A Course of Lectures ON URINE, URINARY DEPOSITS, AND CALCULI.

DELIVERED AT THE PATHOLOGICAL LABORATORY,
DURING THE SESSION 1857-58.

BY

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LECTURE V.

URINE IN DISEASE. SOLUBLE SUBSTANCES PRESENT IN URINE IN DISEASE WHICH DO NOT EXIST IN THE HEALTHY SECRETION. ALBUMEN. *Of Detecting the Presence of Albumen; Tests; Nitric Acid; Heat; Anomalous Results in Employing these Tests; Apparent Presence of Albumen in Urine which contains none; Phosphate resembling Albumen; Uric Acid resembling Albumen; Cases. Apparent Absence of Albumen in Urine which contains a large Quantity; Cases. Cause of the Precipitation of Albumen by Heat being prevented by a Trace of Nitric Acid. Other Tests for Albumen. On Estimating the Quantity of Albumen. Peculiar Substance in Urine allied to Albumen. Of the Importance of Albumen in Urine in a Clinical point of view. Dropsy in Disease of the Kidney. BILE. Tests. Nitric Acid. Heller's Test. Pettenkofer's Test. Yellow Colour of the Cells, etc., in the Urinary Deposit. SUGAR. General Characters of the Urine in Diabetes. Diabetic Sugar. Tests for Diabetic Sugar; Moore's Test; Trommer's Test; Barreswill's and other Solutions. On Testing for Sugar when only Traces are present. Circumstances interfering with the Action of Trommer's Test. Of the Yeast Test. Maumené's or the Perchloride of Tin Test. Bismuth Test. Of Estimating the Quantity of Sugar; volumetrically; by Fermentation; by Dr. Garrod's Method; by the Polarising Saccharimeter. Circumstances under which Sugar is excreted in the Urine. Analyses of Urine in Diabetes. OTHER SOLUBLE SUBSTANCES WHICH ARE NOT PRESENT IN HEALTH. LEUCINE. TYROSINE. INOSITE. ACETONE. CYSTINE.*

[Concluded from page 393.]

The Experiments of Reynoso and Déchambre repeated, with Negative Results. The urine was tested as in Reynoso's experiments, except that carbonate of soda was used to precipitate the excess of subacetate of lead, instead of chloride of sodium. The specimens of urine passed by six patients under the influence of chloroform, for periods of time varying from ten minutes to half an hour, that of an old lady aged 87, of an old man aged 90, and of two children suffering from epilepsy, were carefully examined. In most, the solution became brown upon being boiled; but no opalescence or precipitate was produced. The urine of a healthy man, aged 24, was also subjected to examination, and became brown upon being boiled with the copper test. The results of numerous other experiments upon specimens of urine known to contain no sugar led me to the conclusion that, in all the above cases, the urine was perfectly free from this substance. Kletzensky has repeated Reynoso's experiments, and has failed to confirm his conclusions. Dr. Moore of Dublin (Heller's *Pathological Chemistry of the Urine*, translated by W. D. Moore, A.B., M.B.T.C.D.) has examined the urine of twelve men and women whose ages varied from sixty to eighty-three, but was unable to detect sugar. We may, therefore, conclude that there is at present not sufficient evidence to prove that sugar is *habitually* excreted in the urine of old people, or by patients suffering from chest-disease,

or by those under the influence of chloroform, etc. It is probable that it may be occasionally met with in some of the above cases.

Analyses of Diabetic Urine. It is difficult to estimate the urea in diabetic urine by the old process; but the proportion may be ascertained by the volumetric method, which will be described in a future lecture. The following analyses show the composition of the urine in some cases of diabetes.

47. Urine from a girl aged 19. Specific gravity, 1037; acid, clear, pale.

48. From the same. Specific gravity, 1036; acid.

49. From a man aged 30, about one month before death. Specific gravity, 1023.

50. From a woman aged 28, a week before death. Acid; specific gravity, 1027.

51. From a patient who was passing sixty ounces of urine daily. Reaction acid; specific gravity, 1021.

Analyses.

	47	48	49
Water . .	916.50	894.00	946.8
Solid matters . .	83.50 100	105.10 100	53.2 100
Urea . .	} 82.20 78.2		
Extractives . .			
Uric acid . .	} 10.66 12.96 3.82 3.63 5.44 10.22		
Alkaline salts . .			
Earthy salts . .	} not estimated. 18.99 18.08 20.24 38.04		
Sugar . .			

