

UNIVERSITY OF GLASGOW.

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“OBSERVATIONS ON RENAL FUNCTION”

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THESIS

FOR DEGREE OF M.D.

PRESENTED BY

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## OBSERVATIONS ON RENAL FUNCTION.

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### I. General Considerations:

It has long been realised that tissue destruction does not parallel functional impairment in disease of the kidney. Several attempts to classify the diseases of that organ have from time to time been made, some based on pathological findings, some on clinical features, and others on a combination of both; but none can be said to be satisfactory. It is naturally important that we should diagnose as accurately as possible, the pathological process at work in any particular case, by means of a careful study of the patient's history, the physical signs, and especially a detailed examination of the urine. Such a study is essential to a proper appreciation of prognosis and treatment. But, as in cardiac pathology the functional aspect is now stressed at the expense of the purely mechanical, so in lesions of the kidney, it is recognised that the kidney has a functional reserve dependent upon the "tone" of the secretory unit and the pressure stimulus to secretion, as well as an anatomical reserve conditioned by the number of secretory units in sound working order.

The/

The kidney has several functions to subserve in the normal metabolism of the body<sup>(1)</sup>. It may be said to regulate the osmotic relations in the blood and in the tissues, and to maintain the optimum concentration of the individual constituents of the plasma. It removes from the body certain waste products of nitrogenous metabolism. It gets rid of certain acid bodies. It assists in preserving a constant volume of circulating blood, and in regulating the reaction of the blood. It excretes many toxic substances artificially introduced. In disease, one or more or all of these functions may be impaired. The problem would be simple if the impairment were of equal degree in each case. But this is not so. In actual practice, many and varied combinations of renal impairment are found, though certain broad groups may be differentiated for clinical purposes; for example, the hydraemic group, and the azotaemic. The ideal test of functional capacity would thus be one which would cover all fields of the kidney's activity, and which would detect early pathological changes. This may seem to be crying for the moon, since it has been found that three-quarters of the total renal tissue must be removed in animals before the blood/

blood urea rises.

Many tests have been devised for the investigation of impaired renal function. They may be conveniently grouped under the following headings:-

1. The presence of abnormal urinary constituents, such as protein, blood or casts.
2. The determination of the rate of excretion of certain foreign substances taken by mouth or injected into the body; for example, phenol-sulphone-phthalein.
3. The determination of the amount of normal metabolic products and salts in the blood and urine, and calculation of the ratio between them. Under this heading are included estimation of blood urea, non-protein nitrogen and chlorides, the urea concentration test and the urea concentration factor.
4. The measurement of volume, specific gravity, and solid content, of a number of specimens of urine taken serially, after a test diet.
5. The excretion of new substances, such as hippuric acid, which the kidney alone appears to be able to/

to synthesise.

6. X-ray examination of the renal pelvis.

Everidge, Thomson-Walker et alia<sup>(2)</sup> considered the most helpful renal tests to be the urea concentration test of Maclean and De Wesselow, the estimation of the blood urea, pyelography (for surgical cases) and calculation of the rate of dye excretion. These are probably the most frequently used tests in this country. In America, on the other hand, the greatest reliance is placed upon the two-hour renal test of Hedinger and Schlayer, (as modified by Mosenthal or Christian), the dye excretion test of Rowntree and Geraghty, and a determination of the non-protein or urea nitrogen of the blood.

It will be observed that the two-hour renal test, which is held in high esteem in the United States, finds no place in the ranks of those favoured in this country. Moreover, we have been able to discover only two published references to this test in our literature; viz., a simple description by Beaumont and Dodds,<sup>(3)</sup> and an allusion by Boyd of Edinburgh<sup>(4)</sup> to the equivocal results he had obtained by its use. In view of the fact that small notice/

notice, even of a derogatory nature, had been taken, by British workers, of this test of kidney function, it was considered worthy of an investigation. This has been done, and the results form the subject of this paper.

## II. The two-hour renal Test:

As employed in the United States, the two-hour renal test consists essentially in the examination of two-hourly specimens of urine, with the patient on some standard diet. The patient is usually on the diet for one day, with fluids restricted, and the urine is collected every two hours from 10.a.m. to 8.p.m. The night urine is voided in one specimen at 8.a.m. Each specimen is analysed, the volume, specific gravity, and in some cases the urea and chloride concentrations being noted. The rationale of the test is that the kidney is best tested when it is supplied with the normal products of metabolism, the water-intake being reduced so as to throw strain upon the organ.

This test was first introduced in Germany in 1914 by Hedinger and Schlager<sup>(5)</sup> who found that in cases of nephritis, the quantities of urine passed tended to be of approximately the same volume, the normal diuresis after/

after meals being absent. The specific gravity tended to be fixed at a low level, whereas in normal individuals it showed wide variations during the day.

Mosenthal<sup>(5)</sup> introduced the test in America in 1915. He devised a standard diet, containing approximately the amount of proteim that would be consumed by a normal healthy individual. It contained about 1760 cc. of fluids, 8.5 gm. of salt, 13.4 gm. of nitrogen and considerable quantities of purin substances in the soup, meat, tea and coffee. The patient was given this diet on the day of the test, and the urine collected every two hours from 10 a.m. to 8 p.m. No fluids were given during the night, and the night urine was collected from 8 p.m. to 8 a.m. Each specimen was examined for volume, specific gravity and amount of chloride and nitrogen. In normal individuals he found a variation of at least 10 points in the specific gravity of the specimens; a balance between intake and output of chloride and nitrogen; and a night urine with a specific gravity usually over 1018, high in its concentration of nitrogen (over 1 per cent) and usually less than 400 cc. in volume.

He also noted that diuresis did not always occur/



occur after meals, that the specific gravity varied inversely as the volume, and that the total urinary output should be about 500 cc. less than the intake.

In disease of the kidneys, certain definite changes took place in response to the test diet. Fixation of the specific gravity of the urine was found in various conditions affecting the kidney. The level of fixation varied; for example, in myocardial insufficiency the specific gravity was fixed about the level of 1020. Nocturnal polyuria he held to be one of the first signs of renal impairment.

Cases of granular contracted kidney and chronic interstitial nephritis were characterised by a low and fixed specific gravity, a tendency to total polyuria and a night urine of increased amount with low specific gravity. Chronic parenchymatous nephritis gave results as variable as the clinical symptoms.

O'Hare<sup>(6)</sup> in 1916, studied 34 cases of various types of nephritis by means of the two-hour test. He kept his patients on a fixed diet for two days, and on the third day they were given the test diet, consisting of five meals (2,500 calories) with 1550 cc. of fluids. The results appear to be somewhat anomolous, but the severe/

severe cases showed fixation of the specific gravity and of the amount of chlorides in each specimen. He found the curves of water, chloride and nitrogen excretion to be roughly parallel. He concluded that fixation of the specific gravity appeared to be the most valuable part of the test.

In a later paper with Lewis, Mosenthal<sup>(7)</sup> reaffirmed his former standards of normality. In a comparison of various function tests, they found that the two-hour test gave the earliest indication of renal inefficiency, and also reached its maximum degree of efficiency before the others. They stressed the fact that each test covers only one field of the kidney's activities, and that no single test can measure the function of the kidney as a whole.

In 1918, Lyle and Sharlit<sup>(8)</sup> pointed out that various extra-renal factors can distort the test-meal reaction as interpreted by Mosenthal. These factors comprise the state of water reserve of the tissues, and chilling of the body surface. They affect chiefly the fluid element of the urine, since the skin and lungs make a preferential demand on body-fluids, whereas the excretion of solids by the skin and lungs is practically negligible. They/

They gave details of normal individuals who showed fixation of the specific gravity at a high level, with a night urine over 400 cc. In conclusion, they stated that no decision should be made on the basis of a single test, in ambulatory patients who are exposed to diverse influences of temperature, winds and humidity, and in cases where no strict control over the dietary is attempted.

Mosenthal<sup>(9)</sup> now sat upon the stool of repentance and recanted much of what he had said, admitting that his former standards of normality were inaccurate. He investigated series of normal and nephritic cases upon a high protein diet, a low protein diet and a "normal diet." The "high" diet was the one employed in his first investigation; the "low" diet was the ordinary diet in use at his hospital; the "normal" diet consisted of whatever the patient desired to eat. He concluded that on any diet, the specimens of a normal person should vary at least nine points in specific gravity, and that at least one specimen should have a specific gravity of no less than 1018. The night urine might be as high as 750 cc. The greatest number of exceptions were found under the "normal" diet.

In abnormal cases he found the "low" and "high" diets of equal value, the "normal" diet being, of course, impracticable/

impracticable. In only 12 per cent of cases was there a marked discrepancy between the results of the two diets. He considered nocturnal polyuria to be a distinct sign of renal impairment.

Comparing the two-hour renal test and the dilution-concentration test of Volhard in cases of nephritis, Schlayer and Beckmann<sup>(10)</sup> concluded that the former demonstrated much earlier changes in the kidney. They used two standard diets, a "high" protein and a "low" protein, each with 1800 cc. of fluids. It was found that the former, by virtue of the strain placed upon the kidney, gave evidence of minor degrees of impairment, (in fixation of the specific gravity and volumes) while the latter showed only more gross changes.

In 1921 Sharlit and Lyle<sup>(11)</sup> published an analysis of 300 test-meals, which convinced them that the operation of extra-renal factors vitiated the results obtained from the character of the night urine and the variation of the specific gravity of the two-hourly specimens. They concluded that the rate of elimination of total solids was a better indication of efficiency.

In a series of 52 cases of albuminuria, hypertension or oedema, Bowen<sup>(12)</sup> compared the value of a number of/  
of/

of function tests, including the ratio of day-urine volume to night-urine volume (not less than 2 : 1), the night-urine volume alone (not more than 600 cc.), and the specific gravity of the night urine (at least 1018). In conjunction with other tests, he found all three to be of value, especially the first which he found positive in 96 per cent of cases.

Christian and O'Hare<sup>(13)</sup> considered the two-hour renal test to be the most delicate of all renal function tests. They found that a night urine volume in excess of 600 cc. with a specific gravity of less than 1018, usually indicated chronic nephritis.

### III. The physiological basis of the test.

It is now necessary to consider the physiological aspects of the test. It is, in the first instance, reasonable to postulate that, by supplying the healthy and the diseased kidney with the normal products of metabolism, certain changes in the response of the diseased organ should show themselves. It is a more rational procedure than merely to estimate the excretion of a single end-product, such as urea, or of a foreign substance, such as indigo-carmin, to which the kidney is unaccustomed.

The normal kidney concentrates the various constituents of the plasma in different degree, for excretion in the urine; and in so doing, it does work and consumes oxygen. But the healthy organ is also able to form a very dilute urine when the occasion arises. In other words, it is capable of adapting itself to a wide variety of changes in the composition, reaction and electrical conductivity of the blood. The diseased kidney, as was pointed out by Koranyi,<sup>(14)</sup> is in many cases unable to form either a very concentrated or a very dilute urine. The theories regarding the nature of the secretion of urine do not concern us here. It is sufficient for the present purpose that we recognise the differences in/

in concentrating-power of the healthy and of the diseased kidney, both in regard to the urinary solids as a whole, and to the individual constituents.

Hedinger and Schlayer, when they devised the two-hour renal test, kept their subjects on a standard diet for three days beforehand, so that the effect of previous intake on the test findings should be comparable in each case. Mosenthal, on the other hand, employs a single-day diet, and attempts to balance intake and output of salt, nitrogen and fluids. Now, it has been shown by Wilson <sup>(15)</sup> that nitrogenous equilibrium is not established until the second or third day after change in the amount of protein ingested. In the same way, the excretion of phosphates and sulphates is conditioned by the intake of these salts on the previous three days. Such being the case, it is obvious that subjects undergoing the test should be placed on some standard diet for three days, the urinalysis being made on the third day. For practical reasons, it is impossible to prolong the period of the test any further.

In spite of the fact that Lyle and Sharlit (V.S.) pointed out the effect of extra-renal factors, such as temperature, humidity and winds, in vitiating the findings of the test, it is often employed in America on ambulatory patients who are not strictly supervised. In an admirable study/

study of the water-balance of the body, Rowntree<sup>(16)</sup> points out that sweat may vary from an invisible perspiration to as much as a litre per day. He quotes Benedict and Carpenter as having found in a large series of determinations, that the amount of water lost by the lungs varied from 21 per cent. to 51.4 per cent. of the total water loss.

Bearing in mind these wide variations, which directly affect the renal output, it is apparent that patients should be as nearly as possible under the same set of conditions. Confinement to bed in an ordinary hospital ward should be adequate to meet the case, provided the ward is maintained at an even temperature, and that draughts are excluded as far as possible.

Addie and Foster<sup>(17)</sup> maintain that the specific gravity of the urine is no quantitative indication of the amount of solids in solution, as each dissolved solid exerts a different effect upon the specific gravity. Since the concentrations of the urinary constituents are unknown, they conclude that it is impossible to attach any precise quantitative meaning to estimation of solid excretion by specific gravity readings. To this we would point out that by very definition the specific gravity of a solution is an accurate index of the weight of dissolved solids. It cannot separate quantitatively one solid from another, but we are only concerned here with the total solids in solution/



solution. The latter may be roughly calculated by means of Häser's Coefficient;<sup>(18)</sup> viz., the last two figures of the specific gravity multiplied by 2.33 giving the grammes of solids in one litre. From this, it is a simple matter to calculate the solids in any given volume of urine.

#### IV. The Test Diet.

In this investigation, a standard diet was given for three days, and the test carried out on the third day. It was decided that the diet must be fairly low in protein content, if it were to be given to all types of nephritic patients. In this connection, it rather savours of the mysterious that Mosenthal and Schlayer should use a "high" protein diet in this type of case. It is often definitely harmful, and patients must often be unable to consume all that they are asked to eat.

The standard diet contained approximately 52 gm. of protein and the caloric value was 1638. The fluid intake was at first restricted to 1400 c.c. per day, in order to place the kidneys under strain. A few patients having complained of thirst, and an increase of blood and albumen in the urine having been observed in two cases after the test, the fluids were increased to 1700 cc., making the caloric value 1784.

The/

The following is a copy of the instructions given to the nurse in charge of each case. The fluids at 11 a.m., 1 p.m., and 3 p.m., were each increased by 100 c.c. (V.S.) after eleven tests had been carried out. All normal cases cited received the increased diet.

NEPHRITIC TEST DIET.

All drugs stopped for three days.

The diet on all three days of the experiment is the same but only on the third day is the urine collected.

Programme of third day.

- 7.55 a.m. Patient empties bladder - urine rejected.
- 8 a.m. Breakfast - One large cup of tea (exact volume must be measured).  
Sugar and Milk.  
Two slices bread (toasted)  
20 grams. of butter.
- 10 a.m. Urine collected from patient exactly on the hour. This urine is put in measuring flask and sent to Bio-chemical Laboratory.
- 11 a.m. 300 cc. milk.
- 12 noon. Urine collected as at 10 a.m.
- 1 p.m. Dinner - One boiled egg with salt supplied from Laboratory. One slice of toast.  
10 g. butter.  
Milk 200 cc.
- 2 p.m. Urine collected as at 10 a.m.
- 3 p.m. Water 200 cc.
- 4 p.m. Urine collected as at 10 a.m.
- 4 p.m. Tea - 1 cupful tea (exact volume measured),  
 $\frac{1}{2}$  slices toast, 20 grams. butter.
- 6 p.m./

- 6 p.m. Urine collected as at 10 a.m.
- 7 p.m. Supper - 300 cc. milk.
- 8 p.m. Urine collected as at 10 a.m.
- 8 p.m. till 8 a.m. - Patient to receive NO fluid or food. All urine passed during this period to be kept in receptacles provided. Patient MUST empty his or her bladder at 8 a.m., i.e., on fourth morning and this is to be added to the night urine. NO urine has to be taken by night or day nurses for ordinary routine testing.

N.B. No fluid to be given other than that measured out. Any fluid not consumed must be deducted. Receptacles will be provided.

Careful supervision on the part of the nursing staff is of course a sine qua non; and it is also desirable to enlist the willing co-operation of the patient by divers devices.

The investigation was carried out in 20 normal cases and in 50 abnormal cases. The normal persons were patients who came to hospital with minor injuries or who were convalescing from minor surgical operations. They gave no evidence of any kidney lesion by ordinary clinical examination. The abnormal group consisted of forty three cases of nephritis, two cases of arteriosclerosis, two cases of pyelitis, and one each of anaemia and valvular disease of the heart.

Each urinary specimen was examined for volume and specific gravity; and from these, by means of Häser's co-efficient/

co-efficient, the dissolved solids were calculated. In the nephritic group, the blood-urea and non-protein nitrogen were estimated in most cases, and the urea concentration test carried out, within three days of the two-hour renal test.

The specific gravity was accurately measured by means of the specific gravity balance. The blood examinations were carried out by the methods of Folin and Wu, and the urea concentration estimated by the hypobromite method.

#### V. Results in normal persons.

The results of the test in normal persons are shown below in tabular and graphic form. The tables are self-explanatory. For the sake of brevity only the last two figures of the specific gravity readings are shown. The charts give the curves of volumes, solids and specific gravity in that order from below upwards. The first three columns represent respectively, the volumes of day-urine, night-urine and total 24 hours' urine. The other three columns represent the corresponding excretion of solids.

CASE I. (MALE)

Time.	Volume (c.cms.)	Specific Gravity.	Solids (grammes)
8 a.m.-10	66	24	3.68
10-12	116	16	4.32
12- 2	118	17	4.67
2- 4	88	20	4.10
4- 6	72	19	3.18
6- 8 p.m.	134	12	3.74
Day Total	594		23.69
8 p.m.-8 a.m.	255	23	13.66
Total 24 hrs.	849		37.35

CASE 2. (MALE).

Time.	Volume (c.cms.)	Specific Gravity.	Solids (grammes)
8 a.m.-10	82	22	4.20
10 - 12	112	19	4.94
12 - 2	160	18	6.71
2 - 4	168	15	5.86
4 - 6	72	25	4.19
6 - 8 p.m.	85	24	4.75
Day Total.	679		30.65
8 p.m.-8 a.m.	268	27	16.85
Total 24 hrs.	947		47.50

Case 1.

1030

1020

1010

6 gm

4 gm

2 gm

0 gm

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gm

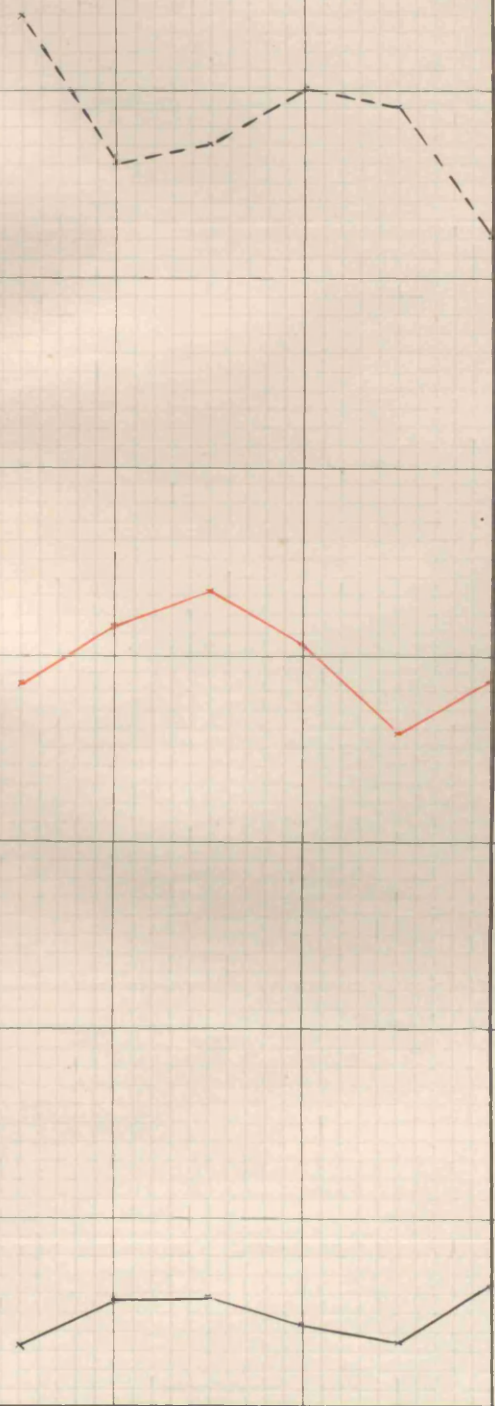
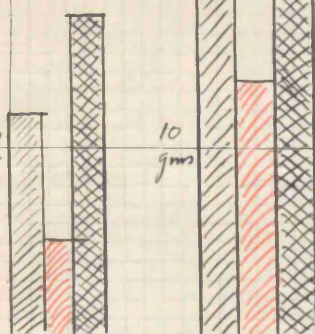
30

20

10 gm

Volume.

Solids.



Case 2.

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

50 gms

40

1500 c.c.

1000 c.c.

500 c.c.

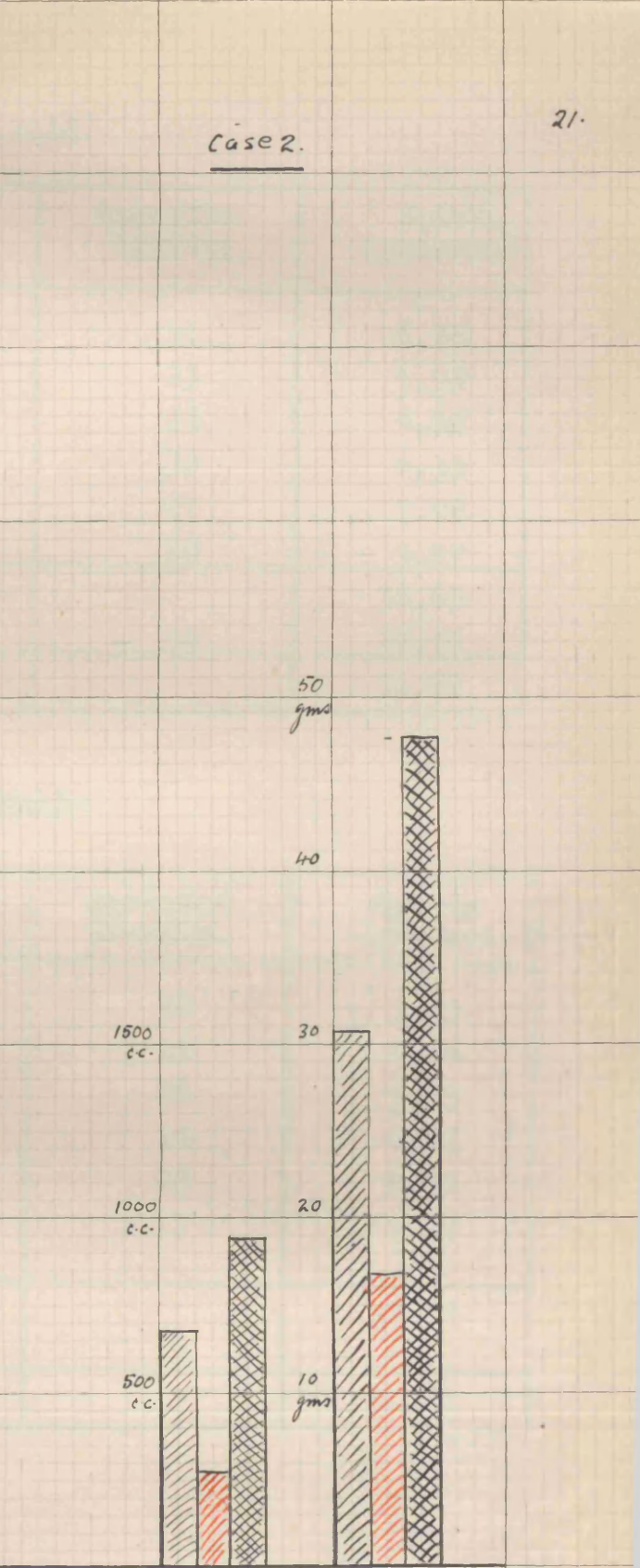
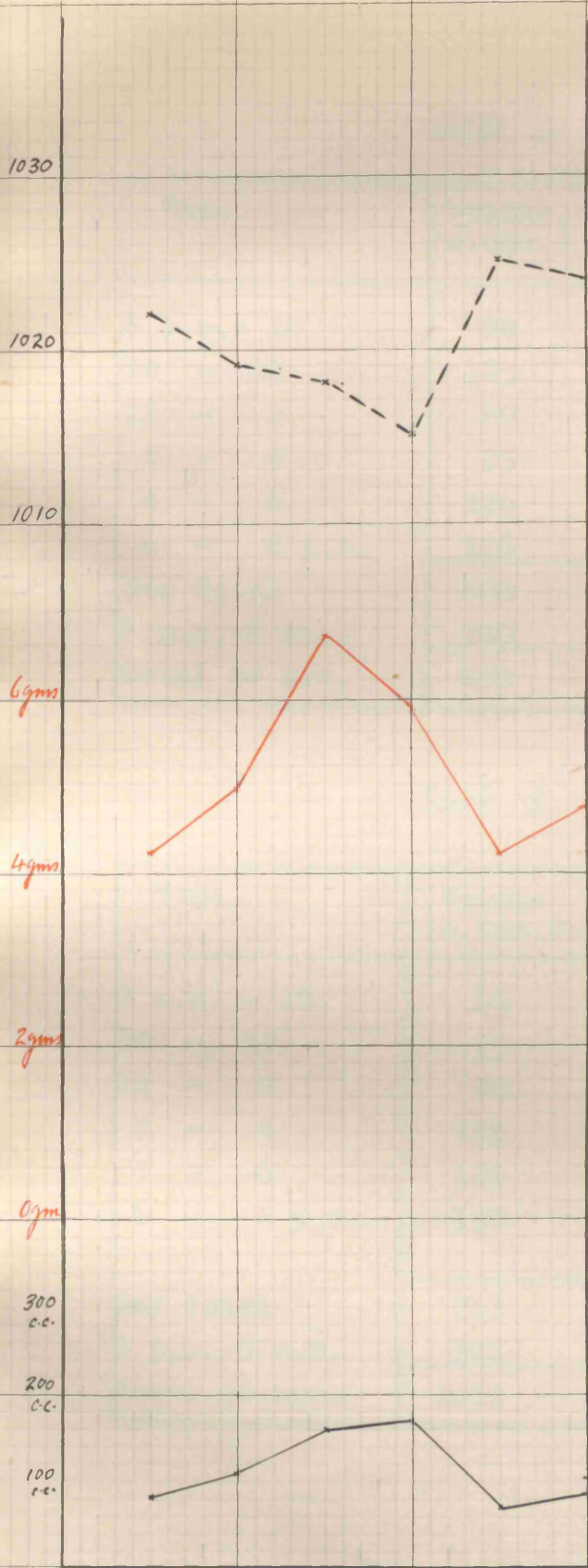
30

20

10 gms

Volume.

Solids.



CASE 3 (MALE).

Time.	Volume. (c.cms.)	Specific Gravity.	Solids (grammes)
8 a.m.- 10	88	31	6.35
10 - 12	103	23	5.52
12 - 2	80	25	4.66
2 - 4	85	32	6.33
4 - 6	126	27	7.92
6 - 8 p.m.	126	20	5.87
Day Total	608		36.65
8 p.m.-8 a.m.	280	30	19.57
Total 24 hrs.	888		56.22

CASE 4 (MALE).

Time.	Volume (c.cms.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	65	22	3.33
10 - 12	95	22	4.86
12 - 2	90	26	5.45
2 - 4	185	14	6.03
4 - 6	128	22	6.56
6 - 8 p.m.	150	17	5.94
Day Total	713		32.17
8 p.m.-8 a.m.	288	27	18.11
Total 24 hrs.	1001		50.28



Case 3.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

60 gms

50

40

30

20

10 gms

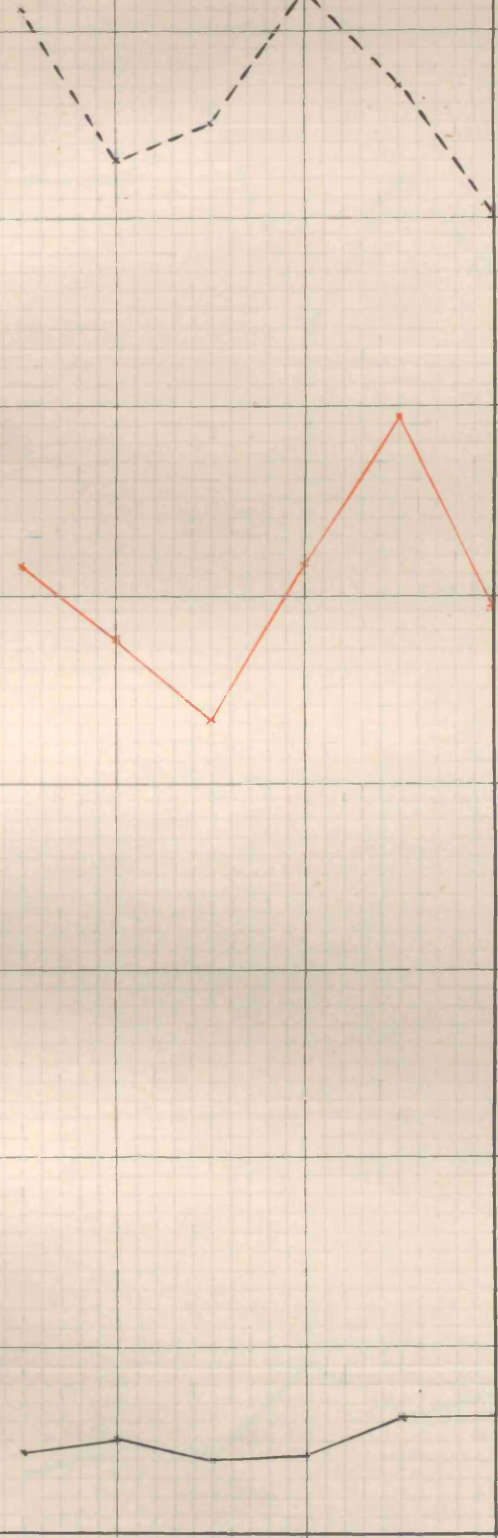
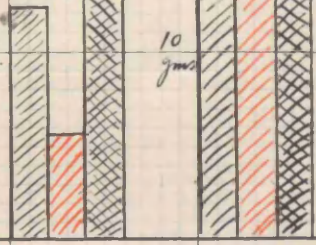
1500 cc.

1000 cc.

500 cc.

Volume.

Solids.



1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8  
Time.

1500 cc.

1000 cc.

500 cc.

Volume.

50 gms

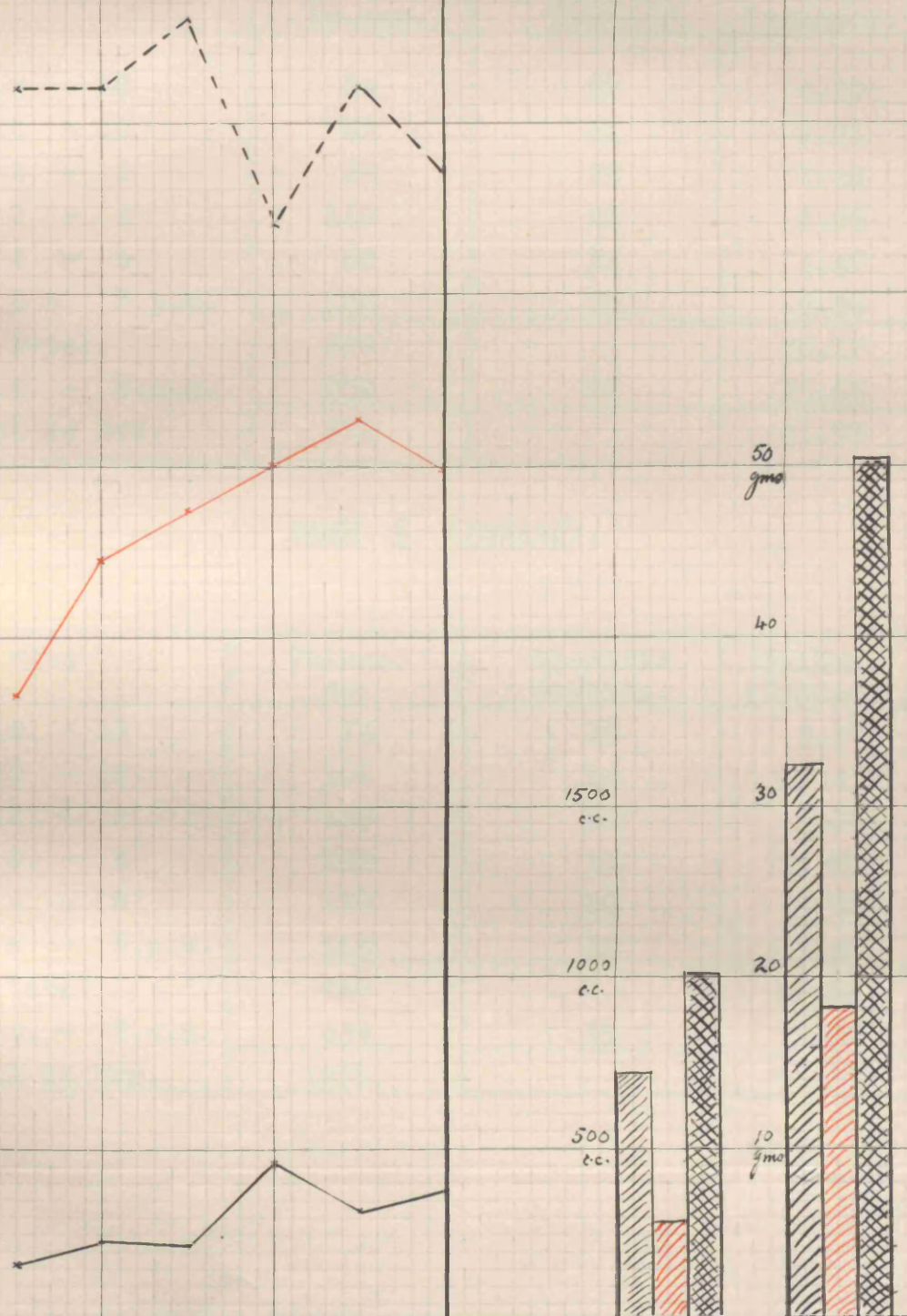
40

30

20

10 gms

Solids.



CASE 5 (MALE).

Time	Volume. (c.cms.)	Specific Gravity.	Solids (grammes.)
8.a.m. - 10	84	22	4.30
10 - 12	82	21	4.01
12 - 2	86	22	4.40
2 - 4	160	08	2.98
4 - 6	80	24	4.47
6 - 8.p.m.	128	20	5.96
Day Total.	620		26.12
8.p.m. - 8.a.m.	252	27	15.85
Total 24 hrs.	872		41.97

CASE 6 (FEMALE).

Time	Volume. cc.	Specific Gravity.	Solids (Grammes.)
8.a.m. - 10	74	19	3.27
10 - 12	106	14	3.45
12 - 2	110	15	3.84
2 - 4	192	11	4.92
4 - 6	170	10	3.96
6 - 8.p.m.	115	12	3.21
Day Total	767		22.65
8.p.m. - 8.a.m.	454	15	15.86
Total 24 hrs.	1221		38.51

1030

1020

1010

6 gm

4 gm

2 gm

0 gm

300 cc.

200 cc.

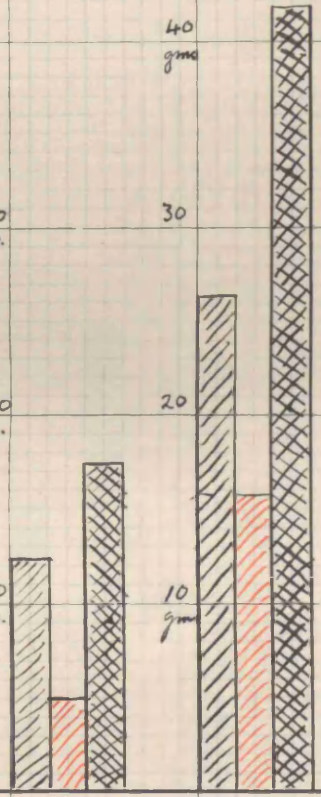
100 cc.

10 12 2 4 6 8  
Time.

1500 cc.

1000 cc.

500 cc.



Volume.

Solids.

Case b.

27.

1030

1020

1010

6gms

4gms

2gms

0gms

300  
c.c.

200  
c.c.

100  
c.c.

10 12 2 4 6 8

1500  
c.c.

1000  
c.c.

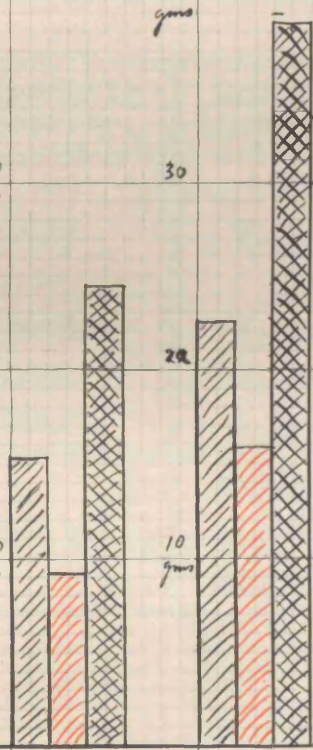
500  
c.c.

40  
gms

30

20

10  
gms



CASE 7 (MALE).

Time.	Volume (c.cms.)	Specific Gravity.	Solids (Grammes).
8 a.m. - 10	94	20	4.38
10 - 12	39	19	1.72
12 - 2	84	19	3.71
2 - 4	80	20	3.73
4 - 6	112	15	3.91
6 - 8 p.m.	83	18	3.48
Day Total.	492		20.93
8 p.m. - 8 a.m.	272	19	12.04
Total 24 hrs.	764		32.97

CASE 8 (MALE).

Time.	Volume (c.cms.)	Specific Gravity.	Solids (grammes).
8 a.m. - 10	-	-	-
10 - 12	180	1019	7.96
12 - 2	-	-	-
2 - 4	109	1013	3.30
4 - 6	292	1011	7.48
6 - 8 p.m.	322	1012	9.00
Day Total.	903		27.74
8 p.m. - 8 a.m.	410	1015	14.33
Total 24 hrs.	1313		42.07

Case 7.

29.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10

12

2

4

6

8

Time.

1500 cc.

1000 cc.

500 cc.

