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OBSERVATIONS ON AN UNUSUAL
CASE OF GLYCOSURIA.

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Thesis submitted for the degree
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I. INTRODUCTION.

Text books usually divide the disease into Acute and Chronic. The Acute cases generally occur in children and young adults, the emaciation being marked and the course rapid.

The Chronic cases usually occur in persons who develop the disease after the 40th. year and in middle aged and elderly obese individuals. Then there are described mild and severe cases. According to Naunyn if the glucose disappears whilst the patient is on a non-carbohydrate diet the case belongs to the former type. If on the other hand he continues to excrete glucose the case is a severe one, for it means that sugar is being produced from the body proteins. Further, text books describe the fat or lipogenous diabetes (*diabète gras*) and the emaciated cases (*diabète maigre*). Langerhans believed the latter were caused by lesions of the pancreas. Exogenous and endogenous cases are also described. The former embrace the cases in which there is some external exciting cause. The latter according to Strumpell and others include those in which there is no apparent external aetiological factor or any evident organic lesion, but in which the disease is thought to be due to some developmental abnormality.

There are also described neurotic cases due to injuries or functional disorders of the nervous system.

According to Fletcher⁽¹⁾ there is no fundamental difference between these cases and no satisfactory classification of these is possible.

The case described later is undoubtedly an unusual one and difficult to fit in with any of the above groups.

Although the disease is usually accompanied by a certain group of symptoms which especially characterize it, yet these may for a long time be in abeyance and may even never become a prominent feature. The case of the writer affords an example of this, the glycosuria being first brought to light at an examination for life insurance.

Cases have been described where the first symptom was a failure of vision and the disease has been first diagnosed by an ophthalmic surgeon. Sometimes the earliest symptom to attract attention may be a localized pruritus and in others furunculosis, and neuralgia are the primary causes of a visit to a medical man. In the present thesis the writer after a discussion of glycosuria in general gives an account of his own case which presents certain unusual features, and also the results of a series of clinical trials showing the variations in the sugar excretion under the influence of varying drugs and diet.

II. PHYSIOLOGICAL CONSIDERATIONS REGARDING DIABETES.

The pathological conditions underlying Diabetes have been the subject of long investigation but much remains to be done on the subject before our knowledge can even approach completeness.

The most obvious sign of a diabetic condition is the occurrence of sugar in the urine which can be detected by ordinary clinical methods. We know now that the sugar present is glucose. Other sugars have been observed, such as milk sugar which occurs in the urine of nursing mothers, laevulose, pentoses and other rarer forms of sugar in certain abnormal pathological conditions.

Glycosuria is the inward and visible sign of abnormal changes occurring within the body, the urine being merely the channel by means of which the excess of sugar is eliminated.

The disease however is essentially a disorder of metabolism and as the liver is the organ which is mainly concerned in carbohydrate metabolism, it is to this organ that our attention must be first directed.

Claude Bernard discovered that sugar could be obtained from the liver of animals even when from the absence of succrine and starchy matter in the food, none could have been brought directly to it from the stomach or intestines. He subsequently discovered that if the liver is washed free from all its sugar immediately after death, it again contains

sugar after the lapse of a few hours. He explained this on the hypothesis that the liver contains a store of material which is readily convertible into sugar and this theory was proved to be correct by the later discovery in the liver of a substance allied to starch and now called glycogen.

Although the greatest amount of glycogen is produced by the liver upon a diet of starch and sugar Pavy afterwards conclusively proved that a certain quantity of it is also produced upon a purely protein diet, the glycogen being formed no doubt by the protoplasmic activity of the liver cells. There are two chief theories as to the destiny of the liver glycogen. It is held by some that the glycogen is converted during life by the agency of a ferment into sugar and that this leaves the liver by the hepatic veins and is thus distributed for use by the tissues. Others again maintain that this glycogen is transformed into substances other than sugar.

The former view is that formulated by Claude Bernard and is adopted by the majority of physiologists, the latter being the view held by Pavy and his adherents.

As in many cases of diabetes the condition may be removed by abstention from carbohydrate food, it appears probable that in this relation Pavy's is the more correct explanation. There are however other cases in which the

diet makes little difference and in these the sugar must arise from the metabolism of the protein constituents of protoplasm. The term diabetes no doubt includes many pathological conditions which all possess in common the symptom of excess of sugar in the blood and therefore in the urine. If foreign sugars such as cane-sugar or milk sugar are injected into the blood they are simply cast out again as foreign bodies by the kidneys and are not assimilated. The only other sugars which increase the hepatic glycogen are those that belong to the glucose or monosaccharide family, notable among these next to dextrose being laevulose. Laevulose has the same empirical formula as dextrose but the arrangement of the atoms in its molecules is different, hence the liver cells are capable of doing what is so difficult in the laboratory i.e. twisting the groups of atoms into the dextrose position and so enabling the formation of the condensed product glycogen to occur.

It cannot be doubted that a common cause of diabetes is a disturbance of this glycogenic function. Pavy denies that the post mortem formation of sugar from glycogen, which occurs in an excised liver is a true picture of what occurs during life, but maintains that it is due to a ferment which is formed only after death. During life he regards the glycogen as a source mainly of fat and partly of protein. It certainly is a fact that increase of

carbohydrate food leads to a formation of fat within the body and in the liver cells and in support of the theory that glycogen may also contribute to the formation of proteins he was the first to show that many proteins contain a carbohydrate radical.

At the present day the prevalent opinion among physiologists is of a compromise between the two extreme views. The liver is held to be the great store-house for sugar. Normally the carbohydrates of the food after being split up by the ferments in the intestines into simpler compounds pass into the liver chiefly in the form of glucose and are stored up there as glycogen. Only a small portion such as laevulose, galactose, maltose and dextrin pass into the liver as such and they represent the remnants which have escaped the fermentative action of the intestines, their fate being similar to that of grape-sugar. The entire vascular system beyond the liver is thus protected from an excess of sugar. The glycogen leaves the liver very slowly and gradually in the form of glucose and is partly used up immediately by the tissues and partly stored up by the muscles and glands in the form of glycogen, ready for use later and partly may be transformed into fat. It is only when this glycogenic function of the liver is disturbed that the condition of hyperglycaemia or excess of sugar in the blood occurs with its resultant glycosuria.

The liver is no doubt able to convert part of its

glycogen into fat, but most if not all of it leaves the liver as glucose. In coming to the latter conclusion physiologists are influenced by what they learn from surviving organs generally. An excised organ is undoubtedly on the road to death but while it retains vitality the phenomena it exhibits are similar in kind to, though they may differ in degree from those which it exhibits during life. It is impossible to suppose that at a given moment called "death" an organ can turn round and do what it never did before. Even in the case of blood coagulation which appears to be a direct instance to the contrary, there is no doubt from recent research that the blood is always tending to clot even during life and is prevented from doing so by the production of anti-substances (anti-thrombin produced in the liver) which neutralise the activity of the thrombin or fibrin ferment.

Diabetes can be produced experimentally in animals - Claude Bernard was the first to show that puncture at the tip of the calamus scriptorius in the fourth ventricle of animals is followed by a glycosuria which persists for several hours. At the end of this period the liver contains no glycogen whilst that present in the muscles is greatly reduced in amount. If before making the puncture the liver has been freed from glycogen by starving the animal or by ligaturing the bile ducts, glycosuria does not occur, showing that excitation of that portion of the brain, resulted in a stimulus to the liver to give up its glycogen.

