THE BRADSHAWE LECTURE ON THE MORBID ANATOMY OF DIABETES MELLITUS.

Delivered before the Royal College of Physicians of London.

By ROBERT SAUNDBY, M.D., F.R.C.P.,

Physician to the General Hospital, Birmingham.

MR. PRESIDENT, FELLOWS OF THE ROYAL COLLEGE OF PHYSICIANS, AND GENTLEMEN,—It is my first duty to express my gratitude to you, and my humble acknowledgment of the honour done to me, and I hope I may say to the city to which I belong, in selecting me to deliver the lecture which, by the pious munificence of his widow, annually commemorates the birthday of the late Dr. Bradshawe, a former Member of this College, and a worthy and esteemed physician, who practised during his lifetime in the town of Reading. It is fitting, also, that I should express on behalf of the College our respectful recognition of this lady's appreciation of the character and aims of our ancient corporation, by founding this lectureship for the promotion of the study of medicine.

I feel deeply conscious of my own inability to perform the task so generously entrusted to me in such a manner as to deserve your praise, but by your courtesy I know I may expect a patient hearing, and from your indulgence I trust I may escape your censure if I fail to attain the high level of excellence which has characterised the discourses of my eminent predecessors in this chair.

The subject I have chosen for your attention to-day is undoubtedly wanting in novelty, but I was induced to select it chiefly because it was a matter on which my thoughts were already engaged, and concerning which I possessed abundant materials for a re-investigation of the questions which have been raised in recent years, with the opportunity of studying them in the light of the most modern methods of histological research. If I have no new discoveries to announce, and if I must content myself rather with the humble position of a critic than that of a revealer of fresh facts or novel theories, I will at least ask you to believe that this has not been from any want of patient industry and careful thought, but because of the great difficulty of making new observations in a field which has engaged the close attention of so many competent observers.

It is my purpose to lay before you an account of the changes observed in the principal organs of the body and in the blood, concluding each description with comments upon points of interest on which my own observations seem to me to have thrown any light.

THE NERVOUS SYSTEM.

Brain.—Though no constant lesion has been observed in the brain, this organ is seldom normal. This statement is at variance with the statistics of cases accumulated from all sources (Windle), but is in harmony with recent observations. Out of twenty-seven cases of which I have records of the necropsies the brain was stated to be normal in only five.

The most common description given is that it was "oedematous and congested, with thickened membranes," eleven out of the twenty-two abnormal brains presenting more or less of these characteristics. It is less often described as anæmic. Atrophy of the convolutions has been stated to be common (Mackenzie); but this does not accord with my observations. These changes are, of course, not peculiar to diabetes, and cannot be considered to have any special relation to its pathology. In quite a minority of cases localised lesions are found, the value of which differs greatly, and in many instances is not easily appraised. Among the most important are tumours in the fourth ventricle and medulla, of which a relatively small number only have been recorded. Not a single instance has come under my own observa-

tion, and I have only found records of ten cases, of which three were published by Frerichs. Of the direct dependence of the diabetes upon the growth in many of these cases there can be no reasonable doubt. Instances have also been recorded of softening (Luys); of the presence of corpora amylacea and colloid masses (Abraham); of sclerosis, of alterations in colour and congestion (Tardieu); and of enlargement of the perivascular spaces (Dickinson). Of these the softening alone is of undoubted value. The congestion and dark colour of the medulla are interesting, but, taken by themselves, prove little; while the enlargement of the perivascular spaces is too common in non-diabetic brain disease, and too exceptional in diabetes to count for much. The observations of Dr. Abraham are a valuable contribution to the histology of the diabetic brain, and possibly belong to the same class as other lesions to which I shall refer immediately which indicate failure of nutrition of the brain tissues, and are rather an effect than a cause of the disease.