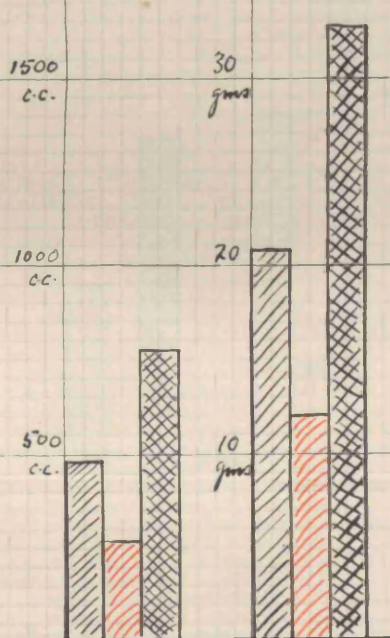
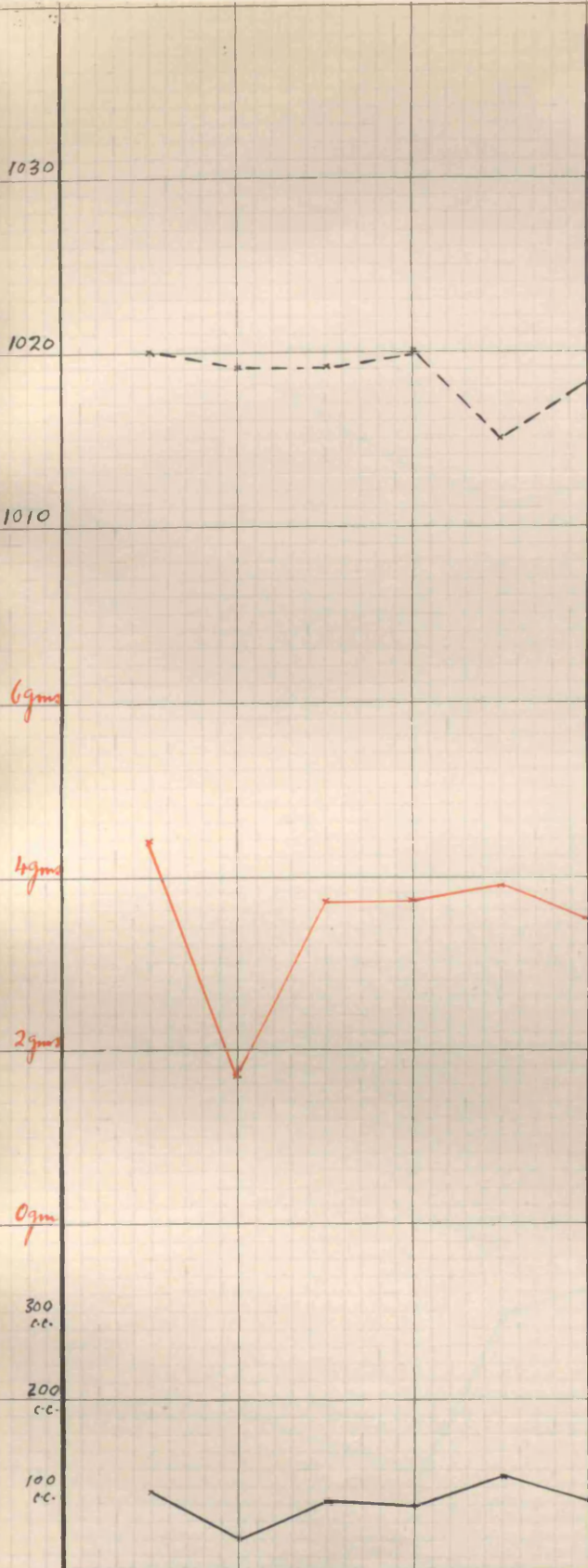
30 gms

20 gms

10 gms

Volume.

Solids.



1030

1020

1010

6gm

4gm

2gm

0gm

300 cc.

200 cc.

100 cc.

10

12

2

4

6

8

Time.

9.0

1500 cc.

1000 cc.

500 cc.

Volume.

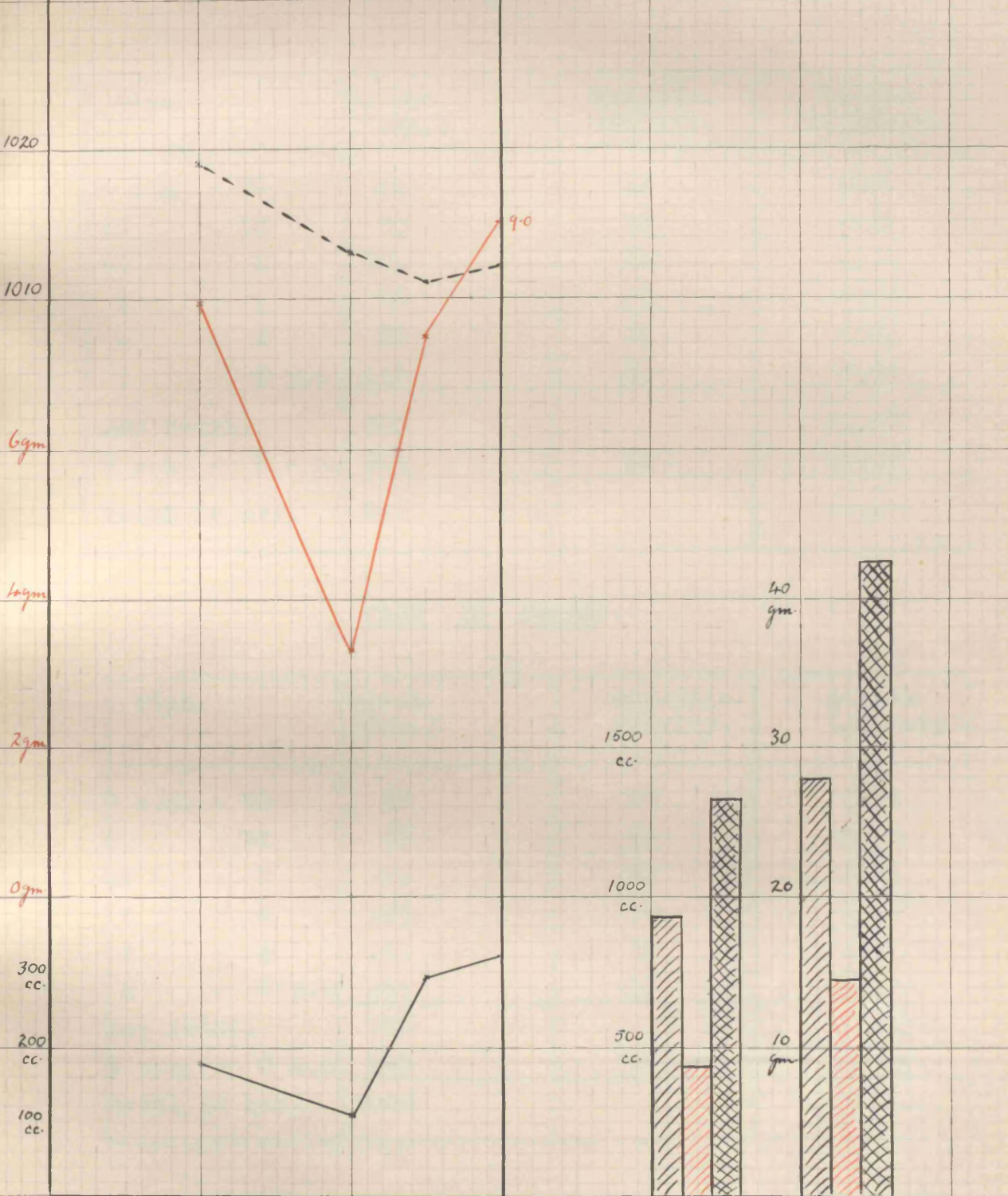
40 gm

30

20

10 gm

Solids.





CASE 9 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m. - 10	45	27	2.83
10 - 12	59	19	2.61
12 - 2	101	20	4.71
2 - 4	79	19	3.49
4 - 6	82	21	4.01
6 - 8 p.m.	146	11	3.78
Day Total.	512		21.43
8 p.m. - 8 a.m.	300	18	12.57
Total 24 hrs.	812		34.00

CASE 10 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes)
8 a.m. - 10	53	29	3.58
10 - 12	68	25	3.96
12 - 2	92	23	4.91
2 - 4	109	20	5.07
4 - 6	250	11	6.41
6 - 8 p.m.	206	12	5.75
Day Total.	778		29.68
8 p.m. - 8 a.m.	228	26	13.81
Total 24 hrs.	1006		43.49

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

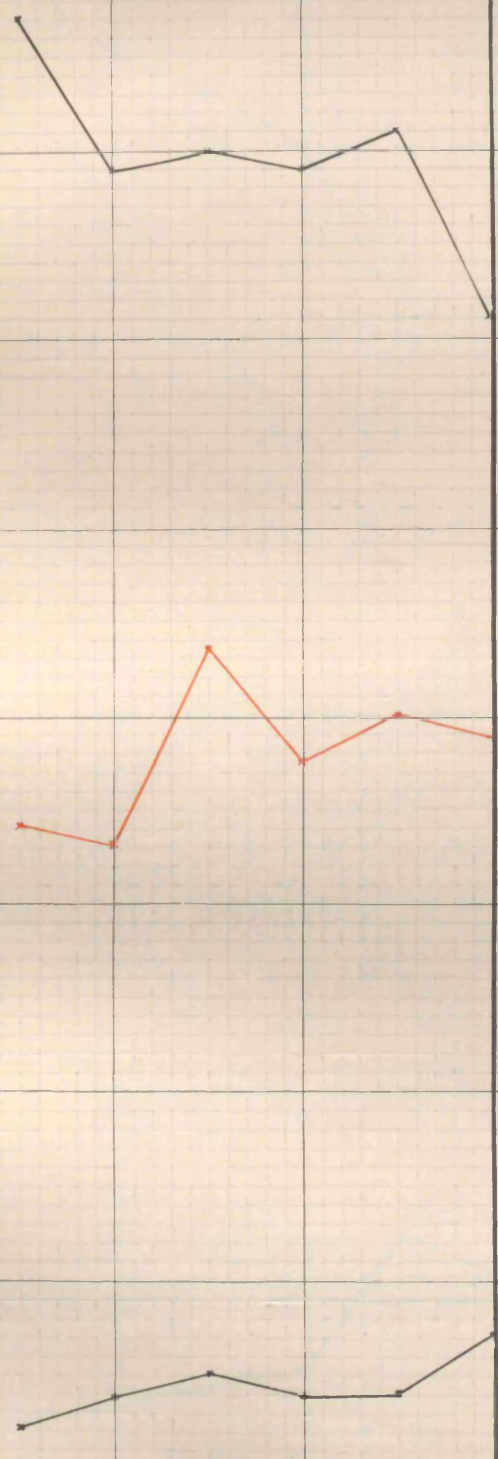
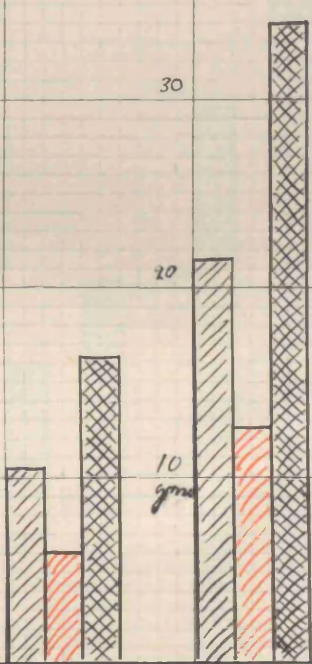
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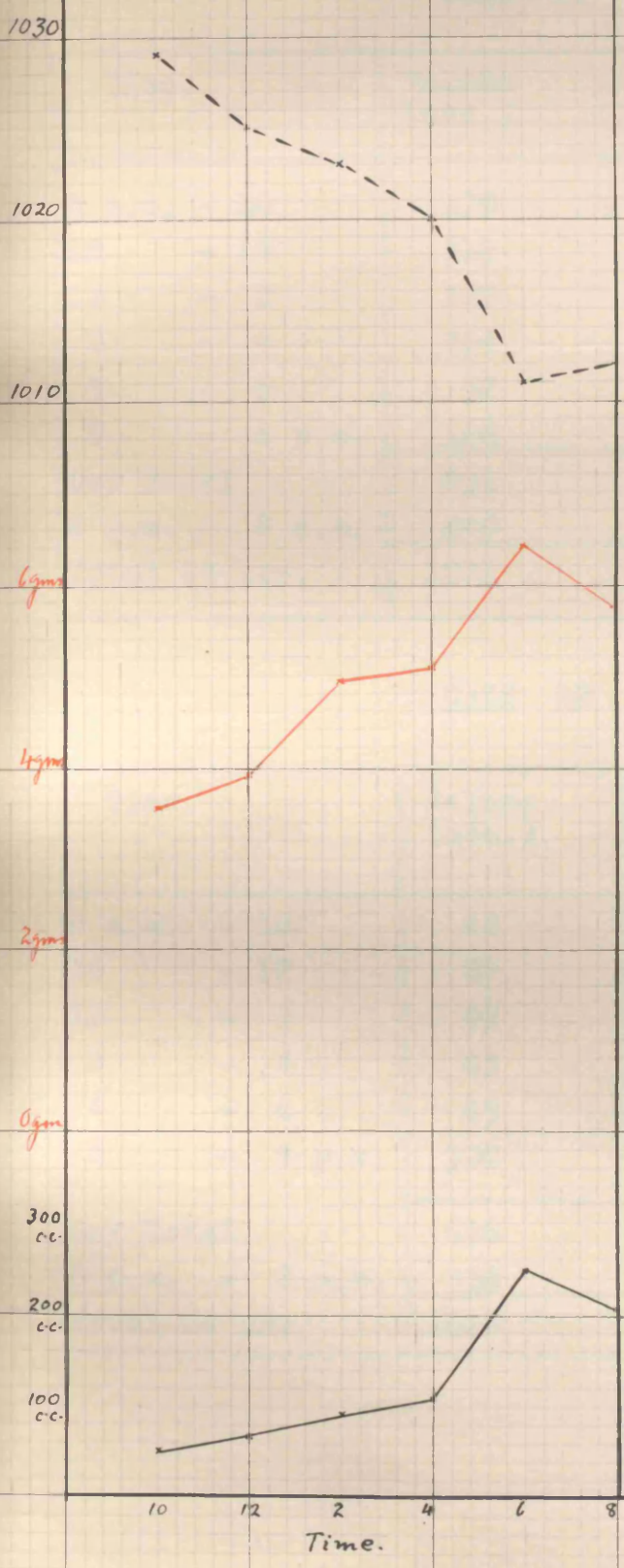
20

10 gms

Volume.

Solids.

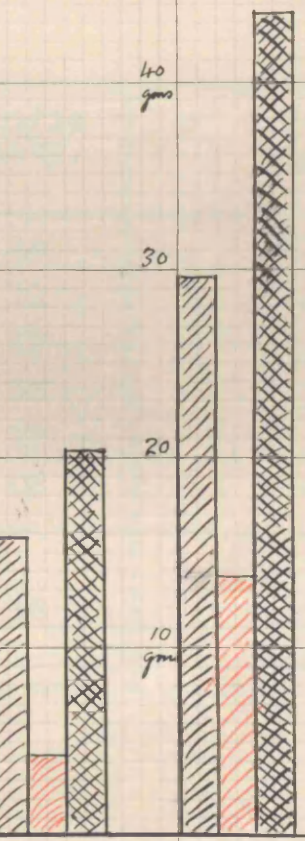




1500 c.c.

1000 c.c.

500 c.c.



Volume.

Solids.

CASE 11 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	170	19	7.52
10 - 12	112	18	4.70
12 - 2	127	18	5.32
2 - 4	204	12	5.70
4 - 6	52	18	2.18
6 - 8 p.m.	166	12	4.63
Day Total.	831		30.05
8 p.m. - 8 a.m.	240	20	11.16
Total 24 hrs.	1071		41.21

CASE 12 (FEMALE).

Time.	Volume. (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	42	18	1.76
10 - 12	87	11	2.22
12 - 2	99	17	3.92
2 - 4	83	18	3.48
4 - 6	85	17	3.36
6 - 8 p.m.	300	06	4.19
Day Total.	696		18.93
8 p.m. - 8 a.m.	330	18	13.84
Total 24 hrs.	1026		32.77

Case 11.

35.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

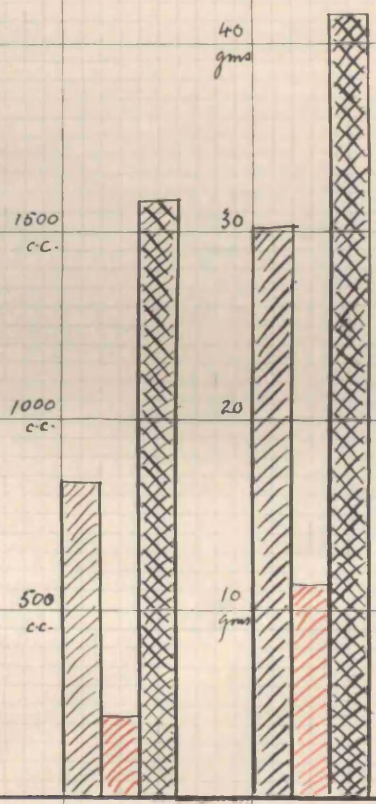
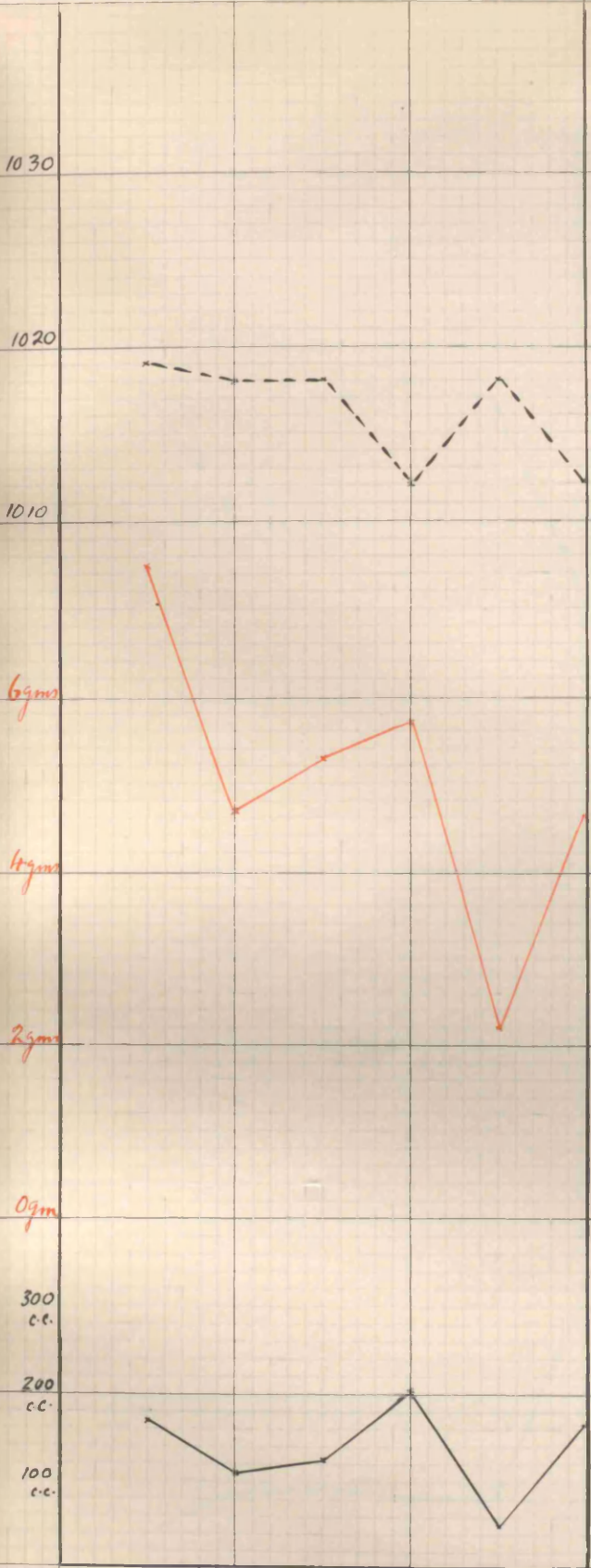
30

20

10 gms

Volume.

Solids.



1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

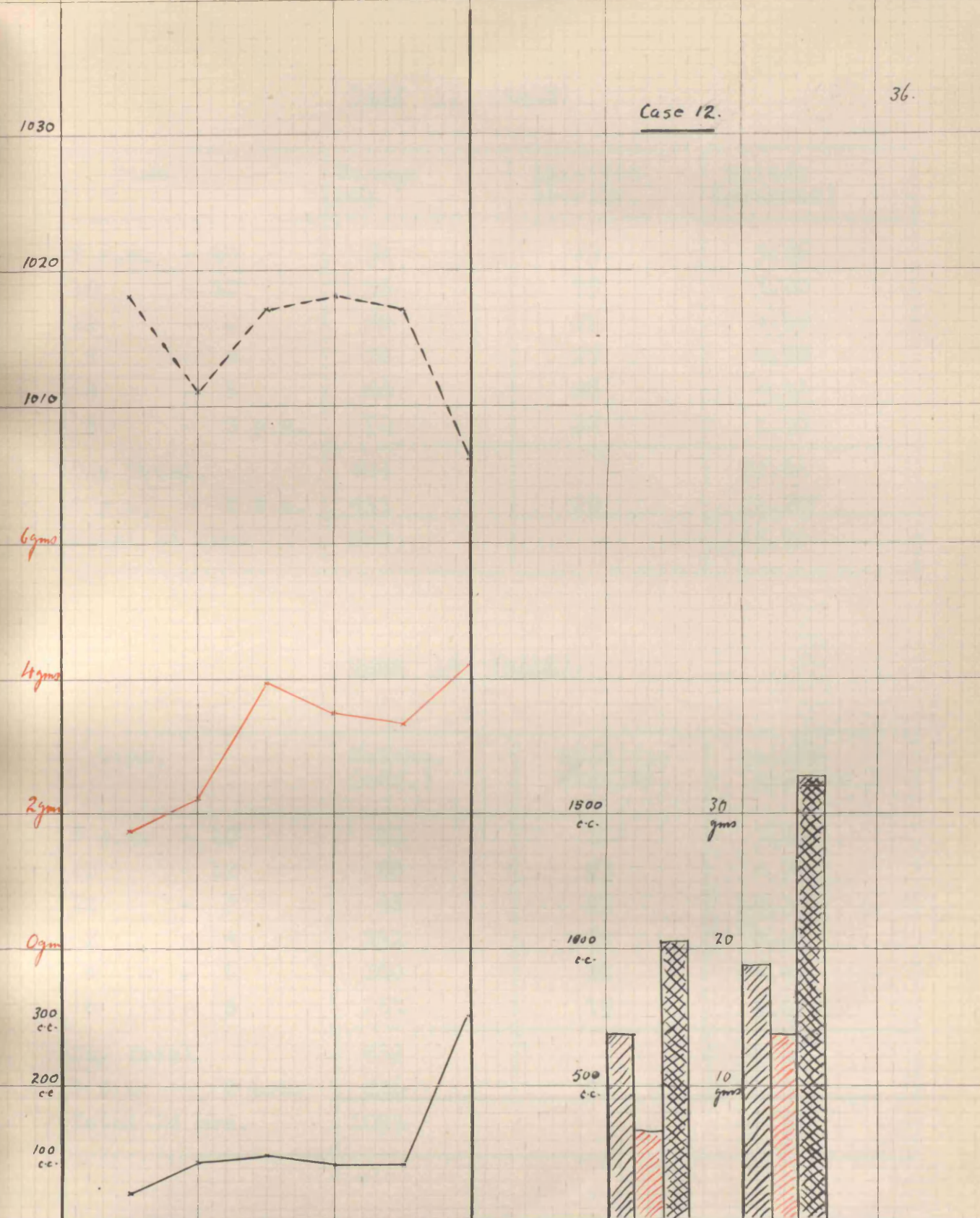
30 gms

20

10 gms

Volume.

Solids.



CASE 13 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes)
8 a.m. - 10	56	25	3.26
10 - 12	55	25	3.20
12 - 2	78	27	4.90
2 - 4	78	27	4.90
4 - 6	68	26	4.11
6 - 8 p.m.	70	22	3.59
Day Total.	405		23.96
8 p.m. - 8 a.m.	455	20	21.20
Total 24 hrs.	860		45.16

CASE 14 (MALE).

Time.	Volume. (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	81	21	3.96
10 - 12	88	23	4.70
12 - 2	88	21	4.30
2 - 4	291	12	8.13
4 - 6	160	12	4.47
6 - 8	151	15	5.27
Day Total	859		30.83
8 p.m. - 8 a.m.	236	21	11.54
Total 24 hrs.	1095		42.37

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

50 gms

40

30

1500 c.c.

1000 c.c.

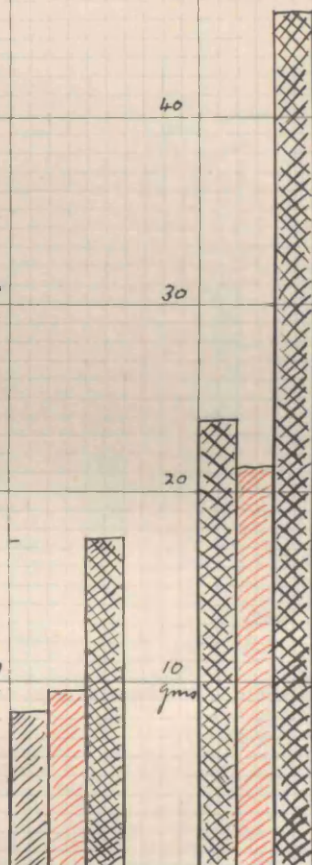
500 c.c.

20

10 gms

Volume.

Solids.





Case 14.

1030

1020

1010

6gms

4gms

2gms

0gms

300

c.c.

200

c.c.

100

c.c.

10 12 2 4 6 8

Time.

1500  
c.c.

1000  
c.c.

500  
c.c.

Volume.

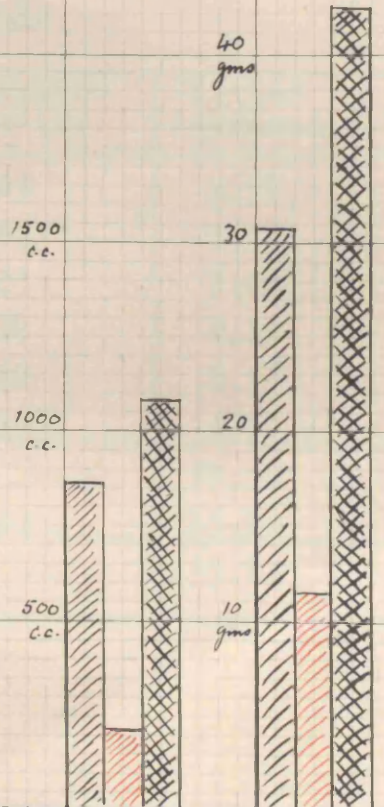
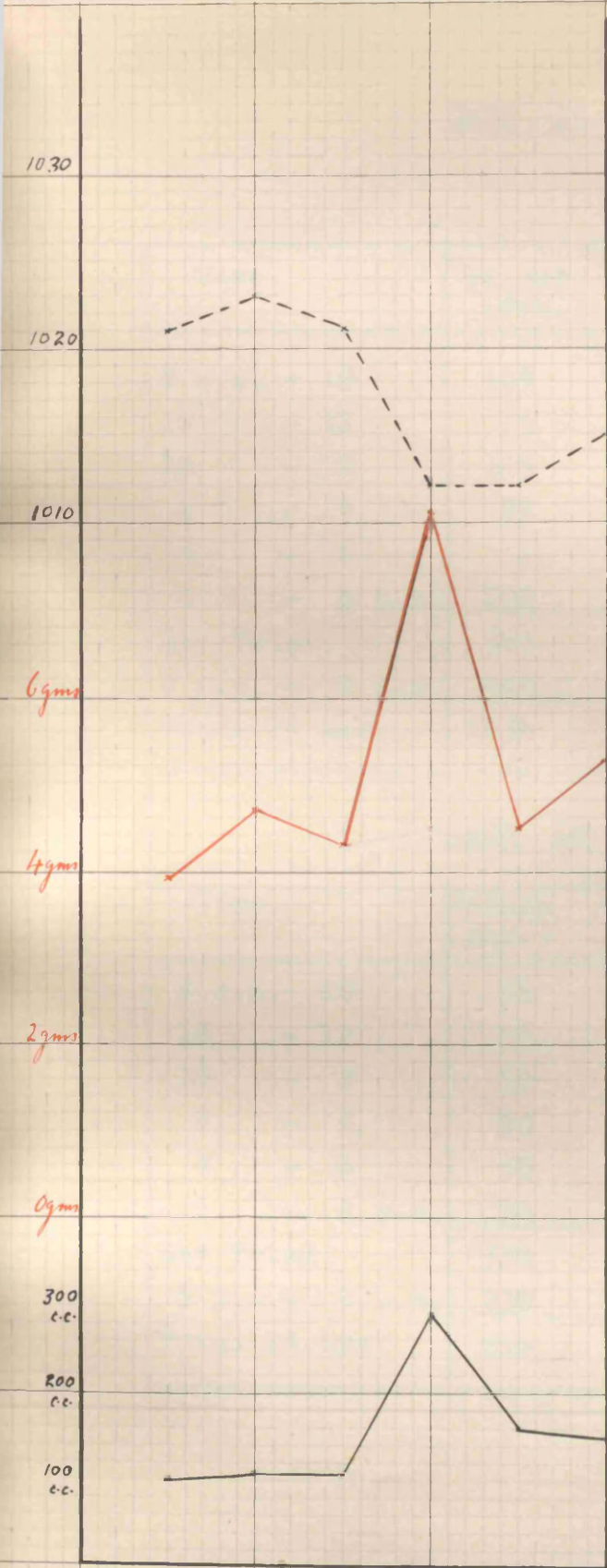
40  
gms

30

20

10  
gms

Solids.



CASE 15 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	104	23	5.57
10 - 12	75	26	4.54
12 - 2	105	25	6.12
2 - 4	97	27	6.10
4 - 6	-	-	-
6 - 8 p.m.	202	26	12.14
Day Total.	583		34.47
8 p.m. - 8 a.m.	448	25	26.09
Total 24 hrs.	1031		60.56

CASE 16 (FEMALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m.- 10	56	23	2.99
10 - 12	56	26	3.39
12 - 2	52	25	3.03
2 - 4	90	20	4.19
4 - 6	50	22	2.56
6 - 8 p.m.	74	22	3.79
Day Total.	378		19.95
8 p.m.- 8 a.m.	238	25	13.86
Total 24 hrs.	616		33.81

Case 15.

41.

1030

1020

1010

6gms

4gms

2gms

0gm

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

12.14

60 gms

50

40

30

20

10 gms

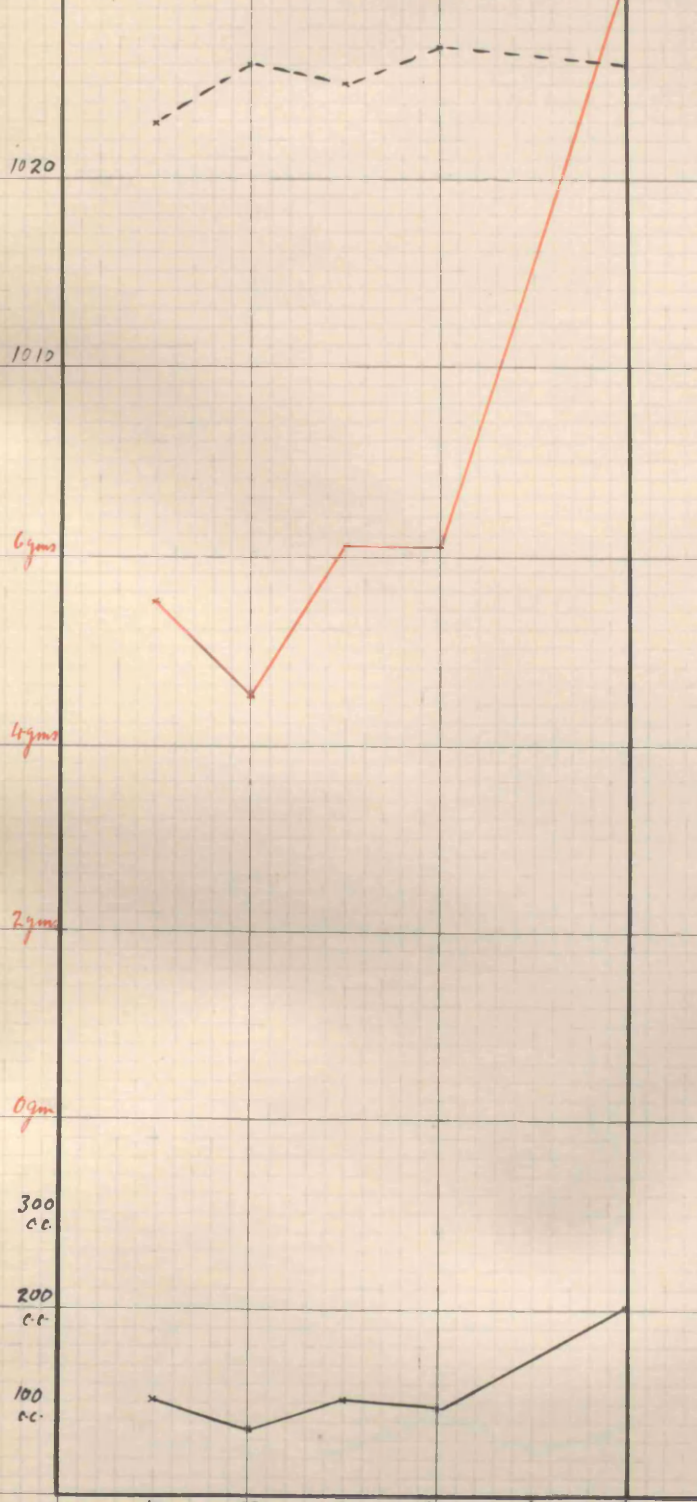
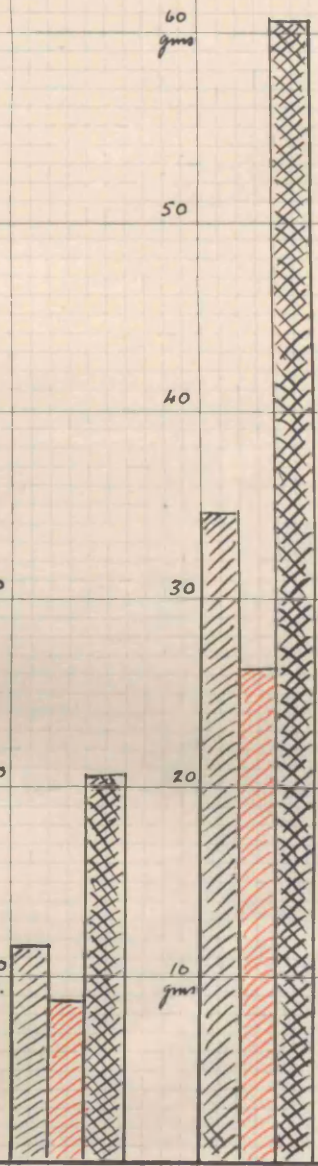
1500 c.c.

1000 c.c.

500 c.c.

Volume.

Solids.



1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

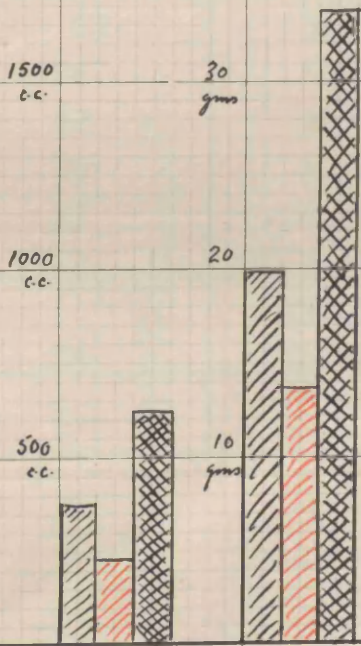
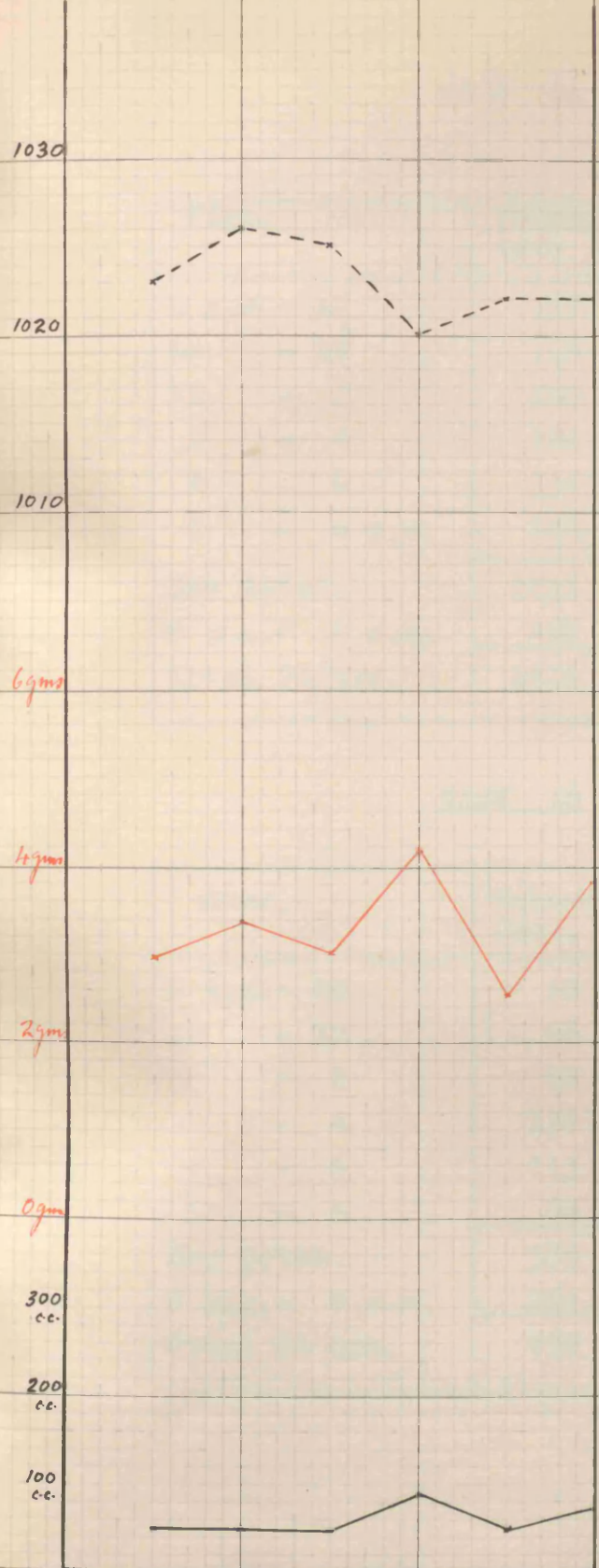
30 gms

20

10 gms

Volume.

Solids.



43

CASE 17 (FEMALE)

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m.- 10	133	16	4.96
10 - 12	118	16	4.40
12 - 2	108	19	4.78
2 - 4	278	11	7.12
4 - 6	234	12	6.54
6 - 8 p.m.	145	16	5.40
Day Total.	1016		33.20
8 p.m.- 8 a.m.	402	22	20.61
Total 24 hrs.	1418		53.81

CASE 18 (MALE).

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m.- 10	68	23	3.63
10 - 12	66	24	3.68
12 - 2	88	22	4.50
2 - 4	152	15	5.31
4 - 6	113	17	4.47
6 - 8	68	22	3.48
Day Total.	555		25.07
8 p.m.- 8 a.m.	295	24	16.49
Total 24 hrs.	850		41.56

Case 17.

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

50 gms

40

1500 c.c.

30

1000 c.c.

