ON THE PRESENCE
OF
OXALATE OF LIME IN THE URINE.

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THE appearance of octohedral crystals in the urine appears first to have been described by M. Vigla. Dr. Bird in England, and afterwards M. Donné in France, recognised the very frequent occurrence of such crystals, and by re-actions observed by the microscope, inferred that these crystals were oxalate of lime. A case occurred to me, in which, from the quantity of octohedral crystals passed, I was able to examine the sediment in nearly the usual method. This, though still not absolutely conclusive, renders the inference, to the chemist, at least more probable. Other forms of oxalate of lime have been mentioned. Dr. Bird describes dumb bells. Such crystals I have frequently met with, deposited on the evaporation of some urine, but so soluble in water, that they must differ altogether in composition from those observed by Dr. Bird.

M. Donné ascribes another form to oxalate of lime,

namely, smooth discs or globules with transparent centres, resembling blood-globules in urine, which indeed at first I supposed they were. I have found these most frequently mixed with the octohedral crystals, but I could not obtain them separately, so as to admit of examination.

Forms derived from the octohedron are sometimes met with, as cubes, which are occasionally found, and once I saw dodecahedral crystals mixed with cubes and octohedra.

The states of the system in which octohedral crystals are seen, vary exceedingly. In acute rheumatism and gout, chronic rheumatism, aggravated hypochondriasis and hysteria, and diabetes, I have found such crystals. In one case in which the rheumatism was slight, the influence of diet and exercise on the mixed deposit of urate of ammonia and oxalate of lime was made the subject of experiment. In other cases in which these octohedral crystals occurred, the symptoms were altogether different; irritation of the urinary organs being the most prominent. The concretion of the crystals, into oxalate of lime-gravel, seemed in one patient to be the cause of this diversity of symptoms.

The connection observed by MM. Donn and Rayer, between seminal weakness and oxalate of lime, I found in two cases; and in a third, where three small oxalate of lime calculi had been passed at long intervals, and octohedral crystals were constantly found in the urine, on one examination a few dead spermatozoa were seen.

July 1842.—John Saunders, æt. 47, formerly a soldier, was admitted an out patient of St. George's Hospital. March 1843 I examined the deposit which had been continually observed in the urine. It consisted of innumerable crystals of uric acid, mixed with octohedral crystals. For twenty years he has suffered more or less from urinary disorders. In 1828 he had rheumatic fever, and says he was confined to bed eleven weeks. The small joints of the fingers are now larger and stiffer than natural, and occasionally very painful.

The urinary sediment was thrown on a filter and washed with distilled water. The red residue was dried, reduced to a fine powder, and treated with dilute hydrochloric acid, which left most of the uric acid undissolved. The acid liquid was filtered, and ammonia gave a very considerable precipitate, when added in excess. When evaporated to dryness, and heated on platinum, the muriate of ammonia was driven off, and the residue effervesced strongly when thrown into dilute acid, and left an alkaline ash when heated more highly. The ash was with difficulty soluble in water, and gave a precipitate with oxalate of ammonia. Hence some organic acid salt of lime was present ; and as oxalate of lime is known to occur in octohedral crystals, the conclusion that these crystals were oxalate of lime is most probable.

October 4th, 1843, I examined the urine of a patient of Mr. Cutler's, and at the same time three small renal calculi, which had been passed, one in July, another in August, and the third in Septem-

ber. Late in October I also examined a fourth calculus. The urine under the microscope contained multitudes of octohedra mixed with some crystals of uric acid. All the calculi were found to consist of oxalate of lime mixed with uric acid.

In searching for these octohedral crystals, I examined some cases of acute rheumatism. The first was Nov. 27th, 1842, a patient of Dr. Seymour's, in St. George's Hospital. Tongue coated, pulse full and quick. Complaints of much pain with redness and swelling, chiefly in the upper extremities. The urine was loaded with a reddish pink sediment, which was dissolved in warm distilled water, and a few drops of the solution were examined by the microscope. Octohedral crystals were seen in great numbers. This is the first attack of acute rheumatism. Had never previously suffered from rheumatic pains. Was bled four times out and in the house for this attack.