There is undoubtedly a tendency in the diabetic brain to the formation of cysts in the white matter. I have found such cysts in the frontal lobes, in the medulla, and in the pons; while in another case a small focus of softening in each crus cerebri looked like an early stage in this process of cyst formation. These cysts are quite free from hæmatoidin staining. Some of them are so small as to be hardly worthy of the name of cysts, but others are as large as horsebeans. It seems probable that this condition is due to a failure of nutrition. The choroid plexuses also occasionally present abnormalities; thus I have found cysts on the choroid plexus of the left lateral ventricle, and the same structure in the fourth ventricle was in one case hypertrophied, while in another case the plexuses of the lateral ventricles were of a dark purple colour, as if from congestion. The lateral ventricles and the *tertia tertio ad quartum ventriculum* have been found dilated without any mechanical obstruction to explain it. Extensive hæmorrhage into the brain substance is rare in diabetes. In Windle's table there are only three examples in 184 necropsies, or in 1.6 per cent. There has been no instance at the General Hospital for twenty years out of a total number of 120 cases with 29 deaths. Dickinson has, however, described minute hæmorrhages as common. Finally, glycogen has been found in large quantities in the medulla oblongata and in the vessels of the cerebral cortex (Futterer). Zaleski found iron present, but we are still in doubt as to how far this is an abnormality.

On careful microscopical examination I have not been able to detect, even with the most modern technical methods, any special histological changes either in the cortex, the basal ganglia, or the medulla. The latter has been the subject of special investigation, but the only positive fact observed has been that the capillaries of the vagus nucleus in one case seem to be abnormally numerous and full of blood. The specimen has been placed under one of the microscopes. I have looked for minute hæmorrhages without finding them, and the absence of blood pigment in the cysts already alluded to is opposed to the view that these originate in that fashion. While not disputing its occasional occurrence, hæmorrhage is certainly not a constant or common form of lesion in the diabetic brain.

Spinal Cord.—In a certain number of cases diabetes has followed the extension of diseased processes from the spinal cord into the medulla, as in locomotor ataxy and insular sclerosis, where the disease is unquestionably the result of the lesion of the medulla. Again, diabetes has not infrequently followed injuries to the spinal column, though in one case where this occurred the cord was apparently uninjured. In connection with these facts it will be remembered that Schiff has produced artificial glycosuria by dividing the cord opposite the second dorsal vertebra; but in cases where the diabetes is neither a complication of a recognised disease of the cord nor a consequence of injury to the spine, this structure has been usually described as normal. Unfortunately, the number of cases in which it has been carefully examined is not large, but in these enough has been found to show that secondary nutritive changes, similar to those in the brain, are apt to occur in the cord; these are dilatation of the central canal, enlargement of the perivascular sheaths, and localised softening. Tumours of the cord in connection with diabetes have been very rarely recorded; the only case known to me is one of myxoma of the dura mater (Shingleton Smith). Glycogen has been found in large quantities in the spinal cord. Microscopical examination of the spinal cord, stained after Weigert's method, has been carefully carried out without any special change being noted.

Cerebro-spinal Nerves.—Tumours situated on or compressing

the vagus nerve have been found associated with diabetes. Three such cases have been recorded (Harley, Henrot, Frerichs), and in each instance the right nerve was the seat of the lesion. In Frerich's case the tumour encroached upon the floor of the fourth ventricle, but in the other two cases no such complication existed, the tumour being situated in the thorax. These observations are very interesting in connection with the recent experiments of Arthaud and Butte, who found that artificially induced neuritis of the central end of the divided vagus caused glycosuria, while a similar lesion of the peripheral end caused hunger, wasting, polyuria, and thirst. Lubimoff has found in one case of diabetes atrophy and pigmentation of the inferior ganglion of the vagus. No pathological observations on the spinal nerves in diabetes are known to me, but it is noteworthy that Arthaud and Butte have produced glycosuria by setting up neuritis in the roots of the first dorsal pair of spinal nerves. Schiff, moreover, has shown that stimulation of the central end of any sensori-motor nerve, such as the sciatic, may be followed by glycosuria. Clinical observation has revealed the existence of a secondary diabetic neuritis, which may be multiple (Leyden) or attack particular nerves (Althaus). In these circumstances it gives rise to the phenomena of paralysis, with wasting and loss of faradic response of the muscles supplied by the affected nerves.