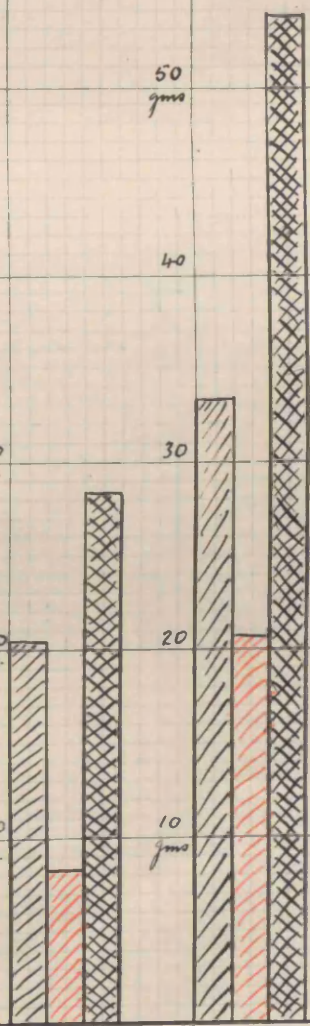
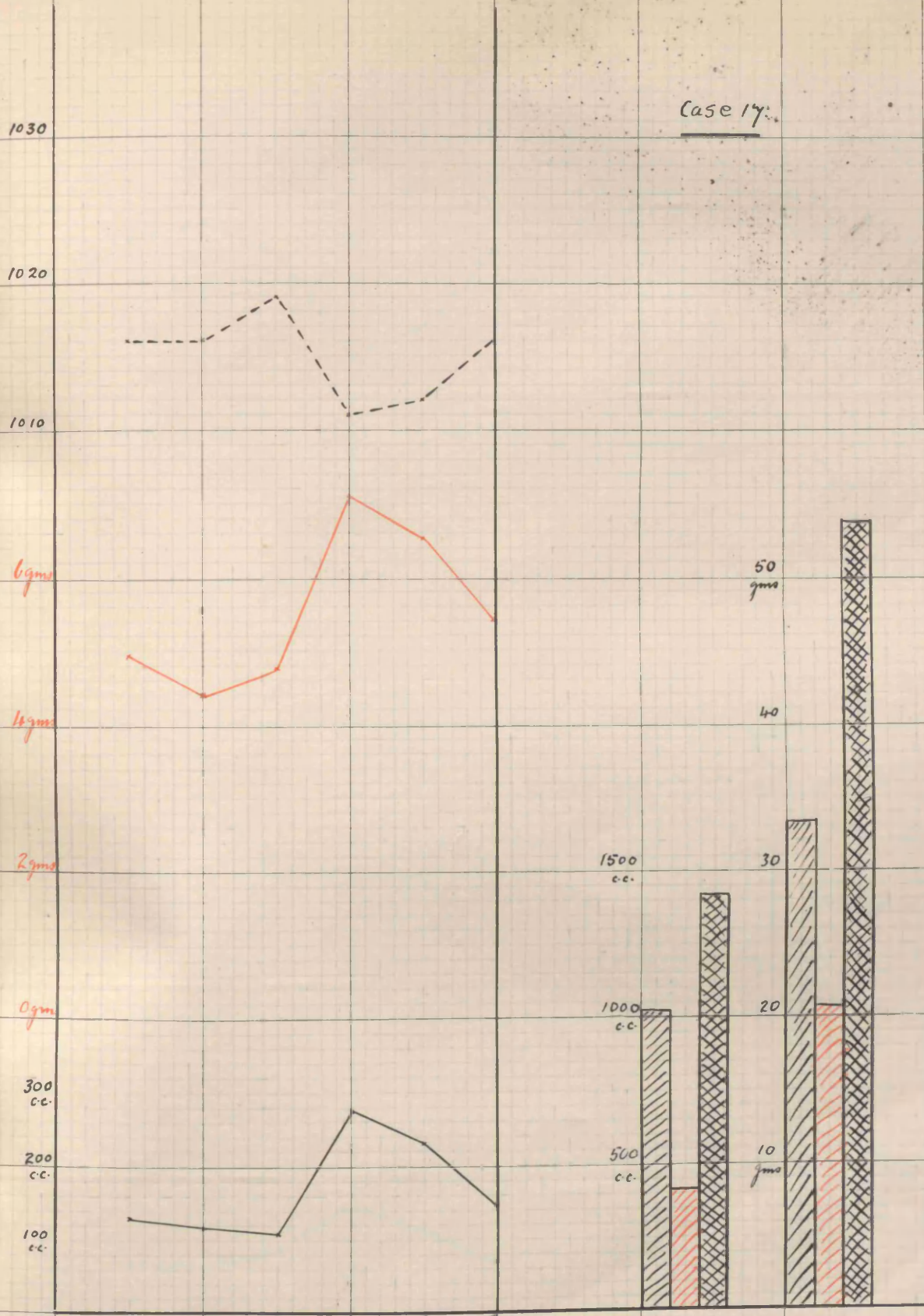
20

500 c.c.

10 gms

Volume.

Solids.



Case 18.

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

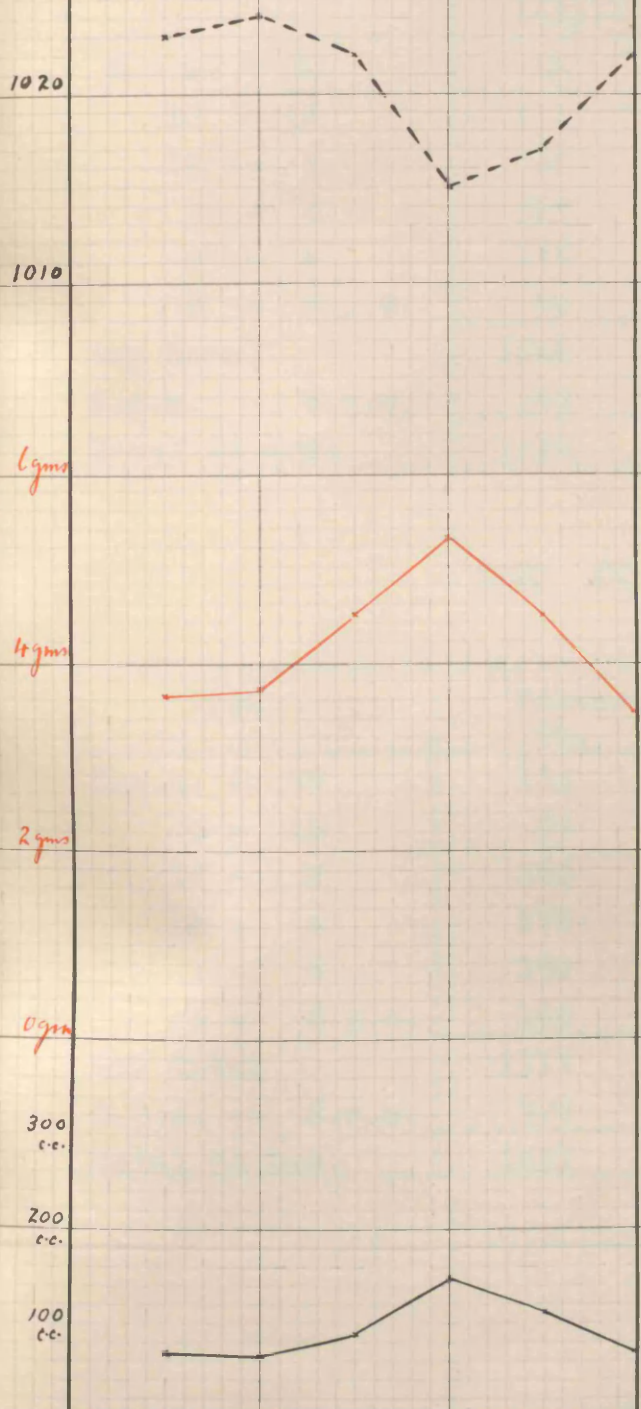
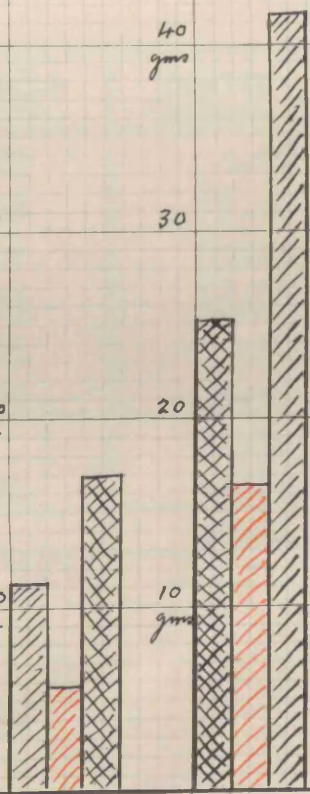
30

20

10 gms

Volume.

Solids.



CASE 19 (MALE)

Time.	Volume (ccs.)	Specific Gravity.	Solids. (grammes.)
8.a.m. - 10	52	23	2.78
10 - 12	117	21	5.72
12 - 2	90	20	4.19
2 - 4	525	09	11.00
4 - 6	173	13	5.23
6 - 8.p.m.	99	15	3.45
Day Total.	1056		32.37
8.p.m. - 8.a.m.	360	21	17.61
Total 24 hrs.	1416		49.98

CASE 20 (MALE).

Time.	Volume. cc.	Specific Gravity.	Solids. (grammes)
8.a.m. - 10	134	19	5.93
10 - 12	85	18	3.56
12 - 2	160	11	4.10
2 - 4	375	06	5.23
4 - 6	192	15	6.70
6 - 8.p.m.	165	14	5.38
Day Total	1111		30.90
8.p.m. - 8.a.m.	320	21	15.66
Total 24 hrs.	1431		46.56



Case 19.

1030

1020

1010

6gm

4gm

2gm

0gm

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

50 gm

40

1500 cc.

1000 cc.

500 cc.

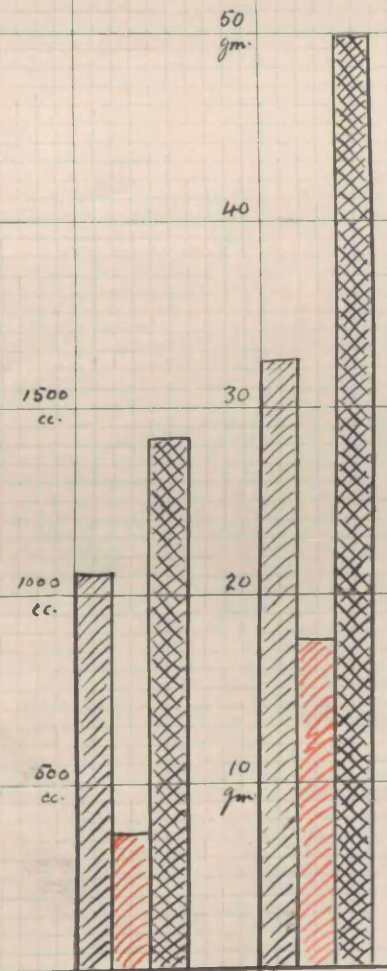
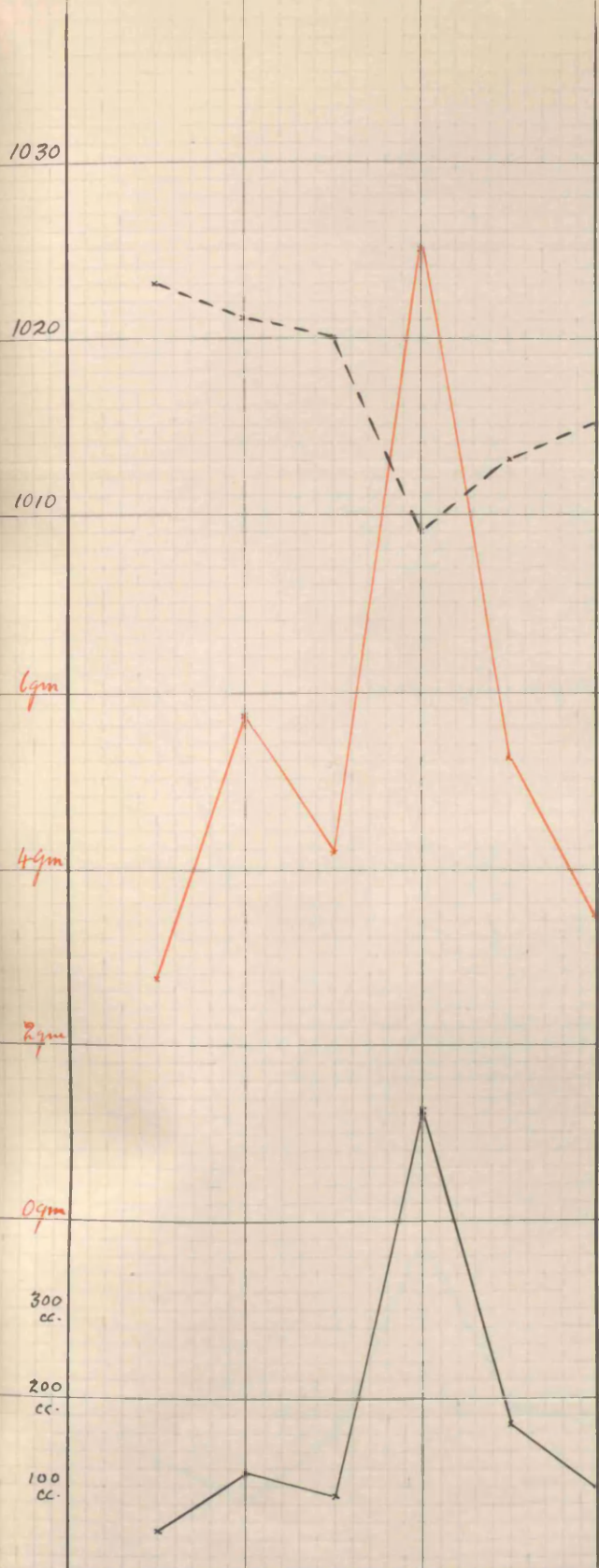
30

20

10 gm

Volume.

Solids.



1030

1020

1010

6 gm

4 gm

2 gm

0 gm

300 cc.

200 cc.

100 cc.

10

12

2

4

6

8

Time.

50 gm

40 gm

30 gm

20 gm

10 gm

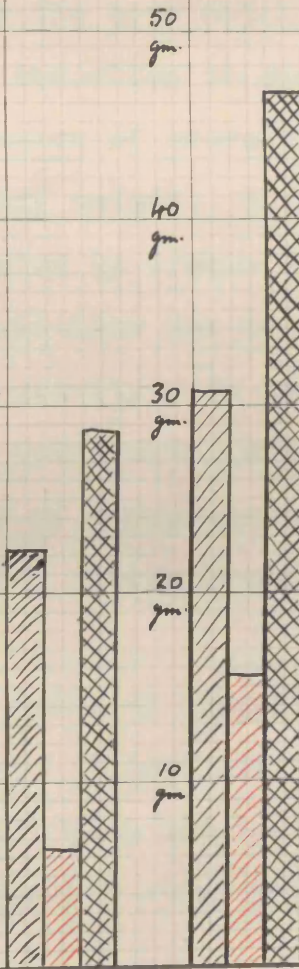
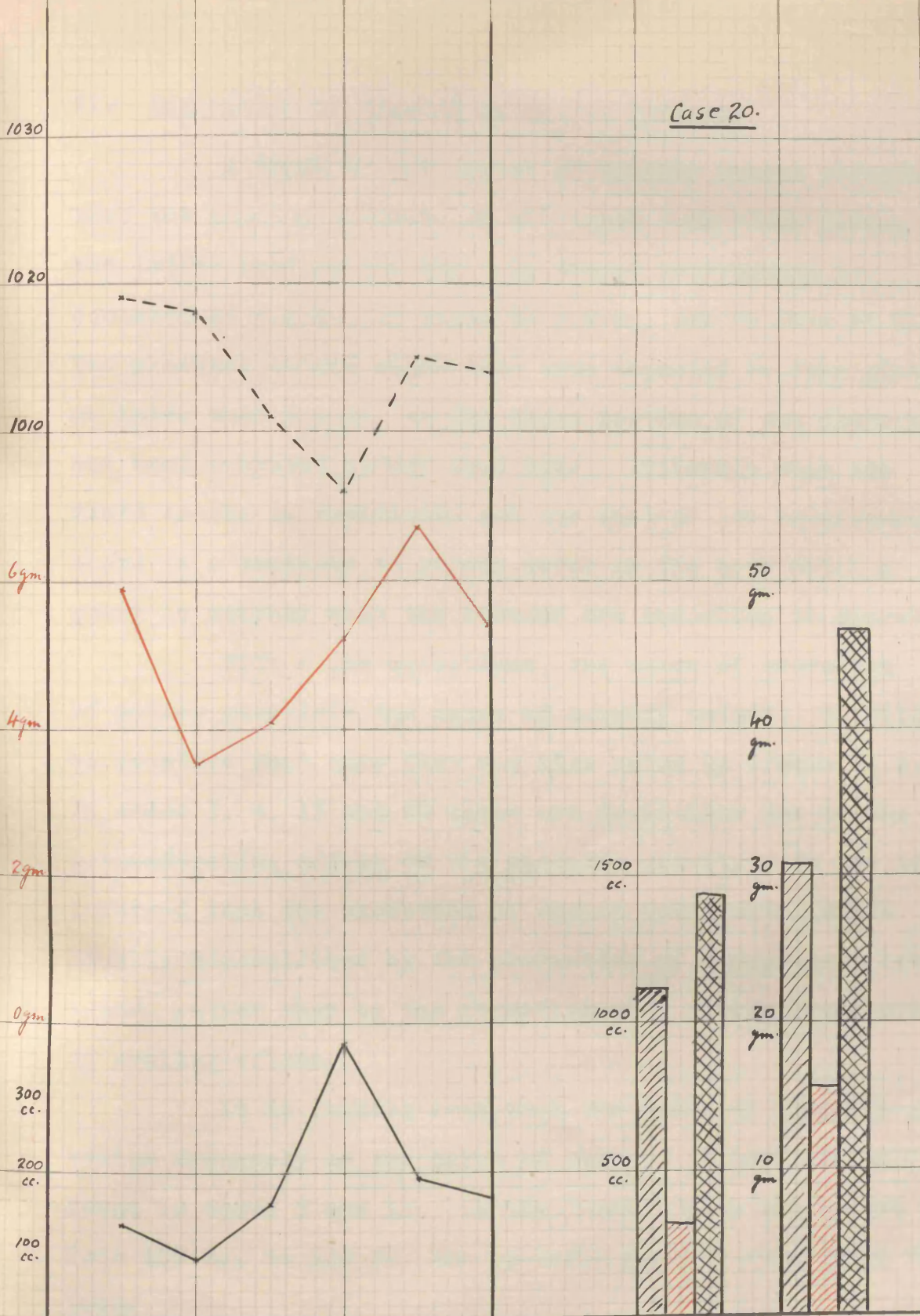
1500 cc.

1000 cc.

500 cc.

Volume.

Solids.



## VI. Discussion of Results in Normal Persons.

A study of the curves of urinary output reveals that the maximum diuresis in all cases took place during the latter half of the day. In twelve individuals it occurred at 4.p.m., in three at 6.p.m., and in five at 8.p.m. The greatest output might have been expected to take place no later than 2.p.m., as the major portion of the dietary had been consumed before that hour. Evidently when the fluid intake is restricted and the diet of low caloric-value, there is a tendency to retain water in the body until a point is reached when the kidneys are compelled to excrete it.

With a few exceptions, the curve of excretion of solids parallels the curve of urinary output. It will be recalled that this fact was also noted by O'Hare (q.v.). In cases 3, 4, 13 and 20 there are deviations due to the preponderating effect of the specific gravity. It may be inferred that the excretion of excess solid material is usually accomplished by the production of a copious dilute urine, rather than by the formation of a concentrated urine of smaller volume.

It is readily seen that the curve of specific gravity varies inversely as the curve of output. Exceptions will be found in cases 8 and 12. In the former, when the volume falls from 180 cc. to 109 cc. the specific gravity also falls from 1019/  
1019/

1019 to 1013.

It is apparent from the charts that the total day-urine volume bears no constant relationship to the night-urine volume. Some American observers, among them Bowen and Sharlit, state that in normal persons the volume of day-urine should be at least twice the volume of night-urine. In the present series, the ratio is over 2 in value in fourteen cases, and below 2 in six cases. Obviously this criterion of normality does not hold good under the conditions of this test.

The actual solid content of the day-urine, night-urine, and 24-hour urine varies too much for the laying down of any maximal and minimal limits. For example, the total solid-excretion in Case 15 is almost double that in Case 7. However, it seemed reasonable to suppose that a comparison of the day-excretion and the night-excretion might yield interesting results in a study of normal and abnormal cases. This will be referred to later.

In Table I we have summarised what appeared, on the whole, to be the salient features of the results; viz:- the total urinary output, the volume of the night-urine, the maximum specific gravity of the specimens, the variation of the specific gravity, the specific gravity of the night urine, and the ratio of day-solids to night-solids.

TABLE I.SUMMARY OF RESULTS IN NORMAL PERSONS.

Case No.	24-hour Urine cc.	Night Urine cc.	Maximum Sp. Gr.	Variation of Sp. Gr.	Sp.Gr. of Night Urine.	Ratio of Day to Night Solids
1	849	255	24	12	23	1.7
2	947	268	27	12	27	1.8
3	888	280	32	12	30	1.9
4	1001	288	27	13	27	1.8
5	872	252	27	19	27	1.7
6	1221	454	19	9	15	1.4
7	764	272	20	5	19	1.7
8	1313	410	19	8	15	1.9
9	812	300	27	16	18	1.7
10	1006	228	29	18	26	2.1
11	1071	240	20	8	20	2.7
12	1026	330	18	12	18	1.4
13	860	455	27	7	20	1.1
14	1095	236	23	11	21	2.6
15	1031	448	27	4	25	1.3
16	616	238	26	6	25	1.5
17	1418	402	22	11	22	1.6
18	850	295	24	9	24	1.5
19	1416	360	23	14	21	1.8
20	1431	320	21	15	21	1.9

### A. The Total Output.

The total urinary output varies from 616 cc. to 1431 cc. with an average of 1024 cc. This seems a remarkable variation, bearing in mind the fact that the patients were under similar conditions of diet and environment for three days. This period may be too short to obtain results which are strictly comparable. Again, much may depend upon the "nervous" condition of the subject while undergoing the test.

In the face of this wide variation in output, we are justified only in assuming that, on this diet, a total output exceeding 1450 cc. would indicate polyuria. Since the total intake of fluids was only 1700 cc., this would appear to leave a very small positive balance for the needs of the body, but it must be remembered that the solid food yields water, which, according to Rowntree, may amount to one litre a day, on an ordinary diet.

### B. The Night-Urine.

The volume of the night-urine varies from 236 cc. to 455 cc. with an average of 316.5 cc. In only one case (No. 13) <sup>does</sup> ~~did~~ this volume exceed that of the day-urine. It will be recalled that Mosenthal allows an upper limit of 750 cc., a figure which has not been approached in this series. His patients, however, were not under standard conditions of environment, etc. We may therefore assume that, under the given conditions, any night-urine exceeding 500 cc. is abnormal/

abnormal.

C. The Maximum Specific Gravity.

The maximum specific gravity is an index of the ability of the kidney to produce a concentrated urine. In this series it varies from 1018 to 1032, with an average of 1024. This agrees closely with the experience of most American writers. Evidently at some period of the day the healthy kidney should excrete a urine with a specific gravity of at least 1018.

D. Variation of Specific Gravity.

The variation of the specific gravity ranges from 4 points to 19 points with an average of 10.9 points. This feature is obviously too variable to allow of much reliance being placed upon it, though perhaps the level of fixation should be taken into account. A variation of less than five points, with a maximum specific gravity of less than 1018, should be considered abnormal. It will be remembered that Mosenthal demanded a variation of at least nine points as a criterion of normality.

E. Specific Gravity of Night-Urine.

The specific gravity of the night urine varies from 1015 to 1030 with an average of 1022. Only two cases (Nos. 6 & 8) fall below 1018. We must, however, accept the fact that the specific gravity of the night-urine may in normal cases be as low as 1015, but is usually over 1018.

F./

F. Ratio of Day Solids to Night Solids.

Addis in 1923 found that with a constant low water-intake, the average percentage of the 24-hour urine volume excreted during the night was 33.8 in normal cases. Taking the night-urine volume as unity, this gives a ratio of 2 : 1. It seemed to us that the expression of a similar ratio in regard to the solids of the urine might show notable differences in health and disease.

It will be observed from Table I that the ratio varies from 1.1 to 2.7 with an average of 1.75. In only four cases is the ratio below 1.5. These low values were somewhat unexpected, but we must accept them as within the bounds of normality.

In summing up, we may assume that, under the conditions of the test, a normal person should show the following reactions:-

- (1) The total urine volume should not exceed 1450 cc.
- (2) The night-urine volume should not exceed 500 cc.
- (3) The maximum specific gravity should be at least 1018.
- (4) The specific gravity should vary not less than five points, except the maximum specific gravity be 1018 or over.
- (5) The specific gravity of the night-urine should usually be not less than 1018, but a lower reading does not necessarily denote abnormality.
- (6) The ratio of day-solids to night solids should usually be at least 1.5 : 1, but only values less than 1 : 1 may be considered definitely abnormal.



## VII. Results in Abnormal Cases.

The abnormal cases investigated were all patients under treatment in the medical wards of Glasgow Royal Infirmary. The tests were carried out when the clinical condition permitted; naturally it was impossible to give the diet to a patient on the verge of uraemia or at the commencement of an acute nephritis. At those stages, no analysis of the water-excretion is necessary. A number of the patients were convalescing from acute nephritis or an acute exacerbation of a chronic nephritis, having merely a persistent trace of blood or albumen in the urine.

The types of case investigated have been already detailed (p. 17). The two patients suffering from arteriosclerosis, and the patient with hyperpiesis were examined from the point of view of the renal impairment which not uncommonly accompanies these conditions. The patient with secondary anaemia and the one with valvular disease of the heart were examined on account of albuminuria.

The results are set forth in tabular and graphic form. Again, only the last two figures of the specific gravity are given.

In the urea concentration test, a third-hour specimen/

specimen was obtained when the second specimen exceeded 120 cc.

A short synopsis of each case, obtained from the Ward Journal, is given with each set of results. We have not differentiated the various types of chronic nephritis, as it was found difficult to place most of the cases in any well-defined category. The brief clinical history provided will perhaps be sufficient to indicate the main features of the disease.

The deviations from the normal standard are noted at the foot of each page.

CASE 1.

FEMALE. AGE 10.

History:- Attacks of sickness, headache and malaise of some months' duration. Severe headache and scanty urine for 3 days before admission to hospital.

Condition on admission:- No oedema. No cardiac abnormality. Blood-pressure 110/85. Urine contained abundant blood and albumen, many granular and a few hyaline casts.

Dismissed "well" with urine free of albumen.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	50	13	1.50
10 - 12	47	18	1.97
12 - 2	75	15	2.61
2 - 4	290	14	9.46
4 - 6	190	11	4.87
6 - 8p.m.	90	15	3.15
Day Total	742		23.56
8p.m. - 8a.m.	575	11	14.73
Total 24 hrs.	1317		38.29

Urea Concentration Test.

Before giving urea:- 1.16 per cent  
 1st hour:- 1.40 per cent  
 2nd hour:- 1.25 per cent

Non-protein nitrogen:- 17 mgs. per cent.

Notes.

Tendency to fixation of specific gravity; nocturnal polyuria; low specific gravity of night urine; low urea concentration.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

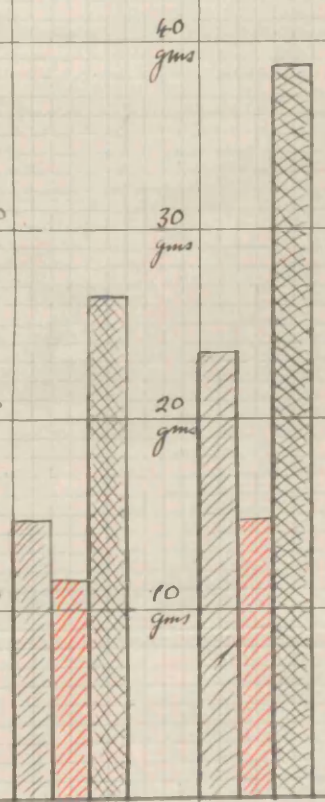
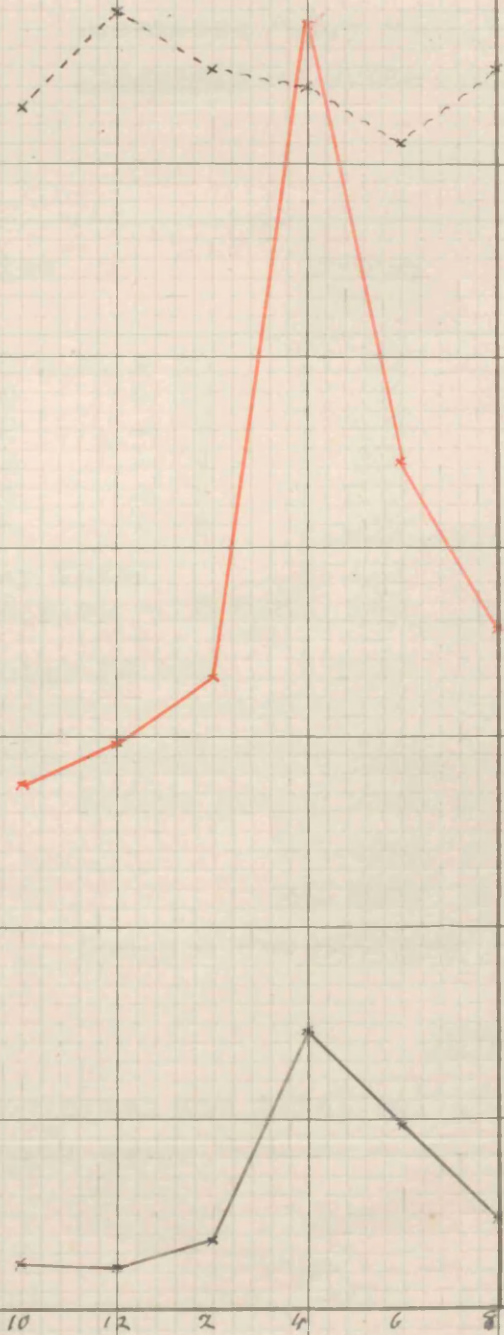
40 gms

30 gms

20 gms

10 gms

Solids.



CASE 2.FEMALE. AGE 14.

History:- Swelling of the face of 10 days' duration. Headache and sore throat for one day previous to admission.

Condition on Admission:- No oedema. No cardiac abnormality. Blood pressure moderate. Urine contained blood and albumen with blood and granular casts and numerous epithelial cells.

Dismissed "very well," with urine free from albumen.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids. (grammes).
8 a.m. - 10	67	09	1.39
10 - 12	56	16	2.08
12 - 2	101	13	3.06
2 - 4	268	06	3.73
4 - 6	230	09	4.82
6 - 8	130	11	3.33
Day Total	852		18.41
8 p.m. - 8 a.m.	640	09	13.49
Total 24 hrs.	1492		31.90

Urea Concentration Test.

Before giving urea - 0.50 per cent.

1st. hour - 1.50 per cent.

2nd hour - 2.05 per cent.

Non-protein nitrogen - 12 mgs. per cent.

NOTES.

Nocturnal and total polyuria; low specific gravity of night urine.

1030

Case 2.

60.

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

Volume.

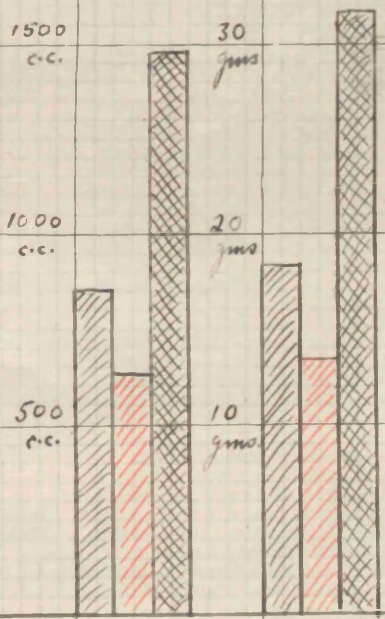
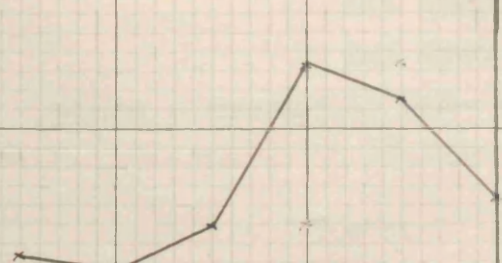
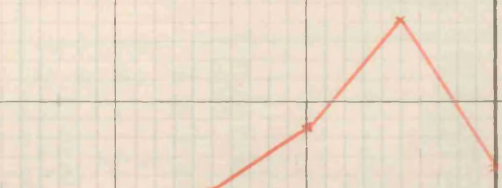
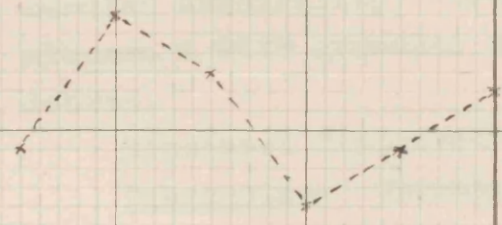
40 gms.

30 gms

20 gms

10 gms

Solids.



CASE 3.

FEMALE. AGE 37.

History:- Swelling of ankles and face of 2 months duration, and commencing 3 weeks before confinement. Intermittent headache for 5 weeks. Dyspnoea. History of nephritis 7 years before.

Condition on admission:- Oedema of face and ankles. No cardiac abnormality. Blood-pressure 125/80. Urine contained albumen + with granular casts, red blood cells, and epithelial debris.

Dismissed "improved", with trace of albumen in urine.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m. - 10	90	18	3.77
10 - 12	80	20	3.72
12 - 2	105	18	4.40
2 - 4	78	17	3.08
4 - 6	94	17	3.72
6 - 8	114	13	3.45
Day Total	561		22.14
8 p.m. - 8 a.m.	546	12	15.26
Total 24 hrs.	1107		37.40

Urea Concentration Test.

Before giving urea - 1.9 per cent.  
1st hour - 1.67 per cent.  
2nd hour - 1.85 per cent.

Blood - urea:- 15 mgs. per cent. Non-protein nitrogen  
18 mgs. per cent.

NOTES.

Nocturnal polyuria; low specific gravity of night urine; urea concentration rather low.

Case 3.

62.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

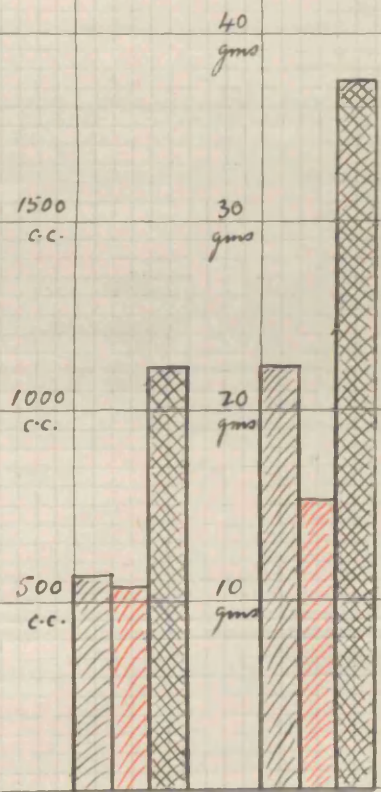
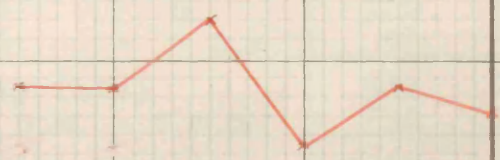
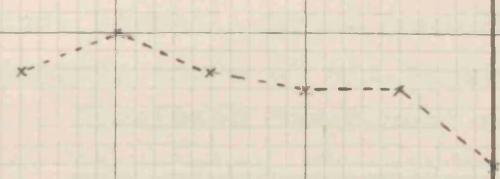
30 gms

20 gms

10 gms

Volume.

Solids.





CASE 4.

FEMALE. AGE 24.

History:- Following influenza, swelling of face and hands, oliguria, and vomiting of 6 weeks duration.

Condition on admission:- Oedema. No cardiac abnormality. Blood-pressure 170/90 (which fell latterly to 120/84). Fundi normal. Urine contained albumen ++ and blood + with numerous casts of all varieties.

Dismissed "improved" with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume. (Ccs.)	Specific Gravity.	Solids. (grammes).
8 a.m. - 10	72	13	2.17
10 - 12	90	15	3.15
12 - 2	70	16	2.61
2 - 4	84	19	3.71
4 - 6	120	17	4.75
6 - 8 p.m.	96	18	4.02
Day Total	532		20.41
8 p.m. - 8 a.m.	580	11	15.86
Total 24 hrs.	1112		36.27

Urea Concentration Test.

Before giving urea - 0.77 per cent.  
 1st hour - 0.83 per cent.  
 2nd hour - 1.33 per cent.

Blood - urea :- 23 mgs. per cent. Non-protein nitrogen:-  
 22 mgs. per cent.

NOTES.

Tendency to fixation of specific gravity; nocturnal polyuria;  
 low specific gravity of night urine; low urea concentration.

1030

Case 4.

64.

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

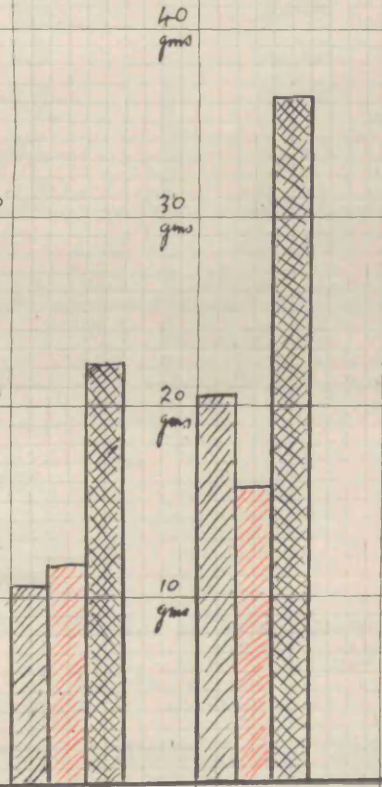
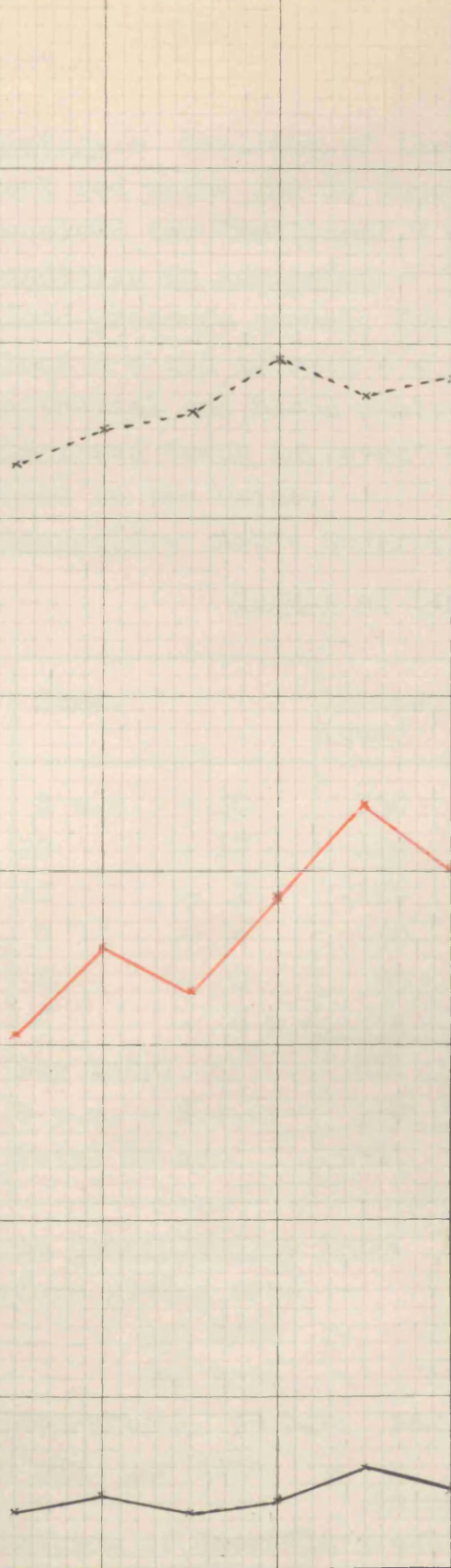
30 gms

20 gms

10 gms

Volume.

Solids.



Case 5.Male. Age 22.

History:- Swelling of the face for 5 weeks. Passage of dark red urine for 10 days before admission. Patient received two "wettings" 7 weeks before admission.

Condition on Admission:- No oedema. No cardiac abnormality. Blood-pressure normal. Fundi normal. Urine contained blood + + and albumen + + + with granular, hyaline, epithelial and blood casts.

