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Thesis

on

Diabetes Mellitus

by

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History of a Case of Diabetes Mellitus.

Until recently the pathology of diabetes was but very imperfectly understood, and its symptoms & accompanying phenomena were therefore sought to be explained by various theories. There is still much about it to be cleared up, while it is classed among the incurable diseases, and there is still plenty scope for theory and speculation as to the real nature of this important disorder. But with physiology & pathology advancing with such rapid strides, what is as yet dark & dim may, ~~xx xxxxxx~~ at no distant date, be expected to be made clear, & one disease more removed from the list of irremediable to be added to that of curable diseases.

I am induced to make the following case of diabetes which came under my observation, the preface to my thesis as it was thought at the time to be very interesting as well as instructive.

Mrs D— at 46, a housekeeper in a gentleman's family in the North, was admitted into Gray's Hospital, Elgin, towards the end of last summer, suffering from an attack of diabetes Mellitus. She was a large stout-made woman, & looked much older than the age given. her hair having been for several years perfectly white. Her attention was first drawn to the state of her health a few weeks before admission.

— from her excessive thirst, & voiding large quantities of urine. On admission she presented all the usual symptoms of a diabetic attack, passing from 8 to 9 pints of urine in the day, of the specific gravity 1·045, & when tested for sugar it gave the characteristic reactions. Her appetite was not very ravenous, but her thirst was extreme & her skin of a dry sallow appearance. She was, moreover afflicted with a most intolerable itching about the vulva & the orifice of the urethra, which had a red irritable appearance. She was put on an animal diet, with an allowance of the vegetables usually recommended. Gluten bread was procured for her, & for drink she was allowed 8 or 10 oz. of lime water in the day. She had also XV grs of pepsine before meals. Opium was likewise given, but in her case, it only had the effect of making her more thirsty, & her mouth more parched during the night. To subdue the itching of the genital organs, a lotion composed of hydrocyanic acid & oil was applied, & with great relief to the patient. This treatment was persisted in for some short time, with the effect of reducing the sp. gr. of the urine only to 1·040. Cod liver oil was administered but from its nauseating effects could not be persevered with. Carbonate of Ammonia & the other alkaline carbonates were substituted for the lime waters, but

without any beneficial result. Thus with an animal diet, lean calf (the gluten bread having become destarched) the vegetables usually allowed, grs. XV of pepsine before meals, together with the alkaline carbonates, varied sometimes with Soda water, for drink, the lowest point to which the urine could be brought in Sp. gr. was 1·036. Going at that time upon Bernard's theory that sugar was a natural secretion of the liver, & that in this case there was more elaborated than could be decomposed by the oxygen in the lungs, chlorate of potass was given in place of the alkaline carbonates, as it was conjectured that this salt from its containing such a large proportion of oxygen, might have the effect of oxygenating to a certain extent the surplus sugar. In prescribing it, this was the theory adopted, as there was no indication of pulmonary disease, that might be supposed to interfere with the Elimination of the sugar. Whether it is to be explained on these grounds or not, it certainly had the effect of reducing the Sp. gr. of the urine to 1·030. That this was not a mere coincidence is proved from the fact that it was given at the same time to another diabetic patient in the hospital, & with a like result, reducing the Specific gravity of the urine in his case from 1·038 to 1·029. This salt dissolved in variable quantities of

water
according to the taste of the patient was administered for a short time, commencing with one drachm, & gradually increasing the dose to two or three drachms per diem. During the time the chlorate of potass was exhibited, the average specific gravity of the urine was 1'032. the thirst was much less, & the appetite was not nearly so keen, and the irritation about the genitals disappeared in a great measure. At length, however, the sp. gr. of the urine rose to 1'034, sometimes less, but seldom more, & the salt at last becoming positively distasteful & the patient, its use was suspended. There was another curious feature in this case. Towards the end of autumn, a large phlegmonous abscess commenced to form in the groin. During the time it was in progress & suppurating, the urine was found to be as low as 1'020 in Sp. gr. and during the whole of this time — about a month altogether, the patient might have been said to be quite well, experiencing little or no thirst & passing about the normal quantity of urine in the day. There was still, however, a very perceptible trace of sugar in the urine, which, being also examined from time to time under the microscope, was found to be crowded with oxalate of lime crystals. It may be asked, how were the crystals of oxalate of lime present in such abundance, there being at the same time very little sugar in the urine? Did they take the place of, or were formed from