Sympathetic Nerves.—Changes in this system of nerves in diabetes seem very early to have attracted the attention of pathologists. Thus Duncan, as long ago as 1818, found the sympathetic in the abdomen three times as thick as normal; and Percy, in 1842, described the semilunar ganglia, the splanchnic nerves and vagus as thickened and of cartilaginous hardness. Klebs and Ph. Munk, in 1870, found changes in the coeliac plexus with destruction of a number of ganglion cells. Lubimoff has also found sclerosis of the sympathetic ganglia and atrophy of their nerve cells. In three of my cases the semilunar ganglia have been found enlarged, and in one case atrophied, with increase of connective tissue and atrophy of nerve cells. Hale White has recently described similar lesions in four cases of diabetes. On the other hand, Shingleton Smith has made numerous observations on the state of the sympathetic ganglia without finding any uniform or definite change. In three of my cases the semilunar ganglia were normal, and I have shown in a paper published in the *BRITISH MEDICAL JOURNAL* in 1883 that similar microscopical changes to those above described are met with apart from diabetes. Yet I have never seen the semilunar ganglia enlarged except in diabetes; in some of my cases the right semilunar ganglion was quite twice the normal size. The importance of these facts depends upon the results of experiments which have shown that destruction of various sympathetic ganglia—for example, the superior and inferior cervical (Pavy), the first thoracic (Eckhard), and the abdominal (Klebs)—and division or ligature of the splanchnic nerves (Hensen, Arthaud and Butte), are followed by glycosuria. Extirpation of the coeliac plexus is followed by wasting and death, with temporary glycosuria and acetonuria (Lustig, Pfeffer).

THE CIRCULATORY SYSTEM.

Heart.—In about 40 per cent. of my cases the heart has been described as free from noticeable change; while in about the same proportion it has been described as pale and soft; more rarely, dilated or hypertrophied, or distinctly fatty. Pericarditis occurs occasionally, and in one case of death from a carbuncle in a diabetic subject the pericardium was full of fluid, fatty blood. Valvular disease is quite exceptional, though Lecorché has described endocarditis as a complication of diabetes, and Maguire has recorded a case. It is said to occur in the later stages, and to affect usually the auricular surface of the mitral valve. The rarity of endocarditis may be estimated from the occurrence of only one case of valvular disease out of the 94 cases collected in Windle's tables; and in my 29 cases there was valvular thickening in one only. Mayer has stated that out of 380 diabetics seen at Carlsbad, 82, or 24 per cent., showed signs of cardiac enlargement; and Schmitz, of Neuenahr, has made a still stronger statement as to the prevalence of fatty heart. Frerichs has drawn attention to glycogenic degeneration of the cardiac muscle, and suggests that this is the real cause of the cardiac debility of diabetes. Hypertrophy of the heart was present in 13 per cent. of cases examined in the Berlin Pathological Institute, and this accords very nearly with my experience. Fatty heart is probably much more common, if we are to judge by the frequency with which the muscular substance is described as pale and soft in reports of diabetic necropsies; yet I should estimate it as occur-

ring in less than 40 per cent. of all cases. The accompanying illustration shows the appearance of the muscle in a very marked case (Fig. 1). Glycogenic deposits in the wall of the heart have only been found by me in such small quantity that I cannot ascribe to them any serious pathological significance. This drawing (Fig. 2) shows a few granules of glycogen deposited between the muscular bundles, but the muscular fibre appears healthy.

Fig. 1.—Heart muscle from a case of very advanced fatty and fibroid degeneration. Fat droplets stained black with osmic acid (Hartnack, oc. 2, obj. 7. Tube drawn out).

Blood.—The blood of diabetics generally looks normal to the naked eye. It is sometimes described as dark, and is sometimes very obviously loaded with fat, a white, cream-like layer rising to the surface when the blood is allowed to stand. Under the microscope, the fat is seen to be at first in a state of molecular subdivision, but these molecules run together to form droplets after

Fig. 2.—Heart muscle apparently healthy, except for a few granules of glycogen lying within the sheaths of the muscular bundles (Hartnack, oc. 2, obj. 7. Tube drawn out).

death, and thus may produce the appearance of capillary embolisms. Occasionally the red blood corpuscles are found broken down into a granular material (Foster, v. Jaksch). In one of my cases the leucocytes were peculiarly large. Quantitative changes in the hæmocytes are common, these being generally reduced in

number, with a corresponding reduction in the hæmoglobin. Normal blood contains sugar in varying amounts. The following table gives the estimate of four observers:—

Name.	Parts per Cent.
Pavy	0.078 to 0.081 (dog).
Otto " " "	0.10 " 0.14 "
Seegen " " "	0.15 " 0.19 (man).
Frerichs " " "	0.12 " 0.3 "

According to Seegen, the amount present in mild cases of diabetes does not exceed the normal, but in severe cases it may rise as high as 0.4 parts per cent.