Dismissed "much improved" with trace of albumen and blood in the urine.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8 a.m. - 10	150	12	4.19
10 - 12	122	13	3.69
12 - 2	136	13	4.12
2 - 4	150	13	4.54
4 - 6	95	11	2.43
6 - 8 p.m.	158	12	4.41
Day Total.	811		23.38
8 p.m. - 8 a.m.	510	13	15.45
Total 24 hrs.	1321		38.83

Urea Concentration Test.

Before giving urea :- 1.28 per cent.

1st hour. :- 1.28 per cent.

2nd hour :- 1.45 per cent.

Blood-urea:- 33 mgs. per cent. Non-protein nitrogen:-  
40 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal polyuria and low specific gravity of night urine; low urea concentration.

Case 5.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

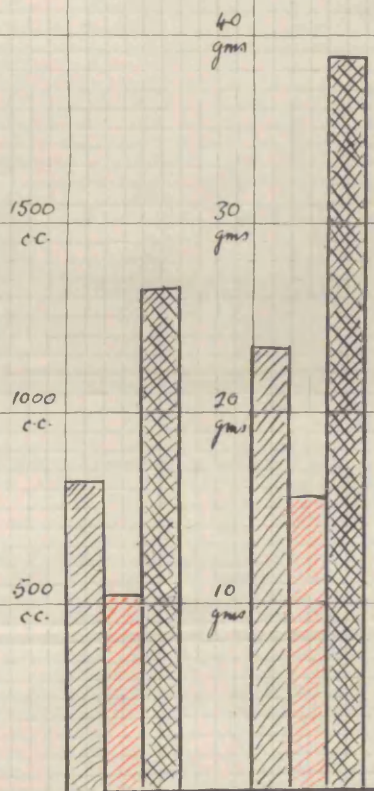
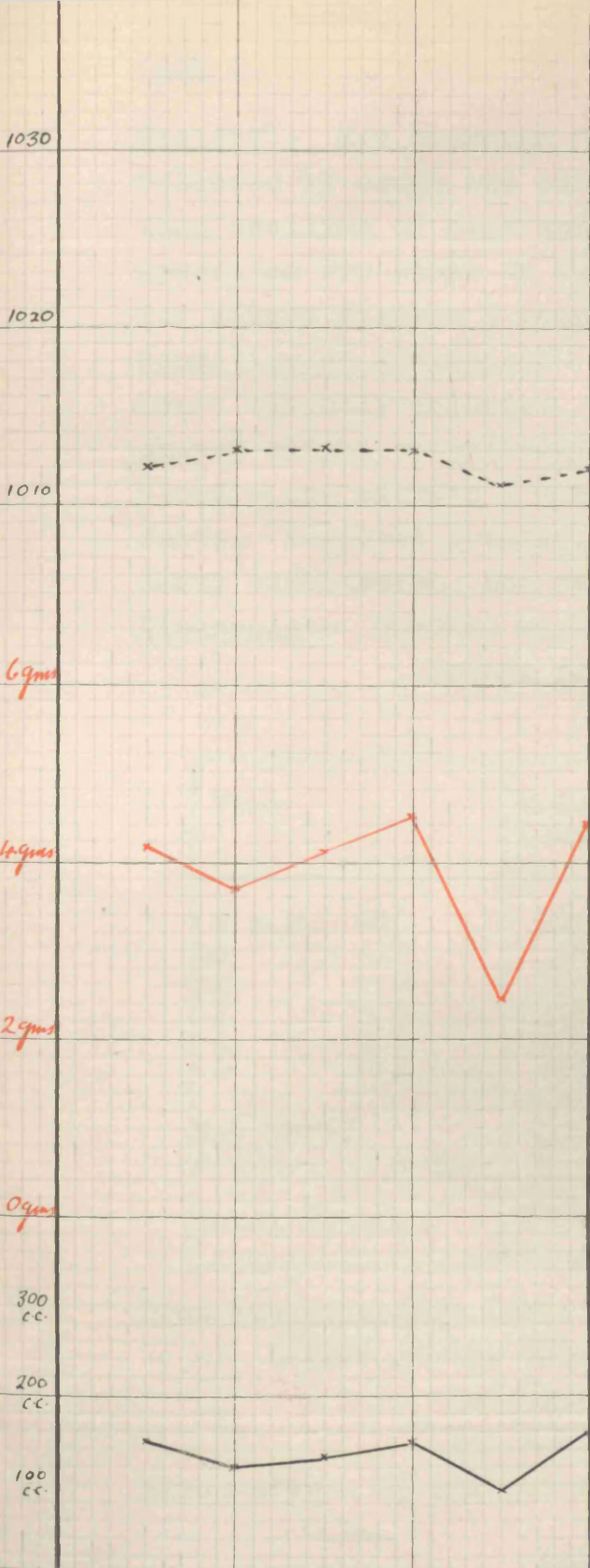
40 gms

30 gms

20 gms

10 gms

Solids.



CASE 6.

MALE AGE, 41.

History:- Had thorough "wetting" a month before admission, followed by cough and pain in chest. Headache for 2 weeks; then swelling of face and passage of dark red urine. Had operation for stone in bladder 5 years ago, and was treated for kidney disease 3 years ago.

Condition on admission:- Oedema of face and ankles. Left heart slightly enlarged. Blood-pressure, 210/100. Fundi showed slight arterio-sclerotic changes. Urine contained blood + and albumen + + + with blood, granular and epithelial casts. Improved greatly. Ureteral calculus discovered on X-ray examination, and removed at operation.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids. (grammes)
8 a.m. -10	104	15	3.63
10 -12	96	16	3.57
12 - 2	104	15	3.63
2 - 4	110	16	4.10
4 - 6	106	15	3.70
6 - 8 p.m.	212	09	4.44
Day Total	732		23.07
8 p.m. - 8 a.m.	632	12	17.67
Total 24 hrs.	1364		40.74.

Urea Concentration Test.

Before giving urea:- 0.85 per cent.

1st hour:- 0.92 per cent.

2nd hour:- 1.15 per cent.

Blood-urea:- 29 mgs per cent. Non-protein nitrogen:- 29 mgs. (per cent.)

Notes.

Nocturnal polyuria; low specific gravity of night urine; low urea concentration.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

500 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

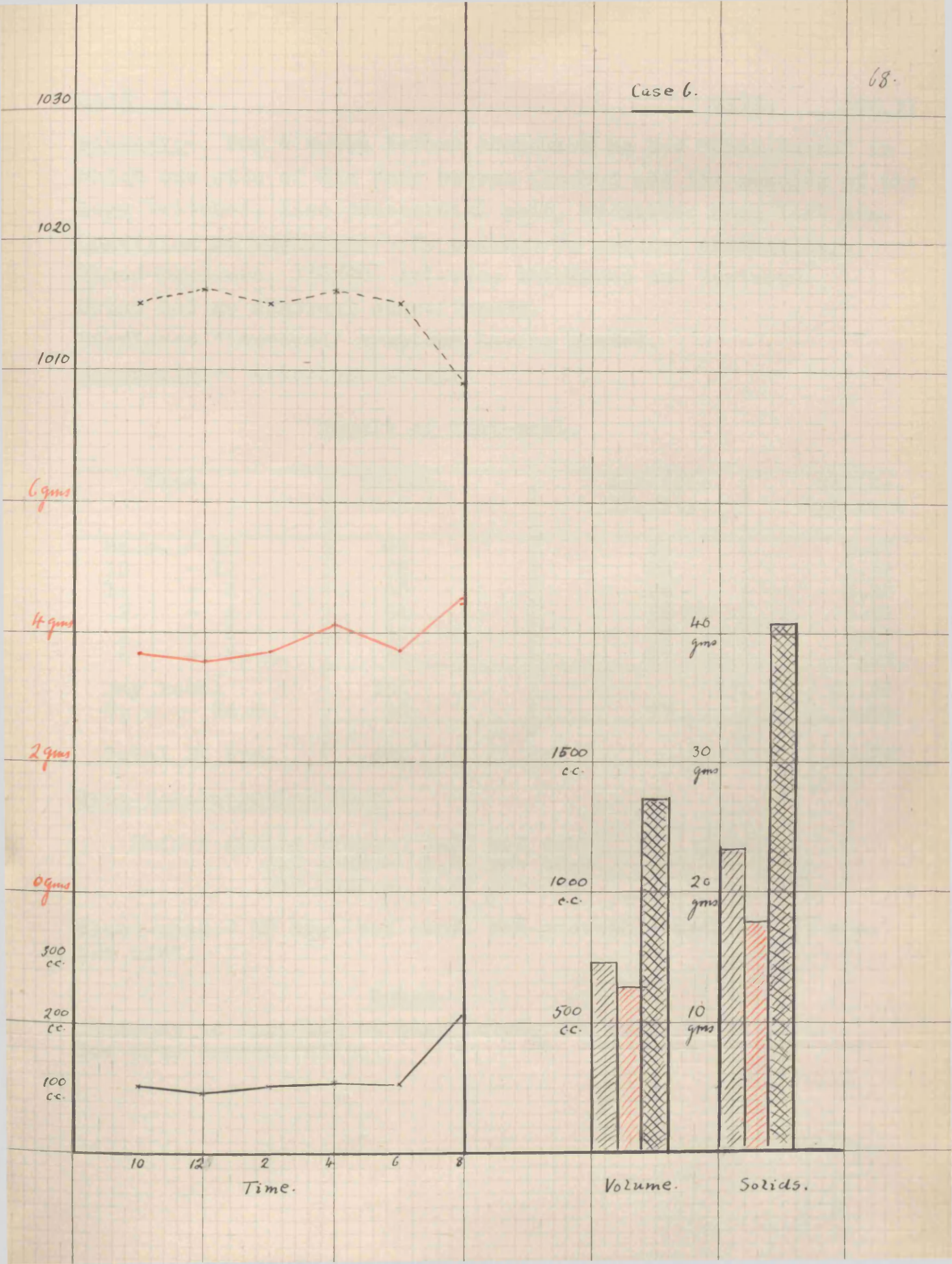
46 gms

30 gms

20 gms

10 gms

Solids.



CASE 7.

MALE. AGE 37.

History:- For 6 weeks before admission he had "weak turns" in which one side of his face became flushed and the muscles of his legs twitched. Also praecordial pain, radiating down left arm.

Condition on admission:- No oedema. No cardiac abnormality.

Blood-pressure, 138/90. Arteries thickened and tortuous.

Urine had no abnormal constituents.

Dismissed "improved" symptoms having abated.

Diagnosis:- Arteriosclerosis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	64	23	3.42
10 - 12	55	26	3.32
12 - 2	58	26	3.50
2 - 4	54	28	3.52
4 - 6	56	28	3.65
6 - 8p.m.	46	27	2.89
Day Total	333		20.30
8p.m. - 8a.m.	88	27	5.59
Total 24 hrs.	421		25.89

Urea Concentration Test.

Before giving urea:- 1.35 per cent  
 2nd hour:- 1.07 per cent  
 3rd hour:- 1.22 per cent

Blood-urea:- 38 mgs. per cent. Non-protein nitrogen:- 33 mgs. per cent.

Notes.

Tendency to fixation at high level; low water excretion; low urea concentration.

Case 7.

70.

1030

1020

1010

6 gms

10 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

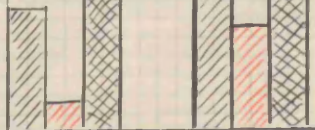
500 c.c.

40 gms

30 gms

20 gms

10 gms



Volume.

Solids.



CASE 8.MALE. AGE, 53.

History:- Vague story of headaches for 7 weeks before admission.

Condition on admission:- Confused and emotional. No oedema. No cardiac abnormality. Blood-pressure, 210/110. Urine had a deposit of urates.

Dismissed "improved" but died of cerebral haemorrhage a year afterwards.

Diagnosis:- Arteriosclerosis.

Result of Test-meal.

Time	Volume (c.cms.)	Specific. gravity.	Solids. (grammes)
8 a.m. - 10	56	22	2.87
10 - 12	66	18	2.76
12 - 2	67	18	2.80
2 - 4	74	24	4.13
4 - 6	70	23	3.75
6 - 8 p.m.	84	22	4.30
Day Total	417		20.61
8 p.m. - 8 a.m.	96	22	4.91
Total 24 hours	513		25.52

Urea Concentration Test.

Before giving urea:- 1.95 per cent.

1st Hour :- 1.73 per cent.

2nd hour :- 1.39 per cent.

Blood Urea:- 45 mgs. per cent. Non-protein nitrogen:-  
34 mgs. per cent.

NOTES.

Tendency to fixation of specific gravity at high level; low urea concentration. Low water excretion.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

30 gms

1000 cc.

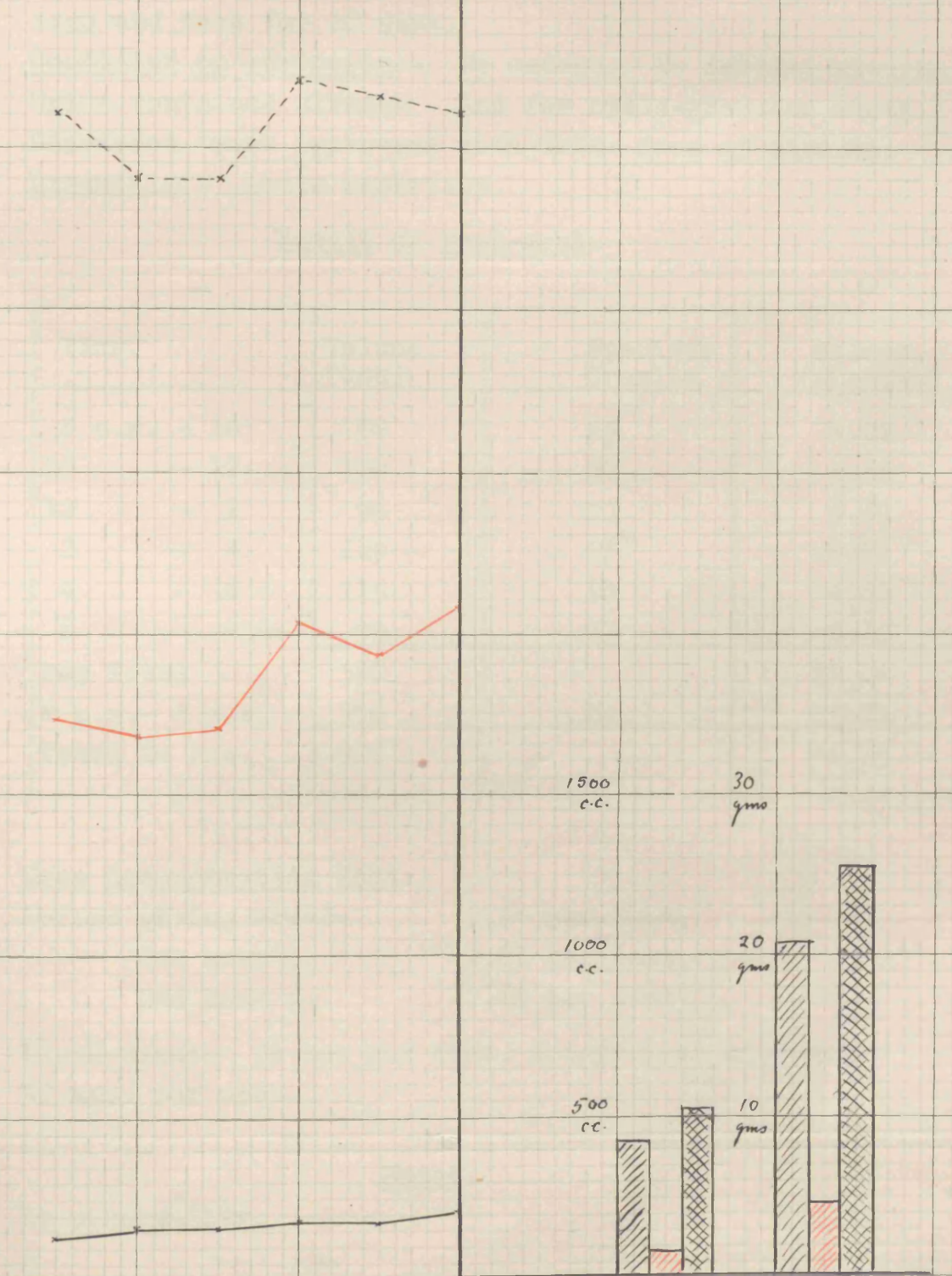
20 gms

500 cc.

10 gms

Volume.

Solids.



History:- Dyspnoea for  $3\frac{1}{2}$  weeks previous to admission. Pain in the loins, severe headache and swelling of feet, legs and face for 10 days.

Condition on admission:- No oedema. No cardiac abnormality. Urine contained albumen - and few hyalo-granular casts. Dismissed "much improved" with urine free of albumen.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity	Solids. (grammes)
8 a.m. - 10	80	23	4.28
10 - 12	100	20	4.66
12 - 2	96	20	4.47
2 - 4	119	17	4.71
4 - 6	115	18	4.82
6 - 8 p.m.	80	22	4.10
Day Total	590		27.04
8 p.m.- 8 a.m.	380	20	17.71
Total 24 hrs.	970		44.75.

Urea Concentration Test.

Before giving urea:- 2.24 per cent.  
 1st hour :- 2.62 per cent.  
 2nd hour :- 2.68 per cent.

Blood-urea:- 36 mgs per cent. Non-protein nitrogen:-  
 32 mgs. per cent.

Notes.

No abnormality.

Case 9.

74.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

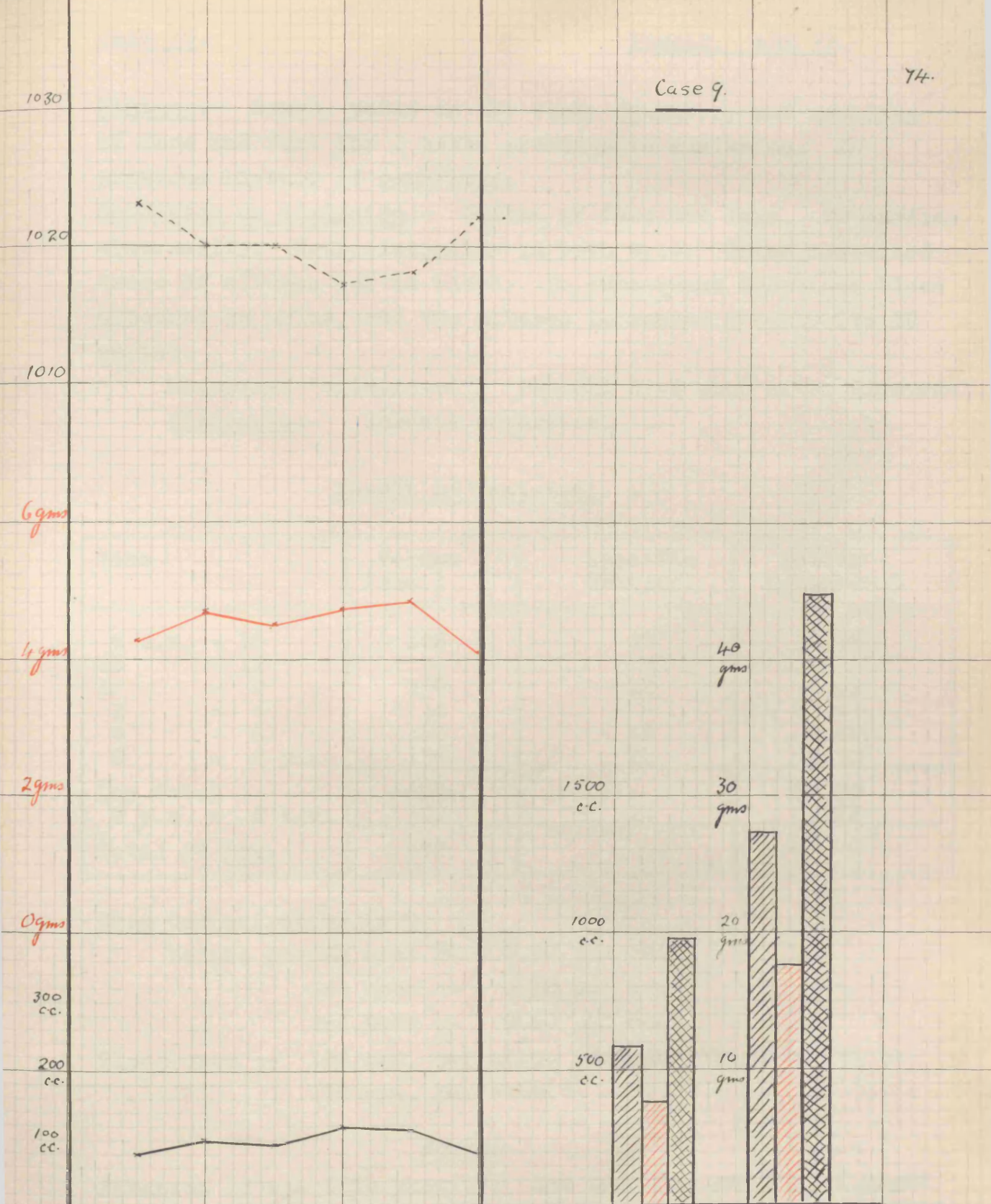
40 gms

30 gms

20 gms

10 gms

Solids.



CASE 10.

FEMALE. AGE 37.

History:- Cough, pains in the back, dyspnoea, and swelling of face and feet for 2 weeks previous to admission. No previous history of nephritis.

Condition on admission:- Oedema of face and legs. No cardiac abnormality. Neuro-retinitis in both eyes. Urine contained trace of albumen but no blood. On subsequent occasions blood appeared in urine, and the albumen increased greatly (to 10 parts).

Dismissed "unimproved". Patient died soon after dismissal.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	138	10	4.38
10 - 12	-	-	-
12 - 2	150	12	4.69
2 - 4	14	-	-
4 - 6	164	12	4.58
6 - 8 p.m.	154	12	4.30
Day Total	670		17.95
8 p.m. - 8 a.m.	322	13	9.75
Total 24 hrs.	992		27.70

Urea Concentration Test.

Before giving urea :- 0.90 per cent.  
 1st hour :- 0.70 per cent.  
 2nd hour :- 0.60 per cent.

Blood-urea :- 184 mgs. per cent. Non-protein nitrogen :-  
 120 mgs. per cent.

NOTES.

Fixation of specific gravity; low specific gravity of night urine; low urea concentration; high blood urea.

Case 10.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

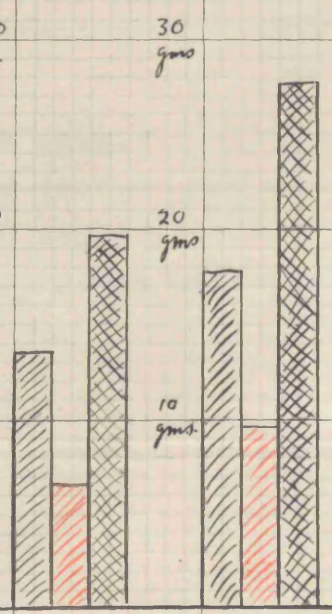
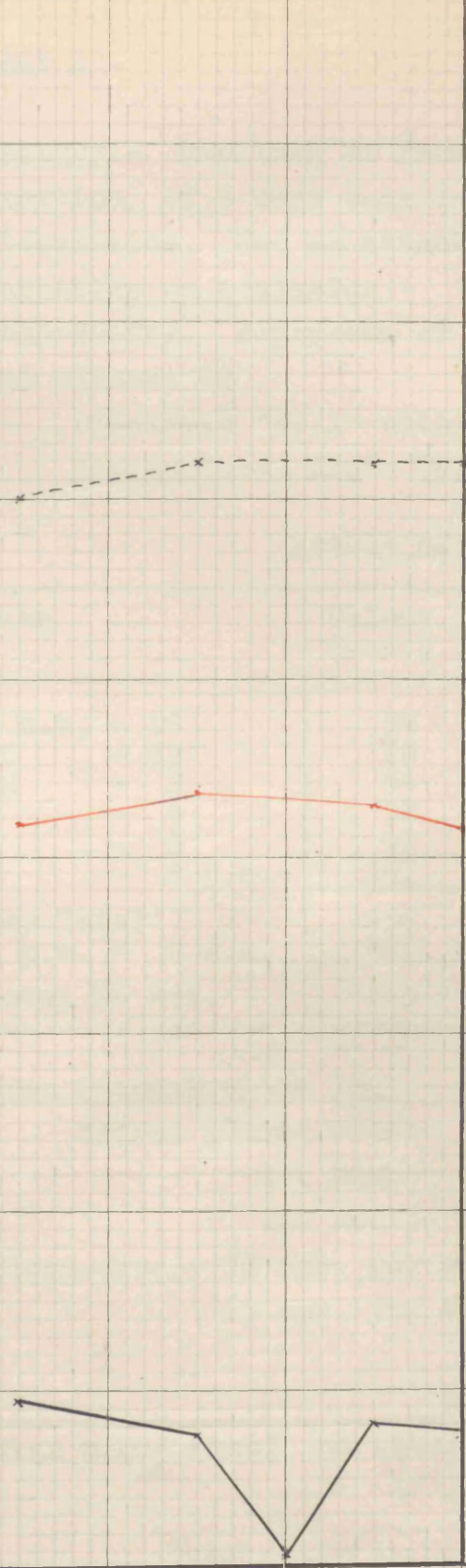
30 gms

20 gms

10 gms

Volume

Solids.



CASE 11.

MALE. AGE 53.

History:- Swelling of face and hands with dyspnoea on exertion, of 5 days duration. No pain or frequency of micturition. Had an attack of nephritis 5 years before.

Condition on admission:- Oedema of face. No cardiac abnormality. Emphysema of lungs. Urine contained blood ++ and albumen ++ .

Dismissed "Well" with urine free from blood and albumen.

Diagnosis:- Acute Nephritis.

Result of Test-meal.

Time	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8 a.m. - 10	54	22	2.76
10 - 12	75	19	3.31
12 - 2	54	26	3.27
2 - 4	72	21	3.52
4 - 6	97	22	4.97
6 - 8 p.m.	107	21	5.23
Day Total	459		23.06
8 p.m. - 8 a.m.	426	21	20.84
Total 24 hrs.	885		43.90

Urea Concentration Test.

Before giving urea:- 1.85 per cent.

1st hour:- 1.91 per cent.

2nd hour:- 2.13 per cent.

Blood-urea:- 72 mgs. per cent. Non-protein nitrogen:-

63 mgs. per cent.

NOTES.

High blood urea; no other abnormality.

1030

1020

1010

6gms

4gms

2gms

0gms

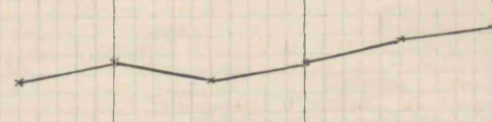
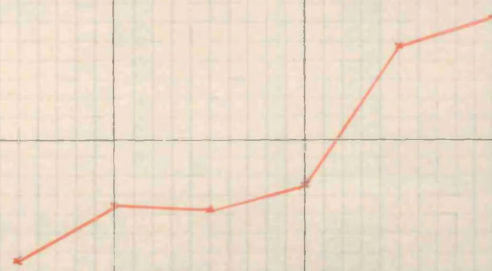
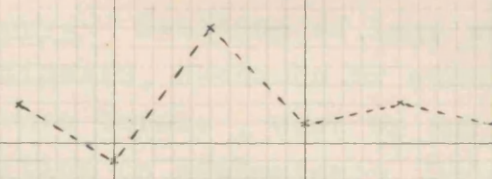
300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.



1500 cc.

1000 cc.

500 cc.

Volume.

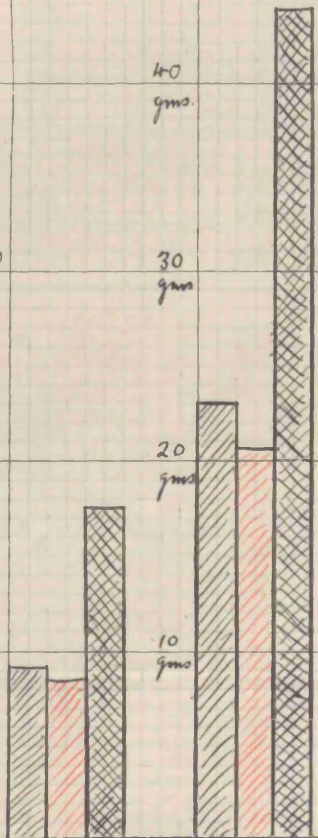
40 gms.

30 gms.

20 gms.

10 gms.

Solids.





CASE 12.

MALE. AGE 51.

History:- Swelling of legs and abdomen of 6 weeks duration. No oliguria, headache or other symptoms. Had acute nephritis 12 years before, when on war service.

Condition on admission:- Oedema of legs and ascites. Heart sounds soft, Blood-pressure, 160/110. Urine contained blood and albumen ++ with blood, epithelial and granular casts. Dismissed "improved" with trace of albumen and blood in urine.

Diagnosis:- Acute exacerbation of chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	44	19	1.94
10 - 12	85	19	3.76
12 - 2	56	23	2.99
2 - 4	28	24	1.56
4 - 6	72	19	3.18
6 - 8p.m.	100	19	4.43
Day Total	385		17.86
8p.m. - 8a.m.	730	17	28.92
Total 24 hrs.	1115		46.78

Urea Concentration Test.

Before giving urea:- 0.50 per cent  
 1st hour:- 1.15 per cent  
 2nd hour:- 1.10 per cent

Blood-urea:- 46 mgs. per cent. Nonprotein nitrogen:- 29 mgs. per cent.

Notes.

Nocturnal polyuria; low urea concentration.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc

200 cc

100 cc

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

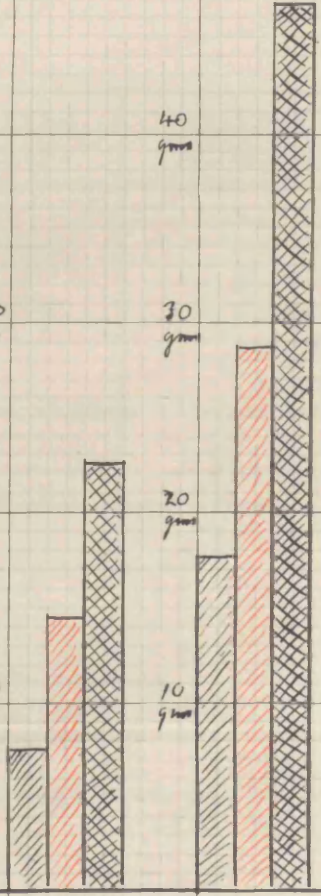
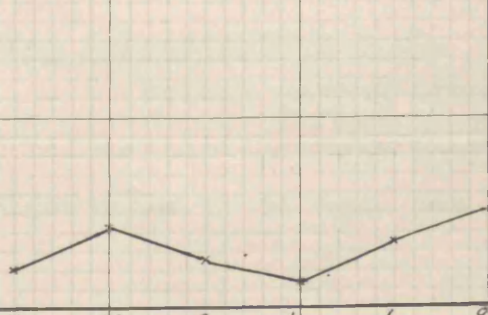
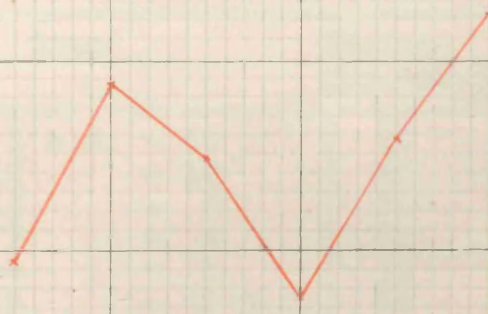
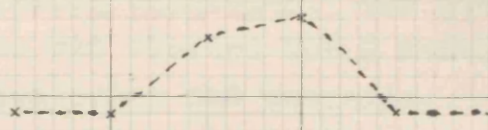
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 13.MALE. AGE, 24.

History:- Oedema of legs and ascites began three months before admission. Was admitted to another hospital where he was treated for 2 months. Had oliguria, frequent headaches and anorexia.

Condition on admission:- Complete anasarca. No cardiac abnormality. Blood-pressure normal. Urine contained blood and albumen ++ with blood cells, epithelial debris and granular casts.

Dismissed "slightly improved", after long period in hospital. He was still very oedematous and had albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (c.cms.)	Specific gravity.	Solids. (grammes)
8 a.m. - 10	70	17	2.77
10 - 12	62	17	2.45
12 - 2	80	17	3.17
2 - 4	92	18	3.85
4 - 6	40	20	1.86
6 - 8 p.m.	68	20	3.16
Day Total	412		17.26
8 p.m. - 8 a.m.	603	17	23.88
Total 24 hours.	1015		41.14

Urea Concentration Test.

Before giving urea:- 0.99 per cent.

1st hour:- 0.85 per cent.

2nd hour:- 0.97 per cent.

Blood-urea :- 51 mgs. per cent. Non-protein nitrogen :-  
37 mgs. per cent.

NOTES.

Fixation of specific gravity at high level; nocturnal polyuria; low urea concentration; high blood urea.

1030

1020

1010

6 gms

4 gms

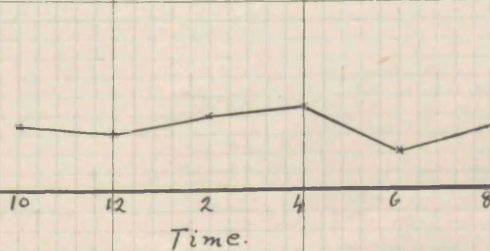
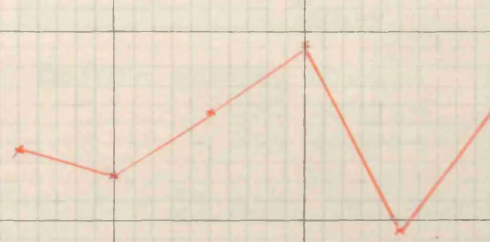
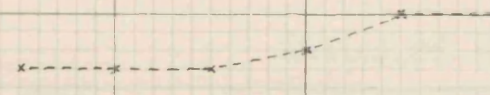
2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.



1500 c.c.

1000 c.c.

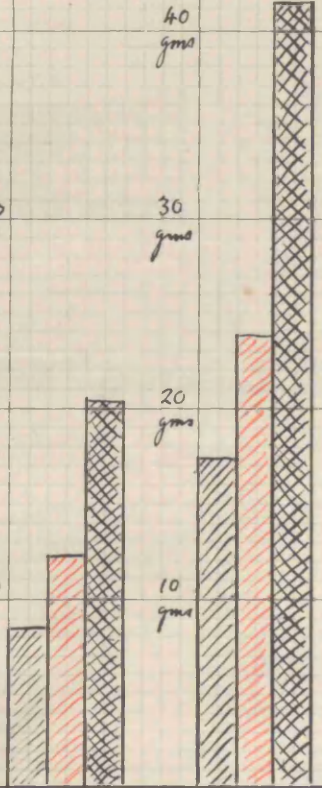
500 c.c.

40 gms

30 gms

20 gms

10 gms



Volume.

Solids.

Time.

CASE 13A. (repeat)

This patient was investigated again, 3 months later. He was still oedematous and his urine contained both blood and albumen, the latter in abundance.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	60	20	2.80
10 - 12	64	22	3.28
12 - 2	82	20	3.82
2 - 4	90	20	4.19
4 - 6	131	20	6.10
6 - 8p.m.	138	22	7.07
Day Total	565		27.26
8p.m. - 8a.m.	544	18	22.81
Total 24 hrs	1109		50.07

Urea Concentration Test.

Before giving urea:- 1.66 per cent  
 1st hour:- 1.44 per cent  
 2nd hour:- 1.83 per cent

Blood-urea:- 33 mgs. per cent. Non-protein nitrogen 35 mgs. per cent.

Notes.

Fixation of specific gravity at high level; nocturnal polyuria; low urea concentration.

Case 13A.

8H.

1030

1020

1010

6gms

4gms

2gms

0gm

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

50 gms

40 gms

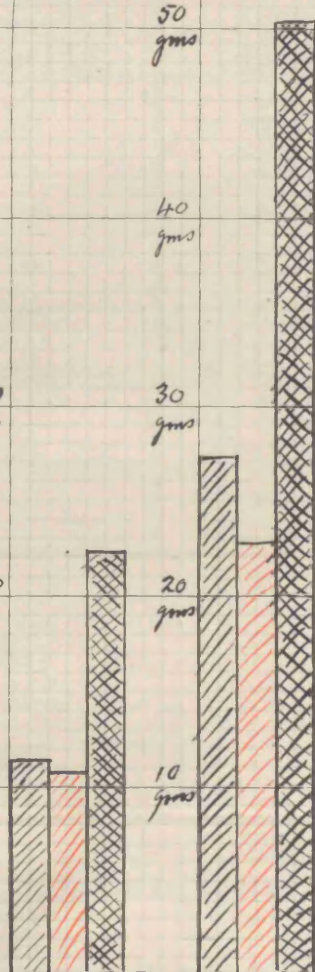
30 gms

20 gms

10 gms

Volume.

Solids.



Case 14.Male. Age 49.

History:- Suffered from weakness and pains in right side of chest for 6 days, with bad cough and spit for last 2 days. Had asthma since a youth. Had bad attack of nephritis a year before, when he was in bed for 10 weeks.

Condition on admission:- No oedema. Consolidation of upper lobe of right lung. Heart displaced to right. Blowing systolic murmur. Urine contained albumen + + + but no blood. Died 4 weeks after admission.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume (ccs.)	Specific Gravity.	Solids. (Grammes)
8 a.m. - 10	180	15	6.29
10 - 12	133	15	4.64
12 - 2	152	17	6.02
2 - 4	160	18	6.71
4 - 6	158	18	6.61
6 - 8 p.m.	155	18	6.49
Day Total.	918		36.76
8 p.m.-8 a.m.	210	20	9.79
Total 24 hrs.	1128		46.55

Urea Concentration Test.

Before giving urea:- 0.83 per cent.

1st hour:- 0.87 per cent.

2nd hour:- 0.97 per cent.

Blood-urea:- 184 mgs. per cent. Non-protein nitrogen:-  
138 mgs. per cent.

Notes.

Fixation of specific gravity at fairly high level; low urea concentration; high blood urea.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

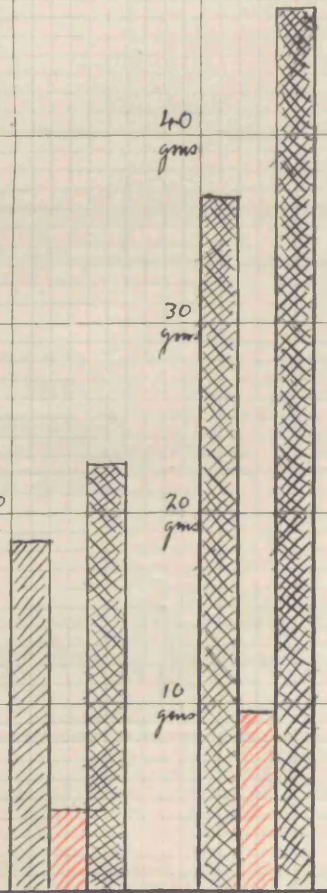
30 gms

20 gms

10 gms

Volume.

Solids.





CASE 15.

FEMALE. AGE 52.

History:- Weakness, dyspnoea and loss of weight for 2 years previous to admission. Dimness of vision for 5 months.

Condition on admission:- No oedema. Heart enlarged to right and left. Blood-pressure, 210/140. Fundi showed gross degenerative changes. Visual acuity much impaired. Urine contained trace of blood and albumen ++ with blood casts. Dismissed "much improved" but has since died.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	63	10	1.47
10 - 12	83	10	1.93
12 - 2	114	10	3.35
2 - 4	85	10	1.98
4 - 6	104	11	2.66
6 - 8p.m.	157	11	4.02
Day Total	606		15.41
8p.m. - 8a.m.	733	11	18.78
Total 24 hrs.	1339		34.19

Urea Concentration Test.