Glycosuria in men is frequently associated with traumatic neuroses, acute brain diseases, meningitis, neuristhenia and with mania and paralysis. Amongst even the earliest workers the opinion prevailed that disease of the pancreas played an important part in the aetiology of diabetes. Among these Ferriehs and Lancereux may be mentioned. The experimental investigations of Von Mering and Minkowski however proved beyond doubt that this was so. These two observers showed that by total extirpation of this organ they were able to produce a severe and fatal diabetes in which the symptoms and course resembled in every way that of the spontaneous form met with in man. If only 20% of the organ was left only a slight diabetes resulted and if over 20% of the gland substance was allowed to remain diabetes was not induced.

The discoverers of pancreatic diabetes therefore concluded that the pancreas produced a kind of secretion. When the pancreas was removed the blood was deprived of this secretion, which loss so affected tissue metabolism that diabetes supervened.

Many poisons also produce diabetes, especially may be mentioned phloridzin. Unlike other poisons that cause temporary glycosuria, phloridzin brings about a most intense form of it. It is glucoside but the quantity of sugar passed in the urine is quite out of proportion to the amount of sugar present in the drug. A derivative

of this drug called phloretin which is free from sugar produced the same results. The action of these poisons is probably on the Kidneys which under their influence are able to abstract sugar from the blood.

III. ETIOLOGY & SYMPTOMS OF DIABETES MELLITUS & GLYCOSURIA.

True diabetes mellitus may be described as a chronic disease usually having a very incipient origin and of a steadily progressing nature, in which certain well marked symptoms are met with giving the disease a clinical picture of which the diagnosis is comparatively easy. The earliest sign of this malady in almost every case is an indescribable feeling of lack ~~of~~^{of} energy and fatigue accompanied by the passage of more urine than usual. These facts dawn on the patient gradually. Very often it is the fulness of the bladder wakening him up at night to be relieved that first draws his attention. Soon this state of things gets worse and he finds that he is getting thinner or else his attention is drawn to this change in his appearance by relatives or friends. Along with this loss of flesh his appetite does not get any weaker, on the contrary he finds that he is always ready to eat a very good meal whilst at the same time he also drinks a good deal of fluid, not only at meals, but also between them. He soon notices that he is becoming more thirsty and finds himself taking copious draughts of water &c. not only during the day but also during the night, when he is compelled to get out of bed to micturate. Later this thirst gains further ground and the polyuria increases. He will now seem to be constantly in want of fluids to quench his thirst and yet he continues parched and dry and thirsty. The tongue becomes red and

glossy and the mouth dry and clammy whilst a fringe of dry mucus forms about the lips. In spite of eating as much and what he likes and drinking as often as he is inclined he feels a gnawing at the stomach. His whole system seems parched up and accompanying this his bowels are constipated. The skin becomes dry and harsh, especially the palms of the hands and the soles of his feet. His face now looks shrunken and drawn whilst the expression is anxious and careworn. He loses all sense of sexual desire though this may return with care and judicious treatment. The whole vitality of the system is very low and he may become subject to boils and carbuncles or else develop a most persistent and aggravating form of eczema or other skin eruption. In the female it is quite common for advice to be sought owing to the distressing pruritus vulvae present, which no doubt takes its origin from the irritation produced by the fermentation of the sugar in the urine in this situation. Other patients complain of pains in the hips and legs and chilliness of the extremities whilst it is not unusual for cataract to form in the lenses of the eye and the ophthalmic surgeon may be the first to recognise the true origin of the disease. The eyes often become sore and weak. They lose their bright expression. Amblyopia may develop and atrophy of the optic nerve is sometimes met with. Dyspnoea is often very trying to the patient and he is frequently the victim of a distressing

sense of constriction in the praecordia. . The pulse varies but with the advance of the disease it becomes weak and irregular. The temperature in most cases is subnormal, reaching as low as 96°F. It is usually when the patient has developed the above symptoms and finds himself in failing health that he resorts to his medical adviser who from the history that he elicits and the examination of the urine soon diagnoses the condition. The urine in this complaint has usually a high specific gravity, ranging from 1025 to 1060, its colour is light amber and it froths easily when shaken. It is said to be sweetish in taste and smells somewhat like honey. On analysis the kind of sugar present is found to be grape-sugar or glucose.

The patient may live in this condition for a long time with careful dieting and treatment and finally die of some intercurrent disease but in a great many cases he succumbs to pneumonia, phthisis or diabetic coma. Certainly quite a large percentage of diabetic patients die from coma.

The above forms a pretty clear train of symptoms which one can hardly mistake for any other disease but a great many cases are met with, where the patient is enjoying the best of health and perhaps only becomes, like the writer, only aware of his condition on being examined for life insurance. Such a state of things is of daily occurrence. But if the condition met with is carefully gone into it will be found that all cases of Glycosuria

are not truly diabetic in origin. In these cases there is usually, only a moderate quantity of sugar in the urine and the term diabetes is often given to this glycosuria irrespective of the fact that the sugar may not be grape-sugar.

IV. DIAGNOSIS AND PROGNOSIS.

Two forms of glycosuria should be distinguished - that in which glucose is present and others in which rarer forms of sugar are apparent. Even if this distinction is made the presence of glucose in the urine does not necessarily mean that the case is one of true diabetes, in spite of the fact that some authorities, notably V. Noorden, take a very pessimistic view of all such abnormalities, and almost insist that if untreated these are bound sooner or later to develop into the typical disease. It is a well known fact that a great many healthy individuals pass traces of sugar in the urine.

Sugar in the urine may be produced by a great many conditions. In the first place excess of sugar in the urine may arise when a condition known as hyperglycaemia or excess of sugar in the blood is present. The amount normally present in the blood is .085 to .09% and if this is exceeded the kidneys, from some cause, probably an increased permeability, throw off this excess and it is found in the urine. This state of things may truly be termed kidney diabetes and in order to be certain that the kidneys are at fault it becomes necessary to prove that either there is an absence of the hyperglycaemic condition or that the sugar excretion is independent of the intake of carbohydrate food.

It is well known that if large quantities of sugar

are given to healthy people a state is reached finally, varying naturally in different persons, when sugar will be found in the urine. Hofmeister⁽²⁾ has shown that in each individual there is a point of maximum assimilation of sugar and if this point is overreached, no more sugar is assimilated and it passes out in the urine. The glycosuria observed in such cases is never very marked - the amount of sugar rarely exceeding 2%. These cases have been called Alimentary Glycosuria.

It has also been found that the amount of sugar excreted varies with the prevailing temperature, being more abundant in hot weather and less so in cold weather whereas in diabetes proper this is not found to be the case. Not a few cases of glycosuria are to be found in persons of a neurotic disposition. Neurasthenics often pass sugar whilst cases are recorded of traumatic neurosis and spinal cord disease in which glycosuria is present. Such is also found to be the case when patients are the subjects of hysteria, delirium tremens, hemiplegia, insanity &c.

Besides these, toxic agencies are known to give rise to glycosuria. A large number of poisons are able to bring about this condition. Of these may be mentioned certain chemical poisons. Pavy⁽³⁾ brought about Glycosuria in dogs by administering phosphoric acid. Goltz⁽⁴⁾ produced the same condition in guinea-pigs by giving them lactic acid whilst Richter⁽⁵⁾ caused it by using hydrochloric acid.

Then again coal gas has been reported to have caused
(6) glycosuria and so has carbon monoxide when inhaled.

Luzzato records cases of glycosuria after large doses of opium and morphine.