	50	51
Water . .	934.2	946.00
Solid matter . .	65.8 100	54.00 100
Urea . .	} 16.94 25.74	
Extractive matters . .		
Uric acid . .	} 1.64 2.40	
Alkaline salts . .		
Earthy salts . .	} 5.82 8.84 3.76 6.96	
Sugar . .		
	41.40 62.01	28.50 52.7

Analyses 52, 53, 54 represent the composition of the urine in a case of diabetes now under my care in the hospital. The patient was a healthy looking girl, only eighteen years of age. She had been suffering from the disease for about three months. Various plans of treatment were tried, without any marked results. She remained under treatment for six weeks, and then left the hospital; but she will probably again come under our notice in a short time. She drank from four to six pints of fluid daily; and, when living on a moderate meat diet, with a small quantity of bread, passed rather under a gallon of urine. The urine was analysed from day to day; and I select three specimens for illustration. When the last was obtained, her diet was restricted to bran-biscuits and milk. The results are expressed in grains, and represent the quantities passed in twenty-four hours. [See Table, next page.]

Let me now refer very briefly to some other *soluble substances* not present in healthy urine, which have been detected lately in small quantities in certain morbid specimens. These are, *leucine, tyrosine, inosite, acetone, and cystine.*

LEUCINE.

Leucine occasionally occurs as a deposit from the urine; but more generally it is held in solution, and can only be obtained by concentration of the fluid when it crystallises out in the form of small spherules, which are composed of acicular crystals which radiate from a common centre. This substance has of late been found in many of the solids and fluids of the animal body. It is not very soluble in water (one part in twenty-seven), but more so in alcohol. It crystallises from aqueous solutions, for the most part in spherical masses, which exhibit a radiated arrangement. From alcohol, leucine is deposited in the form of pearly scales, somewhat resembling cholesterine; but these are composed of small spherules. Dry leucine can be sublimed without change. Leucine has been

Analyses.

	52		53		54	
	March 20th.	In 100 of solid matter.	April 2nd.	In 100 of solid matter.	April 23rd.	In 100 of solid matter.
Quantity of fluid drank in 24 hours	64708.75		36908.75		36968.75	
Specific gravity	1037		1043		1043	
Reaction	Acid.		Acid.		Acid.	
Water	78653.75		69864.50		50857.625	
Solid matter	8840.25		8510.50		6017.375	
Urea			512.20	5.430	455.000	7.561
Sugar	8750.00	98.910	7549.12	88.703	4889.326	81.253
Organic matter			141.07	2.447	501.287	8.333
Fixed salts			308.11	3.620	171.762	2.853

found in the saliva, pancreatic juice, and in the pulmonary tissue of the ox (Cloetta, *Chemical Gazette*, 1856, p. 61). Frerichs and Städeler have detected leucine in the blood, urine, and bile of patients suffering from typhus, small-pox, and other exanthemata. Dr. Thudichum found leucine in the urine of a man whose liver yielded a large quantity of it (*Treatise on the Pathology of the Urine*, 1858). It was obtained by concentrating the urine. This substance is probably formed in the liver, and in health rapidly converted into other compounds. In certain diseases, it is to be detected in very considerable quantity. Crystals of leucine may often be seen in sections of livers of patients who have died of jaundice. Frerichs has given several figures of leucine crystals in the liver, and also in the urine (*Pathologisch-Anatomischer Atlas zur Leberkrankheiten*, von Dr. F. T. Frerichs, Braunschweig, 1858). It occurs especially in the urine of patients suffering from acute yellow atrophy of the liver.

No satisfactory tests for leucine are yet known. If it can be obtained pretty pure by repeated recrystallisation, the dry leucine may be sublimed. The sublimate, composed of aggregations of rhombic plates, could not be mistaken for anything else. Urate of soda and many other substances crystallise in spherical globes, like leucine. Crystals of this form, however, which are soluble in alcohol, and again crystallise in spherules from an aqueous solution, can hardly be anything but leucine. This substance cannot, therefore, be recognised by the form of the crystals alone.

Fig. 9.—Crystals of Leucine. Those represented at *a* were crystallised from water. The rest were obtained from an alcoholic solution.

On obtaining Crystals of Leucine from the Urine. The extractive matters often interfere with the crystallisation of the leucine from urine, and the concentrated extract often remains for days without undergoing any change. Frerichs (*Klinik der Leberkrankheiten*, Band 1, s. 221) recommends that the concentrated urine should be digested for some time with cold absolute alcohol. By this means, the extractive matters are gradually dissolved out. The residue is then to be treated with boiling spirits of wine; and leucine crystallises out as this solution cools. It may be purified by recrystallisation. The

extractive matter may be in great part separated by precipitation with acetate of lead.