Before giving urea:- 0.71 per cent  
 1st hour:- 0.87 per cent  
 2nd hour:- 0.61 per cent

Non-protein nitrogen:- 83 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal polyuria; low specific gravity of night urine; low urea concentration; high non-protein nitrogen.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10

12

2

4

6

8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

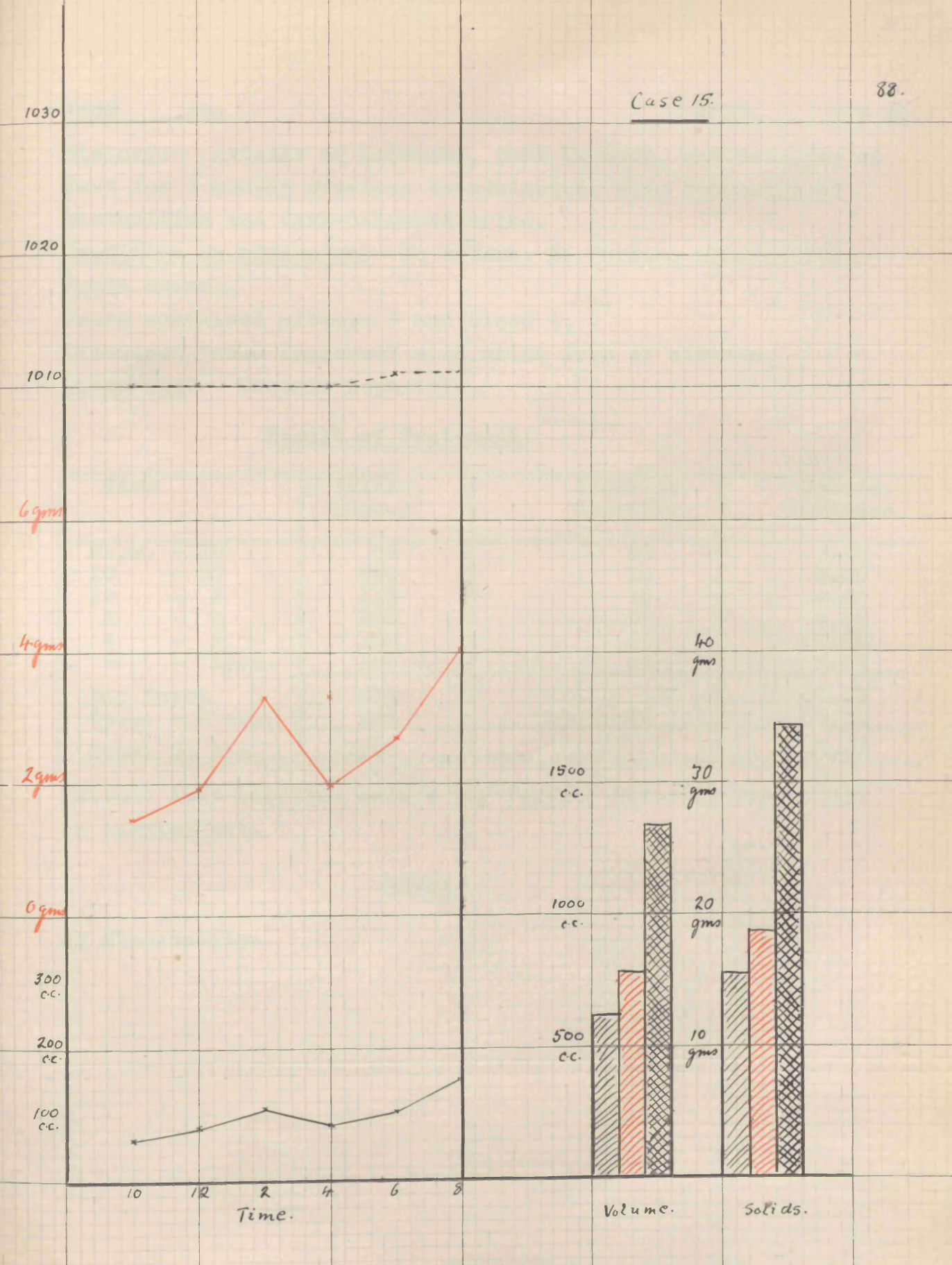
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 16.

MALE. AGE 20.

History:- Attacks of headache, pain in back, and swelling of feet for 8 months previous to admission. Also frequency of micturition and dark-coloured urine.

Condition on admission:- No oedema. No cardiac abnormality.

Fundi normal.

Urine contained albumen + and blood +.

Dismissed "much improved" with urine free of albumen.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	58	23	3.10
10 - 12	200	10	4.66
12 - 2	118	16	4.40
2 - 4	298	07	4.86
4 - 6	100	20	4.66
6 - 8p.m.	165	09	3.45
Day Total	939		25.13
8p.m. - 8 a.m.	229	25	13.34
Total 24 hrs.	1168		38.47

Patient left hospital before any further investigation could be carried out.

Notes.

No abnormality.

1030

1020

1010

6gms

4gms

2gms

0gms

300

200

100

cc.

10 12 2 4 6 8

Time.

1500  
c.c.

1000  
c.c.

500  
c.c.

40  
gms

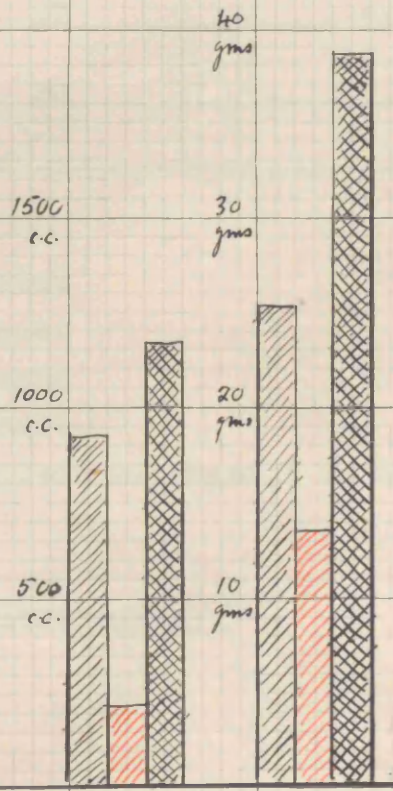
30  
gms

20  
gms

10  
gms

Volume.

Solids.



CASE 17MALE. AGE 29.

History:- Swelling of face, feet and legs of one week's duration, preceded by sore throat, headache, and general pains.

Condition on admission:- No oedema or ascites. No cardiac abnormality. Slight blurring of ocular discs. Urine contained few pus cells, but no albumen, blood or casts. Blood-pressure 140/80. Urine remained albumen-free, during his stay in hospital. Dismissed "much improved". Diagnosis:- Acute focal nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	50	21	2.45
10 - 12	79	19	3.49
12 - 2	116	14	3.78
2 - 4	-	-	-
4 - 6	56	21	2.73
6 - 8p.m.	90	22	4.61
Day Total	391		17.06
8p.m. - 8a.m.	445	20	20.73
Total 24 hrs.	836		37.79

Urea Concentration Test.

Before giving urea:- 1.00 per cent

1st hour:- 1.60 per cent

2nd hour:- 1.90 per cent

3rd hour:- 2.00 per cent

Blood-urea:- 25 mgs. per cent. Non-protein nitrogen:- 25 mgs. per cent.

Notes.

Delayed excretion of urine; no other abnormality.

Case 17.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

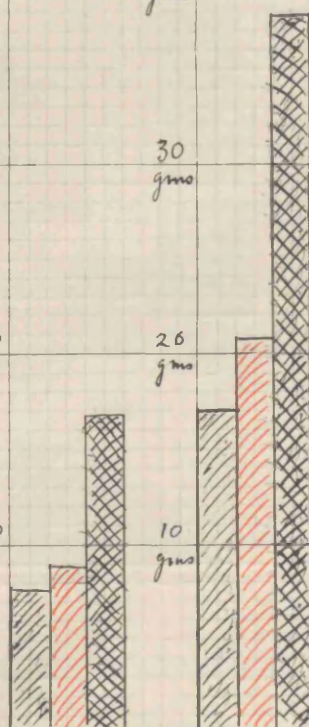
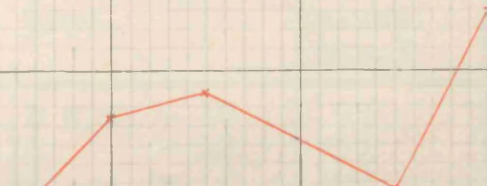
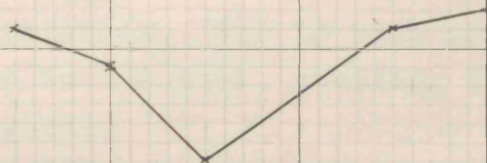
30 gms

26 gms

10 gms

Volume.

Solids.



CASE 18.MALE. AGE, 27.

**History:-** Patient was in hospital on previous occasion for 2 months and was dismissed 3 months ago with slight albuminuria. For 10 days previous to second admission he had pain in the back, swelling of legs body and face, and oliguria.

**Condition on admission:-** Semi-comatose. Marked Oedema. No cardiac abnormality. Blood-pressure, 162/98. Fundi normal. Urine contained albumen + + + and blood +. Only one tube-cast was seen.

Dismissed "improved", with no oedema and slight albuminuria.

**Diagnosis:-** Chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes.)
8 a.m. - 10	98	23	5.24
10 - 12	156	18	6.54
12 - 2	160	18	6.70
2 - 4	147	20	6.85
4 - 6	198	15	6.91
6 - 8p.m.	151	16	5.63
Day Total	910		37.87
8 p.m. - 8 a.m.	680	17	26.93
Total 24 hrs.	1590		64.80

Urea Concentration Test.

Before giving urea:- 0.97 per cent.

1st hour:- 1.15 per cent.

2nd hour:- 1.13 per cent.

Blood-urea:- 37 mgs. per cent. Non-protein nitrogen:- 40mgs per (cent.

Notes.

Nocturnal and total polyuria; low urea concentration.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

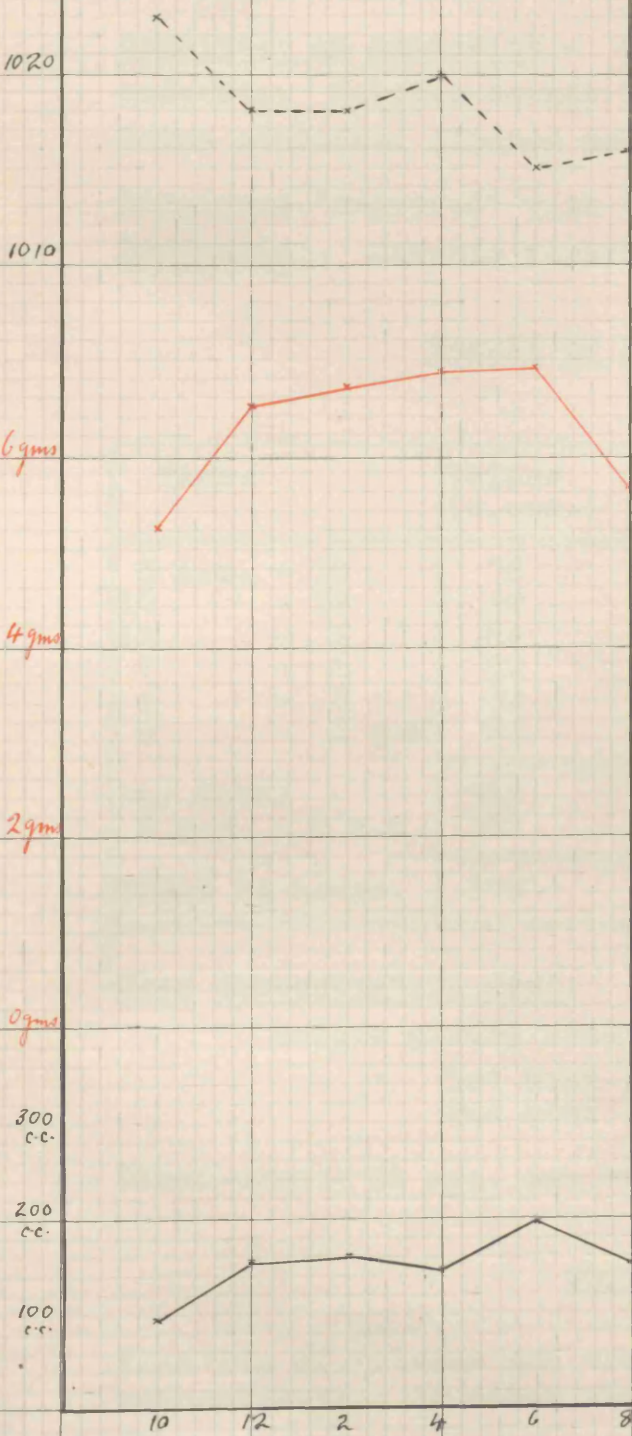
300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

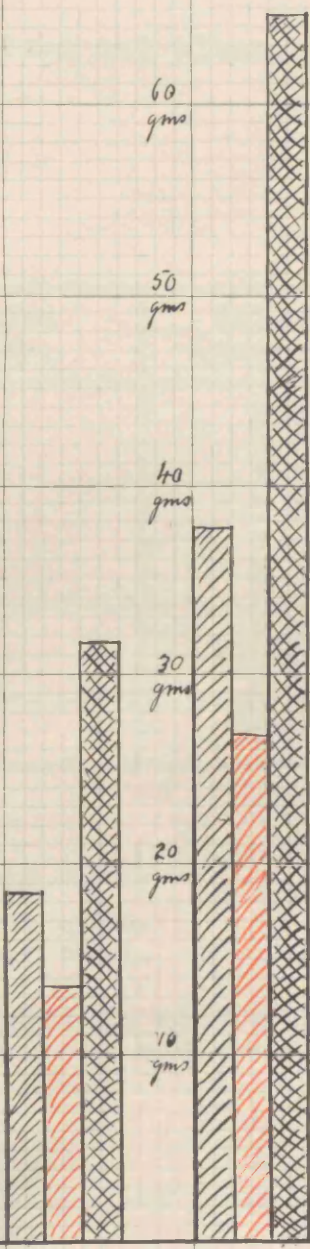


1500 c.c.

1000 c.c.

500 c.c.

Volume.



Solids.



CASE 19.FEMALE. AGE, 20.

History:- Intermittent swelling of face, hands and feet, of 13 months' duration. She was in hospital 8 months ago with same complaint.

Condition on admission:- Oedema of face. Blood-pressure moderate. Cardiac sounds loud and booming in character. Urine contained albumen and blood.

Dismissed "improved" with trace of blood and albumen in urine.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (c.cms.)	Specific gravity.	Solids. (grammes.)
8 a.m. - 10	76	16	2.83
10 - 12	90	15	3.14
12 - 2	84	14	2.74
2 - 6	90	16	3.36
4 - 6	92	14	3.00
6 - 8 p.m.	84	17	3.32
Day Total	516		18.39
8 p.m. - 8 a.m.	382	17	15.13
Total 24 hours.	898		33.52

Urea Concentration Test.

Before giving urea:- 1.26 per cent.

1st hour :- 1.37 per cent.

2nd hour :- 1.56 per cent.

Blood-urea:- 21 mgs. per cent. Non-protein nitrogen :-  
27 mgs. per cent.

NOTES.

Fixation of volumes and specific gravity; low urea concentration; no other abnormalities.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

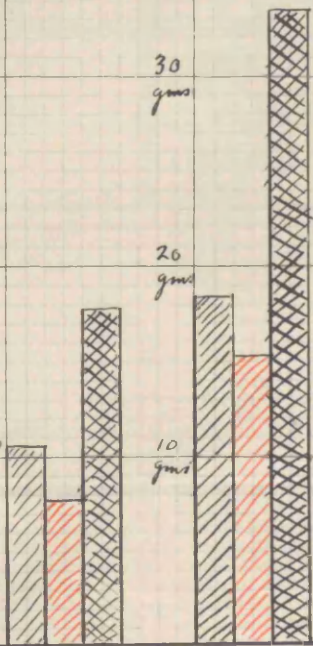
40 gms

30 gms

26 gms

10 gms

Solids.



Case 20.Female. Age 52.

History:- For 10 weeks previous to admission, she suffered from vertigo, headache and lassitude. She lost 2 stones in weight.

Condition on admission:- No oedema. Left heart hypertrophied and 2nd aortic sound accentuated. Blood-pressure 260/158  
Urine contained no albumen or blood.

Dismissed "slightly improved" with blood-pressure unreduced. (but died at home a month afterwards).

Diagnosis:- Hyperpiesis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids. (Grammes)
8 a.m. - 10	58	20	2.70
10 - 12	103	18	4.32
12 - 2	92	19	4.07
2 - 4	140	18	5.87
4 - 6	133	16	4.96
6 - 8 p.m.	218	16	8.12
Day Total	744		30.04
8.p.m.-8 a.m.	186	23	9.96
Total 24 hrs.	930		40.00

Urea Concentration Test.

Before giving urea:- 2.21 per cent.

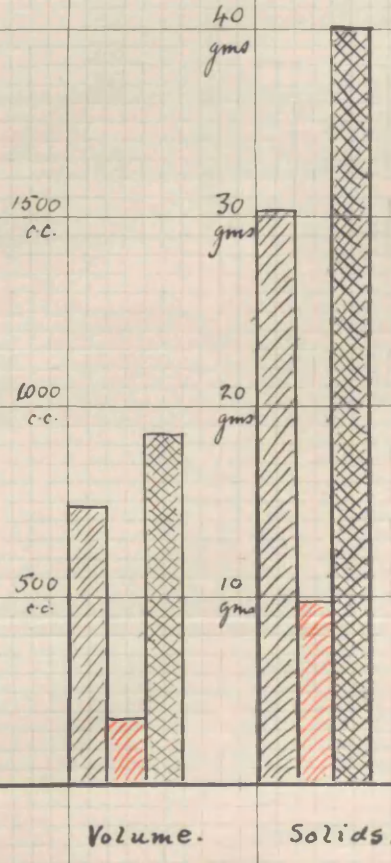
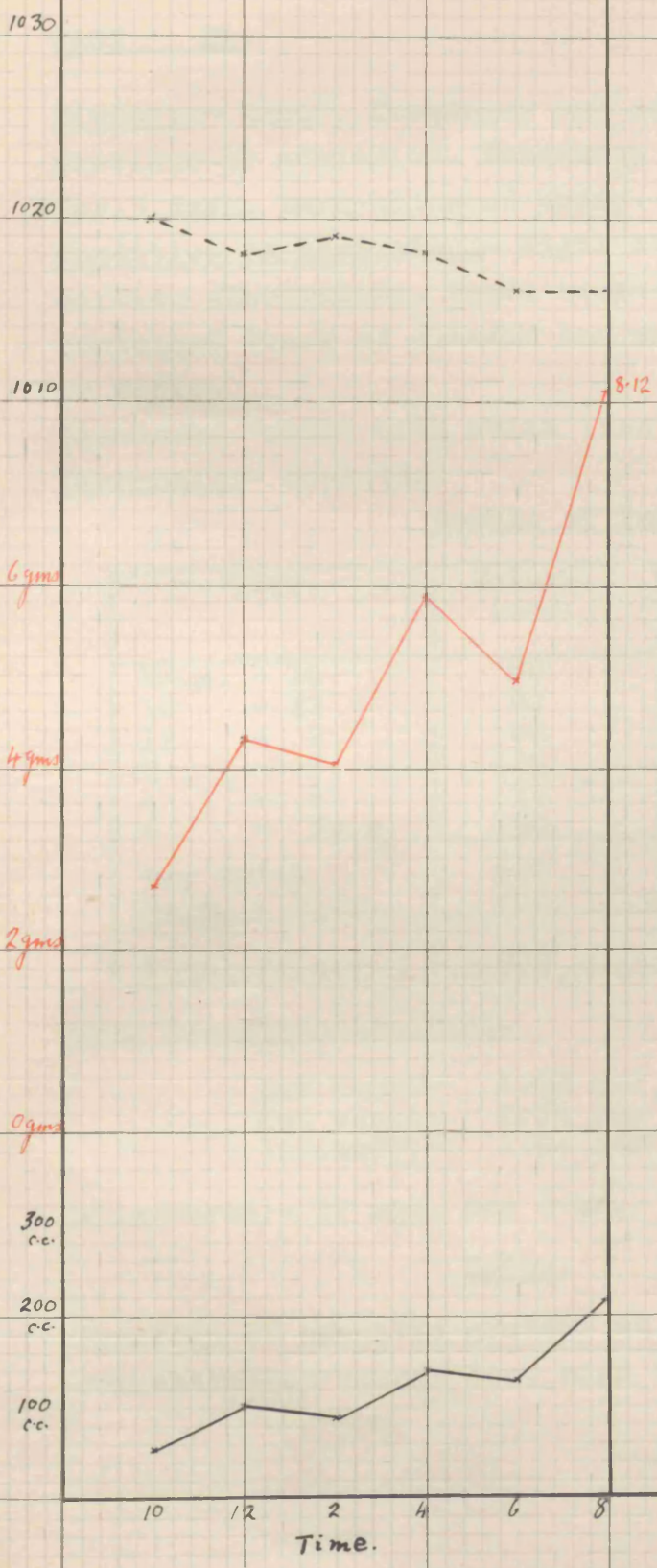
1st hour:- 2.72 per cent.

2nd hour:- 2.71 per cent.

Blood urea:- 24 mgs. per cent. Non-protein nitrogen:-  
31 mgs. per cent.

Notes.

No abnormalities whatsoever.



CASE 21.MALE. AGE 15.

History:- Rigor, frequency and pain on micturition 11 days previous to admission. Frequency and pain continued. Headache for 3 days. Dark-coloured urine. No oedema.

Condition on admission:- Right kidney enlarged and tender. No cardiac abnormality. Fundi normal. Blood-pressure 130/60. Urine contained trace of albumen and many pus cells, but no blood or casts.

Dismissed "well" with urine free from pus and albumen.

Diagnosis:- Pyelitis.

Result of Test-meal.

Time.	Volume, (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	88	21	4.30
10 - 12	82	20	3.82
12 - 2	68	23	3.63
2 - 4	125	22	6.41
4 - 6	74	22	3.79
6 - 8p.m.	90	20	4.19
Day Total	527		26.14
8p.m. - 8a.m.	402	21	19.67
Total 24 hrs.	929		45.81

Urea Concentration Test.

1st hour:- 1.03 per cent  
 2nd hour:- 1.74 per cent  
 3rd.hour:- 1.94 per cent

Blood-urea:- 37 mgs. per cent.

Notes.

Fixation of specific gravity at a high level; urea concentration rather low; high blood urea.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

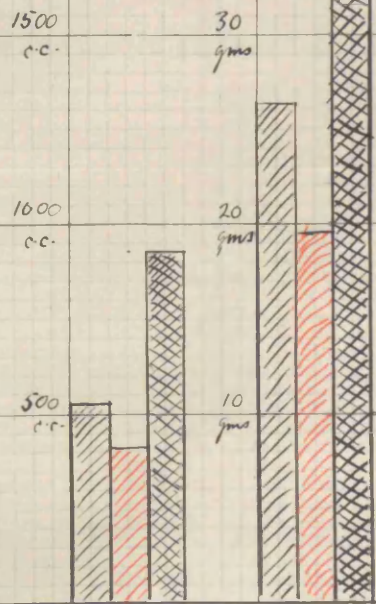
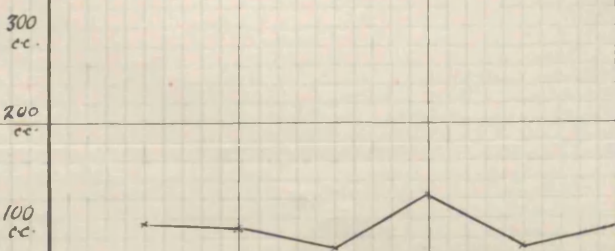
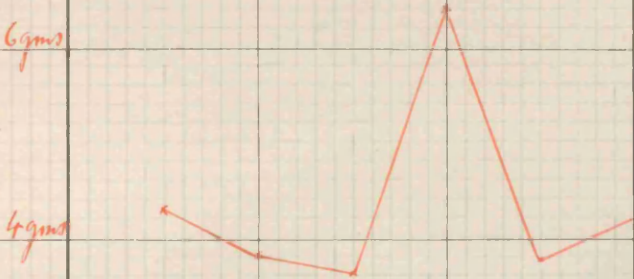
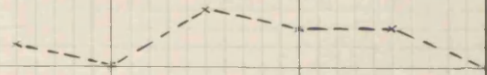
40 gms

30 gms

20 gms

10 gms

Solids.



CASE 22.MALE, AGE. 53.

History:- Swelling of abdomen, face and feet of 6 weeks' duration, following influenzal attack. Also headache, dyspnoea and frequency of micturition.

Condition on admission:- Oedema of face, Heart enlarged to left. V.S. murmur at apex and base. Fundi normal. Blood-pressure, 145/80. Urine contained albumen +, trace of blood and pus, with granular and blood casts.

Dismissed "much improved" with albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids. (grammes)
8 a.m. -10	86	16	3.20
10 -12	135	14	4.39
12 - 2	100	16	3.73
2 - 4	140	15	4.89
4 - 6	118	16	4.40
6 - 8 p.m.	122	16	4.53
Day Total	701		25.16
8 p.m. - 8 a.m.	680	15	23.76
Total 24 hrs.	1381		48.92

Urea Concentration Test.

Before giving urea:- 0.96 per cent.

1st hour:- 1.22 per cent.

2nd hour:- 1.15 per cent.

3rd hour:- 1.20 per cent.

Blood-urea:- 51mgs. per cent. Non-protein nitrogen:- 53mgs. per (cent.)

Notes.

Fixation of specific gravity; nocturnal polyuria and low specific gravity of night urine; low urea concentration; high blood urea.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

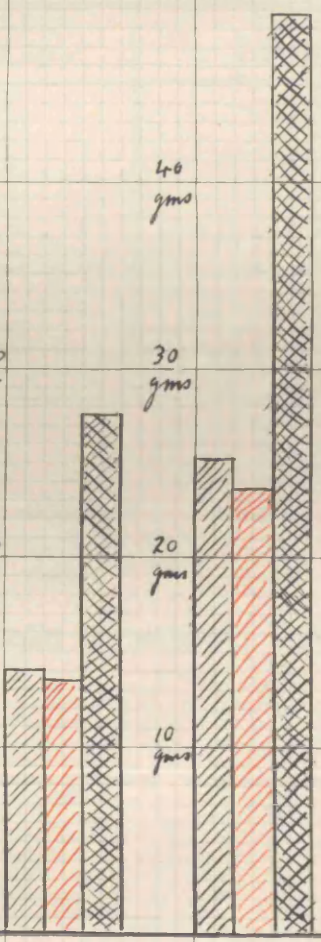
10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.



Volume.

Solids.



CASE 23.FEMALE. AGE 52.

History:- Headache and swelling of feet for 3 months before admission. Convulsions and coma on day of admission.

Condition on admission:- Comatose, Oedema of ankles. 2nd aortic sound accentuated. Blood-pressure, 230/155. Neuroretinitis of left fundus. Urine contained trace of albumen, no blood, and a few granular casts.

Dismissed "improved" with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	22	12	0.61
10 - 12	39	12	1.08
12 - 2	28	16	1.04
2 - 4	52	14	1.69
4 - 6	60	15	2.09
6 - 8p.m.	59	15	2.05
Day Total	260		8.56
8p.m. - 8a.m.	95	21	4.64
Total 24 hrs.	355		13.20

Urea Concentration Test.

Before giving urea:- 1.9 per cent  
 1st hour:- 2.39 per cent  
 2nd hour:- 2.85 per cent

Blood-urea:- 41 mgs. per cent. Non-protein nitrogen:- 36 mgs. per cent.

Notes.

Low output of urine; no other abnormalities.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

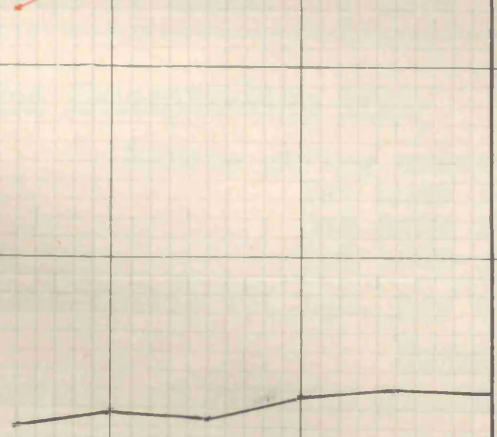
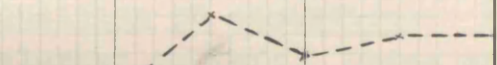
20 gms

10 gms



Volume.

Solids.



CASE 24.MALE. AGE, 58.

History:- Patient was treated in another hospital 2 years ago, on account of blood in urine and generalised oedema. Since then he had remained oedematous and subject to headaches. Admitted on account of severe epistaxis.

Condition on admission:- Exsanguinated. No oedema. Heart enlarged to left. Urine contained abundant blood and albumen, with granular, hyaline and fatty casts.

Dismissed "improved" with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (c.cms.)	Specific Gravity.	Solids. (grammes)
8 a.m. - 10	286	11	7.32
10 - 12	70	10	1.63
12 - 2	164	10	3.82
2 - 4	130	10	3.03
4 - 6	133	10	3.10
6 - 8 p.m.	194	10	4.52
Day Total	977		23.42
8 p.m. - 8 a.m.	602	11	15.33
Total 24 hours.	1579		38.75

Urea Concentration Test.

Before giving urea:- 1.25 per cent.  
 1st hour :- 1.5 per cent.  
 2nd hour :- 1.36 per cent.  
 3rd hour :- 1.40 per cent.

Blood-urea:- 171 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; low urea concentration; high blood urea.

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10

12

2

4

6

8

Time.

1500 c.c.

1000 c.c.

500 c.c.

40 gms

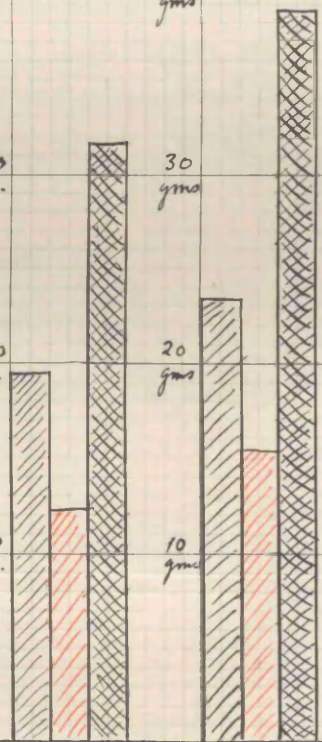
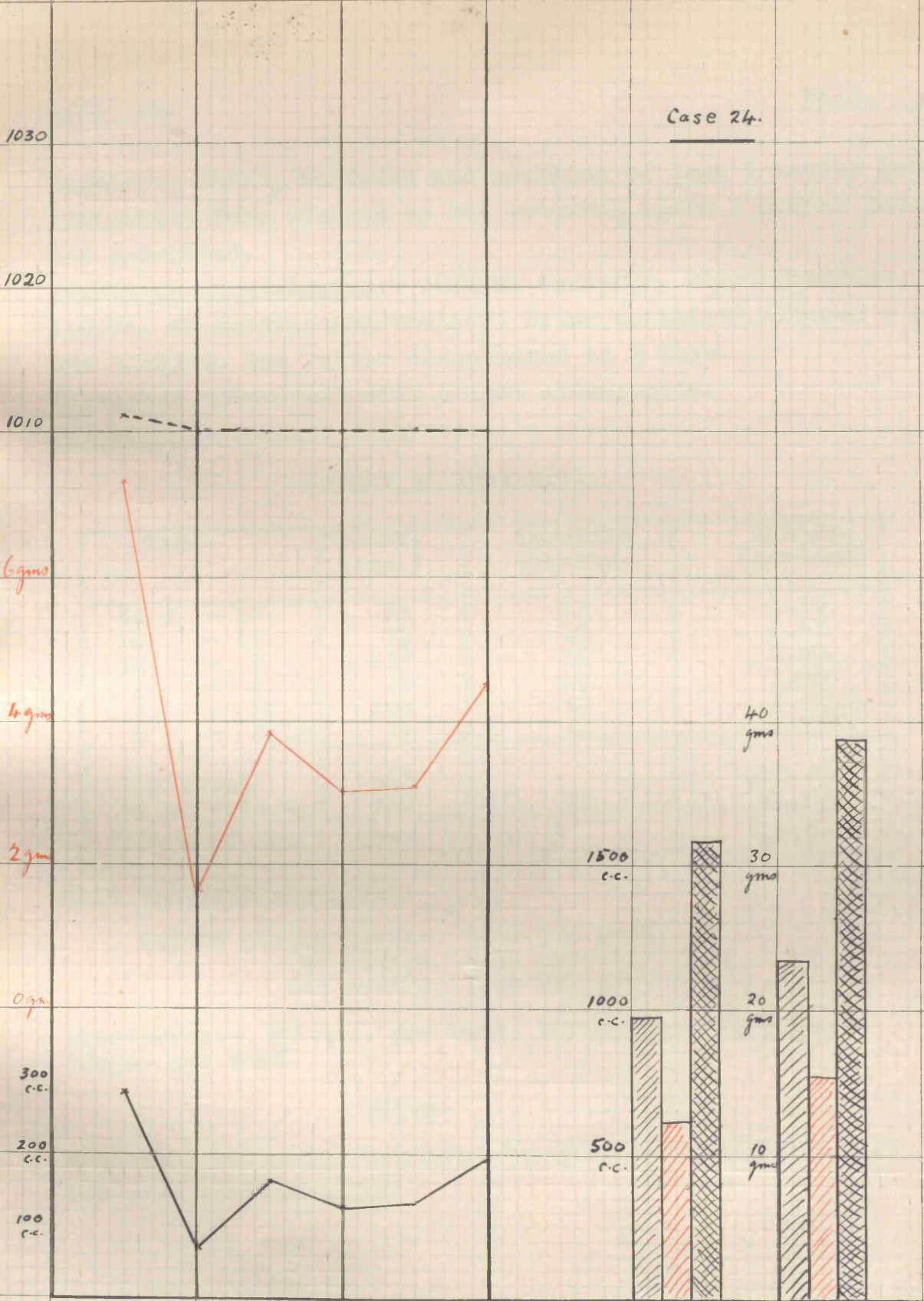
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 25.MALE. AGE 59.

History:- Chill, headache and swelling of legs 7 months before admission. This cleared up but recurred again 3 months later and persisted.

Condition on admission:- General anasarca. Blood-pressure, 140/85. No cardiac abnormality. Urine contained albumen + + + and blood +. The latter disappeared in 2 days.

Dismissed "improved" with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	51	13	1.54
10 - 12	75	15	2.61
12 - 2	238	12	6.65
2 - 4	45	19	1.99
4 - 6	100	19	4.43
6 - 8p.m.	54	18	2.26
Day Total	563		19.48
8p.m. - 8a.m.	712	13	21.56
Total 24 hrs.	1275		41.04

Urea Concentration Test.

Before giving urea:- 0.96 per cent  
 1st hour:- 1.57 per cent  
 2nd hour:- 1.66 per cent

Blood-urea:- 29 mgs. per cent. Non-protein nitrogen:- 29mgs. per cent.

Notes.

Nocturnal polyuria; low specific gravity of night urine; low urea concentration.

1030

1020

1010

6gms

4gms

2gms

0gm

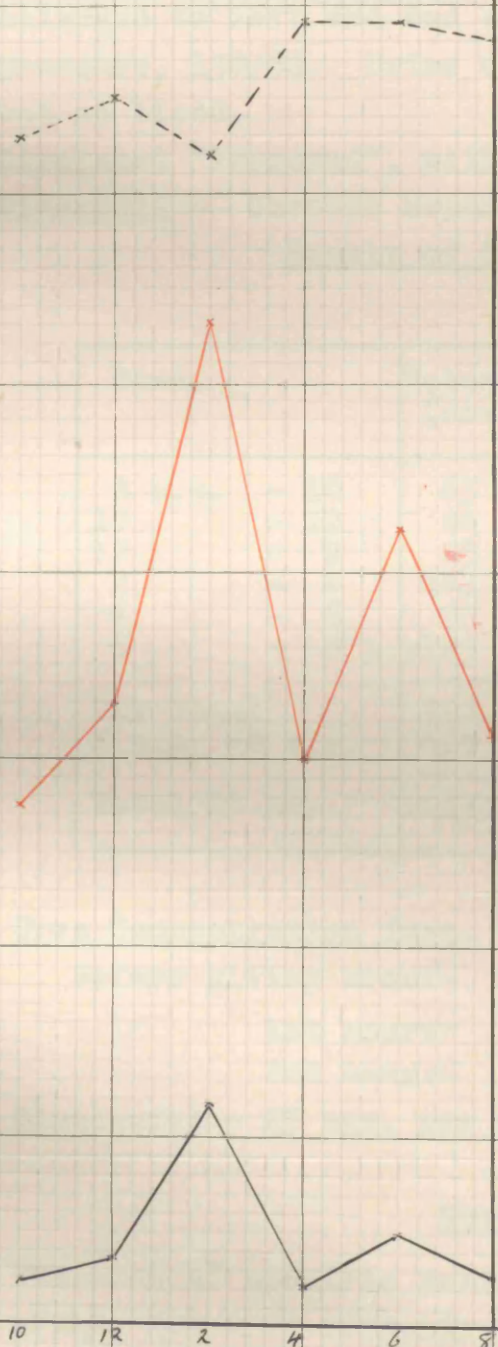
300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

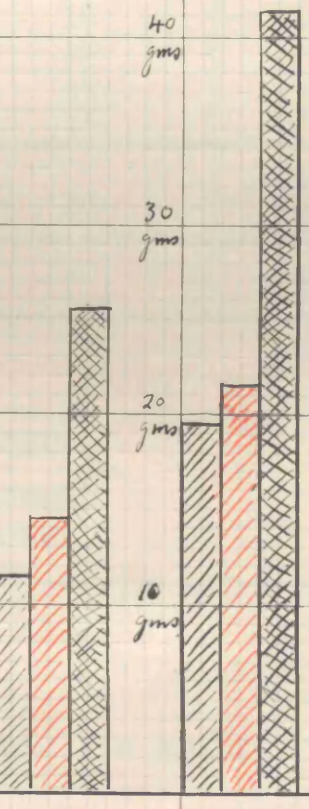
Time.



1500 c.c.

1000 c.c.

500 c.c.



Volume.

Solids.

CASE 26.FEMALE, AGE, 50.

History:- Dyspnoea and swelling of feet and face for 2 years, following operation for peritonitis. Condition gradually became worse.

Condition on admission:- Oedema of legs and face. Heart enlarged to left and 2nd aortic sound accentuated. Blood-pressure, 130/80. Urine contained faint trace of albumen, but no blood.

Dismissed "improved", with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume (ccs.)	Specific Gravity.	Solids (grammes)
8 a.m. - 10	63	11	1.61
10 - 12	84	10	1.96
12 - 2	85	10	1.98
2 - 4	141	10	3.29
4 - 6	92	10	2.14
6 - 8 p.m.	123	09	2.58
Day Total	588		13.56
8 p.m. - 8 a.m.	425	10	9.90
Total 24 hrs.	1013		23.46.

Urea Concentration Test.

Before giving urea:- 0.93 per cent.

1st hour:- 1.39 per cent.

2nd hour:- 1.50 per cent.

Blood-urea:- 27 mgs. per cent. Non-protein nitrogen:- 29mgs. (per cent.)

Notes.

Fixation of specific gravity; low specific gravity of night urine; low urea concentration.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

Volume.

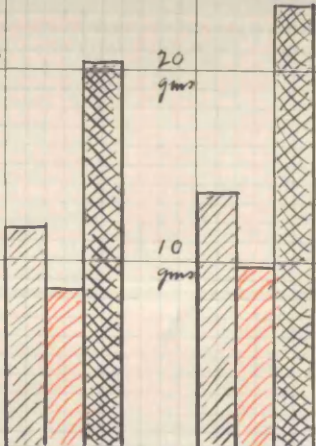
40 gms

30 gms

20 gms

10 gms

Solids.