Chloroform too causes the production of a reducing substance in the urine which in the majority of cases consists of glycuronic acid, whilst Bendix(7) recorded a case of true glycosuria after chloroform.

Ether too has produced glycosuria, as also acetone, amyl nitrite, curare, strychnine, atropine and copaiba balsam.

Gleissner(8) has recently shown that glycosuria may be due to thermal causes. He records a case of attempted suicide, by jumping into cold water, when the urine first passed after the immersion contained albumen and sugar. Many bacterial poisons may also give rise to glycosuria. It is held by many that several of the infective diseases are responsible for this condition.

Heintz(9) has described a cholera glycosuria, whilst transient glycosuria after malaria, typhoid, measles, scarlatina, influenza and whooping cough have also been reported. Glycosuria is well known in cases of syphilis. It may also occur after hunger, in the aged and the obese. of the latter fully 10% of the cases are glycosurics.

In another group of cases the origin of this malady is to be sought for in some functional disturbance

of the organs of the body. Claude Bernard's experiment by medullary puncture may here be cited. Numerous cases may be brought forward where glycosuria occurs in cerebral and spinal conditions. Cerebral haemorrhage, cerebral tumours, multiple sclerosis, tabes, spondylitis &c. Among diseases of other organs, which produce glycosuria, may be mentioned thyroid and suprarenal disease. It may here be mentioned that the administration of adrenalin for a lengthened period will cause glycosuria. But the most important organs in the body that are known to give rise to glycosuria, are the liver and the pancreas. In a large majority of cases of glycosuria, the pancreas is found to be diseased and at other times functional disturbance of this organ gives rise to transient glycosuria. The liver has been found cirrhotic in many instances. Functional derangement of this organ has also led to the presence of sugar in the urine. A case of glycosuria has been reported after an attack of gall stone colic. It must not be forgotten that other sugars besides glucose may occur in the urine and if this is not recognised in the analysis a faulty diagnosis may very easily be made. Among these sugars it is not uncommon to find laevulose or fruit sugar present. Schlesinger⁽¹⁰⁾ records a case in which a patient passed on an average 2.7 grammes of laevulose per diem and Bruning⁽¹¹⁾ reported laevulosuria in a number of cases of cirrhosis of the liver. The etiology of laevulosuria

as well as its significance is clouded in obscurity. It is assumed by some to be due to a special peculiarity of metabolism whereby, although the largest quantities of the different carbohydrates, are all well tolerated yet laevulose itself and its precursors cannot be properly assimilated.

Lactose⁽¹²⁾ is another sugar which is commonly met with in the urine of nursing mothers. These women are also known to pass grape-sugar when the latter is given in excess.

Salkowski⁽¹³⁾ and Jastrowitz discovered that pentose is occasionally present in urine giving rise to pentosuria. This substance reduces cupric salts, does not ferment and is optically inactive. It is clinically a racemic arabinose. Pentosuria may be excreted in fairly large quantities over a considerable time and may easily be taken for diabetes. The diagnosis of this condition however may be made by the absence of the fermentation test and also by the Orcin test which consists in adding a solution of Orcin in hydrochloric acid 30% and then a few drops of Liq-Ferri, a green colour is observed in presence of pentose.

In forming a diagnosis of diabetes it is therefore essential that the greatest care be exercised to determine the character of the sugar present. This sugar as we have seen is glucose or grape sugar. None of the other

sugars that are met with in urine give rise to diabetes, so that it behoves the physician to make sure it is glucose and no other. In order to do this with absolute certainty certain fallacies in the tests employed in the detection of grape sugar must first be had in mind. Before drawing a definite conclusion that the case is one of true diabetes from the urine it must be remembered that the history of the case must show that sugar is present "daily for months and years" (14). If the history is not known the urine must be tested frequently for the presence of grape sugar.

The tests most commonly used are the following, Fehling's Test, Trommer's Test, Picric Acid Test, Phenyl Hydrazine test and the Fermentation test. With the first two tests certain fallacies must not be lost sight of. Fehling's test consists of Copper Sulphate Grs $90\frac{1}{2}$, neutral lactate of potassium grs. 364, solution of caustic potash $\overline{3\text{iv}}$ and distilled water to $\overline{3\text{vi}}$. This test is carried out by boiling a drachm of the reagent in a test tube and then adding a small quantity of the urine. If sugar is present then yellow suboxide of copper is precipitated.

Trommer's Test consists in boiling a drachm of urine in a test-tube to which a few drops of sulphate of copper solution are added and then as much liquor potassae as urine. The presence of copper is indicated if the yellow or orange red suboxide of copper is precipitated. Certain fallacies are to be noted when performing both

these tests. Several drugs for instance, chloral, chloroform, phenacetine, morphia &c. cause the urine to contain glycuronic acid which reduces copper.

If albumen is present it should be removed, before proceeding to the sugar test. Excess of uric acid, creatinine and hippuric acid also reduce copper and their presence must be obviated by testing the urine first. If still in doubt as to the nature of the sugar present, the picric acid test may be employed. This test consists in adding to one inch of urine in a test-tube, about $\frac{1}{4}$ inch of a saturated solution of picric acid and a few drops of caustic potash and heating the mixture. If sugar is present in the urine the solution becomes dark red, owing to the reduction of picric acid into picramic acid. The Phenyl Hydrazine test is also a very reliable one. For this purpose put $\frac{1}{2}$ an inch of phenyl hydrazine hydrochloride and about $\frac{1}{2}$ an inch of powdered sodium acetate in a test tube and then half fill it with the urine. Boil this for two minutes and set it aside to cool. If sugar is present crystals of phenyl glucosazone arranged in stars or fans will be seen under the lower power of the microscope.

To settle the question beyond doubt the fermentation test should be tried. To carry out this test the urine must be acid and all air should be expelled by boiling it for ten minutes. Shake up some urine with a small piece of German yeast and then place this urine in a test tube and invert it over mercury, care being taken to exclude any air

bubbles. Set this aside in a warm corner and examine after a few hours, when, if sugar is present gas will be seen at the top of the tube. A control tube of normal urine with a little yeast should be tested at the same time to be sure that the yeast gave off no gas.

PROGNOSIS. In true diabetes it is rare for the cases to be cured. Transient glycosuria as well as intermittent forms met with in stout overfeeders or in persons who have undergone a severe mental strain are very amenable to treatment. Age has a great deal to do with the longevity of these cases. Young children rarely live long whilst even among those under forty years of age the prognosis, to say the least, is not a good one. After forty the disease is not so serious.

The chief factor in forming a prognosis depends on the facility with which the sugar present in the urine can be eradicated and for how long a time. If this can be done easily and for lengthened periods life may be considerably prolonged by judicious dieting and treatment. Those cases with the persistent presence of much sugar in spite of treatment usually succumb in a few years.

V. TREATMENT OF DIABETES MELLITUS AND GLYCOSURIA.

In treating patients suffering from glycosuria it must not be forgotten that all cases of glycosuria are not necessarily diabetic. Not only this but care must be taken to be sure that the sugar present is glucose and not one of the other sugars. It has been pointed out that some patients are the subject of laevulosuria, others of pentosuria, whilst in another group a drink of beer is followed by the passage of sugar, owing to a peculiar condition in these individuals of being unable to assimilate maltose although the other varieties of carbohydrates are easily tolerated and finally the urine of nursing mothers has been shown to contain lactose. In not a few too sugar is passed through the mere excess of carbohydrates consumed in the food.