Since this time I have frequently found these octohedral crystals in cases of acute rheumatism which have been in St. George's Hospital, though the time at which they occur in rheumatic urine varies considerably.

It is very common to find these crystals also mixed with urate of ammonia in chronic rheumatism. In the following case I was enabled to make some experiments regarding the effect of diet and exercise on the deposit. In it I first observed that the octohedral crystals seemed to vary in quantity at different periods of the day.

March 7th, 1843.—A medical man, æt. 30. Had had acute rheumatism some years previously, and *now* has occasionally slight attacks. The urine usually contains a red sediment, which with the microscope is seen to be mixed with octohedral crystals.

During the twenty-four hours, the water each time it was passed was kept in a separate glass vessel, and it was subjected to examination the following morning, when the specific gravity and the appearance were noted ; the time and the quantity having been previously registered. The food was plain, the quantity drunk usually about 50 ounces daily. The exercise always walking. No medicine whatever was given during the experiments, which lasted four weeks.

March 7th.—Animal diet only ; no bread or vegetables. Exercise moderate—between 5 and 6 miles. Bowels inactive. Skin cold. Urine passed at

Eight o'clock	Eleven	Threa	Six	Eleven	
14 $\frac{3}{4}$	8 $\frac{3}{4}$	8 $\frac{3}{4}$	3 $\frac{3}{4}$	6 $\frac{3}{4}$	= 39 $\frac{3}{4}$
very thick	less thick	more so	more so	more thick	Average.
1019.45	1016.21	1020.07	1027.79	1025.60	= 1021.82

March 8th.—Bowels acted. Skin cold. Animal food and exercise as before.

Seven	$\frac{1}{2}$ -past Eleven	$\frac{1}{4}$ -past Three	Six	Eleven	
13 $\frac{1}{2}$ $\frac{3}{4}$	13 $\frac{3}{4}$	5 $\frac{1}{4}$ $\frac{3}{4}$	2 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{1}{2}$ $\frac{3}{4}$	= 40 $\frac{1}{4}$ $\frac{3}{4}$
little thick	clear	thick	thick	more thick	
1020.22	1012.04	1022.39	1027.02	1028.10	= 1022.13

March 9th.—Bowels inactive. Skin cold. Animal food and exercise as before.

Seven	$\frac{1}{2}$ -past Eleven	$\frac{1}{4}$ -past Three	Six	Eleven	
12 $\frac{3}{4}$	7 $\frac{1}{2}$ $\frac{3}{4}$	4 $\frac{1}{2}$ $\frac{3}{4}$	2 $\frac{1}{2}$ $\frac{3}{4}$	7 $\frac{1}{2}$ $\frac{3}{4}$	= 34 $\frac{3}{4}$
thick	thick	thick	thick	more thick	
1021·12	1011·89	1026·59	1026·09	1024·70	= 1021·37

March 10th.—Bowels acted slightly. Skin perspiring from exercise, which was increased to about eleven miles. Diet as before.

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	$\frac{1}{4}$ -past Three	$\frac{1}{4}$ -past Six	Eleven	
13 $\frac{3}{4}$	6 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{1}{2}$ $\frac{3}{4}$	3 $\frac{1}{2}$ $\frac{3}{4}$	6 $\frac{3}{4}$	= 34 $\frac{3}{4}$
thick	thick	less thick	less thick	thick	
1024·39	1022·07	1025·94	1027·33	1029·64	= 1025·87

March 11th.—Bowels acted slightly. Exercise eleven miles. Diet as before.

