T H E S I S

Presented for

M.D. Degree

by

Alastair Ian Ross

M.B., Ch.B., D.P.H.

April 1941

I hereby declare that the following thesis is entirely my own work.

Address:-

ON VITAMIN C METABOLISM

IN

PULMONARY TUBERCULOSIS.

EX BIBL. UNIV. GRONINGEN

On Vitamin C Metabolism in Pulmonary Tuberculosis.

Following on the preparation of pure crystalline vitamin C (ascorbic acid) a great deal of work has been done in investigating vitamin C metabolism.

The present investigation is concerned with the state of vitamin C metabolism in patients suffering from pulmonary tuberculosis.

This disease being chronic, apart from any specific effect which lack of the vitamin might produce, anything which affects the general resistance and health of the patient is important. Attention has always been directed to diet in tuberculosis. Attempts have been made to fatten patients by giving large quantities of food, and to improve or cure by giving such things as raw red meat, cod liver oil and tomato juice.

If it were shown that the tuberculosis patient required increased quantities of ascorbic acid, the giving of many of these diets and the good effects they often produce would be rationalised. Also such patients could be given extra amounts of the vitamin.

There are many different methods of determining the the state of patients in regard to vitamin C. I chose the "saturation" test described by Abbasy, Harris, Ray and Marrack (1935). This depends upon ascorbic acid

being a powerful reducing agent. The amount excreted in the urine can be measured by its reducing effect on a blue dye - Tillman's reagent, 2:6 dichlorphenolindophenol - which is decolourised.

The first step is to find the total daily excretion of ascorbic acid. As described an 0.1% solution of dye is employed, standardised frequently against a fresh solution of ascorbic acid. The urine is collected in two twelve hour periods. As ascorbic acid quickly becomes oxidised, especially in light, it is preserved by adding enough glacial acetic acid to make a 10% solution and keeping in dark glass bottles. The urine is placed in a 2 c.cm. micro-burette reading to the nearest 0.01 c.cm. If clouded the urine has first to be filtered. 0.05 c.cm. of dye solution is measured into a pointed centrifuge tube and a titration carried out, the end point being reached preferably within 1 minute, certainly within 2 minutes. A tube containing a small amount of urine is helpful for comparison.. When the urine is added the blue colour changes to red. The end point is indicated by the disappearance of the red colour. Not less than 0.5 c.cm., nor more than 2.0 c.cm. of urine should be used. It is usual to continue the test for 6 - 7 days and to calculate the daily average.

As determined by this method, the minimum daily amount excreted in a person whose vitamin C nutrition is adequate is about 13 mgm. (Harris, Abbasy, Yudkin and Kelly, 1936).

Typical examples of gross vitamin C deficiency, such as scurvy, are found associated with greatly lowered excretion of the reduced vitamin in the urine. Giving the vitamin in sufficient quantities cures the patient clinically and at the same time the urinary output rises to normal. (Harris and Ray, 1935).

There are several objections to this test

(1) It is not specific for ascorbic acid. Gluthatione, cystein, thiosulphate and ergothionine also decolourise the dye (van Eekelen, 1936). If a high protein diet is taken the amount of reducing substance in the urine is increased due, as Heinemann (1936) has shown, to increased excretion of thiosulphate. In peptic ulceration, tuberculosis and diabetes, and where the patient has a raised temperature, these substances, particularly thiosulphate, may be excreted in large amounts and give unduly big readings (van Eekelen and Heinemann, 1938).

(2) Aspirin taken during the test period causes a slight increase in the reading (Daniels and Everson, 1936, and Parsons, 1938). Youmans, Corlette, Frank and Corlette (1937) did not find such an increase.

(3) The pH of the urine affects its ascorbic acid content, raising the pH lowering the reading and lowering the pH increasing the reading. (Hawley, Frazer, Button and Stephens, 1936, confirmed by Coombs, 1937).

(4) Even with preservation by 10% glacial acetic acid, some oxidation of ascorbic acid occurs, 20-30% loss in 12 - 15 hours according to Abbasy, Harris, Ray and Marrack, (1935) and Harris, Marrack, Ray and Ward (1935).

(5) Where the urine is highly coloured the end point is difficult to determine (Harde, Rothstein and Ratish, 1935, and Bullowa, Rothstein, Ratish and Harde, 1936).

The daily average ascorbic acid excretion for 6 days having been found the "saturation" test (Abbasy et al,1935) is proceeded with. This is a confirmatory test to find degree of saturation of the patient's tissues with vitamin C. 70 mgm. ascorbic acid per stone of body weight is given daily until a response is obtained, as shown by a considerable excretion of ascorbic acid in the urine. In a deficient patient most of the ascorbic acid is retained and more than two daily doses are required to produce a significant rise in excretion. The results of the test can be expressed either as the number of days taken to produce saturation, or the amount of ascorbic acid necessary to produce saturation.

The advantages of the saturation test are that most of the objections to the simple daily average excretion test are disposed of. Thus a large increase in the ascorbic acid in the urine is due to excretion of ascorbic acid, which has been given by mouth, and not to gluthatione, etc., and the test is therefore particularly valuable in tuberculosis. Similarly with errors due to aspirin, and the colour of the urine. Also the amount by which the body is deficient in ascorbic acid is measured. Harris et al (1935) point out that the test dose technique magnifies the relatively small difference from normal obtained by the average daily excretion test, especially when that test gives figures just below normal or in the borderline region of about 10 - 15 mgm. per day.

These test methods seemed most suitable for the present investigation.

Other tests might have been used.

(1) Capillary fragility tests, either a positive pressure test - Gothlin's (1931) modification of the Rumpel-Leide test, or suction or negative pressure tests (Cutter and Johnson, 1935). These tests, as Gothlin (1937) says, are useful for mass observation and where there are no facilities for titration of ascorbic acid.

(2) Measurement of blood or plasma ascorbic acid by the method of Emmerie and van Eekelen (1934), or that of Farmer and Abt (1935) or Pijoan and Klemperer's (1937) modification.

The technique of any of these tests is rather more difficult in a small laboratory. Also, as suggested by Portnoy and Wilkinson (1938), they are best combined with an oral saturation test, which increases the difficulties.

(3) The intradermal test suggested by Rotter (1937) and modified by Portnoy and Wilkinson (1938). The value of this test has not been confirmed (Zoccoli and Lombardo, 1938, Jetter, 1938 and Goldsmith, Gowe and Ogaard, 1938).

The present investigation is of 35 patients suffering from all stages of pulmonary tuberculosis, tested by the saturation test of Abbasy et al (1935)

The dye for the test was supplied in tablet form by Roche Products, Ltd., each tablet containing an amount of 2 : 6 dichlorphenolindophenol equivalent to 1 mgm ascorbic acid, and when added to 100 c.c. of distilled water making an 0.01% solution. The urine was titrated against 1 c.cm. of this solution, made up freshly every second day. Where the urine content of ascorbic acid was high, known dilutions of the urine were made with distilled water. Where the urine content of ascorbic acid was low, it was titrated against 0.5 c.cm. dye solution.

A third of the daily test dose excreted in the following 24 hours was taken as indicating saturation.

As the urine was passed the amount was measured by the nurse in the ward and a quarter of the amount saved, to which was added sufficient glacial acetic acid to make a 10% solution. The smaller amount of urine was kept in order to economise acid. The objection may be raised that the chances of error in its measurement are increased, but the nurse soon became quite proficient. In the tests on one or two of the patients the whole amount was saved.

The patients were taken in 3 groups.

(1) 18 on absolute rest and febrile.

(2) 6 on absolute rest and afebrile. These patients were being kept in bed because of active disease.

(3) 11 on full activity - up for 12 hours each day, and doing 3 or 4 hours handicraft or gardening.

Groups 1 and 2 were thus patients with active lesions, and group 3 patients with inactive lesions.

All patients, except one, ate, before and during the test, a mixed diet containing green vegetables and a varying amount of fresh fruit. The exception was too ill to take solid food during the last part of his test.

Abbasy et al (1935) have shown that in a healthy person 25 mgm ascorbic acid daily, keeps his ascorbic acid content at such a level that the test dose of ascorbic acid will produce saturation in 2 days.

The patients' diet for the 3 weeks previous to the test and during the test was investigated by asking them to note the amount of fruit and vegetables in each of their meals. They all coöperated very well.

It was arranged to compensate for too small or too large intake of ascorbic acid previous to and during the test. If the diet was estimated to contain less than 25 mgm. daily, after the test was completed an orange, which contains about 25 mgm of ascorbic acid (Abbasy et al, 1935), and no other fruit, was given daily for 3 weeks. The test was then repeated. If the diet was estimated to contain more than 25 mgm. ascorbic acid daily, and if the patients became saturated in 2 days, as their normal ascorbic acid content might be due to excess in their diet, after 3 weeks on 1 orange daily, the test was also repeated.

A second test was not done if a patient took more than 25 mgm. ascorbic acid daily and yet did not become saturated in 2 days.

On 3 patients, although according to the above criteria the test should have been repeated, for various reasons it was not done.

The complete results are tabulated at the end with graphs of figures for each patient.

TABLE 1.

Febrile Cases.

Name.	Wt. in St.Lbs.	Aver. Daily Excretn.	A.D.E. 10 st. body wt.	Days to become sat.	Diet	Classn. of lesion	B.S.R.	Aver. Daily Excretn.	A.D.E. 10 st. body wt.	Days to become sat.	Temp. rising to	Complications
1. Hargreaves	6/7	28.8	44.3	1	+	TB+3	19.0	51.3	78.9	1	100.5	Enteritis
2. Higgins	8/10	104.6	119	1	++	TB+3	18.0	30.8	35.3	1	100.0	
3. Magee	7/5	8.5	11.4	1	+ +	TB+2	14.0	Not repeated			100.0	
4. Milner	6/1	28.9	38.1	2	+	TB+2	17.0	13.6	22.6	3	100.5	
5. Ashe	7/10	16.7	21.6	3	+	TB+3	32.0				102.0	
6. Daley	9/0	6.9	7.6	3	+	TB+2	22.0				101.0	
7. Jones	7/1	10.9	15.6	3	+	TB+2	26.0				99.5	
8. Lancaster	8/0	9.2	11.5	3	+	TB+3	24.0				102.0	Enteritis
9. Radford	9/6	38.8	42.9	3	++	TB+2	24.0	17.8	18.7	3	99.7	
10. Hampson	7/0	10.5	15.0	4	+	TB+3	16.5				101.0	
11. Horner	6/11	9.9	14.3	4	Av	TB+3	15.0				101.0	
12. Kelly	7/10	6.8	8.8	5+	+	TB+3	26.0				99.0	
13. Gilbody	9/0	6.8	7.6	6	++	TB+3	25.0				101.5	Enteritis
14. Howard	6/1	8.1	13.5	6+	+	TB+3	30.0				100.0	
15. Nuttal	8/2	5.8	7.0	6	Low	TB+3	26.0	8.5	10.2	4+	99.5	Died
16. Groom	9/0	8.8	9.8	7	Sl.low	TB+3	-	18.9	21.0	9	101.0	
17. Aukland	8/9	6.9	7.9	8	Low Av	TB+2	30.0	22.2	25.5	4	100.5	
18. Henshall	7/7	10.9	14.5	9	+ +	TB+2	29.0				100.0	

Absolute afebrile cases.

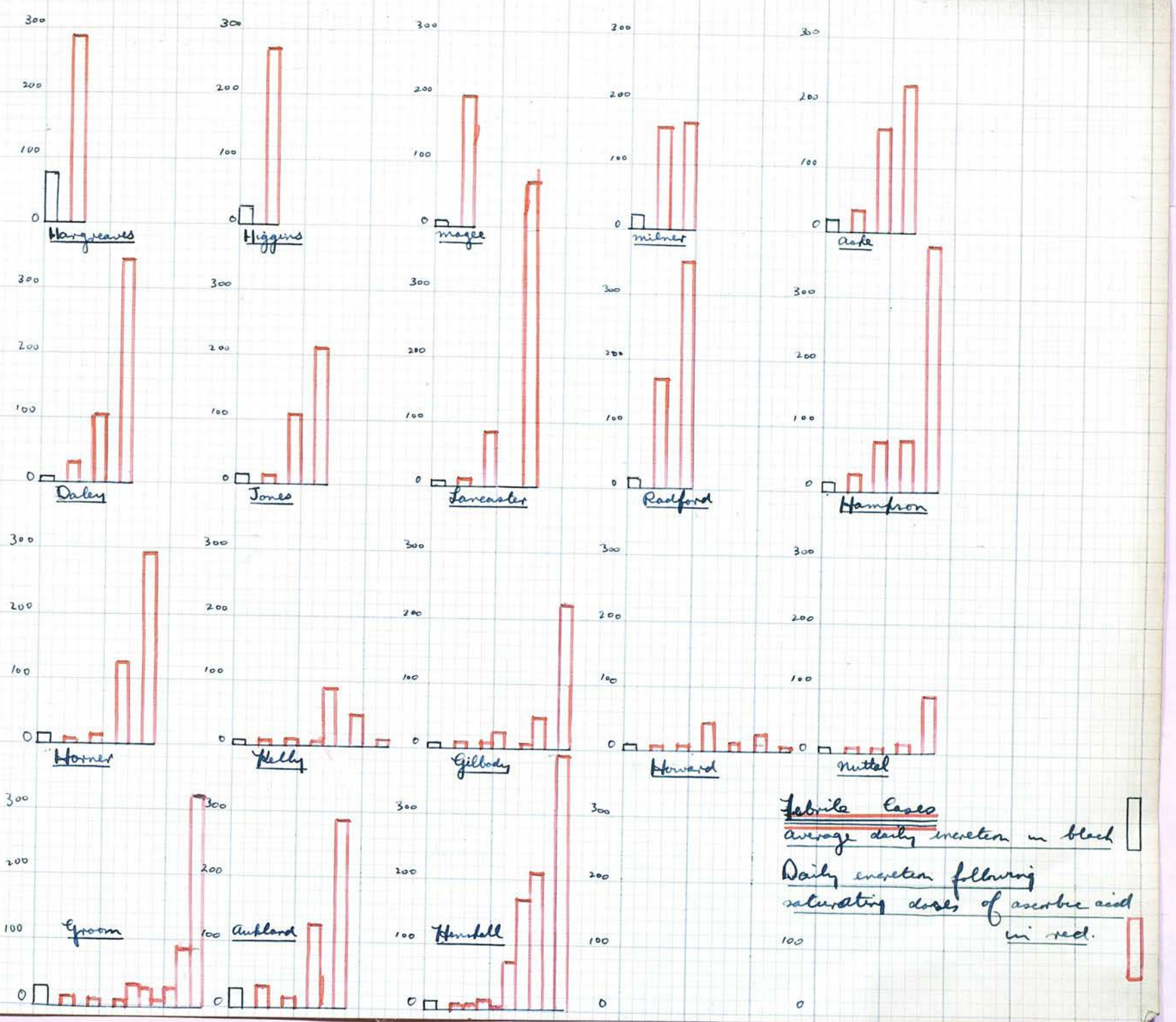
1. Blackwell	10/10	15.7	14.6	1	+	TB+2	15	18.5	17.2	2		
2. Harrop	10/11	19.5	17.3	1	+ +	TB+2	14	14.3	13.3	2		
3. Woodall	8/5	8.9	10.7	2	+ +	TB+2	6	9.7	11.7	2		
4. Petts	8	12.6	15.7	3	+ +	TB+2	24					
5. Hirwin	9/3½	7.4	8.0	4	+ +	TB+2	15					
6. Gordon	9/9	5.5	5.7	5	Sl.low	TB+2	7	8.6	8.8	3		

Very ill patients' names underlined. In tests showing discrepancies between average daily excretion test and saturation test, where the average daily excretion is beyond the limits 10-15 mgm., the figures are underlined.

Ambulant Cases.

C Name.	Wt. in St.Lbs.	Aver. Daily Excretn.	A.D.E. 10 st. body wt.	Days to become sat.	Diet	Classn. of lesion	B.S.R.	Aver. Daily Excretn.	A.D.E. 10 st. body wt.	Days to become saturated.
1. Fielden	9/2	28.2	30.1	1	+	TB+3	12.5	15.9	17.3	2
2. O'Callaghan	8/1	7.9	9.9	1	Av	TB+3	25.5			
3. Wood	11/-	17.0	15.0	1	Av	TB-	8.0			
4. Boyer	8/3	10.9	13.6	2	Av	TB-	10.0			
5. Goldsby	8/9	17.5	20.0	2	+	TB+3	17.2	17.2	19.7	2
6. Key	9/2	15.5	16.1	2	Av	TB+2	24.0			
7. Nicholson	8/1	16.7	20.8	2	Lit+	TB+2	8.0	not repeated		
8. Wilshaw	9/11	22.6	23.3	2	Av	TB+2	26.0			
9. Bird	9/8	10.9	11.4	3	Av	TB-	6.0			
10. Wolstencroft	11/-	11.5	10.5	3	Lit-	TB+3	21.0	not repeated		
11. Graupman	9/9	5.4	5.8	8	-	TB+3	11.0	12.1	12.3	2

Average diet, in these tables, is taken as 25 mgm. ascorbic acid per day.


300
200
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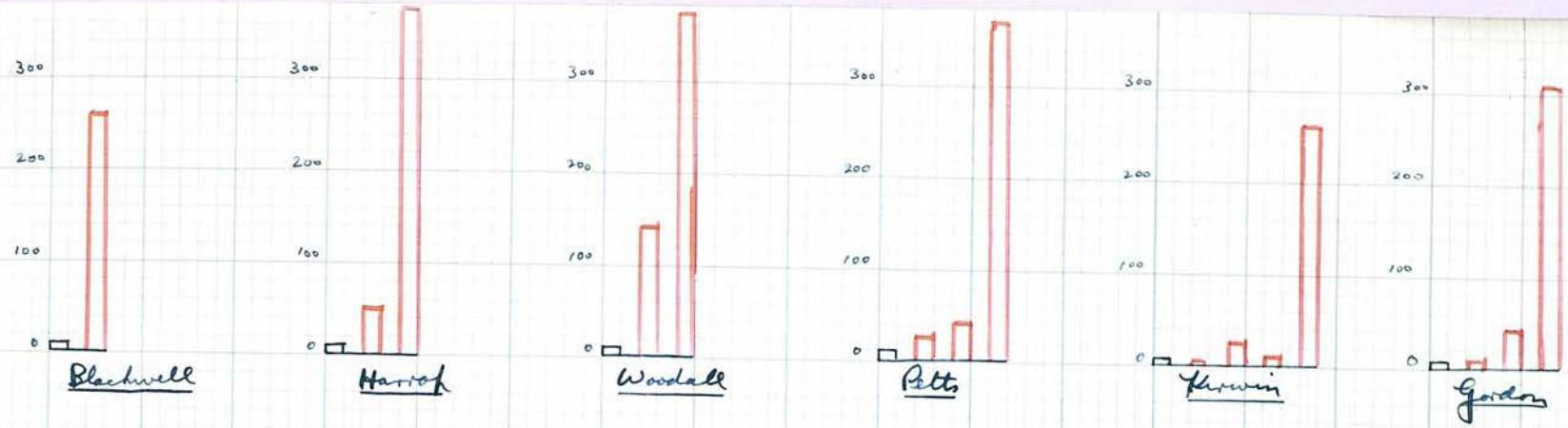
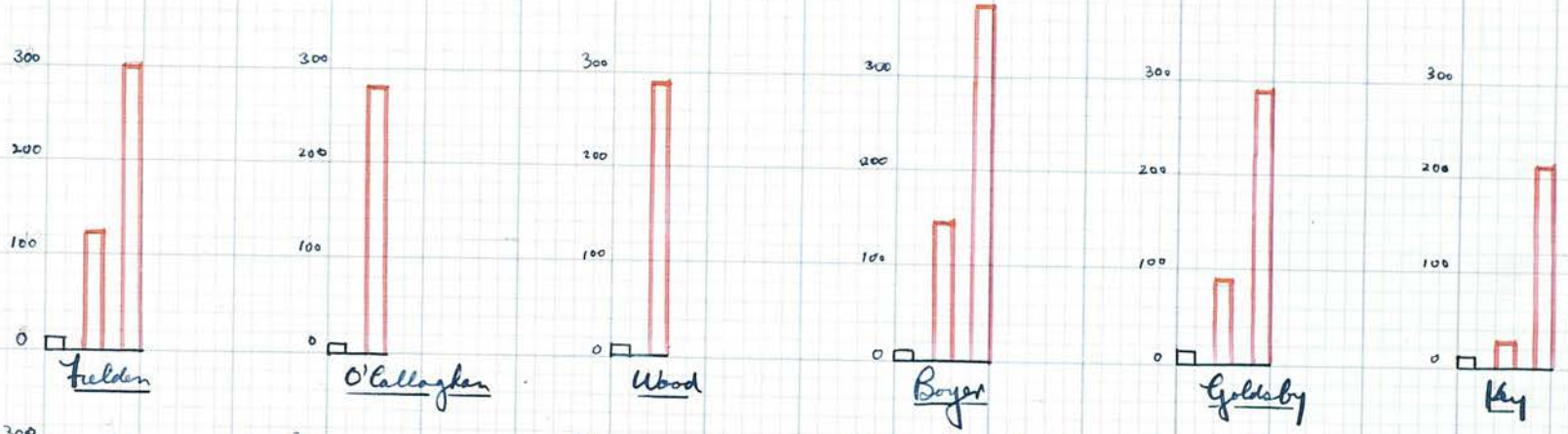
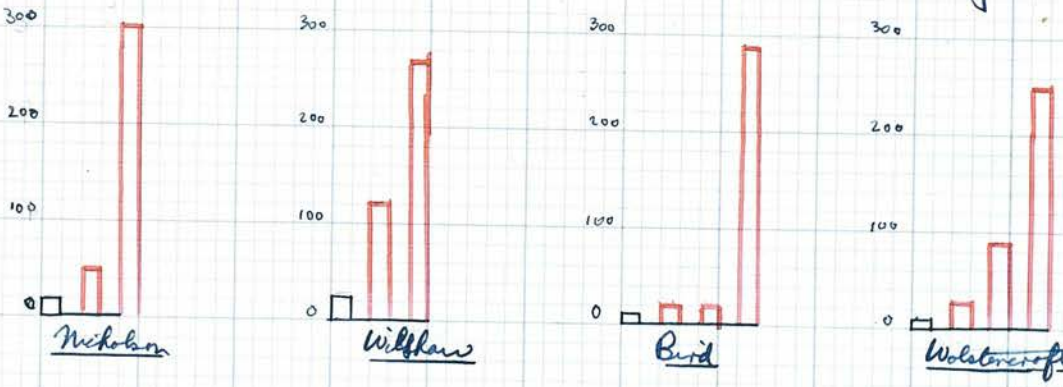
Hargreaves
Higgins
Magee
Milner
Ashe
Daley
Jones
Lancaster
Radford
Hampton
Horner
Kelly
Gilbody
Howard
Nuttal
Groom
Ashland
Hemball
Febrile Cases
average daily excretion in black
Daily excretion following
saturating doses of ascorbic acid
in red.



absolute afebrile cases





Ambulant cases.