The history of every case must be carefully inquired into as regards the consumption of carbohydrates and sugar in excess and a careful series of analyses of the urine should be carried out before treatment is begun. When the true nature of the sugar has been determined steps can then be taken on definite lines. If the sugar is not glucose and the cause of it can be unravelled, the removal of the same will be all that is required, but if grape-sugar is present all are agreed that if possible it must be suppressed or at least reduced to a minimum for the safety of the patient.

No single line of treatment can be laid down to suit

every patient. Each case should be considered on its own merits and treated accordingly. In every instance however it is the opinion of every authority that dietetic measures should at first be given a careful and studied trial. After the results of this mode of treatment have been considered, other measures may be required to remove any traces of the sugar that may still be excreted and recourse may be had to certain drugs whose action has long been known to lead to a diminution of the amount of sugar.

Seeing that most authorities regard the presence of grape-sugar in every case as a forerunner of true diabetes it would be as well to err on the safe side and treat all such cases as likely to end so.

It not unfrequently happens that some families show a certain predisposition to diabetes from heredity whilst some individuals occasionally pass sugar in the urine through indulging in food too rich in sugar. In both these cases the wisest course to adopt is to limit the intake of carbohydrates to a minimum. If this is done it will soon be found that the system suffers no ill effects from the restricted diet and not only is this the case but it is found that in proportion as they abstain from carbohydrates their powers of toleration for these are increased, whilst on the other hand the continued use of carbohydrates leads to a weakening of these powers ^{and} of lowering of the vitality.

Briefly then the above may be said to be as far as prophylaxis will go in the treatment of glycosuria but as this does not do more than prevent to a certain extent the continuance of the malady certain dietetic principles must be thoroughly mastered if we are to prevent true diabetes resulting.

In the first place all that can be done to free the urine from sugar and keep it free must be the goal aimed at. This glycosuric state once attained must be maintained for some lengthened period during which the power for tolerating carbohydrates will increase greatly. Unless this is done the severity of the glycosuria will gradually increase and the tolerating powers for carbohydrates will get weakened more and more, until a state is reached when in spite of treatment the case rapidly merges into diabetes proper. In every case therefore the first thing to be done is to find out what the tolerating powers of the patient for carbohydrates are. In order to do this perhaps as good a method as any is that adopted by Von Noorden⁽¹⁶⁾ and almost universally practised in Germany. For this purpose he gives the patient what he calls a "Test" diet such as the following, in which it will be noticed that a certain amount of carbohydrates form a portion of two meals.

VON NOORDEN'S STANDARD TEST DIET.

BREAKFAST. 200 grammes tea or coffee with one or two
tablespoonfuls of cream.
100 " hot or cold meat (weighed after cooking)
and butter.
or
2 eggs with bacon.
50 grammes white bread.

LUNCH. 2 eggs cooked as desired but without flour.
or
200-250 grammes meat, fish, venison or fowl
weighed after cooking.
Vegetables such as spinach, cabbage, cauliflower,
or asparagus, prepared with broth, butter
or other fat, eggs or thick sour cream.
20 to 25 grammes creamy cheese. (Cammembert, Brie &
Brie, &c.) and butter.
2 glasses of light white or red wine if desired.
1 small cup of coffee with 1 or 2 tablespoon-
fuls of cream.
50 grammes white bread.

DINNER. Clear meat soup, with eggs or green vegetable
in it.
One or two meat dishes as at lunch.
Vegetables as at lunch.
Salad, lettuce, cucumber or tomatoes.
Wine.
No bread.

Drinks during the day (exclusive of wine) one to two
bottles of aerated water.

The urine, excreted every 24 hours is collected, that of the day and night separately, and is examined quantitatively for sugar. It is also examined for acetone, oxybutyric acid, ammonia and nitrogen. If now no sugar is excreted, the amount of bread is gradually increased until sugar does appear in the urine, the diet otherwise remaining unchanged. He is kept on this diet for a certain length of time till the amount of sugar passed remains constant and then the quantity of bread is gradually reduced systematically, time being allowed at each stage of the reduction of bread for the amount of sugar passed to be constant. If the urine becomes free from sugar when still a certain amount of bread is taken the case is classed as a slight form of glycosuria.

This method allows of an easy way of estimating the tolerating powers for carbohydrate and as may be expected these powers vary in different individuals. Every case therefore must be studied carefully, and the tolerating powers duly noted.

Should the urine however only become aglycosuric when bread is entirely excluded from the dietary the case is looked upon as one of moderate severity.

In a third group of patients the sugar only disappears when the diet is further restricted by a reduction of protein substances. These are termed severe cases. A further group is also met with in which the urine cannot be made aglycosuric under any dietary.

Once the influence of the food on glycosuria has been ascertained as well as its effect on acetonuria and the general health, other therapeutic measures may be tried such as the influence of rest and muscular exercise. Here again it will be found that some patients can tolerate more carbohydrate food when taking plenty of exercise whilst others excrete more sugar and are injuriously affected.

Then again it will be found that some can tolerate one form of carbohydrate better than another. Some assimilate potatoes better than bread. Others can take more starchy food in the evening than in the morning. These idiosyncrasies must all be duly recorded for the patients benefit. The influence of certain medicines, alcoholic drinks and of mineral drinks as well as of mineral waters upon the most important constituents of the diabetic urine or on the general health should also be noted for reference.

It is only by this careful method that a satisfactory basis for treatment can be arrived at and the danger of treating diabetics on hard and fast lines avoided.

The physician is now armed with sufficient data to prescribe a definite line of treatment to suit each case. In all slight cases the patient should first of all be made to undergo a period during which the diet contains no carbohydrate. This period should cover a fortnight or three weeks. He is then put on a diet in which the carbohydrates are gradually increased in amount, every allowance

being now made for peculiarities observed before. In every case however care must be exercised that the amount of carbohydrate increase is always below the limit of assimilation, for on no account must this be exceeded or sugar will reappear. The severest stress must be laid on the injunction that on no account must the patient allow any sugar to be passed in his urine in the future. This is of the utmost importance and in fact the only way to protect patients from the dangers of diabetes and if possible to eradicate the diabetic disposition.

Besides regulating the diet for each patient, it is as well to instruct him to go on a strict diabetic diet every now and again, and during such intervals he should be given plenty of fatty foods or else he very often gets weaker and thinner.

Greater difficulty however is met with in the diabetic treatment of severe cases of glycosuria, but much can be done to alleviate the condition. In all such patients the period of restricted diet must be prolonged, great attention being directed to the protein as well as to the carbohydrate constituents of the food. The amount of meat allowed should be restricted to 200 grammes per day though the quantity of eggs and vegetables need not be so limited as they do not affect the sugar contents of the urine to any great degree.

During the period of restricted diet V. Noorden

arranges what he calls "green" or vegetable days. For two or three days the patients are put on a protein fare reduced to its minimum. As the possibility of certain dangers such as acetone bodies being produced in abundance during these green days is not remote, abundance of alkali should now be ordered.

It is essential in all cases where restricted dieting is practised for weeks for carefully exact observations to be made in the daily analysis for acetone bodies. After it has once been established how the patient's health reacts to these restrictions, he may if he returns home from hospital be instructed to undergo shorter periods of restricted diet at home. At the end of this period of restricted dieting, 80 to 100 grammes of bread or other carbohydrate are allowed, preference of course being given to that form of carbohydrate that had been best tolerated. The protein allowed now should be permanently low and not more than 15 grammes of nitrogen should appear in the urine. Every now and again the patient should undergo a period of green days, say once or twice a year, due care being then taken to guard against acetonuria.