Seven	$\frac{3}{4}$ -past Eleven	$\frac{1}{4}$ -past Three	Six	Eleven	
14 $\frac{3}{4}$	7 $\frac{3}{4}$	5 $\frac{1}{2}$ $\frac{3}{4}$	3 $\frac{3}{4}$	6 $\frac{1}{2}$ $\frac{3}{4}$	= 36 $\frac{1}{2}$ $\frac{3}{4}$
slight cloud	thick	thick	thick	clear	
1026·40	1027·28	1026·86	1031·34	1025·63	= 1027·50

March 12th.—Bowels inactive. Skin very cold. Exercise—very small quantity; about two miles. Diet—meat with a little bread three times in the day.

Eight	One	Six	$\frac{1}{2}$ -past Ten	
12 $\frac{3}{4}$	6 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{1}{2}$ $\frac{3}{4}$	11 $\frac{1}{2}$ $\frac{3}{4}$	= 34 $\frac{1}{2}$ $\frac{3}{4}$
clear	thick	thick	clear	
1024·86	1024·39	1023·47	1015·44	= 1022·04

March 13th.—Exercise moderate. Diet as yesterday.

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	$\frac{1}{2}$ -past Three	Six	Eleven	
13 $\frac{3}{4}$	5 $\frac{3}{4}$	4 $\frac{1}{2}$ $\frac{3}{4}$	2 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{3}{4}$	= 29 $\frac{1}{2}$ $\frac{3}{4}$
very thick	thick	thick	thick	thick	
1022·57	1023·60	1025·94	1027·48	1028·70	= 1025·66

March 14th.—Bowels inactive. Skin warmer. Exercise and diet as before.

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
10 $\frac{2}{3}$	7 $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	2 $\frac{2}{3}$ $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	= 28 $\frac{2}{3}$ $\frac{2}{3}$
thick	less thick	thick	thick	slight cloud	
1027.64	1018.06	1021.92	1025.32	1026.09	= 1023.80

March 15th.—Temperature warmer than it has hitherto been.

Eight	Eleven	Three	Six	Eleven	
18 $\frac{2}{3}$	12 $\frac{2}{3}$	13 $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	6 $\frac{1}{2}$ $\frac{2}{3}$	= 53 $\frac{2}{3}$ $\frac{2}{3}$
clear	clear	clear	clear	clear	
1014.02	1009.57	1012.66	1021.46	1022.69	= 1018.08

The exercise and diet were the same as in the three previous days. The quantity of water drank was not at all more. The exercise was not at all stronger. I could find no cause for the great increase in the quantity passed. On examination by the microscope the number of octohedral crystals were found to be innumerable. Up to this day they had been present only in very small numbers.

March 16th :—

Eight	$\frac{1}{2}$ -past Eleven	Three	$\frac{1}{2}$ -past Six	Eleven	
17 $\frac{2}{3}$	8 $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	5 $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	= 38 $\frac{2}{3}$ $\frac{2}{3}$
clear	clear	thick	clear	thick	
1016.05	1012.56	1021.61	1020.69	1029.18	= 1020.01

Octohedral crystals were present in larger number than usual.

March 17th :—

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
13 $\frac{2}{3}$	14 $\frac{2}{3}$	6 $\frac{1}{2}$ $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	6 $\frac{2}{3}$	= 44 $\frac{2}{3}$
clear	clear	clear	clear	thick	
1023.93	1011.11	1021.46	1023.00	1024.39	= 1020.77

The exercise has been as before. Mixed diet three times daily. Bowels acted once in the two days.