the sugar, as we know, that in the oxalic diathesis, oxalate of lime is held to be developed from the malassimilation of the saccharine elements of the food? Or again was there any absorption of purulent matter from this large unhealthy phlegmonous boil, which might be supposed to act as a ferment, transforming or decomposing the sugar in the circulation. That it was one of these phlegmonous abscesses that sometimes accompany this peculiar disorder, there was little doubt, but it was held that the almost entire absence of sugar from the urine was somehow or other connected with the presence of this boil, & that a temporary cure was effected. It may be that this was a case of what writers call "intermittent diabetes" & that the presence of the abscess was a mere coincidence during this intermission. At any rate it was assumed that the great improvement in the condition of the patient, depended on the absorption of purulent matter, which acting as a ferment decomposed the sugar in the system. A seton was therefore inserted over each kidney of the other patient in the hospital, with the idea that the absorption of pus might be effected from the thus artificially produced suppurating surface. This patient, however, was in such a weak & reduced condition, that without any urgent or prominent symptoms, he could

on the fourth day after its insertion, no doubt from the irritation caused by the presence of the foreign bodies, as diabetic patients are very intolerant of any surgical interference. This arises probably from their vital powers being so much lowered by the disease, & they are therefore unable to stand any shock to the system.

In the other patient, so soon as the abscess showed any indications of healing, the urine commenced to rise pari passu in specific gravity, so that by the time it was completely healed, it stood at 1·040.

Entertaining the notion, that, as sugar was formed by the liver, & that it was destined according to Bernard for immediate destruction in the lungs, either the secretion was in excess, & could not be altogether got rid of by this process, or that the secretion being normal the lungs themselves were at fault & could not dispose of all the sugar which was brought to them, attention was now directed to these organs, to ascertain, if possible, whether anything abnormal could be made out respecting them. The lungs as I have mentioned above were healthy, & presenting no signs of tubercular deposit, but the liver by percussion & palpation was found to be enlarged somewhat beyond the normal limit, and the patient complained of a dis-

apreciable feeling "of lightness & drawing up" in the right hypochondriac region. She had also been very subject to attacks of what she called "biliousness" previous to the diabetes declaring itself. I would here remark that diabetic patients have in several instances, whatever may be the reason of it, been subject to this said "biliousness" before the commencement of the disease; atleast I have observed that in the cases recorded this biliary disorder is often mentioned in the previous history of the patient. There is obviously some previous derangement of the hepatic functions, & that this has something to do with the developement of the disease, is probable, but to this I will refer more fully hereafter. Long before she had any apparent symptom of diabetes, she was afflicted with great irritation of the External genital Organs, accompanied with itching of the skin. We may connect this cutaneous affection with the derangement of the hepatic functions referred to above, & when we consider the sympathy that exists between the skin & the liver under the influence of an Elevated temperature, we may possibly find an Explanation of this in the fact that the patient in the discharge of her duty, had to superintend the Culinary Operations of the family, in whose service she was, whereby she

she would be necessarily exposed to great external warmth.

Taking the hint from Professor Dick of Edinburgh, who cures all his diabetic horses by means of iodine (Edin. Med. Journal, Nov. 1858) this substance was now tried, as from its known action on the liver, & in accordance with the Bernardian theory, reasonable hopes were entertained that its use might be attended with some benefit to the patient. The form in which it was administered was the Tinct. Iodin. Com. of the London Pharmacopoeia, commencing with the dose of 10 drops & gradually increasing it to 30 drops three times a day. This tincture continued to be taken for about three weeks without producing any symptoms of iodism whatever though taken in such large doses. Upon the whole there was an improvement in the condition of the patient; - the urine fell about four degrees in Sp. Gr., & she expressed herself as feeling more comfortable. Her thirst was certainly not nearly so great, & the urine passed was less in quantity.