There is besides this rational plan of treatment described above a form of treatment called the (16) "Oat" Cure. Von Noorden found that in some severe cases of

diabetes, if he gave the patient 200 to 250 grammes of oatmeal in the form of gruel every two hours; 200 to 300 grammes of butter and often 100 grammes of vegetable protein or eggs he was often able to cause the sugar in the urine to disappear entirely. He allowed nothing else except a little black coffee, tea, lemon-juice and a little whiskey or brandy. The patient has to submit to this diet for three or four days followed by one or two green days. He says that very often one or two courses of this kind are sufficient to arrive at the aglycosuric stage whilst the acetonuria also passed away. He advises a period of restricted dieting before the Oat cure is begun. The explanation of this phenomenon however is beyond him. He merely records the fact. It would seem as if the organism can best assimilate only one form of carbohydrate at a time and the exclusion of all other forms of carbohydrate is always required by the discoverer.

A little previous to the discovery of the "Oat" cure Mosse recommended the "potato" cure. He also advises the exclusion of all other carbohydrates during the period of potato treatment as well as the reduction of meat to a minimum.

Of the drugs used in the treatment of Diabetes, opium undoubtedly holds the premier position as a therapeutic agent. One is struck however with the host of drugs and quack medicines that have been brought into play to cure this terrible malady. By far the greater number of them however have passed into oblivion whilst only a relatively small number are to-day said to have any great effect in reducing the amount of sugar in the urine.

It is essential before the administration of drugs for the quantity of sugar and urine passed to have been recorded or the beneficial results that may follow drug treatment may not be entirely due to this but to the fact that diabetic measures may also have been ordered at the same time in order to restrict the carbohydrate intake.

If the line of diabetic treatment adopted above had been carried out then it would be quite easy to ascertain exactly what the influence of any particular drug would be on the glycosuria.

Opium is used in the form of the liquid extract and also as codeine. Of the two perhaps codeine is the less constipating. Both these forms reduce the thirst and amount of urine as well as the hunger and amount of sugar passed. The dose of opium is $\frac{1}{2}$ to 5 grains or more per day. Its action is said to be most effective when the

diet is a restricted one, especially if when carbohydrate is being taken the urine still contains traces of sugar.

In all cases the sugar content of the urine should first be reduced to a minimum before this drug is administered
(18)

but he says that "there is no object in giving this drug if carbohydrates are being taken in large quantities."

In many cases especially those bordering between slight and severe glycosuria, the energetic use of opium will often cause the disappearance of the glycosuria in the course of a few days, and for this purpose 12 to 15 centigrammes of opium may be given in 24 hours. At first this drug produces a sensation of fatigue and lassitude. The appetite is weakened for a short time but very soon these wear off and the drug can be given for weeks without unpleasant results. It is also very valuable in treating cases of alimentary glycosuria. Regarding its constipating effects it has been the experience of most physicians to prefer codein to opium and the author himself has found this to be the case. A certain amount of sluggishness of the bowel certainly was produced but the condition was easily rectified by the use of mild aperients. Osler states that codeine has not much effect unless the patient is on rigid diet whilst Saundby on the other hand
(19)
says "Codeine even when given in much larger doses than

are suggested by its principal advocate, is comparatively inert." So far as the author's experience goes, he found that the glucose rapidly diminished on a dose of $\frac{1}{4}$ grain three times a day along with a strict diet.

Next in merit to the opiate, may be placed the Salicylates. Salicylic acid, aspirin and antipyrine all act in more or less the same way. Aspirin perhaps is the least unpleasant to take. These drugs often reduce the glycosuria but they must be employed only in certain cases. The best results are obtained in mild cases where some carbohydrate food is being ingested. The dose is about 15 grains three times a day. These drugs have been found to lose their effect when given for lengthened periods. It is better to give them for a few weeks only in the year. They are unsatisfactory in severe cases. Von Noorden obtained a fair amount of success when he tried an East Indian plant (Syzygium (20) jambulanium). He made use either of the powdered (20 to 30 grammes) or the macerated fruit. The cases were similar to those in which the salicylates gave good results. Arsenic, strychnine, uranium nitrate and potassium bromide are a few of the numberless drugs that have been from time to time brought into prominence by various investigators but none of them have stood the (21) test of time. In 1866 potassium bromide was advocated

by Begbie who stated that the administration of 15 grains three times a day was followed by the entire removal of the sugar from the urine. Needless to say it was tried by others as well as by the author and found wanting. Osler only regards its use as merely "often useful" whilst Von Noorden employs it in glycosuria in Neurotics.

Certain complications of this disease require special mention. The most dangerous one is certainly diabetic coma, from which a great number die. This condition is said to be due to an acid state of the blood termed "acidosis," by Nannyn. The blood in "acidosis" is surcharged with oxybutyric and diacetic acids. The amount of acid present may be gauged to some extent by the quantity of ammonia present above what is normal i.e. .5 to 1 gram. The accumulation of these acids indicates the pressing need of alkalies to neutralise the same. The urine should therefore be constantly tested for them, a positive reaction with ferric chloride indicating the presence of these bodies. Sodium Bicarbonate is usually employed to overcome this acidity of the blood and as much as 200 grains have been given daily. Unfortunately when coma supervenes this large quantity of alkali ~~though it~~ may restore the patient to consciousness, ~~yet~~ In most cases he relapses into coma and death soon after. Ere dismissing the

treatment of diabetes mention must be made of the use of health resorts. It was for a time thought that the beneficial results of a stay at Carlsbad, Vichy, Neuenahr &c., might be equally well obtained by a course of the bottled waters from these sources at home. After extensive trials this has not been found to be the case. Diabetics undoubtedly derive a great deal of benefit by a course of waters at any of the Spas named. They usually return much invigorated and strengthened. Their tolerating powers for carbohydrates are also increased and may remain so for weeks and months after their return. These beneficial effects are no doubt due to more causes than one. The change from the daily worries of life, the outdoor exercise, change of scenery and acquaintances along with the fact that the medical men here are well trained in the treatment of such cases all contribute to bring about the good results reported by nearly all patients.

Of the other symptoms that arise in the course of diabetes the thirst perhaps is the most difficult to contend with. The employment of fluids, ice, lemon-juice &c., are practically useless. They assuage the thirst for a moment only. What must be done must aim at treating the disease as a whole by means of dieting and drugs.

The constipation that is so common may be overcome to a great extent by means of aperient mineral waters or any other aperient that does not contain saccharine matter.

Pruritus is often a very distressing symptom among female diabetics. It should be guarded against by absolute cleanliness. Daily baths should be taken and borax added to the water. The application of boric acid and starch after drying allays the condition greatly or an emollient of a greasy nature may be smeared over the part. *The author found resinol ointment very beneficial here.*

Having so far **discussed** the usual symptoms and course of diabetes mellitus and glycosuria as well as the various ways by which glycosuria can be produced we may naturally turn and ask, what after all is the true cause of diabetes? So far as the exact cause of diabetes is concerned great diversity of opinion prevails, but as has been pointed out earlier two main lines of thought are prevalent, these being the Glycogenic Theory of Claude Bernard and others, and that of Pavy.

Claude Bernard maintained certain points in his theory which are strongly opposed by Pavy. The former held that the greater part, if not the whole of the sugar ingested passed to the liver to be stored up there as glycogen. From this organ the glycogen is reconverted into glucose and is passed out into the system to be used

up by the tissues as they required it. In the tissues and glands this glucose according to him, is partly used up immediately and partly stored up again as glycogen to be called into use ~~again~~ when required. He held that the liver was the great store-house for the system and that it held all the glucose as glycogen till it was wanted by the system, when it reconverted the glycogen into glucose again, in which state it reached the blood. Further he held that this glycogenic function of the liver prevented us from having too much sugar in the blood because only a small amount left the liver at a time and that it was only when this function was disturbed that excess of sugar reached the circulation and produced glycosuria.

