Every effort is made to retain fragments of bone at the seat of a compound fracture, as, if necrosis can be avoided, these fragments play an important part in the subsequent union of the bone. Plating a fracture is out of the question until the wound is healed, and even then must be delayed some time until the health of the patient has improved and there is less risk of operation stirring up a quiescent local septic focus. Fragments of metal in the bone are no detriment to plating so long as they are causing no irritation. In one case of non-union of a fractured radius, with the bone freely peppered with fragments of shrapnel, the bone was plated and the shrapnel left undisturbed; the result of the operation was good.

Head Injuries.

We have had sent us several most successful cases after the prompt trephining of depressed fracture of the vault of the skull, mostly caused by gunshot wound. As we get them there is a horseshoe incision in the scalp which is nearly healed, and under this can be felt the gap left by the removal of bone. These cases have no further symptoms, and require no further surgical treatment. They are fitted with an aluminium plate, held in position by elastic bands round the head, and are then discharged from the service.

Chest Wounds.

When a bullet wound of the chest is received, the patient should at once lie down, as any further exertion or movement increases the haemorrhage to a marked degree. The danger is, a man hardly knows he is hit, and goes on until forced to give up from extreme dyspnoea, due to a large haemorrhage into the pleura. Unless there are urgent symptoms, the chest should not be tapped, as septic infection easily occurs in these cases. Prolonged rest in bed, with strapping of the affected side, and potassium iodide internally, cause the effusion to absorb satisfactorily. If pus is found in the chest, then resection of a piece of rib, with a short but large tube inserted at the lowest border of the empyema, gives good results, and recovery is excellent. One typical case was a private, who had lain for four days on a stretcher, after receiving a perforating gunshot wound of the left chest. To relieve the dyspnoea an incision had been made in the intercostal space and 50 oz. of blood-stained fluid evacuated. On admission here he was dangerously ill; his heart was displaced over the right mammary region, there was an incision at the base of the left lung discharging offensive fluid, and he had a large bedsore over the sacrum. When he had sufficiently recovered, the chest was opened and drained on the above lines. The patient soon picked up, and, when last heard of, he was back with his regiment again.

Foreign Bodies.

Small fragments of metal under the skin can be removed under a local anaesthetic, but irregular pieces may be found firmly held by the subcutaneous tissues, and are difficult to extract. Deep-seated fragments causing no trouble, are, of course, left alone, and, unless very accurately localized by the x ray, are difficult to find; any attempt to grope for such a fragment is a difficult business, very likely to fail.

Conclusion.

The war has certainly altered our ideas of the transport of the sick and wounded in this district. The admirable voluntary organizations which perform these duties are worthy of every praise, and we must see to it, in peace time, that the sick and injured of civil life shall have the same prompt and efficient ambulance facilities available, such as the soldiers now have when sent to the Stoke War Hospital.

SINCE the outbreak of the war a scheme for the manufacture of aniline products on a large scale in Italy has been under consideration with the object of freeing the industry of that country from the domination of German enterprise. The *Industria Nazionale de Anilina* has now been formed at Milan with a capital of £240,000. The initiators, Senator Luigi Della Torre and Signor Aldo Venezini, have secured the co-operation of Professor Ciamician, Senator of the Kingdom of Italy.

THE NEW DIETETIC TREATMENT OF DIABETES MELLITUS.*

By P. J. CAMMIDGE, M.D.LOND.

I do not propose to deal with the practical details of Allen's method, as they are probably familiar, but shall devote my attention chiefly to the metabolic changes produced by the treatment, and its effect on different types of diabetes. The condition to which the name diabetes is applied occurs in a variety of forms with the one symptom of glycosuria in common, but differing in other respects. This variation is even more marked when the blood, urine, and faeces from a number of cases are systematically examined. During the last few years I have had the opportunity of analysing some eight thousand specimens from over five hundred cases of diabetes, including fifty-four I have treated by Allen's method. One of the most striking results has been the frequency with which indications of chronic catarrh of the upper intestinal tract were found (71 per cent.). It can hardly be assumed that the relation is accidental or that the catarrh is a secondary phenomenon, for the history shows that symptoms of indigestion have frequently preceded the discovery of sugar by several years. Cases of this description generally respond well to "alimentary rest," but they are apt to relapse unless the intestinal condition is considered in planning the subsequent treatment.