The alkalinity of the blood serum is reduced, owing to the presence of certain organic acids of doubtful identity, of which diacetic acid and β -oxybutyric acid seem the most probable. The existence of acetone is disputed, as former reports of its presence are believed to be due to the breaking up of diacetic acid to form acetone and carbonic acid gas. In certain experiments conducted by me some years ago in the laboratory of Professor Tilden, at Mason College, I was unable to detect any acetone in the blood of a diabetic patient who had died of coma.

THE RESPIRATORY SYSTEM.

Lungs.—Pathological alterations in the lungs are the rule in diabetics, and perhaps no organ shows more constant changes. In my cases 17 per cent. only were free from disease. The most common condition was congestion or congestion and oedema. The next most frequent alteration was phthisis, which was present in 27 per cent. Small foci of softening were observed in one case, abscess in one, hæmorrhagic infarcts in one, and gangrene also in one.

Dreschfeld has described the following types of lung affection in diabetes:—(1) acute croupous pneumonia, very acute and fatal, but rare; (2) acute broncho-pneumonia, which may terminate by gangrene; (3) chronic caseating tubercular broncho-pneumonia, the common form of diabetic lung complication; (4) chronic non-tubercular broncho-pneumonia; (5) gangrene of the lung.

Fink recognises two forms of diabetic phthisis: (1) tubercular, and (2) fibroid. In the latter there are no tubercle bacilli in the sputa or lung, no caseous deposits, and the lung undergoes chronic induration. Pleurisy and empyema occur rarely. Fat embolisms have been described as playing an important part in the pathology of diabetic coma (Sanders and Hamilton), but it is doubtful if they are not *post-mortem* formations, due to the running together of the fat which was previously held suspended in a molecular state, and in any case they are not present in such numbers as to give rise to any symptoms (Saundby and Barling).

The vessels of the lungs have been described as undergoing hyaline and fibroid thickening, but this is not a primary change, or one in any way peculiar to diabetes.

THE DIGESTIVE SYSTEM.

Liver.—Great interest attaches to this organ, because of its physiological relations to sugar formation. An opinion was at one time held, and has been expressed by recognised authorities, that the liver in diabetes is usually healthy, and even a more than usually healthy appearance has been described as characteristic of it. In my experience this is a very erroneous view. The liver is generally enlarged, weighing from 60 to 80 ounces. In a smaller number it is small, pale, and soft.

Fatty degeneration is very common; congestion is often observed; the consistence of the organ is sometimes abnormally firm. A certain degree of interstitial hepatitis is frequently present, and occasionally this goes so far as to produce distinct cirrhosis. This is attributed by Letulle to the effect of the abnormal destruction of hæmocytes. Hanot and Schachman have also described this form of cirrhosis. The liver is sometimes smooth, at others granular and scarred. The lesion begins, according to these observers, around the radicles of the hepatic vein, but Brault and Gaillard point out, in my opinion rightly, that the new growth begins in both the hepatic and portal areas. This form of cirrhosis is associated with bronzing of the skin. Some degree of interstitial hepatitis may, however, be seen without any evidence of pigmentary deposit in the liver or the integument. (Fig. 3.)

This drawing shows very well-marked commencing cirrhosis in a diabetic liver.

Abscess of the liver is sometimes met with associated with diabetes. I remember one such case when I was a pathologist, and I believe the case presented all the phenomena of severe

diabetes. The liver contained one large abscess and numerous smaller ones. A similar case was reported in the U.S. Navy Reports for 1878. It is permissible to believe that the abscess in these instances was really the cause of the diabetes.

Dickinson has described thrombosis of the branches of the portal vein, and angiomas formed of dilated capillaries near the radicles of the hepatic vein.

Fig. 3.—Section of liver showing commencing interstitial hepatitis in a portal canal. Two newly formed biliary canaliculi are seen near the edges of the acini (Hartnack, oc. 3, obj. 7. Tube drawn out.)