CASE 27.MALE. AGE, 27.

History:- Swelling of feet, ankles and face of only 10 days duration before admission.

Condition on admission:- Oedema of face and ankles. Heart slightly enlarged to left. Blood-pressure, 160/80. Urine contained albumen + + + and blood + +. Dismissed "much improved", with slight albuminuria.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (cc.)	Specific Gravity.	Solids. (grammes)
8 a.m. - 10	145	11	3.71
10 - 12	146	11	3.69
12 - 2	130	12	3.63
2 - 4	138	12	3.85
4 - 6	128	12	3.57
6 - 8 p.m.	160	08	3.00
Day Total	848		21.45
8 p.m. - 8 a.m.	620	08	11.56
Total 24 hrs.	1468		33.01

Urea Concentration Test.

Before giving urea:- 0.91 per cent.

1st hour:- 1.63 per cent.

2nd hour:- 1.85 per cent.

Blood-urea:- 34 mgs. per cent. Non-protein nitrogen:- 39 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; urea concentration rather low.

1030

1020

1010

6gms

4gms

2gms

0gm

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

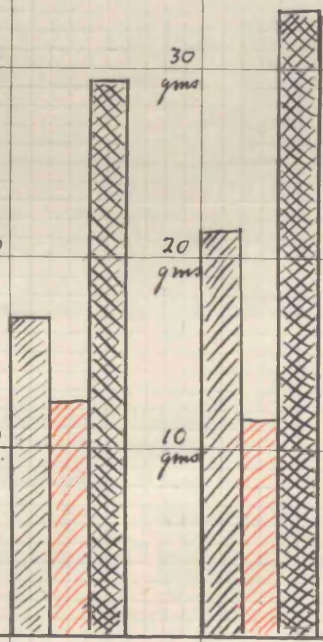
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 28.

MALE. AGE, 18.

History:- Haematuria and headache for a week before admission. Was treated in hospital for similar condition for three months, and was discharged 6 months before second admission. His first period of treatment was characterised by intermittent haematuria.

Condition on admission:- No oedema. No cardiac abnormality. Fundi normal. Blood-pressure moderate. Urine contained albumen + and blood + + , with blood casts, red blood corpuscles and endothelial cells. No evidence of bladder disease on cystoscopy.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time	Volume (c.cms.)	Specific gravity.	Solids. (grammes).
8 a.m. - 10	52	12	1.45
10 - 12	74	12	2.06
12 - 2	82	12	2.29
2 - 4	90	13	2.73
4 - 6	110	09	2.30
6 - 8 p.m.	112	11	2.87
Day total	520		13.70
8 p.m. - 8 a.m.	452	08	8.42
Total 24 hrs.	972		22.12

Urea Concentration Test.

Before giving urea:- 1.49 per cent.  
 1st hour:- 2.22 per cent.  
 2nd hour:- 2.61 per cent.  
 3rd hour:- 2.49 per cent.

Blood-urea:- 22 mgs. per cent. Non-protein nitrogen:- 20 mgs. per cent.

Notes.

Fixation of specific gravity; low specific gravity of night urine; no other abnormalities.

1030

1020

1010

6gms

4gms

2gms

0gm

300  
c.c.

200  
c.c.

100  
c.c.

10 12 2 4 6 8

Time.

1500  
c.c.

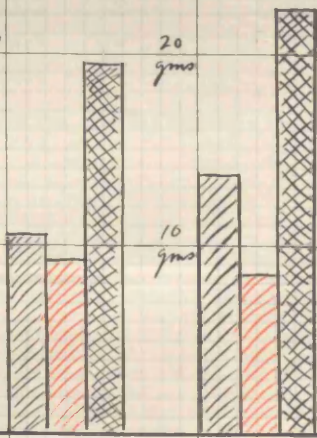
30  
gms

1000  
c.c.

20  
gms

500  
c.c.

10  
gms



Volume.

Solids.

CASE. 29.MALE AGE 21.

History:- Swelling of face, dyspnoea, dark-coloured urine, and occasional headache for one month before admission.

Condition on admission:- No oedema. Heart slightly enlarged to left. Blood-pressure, 130/84. Urine contained albumen + + and blood + + with blood casts, red blood corpuscles, and a few pus cells.

Dismissed "much improved" with slight albuminuria.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	210	12	5.86
10 - 12	109	12	3.04
12 - 2	109	12	3.04
2 - 4	163	09	3.41
4 - 6	111	11	2.84
6 - 8p.m.	136	08	2.53
Day Total	838		20.72
8p.m. - 8a.m.	731	12	20.44
Total 24 hrs.	1569		41.16

Urea Concentration Test.

Before giving urea:- 1.14 per cent  
 1st hour:- 1.31 per cent  
 2nd hour:- 1.66 per cent  
 3rd hour:- 1.55 per cent

Blood-urea:- 53 mgs. per cent. Non-protein nitrogen:-  
 37 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; low urea concentration and high blood urea.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

40 gms

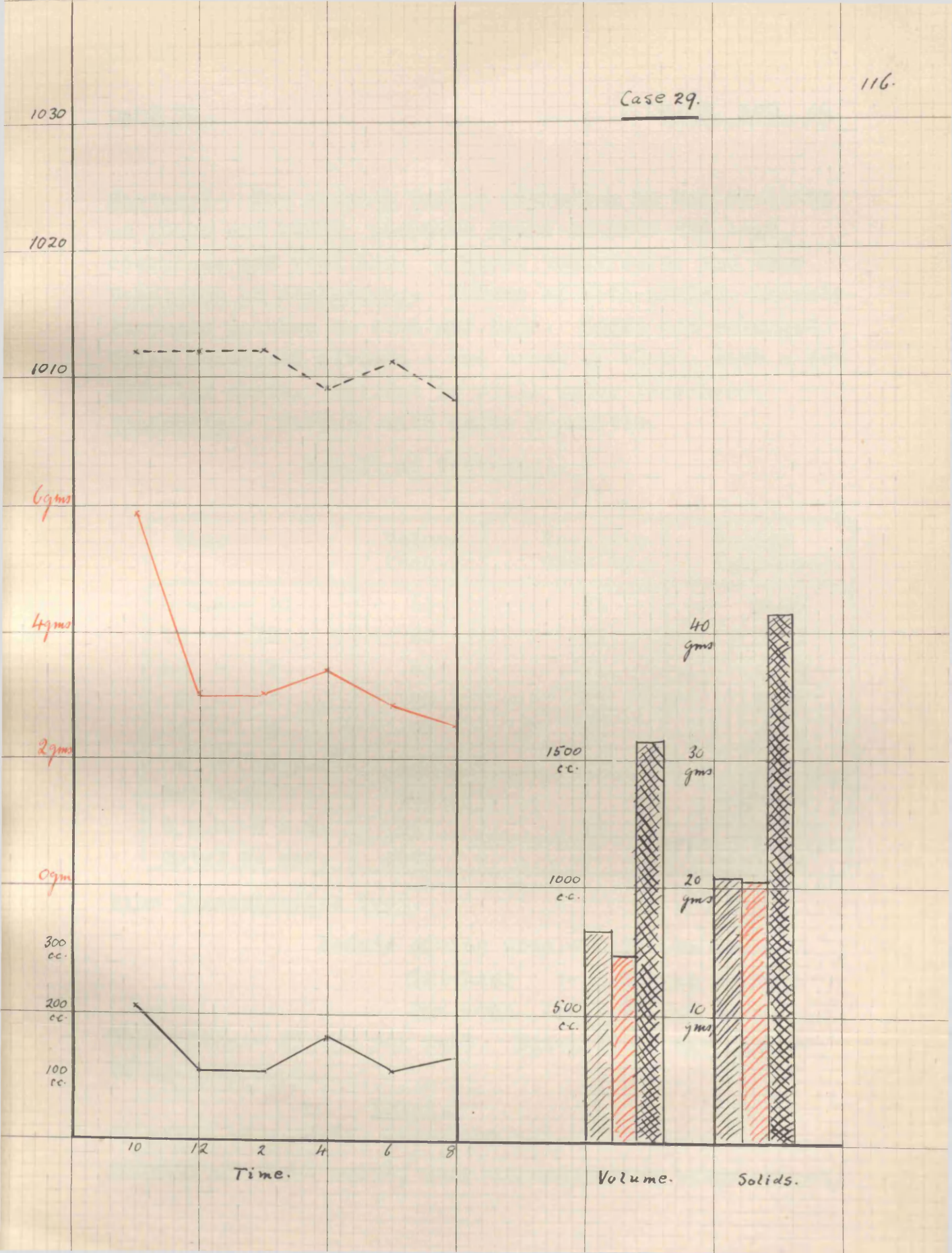
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 30.MALE. AGE, 46.

History:- For a month before admission he had swelling of hands and knees, purpuric spots on arms and legs, diarrhoea and vomiting. A blood transfusion was done

Condition on admission:- Oedema of both ankles, Anaemia. Purpuric patches on arms and legs. Heart not enlarged. Urine contained albumen + and trace of blood, with a few granular casts. Patient is still under treatment.

Diagnosis:- Purpura with acute nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m.- 10	63	21	3.08
10 - 12	80	21	3.91
12 - 2	84	21	4.10
2 - 4	98	23	5.24
4 - 6	77	23	4.12
6 - 8 p.m.	102	20	4.75
Day total	504		25.20
8 p.m.-8 a.m.	567	12	15.84
Total 24 hrs.	1071		41.04

Urea Concentration Test.

Before giving urea:- 0.71 per cent.

1st hour :- 1.61 per cent.

2nd hour :- 1.79 per cent.

Blood-urea:- 29 mg. per cent. Non-protein nitrogen:- 26 mg. per cent.

Notes.

Fixation of volumes; nocturnal polyuria; low specific gravity of night urine; urea concentration below normal.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8  
Time.

1500 cc.

1000 cc.

500 cc.

Volume.

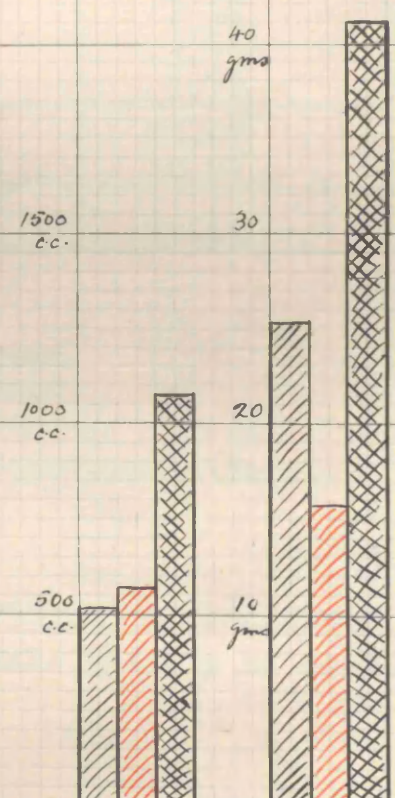
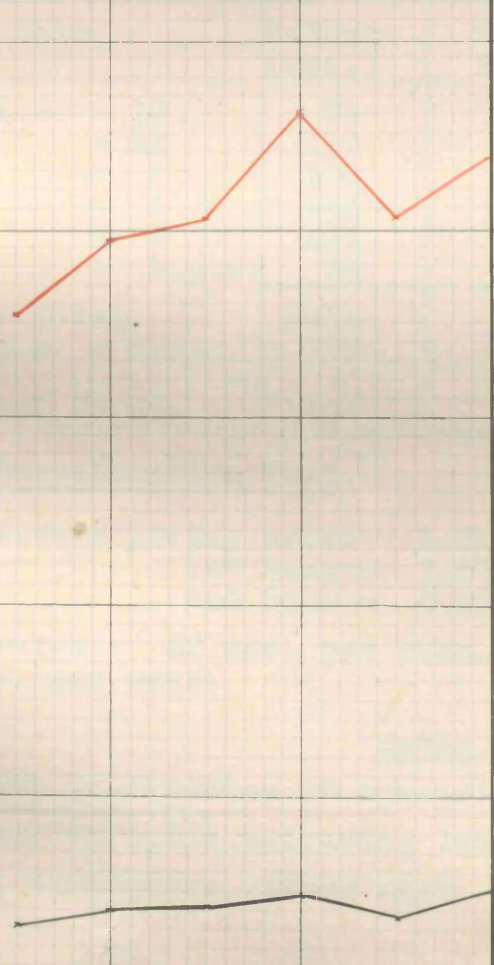
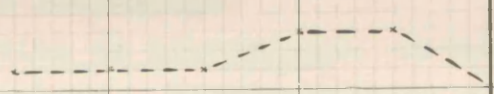
40 gms

30

20

10 gms

Solids.





CASE 31.

MALE AGE 13.

History:- Swelling of feet and legs with dyspnoea for 2 weeks before admission.

Condition on admission:- Oedema of ankles. No cardiac abnormality. Blood-pressure moderate. Urine contained albumen + with few red blood corpuscles and one granular cast.

Dismissed "well", with urine albumen-free.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs.)	Specific Gravity.	Solids. (grammes)
8.a.m. - 10	84	09	1.75
10 - 12	194	05	2.25
12 - 2	200	05	2.33
2 - 4	352	04	3.28
4 - 6	107	07	1.74
6 - 8.p.m.	74	10	1.72
Day Total	1011		13.07
8.p.m. - 8.a.m.	393	11	10.07
Total 24 hrs.	1404		23.14

Urea Concentration Test.

Before giving urea:- 1.80 per cent.

1st hour:- 1.97 per cent.

2nd hour:- 2.56 per cent.

Blood-urea:- 42 mgs. per cent. Non-protein nitrogen:- 26 mgs. per cent.

Notes.

Tendency to fixation of specific gravity at a low level; tendency to total polyuria; low specific gravity of night urine; blood-urea rather high.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

30 gms

1000 c.c.

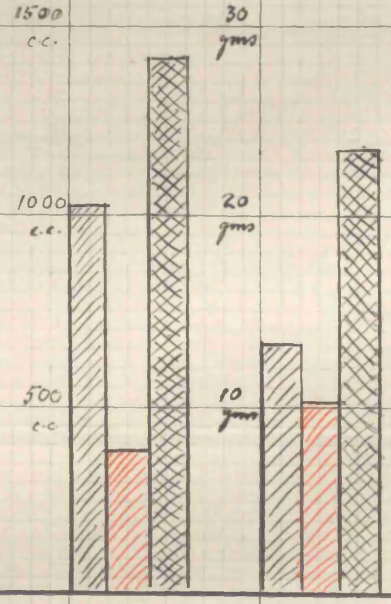
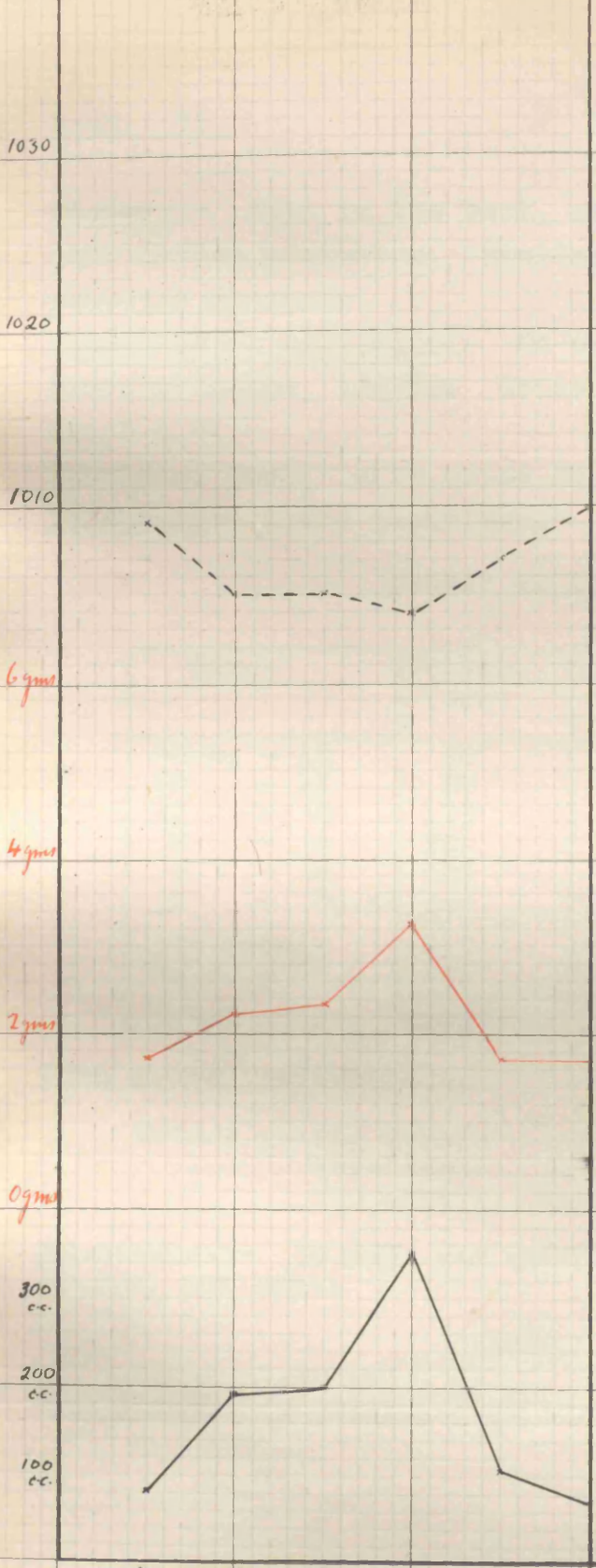
20 gms

500 c.c.

10 gms

Volume.

Solids.



CASE. 32

MALE. AGE 16.

History:- Pain in the back, and red-coloured urine for 4 days before admission. Similar attack 2 years before, with apparent recovery.

Condition on admission:- No oedema. No cardiac abnormality. Blood-pressure, 124/80. Urine contained albumen ++ and blood ++.

Dismissed "well" with urine free from albumen and blood.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	58	13	1.75
10 - 12	82	09	1.71
12 - 2	173	07	2.82
2 - 4	245	03	1.70
4 - 6	209	05	2.43
6 - 8p.m.	248	05	2.88
Day Total	1015		13.29
8p.m. - 8a.m.	226	18	9.47
Total 24 hrs.	1241		22.76

Urea Concentration Test.

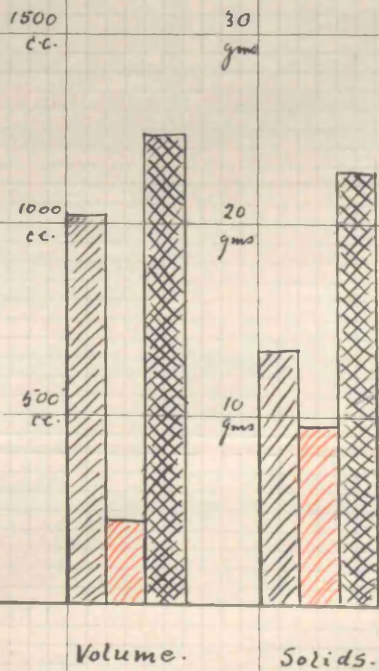
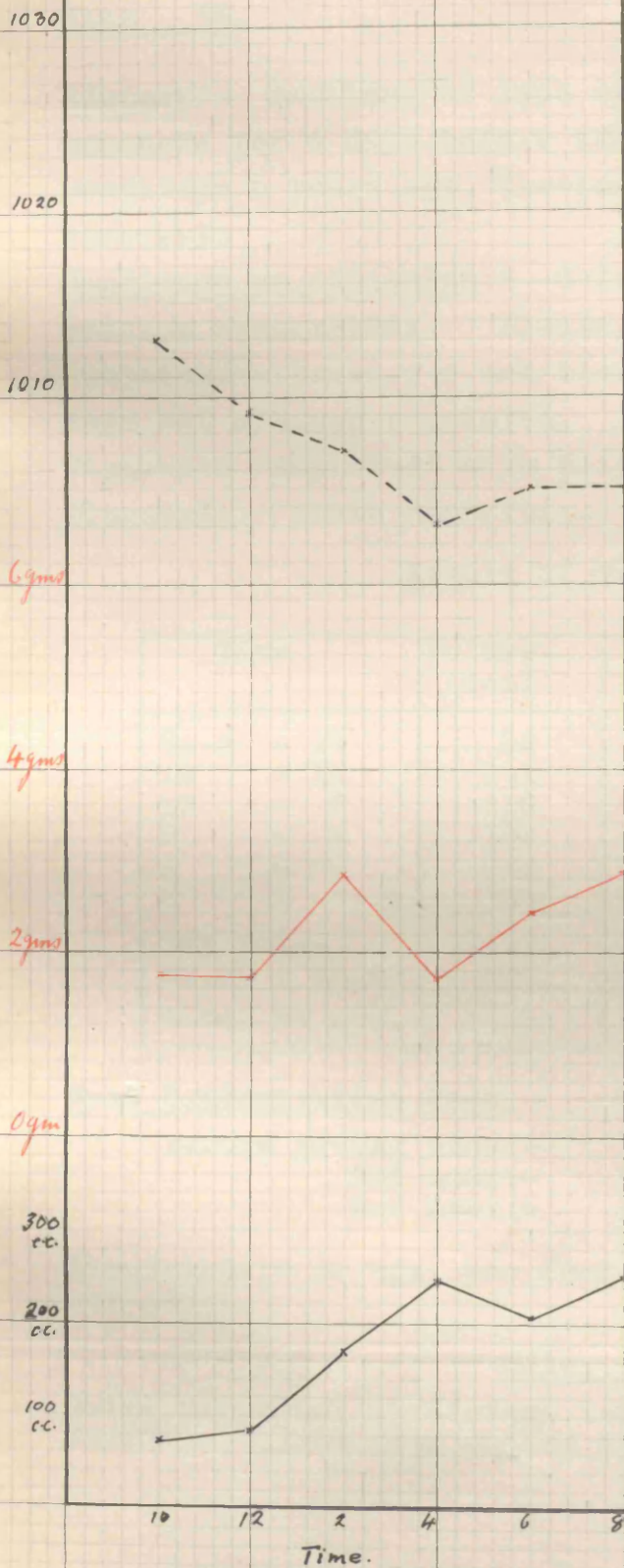
Before giving urea:- 1.94 per cent.  
 1st hour:- 2.25 per cent.  
 2nd hour:- 2.58 per cent

Blood-urea:- 37 mgs. per cent. Non-protein nitrogen:-  
 36 mgs. per cent.

Notes.

and blood-urea

Non-protein nitrogen, rather high; no other abnormality.



CASE 33.

MALE AGE 34.

History:- Swelling of legs and face, pain in the back and headache for 4 days before admission to hospital. Similar condition 6 years ago, lasting 2 months, with apparent recovery.

Condition on admission:- Oedema of face. Lumbar pain. No cardiac abnormality. Blood-pressure, 140/104. Urine contained albumen ++ and blood +. Blood disappeared in 2 days but albumen persisted.

Dismissed "improved" with slight albuminuria.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time	Volume. (ccs)	Specific Gravity.	Solids (grammes)
8a.m. - 10	82	09	1.71
10 - 12	161	05	1.87
12 - 2	110	08	2.05
2 - 4	188	05	2.18
4 - 6	242	04	2.25
6 - 8p.m.	326	03	2.27
<b>Day Total</b>	<b>1109</b>		<b>12.33</b>
8p.m. - 8a.m.	402	15	14.05
<b>Total 24 hrs.</b>	<b>1511</b>		<b>26.38</b>

Urea Concentration Test.

Before giving urea:- 1.38 per cent  
 1st hour:- 1.51 per cent  
 2nd hour:- 2.24 per cent

Blood-urea:- 46 mgs. per cent. Non-protein nitrogen:- 36 mgs. per cent.

Notes.

Total polyuria; persistent low specific gravity without fixation; blood urea rather high.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

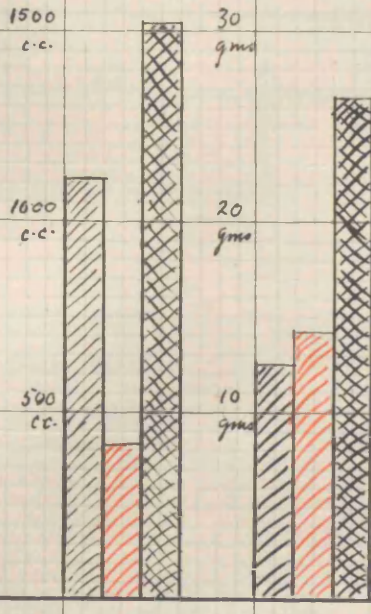
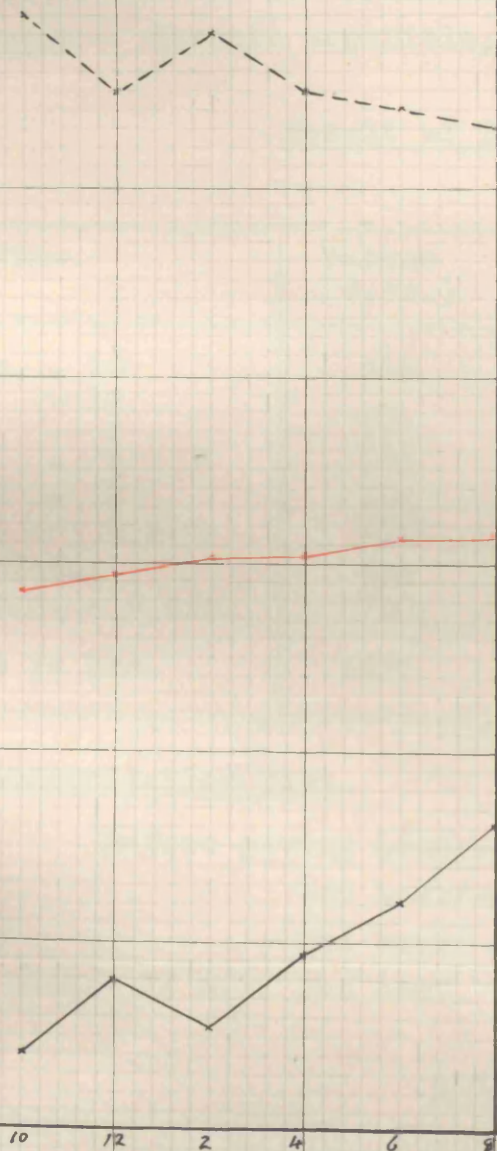
30 gms

20 gms

10 gms

Volume.

Solids.



CASE 34.MALE, AGE 33.

History:- Pneumonia one month before admission. Subsequent feeling of great weakness. Swelling of legs and face for 6 days.

Condition on admission:- Oedema generalised. No cardiac abnormality. Urine contained abundant blood and albumen. Bifid right renal pelvis and ureter seen in pyelogram. Marked oliguria. Oedema disappeared in 3 weeks. Blood persisted in considerable quantity in urine.

Dismissed after 4 months with trace of blood and albumen in urine.

Diagnosis:- Chronic nephritis.

Result of Test Meal.

Time.	Volume (c. cs.)	Specific Gravity.	Solids (grammes)
8 a.m. - 10	218	12	6.09
10 - 12	-	-	-
12 - 2	176	12	4.91
2 - 4	178	14	5.39
4 - 6	192	14	6.26
6 - 8 p.m.	156	12	4.35
Day Total	920		27.00
8 p.m. - 8 a.m.	700	12	19.57
Total 24 hrs.	1620		46.57

Urea Concentration Test.

Before giving urea:- 0.97 per cent.

1st hour:- 1.21 per cent.

2nd hour:- 1.28 per cent.

Blood urea:- 34 mgs. per cent. Non-protein nitrogen:- 31 mgs. per cent.

NOTES

Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; low urea concentration.

Case 34.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

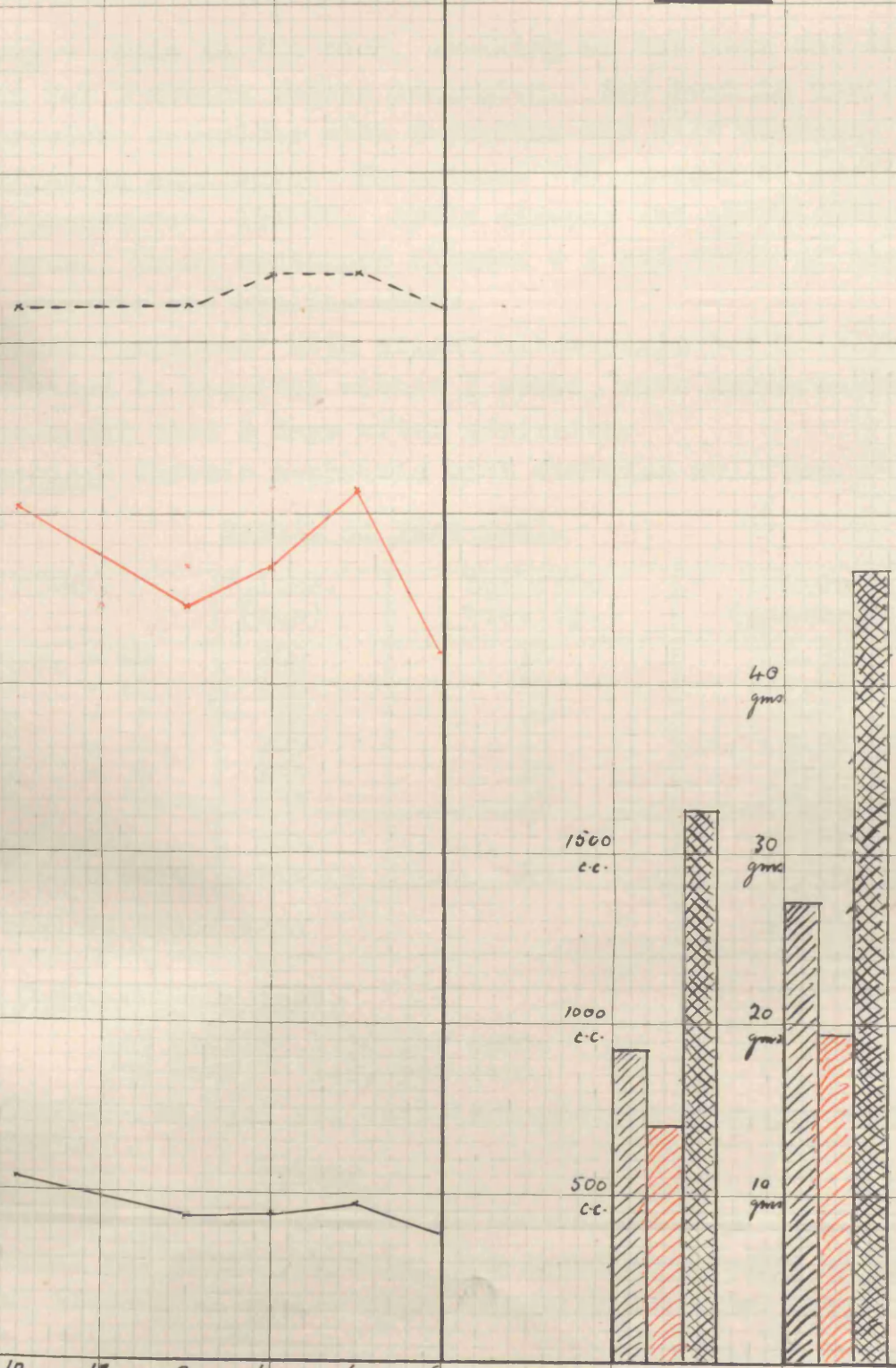
40 gms

30 gms

20 gms

10 gms

Solids.





CASE 35.MALE AGE 55.

History:- Pain in the back, swelling of the legs and dimness of vision for 3 months before admission. Had been in hospital on two previous occasions with nephritis and mild uraemia.

Condition on admission:- No oedema. V.S. murmur at aortic area.

Blood-pressure:- 154/78. Optic atrophy and choroiditis of both eyes. Urine contained albumen ++ and trace of sugar, with granular and hyaline casts.

Dismissed "improved" with slight albuminuria but no glycosuria. Re-admitted to hospital within 3 weeks, with anasarca and great dyspnoea and died 2 days after admission.

Diagnosis:- Chronic nephritis with diabetes mellitus.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	200	18	8.39
10 - 12	165	20	7.69
12 - 2	71	20	3.31
2 - 4	125	17	4.95
4 - 6	146	20	6.80
6 - 8p.m.	194	17	7.68
Day Total	901		38.82
8p.m. - 8a.m.	600	16	22.39
Total 24 hrs.	1501		61.21

Urea Concentration Test.

1st hour:- 1.50 per cent.

2nd hour:- 1.90 per cent.

Blood-urea:- 49 mgs. per cent. Non-protein nitrogen:- 39 mgs. per cent.

Notes.

Fixation of specific gravity at moderately high level; nocturnal and total polyuria; low specific gravity of night urine; blood-urea rather high; slightly low urea concentration.

1030

1020

1010

6gms

4gms

2gms

0gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

1000 c.c.

500 c.c.

Volume.

60 gms

50 gms

40 gms

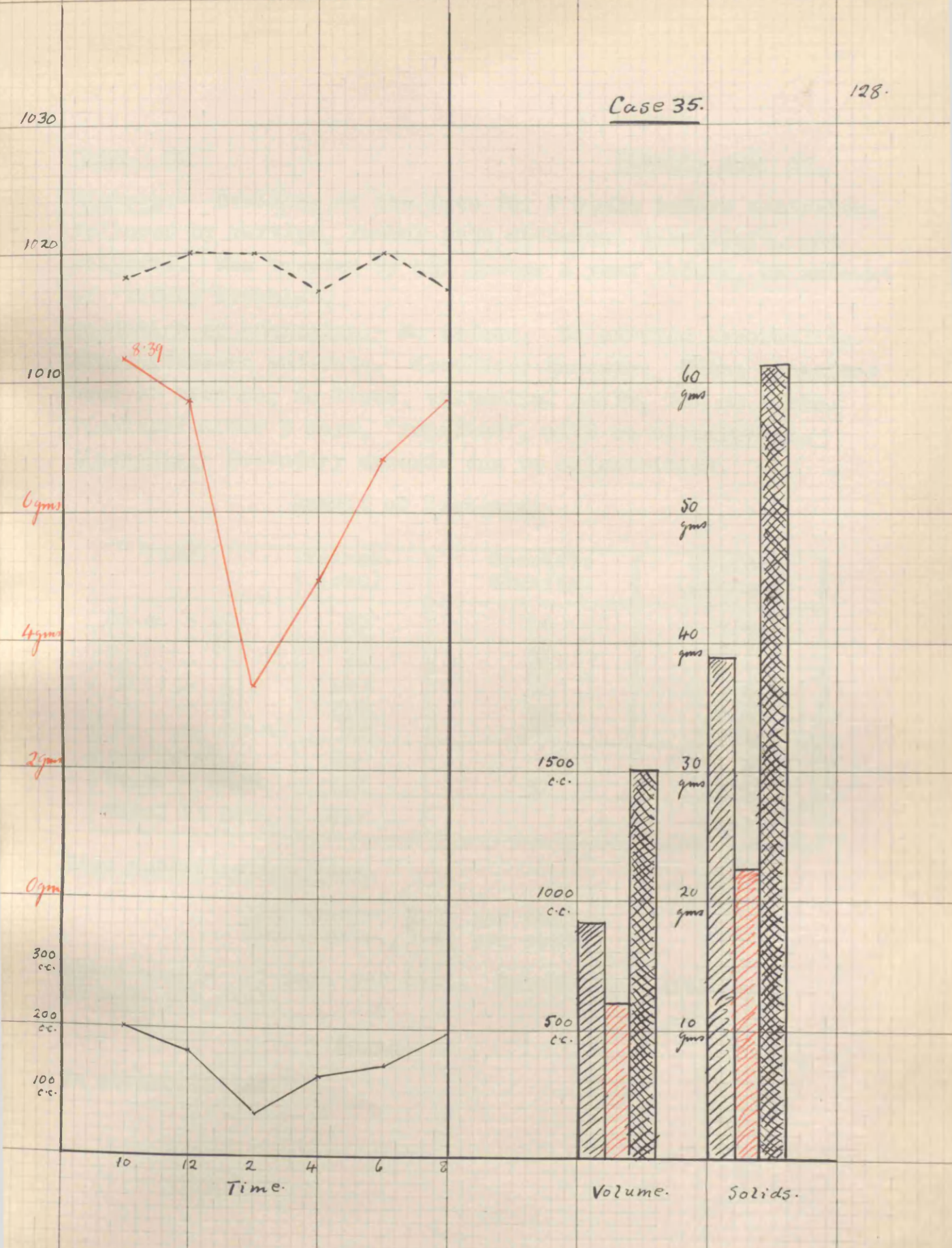
30 gms

20 gms

10 gms

Solids.

8.39



CASE. 36FEMALE. AGE 22.

History:- Swelling of the face for 2 weeks before admission, followed by vertigo, lumbar pain, abdominal discomfort, and oliguria. Was treated by her doctor a year before, on account of "kidney trouble".

Condition on admission:- No oedema. No cardiac abnormality. Blood-pressure moderate. Secondary anaemia. Urine contained haze of albumen, no blood, epithelial cells, but no casts. Dismissed after 5 days, "improved", with no albuminuria.

Diagnosis:- Secondary anaemia due to malnutrition.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	60	26	3.63
10 - 12	58	28	3.78
12 - 2	56	29	3.78
2 - 4	160	16	3.95
4 - 6	215	15	7.51
6 - 8p.m.	62	29	4.18
Day Total	611		26.85
8p.m. - 8a.m.	242	31	17.48
Total 24 hrs.	853		44.33

Urea Concentration Test.

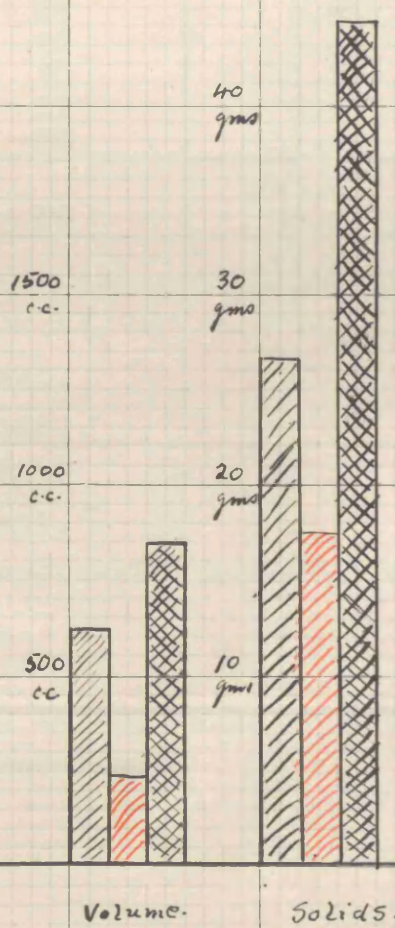
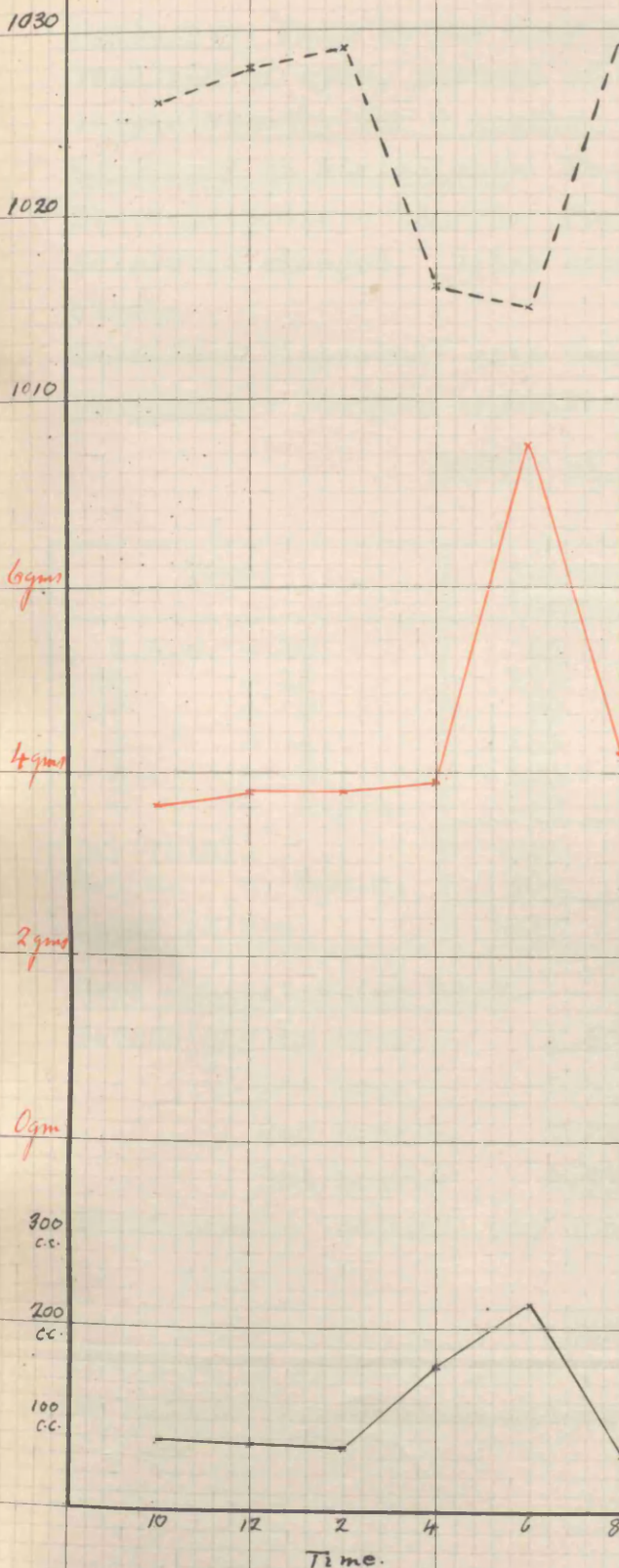
1st hour:- 3.36 per cent.