Average daily excretion in black.

Daily excretion following saturating dose of ascorbic acid in red.

The amount of ascorbic acid excreted daily varied considerably from day to day in some patients. For example, Hargreaves who excreted 6.4 mgm. one day and 59.8 mgm. on the following day, and Milner, 39.5 mgm. and 4.7 mgm. on successive days. // The results are summarised graphically on the two preceeding pages. //

Table 1 summarises the results and Table 2 analyses them.

Table 2 - Analysis of Results

	No. of cases	Ord. Y Sanatorium diet.		25 mgm Ascorbic A/ day	
		Sat. 2 test doses	Unsat. 2 testdoses	Sat. 2 test doses	Unsat. 2 test doses
Febrile	18	4	14	2	15 *
Absolute afebrile	6	3	3	3	3
Ambulant	11	8	3	9	2
	35	15	20	14	20

* Test not repeated on one case saturated on ++ diet

It will be seen that only 15 patients out of the 35 tested showed adequate vitamin C nutrition. One of these, (Graupman), who ate no fruit was normal on repeating the test, and another (Milner) who ate a large amount of fruit was subnormal on repetition.

Of the 18 febrile patients, taking the results of the tests uncorrected for diet, 3 were normal. After the standardised ascorbic acid intake for 3 weeks, 2 were normal.

Of the 6 absolute afebrile patients 3 were normal on their ordinary diet. On repeating the test after giving the standard ascorbic acid intake to such cases as required it, the results were unchanged.

Of the 11 ambulant patients 8 were normal, 1 more becoming normal after having the standard ascorbic acid diet.

An analysis of the more severe degrees of ascorbic acid unsaturation, that is where 4 or more test doses were required to produce saturation in a patient, is shown in Table 3.

Table 3 - showing number of patients taking 4 or more days to become saturated.

	Sanatorium ordinary diet	25 mgm ascorbic acid daily
Febrile	9	9
Absolute afebrile	2	1
Ambulant	1	0

This shows that the more severe degrees of unsaturation are commonest in febrile patients.

Of the 7 very ill patients (Ashe, Gilbody, Groom, Higgins, Howard, Lancaster and Nuttal - names underlined in red in Table 1) only 1 (Higgins) was saturated within 2 days, and he ate very large amountsof fruit. 2 whose diet contained less than 25 mgm. ascorbic acid daily, did not become normal after the standard diet.

Table 4 gives an analysis of the patients according to their blood sedimentation rate. The method used for determining it was a modified Cutler, a 40 mm. column of citrated blood being used and a reading taken in 1 hour. A 12 mm column of serum is the upper limit of normality by this method. The results are given after 3 weeks on the standardised diet, if according to the criteria given above that were necessary, otherwise on their ordinary diet.

Table 4 - Analysis of results according to blood sed. rate (B.S.R.)

B.S.R.	Number	Sat. 2 test doses	Unsat. 2 test doses	Marked unsat. i.e. 4 or more test doses
12	7	5	2	0
15	3	3	0	0
20	8	4	4	3
25	6	1	5	0
30	7	2	5	4
30	3	0	3	2

The sedimentation rate was not done on one patient - Groom - who was very ill. His B.S.R. would certainly have been over 25.

This table shows that on the whole there is a correlation between the blood sedimentation rate and the degree of saturation of the patient. The greater the B.S.R. the less the saturation.

3 of the patients tested, Hargreaves, Lancaster and Gilbody, were suffering from enteritis. Hargreaves was saturated on 25 mgm. ascorbic acid per day. Lancaster and Gilbody, who both ate more than 25 mgm. ascorbic acid daily were unsaturated.

The analysis of the temperatures and sedimentation rates, together with the figures for very ill patients, indicates that the greater the activity of the disease, the greater the amount of ascorbic acid required to produce saturation, or the less adequate is such patients' ascorbic acid nutrition.

Conclusion

As a general conclusion ascorbic acid deficiency is common in patients suffering from pulmonary tuberculosis. Such deficiency is very frequent in more ill patients and not so frequent in more fit patients. Marked deficiency is also common in febrile ill patients and uncommon in those with healing lesions.

A comparison of the value of the average daily excretion test and the saturation test is made below. As mentioned previously the results of the average daily excretion test may vary considerably from day to day, interfering with its accuracy.

On the 35 patients a total of 49 tests was performed. For reasons given previously the saturation test is considered more accurate than the average daily excretion test, and so where the results of the two different tests do not agree, the saturation test result is taken as correct.

The results of the 2 different tests agreed 32 times, 18 times where the patient was shown to have adequate ascorbic acid by the saturation test, and 14 times where the patient was shown to have inadequate ascorbic acid by that test.

In the case of one febrile patient (Hargreaves), after she was put on 25 mgm. ascorbic acid daily and the test repeated, she excreted an average of 51.3 mgm. of reducing substance daily. Clearly the test did not give an accurate estimate of her ascorbic acid nutrition. She was saturated in 1 day.

5 times, where adequate ascorbic was indicated by the saturation test, the average daily excretion test gave too low a reading. Where borderline normal average daily excretion of 10 - 15 mgm. are excluded there was a discrepancy once. The figure in the test was 9.9 mgm/day so that it is just outside the borderline.

12 times, where inadequate ascorbic acid was indicated by the saturation test, the average daily excretion test gave too high a reading. Again excluding borderline average daily excretions, there was a discrepancy in 8 tests. 7 of these tests were done on febrile patients. In 5 of these tests on febrile patients the average daily excretion figure was over 20 mgm.

This shows that the average daily excretion figures cannot be relied on to give a true picture of ascorbic acid nutrition. Certainly in febrile patients suffering from pulmonary tuberculosis the results obtained by it are, in many cases, much too large. Excluding borderline average daily excretion figures of 10 - 15 mgm, then in a non-febrile patient an excretion greater than 15 mgm/day almost certainly means the patient is having adequate ascorbic acid, and an excretion less than 10 mgm/day that the amount of ascorbic acid is inadequate.

The excessively high results given by the average daily excretion test in many febrile patients are probably due to excretion of gluthatione and similar substances as shown by Heinemann (1936) and van Eekelen and Heinemann (1938).

Discussion

The finding that there is an increased need of ascorbic acid in active pulmonary tuberculosis is in agreement with that of other observers - Schroeder (1935), Hasselbach (1936), Heise and Martin (1931), Bullowa et al (1936), Abbasy, Harris and Ellman (1937), Jetter and Bumbalo (1938), Singir and van Bark (1938), Hurford (1938) and Heinemann (1938).

The greatly increased deficiency found in febrile patients and the correspondence with the condition of the patient agree with the results of Abbasy, Hill and Harris (1936) (using average daily excretion method), Heise and Martin (1936) (average daily excretion method), Abbasy, Harris and Ellman (1937) (saturation test method of Abbasy et al, 1935) Heinemann (1938) (van Eekelen's (1936) method of finding daily dose of ascorbic acid necessary).

On the other hand many disagree, that fever or activity of the disease vary the requirements of vitamin C.

Hurford (1938) (using average daily excretion method) in his investigations on 66 patients did not find that pyrexia proved a factor, nor that there was a constant relation between the extent

and activity of the disease and the ascorbic acid state. However he did not control his patients ascorbic acid intake and also the average daily excretion test gives too high readings in febrile patients.

Singir and van Bark (1938) (estimating blood ascorbic acid values) also found no correlation between the type of tuberculosis and blood ascorbic acid values.

Bullowa et al (1936) (using a saturation test method) were also unable to determine any striking correlation between the clinical condition of the patients and their ascorbic acid excretion. In employing the saturation test they gave relatively small doses of vitamin - usually 100 -200 mgm, sometimes 400 mgm per day and varied these doses from day to day, so that it is difficult to estimate the value of their results.

Vaquette (1937) used a saturation test method, giving 300 mgm. ascorbic acid per day, and although 2 controls were saturated with one such dose, that his tuberculosis subjects took 3 - 6 is not so valuable as it would be if larger test doses had been used.

The evidence is thus in favour of increased dificiency of ascorbic acid in febrile patients, suffering from pulmonary tuberculosis , and the more active the disease the more ascorbic acid is required.

Although a state of hypovitaminosis is found in chronic disease when afebrile, for example, rheumatoid arthritis, (Rinehart, Greenberg and Baker, 1936 and Abbasy, Harris and Ellman, 1937) and Addison's disease (Wilkinson and Ashford, 1936) that fever is important is shown by greatly decreased ascorbic acid reserves after the temperature has been up only a few days. For example in pneumonia, (Harde, Rothstein and Ratish, 1935) Abbasy et al, (1935) found that, while their patients were having a fixed amount of ascorbic acid daily, the onset of a feverish cold or influenza or other infection resulted in a sudden drop in daily excretion of ascorbic acid, and that an increased amount was necessary to restore the output to its previous level. Bullowa, Rothstein, Ratish and Harde (1936) found that saturation often occurred during a drop of temperature. Zook and Sharpless (1938) showed that periods of artificial fever increased the vitamin C requiremants of man.

Wright and MacLenathen (1939) have shown that the increase requirement is not due to loss of ascorbic acid in the sweat, the loss by this means being negligible.

The work of Harde and Benjamin (1934) on laboratory animals confirms these findings. They found a reduction of ascorbic acid in tissue in many infections and intoxications.

Harris, Passmore and Pagel (1936) agree. They estimated the ascorbic acid content of suprarenals and livers of guinea pigs suffering from experimentally produced P. pseudo-tuberculosis, B aertryeke infection and chronic tuberculosis, etc., and from the effects of diphtheria toxin, concluding that "Infection causes disappearance of considerable proportion of reserves, whether these be high or low."

The possible explanations of the increased vitamin C necessary in patients suffering from pulmonary tuberculosis are:-

(1) Due to the increased temperature, where with the increased metabolism more vitamin is required, just as more iron, parathyroid hormone etc., are required.

Confirming this are the results set out above, Also (a) The increased amounts of ascorbic acid

necessary in hyperthyroidism (Sure and Theis, 1938). Lewis (1938) found that of 5 hyperthyroid patients, who before operation showed less than normal excretion of ascorbic acid, 4 had normal excretion after operation.

(b) Exercise increases the requirements of rats (van Eekelen and Koay, 1933).

Even in cases without a temperature a mild increased metabolism is a probable factor.

(2) Due to lack of absorption in the gut. Only 3 of the series of patients had enteritis and one of these (Hargreaves) had persistent diarrhoea, and very frequent attacks of vomiting due to partial obstruction due to tuberculous peritonitis, yet she was saturated in one day.

Chinn and Farmer (1939) showed increased faecal excretion in patients with various gastro-intestinal disorders. They specify an alcoholic patient with a gastric resection and cases of colitis. Apparently no patients suffering from enteritis were tested.

In view of the frequency of tuberculosis of the intestine and general mild gastro-intestinal upset, lack of absorption cannot be excluded.

Wright and Lilienfeld (1936) suggest that anacidity or imbalance of the gastric excretion, bacterial destruction of vitamins in the upper part

of the gastro-intestinal tract and inflammatory changes of gastric mucosa are factors. They also suggest that the vitamin may be held in oily laxatives, as already demonstrated by Jackson (1931) with vitamin A.

(3) Due to leucocytosis. Cuttle (1938) reports increased requirements of vitamin C in leukosis, and brings evidence to show that this is partially due to the increased number of white cells. He considers that the leucocytes in infection is a factor.

(4) Specific increased need for the vitamin is certainly very doubtful.

Lack of adequate intake is of course an obvious cause of a hypovitaminosis C and is particularly liable to play a part where the appetite is impaired.

As regards the possible effects, if any, of this state of hypovitaminosis.

(1) Evidence obtained from the experimental animal.

(a) Spontaneous infections in guinea pigs suffering from experimental scurvy.

Topley and Wilson (1936) quote Hamburger and Goldschmidt (1922 - 23), Schmidt, Weyland and Koltysch (1927) and Grant (1926), who say they are common and Holst and Frölich (1912) who state they are uncommon.

(b) Experimental infection in guinea pigs suffering from experimental scurvy.

(i) Tuberculosis

Höjer (1924), Schutze and Zilva (1927) and Grant (1930) have found decreased resistance to tuberculosis in guinea pigs in hypovitaminosis. Mouriquand, Rochaise and Dosdat (1925) made similar findings. For the first 3 weeks the resistance of the animals was increased. Then it suddenly fell.

(ii) Other infections.

Findlay (1923) showed decreased resistance to S. aureus, S. haemolyticus, pneumococcus and B. coli in scorbutic guinea pigs. Schmidt,

Weyland and Koltsch (1927), quoted Topley and Wilson (1936), also found decreased resistance to the common infections.

Robertson (1934) says that there is almost unanimous agreement that there is increased susceptibility to infection in scurvy both spontaneous and experimental.

In spite of these findings the specific immunity reactions are unaffected. Zilva (1919) showed that the serum of guinea pigs suffering from scurvy after immunization with B. Typhosus, yielded agglutinin and amboceptor titres of the same order, as those obtained from the serum of animals receiving ample vitamin C.

(c) Regarding the effects of giving amounts of vitamin C above normal.

Bloch (1935), Bella (1935) and Heise and Martin (1936 - 37) reported no increased resistance in the experimental animal on such treatment. Steinbach and Klein (1936) found that it increased resistance when tuberculin was given in small but repeated doses, large enough in the aggregate to be fatal for control tuberculous animals. It had no effect on skin response to intracutaneous

inoculation and no effect when given in a single fatal dose.

Leichtentritt (1924) and Grant (1930) gave large amounts of vitamin C to tuberculous guinea pigs and noted that it decreased the severity of the lesions.

Madeson and Manwaring (1937 - 38) confirmed the results of Jusatz (1936) who reported that intravenous injection of a massive dose of ascorbic acid in rabbits increased the bactericidal power index about twofold and specific precipitation product about fivefold. They found, using horse serum as an immunizer, prompter formation of precipitins in bigger amounts, and that the precipitins so formed lasted longer.

Ascorbic acid does not have a lethal effect on the tubercle bacillus. van Gagyi (1936) found that tubercle bacilli live for at least 70 hours on media containing 5/100 parts of ascorbic acid, and their virulence was not changed. Heise and Steinken (1937) confirm this.

Summing up the position we may say that scorbutic guinea pigs show increased susceptibility to infection including tuberculosis. There is

conflicting evidence that intake of ascorbic acid above the normal modifies infections in guinea pigs.

(2) Evidence obtained from human patients.

(a) The Sub-vitamin C state and infection.

The sub-vitamin C state in man can be divided into two conditions (i) clinical scurvy, i.e. when the vitamin C content is insufficient to prevent scurvy and (ii) latent scurvy, where the vitamin C content is insufficient for complete saturation.

In clinical scurvy there is a greater tendency to infection, which runs a more serious course, and if a patient, who is on the verge of scurvy develops an infection, he will develop scurvy.

For example, Hess (1920) quotes from an earlier paper of his (1917) "Latent scurvy was prematurely changed to florid scurvy by the presence of a ward infection; an epidemic of "grippe" precipitated an epidemic of scurvy exceptional in its haemorrhagic tendency." Later he states that active pulmonary tuberculosis is not an uncommon secondary manifestation, that pneumonia is a frequent cause of death and that other infections such as pyelitis, otitis, adenitis, widespread recurrence of nasal diphtheria and "grippe" are common in scurvy in infants.

Delf (1921) states that the incidence of scurvy among the natives in South Africa rises with the morbidity from tuberculosis. Frank (1931), in the Sudan, found that when adequate vitamin C was given an epidemic of pneumonia stopped. Mettier, Minot and Townsend (1930), Mackay (1934) and Parson's (1938) observations on children, agree with these findings.

In the "latent" scurvy state there is no evidence that the susceptibility to infection is altered.

Zilva (1937) holds strong views on the subject, saying that "There seems therefore to be in human subjects also a wide margin of unsaturation, which has no obvious detrimental effect on the health of the individual. To apply to this zone of "unsaturation" such expressions as "hypovitaminosis C," "latent or potential scurvy", "vitamin C subnutrition," "subacute scurvy" - expressions which imply ill defined pathological conditions - is not justified by our present state of knowledge."

(b) The effect of giving increased amounts of ascorbic acid.

(i) On susceptibility to infection

There is no evidence that "saturation" of patients decreases their susceptibility to infection.

Wright (1936) giving patients 1,000 mgm. ascorbic acid daily for a long period records that such patients developed abscesses, tonsillitis and otitis media. Recently Fox, Dangerfield, Gottlich and Jokl (1940) tested the administration of vitamin C to a group of native miners, with another similar group as a control - 950 in all. 40 mgm. daily in excess of ordinary intake was given. No evidence of protection from infection was obtained.

(ii) On patients suffering from tuberculosis

Good results have been claimed for the treatment of intestinal tuberculosis with cod liver oil and tomato juice, as introduced by McConkey (1930). 2 of our 3 cases on such treatment were, as shown above, moderately deficient, as are very probably many cases on this treatment.

In pulmonary tuberculosis Radford, de Savitash and Sweany (1937) found a greater percentage favourable course, as judged by red cell count,

haemoglobin, lymphocytes, mononuclears, etc. in patients having 500 c.c. fresh orange juice or synthetic orange juice plus 25 mgm ascorbic acid per day, whereas cases receiving synthetic orange juice without ascorbic acid showed no such change, but their results are by no means conclusive.

Vaquette (1937) reports that his patients treated with ascorbic acid put on weight, but his series of cases is very small.

Martin and Heise (1937) concluded that there was no controlled evidence of effect of ascorbic acid therapy on course of pulmonary tuberculosis.

Josewich (1939) found their patients showed only slight improvement or not at all. There was slight improvement in haemorrhagic cases.

Hurford (1938) treated 42 patients with ascorbic acid for varying periods and found significant improvement in only 7 patients with microcytic anaemia.

Bakksh and Rabbani (1939) concluded that if ascorbic acid is deficient, it is a valuable adjuvant to other forms of treatment. Their cases were watched only 6 weeks - too short a time.

The amount of vitamin C required in healthy individuals is relevant here, since the amount required in health will have a bearing on amount required in disease.

Harris et al (1936), although they found that 75% of working class families examined were below standard in their vitamin C nutrition (middle and professional classes were above) state "A critic may argue that the accepted standard is too high, but this is a mistaken view. A comparison may justly be made with the accepted standard for the intake of iron and with the prevalence of "sub-clinical" nutritional anaemia. Large numbers of poorer people show some degree of nutritional anaemia. They may show no clear cut symptoms of illness, yet when extra iron is given their general health and fitness improve, as evidenced, for example, by their diminished morbidity rate. A similar state of affairs may be true for vitamin C. In any case an intake of one orange a day is more than adequate to bring the intake up to the level of the reputed optimum."

The objection to this argument is that there is really no evidence that saturating an individual benefits his general health, and that one orange a day would represent a considerable relative expenditure for a poor person, and, of course, nowadays they are

very difficult to obtain. Zilva (1937), as set out before, does not agree with Harris.

Other workers have put the daily requirements as considerably higher than Harris.

Gothlin (1934) by comparing human requirements to those required to protect guinea pigs from scurvy, gives the daily requirements of a man, weighing 60 kgm to protect against slightest ascertainable prescorbutic alteration - those in the capillaries - as 19 - 27 mgm.

van Eekelen (1936) put patients on a diet low in vitamin C and then saturated them. The amount required to saturate, minus amount of ascorbic acid excreted above daily average during last few days, divided by number of days on low diet, gives the daily requirements. It worked out at 60 mgm. per 70 kgm. body weight.

Heinemann (1936) using similar technique obtained a similar figure.