In spite of its fatty appearance Weyl and Apt have not found the diabetic liver to contain an excessive amount of fat:

Normal liver	3.70 pts. per mille.
Diabetic " " " "	3.75 " " " "

Moreover, absence of fat from the liver cells has "been" observed by Beale and Frerichs.

Quinke described excess of iron in the liver, deposited in the form of granules. Zaleski has not observed it in granular form; he estimates the diabetic liver to contain 0.685 parts of iron per mille, but he points out that we have no data to enable this to be compared with the normal quantity.

Spleen.—This organ is very frequently described as normal, but the most common naked-eye change is that it is small, pale, and soft. It is more rarely enlarged and congested, and sometimes contains tubercle. It is said to contain excess of iron (Quinke), but, as already explained, data are wanting as to the amount present in health. Glycogen has also been found in it. Hyaline degeneration of the small arteries has been described, but I have not been able to perceive anything abnormal about them.

Pancreas.—Since Lancereaux drew attention to the frequency with which the pancreas is atrophied in diabetes, and went so far as to associate the clinical type of "*diabète maigre*" with this lesion, the changes in this organ have been interesting; but they are especially so since the experiments of Minkowski, Lépine, and others have shown that extirpation of the pancreas in animals is followed by glycosuria. This organ is by no means so carefully examined by pathologists as it deserves to be, and there is wanting that familiarity with its ordinary naked-eye and microscopic appearances which gives value to their descriptions. In many cases no note of its condition has been made. Out of fifteen cases it was atrophied in seven and abnormally firm or fibroid in four, while it was normal in only four. In two of the cases in which it was hard it was also enlarged. So far as my own observations go I am disposed to agree with Lancereaux, as I have found the pancreas shrunken in all my cases of typical wasting diabetes.

That the pancreas stands in some relation to diabetes is shown by the experience of Bull, of New York, whose patient died of diabetes after he had extirpated the pancreas. Duffey has published a case of diabetes associated with cancer of the pancreas; on the other hand, in the cases of pancreatic disease collected by Handfield Jones, and more recently by another distinguished Fellow of this College, Dr. Norman Moore, there is no mention of diabetes.¹ Cyr

¹ In a recent article (August 2nd, 1890) the Editor of the *Philadelphia Medical News* refers to a case of cystic disease of the pancreas from a case of diabetes exhibited by Longstreth in 1877, and to one of multiple pancreatic abscesses with glycosuria reported by Frison in 1875, but on the other hand he mentions that Langenhaus has recently published a case of necrosis of the pancreas in which there was no sugar in the urine.

thinks the atrophy is secondary, and only a result of the general failure of nutrition. Ligature of the duct, and even extirpation of the gland, have not always been followed by diabetes; but the force of this objection is removed by the observation that a small part of the pancreas, if left behind, is capable of supplying the necessary ferment (?). Various theories have been put forward to account for the action of the pancreas. It has been suggested that the pancreas supplies the liver with the fatty acids necessary to the formation of bile acids from glycogen; hence, in affections of the pancreas there is excess of glycogen with resulting diabetes (Popper); excessive production of glucose from diastatic ferments formed in the stomach and duodenum (Bouchardat); the formation of paralogucose by the action of modified pancreatic juice (Cantani); the absorption of the pancreatic ferment, which, passing direct to the liver, changes the glycogen to glucose (Baumel); and the suppression of a normal sugar-destroying ferment which should pass by the pancreatic lymphatics to mingle with the chyle (Lépine).

Brault and Gaillard have described a pigmentary cirrhosis of the pancreas analogous to the pigmentary cirrhosis of the liver observed in diabetes. Pancreatic calculi may cause cystic formation or sclerosis or complete adipose transformation.

Fig. 4.—Section of atrophic cirrhotic pancreas, showing great increase of connective tissue, with *a* hyaline degeneration of glandular epithelium, *b* newly formed ducts, and *c* ducts undergoing atrophy. (Hartnack, oc. 2, obj. 4. Tube drawn out).

The drawing (Fig. 4) is a low-power view of a portion of pancreas, showing great increase of connective tissue with a new formation (?) of ducts and a hyaline degeneration of the pancreatic glandular epithelium. The portions of gland affected by this last lesion seem to become converted into swollen convoluted masses of translucent material containing a few pale nuclei, and bounded by a layer of flattened endothelial cells, whose nuclei, seen edgewise, look like spindle cells (Fig. 5). It is evident that there are two processes going on in the gland: 1, of regeneration of the gland elements, closely resembling that to be described in the epithelium of the kidneys, which is apparently peculiar to diabetes; and 2, an increase of fibrous tissue with destruction of the gland analogous to cirrhosis of the liver.