2nd hour:- 3.47 per cent.

Blood-urea:- 22 mgs. per cent. Non-protein nitrogen:- 29 mgs. per cent.

Notes.

No abnormalities.



CASE 37.MALE. AGE, 33.

History:- Pain in the back for 9 months before admission. Swelling of eyes, passage of dark-red urine, and sickness intermittently for 9 months.

Condition on admission:- No oedema. No cardiac abnormality

Blood-pressure:- 140/80. Fundi showed slight arterio-sclerotic changes. Urine contained albumen + + + and trace of blood.

Dismissed "improved" with fair amount of albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccms.)	Specific Gravity.	Solids. (grammes)
8.a.m. - 10	65	28	4.24
10 - 12	133	29	8.99
12 - 2	52	26	3.15
2 - 4	165	30	11.53
4 - 6	118	29	7.97
6 - 8.p.m.	110	29	7.43
Day Total.	643		43.31
8.p.m. - 8.a.m.	404	30	28.24
Total 24 hrs.	1047		71.55

Urea Concentration Test.

Before giving urea:- 1.66 per cent.

1st hour:- 2.01 per cent.

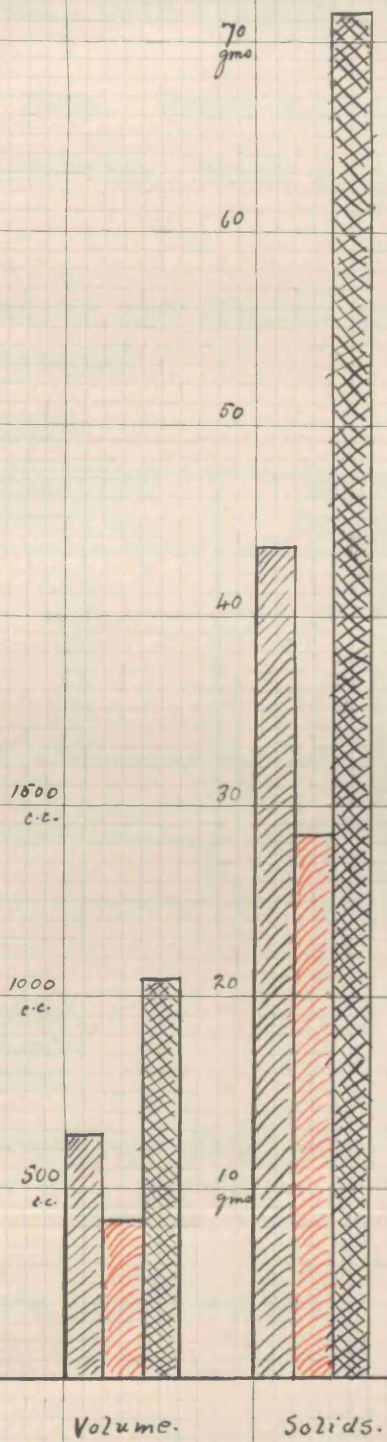
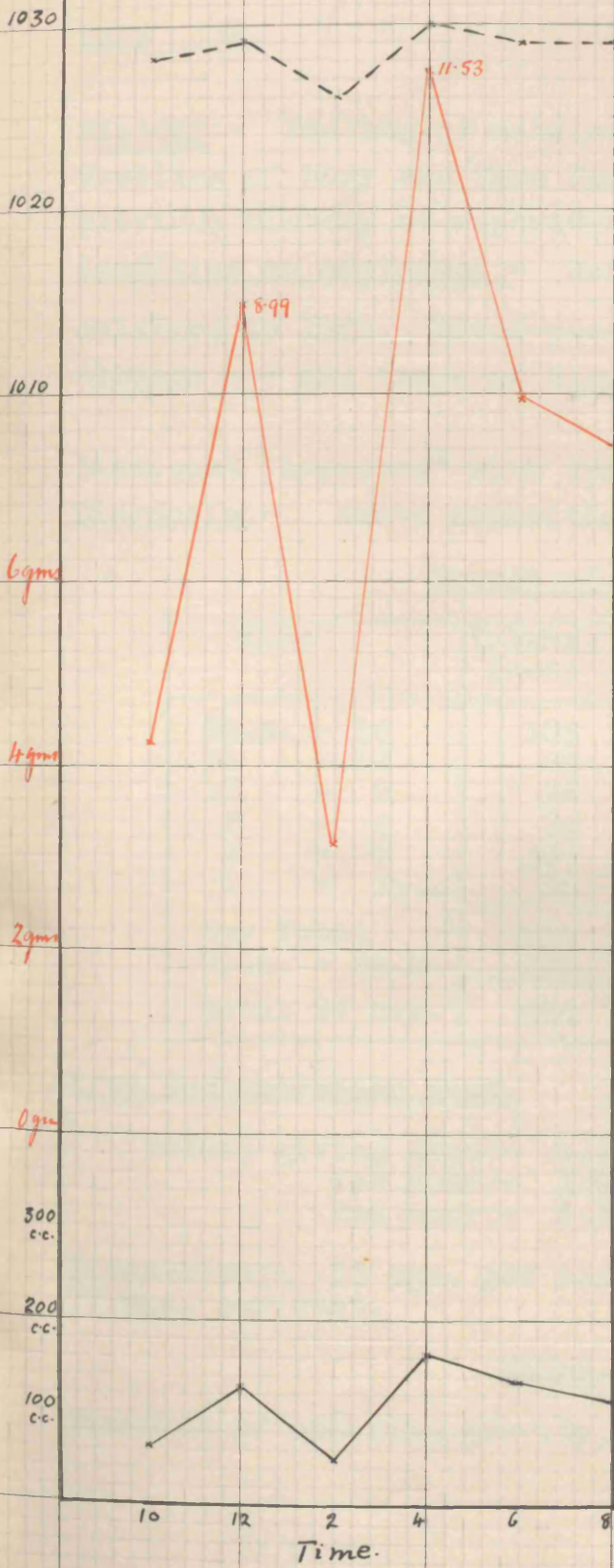
2nd hour:- 2.24 per cent.

3rd hour:- 2.55 per cent.

Blood-urea:- 44 mgs. per cent. Non-protein nitrogen:-40 mgs. per (cent.)

Notes.

Fixation of specific gravity at high level; large excretion of solids; ~~non-protein nitrogen rather high.~~



CASE 38.

FEMALE. AGE 39.

History:- Feeling of malaise for 3 weeks before admission. Swelling of body and face for one week, with oliguria. No previous history of nephritis.

Condition on admission:- Oedema of face. Heart slightly enlarged to left. Blood-pressure moderate. Urine contained albumen + + and trace of blood.

Dismissed "improved" with trace of blood and albumen in urine.

Diagnosis:- Acute nephritis ( ? chronic)

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	105	14	3.42
10 - 12	95	14	3.09
12 - 2	96	14	3.13
2 - 4	74	16	2.75
4 - 6	109	14	3.55
6 - 8p.m.	86	15	2.99
Day Total	565		18.93
8p.m. - 8a.m.	420	17	16.64
Total 24 hrs.	985		35.57

Urea Concentration Test.

Before giving urea:- 1.10 per cent.  
1st hour:- 1.20 per cent.  
2nd hour:- 1.27 per cent.

Blood-urea:- 33 mgs. per cent. Non-protein nitrogen:-  
37 mgs. per cent.

Notes.

Fixation of specific gravity; low urea concentration.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

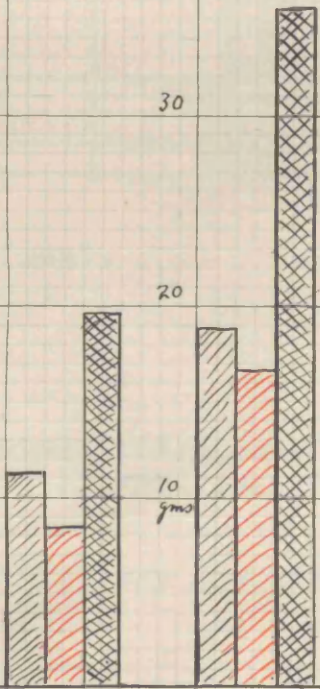
40 gms

30

20

10 gms

Solids.





CASE 39.FEMALE AGE, 18.

History:- Albuminuria discovered at ante-natal clinic - persisted after confinement. Admitted to hospital 2 weeks after normal labour. Headache only subjective symptom.

Condition on admission:- No oedema. No cardiac abnormality.

Urine contained albumen + +, no blood, few pus cells but no casts.

Discharged 'improved' with slight albuminuria.

Diagnosis:- Pyelitis.

Result of Test-meal.

Time	Volume c.c.	Specific Gravity	Solids (grammes)
8a.m. - 10	54	17	2.14
10 " - 12	75	19	3.31
12 " - 2	118	16	4.40
2 " - 4	82	17	3.25
4 " - 6	122	14	3.98
6 " - 8p.m.	85	17	3.36
Daily Total	536		20.44
8p.m. - 8a.m.	440	17	17.43
Total 24 Hrs.	976		37.87

Urea Concentration Test.

Before giving urea:- 0.99 per cent.

1st Hour :- 0.48 " "

2nd Hour :- 0.56 " "

3rd Hour :- 0.27 " "

Blood urea:- 36 mgs. per cent. Non protein nitrogen:-  
33 mgs. per cent.

Notes.

Tendency to fixation of specific gravity; very low urea concentration.

1030

1020

1010

6gms

4gms

2gms

0gms

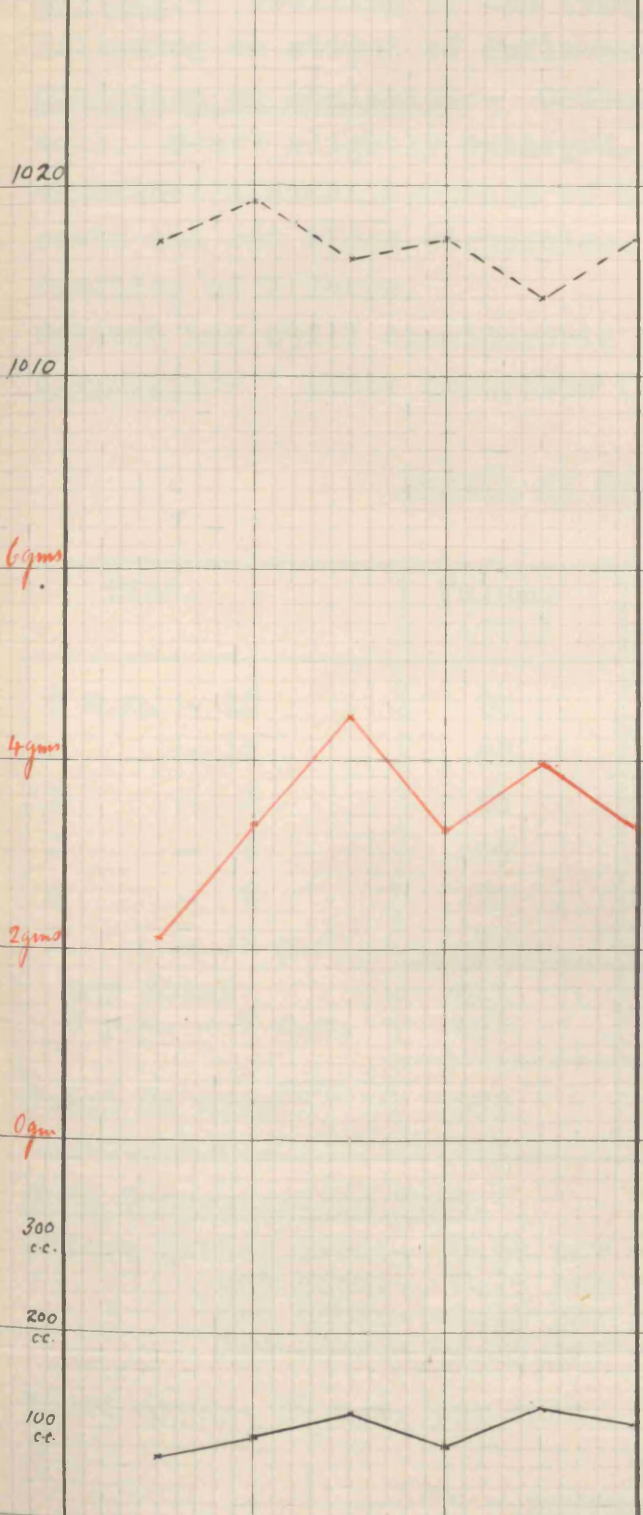
300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

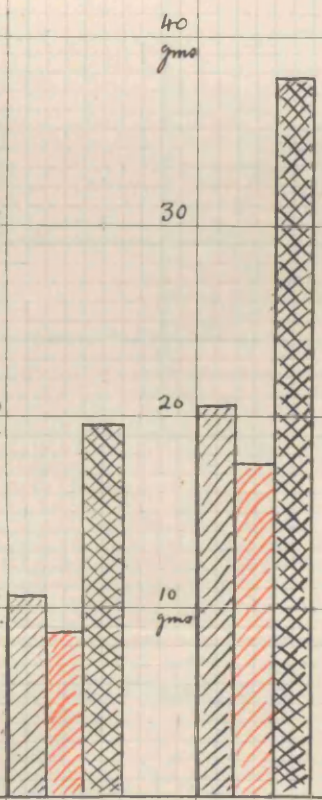
Time.



1500 c.c.

1000 c.c.

500 c.c.



Volume.

Solids.

CASE 40.FEMALE. AGE. 13.

History:- Swelling of the face, sickness and drowsiness following an attack of influenza 3 months before admission.

Condition on Admission:- Oedema of face, legs and abdominal wall. Heart slightly enlarged. V.S. murmur at apex. Urine contained Albumen + + trace of blood, blood and granular casts and red blood corpuscles. Pyelogram showed impaired function of kidneys.

Patient has still considerable blood and albumen in urine.

Diagnosis:- Acute nephritis (? chronic)

Result of Test Meal.

Time.	Volume (cc.)	Specific Gravity.	Solids. (grammes)
8 a.m. - 10	80	17	3.17
10 - 12	98	16	3.64
12 - 2	93	15	3.24
2 - 4	109	15	3.80
4 - 6	77	16	2.86
6 - 8 p.m.	84	15	2.93
Day Total	541		19.64
8 p.m. - 8 a.m.	498	16	18.56
Total 24 hrs.	1039		38.20

Urea Concentration Test.

Before giving urea:- 0.65 per cent.  
 1st hour:- 0.75 per cent.  
 2nd hour:- 0.40 per cent.  
 3rd hour:- 1.15 per cent.

Blood urea:- 39 mgs. per cent. Non-protein nitrogen:- 44 mgs. per cent.

NOTES.

Fixation of specific gravity; tendency to nocturnal polyuria; low specific gravity of night urine; low urea concentration; high non-protein nitrogen.

Case 40

1030

1020

1010

6gms

4gms

2gms

0gms

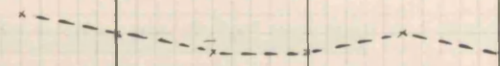
300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.



1500 c.c.

1000 c.c.

500 c.c.

Volume.

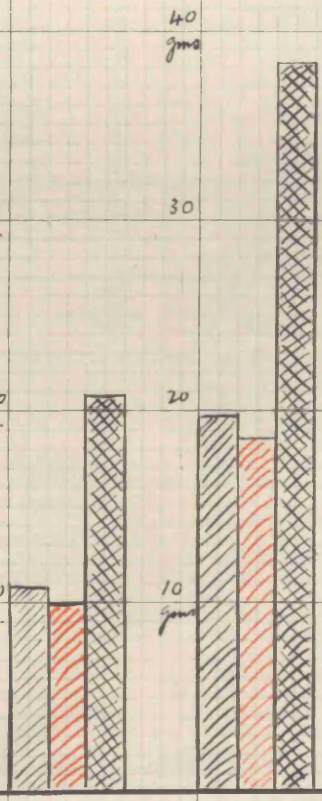
40 gms

30

20

10 gms

Solids.



CASE 41.

FEMALE AGE 47.

History:- Swelling of face, ankles and abdomen for 4 weeks before admission. Had nephritis at the age of 6 years, and again at 16.

Condition on admission:- Oedema of face, back and legs, with ascites. V.S. murmur at apex. Blood-pressure, 290/180. Pronounced neuro-retinitis of both fundi, with oedema of discs. Urine contained albumen ++ and trace of blood.

Dismissed "improved" with slight albuminuria but no oedema.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	152	14	4.96
10 - 12	140	14	4.57
12 - 2	89	14	2.90
2 - 4	180	14	5.87
4 - 6	178	14	5.80
6 - 8p.m.	124	13	3.75
Day Total	863		27.85
8p.m. - 8a.m.	672	13	20.35
Total 24 hrs.	1535		48.20

Urea Concentration Test.

Before giving urea:- 0.61 per cent  
 1st hour:- 0.67 per cent  
 2nd hour:- 0.65 per cent  
 3rd hour:- 0.83 per cent

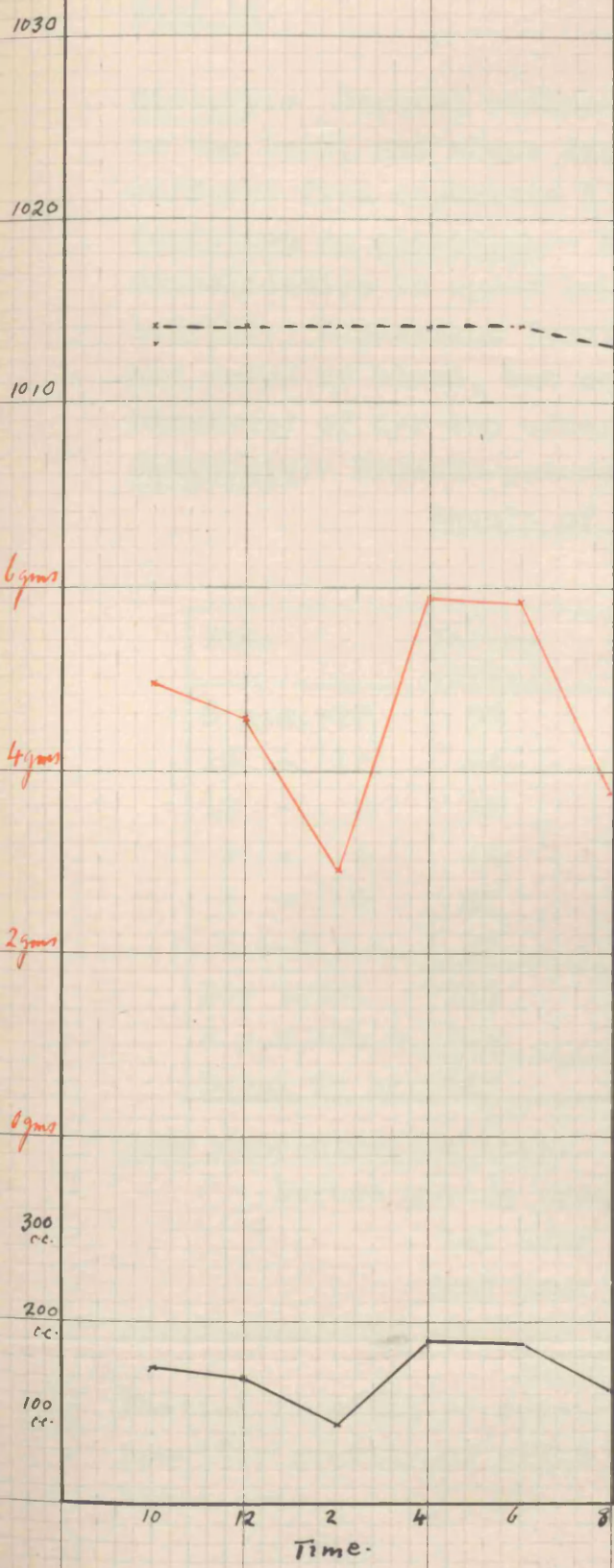
Blood-urea:- 107 mgs. per cent. Non-protein nitrogen:-  
 82 mgs. per cent.

Notes.

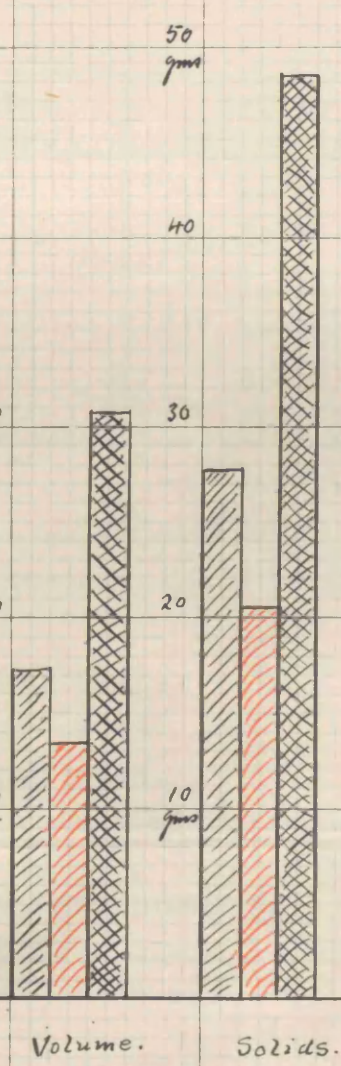
Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; low urea concentration; high blood urea.

Case 41.

140.



6gms  
4gms  
2gms  
0gms  
6gms



Volume. Solids.

CASE 42.

FEMALE. AGE, 56.

History:- General weakness, swelling of the face, and pain in the back, and sides for 8 days before admission. She suffered from nephritis 5 years before, for several months.

Condition on admission:- No oedema. Painful dry cough. Consolidation in upper lobe of right lung. Blood-pressure 148/102. Wassermann Reaction +. Urine contained albumen + and trace of blood, but no casts were found.

Dismissed of her own accord, "improved".

Diagnosis:- Broncho-pneumonia and chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m.-10	50	16	1.86
10 - 12	84	17	3.32
12 - 2	68	16	2.53
2 - 4	44	18	1.84
4 - 6	67	17	2.65
6 - 8 p.m.	82	12	2.29
Day total	395		14.49
8 p.m.-8a.m.	788	13	23.86
Total 24 hrs.	1183		38.35

Urea Concentration Test.

Before giving urea :- 0.81 per cent.

1st hour :- 1.00 per cent.

2nd hour :- 1.20 per cent.

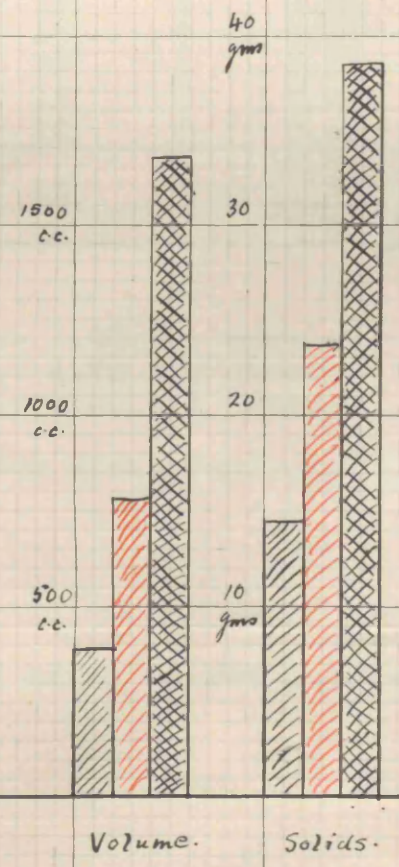
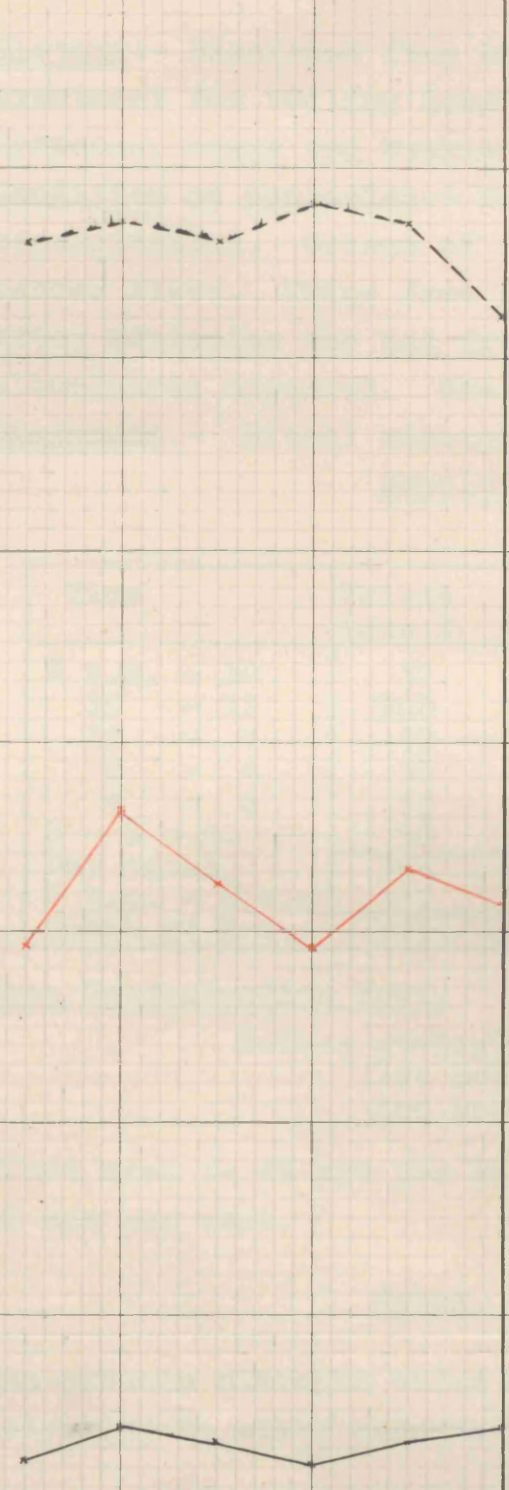
Blood-urea:- 55 mgs. per cent. Non-protein nitrogen:-63 mgs. (per cent.)

Notes.

Partial fixation of specific gravity; nocturnal polyuria; low specific gravity of night urine; low urea concentration; high blood urea.

1030  
1020  
1010  
6 gm  
4 gm  
2 gm  
0 gm  
300 cc  
200 cc  
100 cc

10 12 2 4 6 8  
Time.





CASE 43.FEMALE. AGE, 43.

History:- Dismissed from hospital 3 months before, after treatment for failing heart. Since then she had had dyspnoea, cough and weakness with swelling of face and legs.

Condition on admission:- Oedema of legs and back. Mitral regurgitation. Oedema of bases of both lungs. Enlarged, tender liver. Urine free from albumen.

After admission she had frequent attacks of vomiting and albuminuria appeared. She is improving but still in hospital.

Diagnosis:- Mitral regurgitation with failing heart.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m. - 10	37	20	1.72
10 - 12	100	13	3.03
12 - 2	59	19	2.61
2 - 4	53	22	2.71
4 - 6	59	18	2.46
6 - 8 p.m.	56	20	2.61
Day total	364		15.14
8 p.m. - 8 a.m	357	19	15.80
Total 24 hrs.	721		30.94

Urea Concentration Test.

Before giving urea :- 1.40 per cent.  
 1st hour ; - 1.78 per cent.  
 2nd hour :- 2.00 per cent.

Blood urea :- 46 mgs per cent. Non protein nitrogen :-  
 52 mgs per cent.

Notes.

Non-protein nitrogen value rather high; relative nocturnal polyuria; no other abnormality.

Case 43.

144.

1030

1020

1010

6gms

4gms

2gms

0gms

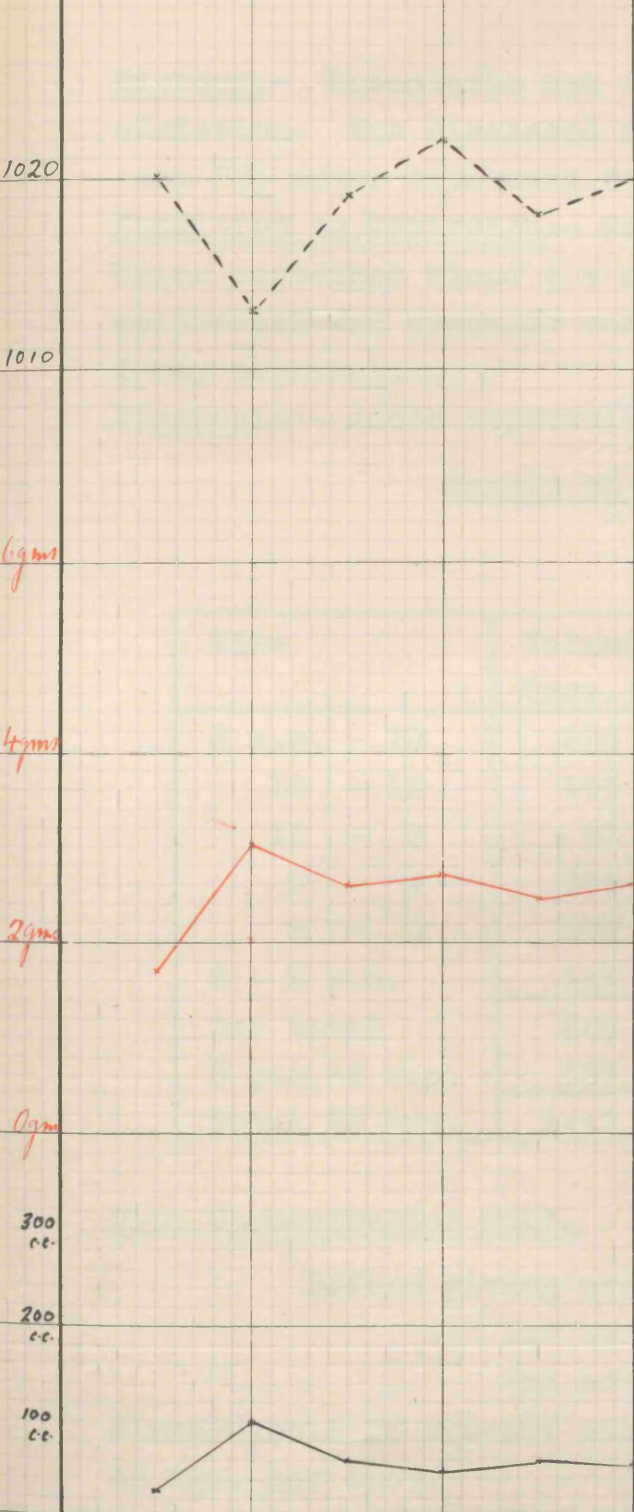
300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.



1500 c.c.

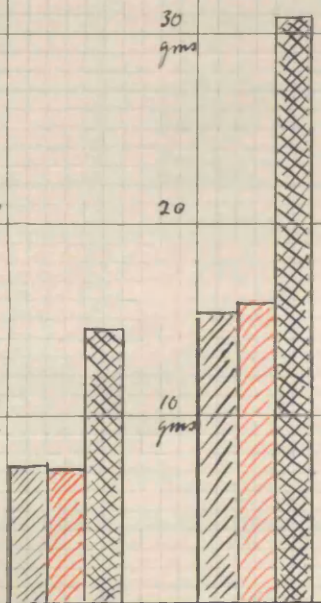
30 gms

1000 c.c.

20 gms

500 c.c.

10 gms



Volume.

Solids.

CASE 44.MALE. AGE, 19.

History:- Haematuria and headache for 2 days before admission. Was dismissed from hospital 5 months ago. (see case 28) after treatment for same condition.

Condition on admission:- No oedema. No cardiac abnormality. Urine contained blood ++ and albumen +, with blood, epithelial and granular casts. No sign of calculus on X-ray examination.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific gravity.	Solids (grammes.)
8 a.m. - 10	165	15	5.76
10 - 12	133	17	5.27
12 - 2	97	16	3.61
2 - 4	200	16	7.46
4 - 6	102	16	3.80
6 - 8 p.m.	148	15	5.16
Day total	845		31.06
8 p.m.-8 a.m.	597	17	23.64
Total 24 hrs.	1442		54.70

Urea Concentration Test.

Before giving urea :- 1.38 per cent.

1st hour :- 1.32 per cent.

2nd hour :- 1.50 per cent.

Blood-urea:- 32 mgs per cent. Non-protein nitrogen:-  
43 mgs. per cent.

Notes.

Fixation of specific gravity; nocturnal and total polyuria; low urea-concentration; non-protein nitrogen rather high.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10

12

2

4

6

8

Time.

1500 cc.

1000 cc.

500 cc.

Volume.

50 gms

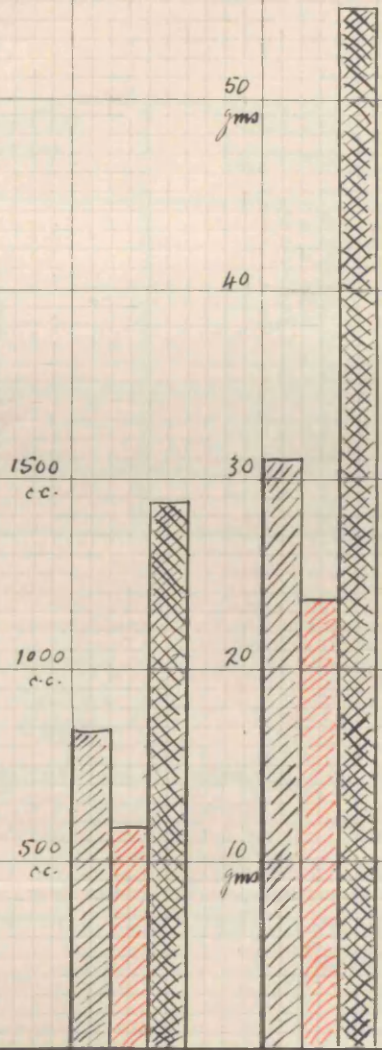
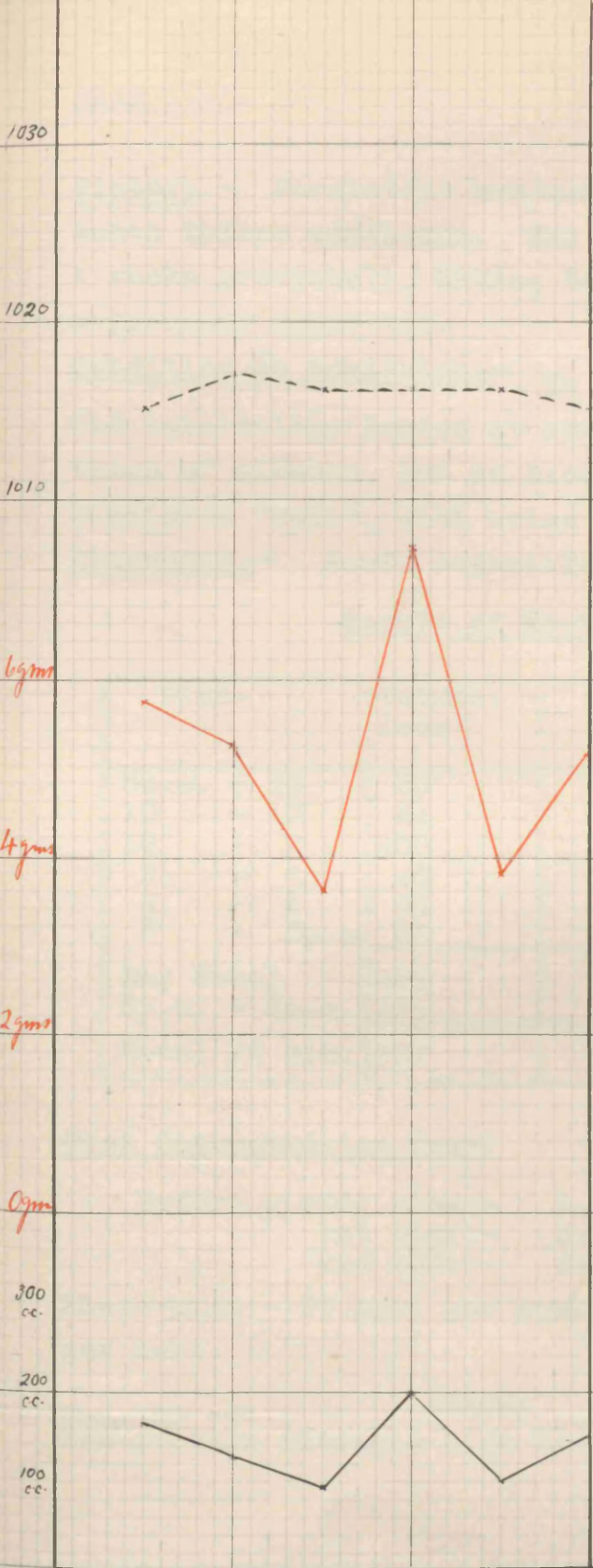
40

30

20

10 gms

Solids.



CASE 45.

MALE. AGE 13.

History:- Persistent headache and swelling of feet for a month before admission. Was dismissed from another hospital 4 weeks previously, having been treated for pneumonia and subsequent nephritis.

Condition on admission:- No oedema. No cardiac abnormality. Old tuberculous lesion at apex of right lung. Urine contained trace of albumen, but no blood or casts.

Dismissed "well", with urine free from albumen.

Diagnosis:- Acute nephritis.

Result of Test-meal.

Time.	Volume. (ccs)	Specific Gravity.	Solids. (grammes)
8a.m. - 10	80	24	4.47
10 - 12	84	17	3.32
12 - 2	100	20	4.66
2 - 4	40	20	1.86
4 - 6	93	17	3.68
6 - 8p.m.	85	11	2.17
Day Total	482		20.16
8p.m. - 8a.m.	425	17	16.83
Total 24 hrs.	907		36.99

Urea Concentration Test.

Before giving urea:- 1.63 per cent.  
 1st hour:- 2.16 per cent.  
 2nd hour:- 2.76 per cent.

Blood-urea:- 39 mgs. per cent. Non-protein nitrogen:- 38 mgs. per cent.

Notes.

<sup>Blood-urea and</sup>  
 ^ Non-protein nitrogen high for his years; no other abnormality.

Case 45.

148.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 cc

200 cc

100 cc

10

12

2

4

6

8

Time.