March 18th :—

Eight	Eleven	Three	Six	Eleven	
18 $\frac{1}{2}$ $\frac{1}{3}$	16 $\frac{1}{2}$ $\frac{1}{3}$	5 $\frac{1}{3}$	5 $\frac{1}{3}$	8 $\frac{1}{3}$	= 52 $\frac{1}{2}$ $\frac{1}{3}$
clear	clear	clear	thick cloud	clear	
1014·66	1009·79	1019·61	1023·78	1023·93	= 1018·35

March 19th :—

$\frac{1}{2}$ -past Seven	Eleven	$\frac{1}{2}$ -past Two	Six	Eleven	
18 $\frac{1}{2}$ $\frac{1}{3}$	10 $\frac{1}{3}$	10 $\frac{1}{3}$	6 $\frac{1}{3}$	8 $\frac{1}{3}$	= 52 $\frac{1}{3}$
clear	clear	clear	clear	clear	
1012·22	1012·94	1013·89	1020·69	1021·00	= 1018·14

March 20th :—Little sore throat. Some headache. Bowels acted well. Skin perspired with walking.

$\frac{1}{2}$ -past Seven	Eleven	Three	Six	Eleven	
18 $\frac{1}{2}$ $\frac{1}{3}$	8 $\frac{1}{3}$	4 $\frac{1}{3}$	4 $\frac{1}{3}$	6 $\frac{1}{2}$ $\frac{1}{3}$	= 41 $\frac{1}{3}$
clear	clear	thick	thick	thick	
1016·52	1017·75	1023·60	1024·86	1027·28	= 1022·00

Diet the same as hitherto. Exercise increased to upwards of ten miles. Deposit very pink.

March 21st.—Bowels acted slightly. Sore throat and headache gone.

Eight	$\frac{1}{2}$ -past Ten	$\frac{1}{2}$ -past Two	Six	Eleven	
15 $\frac{1}{2}$ $\frac{1}{3}$	8 $\frac{1}{3}$	8 $\frac{1}{3}$	5 $\frac{1}{2}$ $\frac{1}{3}$	14 $\frac{1}{2}$ $\frac{1}{3}$	= 51 $\frac{1}{2}$ $\frac{1}{3}$
clear	clear	clear	clear	clear	
1019·76	1009·11	1020·38	1021·92	1014·82	= 1017·19

Diet the same as hitherto. Exercise about four miles. The increased quantity at eleven o'clock at night attributed to a hot room and cold walk.

March 22nd :—

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
12 $\frac{1}{2}$ $\frac{1}{3}$	14 $\frac{1}{2}$ $\frac{1}{3}$	7 $\frac{1}{3}$	3 $\frac{1}{2}$ $\frac{1}{3}$	4 $\frac{1}{2}$ $\frac{1}{3}$	= 41 $\frac{1}{2}$ $\frac{1}{3}$
clear	clear	clear	clear	clear	
1022·69	1009·26	1024·70	1024·24	1027·78	= 1021·73

Diet the same as previously. Bowels acted. Skin warm with exercise.

March 23rd :—

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
15 $\frac{3}{4}$	10 $\frac{3}{4}$	6 $\frac{1}{4}$ $\frac{3}{4}$	4 $\frac{1}{2}$ $\frac{3}{4}$	10 $\frac{3}{4}$	= 45 $\frac{3}{4}$
clear	clear	clear	clear	clear	
1018·22	1017·14	1019·76	1023·00	1014·05	= 1018·43

The urine contains a great number of octohedral crystals.

March 24th :—

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
20 $\frac{3}{4}$	10 $\frac{3}{4}$	6 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{3}{4}$	6 $\frac{3}{4}$	= 47 $\frac{1}{2}$ $\frac{3}{4}$
clear	clear	thickish	thick	thick	
1014·54	1019·14	1025·64	1019·61	1029·61	= 1021·90

Breakfast—bread, egg, and boiled beef. Dinner—mutton. Bowels inactive. Exercise between four and five miles.

March 25th.—Bowels acted. Skin very cold (high wind). Diet—beef and bread. No sugar.

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
12 $\frac{1}{2}$ $\frac{3}{4}$	10 $\frac{1}{2}$ $\frac{3}{4}$	5 $\frac{3}{4}$	5 $\frac{1}{4}$ $\frac{3}{4}$	7 $\frac{1}{4}$ $\frac{3}{4}$	= 40 $\frac{1}{2}$ $\frac{3}{4}$
clear	clear	thick	clear	clear	
1022·69	1016·67	1025·88	1026·71	1024·39	= 1023·26

The exercise to-day was increased to upwards of ten miles.