Such daily requirements are even more a council of perfection - representing more than 2 oranges daily.

What then should be the attitude to the low levels of vitamin C in pulmonary tuberculosis? As shown those patients with active pulmonary tuberculosis and those with pyrexia complicating the disease use much larger amounts of ascorbic acid than healthy individuals. Therefore it would appear to be rational to give them extra amounts of ascorbic acid, optionally keeping them saturated, in spite of the inconclusive evidence of this improving their condition.

In intestinal tuberculosis, where McConkey's regime of tomato juice and cod liver oil is given, in order to obtain the maximum benefit from such treatment the patients should be saturated with ascorbic acid.

Heise and Martin (1936) have shown that tuberculous patients require up to 138 mgm. per day and Heinemann (1938) has shown that febrile patients require 80 to 110 mgm.daily, so probably 100 mgm would be ample plus ordinary diet.

In afebrile patients the diet should be investigated and if it is low in vitamin C this should be corrected.

Accurately to maintain saturation van Eekelen's (1936) method, or the method suggested by Heinemann (1938) may be used. He suggests a preliminary

analysis of whole blood. With 8 mgm per litre concentration about 1,000 mgm. ascorbic acid is necessary to produce saturation. With 4 mgm per litre concentration about 2,000 mgm. is necessary. The amount presumably required is supplied in doses of 250 - 300 mgm. Then after an interval of about 12 hours the concentration of ascorbic acid in whole blood is determined. It should be about 10 - 12 mgm. per litre. 0·8 mgm. per kgm. of body weight is given daily for one week and the blood examination repeated.

The simplified saturation test technique of Harris and Abbasy (1937) might be used where 3 hour (from 9 a.m. to noon) specimens of urine are tested, each 3 hour specimen equalling fairly accurately $\frac{1}{8}$ total day's excretion. Test doses of vitamin are given as in the ordinary saturation test.

The ascorbic acid may be given as synthetic ascorbic acid in tablet form, each tablet containing 25 mgm., or in fresh fruit when in season, green vegetables and, if available, oranges. 100 mgm. daily would be difficult to obtain by eating vegetables, so that much of it would have to be given in tablets.

The saturation test does not appear to be worth while doing to find the activity of a patient's disease. The usual methods of physical signs, temperature, pulse, blood sedimentation rate and X ray findings are easier to perform and more valuable.

Summary

(1) 35 patients suffering from pulmonary tuberculosis were investigated regarding their vitamin C nutrition by urinary excretion and saturation tests.

(2) A hypovitaminosis C was found in many, greater in febrile patients with active disease.

(3) The average daily excretion test is shown to be unsatisfactory for testing febrile pulmonary tuberculous patients.

(4) The results of the workers in this field are reviewed.

(5) The possible causes of this hypovitaminosis C are mentioned.

(6) The effects of a deficiency or excess of vitamin C are considered, it being concluded that on the whole, if marked, the deficiency will have a deleterious effect, [illegible].

(7) The application of these findings to cases of pulmonary tuberculosis is considered.

Febrile patients with active disease should receive 100 mgm. ascorbic acid daily in addition to their ordinary diet.

Non-febrile patients should receive plenty of green vegetables and, if possible, fresh fruit.

My thanks are due to Dr. H. G. Trayer, medical Superintendent, Baguley Sanatorium, Cheshire, for permission to investigate the cases which were under his care, and to Roche Products, Ltd., for a generous free supply of ascorbic acid and 2 : 6 dichlorphenolindophenol tablets.

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The dose of ascorbic acid was given on the days marked thus ✱ and on the following days.

Hargreaves.

Summary of history: 22.2.32. Cough many years. Intestinal and abdominal tuberculosis. T.B. rt. hip. Not much disease in chest. Abdomen troubling her monthly. Temp. 97-100.5: Pulse 84-108. TB+3. B.S.R. 19.

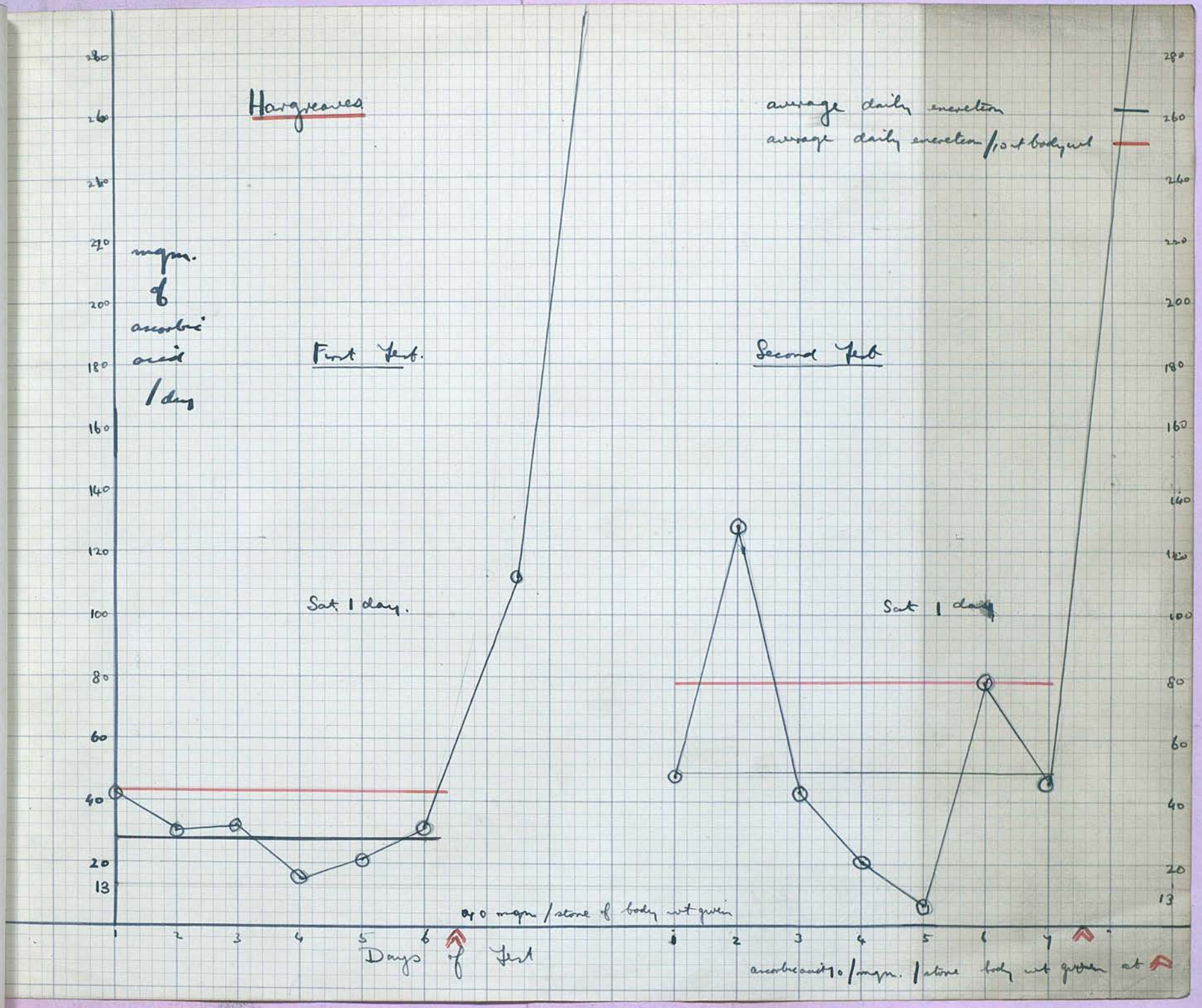
Weight - 6st. 7lbs. Dose of ascorbic acid 450 mgm. Diet - +

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
19	1029	1/2	.90	.98	.92	.90	25.4	
	814		.56	.54	.58	.56	16.3	41.7
20	971		1.01	1.03	1.01	1.02	10.7	
	181	1/8	.80	.84	.84	.83	19.4	30.1
21	543	1/2	.98	.98	1.00	.99	12.2	
	914		.50	.50	.51	.50	20.3	32.5
22	457		.90	.91	.88	.89	5.1	
	571		.64	.61	.62	.62	10.2	15.3
23	914		1.11	1.12	1.13	1.12	9.1	
	1000		.94	.91	.96	.95	11.5	20.6
24	486	1/5	1.06	1.01	1.06	1.04	16.5	
	686	1/2	.96	.95	.95	.95	15.8	32.3
25	114	1/2	.86	.85	.66	.86	3.2	
	✱ 800	1/10	.76	.76	.78	.77	114.0	
26	1600	1/10	.50	.54	.52	.52	340.0	454.0

Average daily excretion 28.8 mgm. Average daily excretion per 10 stone body weight 44.3 mgm. One day to become saturated.

Sept.								
22	486	1/2	.78	.80	.80	.79	13.8	
	1825	1/2	1.16	1.14	1.17	1.16	35.0	48.8
23	1143	1/4	.84	.90	.86	.87	56.2	
	1700	1/3	.92	.91	.88	.90	62.4	128.6
24	120		.66	.66	.64	.65	2.0	
	520	1/5	.70	.71	.73	.71	41.0	43.0
25	680		.50	.49	.49	.49	15.4	
	100	1/3	.88	.88	.88	.88	4.7	20.1
26	400	1/3	1.13	1.13	1.13	1.13	1.7	
	320		.76	.76	.79	.77	4.7	6.4
27	400	1/6	.84	.81	.84	.83	38.4	
	2120		1.07	1.10	1.12	1.10	21.4	59.8
28	160	1/2	.84	.86	.84	.85	4.2	
	1480		.76	.79	.81	.79	20.8	25.0
29	892		.88	.89	.89	.89	11.0	
	✱ 300	1/40	.96	.94	.94	.95	141.0	
30	760	1/20	1.20	1.19	1.18	1.19	141.6	293.6

Average daily excretion 51.3 mgm. Average daily excretion per 10 stone body weight 78.9 mgm. One day to become saturated.


Hargreaves
average daily excretion
average daily excretion / 10 st body wt
mgm. of ascorbic acid / day
First Test.
Second Test
Sat. 1 day.
Sat 1 day
0.1 mgm / stone of body wt given
Days of Test
ascorbic acid 10 / mgm. / stone body wt given at

Higgins.

Summary of history: Admitted 19.5.38. Cough 1 yr. General condition poor. TB+3. Ziii+ sputum. Moderate bilateral disease. Temp. 97-100. Pulse 88-96. B.S.R. 18.

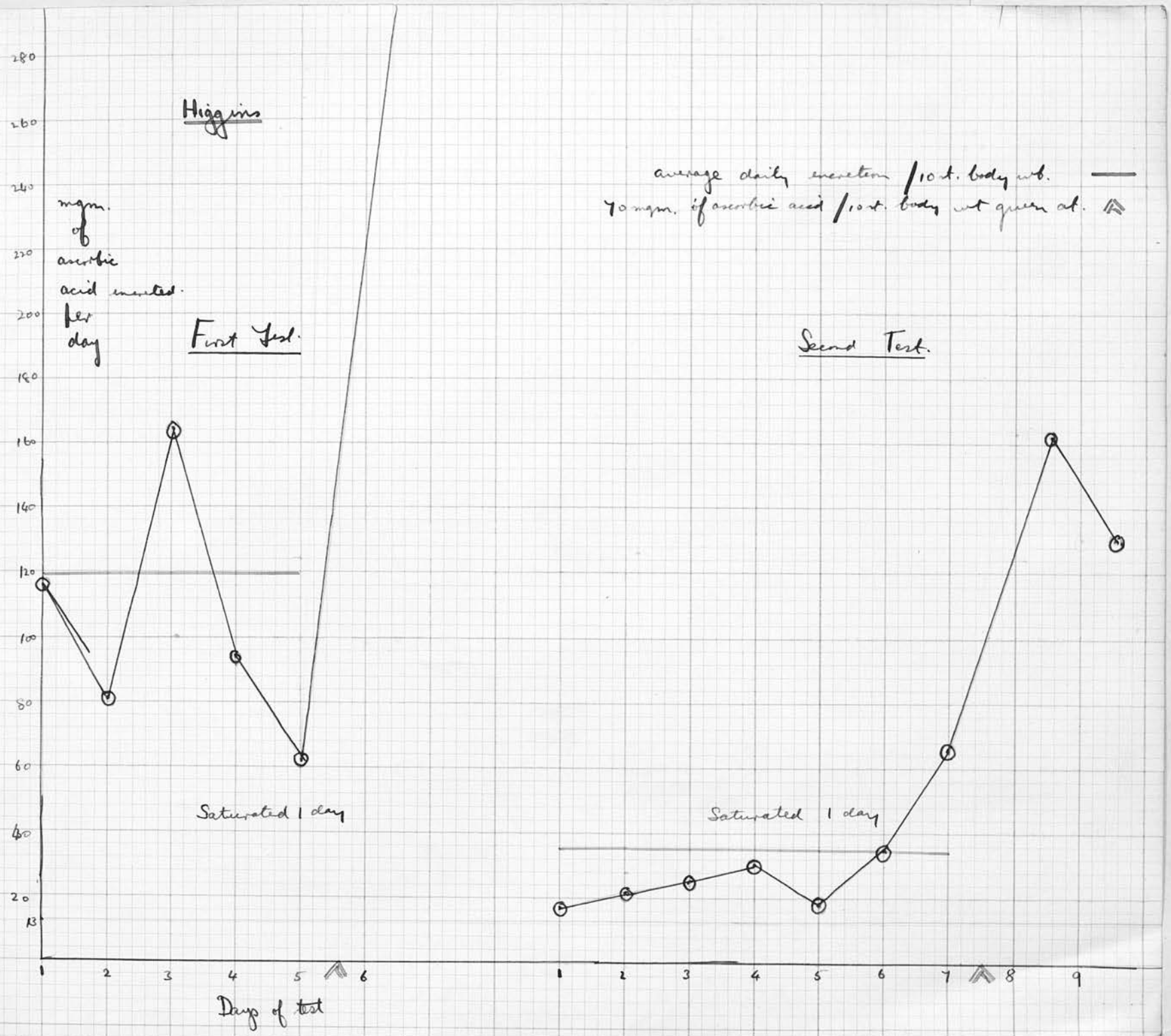
Weight 8st 10lbs. Dose of ascorbic acid 600 mgm. Diet+++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
18	886	1/10	.92	.87	.81	.86	58.0	
	1143	1/8	.87	.86	.88	.87	58.4	116.4
19	657	1/8	.52	.52	.50	.51	58.4	
	629		1.92	2.00	2.00	1.97	22.0	80.4
21	914	1/6	.72	.69	.72	.71	75.2	
	1571	1/5	.97	.99	.98	.98	89.0	164.2
22	686	1/5	.63	.60	.62	.62	53.5	
	1486	1/5	2.20	2.10	2.15	2.15	40.6	94.1
23	571	1/3	.99	1.02	1.00	1.00	19.0	
	1200	1/3	.86	.84	.88	.86	42.5	61.5
24	914	1/3	.65	.66	.68	.66	45.7	
	¥1400	1/60	1.47	1.48	1.49	1.48	311.1	
25	914 .5cc	1/50	1.21	1.19	1.19	1.20	190.0	501.1

Average daily excretion 104.6 mgm. Average daily excretion per 10 stone body weight 119 mgm. One day to become saturated.

Aug.								
19	914		1.60	1.65	1.63	1.63	6.2	
	1714		1.88	1.90	1.93	1.90	10.9	17.1
20	914		1.08	1.11	1.11	1.10	9.1	
	1029		.91	.91	.88	.90	12.5	21.6
21	1029		.88	.90	.92	.90	12.8	
	1744		1.77	1.78	1.80	1.78	12.8	25.6
22	1429		.65	.66	.66	.66	23.8	
	800		1.22	1.25	1.26	1.24	7.3	31.1
23	914		.76	.75	.75	.75	13.4	
	800		1.59	1.62	1.60	1.60	5.5	18.9
24	1614		.63	.63	.61	.63	28.0	
	971		1.50	1.49	1.52	1.50	7.2	35.2
25	543		.70	.74	.73	.72	8.4	
	571	1/5	.53	.55	.56	.55	58.0	66.4
26	457		.66	.65	.63	.65	7.9	
	¥1029	1/10	.73	.75	.72	.73	156.0	
27	800	1/10	.81	.80	.78	.80	112.0	268.0

Average daily excretion 30.8 mgm. Average daily excretion per 10 stone body weight 35.3 mgm. One day to become saturated.


Higgins
mgm. of ascorbic acid excreted per day
First Test.
Second Test.
average daily excretion /10 k. body wt. ——
70 mgm. of ascorbic acid /10 k. body wt given at ^^
Saturated 1 day
Saturated 1 day
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 2 3 4 5 6
1 2 3 4 5 6 7 8 9
Days of test

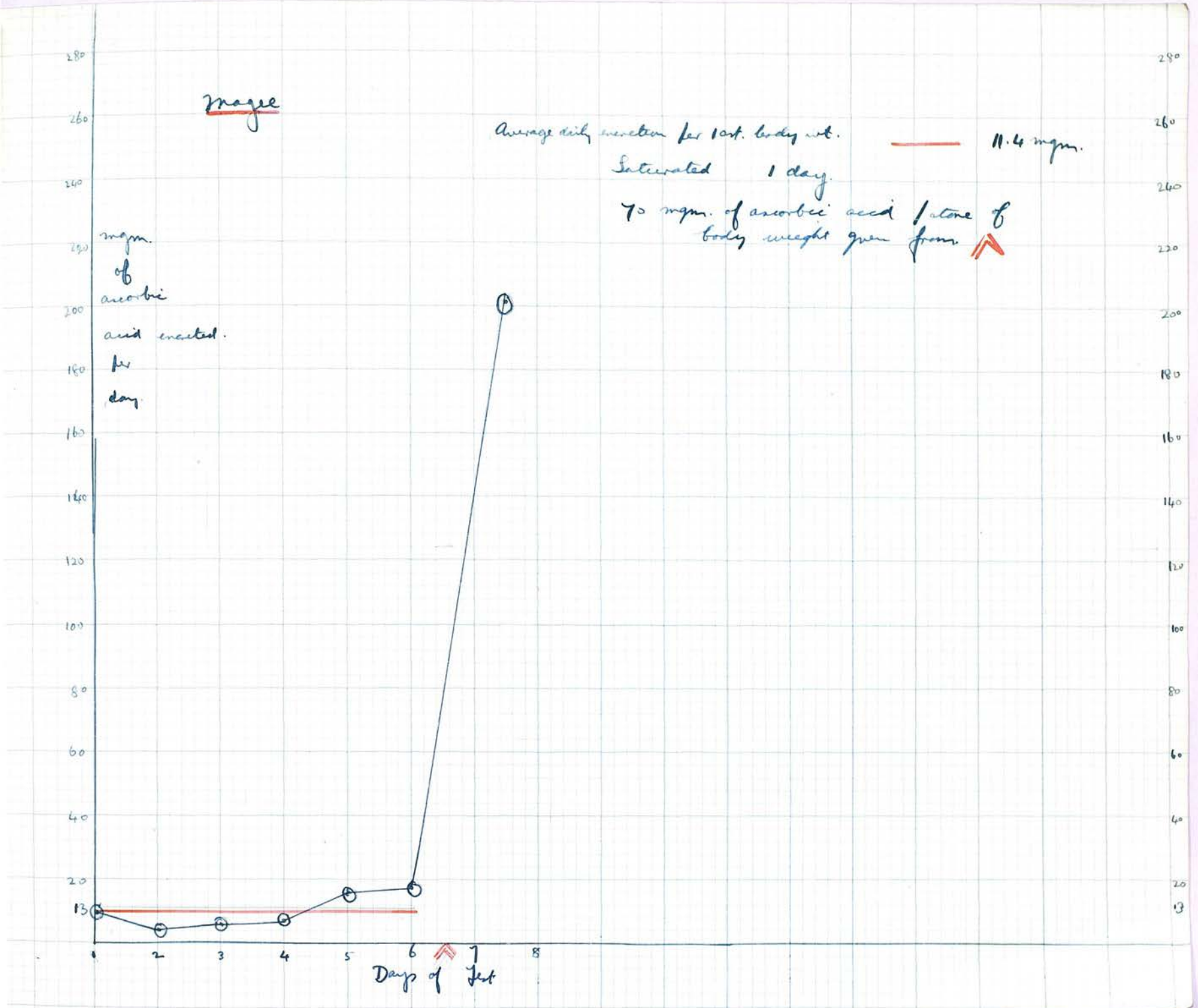
Magee.

Summary of history: Admitted 7.6.38. History lasting one year - cough, loss of weight, etc. Left upper lobe cavitation. Left artificial pneumothorax induced April. Poor collapse. General condition poor. Sputum ℥ss+ TB+2. Temp. 97-100. Pulse 98-112. B.S.R. 14.