I am unable to say what effect the iodine might have ultimately produced, if its use had been continued long enough, as at this time the patient went for change of air to an adjoining County & was therefore beyond my observation.

For this reason the iodine was dropped for fear of producing any untoward constitutional effect.

There are several points of interest in this case. There was the very marked improvement in all the symptoms from the use of the Chlorate of potass, which, it was presumed oxygenated to a certain extent the excess of sugar in the circulation. There was also an almost complete return to health, so far as the diabetes was concerned, on the formation of a phlegmonous abscess in the groin, with the specific gr. of the urine down to 1'020, & an immense deposit of oxalate of lime crystals. That the remission depended on any effect produced by the abscess may be considered doubtful, Still so long as the suppuration was going on, the patient was very well, & as soon as there was indications of healing up, there was a gradual return of all the former symptoms, with the almost entire disappearance of the oxalate of lime & the Sp. gr. of the urine mounting up to 1'040.

In considering the pathology of this disease there are many difficulties to be encountered, arising from the fact that the proper physiological functions of the liver are not as yet fully ascertained, believing as I do, that ~~the seat of the disease~~ lies in

this man, & that ~~xx x xxxx~~ a more extended knowledge of these functions will ultimately lead to the true pathology of diabetes mellitus.

The splendid discovery of Bernard that sugar was formed by the liver, & that it was destined for immediate destruction in the lungs, was a great step in advance, by giving us a glimpse into the probable nature of diabetes viz:- that the sugar was formed in excess, & not being eliminated by the lungs, was then carried into the circulation, acting powerfully as a diuretic, & carrying with it the principles of life, leading to emaciation and death. Further researches, however, into the glucogenic function of the liver, have tended to overturn this theory, which was simple & ingenious enough, but which suggested to us nothing practical in the way of treatment, except this, that give we animal, saccharine, or vegetable food still sugar continues to be formed in excess (though in different quantities in each case) & that being unacquainted with the particular process, whereby it was eliminated by the lungs, we could do very little to assist them in their destructive operations.

Researches recently instituted by Dr Pavy (Guy's Hospital Reports, 1858) so to show that the healthy liver during life does not secrete sugar, & that the sugar which had hitherto been found in the liver & the right side of the heart was merely a post-mortem change of the natural secretion of the liver, & this liver material he calls hepatine. ~~This substance~~ is not formed for the purpose of being converted into sugar of which only the merest trace is found in the right side of the heart during life. The facts & experiments which he brings forward in support of his statements clearly demonstrate that a glucogenic function cannot be assigned to the liver, & consequently that the theory which supposes that the lungs in diabetes fail to eliminate the sugar formed by this organ, can no longer be tenable, as representing a state of things which does not & cannot exist.

~~In attempting to explain the pathology of diabetes~~ in conformity with the more fully ascertained functions of the liver, some other theory must be advanced, which supposes that, owing to some abnormal condition of the hepatic organ, as well as of the blood, this hepatine undergoes a saccharine transformation. This may be some sugar,

it is true, formed from the food during digestion, as according to Bernard, the gastric & pancreatic fluids possess the power of converting starch into grape sugar. If we feed a healthy man on animal food to the exclusion of all starchy substances, as in the experiments of Mr. McGigor, no sugar will be found in the contents of the stomach during digestion but if we subject a diabetic patient to the same treatment, cutting off every source, wherely sugar or any substance capable of being converted into the same, might be conveyed into the stomach, & then examine its contents when in a state of digestion, sugar will be found. From this arose the theory that diabetic sugar was formed through faulty digestion of the food. But the presence of sugar under this condition, can, I think be explained from the fact that the whole system in diabetes is saturated with sugar — there is sugar in the urine, in the blood, in the saliva & the faeces, & the secretion of the stomach may, therefore be reasonably supposed to share in the general impregnation, so that the gastric fluid will contain it, remember, its every source is cut off as before.