March 26th.—Bowels inactive. Day very cold. Very sharp east winds. Meat only, with an egg. No sugar. Meat three times in the day.

Eight	Eleven	$\frac{1}{2}$ -past Two	Six	Eleven	
20 $\frac{3}{4}$	11 $\frac{1}{4}$ $\frac{3}{4}$	14 $\frac{3}{4}$	6 $\frac{1}{4}$ $\frac{3}{4}$	12 $\frac{1}{2}$ $\frac{3}{4}$	= 64 $\frac{3}{4}$
clear	clear	clear	clear	clear	
1014·05	1008·95	1015·19	1021·61	1013·28	= 1014·61

Exercise—the smallest hitherto taken ; about

three miles. Quantity drank, about the same as in previous experiments. The water passed at six o'clock contained oxalate of lime octohedra in unusual number; the crystals aggregated in masses.

March 27th.—Bowels inactive. Temperature less cold. Diet—two eggs, beef and mutton, water and tea without sugar. Exercise moderate.

$\frac{1}{2}$ -past Seven	Eleven	Three	Six	Eleven	
20 $\frac{2}{3}$	6 $\frac{1}{2}$ $\frac{2}{3}$	7 $\frac{2}{3}$	3 $\frac{2}{3}$	8 $\frac{1}{2}$ $\frac{2}{3}$	= 45
clear	clear	thick	clear	clear	
1012·50	1021·92	1025·47	1029·03	1021·46	= 1022·07
Scarcely any octohedral crystals.			Aggregated masses of oxalate of lime.		

March 28th.—Bowels inactive. Skin warmer. Diet—animal food only. Exercise, upwards of ten miles. No sugar.

$\frac{1}{2}$ -past Seven	Eleven	Three	Six	Eleven	
18 $\frac{2}{3}$	8 $\frac{1}{2}$ $\frac{2}{3}$	10 $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	16 $\frac{1}{2}$ $\frac{2}{3}$	= 57 $\frac{1}{2}$ $\frac{2}{3}$
clear	clear	clear	clear	clear	
1015·28	1018·83	1016·36	1023·00	1013·28	= 1019·35
Little oxalate of lime.		Octohedra in considerable quantity, but less than yesterday.			

March 29th.—Bowels acted. Diet mixed, consisting of bread and meat. Exercise, about five miles. No sugar.

Seven	Eleven	Three	Six	Eleven	
20 $\frac{2}{3}$	10 $\frac{1}{2}$ $\frac{2}{3}$	6 $\frac{1}{2}$ $\frac{2}{3}$	4 $\frac{1}{2}$ $\frac{2}{3}$	8 $\frac{2}{3}$	= 49 $\frac{1}{2}$ $\frac{2}{3}$
clear	clear	thick	clear	clear	
1014·54	1015·75	1017·91	1021·00	1021·30	= 1018·10
Little oxalate.		Multitudes of octohedra.			

March 30th.—Bowels inactive. Exercise about the same. No sugar.

Eight	Eleven	Three	Six	Eleven	
23 $\frac{2}{3}$	104 $\frac{2}{3}$	54 $\frac{2}{3}$	5 $\frac{2}{3}$	54 $\frac{2}{3}$	= 49 $\frac{1}{3}$
clear	clear	thick	clear	clear	
1010·50	1013·58	1022·23	1023·16	1027·78	= 1019·45
Very few octohedral crystals.			Many more.	Great numbers, but not in masses.	

March 31st.—Bowels acted. Exercise about the same. Dinner, chiefly meat; at other times, less bread.