Weight 7st 5lbs. Dose of ascorbic acid 500 mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
30	343		.99	.96	.99	.98	4.0	
	857		1.27	1.29	1.32	1.29	7.4	11.4
31	457		1.83	1.83	1.84	1.83	2.8	
	510	.5cc	1.32	1.35	1.35	1.34	2.1	4.9
Aug1	457	"	1.66	1.67	1.68	1.67	3.0	
	657	"	1.77	1.78	1.72	1.76	2.5	5.5
2	800	"	.85	.84	.87	.85	5.2	
	114		1.18	1.19	1.20	1.19	1.0	6.2
3	457		.82	.80	.84	.82	6.1	
	1142		1.21	1.22	1.22	1.22	10.1	16.2
4	1086		1.08	1.10	1.10	1.10	11.1	
	571		1.14	1.16	1.18	1.16	5.7	16.8
5	457		1.94	1.97	1.95	1.95	2.1	
	¥1143	1/20	.89	.88	.90	.89	142.8	
6	457	1/20	.87	.86	.88	.87	58.6	201.4

Average daily excretion 8.5 mgm. Average daily excretion per 10 stone body weight 11.4 mgm. One day to become saturated.


Magee
Average daily excretion per kgm. body wt.
Saturated 1 day.
11.4 mgm.
70 mgm. of ascorbic acid / stone of body weight given from
mgm. of ascorbic acid excreted per day
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
2
3
4
5
6
7
8
Days of Test

Milner.

Summary of history: 4.8.38. Cough 4 years. General condition poor. Žii+ TB+2. Extensive bilateral disease with cavitation. Temp. 97-100.5: Pulse 80-104 B.S.R. 17.

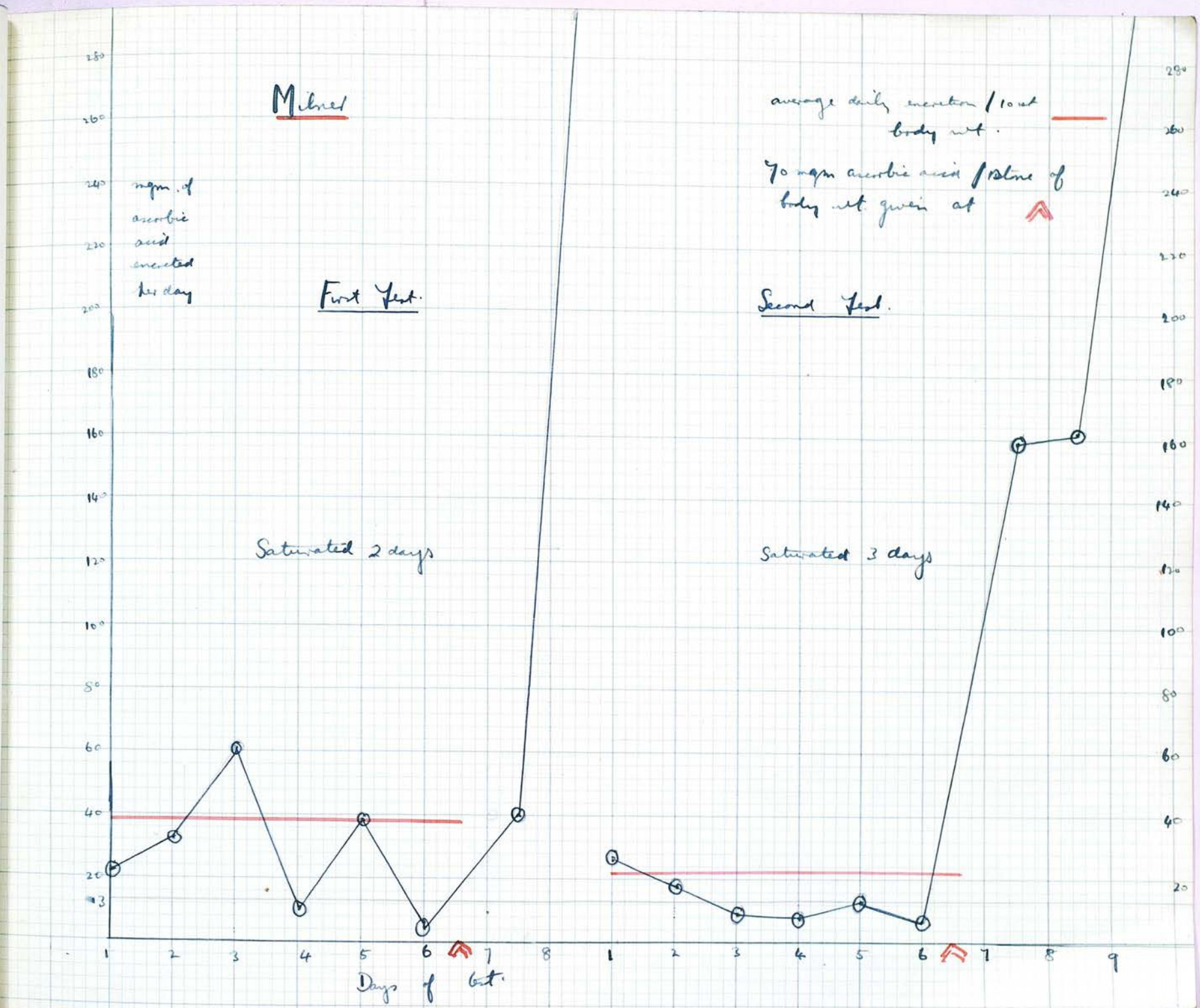
Weight 6st. 11b. Dose of ascorbic acid 450 mgm. Diet+

1938.	Amount of urine 12 hrs	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Sept.	c.c.						mgm	
22	343		.84	.86	.87	.86	6.0	
	1029		.64	.70	.69	.68	16.8	22.8
23	571		.57	.59	.61	.59	10.6	
	1270		.62	.64	.66	.64	22.0	32.6
24	520	1/2	.92	.90	.96	.93	12.4	
	440	1/3	.76	.77	.77	.77	48.0	60.4
25	480		.76	.77	.78	.77	6.9	
	200	1/2	.88	.88	.89	.88	5.0	11.9
26	800		.90	.88	.88	.89	19.0	
	380	1/3	.64	.66	.64	.65	20.5	39.5
27	200		1.39	1.37	1.34	1.37	1.6	
	160		.56	.58	.58	.57	3.1	4.7
28	400	1/2	.97	.96	.94	.96	8.2	
	Nil							8.2
29	200	1/2	.84	.82	.83	.83	5.3	
	¥Nil							
30	150	1/20	.65	.66	.65	.65	40.0	40.0
	215	1/40	.72	.74	.68	.71	134.4	
Oct.1	520	1/40	.70	.69	.69	.69	345.2	479.6

Average daily excretion 28.9 mgm. Average daily excretion per 10 stone body weight 38.1 mgm. Two days to become saturated.

Nov.5	800		.86	.86	.87	.86	10.0	
	580	1/2	.76	.78	.78	.77	16.6	26.6
6	280	1/4	.82	.80	.82	.81	17.2	
	140		.88	.90	.88	.89	1.7	18.9
7	200		.59	.59	.60	.59	3.8	
	300	1/2	1.58	1.61	1.61	1.60	4.3	8.1
8	272	1/2	1.10	1.08	1.09	1.09	5.5	
	224		1.08	1.08	1.07	1.08	2.3	7.8
9	320	1/2	.90	.91	.90	.90	7.8	
	336	1/2	1.48	1.50	1.51	1.50	5.0	12.8
10	200	1/2	1.36	1.37	1.40	1.38	3.2	
	324		1.05	1.07	1.08	1.07	3.8	7.0
15	Missed							
	¥780	1/10	.71	.71	.70	.71	122.0	
16	320	1/10	.96	.97	.97	.97	37.0	159.0
	760	1/10	.66	.66	.68	.67	127.0	
17	200	1/10	.62	.63	.64	.63	35.0	162.0
	552	1/60	.98	1.00	1.00	.99	372.0	
18	200	1/40	1.04	1.06	1.06	1.05	84.0	456.0

Average daily excretion 13.6 mgm. Average daily excretion per 10 stone body weight 22.6 mgm. Days to become saturated 3.


Mikael
mgm. of ascorbic acid excreted per day
First Test.
Second Test.
average daily excretion / 10 wt body wt.
70 mgm ascorbic acid / stone of body wt given at
Saturated 2 days
Saturated 3 days
Days of Exp.

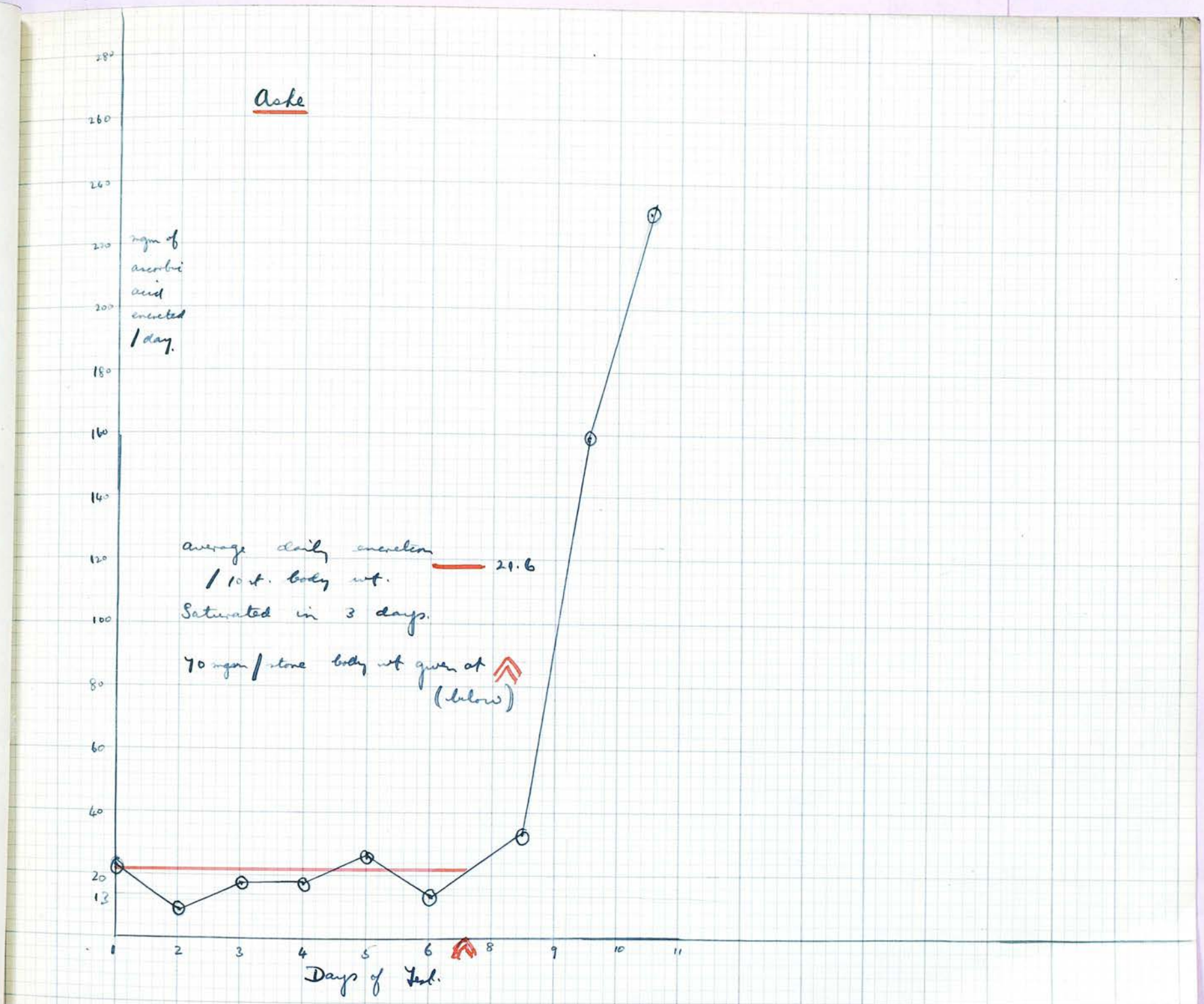
Ashe.

Summary of history: Admitted 19.5.38. Cough since winter. Staining December. Extensive disease throughout L. lung. Infiltration rt. apex & base.
TB+3. Temp. 97-102. Pulse 96-130. B.S.R.32. Died 15.8.38.

Weight 7st. 10lbs. Dose of ascorbic acid 500 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
30	628	1/2	.62	.68	.65	.65	21.6	
	114		.76	.77	.77	.77	1.5	23.1
31	343		.64	.62	.62	.63	6.0	
	229		.77	.75	.76	.76	3.4	9.4
Aug.1	600		.62	.60	.58	.60	11.1	
			.73	.76	.75	.75	6.8	17.9
2	457		.49	.50	.50	.50	13.0	
	329		.54	.53	.56	.54	4.7	17.7
3	343		.91	.92	.96	.93	9.0	
	1143		.74	.76	.72	.74	17.3	26.3
4	with faeces							
	457		.87	.90	.90	.88	14.2	14.2+
5	228		.57	.57	.60	.58	4.4	
	✱ 286		.50	.50	.52	.51	7.4	
6	343	1/20	1.32	1.32	1.34	1.32	28.0	35.4
	571	1/20	1.36	1.36	1.35	1.36	102.0	
7	457	1/20	.92	.87	.88	.88	57.8	159.8
	228	1/40	.80	.77	.77	.78	116.0	
8	457	1/20	.86	.88	.85	.86	115.0	231.0

Average daily excretion 16.7 mgm. Average daily excretion per 10 stone body weight 21.6 mgm. Days taken to become saturated - 3.


Aske
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
mgm of ascorbic acid excreted / day.
average daily excretion / 10 st. body wt. 20.6
Saturated in 3 days.
70 mgm / stone body wt given at (below)
1
2
3
4
5
6
8
9
10
11
Days of Test.

Daley.

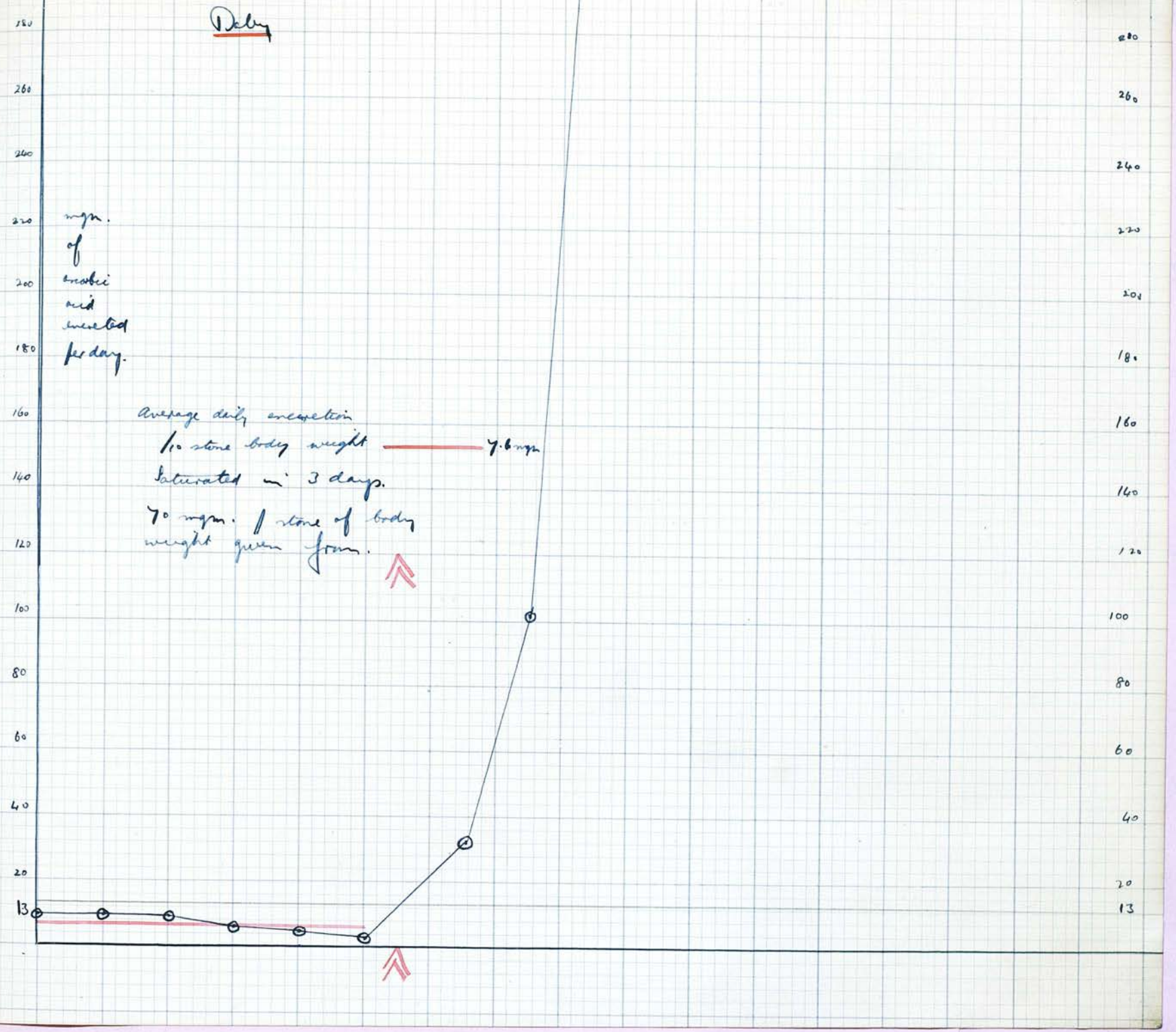
Summary of history: 5.9.38. Cough 6 years. General condition poor. Ziv+ Temp. 97-101. Pulse 84-114. B.S.R. 22. Cavitation left upper lobe and extensive infiltration right upper lobe. TB+2.

Weight about 9 stones. Dose of ascorbic acid 600 mgm. Diet+

1938.	Amount urine per 12 hours.	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
5	390		.68	.66	.66	.67	6.5	
	390		1.32	1.36	1.38	1.35	3.3	9.8
6	400		.86	.90	.88	.88	5.1	
	60	1/3	.72	.73	.72	.72	2.8	8.9
7	400		.57	.55	.56	.56	8.0	
	60		1.58	1.62	1.64	1.61	0.4	8.4
8	370		.98	1.00	.99	.99	4.2	
	480		2.90	2.95	2.97	2.94	1.9	6.1
9	330		1.10	1.11	1.08	1.10	3.4	
	610		2.86	2.88	2.89	2.88	2.3	5.7
10	580		2.38	2.37	2.25	2.30	2.8	
	270		2.87	2.73	2.77	2.79	1.1	3.9
11	130		1.72	1.76	1.78	1.75	.9	
	X 370	1/5	.83	.84	.84	.84	21.6	
12	450	1/2	.98	.98	.96	.97	11.3	32.9
	120	1/20	1.02	1.01	.99	1.00	26.0	
13	630	1/20	1.84	1.87	1.85	1.85	76.0	102.0
	810	1/20	.52	.54	.52	.53	343.0	343.0

Average daily excretion 6.9 mgm. Average daily excretion per 10 stone body weight 7.6 mgm. Days to become saturated 3.

Daily


mgm. of arabic acid excreted per day.
Average daily excretion
1/10 stone body weight ——— 7.6 mgm
Saturated in 3 days.
70 mgm. / stone of body weight given from.
180
260
240
220
200
180
160
140
120
100
80
60
40
20
13

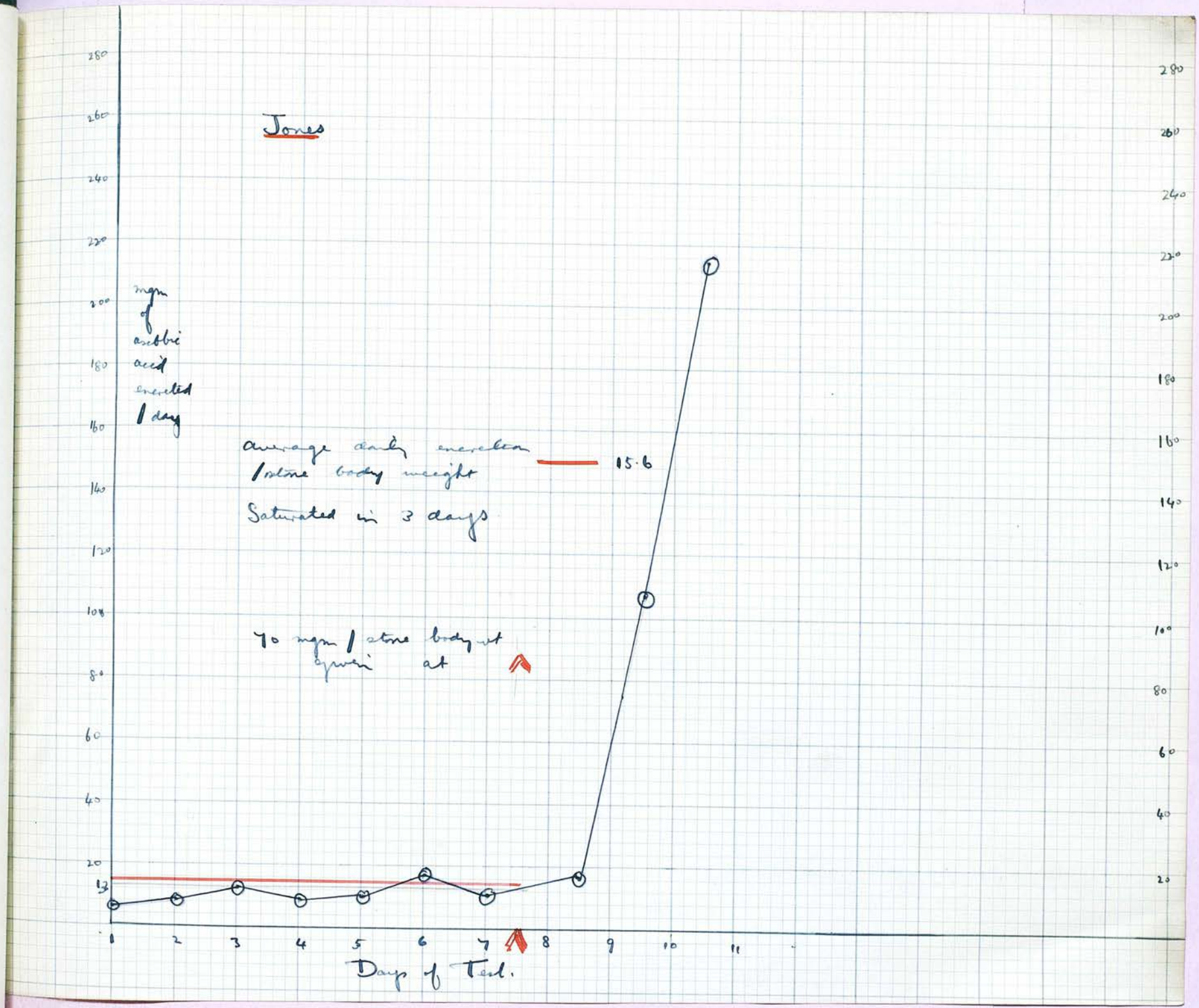
Jones

Summary of History: December 1937. Cough and loss of weight. Extensive disease of left lung with cavitation upper lobe. Scattered disease rt. particularly mid zone.
Temp. 99.5 Pulse 80.110 B.S.R. 26.