I incline to the opinion that diabetes is a disease which will be found to occur much more frequently amongst the higher classes of society or amongst those who like them over-feed themselves & are given to bodily indolence, than amongst the lower class. We do not often find cases of diabetes in a public hospital, or among the poor. If it be any proof of this opinion, I may state that all the cases of diabetes which came under my notice during the last eighteen months belonged to the former class. They were four in number, one was an inmate in very easy circumstances, the other three were servants in families belonging to the higher ranks of life, where from their being in rather elevated positions in the same, we may suppose that their work was light, & their food was heavy.

Excess in the kind & quantity of the ingesta may favor the developement of the disease.

Starting with the facts, that, as clearly shown by the Experiments of Dr Pavy, whenever the hepatic comes in contact with the blood, or the living tissue, or even the saliva, it is immediately converted into sugar (the slight trace of sugar which is normally found in the right side of the heart, being probably due to a little transudation of the living material into the

circulation) & also that particular kinds of food affect not only the quantity of the hepatine in the liver, but also most materially the size of the organ itself, we may venture to propose the following theories as affording a possible explanation regarding the emotion of diabetic patients —

1. The quality of the ingesta may operate in producing diabetes. Vegetable diet alone is found by Dr Pavy's Experiments to increase the size of the liver & the quantity of hepatine secreted, in relative proportions, & to twice the extent as when a purely animal diet is given. When mixed with sugar, an animal diet produces nearly the same changes in the liver, as when a purely vegetable diet is given. It is reasonable to infer that the same changes which are found to occur in the lower animals, will be also produced in the human subject, & that as a result of these changes in the emotion of the liver, a state favorable for the development of diabetes will be present, so long as the liver is increased in size & the hepatine in quantity. Moreover a saccharine state of the urine was observed in several dogs, that were fed on a mixture of animal food with sugar, showing

clearly that the quality of the food led to an abnormal condition of the liver, whereby the presence of sugar was determined in the urine. In fact, the kind of diet is mentioned by some authors, as being one of the causes of diabetes - thus Dr. Camplin, relating his own experience of the disease (reprint from the Medico-Chirurgical Transactions) states that before it commenced he was "bilious", & in consequence was much given to "rice, fruit &c". He also refers to other two diabetic patients, who had been "great bread eaters". It is more than probable, therefore, that what may be called the too carbonaceous quality of the food will under certain conditions give rise to diabetes. Now what may these conditions be? Under the influence of too amylaceous & saccharine a diet, we have the liver abnormally enlarged, secreting hepatine & biliary matter in proportion to its increase - increased size corresponding to increased function, in short it is in a state of plethora and chronic congestion. In diabetes, says M. Gubler "it is almost always hyperæmic and enlarged", (Brit. Med. Journ. Nov-1858). As a result of this hyperæmia & congestion, we can conceive that ~~there~~ an escape ~~escape~~ of the hepatine from the hepatic cells (which are actively secreting, & are distended with this material)

into the blood may be occasioned, by which it is at once converted into sugar. "Compression of the liver, as in violent "struggling, will naturally tend to occasion an escape of the "the contents of the hepatic cells into the circulation. Again "during obstruction of the breathing, the right side of the "heart becomes gorged with blood, & the whole venous system "congested. By the retardation in the flow of the blood & "the distension to which the liver is submitted, "there is produced an intimate admixture between the "contents of the liver cells ~~& blood~~ & blood vessels. A transu= "dation of liver material into the blood will immediately "occasion the presence of sugar" (Guy's Hospital Reports) Or the liver may be regarded as in a state of disordered nutrition, much short, of course, of the true inflam= matory process, wherein it may be supposed, (if not contrary to the rules of all true pathology) that a degree of serous transudation from the capillaries will be produced, leading to "an intimate admixture between the contents of the liver cells & blood vessels". In either case sugar will be formed, probably by a chemical transformation. The liver by a vital action selects & attracts the saccharine elements of the food, assimilating them as hepatine, which again by a process of deoxidation, it is presumed is converted into fat. That it is through the agency of the bile, that