1500 cc.

1000 cc.

500 cc.

Volume

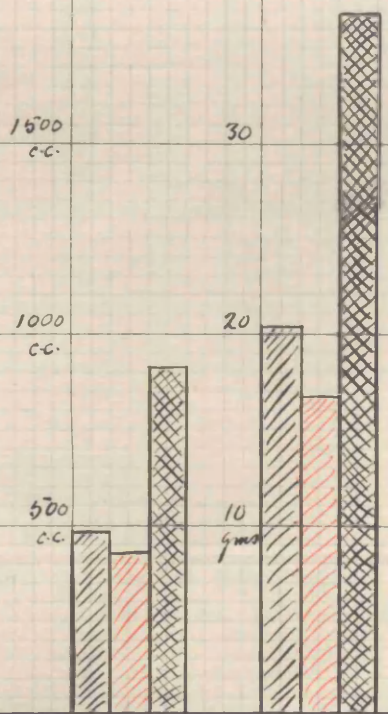
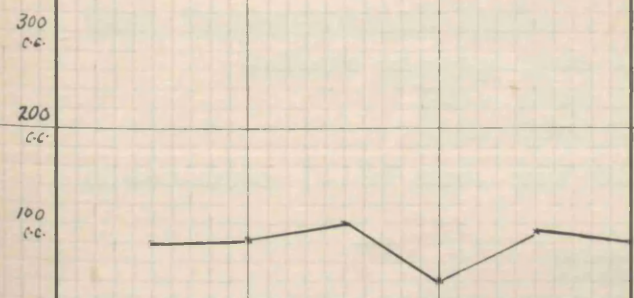
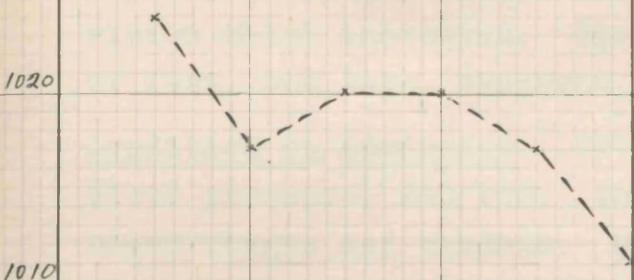
40 gms

30

20

10 gms

Solids.



CASE 46.

FEMALE. AGE, 44.

History:- Hemiplegia a year before admission. Apparently had nephritis at this time. Soon afterwards she had dimness of vision which increased. For last six weeks she had swelling of feet, and legs, dyspnoea, polyuria, and thirst.

Condition on Admission. Orthopnoea. Heart enlarged to left. Blood pressure, 240/150. Fundi showed neuro-retinitis, haemorrhages and exudate. Urine contained albumen + + + with epithelial debris and numerous granular and hyaline casts.

Dismissed "improved", with slight albuminuria.

Diagnosis :- Chronic nephritis.

Result of Test.meal.

Time	Volume (ccs).	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	124	17	4.91
10 - 12	99	17	3.92
12 - 2	104	17	4.12
2 - 4	23 x	-	-
4 - 6	172	18	7.21
6 - 8 p.m.	156	17	6.18
Day Total	678		26.34
8 p.m. - 8 a.m.	975	16	36.34
Total 24 hours.	1653		62.68

Urea Concentration Test.

Before giving urea :- 0.85 per cent.  
1st. hour :- 0.89 per cent.  
2nd. hour :- 1.17 per cent.

Blood-urea :- 67 mgs. per cent. Non-protein nitrogen :- 54 mgs. per cent.

NOTES.

Fixation of specific gravity; nocturnal and total polyuria; low specific gravity of night urine; low urea concentration and high blood-urea.

x This specimen was contaminated with faeces.

1030

1020

1010

6gms

4gms

2gms

0gms

300

cc.

200

cc.

100

cc.

10 12 2 4 6 8

Time.

60  
gms.

50

40

30

20

10

gms

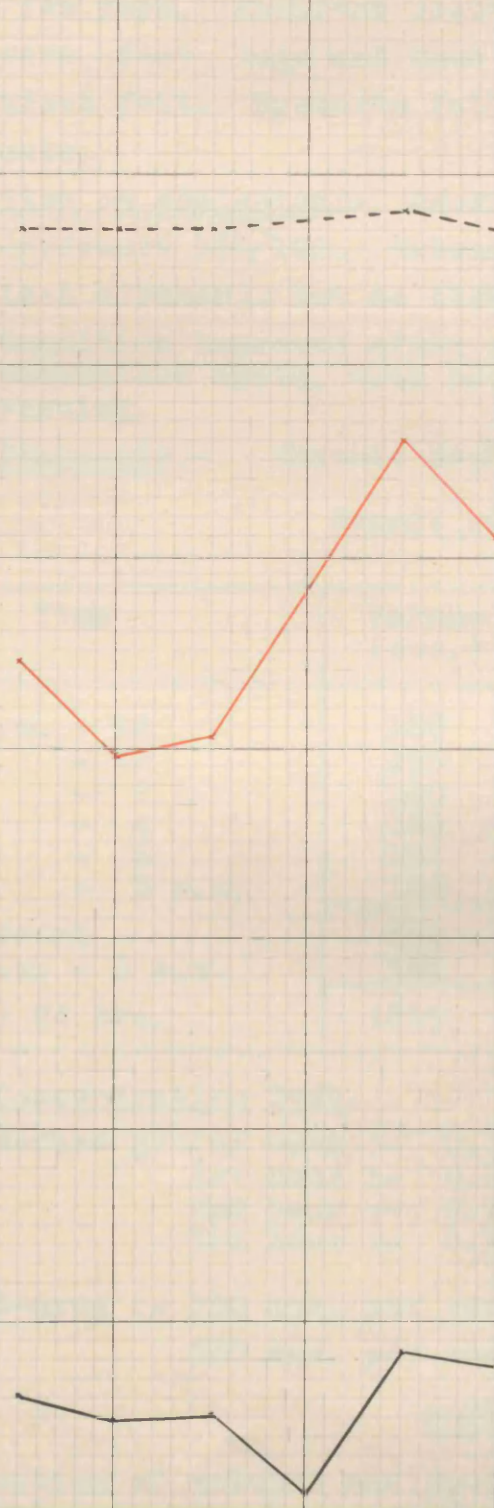
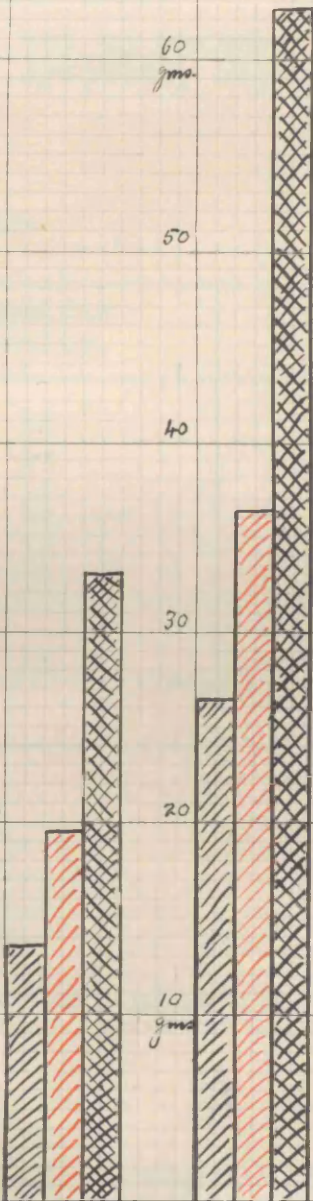
1500  
c.c.

1000  
c.c.

500  
c.c.

Volume.

Solids.





CASE 47.MALE. AGE 23.

History:- Six months before admission, the feet were swollen for a few days. Apparent recovery followed. Four weeks before admission, feet, legs and face became swollen. No other discomfort felt. Nycturia followed. He has had frequent epistaxis.

Condition on admission:- General anasarca. Heart not enlarged. Blood-pressure 160/100. Retinal haemorrhage noted. Urine contained albumen++ but no blood. No casts seen.

Condition improved after admission, but he became oedematous again, with sickness and dyspnoea, death ensuing.

Diagnosis:- Chronic Nephritis.

Result of Test-Meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes.)
8 a.m. - 10	108	14	3.52
10 - 12	155	14	5.05
12 - 2	140	14	4.57
2 - 4	166	14	5.41
4 - 6	132	15	4.61
6 - 8 p.m.	168	14	5.47
Day Total	869		28.63
8 p.m. - 8 a.m.	966	14	31.51
Total 24 hrs.	1835		60.14

Urea Concentration Test.

Before giving urea :- 0.83 per cent.  
 1st hour :- 0.85 per cent.  
 2nd hour :- 0.90 per cent.  
 3rd hour :- 0.90 per cent.

Blood-urea :- 196 mgs. per cent. Non-protein nitrogen :-  
 200 mgs. per cent.

NOTES.

Fixation of volumes and specific gravity; nocturnal polyuria; total polyuria; low specific gravity of night urine; very low urea concentration and high blood urea.

1030

1020

1010

6gms

4gms

2gms

0gms

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

60 gms

50

40

1500 cc.

1000 cc.

500 cc.

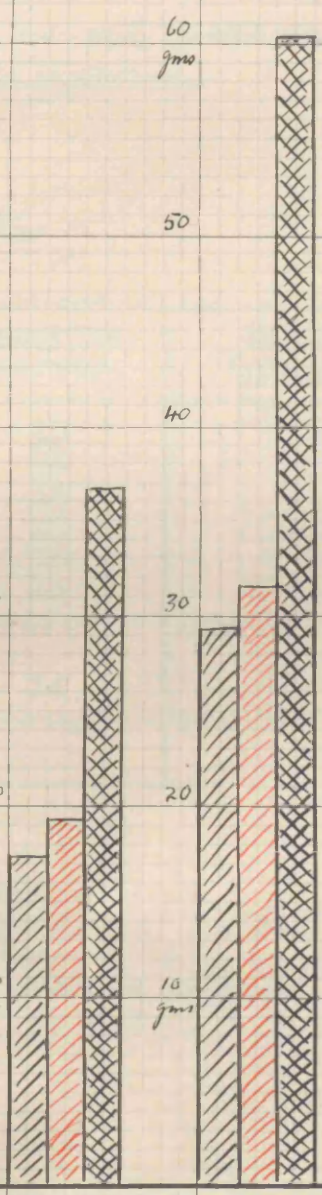
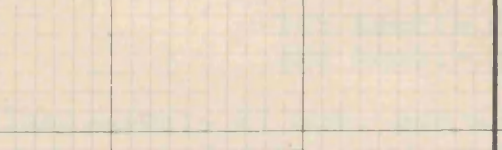
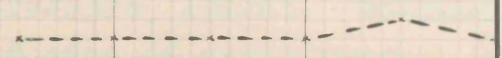
30

20

10 gms

Volume.

Solids.



CASE 48.MALE. AGE, 26.

History:- Malaise for 2 weeks before admission. During last 3 days he had headache, swelling of face and legs, oliguria and sickness.

Condition on admission:- Mentally confused. Oedema of face, feet and back. Heart slightly enlarged to left. Blood-pressure, 132/83. Dullness at bases of both lungs. Blurring of edge of optic discs. Urine contained albumen ++ and blood ++, with many pus cells, hyaline and blood casts. Patient is still in hospital but has improved.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time.	Volume (c.cms.)	Specific gravity.	Solids (grammes)
8 a.m. - 10	126	13	3.81
10 - 12	140	14	4.57
12 - 2	140	15	4.89
2 - 4	102	15	3.56
4 - 6	94	16	3.50
6 - 8 p.m.	184	14	6.00
Day Total	786		26.33
8 p.m. - 8 a.m.	862	14	28.12
Total 24 hours.	1648		54.45

Urea Concentration Test:

1st hour:- 1.05 per cent.  
2nd hour:- 1.00 per cent.

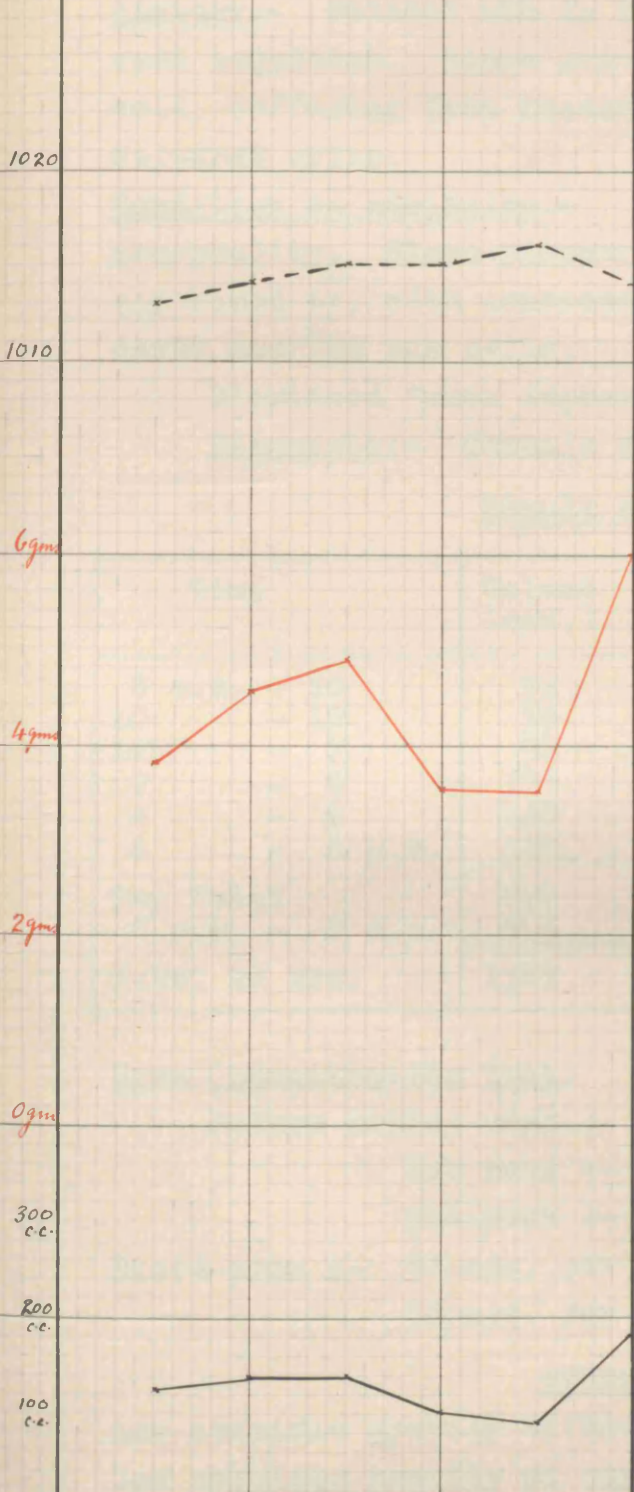
Blood-urea:- 63 mgs. per cent. Non protein nitrogen:-  
52 mgs. per cent.

NOTES.

Fixation of specific gravity; nocturnal polyuria; total polyuria; low specific gravity of night urine; very low urea concentration; high blood urea.

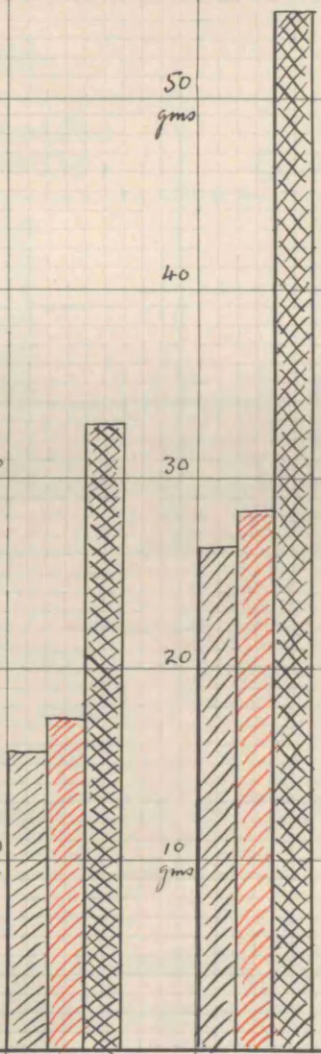
1030  
1020  
1010  
6gms  
4gms  
2gms  
0gms  
300 c.c.  
200 c.c.  
100 c.c.

10 12 2 4 6 8  
Time.



1500 c.c.  
1000 c.c.  
500 c.c.

50 gms  
40  
30  
20  
10 gms



Volume. Solids.

CASE 49.FEMALE. AGE 11.

History:- Patient was in hospital for second time, with same complaint. Since previous discharge she had not been well, suffering from headache and swelling of face, with red coloured urine.

Condition on admission:- Oedema of face. No cardiac abnormality. Blood-pressure, 90/65. Urine contained albumen ++, blood ++, with numerous red blood corpuscles, granular casts and few pus cells.

Dismissed "much improved" with slight albuminuria.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume (ccs.)	Specific Gravity.	Solids (grammes).
8 a.m. - 10	52	14	1.69
10 - 12	59	13	1.78
12 - 2	92	11	2.35
2 - 4	376	03	2.62
4 - 6	140	09	2.93
6 - 8 p.m.	158	08	2.94
Day Total	877		14.31
8 p.m. - 8 a.m.	504	05	5.87
Total 24 hrs.	1381		20.18

Urea Concentration Test.

Before giving urea :- 1.8 per cent.

1st hour :- 1.75 per cent.

2nd hour :- 2.31 per cent.

Blood-urea :- 44 mgs. per cent. Non-protein nitrogen :-  
30 mgs. per cent.

NOTES.

Low specific gravity without fixation; nocturnal polyuria; low specific gravity of night urine; blood-urea rather high.

1030

1020

1010

6 gms

4 gms

2 gms

0 gms

300 c.c.

200 c.c.

100 c.c.

10 12 2 4 6 8

Time.

1500 c.c.

30 gms

1000 c.c.

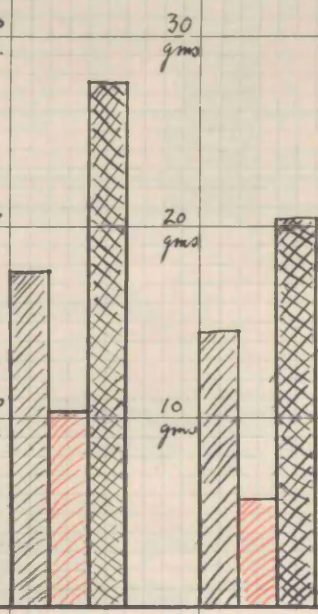
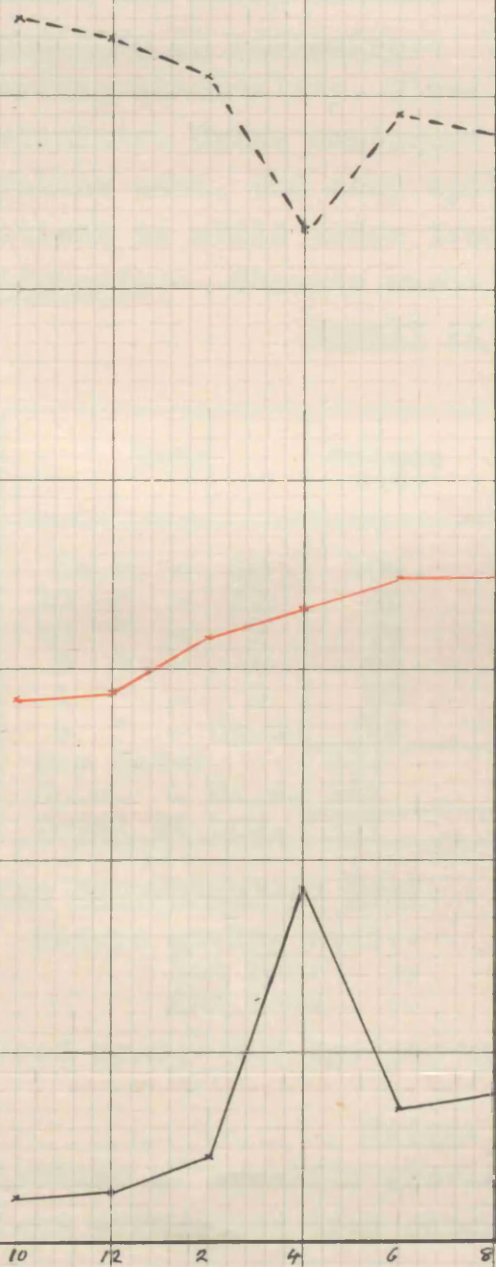
20 gms

500 c.c.

10 gms

Volume.

Solids.



CASE 50.FEMALE AGE, 44.

History:- Dyspnoea and polyuria for 8 months before admission. Severe dyspnoea and oedema of feet and face for last two months. Frequent bouts of vomiting. Dimness of vision for seven months.

Condition on admission:- Oedema of face and legs. No cardiac abnormality. Blood pressure 248/144. Double neuro-retinitis. Urine contained albumen - - with an occasional hyaline cast, and many epithelial cells.

Patient is still under treatment, being little improved.

Diagnosis:- Chronic nephritis.

Result of Test-meal.

Time	Volume c.c.	Specific Gravity.	Solids grammes
8a.m. - 10	100	10	2.33
10 " - 12	95	10	2.21
12 " - 2	76	12	2.12
2 " - 4	69	10	1.61
4 " - 6	68	12	1.89
6 " - 8p.m.	62	13	1.87
Day Total	470		12.03
8p.m. - 8a.m.	467	11	11.96
Total 24 hrs.	937		23.99

Urea Concentration Test.

Before giving urea:- 0.54 per cent.  
 1st Hour :- 0.60 " "  
 2nd Hour :- 0.35 " "

Blood urea:- 107 mg. per cent. Non-protein nitrogen:-  
 120 mg. per cent.

Notes.

Fixation of specific gravity; low specific gravity of night urine; low urea concentration; high blood urea.

Case 50.

1030

1020

1010

6 gm

4 gm

2 gm

0 gm

300 cc.

200 cc.

100 cc.

10 12 2 4 6 8

Time.

1500 cc.

1000 cc.

500 cc.

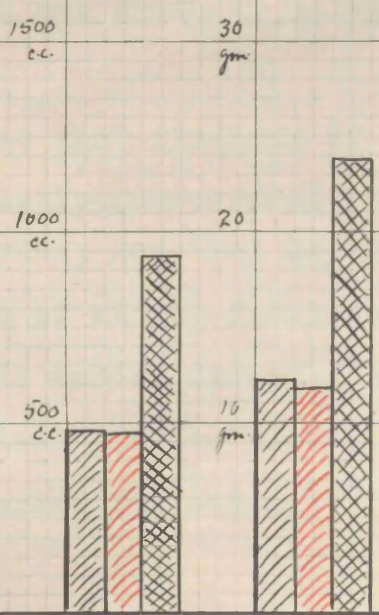
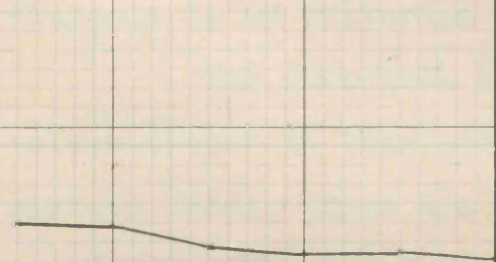
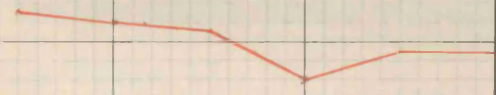
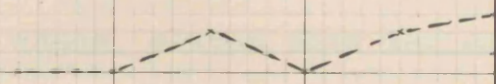
30 gm

20 gm

10 gm

Volume.

Solids.





### VIII. DISCUSSION OF RESULTS.

The curves of day-urine output differ in some respects from the normal. In sixteen cases a flat curve indicates definite fixation of quantities. Of the remaining cases, eleven show maximum diuresis at 8 p.m., four at 6 p.m., ten at 4 p.m., and ten in the early part of the day.

Of the sixteen cases with fixation of volumes, four are considered in Table II ( p. 164) to have no renal impairment, so we cannot look upon this phenomenon as a sign of loss of function. The remainder show a tendency to delay maximum output until 8 p.m. This again is not absolutely indicative of renal damage, as four of the twelve cases under consideration are shown to be normal in Table II.

We may venture to state that fixation of volumes may take place with normally-functioning kidneys when the fluid intake is restricted; and that delay in diuresis is no criterion of loss of kidney function.

The excretion of solids varies directly as the volume-output in thirty-five cases. In the remaining sixteen cases, there are well-marked variations. In view/

view of the similar results obtained in normal persons, this observation does not appear to have any special significance.

The specific gravity varies inversely as the volume in twenty-eight cases only. There are thus twenty-three cases in which the normal relationship between specific gravity and volume does not hold good. To seek a reason for this would probably lead us to the realm of mere speculation. Evidently the damaged kidney is in many instances incapable of adjusting itself to the excretion of varying amounts of water and of solids.

In eleven cases the night-urine volume exceeds the day-urine volume. This occurred in only one of the normal cases.

In only six cases (Nos. 3, 16, 27, 31, 32 and 33) is there a noticeable difference between the ratio of day-urine volume to night-urine volume, and the corresponding ratio of solid-excretion.

In eleven cases the night-solids exceed the day-solids, including three cases which do not appear in the corresponding volume-series. One patient, (No. 37) has a total solid-excretion of 71.55 gm., a very large amount considering the low-caloric diet he was receiving. The renal/

renal efficiency in his case, appears to be quite adequate.

The total excretion of solids in this series of cases varies as widely as did the normal excretion, depending upon the clinical condition of the patient at the time of the test. Fluid-retention means retention of solids. Polyuria bespeaks a large excretion of substances in solution. All normal cases eliminated no less than 30 gm. in the 24 hours. A number of the abnormal series excreted less than 30 gm. indicating retention in the body.

It could not be taken for granted that every one of the patients tested had impaired renal function. Some of them were practically convalescent, and in these cases the kidneys might be expected to be in sound working order in spite of a certain amount of structural damage, temporary or permanent.

In Table II therefore, we have summarised the main features of the tests, and indicated by a positive sign those cases which show renal impairment, judged by the results of all the tests carried out. A negative sign indicates no evidence of inefficiency. In assessing abnormality, we have employed the following standards of normality:-

- (1) The total 24 hours' urine should not exceed 14.50 cc.
- (2)/

- (2) The night-urine should not exceed 500 cc.
- (3) The maximum specific gravity of the specimens should be no less than 1018.
- (4) There should be a specific gravity variation of at least six points during the day, unless the maximum specific gravity is at least 1019.
- (5) The specific gravity of the night-urine should be no less than 1015.
- (6) The urea concentration should be at least two per cent in the second or third specimen.
- (7) The blood urea and non-protein nitrogen should vary between 20 mg. and 40 mg. per cent. In children the value may be below 20 mg., and in people past middle life it may be as high as 60 mg., according to Maclean<sup>(19)</sup>. Much depends upon the experience of the investigator. In this analysis we have decided to consider abnormal a blood-urea or non-protein nitrogen greater than 35 mg. per cent. in a person under 20 years of age, and to fix 50 mg. per cent. as the upper limit of the normal in persons of over 50 years.

The ratio of day-solids to night-solids (taking the latter as unity) is also shown in Table II, but it is obvious that this ratio is of no significance as a sign of renal impairment. In this series the value varies from 0.6 to 4.2. In one case (No. 14) with definite loss of function, the value is actually 3.7. On the whole, the results are lower than in the normal series, but this fact is fully explained by the frequent occurrence/

occurrence of nocturnal polyuria.

It was decided to designate a "positive" result, every case which was abnormal when judged by any three of the standards which we have laid down. It is manifestly impossible to diagnose any degree of renal impairment from the result of a single test, unless the deviation from the normal in that test is of a striking nature. Any patient, however, who gives an abnormal result in respect of three separate criteria, may reasonably be assumed to have impaired kidneys.

TABLE II.

## SUMMARY OF RESULTS IN ABNORMAL CASES.

Case No.	Sex.	Age.	24 Hours' Urine cc.	Night Urine cc.	Maxi- mation Sp.Gr. of Urine.	Sp.Gr. of Night Urine.	Ratio of Solids.	Blood Urea mg.	N.P.N. mg.	x Urea Conc. Test.	Diagnosis	Result.
1	F	10	1317	575	18	7	1.6	-	17	1.25	Acute Nephritis	+
2	F	14	1492	640	16	10	1.3	-	12	2.05	Acute Nephritis	+
3	F	37	1107	546	20	8	1.4	15	18	1.85	Chronic "	+
4	F	24	1112	580	19	8	1.3	23	22	1.33	Chronic "	+
5	M	22	1321	510	13	2	1.5	33	40	1.45	Acute "	+
6	M	41	1364	632	16	7	1.3	29	29	1.15	Chronic "	+
7	M	37	421	88	28	5	3.6	38	33	1.22	Arterio-sclerosis	-
8	M	53	513	96	24	6	4.2	45	34	1.73	Arterio-sclerosis	-
9	M	39	970	380	23	6	1.5	36	32	2.68	Acute Nephritis	-
10	F	37	992	322	13	3	1.9	184	120	0.60	Chronic Nephritis	+
11	M	53	885	426	26	7	1.1	72	63	2.13	Acute Nephritis	+
12	M	51	1115	730	24	7	0.6	46	29	1.10	Chronic Nephritis	+
13	M	24	1015	603	20	3	0.7	51	37	0.97	Chronic Nephritis	+
13A			1109	544	22	4	1.2	33	35	1.83	Do.	-
14	M	49	1128	210	20	5	3.7	184	138	0.97	Chronic Nephritis	+
15	F	52	1339	733	11	1	0.8	-	83	0.61	Chronic Nephritis	+
16	M	20	1168	229	25	18	1.9	-	-	-	Chronic Nephritis	-
17	M	29	836	445	22	8	0.8	25	25	2.00	Acute Nephritis	+
18	M	27	1590	680	23	8	1.4	37	40	1.13	Chronic Nephritis	-
19	F	20	898	382	17	3	1.2	21	27	1.56	Chronic Nephritis	+
20	F	52	930	186	23	7	3.0	24	31	2.71	Hyperplasia	-
21	M	15	929	402	23	3	1.3	37	-	1.94	Pyelitis	+
22	M	53	1381	680	16	2	1.1	51	53	1.20	Chronic Nephritis	+
23	F	52	355	95	21	9	1.8	41	36	2.85	Chronic Nephritis	-
24	M	58	1579	602	11	1	1.5	171	-	1.40	Chronic Nephritis	+
25	M	59	1275	712	19	7	0.9	29	29	1.66	Chronic Nephritis	+
26	F	50	1013	425	11	2	1.3	27	29	1.50	Chronic Nephritis	+
27	M	27	1468	620	12	4	1.8	34	39	1.85	Acute Nephritis	+
28	M	18	972	452	13	5	1.6	22	20	2.61	Acute Nephritis	+
29	M	21	1569	731	12	4	1.0	53	37	1.66	Acute Nephritis	+
30	M	46	1071	567	23	11	1.6	29	26	1.79	Acute Nephritis	+

x Non-protein nitrogen.

Case No.	Sex.	Age.	Hours' Urine cc.	24 Hours' Urine cc.	Night Urine cc.	Maxi- mum Sp. Gr.	Vari- ation of Sp. Gr. of Night Urine.	Sp. Gr. of Night Urine.	Ratio of Solids.	Blood Urea mg.	N. P. N. mg.	X N. P. N. Conc. Test.	Urea	Diagnosis.	Result
31	M	13	1404	393	11	7	11	1.3	42	26	2.56		Acute Nephritis	+	
32	M	16	1241	226	18	15	18	1.4	37	36	2.58		Acute Nephritis	-	
33	M	34	1511	402	15	12	15	0.8	46	36	2.24		Acute Nephritis	+	
34	M	33	1501	700	14	2	12	1.4	34	31	1.28		Chronic Nephritis	+	
35	M	55	1620	600	20	4	16	1.7	49	39	1.90		Chronic Nephritis	+	
36	P	22	853	242	31	16	31	1.5	22	29	3.47		Anaemia	-	
37	M	33	1047	404	30	4	30	1.5	44	40	2.55		Chronic Nephritis	-	
38	P	39	985	420	17	3	17	1.1	33	37	1.27		Chronic Nephritis	+	
39	P	18	976	440	19	5	17	1.2	36	33	0.56		Pyelitis	-	
40	P	13	1039	498	17	2	16	1.1	39	44	1.15		Chronic Nephritis	+	
41	P	47	1535	672	14	1	13	1.3	107	82	0.83		Chronic Nephritis	+	
42	P	56	1183	788	18	6	13	0.6	55	63	1.20		Chronic Nephritis	-	
43	P	43	721	357	22	9	19	1.0	46	52	2.00		V. D. H.	+	
44	M	19	1442	597	17	2	17	1.3	32	33	1.50		Acute Nephritis	-	
45	M	13	907	425	24	13	17	1.2	39	38	2.76		Acute Nephritis	+	
46	F	44	1653	975	18	2	16	0.7	67	54	1.17		Chronic Nephritis	+	
47	M	23	1835	966	15	1	14	0.9	196	200	0.90		Chronic Nephritis	+	
48	M	26	1648	862	16	3	14	0.9	63	52	1.00		Chronic Nephritis	+	
49	P	11	1381	504	14	11	05	2.4	44	30	2.31		Chronic Nephritis	+	
50	F	44	937	467	13	3	11	1.0	107	120	0.35		Chronic Nephritis	+	

x Non-protein nitrogen.

Judged by the tests carried out, fourteen of the cases have been deemed to show no renal inefficiency, while the remaining thirty-seven cases exhibit various degrees of impairment. Cases Nos. 1-11, who received only 1400 cc. of fluids, have been grouped with the others, there being no essential differences in the reaction to the test-diet: indeed, some of these patients excreted more urine than those with the increased intake.

We shall now deal seriatim with the results set forth in Table II.

A. The 24 hours' Urine Volume.

The volume of urine eliminated in 24 hours varies from 355 cc. in Case No. 23 to 1835 cc. in Case No. 47. It is difficult to appreciate the significance of a small urinary output (as in Cases No. 7, 8 and 23) where there is no oedema and no sign of cardiac decompensation. Extra-renal factors probably play a part. Polyuria, on the other hand, is a well-recognised phenomenon in chronic nephritis, even when the patient is not eliminating oedema. It is one object of the test-diet to set a standard by which we can estimate the degree of polyuria.

Of/



Of the thirty-seven cases showing functional impairment, twelve (32 per cent.) have a total urine volume exceeding 1450 cc. Of the cases considered to be normal, none shows polyuria. It may be said, then, that patients with total polyuria have defective renal function, but that only a proportion of abnormal cases exhibit polyuria.

B. The Night-Urine Volume.

The night-urine volumes vary from 88 cc. to 966 cc. In twenty-five (68 per cent.) of the "positive" cases, the volume exceeds 500 cc., this being found in only one of the negative cases. The finding bears out the opinion of American writers that nocturnal polyuria, when present, is a sign of diminished functional activity.

C. The Maximum Specific Gravity.

The maximum Specific Gravity varies from 1011 to 1031. In twenty-three (62 per cent.) of the "positive" cases it is below 1018. In the "negative" group the reading is at least 1018 in every case. This feature of the test is evidently of some service.

D. The Variation of Specific Gravity.

Nineteen/

Nineteen (51%) of the "positive" group do not conform to the standard adopted, but all of the "negative" group show the required variation. This criterion of kidney-efficiency is not of universal value, but a study of Cases 5, 10, 15, 22, 24, 26 and 47, makes it clear that in some cases the damaged organ is incapable of varying the specific gravity of the urine more than a few points, and always at a low level (1010-1014). It is our experience that this occurs only when the impairment is of considerable degree.

E. The Specific Gravity of the Night-Urine.

The specific gravity of the night-urine is below 1015 in twenty-three cases (62 per cent.) of the "positive" group, but in none of the "negative" group. This test of function is apparently of some value, as in the large majority of normal cases the specific gravity is not less than 1018, the standard usually accepted in the United States. Mosenthal admits that in an occasional case, the specific gravity of the night-urine may be as low as 1015, but he considers 1018 a fair and just minimum by which to judge the abnormal. Had we accepted this standard in our analysis, the number of "positive" cases would/

would have been considerably higher. In the face of the results in normal persons, we did not feel justified in doing so.

F. Ratio of Day Solids to Night Solids.

This ratio, for reasons already given, was not used to determine abnormality, the results being of an equivocal nature. We have been unable to draw any dividing line between the normal and the abnormal, in regard to the relative excretion of solids during the day and during the night.

G. The Blood-urea and Non-protein Nitrogen.

The blood analyses may be conveniently discussed together, as the concentration of blood-urea and of non-protein nitrogen, generally speaking, vary in a similar manner. Twenty cases of the "positive" group are characterised by a relatively high percentage of blood-urea, or non-protein nitrogen, or both. In five cases of the "negative" group, however, the amount of one or other is just above the normal limit. This may be due to faulty technique, but in all doubtful cases the estimations were duplicated. At any rate, we have/

have decided that, as the other tests are negative in character, the patients in question are the possessors of normally-functioning kidneys.

The blood-urea value, if normal, is no real criterion of renal efficiency, for by means of rest in bed and a low-protein diet, a high concentration may fall rapidly to ordinary level. A concentration of over 50 mg. per cent. must be regarded as evidence of renal impairment, except in cases of myocardial decompensation, acute abdominal conditions, and in prolonged vomiting, all of which, according to Beaumont and Dodds, increase the level of blood-urea.

H. The Urea Concentration Test.

The urea concentration of the urine is below 2 per cent. at the second or third hour in thirty-one cases (84 per cent.) of the "positive" group, and in four cases (11 per cent.) of the "negative" group, showing that this test is an exceedingly useful one. Apparently the ability of the kidney to concentrate urea is a better index of renal function than any constituent of the test-diet reaction.

In/

In cases 7 and 8, both patients suffering from arteriosclerosis, the urea concentration is low, but the test-diet gives a normal result. From a clinical standpoint there was no evidence of renal damage; thus it may be that in those cases with thickened arteries and a high blood-pressure, the test-meal offers better evidence for or against functional impairment than does the urea concentration test.

Case 43 is an example of a normal urea concentration with a relatively high level of blood-urea. This is commonly met with in cardiac cases with oedema, and with the aid of the test-diet findings, we had no difficulty in judging the renal function to be quite good.

In Table III. we have summarised the number and percentage of abnormal results for each test, in the "positive" and "negative" groups.

TABLE III.

	Positive Group.		Negative Group.	
	Cases	%	Cases	%
Total	12	32	0	0
Polyuria				
Nocturnal	25	68	1	3
Polyuria				
Maximum	23	62	0	0
Sp. Gr.				
Variation	19	51	0	0
of Sp. Gr.				
Sp. Gr. of	23	62	0	0
Night Urine				
Blood Analysis	20	54	5	13
Urea Conc.	31	84	4	11
Test.				

CONCLUSIONS.

1. In any test of renal function by means of a standard diet, the patients should be under similar conditions of environment, and should be under careful supervision.
2. The diet should be given for at least two days previous to the day of the test, to allow equilibrium between intake and output to take place.
3. It is important to realise that no absolute standard for the normal individual can be laid down, as the character of the diet plays a dominant part. The normal limits must be determined for the particular diet employed.
4. Nocturnal polyuria appears to be the most constant sign of diminished kidney-efficiency, judged by the test-diet. Next in order of merit come the maximum specific gravity and the specific gravity of the night-urine. The variation of specific gravity is of less value unless/

unless it is minimal in amount.

5. No single constituent of the test-diet result is so reliable as the urea concentration test.
6. For routine use, the urea concentration test is of greater service than the test-diet, especially when combined with an estimation of the blood-urea or non-protein nitrogen concentration. In doubtful cases, where the clinical signs do not agree with the result of these estimations, the test-diet results, taken together, give useful information for or against impairment of function.
7. Clinical signs, correctly interpreted, form the best indication of renal damage. Tests of functional capacity are simply an aid to diagnosis and prognosis.

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