Weight - 7 st 1 lb. Dose of ascorbic acid - 500 mgm.
Diet - +

1938.	Amount urine per 12 hours C.C.	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excr. per day	Total mgm
Aug 9	200		.58	.61	.61	.60	3.7	6.7
	228		.83	.85	.86	.85	3.0	
10	271		1.19	1.20	1.23	1.21	2.5	
	800		1.53	1.55	1.56	1.55	5.7	8.2
11	343		1.6	1.6	1.61	1.60	2.4	
	1057		1.21	1.20	1.18	1.18	9.9	12.3
12	114		.81	.81	.84	.82	1.6	
	543		.82	.84	.86	.84	7.4	9.0
13	200	1/2	.9	.94	.92	.92	4.8	
	600		1.13	1.16	1.18	1.16	5.8	10.6
14	486		.55	.50	.53	.53	10.2	
	985		1.47	1.47	1.43	1.46	7.6	17.8
15	171		.56	.58	.55	.57	3.3	
	571		.84	.80	.79	.81	7.8	11.1
16	343		.94	.93	.93	.93	4.1	
	645		.61	.62	.64	.62	11.5	[illegible]
17	257		.50	.50	.50	.50	5.7	17.2
	929	1/5	.73	.72	.71	.72	71.4	
18	200	1/10	.61	.63	.62	.62	36.0	107.4
	371	1/20	.51	.54	.54	.53	154.0	
19	229	1/20	.84	.84	.86	.85	60.	214.0
	914	1/30	.82	.78	.80	.80	224.0	
20	600	1/10	.56	.57	.56	.56	117.	341.

Average daily excretion 10.9 mgm. Average daily excretion per 10 stone body weight 15.6 Days to become saturated - 3


Jones
mgm of ascorbic acid excreted / day
average daily excretion / stone body weight
15·6
Saturated in 3 days
70 mgm / stone body wt given at
Days of Test.

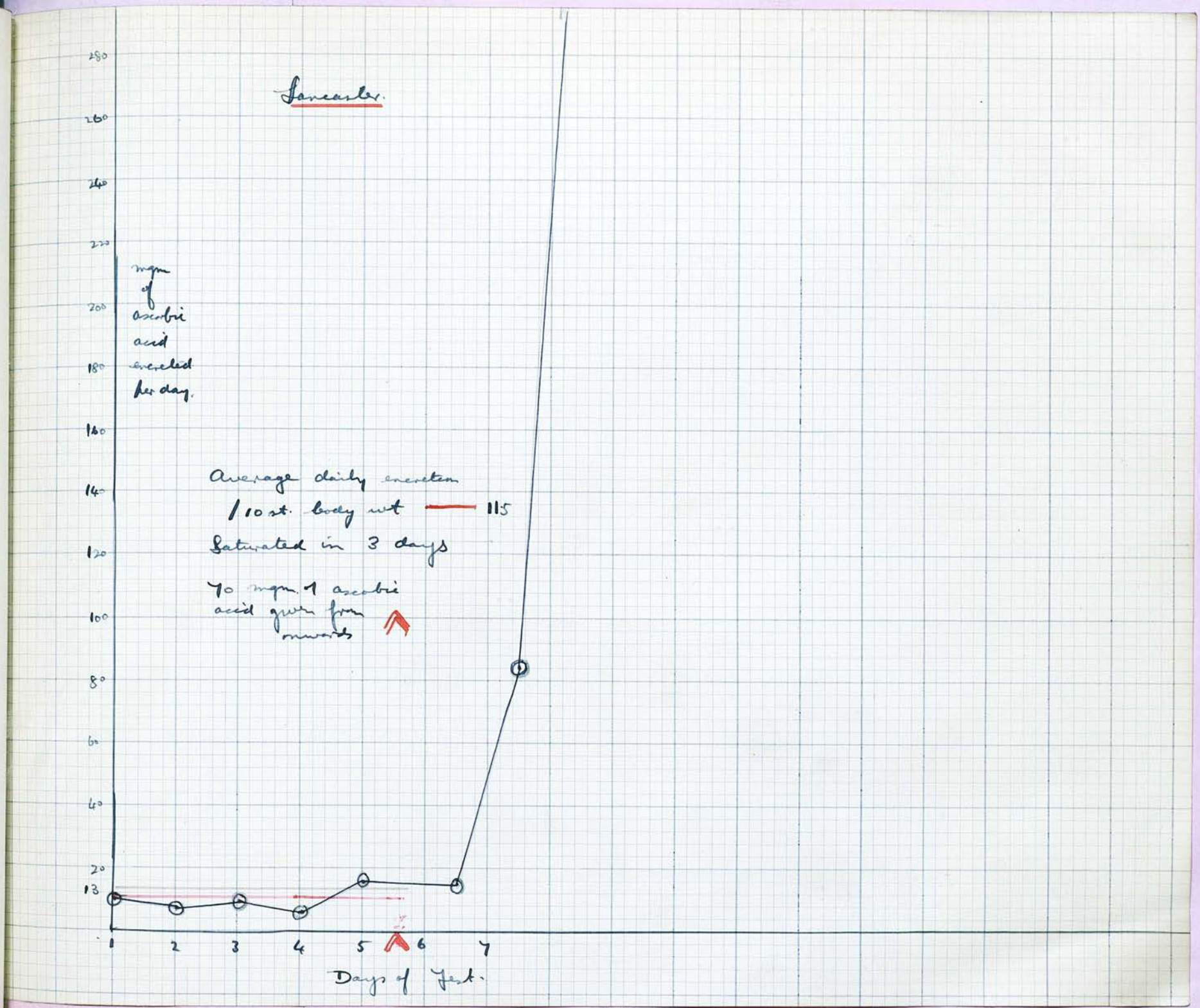
Lancaster.

Summary of history: 17.3.38. Ex+ TB+3. Cough, spit, weakness, one year. T.B. larynx and intestinal tuberculosis 5 weeks. Extreme bilateral disease with cavitation. Persistent diarrhoea. Larynx gross ulceration. Temp.97-102 Pulse 90-110. B.S.R. 24.

Weight about 8 stones. Dose of ascorbic acid 550 mgm. Diet average. ½ss tomato juice and cod liver oil daily.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
23	252	.5cc	.94	.97	.95	.95	1.3	
	320	1/4	1.49	1.50	1.52	1.50	8.4	9.7
24	600		1.88	1.86	1.88	1.87	7.0	
	120		1.28	1.28	1.29	1.28	.5	7.5
25	400	.5cc	.49	.51	.54	.51	4.5	
	600	"	.89	.90	.91	.90	3.7	8.2
27	600	"	1.61	1.58	1.61	1.60	2.6	
	400		1.33	1.34	1.36	1.34	3.3	5.9
28	400		.59	.59	.57	.58	3.3	
	740		.65	.64	.67	.65	12.5	15.8
29	458		.62	.62	.61	.62	8.2	
	✕ 272		1.00	1.00	.98	1.00	3.0	
30	600		.53	.51	.54	.53	12.5	15.5
	332	1/20	.88	.88	.86	.87	84	
31	Lost							84+
	1232	1/25	.84	.84	.81	.83	410.0	
Aug1	300	1/25	1.27	1.27	1.30	1.29	65.0	475.0

Average daily excretion 92 mgm. Average daily excretion per 10 stone body weight 11.5 mgm. ~~Two~~ Three days to become saturated.


Jonesville.
mgm of ascorbic acid excreted per day.
Average daily excretion
1/10 st. body wt — 115
Saturated in 3 days
70 mgm. of ascorbic acid given from onwards
Days of Test.

Radford.

Summary of history: 15.1.38. 6 months history. Zi+ TB+3
Developed serous effused extensive generalised disease left lung with cavitation upper lobe. Artificial pneumothorax 25.1.38.-23.3.38. Larynx 26.7.38. Temp. 97-99.7. Pulse 84-100. B.S.R. 24.

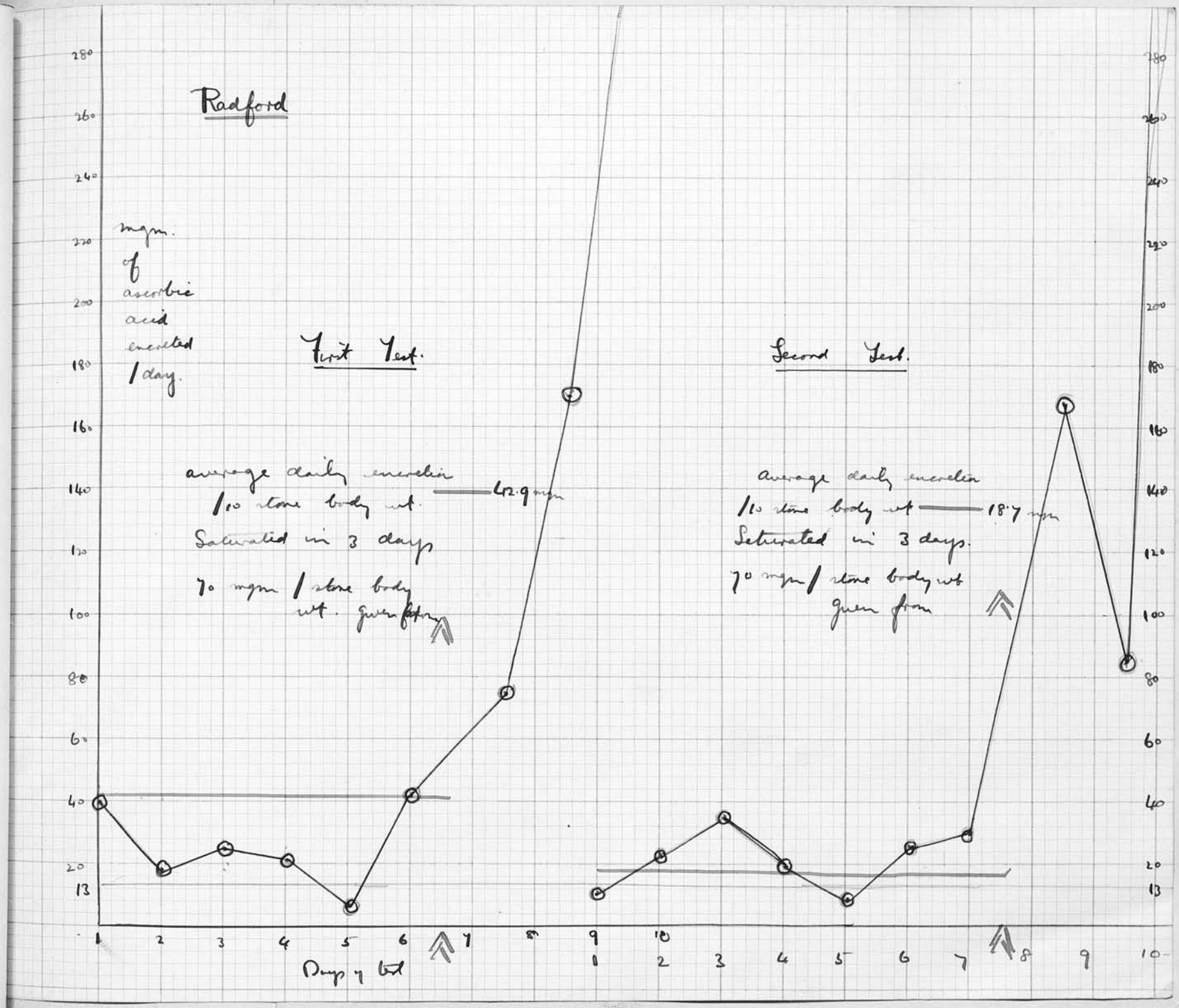
Weight 9st 6lbs. Dose of ascorbic acid 650 mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Sept.	c.c.						mgm	
22	514	1/3	.55	.57	.58	.57	30.0	
	514	1/3	1.21	1.18	1.29	1.22	14.1	44.1
23	686	1/4	2.19	2.11	2.15	2.15	28.3	
	430	1/5	1.94	1.94	1.96	1.94	12.5	41.8
24	240	1/3	1.01	.98	1.00	1.00	7.5	
	520	1/2	1.04	1.01	.98	1.01	10.4	17.9
25	600		.58	.59	.62	.60	11.1	
	393	1/3	.55	.56	.57	.56	14.0	25.1
26	320	1/2	.98	1.00	.99	.99	7.2	
	720	1/3	.62	.60	.58	.60	13.3	20.5
27	with faeces.							
	600		.86	.85	.81	.84	7.9	7.9+
28	340		.65	.60	.60	.62	6.2	
	900		.78	.80	.81	.80	37.6	43.8
29	x160	1/20	.96	.96	.92	.95	36.0	
	x200	1/20	.78	.78	.74	.77	58.0	
30	50	1/20	.62	.63	.63	.63	17.8	75.8
	105	1/40	.74	.78	.76	.76	61.6	
Oct1	300	1/20	.63	.60	.61	.61	109.0	170.6
	180	1/60	.78	.80	.79	.79	150.0	
2	600	1/50	1.65	1.67	1.66	1.66	207.0	357.0

Average daily excretion 38.8 mgm. Average daily excretion per 10 stone body weight 42.9 mgm. Days taken to become saturated - 3.

Oct.								
26	240		.86	.86	.87	.86	6.1	
	300		.69	.68	.68	.68	5.7	11.8
27	320		.56	.56	.55	.56	6.4	
	520	1/3	1.04	1.01	1.04	1.03	16.2	22.6
28	540	1/3	1.05	1.02	1.01	1.03	17.4	
	760	1/3	1.38	1.39	1.36	1.38	18.3	35.7
29	360	1/6	1.28	1.29	1.31	1.29	18.1	
	160		1.10	1.11	1.12	1.11	1.6	19.7
30	380	1/2	1.56	1.57	1.52	1.55	5.4	
	520	1/2	1.03	1.04	1.04	1.04	2.7	8.1
31	220	1/2	1.47	1.48	1.48	1.48	3.4	
	700	1/3	.98	.99	.99	.99	22.7	26.1

-contd.


Radford
mgm. of ascorbic acid excreted / day.
First Test.
Second Test.
average daily excretion / 10 stone body wt. 42.9 mgm
Saturated in 3 days
70 mgm / stone body wt. given from
average daily excretion / 10 stone body wt 18.7 mgm
Saturated in 3 days.
70 mgm / stone body wt given from
Days of test

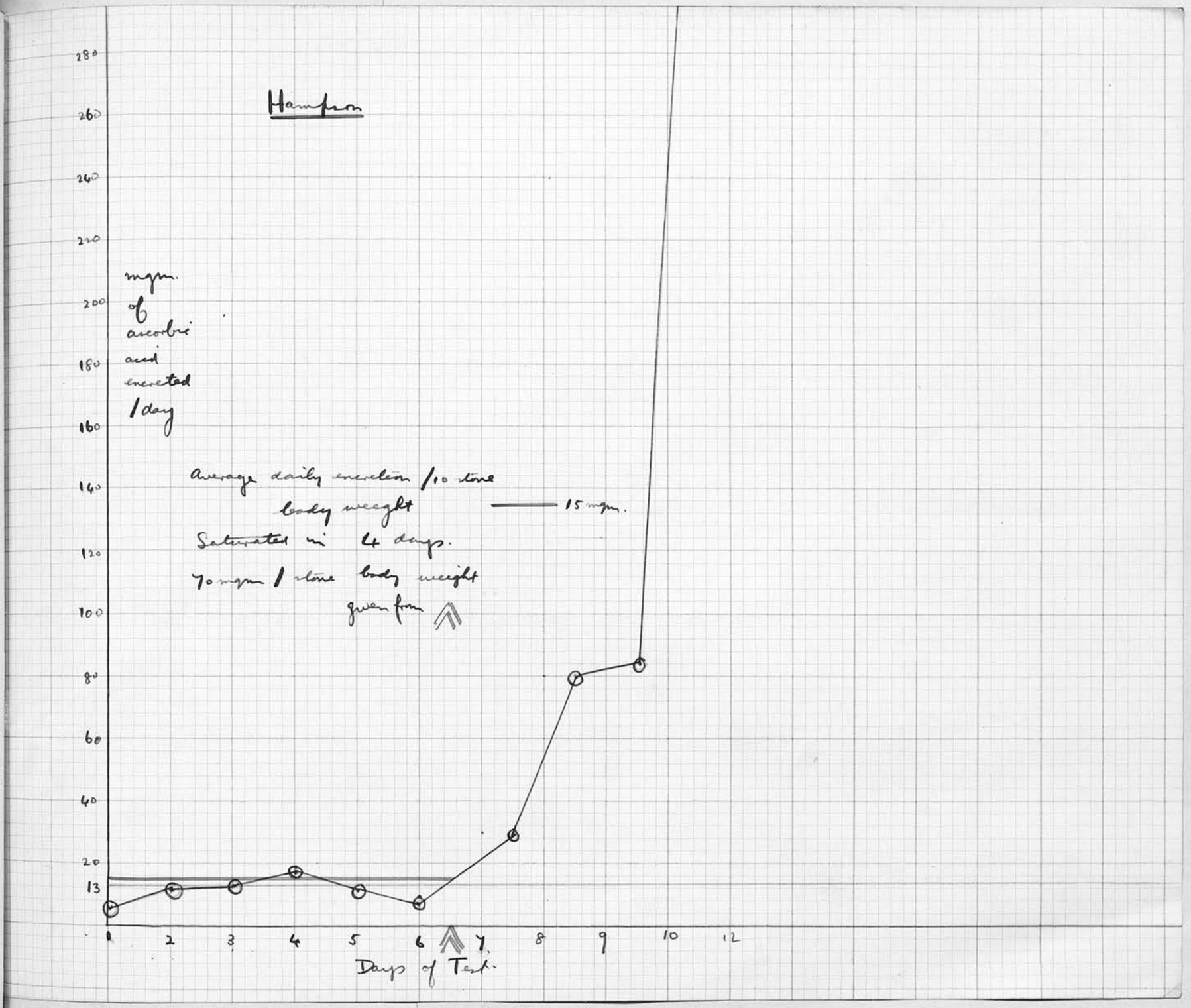
Hampson.