This process is undoubtedly inflammation and not simple atrophy. In the earlier stages of the process the gland is swollen from abundant infiltration of its tissue with round cells. A section of such a swollen pancreas, obtained from a case of rather acute diabetes, is shown under one of the microscopes (Fig. 6).

It has been suggested that the atrophy of the pancreas may be secondary to disease of the coeliac plexus; but Lustig found that extirpation of this plexus was not followed by atrophy of the pancreas; and this has been confirmed by Peiper.

Fig. 5.—Highly magnified view of a group of pancreatic acini which has undergone hyaline degeneration (Hartnack, oc. 3, obj. 7. Tube drawn out).

Stomach.—It is unfortunate that the stomach is often omitted in *post-mortem* reports. I have notes of its condition in only eleven cases, but it is significant that in only one instance was it found to present no morbid alteration. In three cases it was dilated, in three there were hæmorrhages, generally near the pyloric end, in two the mucous lining was congested, in one softened, and in one in a state of chronic catarrh. Windle speaks of "thickening" of the mucous membrane as not uncommon, and also of distension of the organ by gas.

Fig. 6.—Section of enlarged pancreas showing commencing cirrhosis with infiltration of the connective tissue spaces by round cells (Hartnack, oc. 2, obj. 4. Tube drawn out).

Intestines.—The large bowel is generally found filled with hardened faecal masses, and congestion or catarrhal conditions of

the mucous membrane are not uncommon. Hæmorrhages similar to those in the stomach also occur in the duodenum. In two instances large masses of *tænia medio-canellata* were present. The mesenteric glands were twice found to be enlarged.

Frerichs has described a dysenteric condition of the large intestine, and Ebstein desquamation of the epithelium lining the bowel.

GENITO-URINARY SYSTEM.

Kidneys.—In not one of my cases were the kidneys described as normal, though in many the changes were not of great importance. The most common condition appears to be a slight degree of fatty degeneration. This comes out in Windle's tables as well as my own. Such kidneys are generally enlarged, and their capsules are often adherent. Less commonly the kidneys are enlarged and congested. Sometimes there is thinning of the cortex, or distinct contraction of the organ. Tubercle and lardaceous disease occur occasionally, and the kidney may become gangrenous (Turner). The above-mentioned fatty change has been described specially by Fichtner, who regards it as characteristic of diabetes.

But the most interesting histological fact in the diabetic kidney is the hyaline degeneration of the tubular epithelium, which was first described by Armanni. His observations were confirmed by Ebstein, who assigned the seat of the lesion to the descending limb of Henle's tubes, but this was disputed by Ferraro, who

Fig. 7.—Portion of Henle's looped tube showing hyaline degeneration of the epithelium (Armanni's lesion, Hartnack, oc. 2, obj. 7. Tube drawn out).

however, found the change nowhere outside the medullary portion of the kidney. This last observer attributed the changes to a primary lesion of the vascular walls. These changes in the epithelium and the co-existing hyaline changes in the vessels were well described by a distinguished Fellow of this College, Dr. Stephen Mackenzie, in opening a discussion at the Pathological Society of London in 1883. Ehrlich also described "as characteristic of and peculiar to diabetes," a hyaline degeneration of the epithelium of that part of the kidney between the cortex and the pyramid, that is, the boundary zone; and Strauss proved that this lesion is identical with that described by Armanni. Strauss found that it was only present in one out of three cases, but he agreed that it is absolutely characteristic of diabetes, and he attributed it to the osmosis of sugar into the cells. Ehrlich considered that the change was due to glycogenic infiltration of the cells, but

Strauss, in a later paper, says that no glycogen may be visible, even when all Ehrlich's precautions are taken.