Although one can imagine that impairment of the functions of the pancreas is responsible to some extent for the imperfect carbohydrate metabolism in these cases, and that physiological rest of the gland will therefore bring about an improvement, we should not overlook the effect of starvation on the intestine itself. It may be partly a de-intoxicating process, as Guelpa supposed, but as Lombroso has shown that the intestine yields a glycolytic agent to the blood even more readily than the pancreas, it is possible that the physiological rest may influence the production of this substance and so control the glycosuria. The analogy between the diabetes produced in animals by partial extirpation of the pancreas and in the human subject is probably not as close, in this type of case at least, as some have imagined, since, on the one hand, we are dealing with a surgical mutilation of a non-progressive character, whereas on the other we have to treat a pathological state that tends to progress, and, even when checked, to recur.

It is comparatively uncommon, in my experience, to find evidence of advanced cirrhosis of the pancreas in diabetics, but signs of some interference with the digestive functions of the gland were met with in 72 per cent. of my cases. In most of them (67 per cent.) there were also indications that the functions of the liver were being imperfectly carried out, while in 27 per cent. the hepatic disturbance was more pronounced apparently than the pancreatic. It is convenient, therefore, to recognize three types: (1) the pancreatic, (2) the hepatic, and (3) the pancreo-hepatic—a classification I find of help in prognosis and treatment.

The outlook for patients with a cirrhotic pancreas is fairly good, provided a suitable diet is adopted. I have not found that they are materially benefited by starvation, and as their digestive powers for all three classes of food-stuffs are defective it is more important to ensure adequate nourishment than to worry over the traces of sugar they generally pass.

Strictly speaking, the hepatic type does not come under the heading of diabetes, for although a reducing substance is passed in the urine it is not a sugar, but an alpha-ketonic acid, to which I have given the name pseudo-laevulose, as it is laevo-rotatory, like laevulose. Pseudo-laevulose is met with in the urine of most advanced cases of diabetes, along with dextrose, especially if the diet contains much protein, and it is from protein that it is probably formed; but it also occurs alone, and may lead to an incorrect diagnosis of diabetes. To treat such cases on orthodox lines is a waste of time and may do more harm than good. A carbohydrate-free diet only makes matters worse. Although starvation will clear the urine of "sugar," the same result may be obtained, with greater comfort to the patient, by eliminating proteins from the

* Abstract of a lecture given before the Harveian Society on April 19th, 1917.

diet, or greatly reducing the intake. An abundance of green vegetables, with dextrinized starches or pure dextrose, is the best diet for a time; later other foods can be cautiously added if proteins are taken sparingly. The prognosis appears to be good, for I have several patients who have remained sugar-free and in good health for three or four years. It seems probable that some of the success of the various "carbohydrate cures" for diabetes is to be explained by cases of this kind.

What I have termed the pancreo-hepatic type is probably one development of the intestinal type. There may or may not be evidence of intestinal catarrh when the patients come under observation, but they show signs of pancreatic insufficiency and more or less disturbance of the functions of the liver. The prognosis is most hopeful when hepatic insufficiency is the more pronounced feature. These cases correspond to what has been termed "gouty" glycosuria. Typical attacks of gout are rare, but there is a special liability to cardio-vascular and kidney disturbances, cataract, neuralgia, and neuritis. Striking variations in the excretion of uric acid, creatinine, and amino acids are generally found, and pseudo-leucosuria sometimes constitutes more than half the total "sugar." Signs of chronic colitis are common in the faeces.

The nervous complications are commonly regarded as resulting from the gout, but they really arise from the hyperglycaemia, and so long as this is not controlled they persist. A short period of starvation is often helpful, but satisfactory results can be obtained by limiting the protein and carbohydrate intake for several days, then giving one or two vegetable days, followed occasionally by a porridge or potato day. The subsequent diet is arranged according to the patient's tolerance for protein and carbohydrate, care being taken, however, to limit the purin as much as possible. If the gouty and diabetic symptoms are both severe an alternating diet, calculated to control each in turn, is advisable. Typical "gouty" glycosuria is most common after middle life, but even in younger people a predominance of the signs of hepatic insufficiency warrants a more cheerful outlook than when they are absent. In these, as in the typical gouty cases, there is a marked tendency for the hyperglycaemia to persist for a considerable time after the urine has become sugar-free; and unless this is borne in mind, and the urinary analyses are controlled by blood-sugar estimations, the results of treatment are very likely to be disappointing, for our aim in all cases of diabetes should be to prevent hyperglycaemia, not merely to eliminate sugar from the urine. So long as blood-sugar estimations were difficult to carry out there was a valid excuse for relying entirely on the indications afforded by the urine, but the modern micro-chemical analysis is so readily performed that we should not be content with the shadow, but grasp at the substance.