Seven	Eleven	Three	Six	Eleven	
164 $\frac{2}{3}$	114 $\frac{2}{3}$	54 $\frac{2}{3}$	44 $\frac{2}{3}$	54 $\frac{2}{3}$	= 42 $\frac{2}{3}$
clear	clear	clear	clear	clear	
1014·82	1012·35	1021·77	1024·08	1025·01	= 1019·80
Few octohedra.	More octohedra.		Still more octohedra.		

April 1st.—Bowels inactive. Skin warmer. Exercise and food much as before. No sugar.

$\frac{1}{2}$ -past Seven	$\frac{1}{2}$ -past Eleven	Three	Six	Eleven	
13 $\frac{2}{3}$	74 $\frac{2}{3}$	5 $\frac{2}{3}$	54 $\frac{2}{3}$	54 $\frac{2}{3}$	= 36 $\frac{2}{3}$
clear	clear	thick	clear	clear	
1022·23	1019·76	1024·70	1024·39	1024·08	= 1023·03
		Very few octohedra.		Innumerable octohedra forming a visible sediment.	

April 2nd.—Bowels acted. Skin warm. Diet, chiefly meat, with little bread three times in the day, with water and wine. Exercise moderate. No sugar.

$\frac{1}{2}$ -past Seven	Eleven	Three	Six	Eleven	
18 $\frac{2}{3}$	8 $\frac{2}{3}$	8 $\frac{2}{3}$	8 $\frac{2}{3}$	11 $\frac{2}{3}$	= 53 $\frac{2}{3}$
clear	clear	clear	clear	clear	
1015·44	1013·15	1018·53	1021·00	1009·88	= 1015·60
Very many very small octohedra.		Very few octohedra.			

April 3rd.—Bowels acted. Skin warm. Diet and exercise as yesterday.

$\frac{1}{2}$ -past				
Seven	Eleven	Three	Six	Eleven
$16\frac{1}{2}$ 3	9 3	$5\frac{1}{2}$ 3	5 3	5 3 = 41 3
clear	clear	clear	clear	clear
1018·22	1018·53	1023·93	1023·00	1025·64 = 1021·86

Very few octohedral crystals.

Hence we have :—

In 28 days, 1224 $\frac{1}{2}$ ounces. Sp. gr. on average, 1020·75. Average daily, $43\frac{1}{2}$ 3 nearly.

At Eight o'clock, morning	Eleven	Three	Six	Eleven at night.
$443\frac{1}{2}$ 3 1018·90	$261\frac{1}{2}$ 3 1015·90	$184\frac{1}{2}$ 3 1021·83	$123\frac{1}{2}$ 3 1024·14	$211\frac{1}{2}$ 3 1023·02
about $15\frac{1}{2}$ 3 daily	$9\frac{1}{2}$ 3 daily	$6\frac{1}{2}$ 3 daily	$4\frac{1}{2}$ 3 daily	$7\frac{1}{2}$ 3 daily

Eight days on meat only, with water, tea, and wine.

Quantity, $350\frac{1}{2}$ 3.	Average sp. gr., 1022·41.	Average quantity daily, $43\frac{1}{2}$ 3 nearly.		
$124\frac{1}{2}$ 3 1020·42	$68\frac{1}{2}$ 3 1019·91	$60\frac{1}{2}$ 3 1022·36	$28\frac{1}{2}$ 3 1026·65	$69\frac{1}{2}$ 3 1022·71
$15\frac{1}{2}$ 3 daily	$8\frac{1}{2}$ 3 daily	$7\frac{1}{2}$ 3 daily	$3\frac{1}{2}$ 3 daily	$8\frac{1}{2}$ 3 daily

Twenty days on mixed diet without vegetables.

Quantity, $873\frac{1}{2}$ 3.	Average sp. gr., 1020·32.	Average quantity daily, $43\frac{1}{2}$ 3 nearly.		
$319\frac{1}{2}$ 3 1018·40	$193\frac{1}{2}$ 3 1015·30	$123\frac{1}{2}$ 3 1021·63	95 3 1023·14	$142\frac{1}{2}$ 3 1023·15
16 3 daily	$9\frac{1}{2}$ 3 daily	$6\frac{1}{2}$ 3 daily	$4\frac{1}{2}$ 3 daily	$7\frac{1}{2}$ 3 daily

Five days in which the exercise was in great excess.

