In conclusion, I have only to emphasise that the methods which have been under discussion are not put forward as adequately-tested therapeutic measures. They may, however, chance to be, if I may so express them unblamed, contributions to the building up of the newer and better system of therapeutics.

NOTES AND REFERENCES.

¹ BRITISH MEDICAL JOURNAL, December 19th, 1891. ² BRITISH MEDICAL JOURNAL, *loc. cit.* ³ BRITISH MEDICAL JOURNAL, *loc. cit.* ⁴ *Lancet*, February 25th, 1893. ⁵ BRITISH MEDICAL JOURNAL, February 3rd, 1894. These tubes can be obtained from Mr. A. E. Dean, 73, Hatton Garden, E.C. ⁶ BRITISH MEDICAL JOURNAL, July 29th, 1893. ⁷ BRITISH MEDICAL JOURNAL, July 29th, 1893. ⁸ *Loc. cit.* ⁹ This case was very kindly placed at my disposal for these observations by Surgeon Colonel E. Fairland and Professor Cayley. ¹⁰ Here and elsewhere in this paper where the temperature at which the determination was made is not directly stated it is to be understood that the determination was made at 18.5° C. or *circ.* 65° F. I find that this temperature has several advantages over the temperature 37° C. or 98.4° F., which was originally proposed by me as a suitable standard temperature for coagulability determinations. A temperature of 18.5° C. presents the following advantages: (a) coagulation takes place more slowly than at 37° C., and therefore the determinations can be made more accurately; (b) the temperature approximates to the temperature at which ordinary hospital wards are kept; (c) the tubes therefore require very little cooling or heating to bring them to the correct temperature; (d) the proposed standard temperature is a mean between freezing point and blood heat, and therefore is easily remembered as "half blood heat." ¹¹ *Archiv f. Heilkunde*, 1878. ¹² *Vide infra*, effect of alcohol on coagulability. ¹³ *Proceedings Royal Society*, vol. lv. ¹⁴ These statements may, I believe, be accepted as accurate, for they were confirmed by the grandfather, who has an extraordinarily wide experience of hæmophilic hæmorrhage, as he has stood by the death beds of his six sons who all succumbed to hæmophilic bleeding or to its sequelæ. ¹⁵ The more favourable temperature conditions and the hæmorrhagic increase of coagulability brought about by hæmorrhage that had occurred are no doubt responsible for a good deal of the observed acceleration of coagulation time. It is, however, only legitimate to infer that the administration of calcium chloride was largely contributory to it. ¹⁶ Compare the results already recorded of previous additions of lime to the extravascular blood of this child. ¹⁷ BRITISH MEDICAL JOURNAL, July 22nd, 1893. ¹⁸ Peptone is known to be inefficacious when administered by the stomach. Leech extract has in my experience also proved inefficacious. ¹⁹ This hæmorrhage, which had continued for more than a month on the regimen of lemon juice, was brought to a complete standstill by the exhibition of 2 grammes of calcium chloride daily diluted in 3 pints of barley water, and taken in sips in order to produce a local as well as a general effect. Coagulation time, which stood at 6½ minutes before the exhibition of lime, came down by gradual steps to 3½ minutes a few days after the commencement of the treatment. ²⁰ *Zeitschrift f. Biologie*, 1882. ²¹ *Arch. f. Heilkunde*, 1878.

THE CROONIAN LECTURES

ON

A NEW DEPARTURE IN DIABETES.

Delivered before the Royal College of Physicians of London.

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[Special Abstract Report.]

LECTURE IV.

THE DESTINATION OF CARBO-HYDRATES TAKEN AS FOOD. DURING the process of digestion, carbo-hydrates not already soluble were rendered soluble by ferment action. The complex starch molecule was hydrated and broken down into the smaller molecules of, at first dextrine and maltose, and, finally, of maltose alone. An analogous process occurred in the digestion of proteid. The proteid molecule was hydrated and broken down, albumoses and peptone, and, as already stated, sugar being the products. We had not, as had been supposed, to go to the liver for this breaking-down process, which was, in fact, accomplished by digestive fermentation. Rather did the liver exercise a protoplasmic action on the products broken down by digestion.