A nervous element enters into many cases of diabetes, no doubt, but it is rarely possible to prove it. I think that the relation between the magnesium and calcium output in the urine may possibly afford some indication, for I have found that the former is usually higher than the latter in nervous people, and that a sudden rise in the magnesium, with little or no change in the calcium, occurs as the result of worry, anger, grief, etc. Cases in which a nervous factor enters into the pathology answer well to treatment by alimentary rest, but always do best when treated away from home and their ordinary surroundings. I give these patients as much fresh green vegetable as possible to supply them with an abundance of inorganic salts, and I find that minute doses of magnesium sulphate, taking care to avoid a purgative effect, improve their mental condition, and tend to control the glycosuria.

It will have been gathered that I do not look upon Allen's fasting treatment as the best for all forms of glycosuria, but I do consider that it marks a great advance in the available methods, and gives results that can be obtained by no other means in many instances. It must be used with judgement, however, and one should always bear in mind that the keynote of the treatment is under-nutrition. A practical question that sometimes arises, therefore, is whether a controlled, and may be mild, glycosuria with an adequate diet and reasonable enjoyment of life is not preferable to the theoretical ideal of a permanently sugar-free urine, which can only be secured by a diet that will not satisfy the pangs of hunger, and requires constant close supervision. The answer will depend on circumstances and the temperament of the

patient. These should be considered carefully before advising the treatment, as once it is begun it must be persevered with, since a return to an ordinary carbohydrate-free diet always brings about a rapid increase in the acidosis, with excessive tissue waste and death from diabetic coma.

Coma, formerly one of the most common causes of death in diabetes, should now be one of the rarest, for in starvation, followed by a largely vegetable diet, we have a powerful weapon for controlling the acidosis from which it arises. Essentially acidosis results from the imperfect oxidation of fat, and this in its turn is dependent upon faulty combustion of carbohydrate by the tissues, for fat seems to be a less readily oxidized footstuff than sugar, and needs the fire of burning sugar to bring about its complete combustion. It has been calculated that one part of dextrose to three parts of higher fatty acids is required for the purpose. Since the maximum rate at which dextrose can be oxidized by diabetics is always lower than in health the diabetic is not capable of utilizing as much fat as a normal individual, so that acidosis is more prone to develop, the fat smokes, as it were, the "smoke" being represented by abnormal acid products. In order to check a diabetic acidosis it is necessary to prevent "smoking" of the fat by restoring the proper relation of dextrose to fatty acid oxidation, which may be done by increasing the utilization of carbohydrates and diminishing the fat. Starvation will obviously accomplish the latter and tends to increase carbohydrate tolerance. The immediate effect of the fasting treatment will depend upon the amount of fat stored in the body, and therefore upon the nature of the previous diet. If much fat has been taken and there is a considerable deposit of adipose tissue the sugar available may be quite inadequate for its complete combustion and there will be a rapid rise in the acidosis until the fat has been used up and a more normal relation between fatty acids and dextrose has been reached, but even then the acidosis may continue, for proteins contain fatty acid radicals yielding acid bodies when they are imperfectly oxidized, and some diabetics have lost the power of utilizing the dextrose contained in the protein molecule which normally suffices for their complete combustion. By persisting with the starvation, however, the ability of the organism to utilize carbohydrate usually becomes so far restored that enough is available to control the formation of abnormal acid end-products from both sources. Every case cannot be expected to react to starvation in the same way, the determining factors being the amount of stored fat, the power to utilize the carbohydrate stored in the form of glycogen, and the extent to which sugar of protein origin can be made use of. Consequently three practical deductions may be drawn: (1) There is more danger of serious acidosis during the starvation of fat than thin diabetics; (2) when acidosis is present the patient should be prepared for starvation by a fat-free, protein poor, diet for several days; (3) an initial increase in the acidosis is to be expected in most cases, but should not put a stop to the treatment unless it assumes threatening proportions. When this occurs the fast should be terminated for the time being and the treatment directed to the acidosis. A restricted diet and alkaline therapy for a few days will generally serve to control the condition, when a further fast will usually result in improvement in carbohydrate metabolism without increasing the acidosis.