Quantity, 209 3.	Average sp. gr., 1023·20.	Average quantity, $41\frac{1}{2}$ 3.		
$75\frac{1}{2}$ 3 1021·07	$40\frac{1}{2}$ 3 1020·52	30 3 1023·73	$20\frac{1}{2}$ 3 1026·65	43 3 1024·04
15 3 daily	8 3 daily	6 3 daily	4 3 daily	$8\frac{1}{2}$ 3 daily

Twenty-three days in which the exercise was moderate.

Quantity, 1018 3.	Average sp. gr., 1020·11.	Average quantity, 44 3 daily.		
$368\frac{1}{2}$ 3 1018·01	221 3 1014·81	$153\frac{1}{2}$ 3 1021·33	$107\frac{1}{2}$ 3 1023·60	$168\frac{1}{2}$ 3 1022·80
16 3 daily	$9\frac{1}{2}$ 3 daily	$6\frac{1}{2}$ 3 daily	$4\frac{1}{2}$ 3 daily	$7\frac{1}{2}$ 3 daily

Three days in which the exercise was in excess, and the food only animal.

Quantity, 128 3.	Average sp. gr., 1023·57.	Average quantity, $42\frac{1}{2}$ 3.		
45 3 1022·02	22 3 1022·72	21 3 1023·05	11 3 1027·22	29 3 1022·85
15 3 daily	$7\frac{1}{2}$ 3 daily	7 3 daily	$3\frac{1}{2}$ 3 daily	$9\frac{1}{2}$ 3 daily

Two days in which the exercise was in excess, and the food mixed.

Quantity, 81½ 3.		Average sp. gr., 1022·63.		Average quantity, 40½ 3.					
30½ 3	1019·60	18½ 3	1017·21	9 3	1024·74	9½ 3	1025·78	13¾ 3	1025·83
15½ 3	daily	9½ 3	daily	4½ 3	daily	4½ 3	daily	6¾ 3	daily

Five days. Exercise moderate. Diet, animal food only.

Quantity, 222½ 3.		Average sp. gr., 1020·51.		Average quantity daily, 44½ 3.					
79½ 3	1017·47	46½ 3	1014·20	39½ 3	1021·94	17½ 3	1026·34	40 3	1022·63
16 3	daily	9½ 3	daily	7¾ 3	daily	3½ 3	daily	8 3	daily

Eighteen days. Exercise moderate, and the diet mixed.

Quantity, 803½ 3.		Average sp. gr., 1020·10.		Average quantity daily, 44½ 3.					
288¾ 3	1018·16	185½ 3	1014·98	114½ 3	1021·11	86 3	1022·85	128¾ 3	1023·41
16 3	daily	10½ 3	daily	6½ 3	daily	4¾ 3	daily	7 3	daily

Omitting the times of day we have :—

28 days' average, daily quantity, and specific gravity . .	=	$43\frac{3}{4}$ 3	sp. gr. 1020·75
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Diet.

8 days. Meat diet only. Average quantity and sp. gr.	=	$43\frac{3}{4}$ 3	1022·41
20 days. Mixed diet	=	$43\frac{3}{4}$ 3	1020·32

Exercise.

5 days. Exercise in great excess. Average quantity, and specific gravity	=	$41\frac{3}{4}$ 3	1023·20
23 days. Exercise moderate	=	44 3	1020·11

Diet and exercise.