THE PROTOPLASM OF THE VILLI.

Before they reached the liver at all, however, the products of digestive action had already been brought into relation with active protoplasmic bodies—the lymphoid cells of the villi of the intestine. It had been shown in the course of these lectures that protoplasm could synthesise carbo-hydrate with nitrogenous matter into proteid, and it was a fact that in the villi peptone and carbo-hydrate disappeared. The conclusion was justified that the synthesis actually took

Fig. 3.—Point of villus in section from fasting rabbit. Treated with osmic acid. No fat perceptible. $\times 600$. (From a photomicrograph.)

Fig. 4.—Point of villus in section from rabbit killed four hours after having been fed with oats. Treated with osmic acid. Fat displayed. $\times 600$.

place under the influence of the protoplasm of the villi. The chyle was described by physiologists as an "oleo-albuminous" fluid, and much of the newly-formed proteid reached the general circulation by that medium. Some passed by way of the portal blood, which yielded rather more of the amylose derivative of proteid on analysis than blood from other parts of the body. The protoplasm of the villi thus acted as a first line of defence, protecting the general circulation from the entrance into it of the carbo-hydrate of the food as such.

Fig. 5.—Appearances presented by cells of villi from a fasting rabbit.

But the protoplasm of the villi accomplished something more. There was no doubt that animals possessed the power of converting carbo-hydrates into fat. After the ingestion of fat the cells of the villi became charged with fat globules, which passed into the lacteals, and thence into the receptaculum chyli. The fat in a minute state of subdivision was taken up by the cells of the villi, and thence transmitted to the lacteals. A precisely similar process was to be observed after the ingestion of carbo-hydrate food. Oats contained only about 5 per cent. of fat, yet after a meal of oats the lacteals in the rabbit were as fully distended with milky chyle as in the dog after a meal of fat.

Fig. 6.—Appearances presented by cells of villi from a rabbit killed four hours after having been fed with oats.

This point was illustrated by a number of lantern slides,

some of which are reproduced here. In all cases the microscopic preparations were treated with osmic acid, which blackened any fat which might be present. Fig. 4 shows a section, under a high power, of a villus from a rabbit, killed four hours after having been fed with oats; the blackening indicating fat is especially evident near the tip of the villus. Fig. 3 represents the tip, also highly magnified, of a villus from a fasting rabbit. It will be seen that in the first named preparation fat was present in abundance, whereas it was absent from the other. The same point is illustrated by Figs. 5 and 6, which are drawings of slides made from the scrapings of the intestinal mucous membrane in a fasting rabbit, and in one fed four hours previously on oats. The separate columnar epithelium cells can here be distinguished, and it will be seen that those from the animal recently fed on oats are full of oil drops.

The conclusion, therefore, was warranted that the carbo-hydrates of the food were converted into fat by the protoplasm of the cells of the villi, and entered the system in a manner exactly similar to the manner in which fats taken as such entered the system. The villi thus became invested with an importance not previously known to be theirs. It would appear, moreover, that the cells of the intestinal mucous membrane were the seat of the process through which persons became fat on a carbo-hydrate diet.

THE LIVER AND CARBO-HYDRATES.

In the liver glycogen was formed by the transmutation of the surplus carbo-hydrate of the food which escaped synthesis by the cells of the villi. With full ingestion of carbo-hydrates there might be as much as 5 per 1,000 of carbo-hydrate in the portal blood. Probably the glycogen stored in the liver went eventually to the formation of fat, for there was evidence that the liver was a fat-forming organ. The liver, therefore, had its share in preventing the entrance of free carbo-hydrates into the circulation. There were thus two lines of defence—the villi and the liver. Even in health both lines of defence might be passed; this happened if too much carbo-hydrate was ingested, and then the urine became saccharine.

THE CARBO-HYDRATES IN DIABETES.

In diabetes the two lines of defence were less perfect than in health, were inadequate to accomplish their function of synthesising the carbo-hydrates, and thus carbo-hydrate reached the general circulation in excessive quantity, and appeared in the urine as sugar. If the defect in the lines of defence were but slight, the individual might take a diet containing a small amount of carbo-hydrate, and no sugar would appear in the urine. In every case of glycosuria there was a limit to the power of the organism to stop the entrance of carbo-hydrate into the blood of the general circulation, and if the diet were such that this limit was not passed, no sugar reached the urine.