this deoxidation is effected, is more than likely.
Thus sugar is formed from starch, hepatine to a great extent from sugar, & fat from hepatine. Hepatine from its facility of being converted into sugar must be very similar to the latter body in its composition. As bearing somewhat on this point, I may here digress a little, & take notice of what Dr Carpie mentions (in his Pract. & Physic) as "a curious circumstance" serving "to show the connection between albuminous & saccharine secretion". Dr Bostock had laid past during the winter season "a quantity of diabetic extract, granular, & half-crystallized, not dissimilar to fine brown sugar". It "was left enveloped in several folds of paper in a damp room". On examining it at the end of the winter season, "this extract was much diminished in size, had lost all appearance of sugar, was of a viscid consistence like half-melted glue, & had acquired a musty smell". "Dr Bostock ascertained that it was no longer saccharine, but was converted into a substance like coagulated albumen". Dr Carpie is much puzzled in regard to this so called conversion of sugar into albumen, & discover whence came the nitrogen of the albumen, but on the principle that a little leaven leaveneth the whole, he supposes that

sufficient to effect the metamorphosis
a little urea had been left behind in the Extract.
I think it very probable that this was an instance of the
reconversion of sugar into hepatine, from which it
had been formed; especially as the physical properties
of the transformed substance agree pretty closely with
those ascribed to hepatine in an impure state by Dr
Pavy. Besides, as according to Bernard, hepatine is
void of nitrogen, all speculation regarding its probable
source is unnecessary.

Cold, ✱-drinking cold fluids when the body is in a
state of heat & perspiring, or a fit of intemperance
are mentioned by authors as exciting causes of diabetes.
There may operate as direct exciting causes, promoting
a hyperplasia of Congestion in the liver, already pre-
disposed to it's being affected in this manner, from
its emotion caused by the quality of the injesta.
whereby an increase of the hepatine & the
blood will be occasioned.

2. The quantity combined with the quality of the
injesta may give rise to the emotion favorable
for the development of diabetes.

Dr Pavy is of opinion that the quantity of the food does
not to any significant Extent occasion an increase
in the size of the liver, or the hepatine present;

The time allowed to determine this point & his experiments on the lower animals was probably not sufficiently long. At any rate, it may, I think not only be shown that the quantity together with the quality of the food will affect the state of the liver in another way, but also that an increase in its size may not be a necessary condition for the production of diabetes. A full luxurious mode of living along with an inactive state of the body, will & overstimulation of the liver, tend to occasion an increase in its size. "Should the food be too abundant, & too rich in azotized matter, this amounts to a deficiency of oxygen" (Gregory - Organic Chemistry) Again "when oxygen is deficient, combustible matter accumulates in the blood beyond the due proportion, & the liver is called on to work beyond its powers in secreting bile & forming fat, & hepatic disease ensues, as we see in hot climates where people indulge in full feeding, & the respiration is languid." (Gregory). Thus we will have a corresponding pathologic condition of the liver from excess in kind & quantity of the food, as, from accumulation of effete matter in the blood, consequent on the deficient supply of oxygen, its' function will be increased, & increased function leads to increased size. The quality of the food too, i.e. containing a large proportion of azotized

or saccharine elements, will assist in bringing about this condition.

The liver being thus predisposed to take on a diabetic action so to speak, we may have this result actually produced on the application of any exciting cause, as cold, or intemperance. Enlargement & congestion of the liver will, therefore depend, on a faulty state of the secondary as well as the primary digestion. The causes leading to this result may possibly take longer time in their operation, than those having for their origin the bad quality of the ingesta (?).

It is allowable to go farther than this, & hold that the conversion of hepatine into sugar depends upon a somewhat different pathological condition of the liver, when overstimulated in disposing of an excess of effete matter in the blood, than that which I have described.

That the bile plays a most important part in the conversion of hepatine into fat, is as I have already said, most probable.