(1) 3 days. Exercise in excess. Diet only animal. Average quantity and specific gravity . .	=	$42\frac{1}{2}$ 3	1023·57
(2) 2 days. Exercise in excess, and diet mixed . .	=	$40\frac{1}{2}$ 3	1022·63
(3) 5 days. Exercise moderate; diet only animal . .	=	$44\frac{1}{2}$ 3	1020·51
(4) 18 days. Exercise moderate, and diet mixed . .	=	$44\frac{1}{2}$ 3	1020·10

If now we assume that (2) differs from (3) and (4) only in the quantity of water, then an average diminution of $4\frac{1}{2}$ 3 of water increases the average

sp. gr. 212 parts in 10,000, and at the same rate the diminution of $2\frac{1}{3}$ should increase sp. gr. 106. And if $40\frac{1}{2}\frac{1}{3}$ have sp. gr. 1022·63, $42\frac{1}{2}\frac{1}{3}$ should have sp. gr. 1021·57; but from (1) they had specific gravity 1023·57, that is, 200 parts in 10,000 more than on the above hypothesis they should have. Hence with animal diet, and an excess of exercise, there is a considerable increase in the specific gravity of the urine.

By comparing (3) and (4), we see that whilst the exercise is moderate, the difference in specific gravity is very small, when a diet of only animal food, and of animal food and bread are compared. By comparing (1) and (2), it appears, that when the exercise is increased, the specific gravity is considerably greater when living on animal food than it is when living on a mixed diet of animal food and bread.

Regarding the deposit of urate of ammonia, it may be observed that the diet was as much as possible animal, yet at the end of the month, the water in general was far clearer than it was when the experiments were begun; still the disappearance of urate of ammonia did not immediately follow restriction to animal diet.

Regarding the oxalate of lime, it may be observed, that though, during the whole month, no vegetable excepting bread was taken, and even this for eight days was entirely abstained from, still, even at the end of the month, oxalate of lime appeared in large

quantities. The occasional great increase in the quantity of urine when oxalate of lime was passing in large quantities is worthy of attention.

It would be easy to multiply examples of the connection between octohedral crystals and rheumatism ; but as no variation in the treatment of ordinary rheumatism seems to be thereby indicated, the fact seems only interesting, as showing the close connection between the red deposit and octohedral crystals.

Octohedral crystals in the urine, and symptoms of a totally different kind, frequently occur together.

The patient complains of pain in one or both loins, of frequent desire to pass his water, which is sometimes in very small quantity ; at other times so much as to simulate diabetes. There are sudden calls to empty the bladder, and if it is delayed, considerable pain is produced. The urine when examined contains only a slight cloud, which does not disappear with heat. In other respects it appears natural. When examined with the microscope, the cloud is seen to consist sometimes entirely of octohedral crystals. More frequently of these crystals mixed with globules of mucus, and sometimes with large and small scales of epithelium. These cases, in consequence of the frequent desire to make water, usually fall under the notice of the surgeon. From Mr. Cutler I have frequently received such water for examination.

The above symptoms closely resemble those

which are sometimes produced by a small calculus in the kidney. And in one case which I saw, they suddenly ceased after sharp pain in the course of the right ureter, and slight retraction of the testicle, which lasted only a few seconds. Innumerable white octohedral crystals united together were found in the water afterwards. To the naked eye, this mass of crystals was scarcely visible. Such concretions are very easily overlooked from their transparent whiteness. These crystals, from their great insolubility, and the consequent affinity of oxalic acid for lime, are far more apt to be formed in the kidney than crystals of uric acid. For urate of ammonia requires to be some time in contact with a dilute acid, before it assumes the sharp crystalline form, which is well described as lancet-shaped. Thus in gout, the urine may not unfrequently be passed from the bladder, without having crystallised: no trace of uric acid crystals, if the examination is immediately made, can be seen with the microscope, but after the lapse of some hours, multitudes of the well-known crystals appear.

The treatment which proved most beneficial in these cases of irritation, was that which improved the general health. In two of Mr. Cutler's patients the symptoms followed mental anxiety. Medicines had little effect, but as the causes for anxiety disappeared, the symptoms ceased.