Pavy on the other hand says "I strongly maintain that instead of the liver being essentially a sugar forming, it is a sugar assimilating organ." Its great function in relation to sugar is to prevent this principle reaching the circulation to any material extent. (15) He says that the amount of sugar in a person's blood varies with his state of health and that the amount eliminated by the kidneys is proportionate to the amount entering the circulation. There is a great deal to be said in favour of Pavy in his contention, for, if, as Claude Bernard

maintains, sugar is constantly passing from the liver to the blood and enters the capillaries, then it is natural to expect that this blood would enter as such into the capillaries of the kidneys where as a consequence it would be excreted and we would all be diabetics.

Pavy goes on further to say that when the liver has
(15)
"its assimilative action properly exerted, so little sugar is allowed to pass into the general circulation that the quantity existing in arterial blood is insufficient for rendering the urine more appreciably saccharine than is observed in a healthy state, but when its assimilative action is not properly exerted, sugar is allowed to pass and in proportion as it does so, the urine acquires a more or less marked saccharine character." He goes on further to show that the ultimate cause of diabetes is to be sought for in the Nervous System. He points out by means of
(15)
various experiments performed that by supplying the liver with arterial blood, the amyloid contents of the liver are converted into glucose and pass out into the circulation producing the diabetic state, and that the main reason that the liver retains the amyloid substance, is due to the fact that it is par excellence the organ to be supplied by venous blood. He also showed that the arterial supply of the liver could be increased by severing the sympathetic filaments ascending from the

superior thoracic ganglion to accompany the vertebral artery and also by removal of the superior cervical ganglion. He therefore concluded from these experiments that the aetiological factor in the production of diabetes was to be found in the brain and that it was induced by paralysis of vaso-motor impulses to the liver. Besides these two theories there are some who while upholding C. Bernard's glycogenic theory yet maintain that the passage of glucose from the liver into the system is due to another cause. They attribute the origin of the disease to a morbid condition of the pancreas - an organ which is certainly very often diseased in cases of true diabetes. Among these may be mentioned V. Noorden. He maintains that owing to this organ being so often diseased in diabetes, we must search here for the true origin of this malady. In his own words he makes this assertion that this organ either "supplies to the blood a substance which has something to do with the building up or with the breaking down of glycogen. This might be a ferment which favours the act of polymerisation in the formation of glycogen or it might be an anti-ferment which prevents too rapid distention of glycogen."

Other causative factors have been frequently brought forward by various men not as the actual aetiological

agent in producing the disease but as acting in some way in helping to bring about diabetes. Only as recently as January of this year (Lancet Jan. 1910)⁽¹⁷⁾ Dr. Henry C. Drury and Dr. Finny drew attention to the occurrence of Grave's Disease being followed by diabetes and Dr. John A. Watson recalled in the same paper a case of exophthalmic goitre of very rapid course. The urine when this case was admitted into hospital was free from sugar. About the 10th day after admission sugar and diacetic acid were found in the urine. The sugar disappeared just before death but the peculiar diabetic odour of the breath still remained.

From what has already been written it will be seen that sugar in the urine is not always a pathological condition. The fact that in health, a small percentage of sugar may be detected by suitable methods, that a condition of glycosuria can be induced by the excessive consumption of carbohydrates and saccharine foods, that drugs, neurotic diseases &c., can produce this condition, would lead us to expect that a great many cases of glycosuria may only be transient in origin and that if the cause were removed the sugar would disappear with it. This certainly is the case where the glycosuria has been either induced or when the causative factor is known but when this cannot be found the question might

well be put, are there any recorded cases where sugar has constantly been passed for years without diabetes developing? If not, can a case of glycosuria persisting for over nine years and untreated at that, be called diabetes and should such a case be considered outside the range of an insurable life? After a careful survey of the opinion of experts on the subject of diabetes and glycosuria, one cannot but be struck with the pessimistic prognosis given in almost every case. Von Noorden who has treated upwards of 2500 case gives one a most gloomy outlook as to the outcome of glycosuria, maintaining almost emphatically that unless either the glycosuria is stopped or reduced to a minimum by dieting &c., the patient is sure to become a true diabetic. Pavy also takes the same view.

VI. ACCOUNT OF AUTHOR'S CASE.

The fact that persistent glycosuria has been the fate of the author led to the query above as to the length of time that would elapse before his condition would develop into diabetes proper. A brief survey of his malady will perhaps bring out more forcibly the reason why this question was asked.

In the first place it is as well to say that his parentage was a mixed one - his father being an Englishman and his mother an Anglo-Indian. For twenty years of his early life he lived in Singapore (Straits Settlements) where he was born. At this age he left the island to come to Edinburgh to study medicine. During his stay in the tropics he had one severe attack of malaria at the age of seven. Convalescence was slow but recovery was complete. He enjoyed the best of health and was not afflicted again in any other way nor did the malaria recur. At the time he left the Straits he weighed 9 st. 10 lbs., but 6 months after residing in Edinburgh he scaled 10 st. 10 lbs., and from that time to the present his weight has been more or less constant. Excepting an attack of articular rheumatism in the knees and an occasional attack of ~~low~~ - neck during the five years period of study, nothing ailed him. But for these

he enjoyed the best of health to his knowledge at any rate. He graduated in 1899 and two years later after entering the matrimonial state he had occasion to insure his life, when to his utter consternation he found his urine was loaded with sugar. Little notice was taken by him of the condition as not a single symptom of diabetes manifested itself. Polyuria has never been present, not more than 60 ounces of urine being passed during 24 hours at any time. Whenever a quantitative estimation was made not more than 55 ounces were recorded nor had he occasion to wake up during the night to relieve his bladder except occasionally after a convivial evening when perhaps an excess of beer, &c., might have been consumed. There was never any thirst present that was at all inordinate. Fatigue was never complained of. He had been in the habit of having an afternoon nap every day but to attribute this to fatigue would be fallacious because he could always enjoy an afternoon's recreation at tennis or cricket as well as anybody.

Such a state of things thus continued without any untoward symptom developing until six years more had elapsed and then during the Summer of 1906 he found himself afflicted with a very irritating scrotum. This led to scratching during sleep and an eczematous eruption broke out on each side of the thighs. This spread

through the agency of the fingers to the eyelids and face. The eruption continued more or less persistently from July when it first appeared till September when it died away altogether, and no signs of the disease made their appearance till the following June 1907. In that month the same localities were attacked, the region of the scrotum and penis being very severely involved, whilst the face was also more acutely affected. But under treatment it subsided somewhat, appearing and disappearing more or less with aggravating persistence till once again September arrived when it once more left these parts.