TYROSINE.

This substance has been detected in the urine of typhus fever by Frerichs and Städeler. Like leucine, it is probably produced in the liver. It has been detected in this organ by Frerichs, Dr. Thudichum, and many other observers. It has been extracted from several animal fluids. Tyrosine crystallises in long white needles, and is very slightly soluble in cold water. It is dissolved by boiling water, alcohol, ether, the mineral acids, and alkalies. It may be prepared by boiling horn, feathers, or hair, with sulphuric acid for forty hours. The dark brown liquid is to be made alkaline with milk of lime, warmed, and then filtered. Sulphuric acid is added to

Fig. 10.—Crystals of Tyrosine from a solution in boiling water.

neutralisation, and crystals are deposited upon evaporating the liquid. A very delicate test for this substance has been proposed by Hoffman. A solution of nitrate of protoxide of mercury, nearly neutral, is to be added to the solution suspected to contain tyrosine. If this body be present, a reddish precipitate is produced, and the supernatant fluid is of a very dark rose colour. Tyrosine crystallises in long white needles, which are aggregated to form brush-like masses. De la Rue found tyrosine in the cochineal insect. This is doubtless one of the substances resulting from the disintegration of albuminous substances. I have found it in considerable quantity in urine which contained much uric acid, and had been left to stand in a warm place for many weeks.

INOSITE.

Inosita was discovered by Scherer in the juice of muscle, after the creatine and creatinine had been separated. It is termed muscle-sugar, and may be obtained in the form of colourless prismatic crystals, which are efflorescent. Inosite does not reduce the oxide of copper to the state of suboxide, as is the case with diabetic sugar and grape-sugar. It tastes sweet, and has the same composition as the latter substance. Inosite may be detected by evaporation nearly to dryness in a platinum basin, when, if a little ammonia and chloride of calcium be

added, a rose colour is produced, especially if the mixture be again concentrated by evaporation.

Gloëta has found inosite in the urine in Bright's disease, but has failed to detect it in the healthy secretion. He has discovered it in the lungs, liver, spleen, and kidneys. The lungs also contain traces of uric acid, taurine, and leucine. M. Hohl has lately recorded a case of diabetes in which a large quantity of inosite was obtained from the urine (*Gazette Hebdomadaire de Médecine et de Chirurgie*, 1850, p. 221; *Journal de la Physiologie*, No. vi, p. 344). In this case, the proportion of sugar gradually diminished, and at the same time the quantity of urea excreted became less, while the inosite gradually increased in amount until upwards of three hundred grains of this substance were passed in the twenty-four hours. This observation is one of great interest in connexion with the pathology of diabetes.

ACETONE.

Dr. Petters, at the suggestion of Dr. Lerch of Prague, sought for acetone in the urine of a case of diabetes, and discovered it both in the blood and urine (*Vierteljahrsschrift für die Practische Heilkunde*, Prag, 1857, vol. iii, p. 81). The peculiar smell of diabetic urine is to be attributed to the presence of acetone, according to this observer (Thudichum, *Pathology of the Urine*, p. 315).

CYSTINE.

Cystine is found in a state of solution in the urine in some cases, although it more usually occurs as a deposit. We shall therefore consider it more particularly under the head of urinary deposits. Julius Müller (*Archiv der Pharmacie*) obtained some urine from a boy 6½ years of age, which contained cystine in solution. The urine was alkaline. The cystine was precipitated in the crystalline form by the addition of excess of acetic acid. Crystals of cystine are represented in Plate x, figs. 1, 2, 3, 4, of *Illustrations of Urine, Urinary Deposits, and Calculi*.

I have ventured to occupy some time in drawing your attention to the characters of some substances the presence of which in urine has only very recently been demonstrated. Probably, when the various materials removed in this excretion shall have been more thoroughly investigated, and when we know more relating to the precise conditions under which they are formed in the animal economy, the treatment of many diseases will be placed on a sounder basis, and we shall be able to relieve sufferings and prevent the progress of morbid changes over which we have now very little control. It is true, there are many who consider all this minute scrutiny and scientific investigation as useless, or at least unnecessary and unpractical. This is a state of mind which it is difficult to understand; for it seems to me perfectly certain that the more minutely our investigation of diseased processes is carried out, the more we shall know about them, and the better able shall we be to suggest plans of treatment to combat the abnormal changes. That all this will ultimately lead to great practical results in treatment, I believe most sincerely; and I feel that any amount of time devoted to such researches is usefully and advantageously spent. If, then, I have tired you with some of these chemical details, my earnest belief that they are useful to the progress of medicine, and the desire, therefore, to see you prosecute such researches, must be my excuse.