During the fasting period as much exercise as practicable should be taken, as it shortens the duration of the fast. After feeding is commenced the exercise should be continued, short periods of vigorous exercise after meals being preferable to long walks. Excessive fatigue should be avoided. Mental occupation is also most desirable, and patients should be encouraged to continue, or resume, their ordinary work if possible.

Between 1912 and 1915 I published a series of articles, pointing out that a quantitative regulation of the diet is required in all cases of glycosuria, and that control of the protein intake is quite as necessary as adjustment of the carbohydrate allowance, for analyses of the excreta in my cases had shown that merely to eliminate sugar from the urine does not suffice to control the disease if the patient is not at the same time placed in nitrogenous equilibrium. This can only be ensured by teaching him to take his diet quantitatively. It is gratifying to find that my conclusions are important features of Allen's treat-

ment, but I am sorry to see that in an attempt to simplify it an empirical method of attempting to establish nitrogenous equilibrium has been generally adopted. Daily analysis of the urine during the fasting period shows that, coincident with the fall in the sugar excretion, there is a drop in the whole level of metabolism, the total nitrogen sinking until it stands at a steady level of 4 or 5 grams a day. At first there may be a rise in the output of uric acid and creatinine, but as the fasting proceeds they also sink, and the same is true of the amino acids. When protein is added to the diet the excretion of these substances rises again until a level is reached at which the total nitrogen of the urine, plus 1 gram to allow for the loss in the faeces, balances the nitrogen content of the diet. If the protein intake is maintained at about this amount the patient remains in nitrogenous equilibrium, but if more protein is given evidences of a disturbance of nitrogenous metabolism shortly appear, and ultimately sugar is passed in the urine. Merely to rely upon the appearance of glycosuria is therefore far from being an ideal method of regulating the protein intake, and I have found the adoption of a fixed figure governed by the weight equally unsatisfactory in many instances. Estimation of the carbohydrate tolerance presents no great difficulty, especially if analysis of the urine is controlled by determinations of the sugar content of the blood. When treating children it is important to remember, however, that the diet, both as regards protein and carbohydrate, should not be increased at the same rate as for adults, 1 gram of carbohydrate for a child of 10 kilograms, for instance, being about equal to 4 grams to an adult.

Regulation of the fat intake requires more care than is frequently given to it. Fat is generally regarded as a make-weight by which the caloric value of the diet can be adjusted to the theoretical requirement worked out from the patient's weight, but modern research suggests that a carefully adjusted fat supply is as important as a correctly arranged intake of protein and carbohydrate. Bloor has shown that abnormal lipid values in the blood are common in diabetes, apart from obvious lipaemia, especially in severe and chronic cases, and that these lipoids originate from the fat of the food. Increase in the latter involves, therefore, the overloading of an already defective mechanism, whereas fasting, or a reduced fat supply, removes the excess of lipoids and leads to more efficient fat metabolism. There does not appear, however, to be any definite relation between the lipid content of the blood and the appearance of acetone bodies in the urine.

The importance of not commencing the fast in severe cases with acidosis until the patient has been kept for a few days on a fat-free diet, poor in protein, has been referred to, and it is equally important that fat should not be added to the diet subsequently until a considerable carbohydrate and protein tolerance has been established. A creamy blood, an increase in the ketonuria, and the appearance of glycosuria should be controlled by reducing the fat, otherwise it is best to regulate the diet so that a progressive loss in weight is prevented, while a gain, or more correctly an increase in adipose tissue, is avoided.