In May 1909 the disease broke out once more in exactly the same regions. It will be noticed that each successive year it broke out earlier though on each occasion the advent of September always saw its disappearance. During this last attack the skin of the penis was most acutely affected. The praeputial opening became quite small from contraction, whilst the edges were all cracked and weeping. By the third week in July 1909 the prepuce became so cracked and irritable that he decided to resort to circumcision, more so as micturition caused a great deal of smarting and itching. A surgeon was called in who was aware of the glycosuria and asked to operate. Knowing that diabetics are not

good patients when the knife is used, he had his doubts as to the advisability of proceeding. However, circumcision was performed quite successfully. The patient did his rounds daily for the next five days on foot, set out on his holidays to Arran at the end of that time, removed the stitches on the 6th day and found the wound perfectly healed by the 10th day. The eczema however did not quite forsake the scrotum though the thighs were less affected after the operation. As soon as September set in all the symptoms again subsided and except for a slight irritation of the eyelids no other signs of the disease have as yet put in an appearance (April 18). That the eruption was due to the fermentation of the sugar in the urine on the scrotum and thighs is scarcely to be doubted but the author at first declined to believe this owing to the eruption not breaking out more evenly over the whole body.

No doubt the reason that the disease only appears during the hottest months of the year is to be explained by the fact that during the warmer days fermentation is more rapid whilst as has been pointed out already a larger percentage of sugar is said to be passed during the hottest months of the year.

Apart from the eczematous eruption appearing periodically the patient still enjoys perfect health in every

way. For the first two years when the eczema appeared dieting was carried out to a limited extent. All forms of sugar were excluded but this in no way improved the condition. For the past 6 months all carbohydrates have been cut off and gluten bread and cream taken in place of white bread and milk but in spite of this a small percentage of sugar is still present in the urine. For the past few months the author has been endeavouring to gauge the effects not only of dieting but also of drugs, making use of codeine and aspirin chiefly. The results are given in tabular form below. From this it will be noticed that dieting alone reduced the amount of sugar considerably but not altogether whilst opium along with strict dieting practically freed the urine from sugar. Aspirin and Potassium Bromide were also tried as will be seen but the results were not so satisfactory. The specific gravity on no occasion exceeded 1020 except in one analysis when it reached 1023, whilst the amount of urine collected still averaged a little over 55 ounces. Acetone, oxybutyric and diabetic acids were sought for on each occasion that an analysis was made but on no occasion was there more than a trace of acetone present. Of the two acids named there never was any to be detected.

If we were now to consider the case after the

history given above some difficulty will be found in determining not only its etiology but also ~~its~~ its classification. As we have seen already the classification adopted is that of V. Noorden who divided cases of glycosuria into four mild, moderate, severe and extreme. The case under consideration presents certain features which come under more than one of these groups. The mild cases he speaks of include those cases in which a certain amount of carbohydrate is assimilated in the diet without the appearance of sugar in the urine whilst in the moderately severe we find a class where stricter measures must be adopted in order to get the same result. Here the amount of carbohydrates only require reduction whereas in the severe cases not only must this be done but the protein elements require diminution also. Finally in the extreme cases nothing can be done to render the urine aglycosuric. The case of the author then cannot be placed among the first or second group from the simple fact that sugar not only persists but remains in the urine when all carbohydrates are cut off. It is true that under the action of codeine the aglycosuric state was attained but as we have seen the classification was based on the fact that aglycosuria must result from dietetic measures alone. Seeing that the glycosuria

persisted in spite of these are we justified in putting the case in class three or the severe cases, for it is quite evident that in the last group the case finds no place? Of the four perhaps this would be the most suitable group to class it in and yet when the case is further analysed it will be perfectly clear that this would still be an erroneous assumption. It would only be fair if we took this stand to expect that any case termed severe would certainly if untreated, develop more or less rapidly into diabetes proper and yet here is a case with a known history of 9 years glycosuria which has been practically untreated and which has remained in the same state more or less at the end of that time. Osler himself has said, a case ought only to be called diabetes when grape-sugar is passed for "weeks, months or years" so that if we followed him we would be compelled to call the author's case one of true diabetes and place it in exactly the same position in V. Noorden's groups. To do so, would certainly imply at least that we should expect to find some of the cardinal symptoms of the disease besides the presence of grape-sugar constantly present. Again it would also be expected that a case such as this, would ere the present time at the most, ~~at have reached~~ ~~have reached~~ reached such a stage of severity as to be quite easily recognised.

After nine years, however, what do we actually find?

Except for the periodic attacks of eczema, the patient finds his health in exactly the same state as he was before he became aware of his condition, and not only is this the case but his glycosuria still answers not only to diabetic measures to a remarkable degree but also to the effects of codeine very rapidly.

Let us for a moment consider his case from a diabetic point of view and compare how far it agrees with a diagnosis of diabetes. Here we have a man of 36 years of age who has enjoyed the best of health from childhood and yet who at the age of 27 became aware that he was passing sugar in his urine. At the latter age he casually goes to have his life insured and there he is told that he is suffering from diabetes and that he should at once eradicate the sugar present in his urine or else remain an uninsurable life. Feeling some apprehension for his future he tries for a short time to remove this condition by dieting and treatment with salicylates but failing to see any change taking place he commences studying the subject more deeply in order to fathom not only its cause but also its most rational mode of treatment.

What he finds after patient study convinces him of the fact that exact etiological factor is still missing

and further that not only is there great diversity of opinion in the aetiology but also in the mode of diatetic treatment. He very soon reconciles himself to the fact that he is a glycosuria patient in whom no active steps need be taken unless other symptoms of diabetes develop. For the next few years therefore, he takes no notice of his complaint until his attention is drawn once again to the same by the occurrence of periodic attacks of eczema. His health during all this time being exceptional he is loath to think that even the eczema is due to the glycosuria. Occasionally during this period casual tests are made for sugar whenever the idea of insurance recurs and every time he finds the suboxide of copper coming down thickly. But the attacks of eczema coming on in the third year in succession compels him to pay some more attention to his diet and to have quantitative as well as qualitative tests carried out with his urine. Here again he finds himself more or less baffled to account for his condition. He takes the specific gravity on every occasion and in no instance did he find it exceed 1020 and more often than not 1015. The amount of urine passed was in direct proportion to that drunk and not more than 55 ounces were ever recorded.

Further, he did not develop thirst which is so common in diabetes, nor did he ever notice that he

required any more to drink than those around him. Hunger too never afflicted him. His daily dietary consisted of the following ever since his student days. Breakfast of a couple of eggs and a few slices of bacon or a brace of sausages, or a plate of porridge and a breakfast cup of tea along with a slice of toast. Dinner a plate of soup or broth, a chop or minced meat and potatoes and dessert - either a rice pudding or stewed fruit. Tea at 5 p.m., usually some toast and a couple of eggs or a tea-cake. Supper a cup of tea and fish or meat. His appetite was never extraordinary nor had he occasion to curb his desire for food owing to its exorbitant nature. During breakfast, tea and supper two cups of tea was nearly always the amount drunk. The above then formed the daily routine programme for meals, so that on the whole it cannot be put forward that any exceptional amount of food was consumed. If any peculiarity was to be noted it was that of having what is commonly called a sweet tooth but even here sweets were never indulged in to any degree. The tea was sweetened with the usual two lumps of sugar whilst the habit of buying sweets for private consumption was rarely practised. There never was any particular desire to eat these luxuries. With regard to alcoholic beverages whisky, brandy or gin were very occasionally drunk and

then they were preferred in lemonade, beer, however, was the chief drink taken and then not more than two tumblers, usually one sufficed. But to all intents and purposes sugar did not form any ^{great} ~~good~~ attraction. In fact off and on sugar was disallowed in the tea for months without creating any privation and now after nearly 12 months tea is preferred without it. For the last 6 months no saccharine matter has been allowed at all, but the effect has been inappreciable with regard to the general health and body weight.