A diabetic was a person who had not protoplasmic power sufficient to dispose of the carbo-hydrates in his diet by synthesis to proteid, by transmutation into fat, and by dehydration into glycogen. The question was, Why did protoplasm lose this power? It could not be supposed that the fault lay with the protoplasm itself, for this power was one of its constant properties wherever it was met with. It must depend on the conditions under which it was placed. Dr. Pavy said that he had long had the conviction that the exercise or non-exercise of this protoplasmic power was influenced by the condition of the vessels, which, again, was determined by the condition of the nervous system. A hyper-oxygenated state of the blood favoured the passage of carbo-hydrate matter into glucose, and was capable of producing saccharine urine. Dilatation of the arterioles allowed a rush of blood through the capillaries, so that the blood in the veins was not sufficiently de-arterialised. Under such circumstances the passage of carbo-hydrates into glucose would be favoured. The whole history of diabetes went to prove that it was frequently to be attributed to the condition of the nervous system.

But in some cases of diabetes there was more than this. There were severe cases in which neither strict animal diet nor complete abstinence from all food sufficed altogether to prevent the appearance of sugar in the urine. The tissues, therefore

must yield the sugar, and since they consisted mainly of proteid matter, which had a glucoside constitution, it was only necessary to suppose the existence of a ferment action. Phloridzin diabetes was possibly of this nature, the drug acting as a ferment.

FATTY DEGENERATION.

Fatty degeneration of proteid tissue was an analogous process. It might well be that one kind of ferment might lead to the cleavage-off of sugar, and another to the cleavage-off of fat. As hyper-oxygenation favoured cleavage-off of sugar, so hypo-oxygenation favoured the cleavage-off of fat. The manner in which the deficient oxygenation was produced made no difference—whether through deficient respiratory power, sluggish circulation, or deficiency in the number of the red corpuscular elements in the blood, as in idiopathic anæmia, in which disease fatty degeneration was of frequent occurrence.

CONCLUSION.

In a peroration, which was eloquent by reason of its simplicity, Dr. Pavy, after thanking the College for the opportunity of bringing forward results which he believed to be of the first importance to physiology and medicine, said that throughout his researches, which had occupied so large a part of the active time of thirty years, he had always sought to be guided by the injunction of Harvey, "to search and study out the secrets of Nature by way of experiment."

SUPRAPUBIC PROSTATECTOMY OR MCGILL'S OPERATION.¹

WITH REPORT OF A SERIES OF 12 CASES.

By A. W. MAYO ROBSON, F.R.C.S.Eng.,

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It is only within the last decade that the operative treatment of hypertrophied prostate has received the attention it deserves, and I venture to think that to no one surgeon is the present position of the subject due so much as to my late friend and colleague, A. F. McGill, who, by a series of cases reported and shown at the British Medical Association meeting in Leeds, in 1889, clearly demonstrated that suprapubic prostatectomy was a practicable and effectual method of treatment. Both on this account and because of our desire to perpetuate the memory of our late colleague we speak of the operation in Leeds as "McGill's operation."

So far as I can see, all the minor operative procedures through the perineum and urethra have proved disappointing, and even perineal prostatotomy or prostatectomy, which has a number of advocates, shows a mortality of 13 per cent., and is only of use in the case of a projecting or pedunculated middle lobe. The experience of any one surgeon in suprapubic prostatectomy must be comparatively limited, not on account of the infrequency of prostatic disease but because of the unsuitability of the greater number of cases for operative treatment, either on account of sufficient relief being effected by catheterism or else because of kidney or other complications rendering the subjects unfit for any major operation. Hence my reason for giving the results of my personal experience in so small a number as 12 cases; but I should at the same time remark that my impressions are derived from a considerably greater number of cases, "about 30," which I have witnessed or taken part in, in the hands of my colleagues or other surgeons.

The following is a list of the cases that have come under my care, and in order to save time I hand round a printed table giving brief details of each case.