Now when effete matter accumulates in the blood, & the liver is unnaturally stimulated in getting rid of the same it is reasonable to infer that the organ is in a state of depraved nutrition, that its biliary secretion is vitiated & in consequence fails to bring about

the change whereby the hepatine is assimilated as fat, & that the hepatine entering the circulation unchanged at once becomes sugar. We can therefore see how it may be that an increase in the size of the liver is not so much a necessary condition for the development of diabetes, as that, from it's being a blood disease sooner or later, the bile being an excrement as well as a secretion is surcharged with effete matter whereby there is a subversion of it's fat forming function. There may be a diabetic as well as an oxalic or uric acid diathesis, whereby a predisposition to it had existed before the exciting causes came into operation. If this may be so, it can be seen, how in some instances it has been known to be hereditary or attacks members of the same family. A probable explanation may also be thus afforded of the connection that is sometimes found to subsist between diabetes & gout or calculus, by also referring this last complication to an abnormal state of the secondary digestion superinduced by the habits of the individual. What I mean is this – gout for the most part occurs amongst the overfed & plethoric, in fact amongst the same class of persons, who, I have supposed are most commonly afflicted with diabetes – As Dr Watson says (Pract of Physic) "in the London

hospitals it is not very uncommon for us to meet with gout, but then it is in persons who have lived fully & inactively, in the servants of wealthy families for instance, butlers, coachmen footmen" (I may here take the liberty of mentioning that of the four cases of diabetes which came under my notice one was a butler, the other a coachmen in "wealthy families") "men who often live more luxuriously & more idly a great deal than their masters".

In gout there is in the blood a redundancy of effete matter, which cannot be got rid of by the Emunctories of the body. The great Emunctory the liver, by which the products of the secondary assimilative process are to a great extent Excreted, is badly employed, its biliary function therefore apt to be deranged. "There is a manifest derangement of the hepatic secretion" the functions of digestion, & hepatic & urinary secretion are much deranged + + + — these hypochondriac regions, especially the right, are the seat of a sort of painful tension & uneasiness" Copland (Pract of Physic)

The affinities between diabetes gout & Calculus are probably thus also explained. "Should the food be too abundant & too rich in Laxigenous

matter this amounts to a deficiency of oxygen; & if at the same time there be a deficiency of alkali, necessary to promote the oxidation of the effete matter in the blood, we have the uric acid diathesis, or with a little more oxygen the oxalic acid diathesis" (Gregory)

According to the theories which have been broached regarding the nature of diabetes, I may venture to divide it into two varieties, depending on causes somewhat different ~~cases~~.

1. Diabetes may be a result of the quality ~~of~~ ~~the quantity~~ of the ingesta, which being too amylaceous or saccharine in kind will tend to occasion an increase in the size of the liver & quantity of its hepatine. This plethoric & hyperaemic condition of the liver is liable to be attended with a transudation of the contents of the hepatic cells into the blood, by which the hepatine is at once converted into sugar.

2. Diabetes may be the effect in those who are over fed & luxurious in their mode of living, or in those whose hepatic functions are deranged from some other cause, of an abnormal state of the biliary secretion, which either acts directly as a ferment & converts the hepatine into sugar, or fails to bring about

& assimilation as fat.

This view of the matter may receive some confirmation from the fact that there are some cases of diabetes much more under our control than others. Some are wonderfully improved, may even be cured, & restricting ~~the~~ patient to an animal diet, & cutting off all those sources of the amylaceous & saccharine constituents of the food, which lead to those changes in the liver, whereby, as I have endeavoured to describe, a diabetic emotion is produced. Others again, are almost totally unaffected by any course of treatment we may adopt, running their course unchecked either by dietetic or medicinal means; - & here we may refer to the second variety - in which the fault lying partly in the primary & partly in the secondary digestion, more nervous cannot be supposed to have the same speedy impression. If the Chemistry of the liver were better understood than it is at present, it might even be shown that the disease might be aggravated by a nitrogenous diet, & that, as has been lately proposed, some benefit might be derived from a mixed ~~diet~~ amylaceous or saccharine diet.