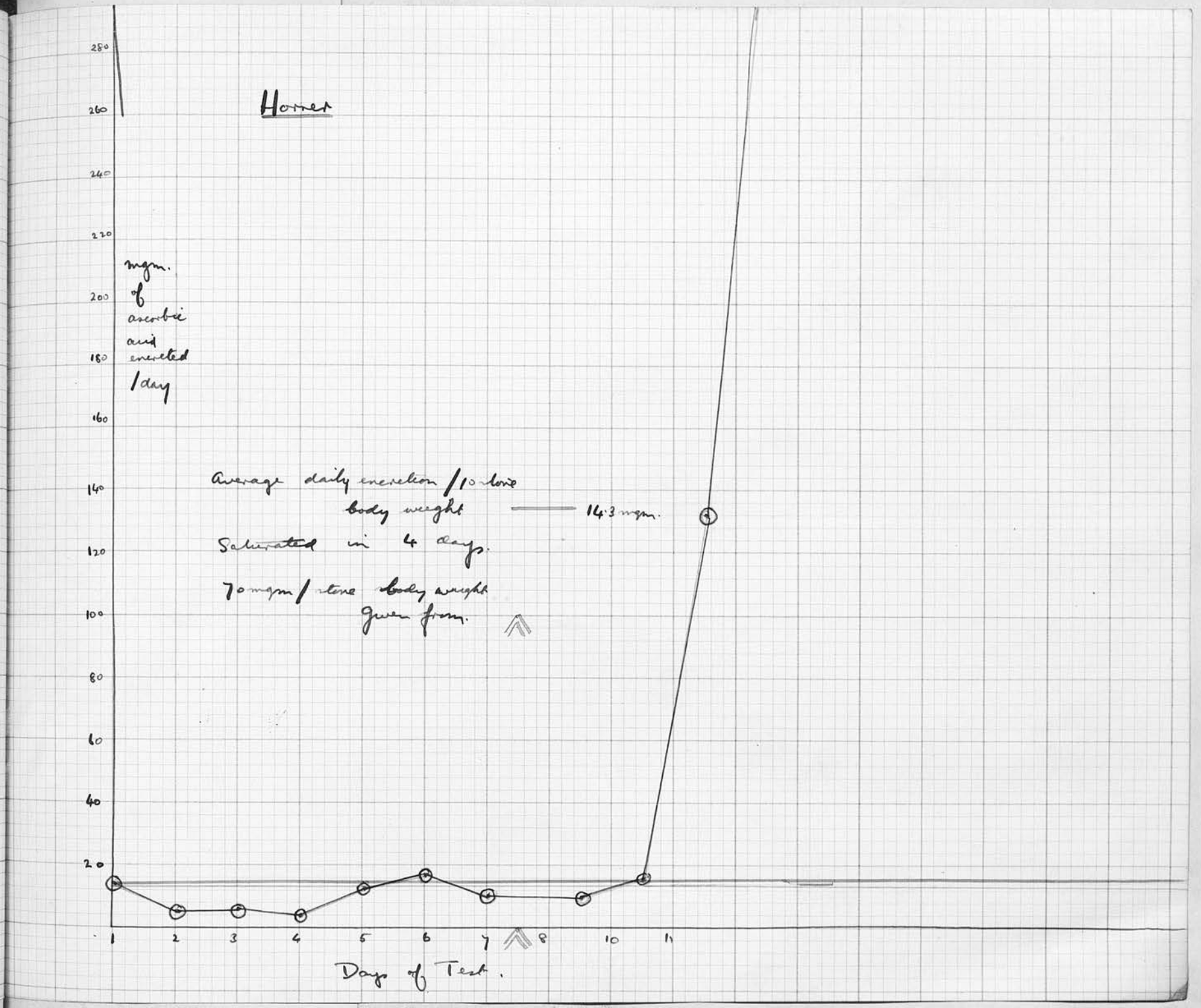
Summary of history: Six months history of cough. Scattered bilateral disease with cavitation. ℥i of positive sputum. Deveoped tuberculosis of larynx 19.5.38. Temp. 97-101. Pulse 88-110. B.S.R. 16.5.

Weight about 7 stones. Dose of ascorbic acid 500 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm.	
11	228		1.71	1.65	1.69	1.67	1.4	
	629		1.79	1.73	1.76	1.76	3.9	5.3
12	571	.5cc	1.75	1.75	1.80	1.47	2.2	
	771		1.03	.97	.99	1.00	8.5	10.7
13	314		.59	.55	.54	.56	6.3	
	486		.95	.90	.92	.92	5.8	12.1
14	628		.71	.70	.74	.73	9.6	
	414		.62	.64	.68	.64	7.2	16.8
15	457		.98	.97	.98	.98	5.2	
	371		.69	.69	.67	.68	6.1	11.3
16	457		1.20	1.21	1.17	1.93	4.3	
	571		1.89	1.92	1.86	1.89	3.6	7.9
17	714		1.33	1.35	1.33	1.34	5.9	
	✱1270		.74	.70	.73	.72	19.6	
18	543		.65	.66	.65	.65	9.4	29.0
	771	1/10	1.28	1.24	1.26	1.26	68.0	
19	628	1/2	.60	.56	.59	.58	12.0	80.0
	457	1/10	2.37	2.40	2.44	2.40	21.0	
20	571	1/10	1.06	1.07	1.08.	1.07	63.0	84.0
	600	1/20	1.11	1.13	1.14	1.13	119.0	
21	686	1/20	.57	.59	.57	.58	264.0	383.0

Average daily excretion 10.5 mgm. Average daily excretion per 10 stone body weight 15 mgm. Days to become saturated--4.


Hampson
mgm. of ascorbic acid excreted / day
Average daily excretion / 10 stone body weight
15 mgm.
Saturated in 4 days.
70 mgm / stone body weight given from
Days of Test.
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
2
3
4
5
6
7
8
9
10
12


Horner
280
260
240
220
200
180
160
140
120
100
80
60
40
20
mgm. of ascorbic acid excreted / day
Average daily excretion / 10 stone body weight — 14·3 mgm.
Saturated in 4 days.
70 mgm / stone body weight given from.
1
2
3
4
5
6
7
8
10
11
Days of Test.

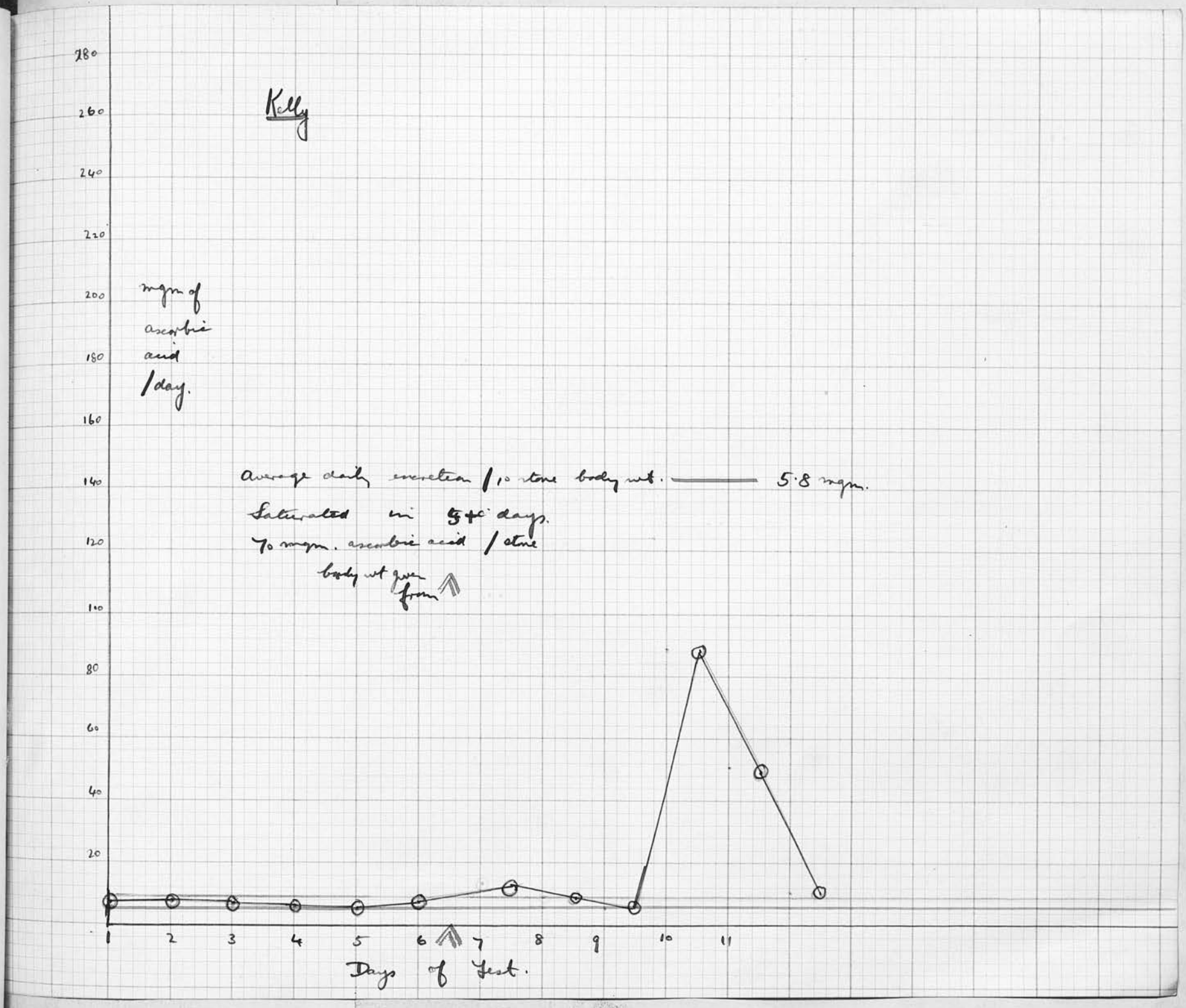
Kelly.

Summary of history: Patient from 30.11.36.-29.4.37. 26.8.37.-21.10.37. 7.7.38.-onwards. Bronchitis 4 yrs. Sever pneumothorax 25.12.37. TB+3. Temp. 97-99. Pulse 80-100. B.S.R. 26. Bilateral fibrotic disease with cavitation. Took discharge 10.8.38. against advice.

Weight 7st. 10lbs. Dose of ascorbic acid - 550 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
29	224		.96	.94	.90	.94	2.7	
	1080		1.22	1.18	1.21	1.22	4.9	7.6
30	580		1.27	1.29	1.31	1.29	2.5	
	600	.5cc	.60	.61	.63	.61	5.4	7.9
31	200		.52	.53	.52	.52	4.3	
	600	.5cc	1.18	1.20	1.21	1.19	2.8	7.1
Aug1	600	"	1.28	1.31	1.35	1.31	2.5	
	1172	"	1.69	1.70	1.71	1.70	3.6	6.1
2	648	"	1.31	1.32	1.36	1.33	2.7	
	300	"	1.15	1.15	1.16	1.15	1.4	4.1.
3	300	"	.62	.59	.64	.62	2.7	
	800		.79	.78	.80	.79	5.6	8.3
4	760	"	1.44	1.45	1.48	1.46	2.5	
	¥ 800		.98	1.02	1.01	1.00	8.9	
5	680	.5cc	.96	.95	.95	.95	3.9	12.8
	280	"	1.35	1.35	1.36	1.35	1.2	
6	680		.92	.90	.94	.92	8.4	9.6
	320		.65	.65	.67	.66	5.5	
7	Lost							5.5+
	700	1/5	.64	.61	.60	.62	63.6	
8	800	1/20	.72	.75	.74	.74	24.6	88.2
	800	1/5	1.22	1.21	1.19	1.21	44.4	
9	600		1.00	1.05	1.05	1.03	6.4	50.8
	700		.79	.80	.79	.79	9.8	
10	220		1.94	1.92	1.94	1.93	1.3	11.1
	800		1.20	1.21	1.20	1.20	4.1	

Average daily excretion 6.8 mgm. Average daily excretion per 10 stone body weight 5.8 mgm. Days to become saturated 5+


Kelly
mgm of ascorbic acid / day.
average daily excretion / 10 stone body wt. ——— 5·8 mgm.
Saturated in 5 4 days.
70 mgm. ascorbic acid / stone body wt given from
280
260
240
220
200
180
160
140
120
100
80
60
40
20
1 2 3 4 5 6 7 8 9 10 11
Days of Test.

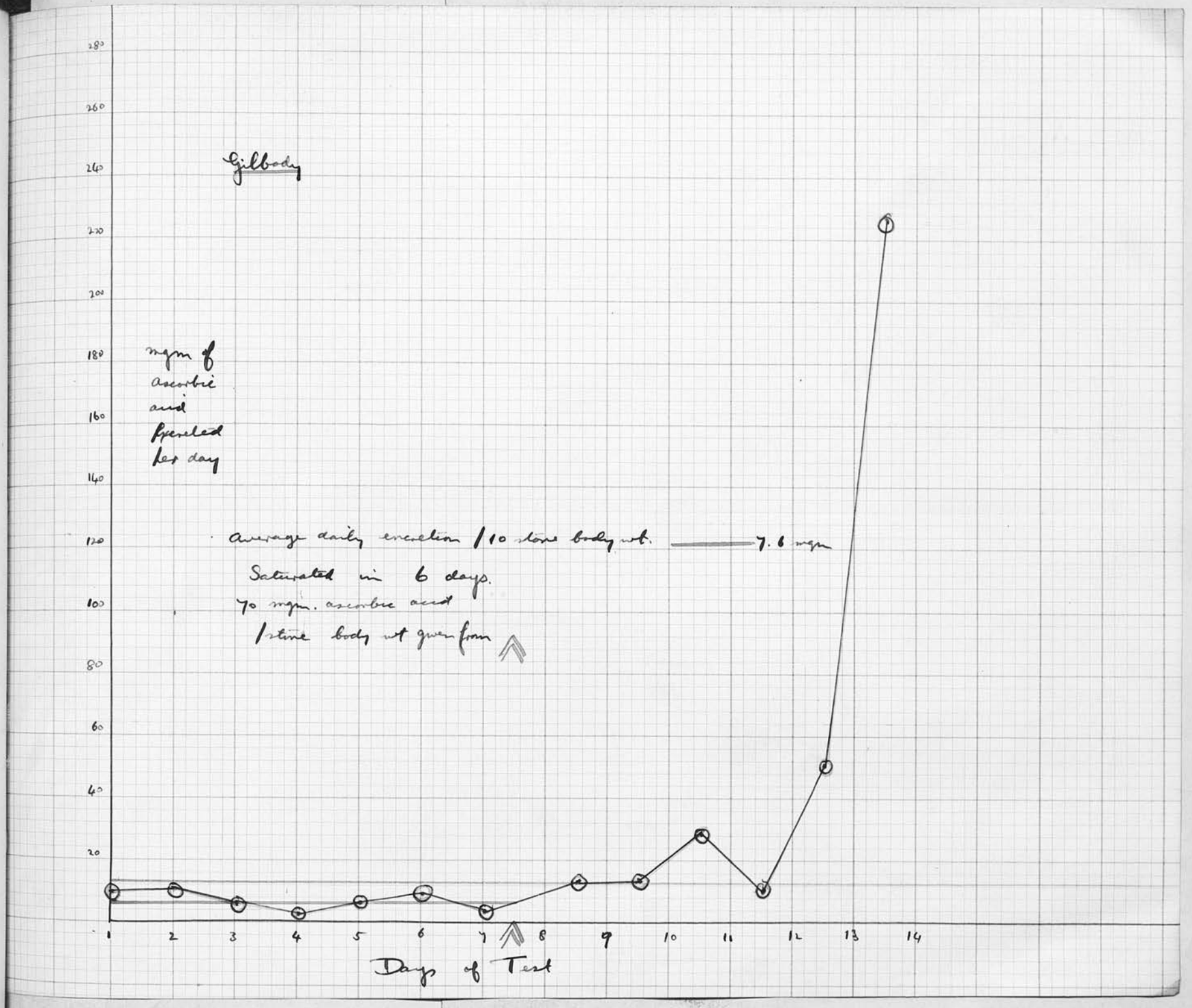
Gilbody.

Summary of history: Admitted 15.9.38. History of 16 months. Poor condition. Great loss of weight. ŻiiiT sputum. Temp. 97-101.5: Pulse 110-112. Extensive bilateral disease. TB+3. B.S.R.26.5 Enteritis.

Weight: About 9st. Dose of ascorbic acid 600 mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
4	240		.67	.65	.68	.67	4.0	
	245		.59	.61	.64	.61	4.4	8.4
5	230	1/2	.64	.61	.62	.62	8.2	
	138		.51	.55	.53	.53	2.9	11.1
6	148	1/2	.82	.84	.84	.83	3.9	
	70	1/3	1.43	1.46	1.44	1.44	1.8	5.7
7	40	1/3	.70	.73	.71	.71	1.8	
	80		.62	.63	.64	.63	1.4	3.2
8	250		.54	.56	.54	.55	5.0	
	150		.95	.95	.97	.96	1.7	6.7
9	360		.60	.63	.65	.64	6.3	
	320		1.17	1.18	1.20	1.18	3.0	9.3
10	150		.54	.54	.53	.53	3.2	
	20		.86	.86	.87	.86	.3	3.5
11	20		1.97	2.04	2.03	2.01		
	X370	1/2	1.13	1.17	1.15	1.15	2.8	
12	300	1/2	.60	.58	.61	.60	11.0	13.8
	630	1/2	.96	.96	.95	.96	14.3	
13								14.3
	156	1/3	.53	.54	.53	.53	10.2	
	200	1/5	.65	.64	.65	.65	17.2	27.4
14	100	1/10	1.36	1.36	1.38	1.37	8.1	
	100	1/10	1.77	1.77	1.75	1.76	6.3	14.4
15	220	1/50	1.02	1.02	1.02	1.02	12.0	
	120	1/20	.69	.68	.69	.69	38.8	50.8
16	360	1/40	.82	.79	.80	.80	200.0	
	220	1/20	1.81	1.79	1.79	1.80	26.0	226.0

Average daily excretion 6.8 mgm. Average daily excretion per 10 stone body weight 7.6 mgm. Days to become saturated - 6.


Gilbody
mgm of ascorbic acid excreted per day
average daily excretion / 10 stone body wt. ——— 7.6 mgm
Saturated in 6 days.
70 mgm. ascorbic acid / stone body wt given from
Days of Test

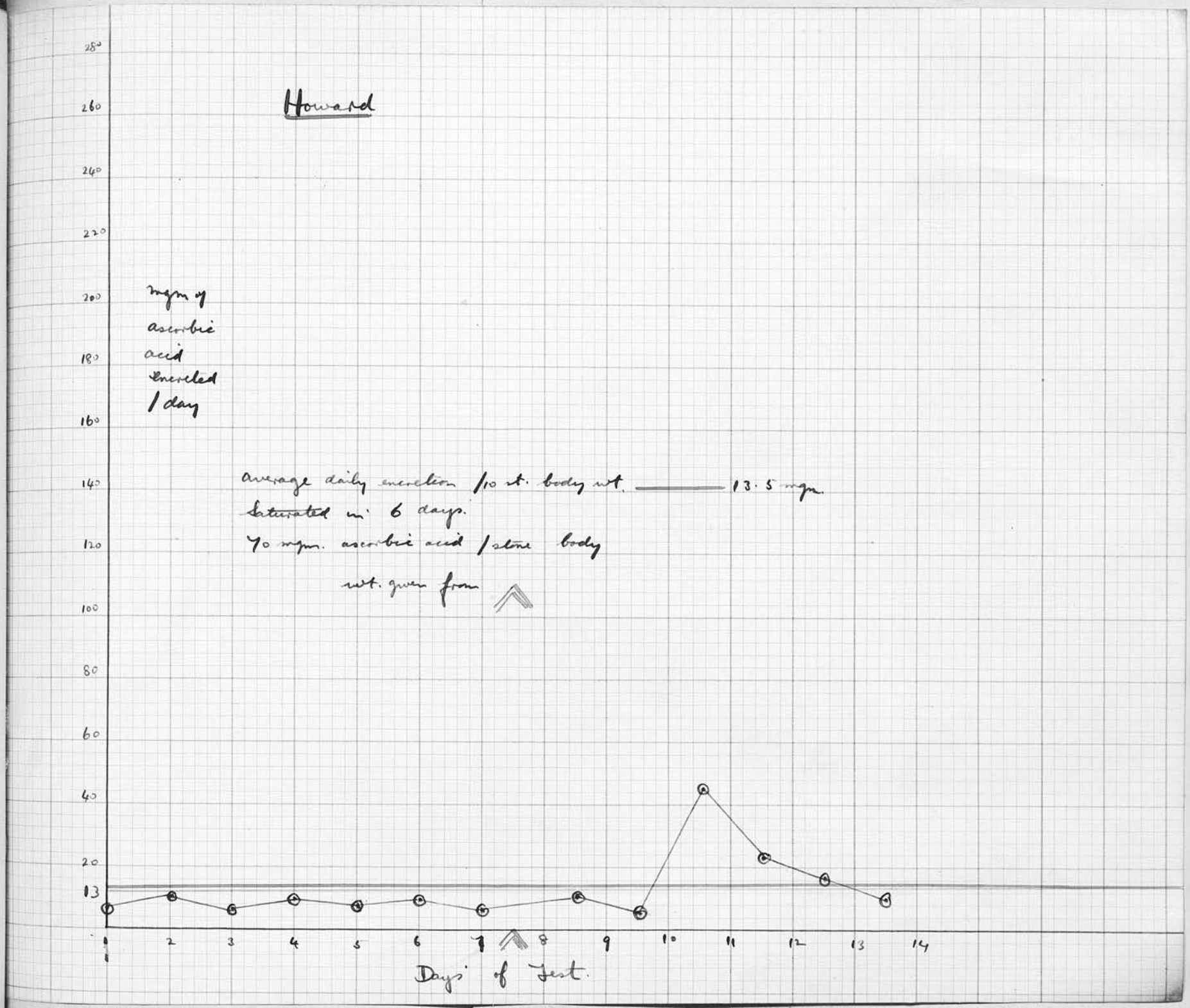
Howard.

Summary of history: Cough for many years. Bilateral disease with cavitation. Temperature rising to 100. B.S.R. 30. Took discharge against advice.