With reference to its causation, Albertoni and Pisenti have investigated the changes produced by administering small doses of acetone to rabbits. They found the following lesions: (1) granular degeneration of the epithelium of the convoluted tubes, the nuclei still staining well; (2) complete destruction of the epithelium with disappearance of the nuclei, and slight dilatation of Bowman's capsules; the glomeruli and connective tissue were not affected. They suggest the possibility that the necrosis of the epithelium observed by Ebstein may be due to the action of acetone on the kidneys.

Fig. 8.—Renal tubule showing masses of glycogen within the epithelial cells or free (Hartnack, oc. 3, obj. 7. Tube drawn out).

Stokvis, too, found that artificial diabetes, produced by injecting grape sugar into the blood, caused albuminuria; and he believes that this sets up a chronic nephritis. Both these are possible explanations of the fatty change already alluded to, which is entirely like that of slight chronic parenchymatous nephritis due to infective disease; but they do not throw any light upon this peculiar and characteristic hyaline change.

My observations entirely confirm the existence of this hyaline degeneration and its restriction to the epithelium of Henle's tubes. It is well shown in the illustration (Fig. 7), and is quite different from the glycogenic infiltration which may also be present, as shown in the drawing (Fig. 8), though this fails to bring out the characteristic mahogany staining of the glycogen granules.

Fig. 9.—Portion of renal tubule showing fat droplets, stained black with osmic acid, lying within the epithelial cells or free in the lumen (Hartnack, oc. 3, obj. 7. Tube drawn out).

The kidneys, like many other organs in diabetes, may present marked fatty degeneration (Fig. 9), droplets staining black with osmic acid being abundantly visible within the epithelial cells and free in the lumina of the tubules, the straight tubules being chiefly affected. Not uncommonly the kidneys present all the characteristic features of chronic diffuse nephritis, as is illustrated by one of the microscopic specimens.

Bladder.—This organ is usually normal, but it is often dilated and hypertrophied. The mucous lining sometimes may be the seat of hæmorrhages.

Ovaries.—Israel has described a case in which there was gangrene of both ovaries associated with recent general peritonitis. These organs have also been described as cystic and atrophied, but these are common conditions, and not in any way specially associated with diabetes.

Concluding Remarks.—It is very plain that diabetes, far from having no morbid anatomy, has one of a very complicated kind, and one that cannot be without bearing upon its pathology. The most important lesion is, in my opinion, the wasting of the pancreas, but it is not until this organ has been carefully examined

in a larger series of cases than I have been able to collect that we shall be in a position to speak definitely as to its pathological position and value. Of great importance, too, are the changes in the abdominal sympathetic ganglia, though they are too inconstant to form the basis of a satisfactory theory. The liver changes are probably altogether secondary to a functional hyperæmia induced under nervous influence. The other changes in kidneys, lungs, heart, and brain, are merely the results of defective nutrition and of long-standing hyperglycæmia. But the morbid anatomy of diabetes is not yet completed, as is shown by our imperfect knowledge of the state of the pancreas. Unfortunately diabetes is a rare disease even in our great hospitals, hence it is a work of many years to accumulate a series of carefully observed cases, so that with our custom of holding pathological appointments only for a few years, few of us get the opportunity of doing so. I have to express my thanks to the late Pathologist to the General Hospital, Dr. G. F. Crooke, and to his successor, Dr. Ratcliffe, for the assistance they have given me in this work in many ways, and especially in cutting and mounting microscopic sections.

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AN ADDRESS

DELIVERED AT THE OPENING OF

THE SECTION OF DERMATOLOGY.

At the Annual Meeting of the British Medical Association, held in Birmingham, July, 1890.

By JONATHAN HUTCHINSON, F.R.S., LL.D.,

Ex-President of the Royal College of Surgeons.

THE FUTURE OF DERMATOLOGY.

THE dermatologist has before him two principal duties; first, the all-important and paramount one, to cure or relieve those who consult him for skin diseases; and next, to add to the general knowledge of pathology by the study of the phenomena which are brought under his observation. In former days the first was almost his exclusive aim, but of late it has dawned upon us with increasing clearness that we have, in the morbid affections of the integument, unequalled opportunities for the investigation of the laws which regulate diseased action. Not only are we beginning to perceive the value of the information which may be derived from skin diseases as regards pathogeny in general, but we have also to some extent found out that the shortest road to successful therapeutics, even in our own department, lies not in toilsome empiricism, but in the attempt to understand rightly the laws under which these diseases are evoked.