While it is unnecessary here to consider the subject of the diagnosis of prostatic enlargement, I may be pardoned for pointing out a method which, doubtless practised by some, is certainly not generally employed, namely, that by means of bimanual examination, either with or without an anæsthetic, the condition of the whole of the prostate may be mapped out, and the presence or absence of other organic disease of the bladder may be ascertained. The method I usually employ is with the patient on his back, and, after emptying the bladder, to bring him to the right side of the

bed, to prop the shoulders with pillows, and to ask the patient to flex the thighs; then, with the right index finger, well greased, inserted into the rectum, and the left hand well warmed placed on the hypogastric region and gently pressed backwards, the intervening bladder and prostate can be quite clearly felt, and the latter can be mapped out. If a catheter be then passed, the thickness of the middle lobe, or of the bar at the neck of the bladder, can be accurately gauged by the left hand pressing the catheter backward on to the finger in the rectum, which is then able to estimate the thickness of tissue intervening.

Next, with regard to the selection of cases. This comes under two distinct categories (1) those not requiring operative treatment, and (2) those disqualified by other disease. Whenever a patient has no large amount of residual urine, and can be made comfortable by the passage of a catheter at night, or night and morning, and where catheterism is well borne and not difficult or distressing, operative treatment is unnecessary. In the presence of complete atony of the muscular coat of the bladder, operation is advisable if the atony be only of short duration, say a few weeks; but if the conditions have existed for many months the removal of the obstruction to the urinary outflow, even if successfully accomplished, can probably lead to very slight ultimate benefit, but I am convinced that atony of less duration can be overcome by tonics and galvanism when the obstruction is removed.

The presence of a large amount of residual urine associated with fair vesical contractility and not diminishing after regular catheterism, the patient being otherwise in fair health, is a decided indication for prostatectomy, unless the relief given by the catheter is considered adequate by the patient.

Cystitis associated with enlarged prostate, especially if catheterism is difficult and painful, is an indication rather than otherwise for suprapubic prostatectomy, as at the same time the bladder can be thoroughly purified and drained. The presence of a calculus, or of calculous material associated with prostatic enlargement and residual urine, is an indication for suprapubic lithotomy followed by prostatectomy, as at the same time it enables the bladder to be thoroughly cleared, the coexisting cystitis to be treated by drainage, and the obstruction at the neck of the bladder to be removed.

Contraindications.—The presence of advanced kidney disease, especially if associated with a greatly diminished excretion of urea; chronic atony of the bladder; glycosuria; well-marked degeneration of the blood vessels associated with general senile debility, or other organic disease which would render any major operation inadvisable, would lead the surgeon to seek to give relief by catheterism or simple perineal drainage rather than by a more serious operation. It is unnecessary to enter into all the minutiae of the operation, but there are certain details which I may perhaps be excused for mentioning.

Besides aseptising the skin by a previous carbolic dressing and washing out the bladder with boracic lotion, I usually like to give my patient 5 to 10 grains of boracic acid and a little saccharin thrice daily for a few days before operation, so as to render the urine aseptic if possible. The rectal bag, by raising the prostate nearer to the manipulating finger, is of advantage, but I think it is important not to overdistend it, lest rupture of the rectum or inflammation in the meso-rectum ensue, and I only have 4 or, at most, 6 ounces of water introduced. The bladder is distended with boracic lotion until it can be felt above the pubes, no fixed quantity being employed. In two cases the peritoneum has been in touch with the pubes, and in Case 9 it was so fixed to it that I had to deliberately open the serous membrane to reach the bladder, after which I carefully separated it and closed the peritoneal opening before incising the bladder, the patient being no worse for the complication.

In removing the obstruction I have found McGill's scissors or the cutting-ring forceps invented by my colleague Mr. Jessop to answer best for the sessile or pedunculated enlargement of the middle lobe, and for the ring-like obstruction I have used the scissors, first at one side and then at the other, so as to cut out a V-shaped portion, making a clear channel from the vesical pouch straight into the urethra, down which the finger is passed to see that the passage is clear.

¹ Contributed to the International Congress held in Rome, March, 1894.