Weight 6st 1-lb. Dose of ascorbic acid 550 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
May	c.c.						mgm	
8	249		.65	.70	.73	.69	3.5	
	471		1.43	1.34	1.40	1.39	3.4	6.9
9	264		1.24	1.18	1.16	1.19	1.1	
	817		1.00	0.84	0.74	.86	9.5	10.6
11	469		.84	.85	1.04	.94	4.7	
	220		.83	.82	.79	.81	2.9	7.6
12	400		.90	.92	.73	.85	5.3	
	497		.79	.79	.86	.81	6.1	11.4
13	243		.78	.77	.79	.78	3.1	
	439		1.11	1.02	1.02	1.05	4.3	7.1
14	272		.71	.73	.71	.72	3.9	
	714		1.10	1.09	1.24	1.14	6.5	10.4
15	346		1.32	1.14	1.23	1.23	2.9	
	346		.95	.92	.95	.93	3.8	6.7
16	✱349		.80	.82	.82	.81	4.3	
	408		.93	.83	.74	.83	4.9	9.2
17	157		.84	.80	.86	.83	1.9	
	229		.80	.84	.82	.82	3.1	5.0
18	257		.55	.56	.50	.54	5.2	
	457	1/6	.90	1.10	.91	1.00	39.2	44.4
19	400	1/5	1.47	1.46	1.44	1.46	15.3	
	343	1/2	.90	1.00	1.50	1.13	7.7	23.0
20	400	1/3	1.18	1.17	1.12	1.15	11.2	
	243	1/4	1.89	1.93	1.96	1.93	5.6	16.8
21	300	1/5	1.91	1.92	1.93	1.92	9.0	
	86		.50	.50	.51	.50	2.5	11.5

Average daily excretion 8.1 mgm. Average daily excretion per 10 stone body weight 13.5 mgm. Days to become saturated - 6 plus.


Howard
mgm of ascorbic acid excreted / day
average daily excretion / 10 st. body wt. ——— 13.5 mgm.
Saturated in 6 days.
70 mgm. ascorbic acid / stone body wt. given from
Days of Test.

Nuttal.

Summary of history: Patient from 26.3.36--5.11.36 and from 10.5.37--30.9.38.(Died). 1933. Cough, loss of wt. etc. Bilateral cavitation. Old larynx. Now very ill. Persistent temperature of 97-99.5. Pulse 98-100, since admission. B.S.R. 26.

Weight 8st 2lbs. Dose of ascorbic acid 550 mgm. Diet: deficient

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July.	c.c.						mgm	
23	300	.5cc	.74	.78	.72	.75	2.2	
	350	1cc	.95	.96	.99	.97	4.0	6.2
24	892	.5cc	1.75	1.76	1.80	1.77	2.7	
	568	"	1.98	2.06	2.15	2.06	1.5	4.2
25	472	"	1.05	1.09	1.06	1.07	1.9	
	400	"	1.86	1.86	1.83	1.85	1.2	3.1
27	552	"	.92	.94	.90	.92	3.3	
	760	"	1.55	1.56	1.58	1.56	6.1	9.4
28	320	"	1.26	1.21	1.21	1.23	1.4	
	840	"	.99	.97	.99	.98	4.7	6.1
29	200	"	1.11	1.16	1.15	1.14	1.0	
	✱416	"	.74	.72	.70	.72	3.2	
30	172	"	.60	.59	.64	.61	1.5	4.7
	372	"	.87	.89	.90	.89	2.2	
31	100	"	.76	.76	.78	.77	.7	2.9
	300	"	1.09	1.09	1.11	1.09	1.5	
Aug1	108	1/10	3.02	3.05	2.98	3.02	1.8	3.3
	150	1/5	.79	.77	.75	.77	11.5	
2	160	.5cc	1.02	1.04	1.04	1.03	.9	12.4
	224	1/20	1.01	.98	.99	..99	50.2	
3	368	1/25	.70	.70	.67	.69	127.5	177.7
	328 .5cc	1/25	1.39	1.43	1.43	1.42	31.2	
4	360	1/25	.54	.51	.50	.52	291.5	322.7

Average daily excretion 5.8 mgm. Average daily excretion per 10 stone body weight 7.0 mgm. Days to become saturated 6.

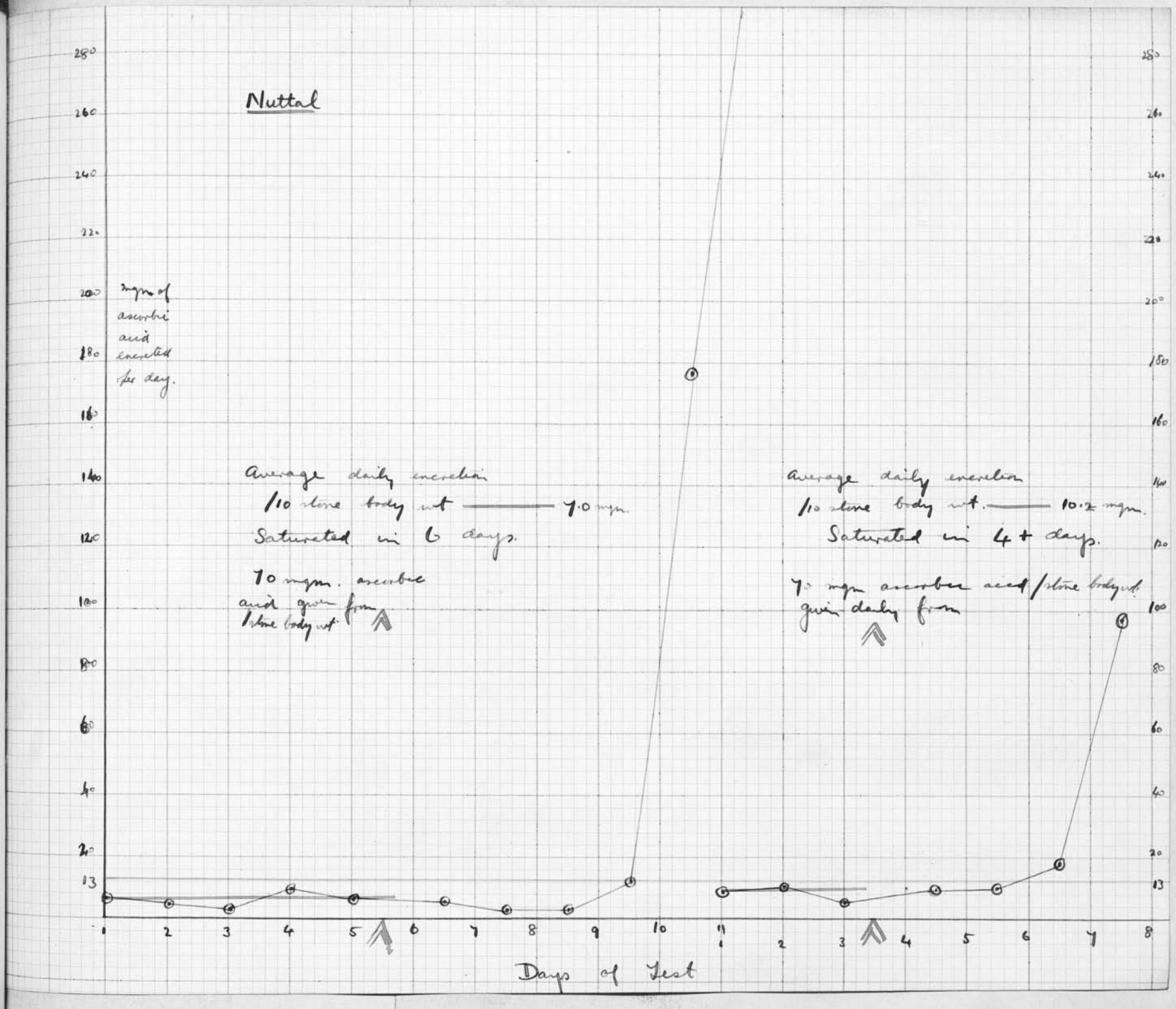
Sept.								
23	540		1.25	1.28	1.32	1.28	4.6	
	914		2.42	2.33	2.38	2.38	4.3	8.9
24	571		1.06	1.08	1.08	1.07	5.9	
	686		1.40	1.44	1.45	1.43	5.3	11.2
25	343		.91	.95	194	.93	4.1	
	171		1.39	1.41	1.43	1.41	1.3	5.4
26	457		1.26	1.27	1.25	1.26	4.0	
	✱457		1.51	1.50	1.53	1.51	3.3	
27	457		.98	1.00	1.00	.99	5.8	9.1
	457		1.21	1.23	1.26	1.23	4.1	
28	629		1.19	1.20	1.20	1.20	5.9	10.0
	457		1.34	1.33	1.37	1.35	5.0	
29	571		.97	.97	.99	.98	13.0	18.0

-continued.

Nuttal -continued.

	Amount urine per 12 hours.	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
1938. Sept.	c.c.						mgm	
29	343	1/10	1.19	1.21	1.23	1.21	31.7	
30	457	1/20	1.57	1.50	1.55	1.54	66.0	97.7
			Death.					

Average daily excretion 8.5 mgm. Average daily excretion per 10 stone body weight 10.2 mgm. Days to become saturated - 4 plus


Nuttal
mgms of ascorbic acid excreted per day.
Average daily excretion
1/10 stone body wt ——— 7.0 mgm.
Saturated in 6 days.
70 mgm. ascorbic acid given from
Average daily excretion
1/10 stone body wt. ——— 10.2 mgm.
Saturated in 4+ days.
70 mgm ascorbic acid/stone body wt given daily from
Days of Test

Groom.

Summary of history: 3 years history. Cachectic on admission. Extensive bilateral disease.

Temp. 97-101. Pulse 88-112. B.S.R. not done.

Weight about 9st. Dose of ascorbic acid 600 mgm. Diet slightly low.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
18	343		.86	.86	.84	.85	4.4	
	286	1/3	.99	.95	.97	.97	4.8	9.2
19	200		1.10	1.08	1.12	1.10	2.7	
	342		1.09	1.11	1.13	1.11	3.5	6.2
21	343		1.00	1.01	1.01	1.01	3.7	
	399		.76	.75	.75	.75	5.9	9.6
22	429		.72	.76	.76	.75	6.5	
	286		1.14	1.10	1.10	1.11	2.8	9.3
23			1.24	1.26	1.45	1.32	3.7	
	571		1.03	1.06	1.08	1.06	6.1	9.8
24	171		1.05	1.06	1.07	1.06	2.1	
	*171		1.34	1.33	1.33	1.33	1.4	
25	657		.60	.63	.61	.61	12.1	13.5
	143		.88	.90	.91	.90	1.8	
26	342		.74	.73	.79	.77	5.0	6.8
	510		1.22	1.24	1.27	1.24	4.6	
27	742		.64	.65	.64	.64	13.0	17.6
	771		1.15	1.16	1.15	1.15	7.5	
28	600		.77	.74	.75	.75	8.9	16.4
	686	1/5	1.62	1.65	1.63	1.63	19.5	
29	857	1/5	.82	.86	.87	.85	25.0	44.5
	799	1/10	1.28	1.30	1.31	1.30	68.0	
30	799	1/10	1.58	1.64	1.68	1.64	55.0	123.0
	1143	1/20	.77	.77	.73	.76	336.0	
31	686	1/20	.66	.62	.67	.65	236.0	572.0

Average daily excretion 8.8 mgm. Average daily excretion per 10 stone body weight 9.8 mgm. Days to become saturated 7.

Aug.								
24	457	1/2	1.12	1.16	1.12	1.13	9.0	
	457		1.42	1.47	1.45	1.45	3.5	12.5
25	914		.72	.73	.75	.73	13.9	
	229		.69	.72	.74	.72	3.6	17.5
26	343		.63	.64	.64	.64	6.0	
	686		1.19	1.16	1.17	1.17	6.6	12.6
27	571		.70	.67	.66	.68	8.4	
	229		1.06	1.07	1.07	1.07	2.4	10.8
28	457	1/2	.65	.67	.67	.66	15.2	
	343		1.15	1.16	1.16	1.16	3.3	18.5
29	571		.61	.60	.61	.61	10.5	
	343		.86	.88	.88	.87	4.3	14.8

-continued

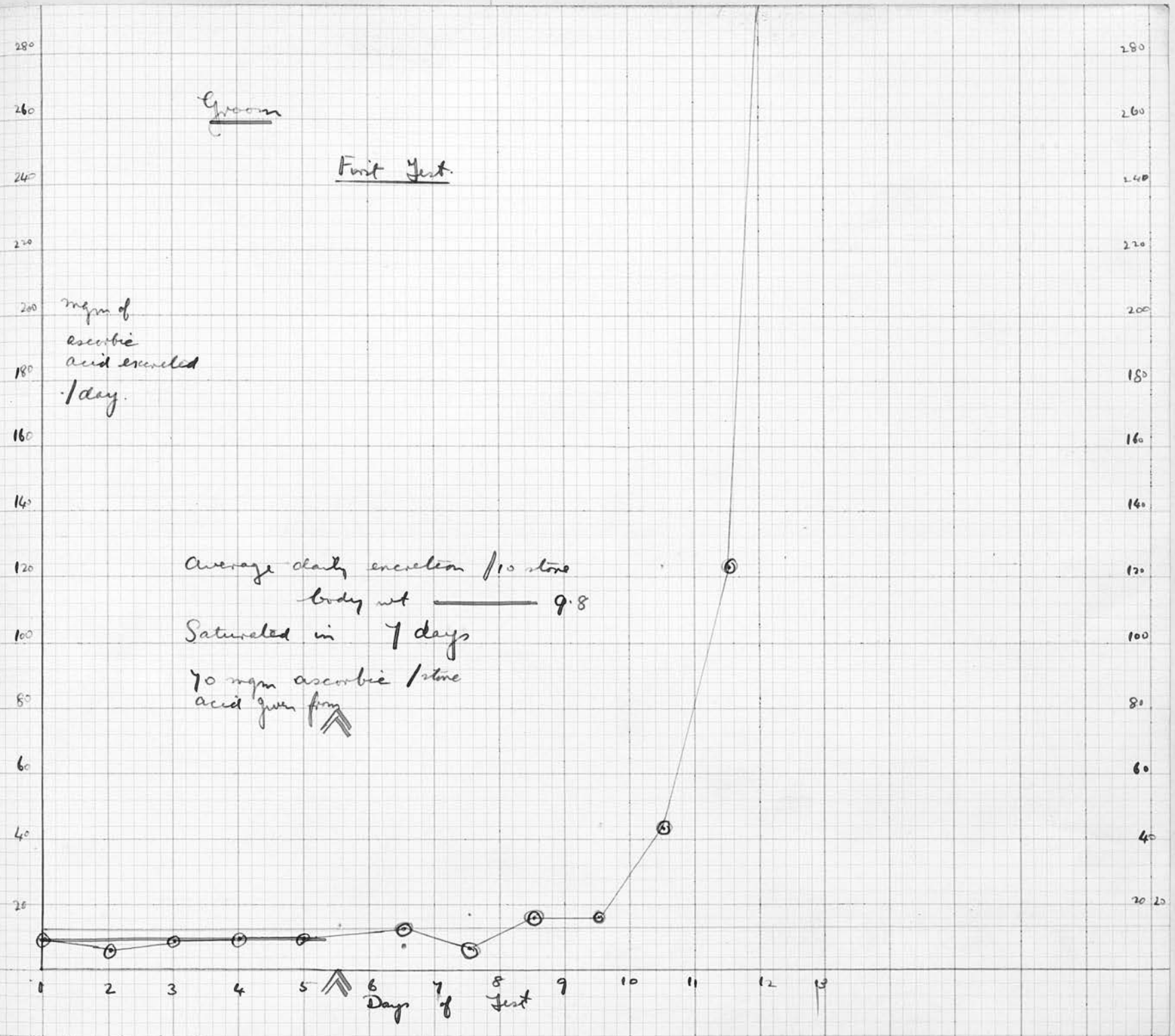
Groom.-continued.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
30	457		.64	.68	.67	.66	9.1	
	¥ 457		.79	.81	.80	.80	6.3	
31	686		.95	.91	.96	.94	8.0	14.3
	571		2.14	2.29	2.25	2.29	2.7	
Sepl	229		.71	.68	.71	.70	3.6	6.3
	686		1.93	1.94	1.99	1.95	3.3	
2	571		2.65	2.71	2.73	2.69	2.4	5.7
	800		.78	.78	.77	.78	11.4	
3	571		.78	.78	.79	.78	24.3	35.7
	571		1.79	1.59	1.69	1.69	11.3	
4	800		1.44	1.31	1.30	1.35	17.3	28.6
	229		1.85	1.95	1.93	1.91	4.0	
5	229		1.41	1.50	1.41	1.44	5.3	9.3
	457		1.29	1.36	1.22	1.29	11.8	
6	1143		1.44	1.45	1.46	1.45	17.6	29.4
	350		1.03	1.12	1.06	1.07	72.8	
7	343		1.31	1.32	1.29	1.31	14.6	87.4
	343	1/20	.60	.62	.64	.62	122.0	
8	457	1/20	.88	.90	.94	.91	202.0	324.0

Average daily excretion 18.9 mgm. Average daily excretion per 10 stone body weight 21.0 Days to become saturated 8.

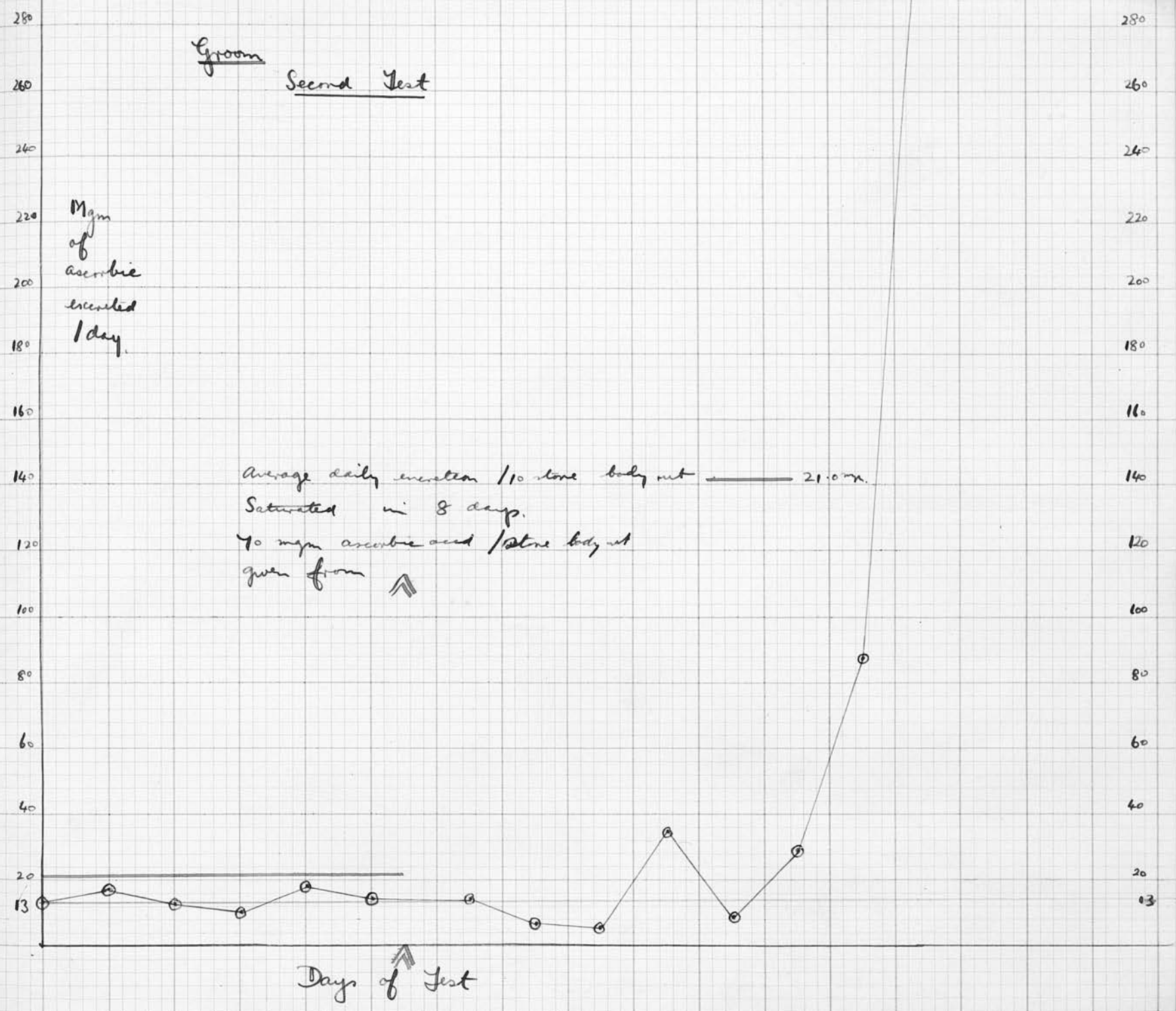
Groom

First Test.



Groom

Second Test



Aukland.

Summary of history: 11.6.36. Cough 6 months. TB+2. Zij anorexia and occasional vomiting. Temp. 97-100.5. B.S.R. 30. Enteritis.