At regular intervals the whole level of the diet should be materially reduced to avoid overtaxing the defective metabolic functions of the patient. The extent and frequency of the reduction varies with the severity of the case, so that no hard and fast rules should be laid down, but generally one half the usual diet for one day a week is sufficient. In some cases this means that the patient must fast, in others he is limited to low-value green vegetables with two or three eggs, while in others a fair amount of carbohydrate can be taken, provided that the protein and fat are kept low. When carbohydrate tolerance is very defective it is necessary to prescribe one or two vegetable days each week in addition. As the patient improves, more carbohydrate is gradually added to the diet, and the stringency of the fast or semi-fast days is reduced, but progress should be very slow, with sufficient interval between each advance to test thoroughly his powers of dealing with the larger ration. No addition should be made to the protein until all traces of acetone have been absent for some weeks, and there is no evidence of abnormal tissue waste, even then it should be increased very slowly, guided by the nitrogen output in the urine. Most diabetic foods, if not fraudulent as regards their carbohydrate content, consist chiefly of protein, and must

therefore be allowed for in calculating the protein allowance.

Management of the diet is at present our only reliable means for combating diabetes, but it is probable that other methods will be discovered. The recent work of Murlin, Kramer, and others opens a new field in this connexion. Experiment has shown that the mechanism regulating the level of the blood sugar is peculiarly sensitive to disturbances in the acid-base equilibrium of the body, acid production leading to hyperglycaemia, while alkalosis exerts an influence in the opposite direction. Applying this idea, Murlin and Kramer, and more recently Underhill, have reported considerable improvement in cases of glycosuria subjected to careful alkaline therapy. The former used normal sodium carbonate given intraduodenally in 1 per cent. solution. Underhill employed large doses of sodium bicarbonate given by the mouth. Since meats and cereals are in general acid-producing foodstuffs, while vegetables and fruits usually yield an excess of bases, a diet rich in the former will tend to raise the sugar content of the blood, whereas a vegetable diet will lower it. May this not be one of the reasons why the largely vegetable diet given after the fast in the alimentary rest treatment is associated with an increase in carbohydrate tolerance, and partly explain the deleterious effect of more protein than is needed to make good the actual wear and tear of the body?

THE VARIATIONS IN WEIGHT OF THE TUBERCULOUS UNDER SANATORIUM TREATMENT.

By J. HENDERSON SMITH, M.B., CH.B.

THROUGH the courtesy of Dr. S. Vere Pearson I recently had the opportunity of examining the record of weights kept at Mundesley Sanatorium, and an analysis of the six years 1909-14 has given the results here set forth.

The patients at Mundesley are all tuberculous. A few cases are included where the lung symptoms are of subordinate importance, such as laryngitis or peritonitis, but the overwhelming majority are definite pulmonary cases. All stages of the disease are represented and no attempt has been made here to subdivide them into groups. Patients are weighed at regular weekly intervals on getting out of bed, and care is taken that the weight of the clothes does not vary. The weighing is done to a quarter of a pound, the machines are inspected and tested regularly, and there is no reason to doubt that the record is substantially accurate.

In such a place as a sanatorium, where full nourishment is insisted on and where so many of the patients arrive far under their proper weight, we should expect the weekly observations to show on the whole an increase in weight. And this is in fact the case. Each week no doubt some of the patients may lose in weight or remain stationary, but taking all the patients together we find that usually the gains exceed the losses, and there is on the average a net increase per patient per week. In 285 out of 312 weeks there was a gain in weight and in only 27 a loss, the weekly average varying from a gain of over 1.4 lb. per patient to a loss of over 0.4 lb. (See Table I,

TABLE I.—Showing the Average Weekly Gain or Loss per Patient in 312 Consecutive Weeks.

Net Loss.			
In 2 weeks	"	more than .4, not more than .5 lb.	
3	"	.3	.4 lb.
7	"	.2	.3 lb.
5	"	.1	.2 lb.
10	"	0	.1 lb.
Net Gain.			
In 22 weeks	...	more than 0, not more than .1 lb.	
20	"	.1	.2 lb.
26	"	.2	.3 lb.
34	"	.3	.4 lb.
28	"	.4	.5 lb.
34	"	.5	.6 lb.
35	"	.6	.7 lb.
32	"	.7	.8 lb.
17	"	.8	.9 lb.
12	"	.9	1.0 lb.
13	"	1.0	1.1 lb.
4	"	1.1	1.2 lb.
5	"	1.2	1.3 lb.
2	"	1.3	1.4 lb.
1	"	1.4	1.5 lb.