So far then we find thirst, hunger and polyuria - three of the cardinal symptoms of diabetes - absent. Let us go further. Constipation, a not unusual feature in this disease, has never troubled him. Every morning he has an evacuation of the normal quantity and consistency. Occasionally like any one else a day may pass without a movement of the bowels, but on the whole the bowels have always been very regular. As to fatigue being experienced the writer can safely say he has not felt this to any marked extent. Being a general practitioner he has daily employed a bicycle on his round of two or three hours in a hilly district. The work certainly cannot be called heavy but in spite of cycling or walking when the weather was at times unfit, he never felt the weariness of limb and body on returning

home, During the summer outdoor exercise was freely indulged in, especially on the cricket field every available afternoon for an hour or two either at bowling or batting at the nets, and every Saturday the whole afternoon was spent at this pastime in cricket matches. Amongst the members of his team he has always been considered one of the fastest sprinters.

Loss of flesh forms a prominent feature in diabetes but this has never taken place with the writer. Even when the appetite did not come up to the mark for a day or two from colds or chills there was never any loss of weight to be noticed nor has the alteration to strict diabetic diet induced a change of a pound in weight.

The writer's weight to-day in his clothes is 10 st. 8 lbs.

(18)
Atrophy of the optic nerve is not of rare occurrence but the author can see now as far and as well as ever he did. Even during his University days he could see the infirmary clock and read off the time quite easily from the middle of Warrender ^{Park} ~~Pond~~ and to-day it is a common practice to read the time from the Church clock here at a distance of at least 200 yards.

(18)
In many diabetics we are told that "boils and carbuncles are extremely common", that ~~arterio~~-sclerosis and associated gangrene occur, often there is perforating ulcer of the foot, sometimes bronzing of the skin

and occasionally profuse sweating. These symptoms are all mentioned by Osler in his text book on medicine but the writer can find no evidence of any of them. As regards boils and carbuncles he can say that he cannot remember, except when quite a boy, ever having been affected with any. In fact he has always noticed that all cuts and abrasions healed very rapidly with little or no pus. So confident was he of his tissues healing so well that he entertained no fears whatever of sloughing taking place after circumcision, and this proved to be correct for the wound healed perfectly in 10 days as was mentioned earlier. The conditions of his arteries whether radial, ulnar or temporal show no tendency to arterio-sclerosis⁽¹⁸⁾ whilst morbid bronzing of the skin in any locality has never been noticed. Being of mixed extraction he has the brownish skin more of the Malayan type than otherwise.

The pulse moreover is perfectly normal. If anything the tension perhaps is a little firmer than ordinary but this is to be expected seeing that he has been more or less an athlete all his days. The rate is 72 per minute. If we turn now to the temperature we are again unable to note any difference from the normal. On no occasion when the temperature was taken was it ever found below 98.4

(18)

Impotency has also been noted in cases of diabetes but the author cannot be classed among the impotent for he had three children in four years and but for an abortion he would now be the father of five children, as it is he had four, the last coming on the scene last year. Had he married his present wife when she was 18 or thereabouts instead of 28 years of age the probability would lie in his being the father of another four or even five. And so on, we may take the rarer or the commonest symptoms present in most diabetic cases and the search would be in vain exception being taken of course to the glycosuria and the periodic attacks of summer eczema.

Having now gone more or less minutely into the symptoms present in diabetes and in the author's own case there can be very little hesitation in calling the condition he suffers from, non-diabetic-glycosuria. We cannot very well even call it alimentary glycosuria as this condition is said to be a physiological one, caused by the excessive consumption of carbohydrates and saccharine matter which produced the glycosuria. Moreover the moment the carbohydrate intake was restricted the condition passed away whereas here persistency of the glycosuria is the cardinal symptom in spite of dieting.

The diet for the past six months has been strictly

diabetic. Gluten bread and cream being taken daily in place of white bread and milk and even then the urine contained .33% of sugar.

We are therefore reduced to calling his condition non-diabetic-glycosuria and this is the author's own opinion. He is more inclined to believe that it will always remain so, if he continues judiciously in taking no risks and dieting himself on diabetic lines.

In discussing the aetiology of diabetes and glycosuria we found that the cause of these diseases was to be sought for in the liver, the nervous system or in the pancreas. Of the other casual association of disease of the thyroid, &c., being connected with author's case, no heed need be taken as none of these are present here. That his case is due to the nervous system seems to him scarcely tenable as none of the nervous symptoms are at all in evidence. Diabetic tabes, peripheral neuritis, optic atrophy, hypochondriasis, neurasthenia, traumatic neurosis, &c., are all absent. Neither can he be said to be the subject of "an extraordinary degree of restlessness or anxiety." On the contrary he is quite of an opposite disposition, being cheerful and quite Bohemian in his way and treating his condition more or less as a physiological rather than a pathological entity.

That his glycosuria is due to disease of the pancreas need not detain us long for had any organic disease been present it would have manifested itself ere this and have given rise to dyspeptic trouble and loss of appetite from the derangement that would arise by the failure to assimilate fat. The author can take fat very easily and seems to assimilate it with avidity. It is quite usual for him to take his egg and bacon on rising steeped in fat without the least discomfort then or afterwards. The course of pancreatic diabetes moreover is rapid and emaciation is very well marked whilst here the condition is very slow and no emaciation at all is present.

The liver then must be the organ in which we must find the true cause of his complaint. To this the author is more inclined than any other. In giving the history of the case the writer omitted to mention that both his parents were alcoholics and both died ere reaching 40 years of age. Of his brothers three died at ages bordering on 30, only one being now alive aged 38. In inclining to the belief that the true casual factor of his glycosuria is to be found in the liver the author is influenced by the following considerations. He comes of alcoholic parents and no doubt inherited from them a tendency to a functionally ^{defective} ~~digestive~~ hepatic

organ. The diet in Singapore consisted chiefly of rice and hot curries ~~as~~ well as other hot dishes in which cayenne in the form of chili-paste played no insignificant part. For twenty years he subsisted on the diet, which no doubt aided in further derangement of his already defective liver. Finally the fact that in early childhood he developed a severe attack of malaria must not be lost sight of. Whether this derangement of the hepatic junction is due to the action of a ferment or anti-ferment produced by the pancreas as advanced by V. Noorden or to the paralysis of the vaso-motor nerves from the liver to the brain as advocated by Pavy, the author is unable to say but he prefers to believe that neither of these theories hold good in his own case and that the true origin of his glycosuria is to be found in some functional derangement of the liver and that with care in dieting little fear need be entertained that the condition will pass into the true diabetic form of the disease.

Strict diabetic diet cream & gluten bread.	Same diet milk & gluten bread.	Same diet cream & gluten bread. codein grs $\frac{1}{2}$ three times a day.	Diabetic diet + 50 grammes white bread and aspirin 15 grains three times a day.	Same diet as last + K Br grs 15 three times a day.	Ordinary diet.
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Amount of urine in ounces	54 ozs.	55	51	54	55	58
Specific gravity	1015	1015	1020	1018	1015	1010
Amount of sugar	.33%	.44%	<i>practically</i> nil	.35%	.43%	.37%
Amount of Acetone	traces	traces	traces	slight traces	traces.	<i>very slight</i>
Oxybutyric Acid.	Nil	nil	nil	nil	nil	<i>nil</i>
Diacetic Acid	nil	nil	nil	nil	nil	<i>nil</i>
Ammonia	.146%	Not estimated	Urine spoilt	.107%	.131%	<i>not given</i>
Albumen	nil	nil	nil	nil	nil	<i>nil</i>

The above results were obtained from analyses carried out by
the Chemical Research Association Ltd London.

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