4th Connections with other diseases are

remarkable & most suspicious. Thus Dr Johnston mentions its conjunction with hooping Cough, under the name of "pertussal Glucosuria" (Lancet Nov 12 1838) He bases his explanation of this occurrence on the Experiments of Bernard who "shows that sugar can be produced at any time in the urine of any animal by slight continued irritation of the medulla oblongata" From this he runs to the conclusion that it is [redacted] "the irritation & not inflammation of the medulla oblongata" the most regular post-mortem appearance in hooping cough (according to Dr Copland) which is the cause of the saccharine urine. But leaves a most important particular in these words "the results show that sugar is not present in the first stage, but makes its appearance in the second or spasmodic" stage. This fact will explain the complication in a different, & shrewdly conceive, a much more probable manner. The "irritation & not inflammation of the medulla oblongata" may certainly give rise to the second or spasmodic stage through the laryngeal branches of the pneumogastric nerve, but then this same second spasmodic stage will also, I apprehend, by its affecting the condition of the liver, give rise to the saccharine urine,—

— In the severe paroxysms of hooping cough there is great disturbance of the respiration, the patient struggling for breath & "the air passes in a slow & niggardly manner towards the lungs, through the chink of the glottis, which is spasmodically narrowed" & "during the fits the transmission of blood through the lungs is obstructed" (Watson, Pract. of Physic).
From the lungs being thus compressed & the struggling & the blood being thus obstructed in the lungs thereby producing Mechanical congestion in the liver, we will have, in the manner I have endeavoured to explain, a saccharine state of the urine. Dr. Pavy proves this directly by an experiment on a dog, which had been half-asphyxiated by muffling its nose, & as a result of this sugar was found in the circulation to a considerable extent. This explanation is removed all the more likely from Dr. Johnston mentioning a little further on that he found a saccharine state of the urine in a hysterical patient, who suffered from "a severe spasmodic cough", but the important fact is stated that "after any attack of this kind, her urine shows a larger quantity of sugar than when she is perfectly quiet". We can hardly suppose, that

there was any "irritation if not inflammation of the Medulla oblongata" to account for the saccharine urine in this case of pure hysteria. It may even be suspected that sugar, if looked for, might not unfrequently be found in the urine of those hysterical patients who mingle themselves in a spasmodic barking cough.

The complications which I have alluded to confirm the notion that there are two Orders of diabetes, as they can be referred to the first variety, in which from congestion of the liver there is an escape of the hepatine into the blood. In these when the cause is removed the saccharine state of the urine no longer exists. In hooping cough, we dont Expect to find sugar in the urine when the patient gets well. Phthisis is another complication of diabetes. "It is certain that the greater majority of diabetic patients die phthisical" (Bennett - Prin + Pract of Med). The occurrence of both in the same individual may in some instances be regarded as a coincidence, - as when diabetes attacks a patient originally predisposed to phthisis. In other cases the pulmonary complication may be a result of a diabetic attack.

diabetes by its transforming, & throwing out of the system as sugar, the fatty constituents of the food which should go to nourish & build up the economy places the patient in a position, the most favorable for the development of phthisis "The blood contains a deficiency of nutritive materials, in tubercular Exudation" (Bennett, op. cit.) This deficiency of nutritive materials, I have encountered to show is occasioned by the hepatic not being converted into fat. "Phthisis pulmonalis is a very common complication of diabetes in persons under 30, a circumstance which appears to me to support the pathological views formerly given, as to the great importance which should be attached to derangement of the nutritive functions, as a cause of tubercular disease" (Bennett, op. cit). Truly may it be said of diabetes, especially when conjoined with phthisis, — the lamp of life burns out for want of oil.

The relation of the nervous system to this disease is by no means to be lost sight of. A proper healthy condition of the innervation of the liver is essential to the due performance of its vital functions.

If we irritate the eighth pair of nerves at their origin in the fourth ventricle, we have, according to Bernard a saccharine state of the urine produced; but he also asserts that a like result follows on the functions of the brain being destroyed by a violent blow on the head, & also after the administration of woorali poison. However "he found that when the respiratory function is violently stimulated, sugar appears in the urine" (quoted from Bennett (Pro. & Pract of Med) He was led to conclude from his observations on the diabetes artificially produced by irritating the eighth pair of nerves, & by violently stimulating the respiration "that the nervous action necessary for the secretion of sugar, does not originate in the brain, but transmitted directly along the pneumogastrics, but indirectly & by reflex action; the vagi being incident nerves, the medulla oblongata the centre, & the spinal cord, communicating with the solar ganglia, the excito-motor channel" (Op Cit). He also supposes that the lungs [redacted] when violently stimulated act by reflex action on the liver, & the liver again on the kidneys to produce saccharine urine.
Though it would be presumption on my part to criticise the researches and opinions of such an authority