In the next lecture, I shall have to describe the character of casts of the uriniferous tubes, which vary much in different renal diseases. But it is not possible to discuss this subject profitably without referring to many points connected with the anatomy of the kidney; and I therefore propose to give a brief outline of the anatomy of this organ, and especially of those parts concerned in the formation of casts.

ARREST OF DECAY. You remember reading how upon a day not many years since, certain miners, working far underground, came upon the body of a poor fellow who had perished in the suffocating pit forty years before. Some chemical agent to which the body had been subjected—an agent prepared in the laboratory of nature—had effectually arrested the progress of decay. They brought it up to the surface, and for awhile, till it crumbled away through exposure to the atmosphere, it lay there, the image of a fine sturdy young man. No convulsion had passed over the face in death; the features were tranquil; the hair was black as jet. No one recognised the face—a generation had grown up since the day on which the miner went down his shaft for the last time. But a tottering old woman, who had hurried from her cottage at hearing the news, came up, and she knew again the face which through all these years she had never quite forgot. (*Fraser's Mag.* for June.)

Illustrations

OF

HOSPITAL PRACTICE:

METROPOLITAN AND PROVINCIAL.

LIVERPOOL NORTHERN HOSPITAL.

CASES OF ACUTE DISEASE OF THE CHEST.

Under the care of A. T. H. WATERS, M.R.C.P., Physician to the Hospital.

[From Notes by MR. JACKSON, Clinical Clerk.]

CASE I. Pneumonia: Local Blood-letting: Administration of Antimony: Recovery. W. Edwards, aged 20, sailor, a stout, strong, muscular man, was admitted into the Hospital on March 29th, 1860. Six days before admission, whilst on board ship, he took cold, and was obliged to lie up for two days; he resumed his work on the third day, but was again compelled to give up. He had had no rigors, but a good deal of dyspnoea and cough, and had slept but little. He had taken some medicine, and a blister had been applied.

On admission, he complained of shortness of breath; he had no pain in the chest, except on taking a deep inspiration; the face was much flushed; the skin hot and burning; the pulse 110, full and strong; respirations 40 per minute; the tongue was dry and brown; there was much general distress. Over the whole of the back of the left lung, crepitation was heard, with bronchial breathing and bronchophony, which were especially loud at the upper part. There was less movement of the left side of the chest than of the right. There was dulness on percussion over the back of the left lung, extending as far forwards as the axilla. There was slight crepitation at the back of the right lung, but no dulness. The anterior parts of both lungs were resonant, and their breath-sounds normal. The heart-sounds were also normal. He was cupped between the scapulae to twelve ounces.

R. Antim. potassio-tart. gr. j; liquoris ammon. acetatis ʒss; aquæ ʒij. Fiat haustus tertiâ quâque horâ sumendus.

Low diet.

March 30th. He had slept a little. The face was still flushed and dusky; pulse 106; the skin was less hot; the tongue moist, furred. He had no sickness. The sputum was very scanty. The auscultatory signs were the same, not increased in extent.

March 31st. He had slept well. The pulse was 80; the respirations 34; tongue moist and cleaner. He had no pain in the chest; there was less dulness at the back of the left lung, and the extent of surface over which crepitation was heard was less. The breath-sounds of the right lung were normal. Beef-tea and arrowroot were ordered.

April 2nd. A herpetic eruption appeared around the mouth and on the tongue. The lung-symptoms were improving. He was ordered to take the mixture three times a day only.

April 3rd. He expressed himself as feeling quite well. There was no crepitation over the back of the left lung, but dulness with bronchial breathing and bronchophony over a small space at the lower part; elsewhere, the breathing was good. The medicine was omitted, and he was ordered chop-diet.

He continued to improve rapidly; and on the 7th, the breath-sounds were normal all over both lungs, except just at the lower part of the left, where there was slight crepitation on taking a deep inspiration. He said he felt quite well, and wished to go out. Discharged.

CASE II. Pneumonia: Administration of Antimony: Recovery. Lewis Jackson, aged 47, sailor, was admitted into the Hospital on March 14th, 1860. He was a coloured man, in good condition, stout and muscular. Having been previously in good health, he was exposed to severe cold about a week before admission, and was soon after seized with pain in the epigastrium and cough. This compelled him to give up his work. He was attended by a surgeon, who applied leeches to the seat of pain, and gave him medicine.

On admission, he complained of pain in the epigastrium, dyspnoea, and want of sleep. The skin was hot; pulse 92; there was pain in the left side on taking a deep inspiration, and