was at Bar Harbor in August, and received a telegram asking me to come at once to see her at Newport. She was dead before I arrived, and I learned from Dr. Cleveland, of New York, who attended her, that she was sick but eight days, and had developed an *acute* diabetes, which rapidly proved fatal. I had no hesitation in saying, that had she survived the first fierceness of the attack, she would have had to contend with gangrene. The opinion was given, not because of her age, but because of the diabetes.

Sugar in the urine has been developed by falls upon the head, and also in certain forms of apoplexies, but I have just made a, to me, most interesting observation. I wish to know if any of you have made one like it, for I find none such reported.

In January, 1885, a wealthy gentleman, a long-time patient of mine, of most vigorous constitution, then seventy-six years of age, had an apoplectic seizure, from which he reacted, and finally settled down into a chronic semi-paralytic. On the 9th of this November, 1888, in the evening, I was suddenly summoned to see him by his son-in-law, a physician. He was comatose, face very much flushed, temperature 103°, pulse 120, and had Cheyne-Stokes respiration. There was no increase of paralysis of the extremities. Basic effusion was diagnosed. Under treatment he improved, and was very much better by morning.

His urine during his sickness had been repeatedly examined, and, with the

exception, at times, of slight traces of albumin, there was nothing abnormal. On my morning visit, mindful of the symptoms of the night before, I proposed an immediate examination of the urine. This was done, and decided sugar reactions were produced by fresh Fehling solution.

Here was auto-physiology. Temporary pressure upon, and disturbance of the respiratory centres, and also pressure upon the diabetic regions of Bernard. As the effusion disappeared with the mending of the patient's condition, the sugar has gone with it, and now the tests give no traces of it. It will be interesting in this case, if the patient survives, to note both as to sugar and as to gangrene.

I had written thus about this case, when I had occasion to make another note. I saw the patient daily for four or five days, when it looked as though matters were about to resume their old course, and I made the next appointment for two days ahead. But on the 15th I was summoned again. The patient was in deep coma, breathing 60 per minute, pulse 150. *The urine gave sugar reactions more decided than before.* Respiration could be stopped by reflex at once—that is, by any peripheral irritation about the mouth or thorax. This would occur on an attempt to give liquids, then after a few automatic adjustments, the breathing would go on as rapidly as before. Within two hours death took place. There was no filling of the bronchi with mucus. The patient simply stopped breathing. Pressure on the pneumogastric centres was profound. It was a quick and permanent application of the air-brakes.

In practice we all have our puzzling cases. Some we clear up during the life of the patient, while others die, and, it may be, not until long afterward does the knowledge come to us of what probably was the matter. Some similar case, or some reading or discourse may give us light. I recall one such case in the direction of the present paper. A distinguished, wealthy lawyer was attacked with an obscure disease. It was rapidly fatal. Dr. James Darrach was the physician, and I was sent for in consultation. It is not necessary to give the details. I cannot remember whether the urine was examined; certainly, I think, not for sugar. Symptoms of sepsis were marked, and among the incidents there was enormous swelling of the abdominal walls, both anteriorly and laterally. I made free and deep incisions into the flanks, and from the cellular tissue mephitic gases and fluids, like those that flow from moist gangrenes, came in abundance. I think, in the light of what has been developed in my researches, that that patient died from an acute attack of diabetic gangrene.

There was no consumption, or even a suggestion of it, in *any* diabetic of whatever kind that I have seen, except the one I vaguely remember, which I have already spoken of as being in the hospital when I was resident. I now submit, from what we have heard, whether among all the gangrenes mentioned in books and indexes, viz., traumatic, hospital, senile, symmetrical, spontaneous, puerperal, visceral, infantile, congenital, cutaneous, mephitic, spreading, ex-

anæmic, arterial, static, dry, wet, moist, humid, white, etc., the much-neglected diabetic gangrene should not be included? We have seen that *diabetic* gangrene makes, with good reason, higher pathological claims to notice than most of the kinds above given.

It is rash to make assertions. I, however, will say I should not be surprised to find, after thorough investigation, that in *numbers*, in civil practice, diabetic gangrenes would be found to hold the second place, traumatic gangrenes, including those from frost-bite, burns, and scalds, only exceeding them.