as Bernard, still it is due borne in mind that these conclusions respecting the influence of the nervous system in producing artificial diabetes, were based, to a great extent on the theory that sugar was a natural & normal secretion of the liver during life, & that any stimulus, therefore, acting indirectly through the nervous system might be supposed to increase this function, & hence the sugar in the urine. I must therefore venture to differ from him as to his conclusions respecting the production of artificial diabetes, as I humbly conceive that the pathological conditions observed will admit of a different interpretation in accordance with the views formerly given. Violent blows on the head, whereby the cerebral functions are destroyed, tend to kill by coma. So does the woorali. In a state of coma, there is slow stertorous breathing, the blood tends to stagnate in the capillaries of the lungs from deficient aeration, & as a consequence of this obstruction, the right side of the heart is gorged with blood, & venous congestion is caused by this retardation in the flow of the blood in the liver, & the congestion to which its vessels are subjected, an escape of the hepatic into the circulation

will be occasioned, & hence the presence of sugar in the ~~blood~~. Violent disturbance of the respiration by interfering with the proper aeration of the blood in the lungs will also give rise to the same condition ~~[illegible]~~. If it be true that irritation applied to the trunk or origin of a nerve is felt at its extremities, & that irritation of the roots of the pneumogastric in the floor of the fourth ventricle will give rise to violent & spasmodic respiratory actions, at least through its laryngeal branches, & also to violent struggling on the part of the subject operated on, then the diabetic condition so produced, will admit ~~of~~ of the same explanation as given above, without ascribing it to an indirect reflex influence.

The exhibition of Chloroform or Ether may give rise to a saccharine state of the blood in the same manner, by their disturbing the function of the brain & lungs.

Regarding the treatment of diabetes, the indications to be fulfilled, are not so easily carried out in practice. In those cases where we can learn that the kind of food has had anything to do with the production of the disease, great benefit is to be expected from restricting the patient to an animal diet. In these recent

cases, when the patient is as yet strong & not reduced in flesh some advantage may be derived from the Exhibition of iodine, which along with the shutting off of all saccharine substances or any substance capable of being converted into sugar, will tend to diminish the size of the liver & lessen the secretion of hepatine. The bran cake for bread, & for drink the alkaline carbonates or the chlorate of potass may be given. And specially in those cases where we can suppose that the disease is a result in part of a faulty state of the secondary digestion, are they indicated, so as to oxidize the effete matter of the blood. Iron is also indicated from the drain on the system producing such languor & debility, & a diminution in the red Corpuscles. A preparation of iron - the Liq. Ferri Permitrat. might be found to be useful, from its being not only a tonic, but also a powerful astringent, tending to check the diuresis. Opium besides ~~[illegible]~~ "diminishing the nervous irritability of the patient" will also restrain the excessive action of the kidneys. Cod liver oil, from the great efficiency of nutritious materials is most particularly indicated. The quantity of animal food allowed, should

be carefully regulated according to the digestive powers of the patient, & should contain a good proportion of fat. By diluting it with some vegetables, such as cabbage, spinach &c, which contain but little saccharine matter, the tendency to increase the effete matter of the blood will be avoided. Large draughts of water are very irritating & not necessary to quench the thirst, as a small quantity of lemon, especially if tepid will have the same effect.

Equal parts of milk & lime water is not only an agreeable beverage, but stables the stomach better than simple water.

By adopting more or less of these measures, we will sometimes succeed in placing the patient in a sort of neutral ground, where, if he takes proper care of himself, as to diet & avoiding every source of danger, such as cold, intemperance &c we may hope to retain.

In conclusion I beg to say that I have had to write my essay in a very hurried manner. Had I taken more time in the writing of it, I might possibly have clearer put the views regarding the pathology of diabetes in a clearer light, but I trust that I have made myself understood as to what I mean.