A few remarks upon the proximate and remote causes of diabetes which also have a bearing upon the production of gangrene. We have seen that diabetes is no disease of the poor in general. Drs. Tyson, Morton, and Darrach will give you some interesting facts about this.[1] I also have a good instance to add, illustrating the enchantment of distance even in science. Last Sunday I was speaking with Prof. Penrose on this matter of the poor and the rich, when he said, "And yet I don't know, Hunt; you remember the cases that used to be in the hospital when we were residents, and the work done in studying them under Drs. Wood and Pepper?" I remembered all that, but did not remember the number of cases. I kept my own counsel, and next day I went for the record. The number of diabetics, as such, that were admitted into the hospital during Dr. Penrose's residency, 1851–53, two years, were just *three;* so, in the lapse of time, much work over a few cases is translated into the same work distributed over many cases.

From 1842 to 1888 inclusive, a period of forty-seven years, *fifty-nine* cases of diabetes were admitted into the hospital, an average of 1.28 cases per year. From 1842 to 1848 there was not a case; from 1858 to 1869 there was not a case, and in the first part of this time the Pennsylvania Hospital was practically the only hospital in our city for the respectable poor to go for treatment. Thus, from the wealthy and middle classes of this community, I have brought to light more than twice as many cases of diabetes, most of them recent, as have been treated in the Pennsylvania Hospital for fifty years.

[1] In the discussion which followed this paper Dr. Tyson said: "In regard to the infrequency of diabetes among the poor no better proof could be given than the fact that in the Philadelphia Hospital, in which more than a thousand patients are present at one time, it will often be impossible for weeks to get a case for lecture." Dr. Morton also stated: "An inquiry recently made of the superintendents of our State hospitals for the insane shows that although more than twenty thousand patients belonging to the indigent class have been under the care of the present medical officers of these hospitals, there has not, it seems, been a single case of diabetic gangrene in the institutions at Harrisburg, Dixmont, Danville, Norristown, or Warren." Dr. James Darrach said: "Dr. Hunt has mentioned that diabetes is a disease of the well-to-do, and referred to the rarity of the disease in hospital patients and among the poor. This would appear to be corroborated by the statement of Dr. Jordas, who states that in an aggregate of 22,735 admissions into, I think, four hospitals in Lisbon, there was not one case of diabetes; and of 5700 deaths in 1862, four only were from this cause."

Diabetes seems, in its affinities, to be more nearly allied to gout than to phthisis. One of Dr. Cheston's gangrene patients was a man over six feet high, weighing 250 pounds. He was a waiter in a private family, and surrounded with all the accessories of wealth. I could not establish that excess in the use of wine or strong drink had much, if anything, to do with the production of diabetes. A diabetic drunkard is rare; I have never seen one. I think, however, that over-feeding plays a much more important part as a proximate cause. Aside from the boulimia that is often an accompaniment of the disease, it will be found that most diabetics are over-eaters in habit. I know that most of my patients were, to say the least, good feeders, and some of them excessive ones, and one was noted in this way. Well-to-do people, in times of peace and plenty, eat too much. The laboring classes may eat as much in quantity, but they work it off. Excess in food clogs, excess in drink crazes; so the former habit has the advantage in morals, but which kills most is a question.

I shall only glance at the theories of diabetes. Faults of the nervous, vascular, and visceral systems have been, respectively by some, and *all* together by others, considered to be at the bottom of the trouble. I incline to deranged vaso-motor effects (stasis or paralysis of the vessels, with or without atheroma or arterial sclerosis) as most explanatory. What better fact could we wish to sustain this position than the influence of the disease on virility, a condition almost absolutely dependent upon normal vaso-motor function? Men with diabetes are mostly impotent; Marchal says, always so. He gives some strange cases of marital infelicities, such as unfortunate charges of infidelity by wives against their husbands, when really the poor fellows were helpless diabetics. One of these is described as a veritable athlete, and he was an example of the fact that in this disease great and peculiar strength in one direction may for a time coexist with great and peculiar weakness in another.

The knowledge of diabetes is ancient, and, in looking over the old records I thought that I might stumble on one of diabetic gangrene, but in this I was disappointed.[1]

[1] Coincident with the reading of the proof of this paper, I received (December 6, 1888) a copy of the Berliner klinische Wochenschrift, No. 47, November 19, 1888. It contains the first part of an article by Dr. Max Schüller, of Berlin, called "Ein Beitrag zur Kenntnisse der phlegmonösen und gangränösen Processe bei Diabetes." The author also intimates that gangrene, etc., is more than a mere coincidence in diabetes. He says: "While many cases of glycosuria, as, for example, those following experimental researches upon and injuries of the central nervous system, have found an essential clearing up, the relation between pus formations, furuncle, carbuncle, gangrenous process, and glycosuria is still quite dark. The view that these cases are essentially only complications of an unrecognized diabetes has still its adherents. I now have nothing new to offer as explanatory, and will consider this part of the subject no further."