Weight 8st. 9lbs. Dose of ascorbic acid 650 mgm. Diet low average

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
19	475		.71	.70	.75	.72	3.6	
	1000		3.50	3.30	3.30	3.39	3.3	6.9
21	425		.68	.71	.68	.69	3.4	
	1525		3.64	3.71	3.67	3.67	2.2	5.6
22	475		.93	.93	.92	.93	5.2	
	1025		3.74	3.56	3.63	3.64	1.6	6.8
23	450		.60	.60	.59	.61	3.4	
	580		.93	.95	.97	.95	3.3	6.7
24	248		.60	.63	.58	.60	2.3	
	476		.98	.98	.96	.97	2.7	5.0
25	400		.50	.51	.53	.51	4.1	
	440		.76	.75	.77	.76	3.3	7.4
27	500		.91	.92	.88	.90	3.1	
	932		1.11	1.11	1.08	1.10	4.6	8.7
28	476		.77	.77	.75	.76	3.4	
	✱650		.59	.61	.62	.61	10.9	
29	100		.69	.69	.70	.69	1.6	11.5
	728		1.19	1.21	1.21	1.20	6.7	
30	552		.58	.56	.58	.57	10.8	17.5
	844		.85	.91	.90	.88	5.4	
31	1380		1.47	1.43	1.46	1.45	5.3	10.7
	475		.93	.93	.92	.93	5.2	
Aug 1	400		.91	.92	.92	.92	4.9	10.1
	1608		.57	.58	.57	.57	31.0	
2	820		.95	.99	.98	.97	9.4	40.4
	500		1.08	1.08	1.09	1.08	5.1	
3	652		.45	.45	.45	.45	16.0	21.1
	1268		1.29	1.28	1.30	1.29	5.6	
4	480	1/25	.76	.78	.75	.76	172.5	178.1
	560	1/25	1.08	1.09	1.11	1.09	413.9	
5	700	1/25	.98	.97	1.01	.99	442.7	856.6

Average daily excretion 6.9 mgm. Average daily excretion per 10 stone body weight 7.9 mgm. Days to become saturated 8.

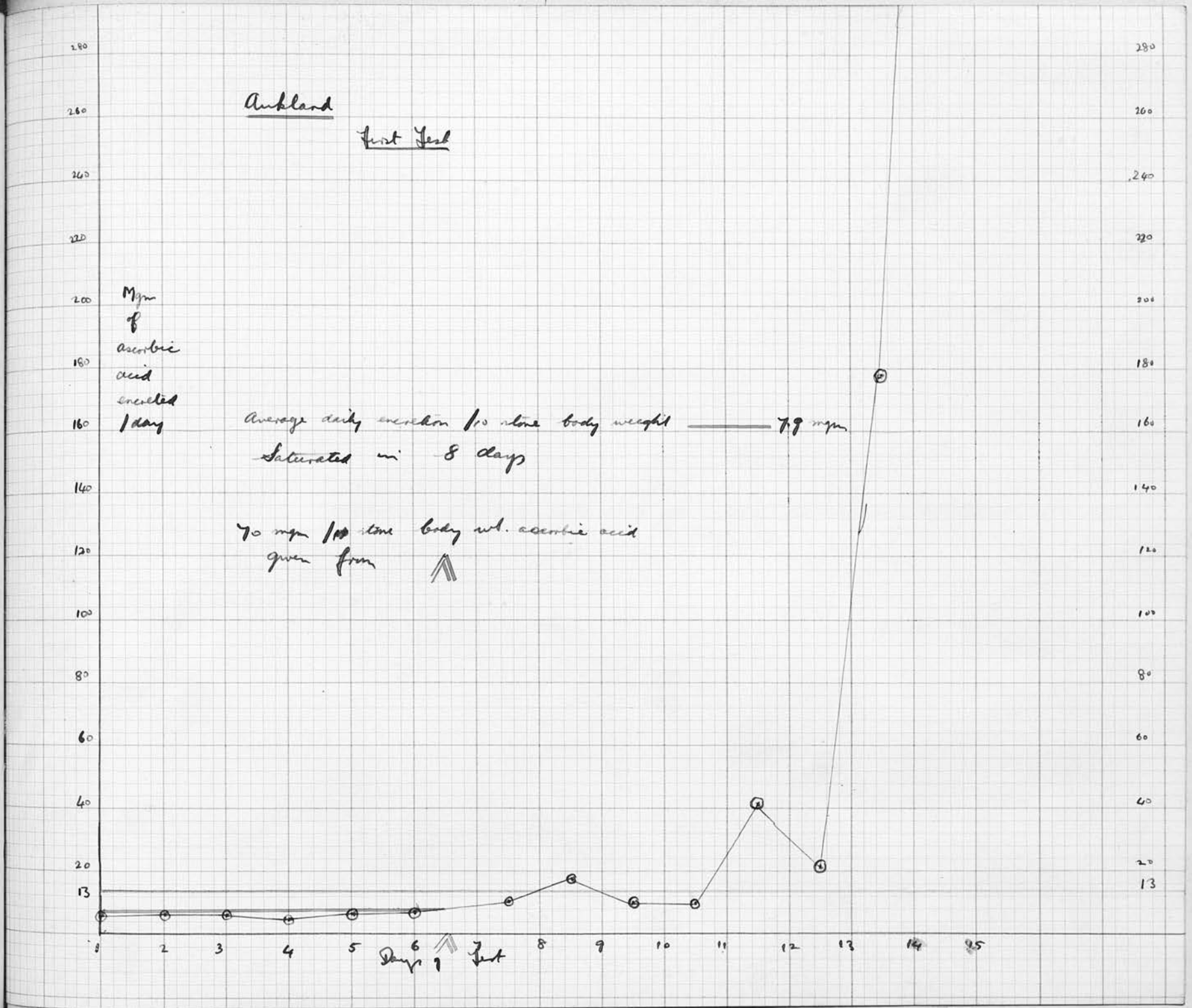
Aug.								
19	200		.72	.73	.71	.72	3.1	
	556		.70	.68	.66	.68	9.1	12.2
20	672		.51	.51	.54	.52	14.3	
	1216		1.78	1.77	1.78	1.78	7.6	21.9
21	672	1/2	.80	.80	.80	.80	18.9	
	628		.53	.53	.52	.53	13.4	32.3
22	200	1/2	.80	.82	.80	.81	4.8	
	860		1.19	1.27	1.24	1.23	8.6	13.4

-continued

Aukland. -contd.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
23	420		.54	.56	.56	.55	8.3	
	880		1.66	1.65	1.67	1.66	5.9	14.2
24	780	1/2	.91	.90	.88	.90	19.4	
	536		.81	.82	.80	.81	9.9	29.3
25	464	1/2	.72	.68	.70	.70	14.7	
	*1344		.96	.95	.95	.95	15.6	
26	360	1/10	1.95	2.00	2.05	2.00	20.0	35.6
	1036		1.86	1.82	1.85	1.84	6.3	
27	460	1/2	.88	.88	.88	.88	10.6	16.9
	480	1/5	.72	.69	.69	.70	38.0	
28	300	1/20	.67	.70	.71	.69	96.4	134.4
	856	1/20	.83	.87	.84	.85	225.0	
29	360	1/10	.61	.61	.62	.61	65.0	290.0

Average daily excretion 22.2 mgm. Average daily excretion per 10 stone body weight 25.5 mgm. Days to become saturated 4.


Auckland
First Test
Mgm of ascorbic acid excreted / day
Average daily excretion / 10 stone body weight ——— 7.9 mgm
Saturated in 8 days
70 mgm / 10 stone body wt. ascorbic acid given from
Days
First
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
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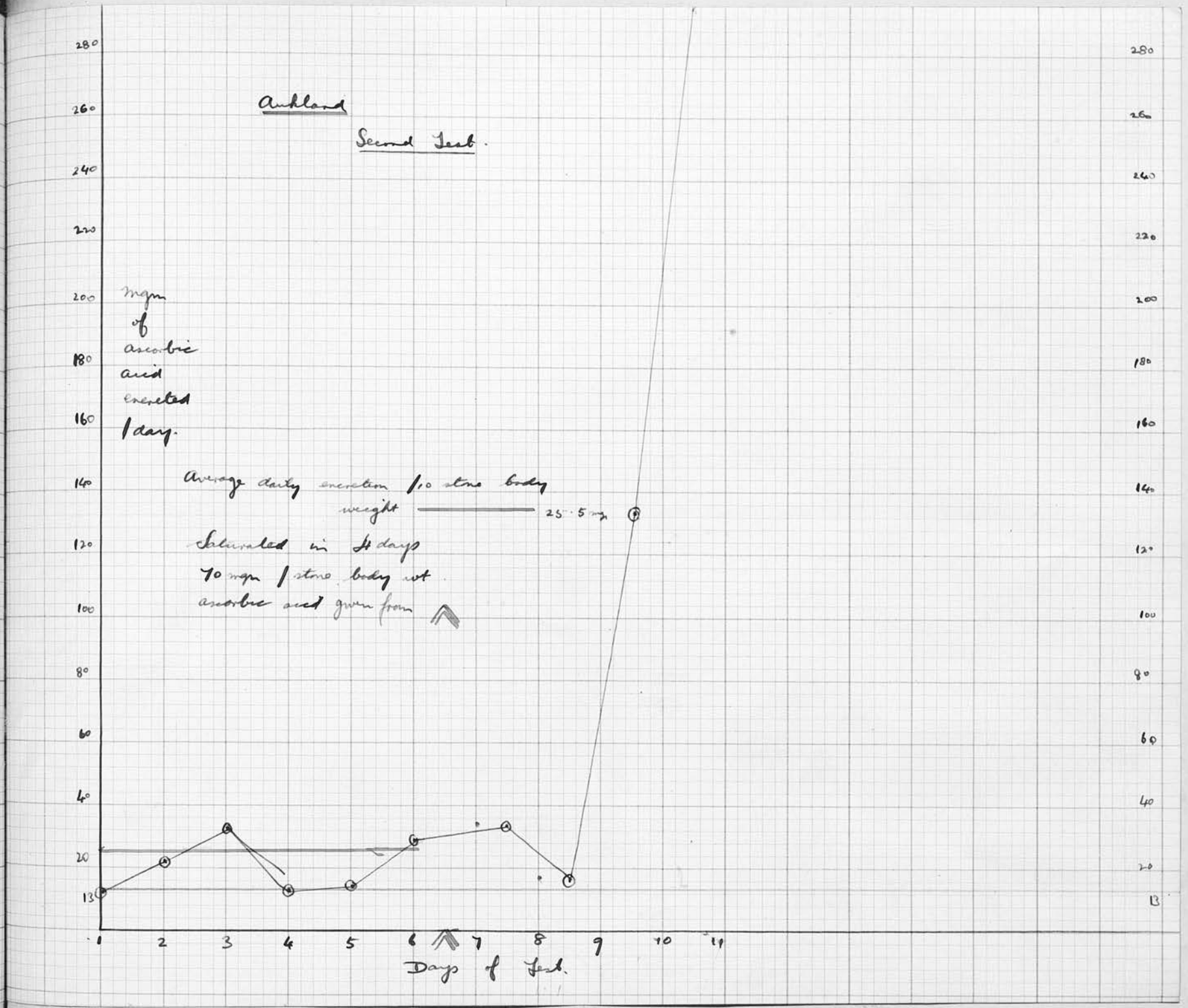
14
15


Auckland
Second Test.
mgm of ascorbic acid excreted / day.
Average daily excretion / 10 stone body weight ——— 25·5 mgm
Saturated in 4 days
70 mgm / stone body wt ascorbic acid given from
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 2 3 4 5 6 7 8 9 10 11
Days of Test.

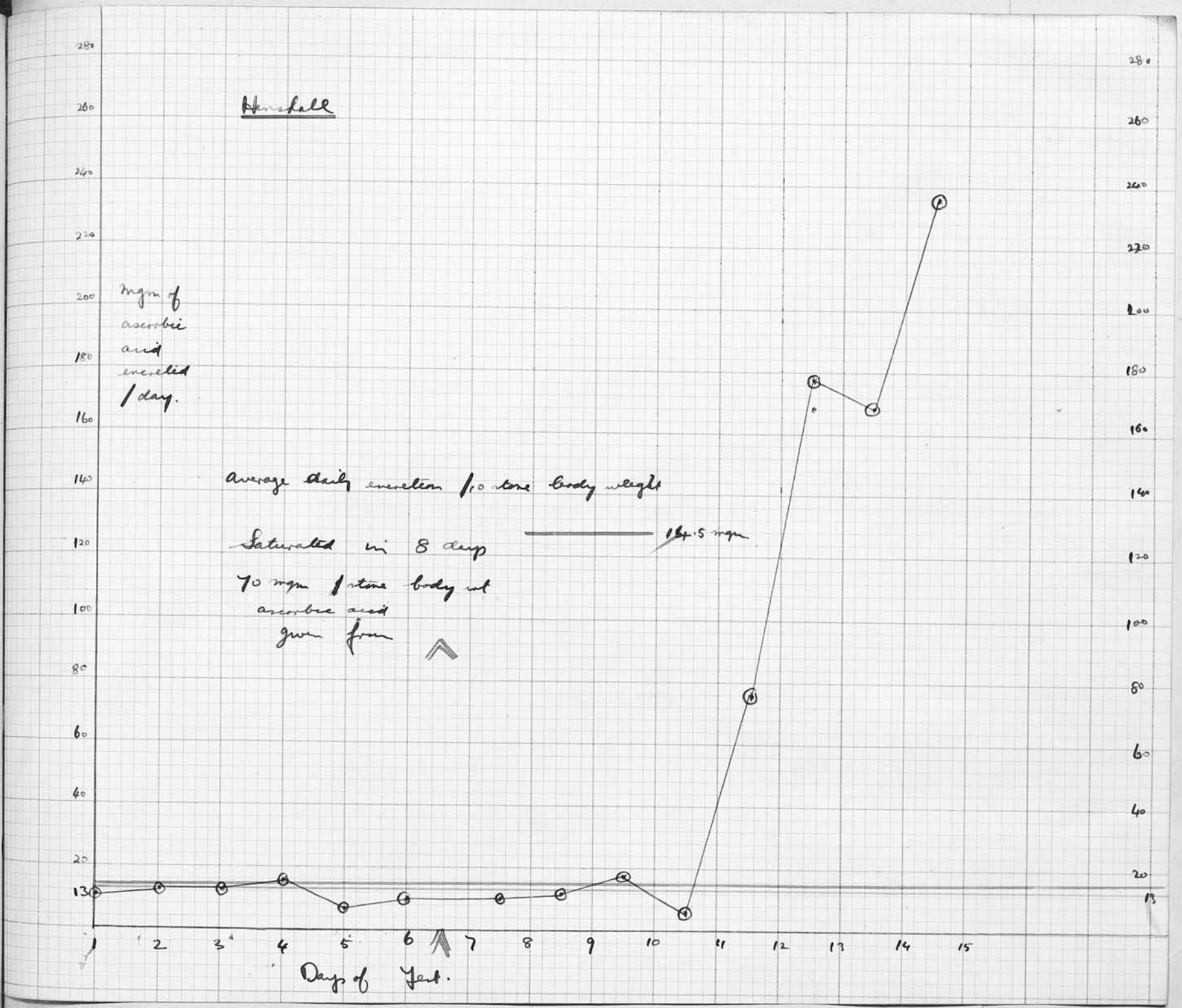
Henshall.

Summary of history: Cough, sputum, night sweats, loss of weight, 18 months. Cavitation L. upper lobe. L. APT 2/3/38. Unsatisfactory collapse. Zss+ sputum Temp. up to 100. B.S.R. 29. Not progressing satisfactorily.

Weight 7st. 7lbs. Dose of ascorbic acid 500 mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
13	740		1.31	1.33	1.32	1.32	6.2	
	500		1.14	1.13	1.15	1.14	4.9	11.1
14	1100		1.23	1.29	1.25	1.26	9.7	
	340		1.36	1.38	1.39	1.38	2.6	12.3
15	660		.95	.97	.97	.96	7.6	
	360		.90	.88	.87	.88	4.5	12.1
16	600		.67	.65	.69	.67	10.0	
	580		1.30	1.29	1.27	1.29	5.0	15.0
17	600		1.68	1.68	1.70	1.69	4.5	
	292		1.33	1.34	1.34	1.34	2.4	6.9
18	200		.86	.84	.86	.85	2.5	
	720		1.32	1.34	1.35	1.33	6.0	8.5
19	340		1.26	1.24	1.29	1.26	2.9	
	✱ 320		1.23	1.21	1.24	1.23	2.9	
20	720		1.04	1.08	1.07	1.06	7.5	10.4
	500		.94	.97	.95	.95	5.8	
21	300		.58	.56	.56	.57	5.8	11.6
	280	1/5	1.16	1.14	1.12	1.14	12.5	
22	400		1.02	1.02	1.01	1.02	4.4	16.9
	320		.84	.81	.82	.82	4.3	
23	200		1.50	1.51	1.51	1.50	1.5	5.8
	120	1/20	.57	.52	.50	.53	52.0	
24	200	1/20	1.92	1.88	1.89	1.90	23.4	75.4
	480	1/20	.59	.61	.61	..60	178.0	
25	Nil							
	100	1/8	1.19	1.18	1.18	1.18	56.4	
26	300	1/40	1.20	1.16	1.20	1.17	112.0	168.4
	120	1/40	.68	.70	.72	..70	76.0	
27	700	1/20	1.12	1.11	1.10	1.11	140.0	216.0
	520	1/50	1.16	1.14	1.15	1.15	252.5	
28	200	1/150	1.68	1.70	1.69	1.69	207.0	459.5

Average daily excretion 10.9 mgm. Average daily excretion per 10 stones body weight 14.5 mgm. Days to become saturated - 9.


Hemshall
mgm of ascorbic acid excreted / day.
average daily excretion / 10 stone body weight
Saturated in 8 days
70 mgm / stone body wt ascorbic acid given from
13
Days of Test.

Blackwell.

Summary of history: Cough and little sputum for past 8 months. Cavitation upper lobe rt. lung. APT with fair collapse. Some recent spread mid zone L. No sputum. B.S.R. 15. afebrile

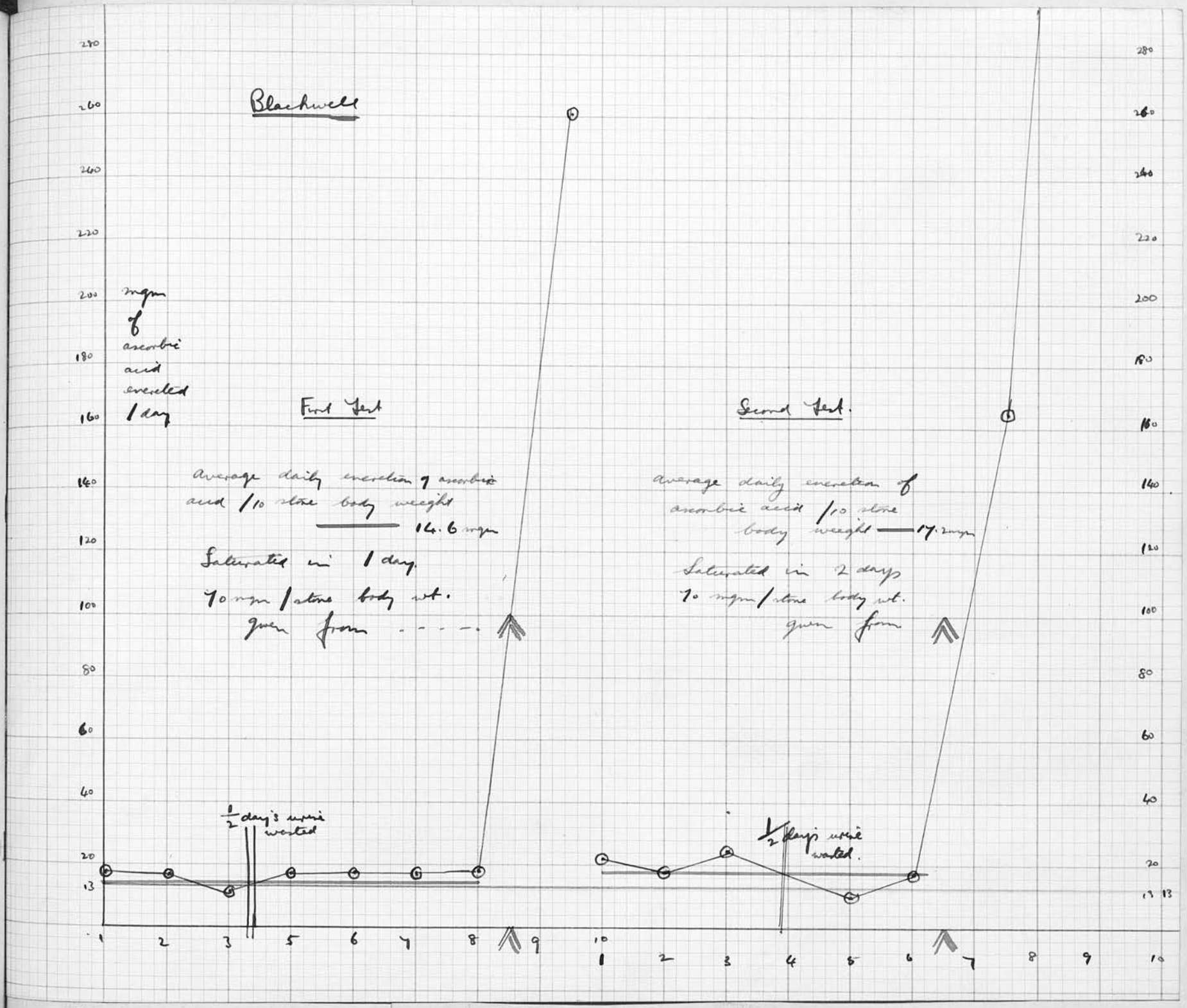
Weight 10st. 10lbs. Dose of ascorbic acid 600 mgm. Diet +

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
May	c.c.						mgm	
12	342		.65	.64	.60	.63	6.1	
	691		.66	.67	.65	.66	10.4	16.5
13	502		.50	.52	.52	.51	9.8	
	556		.88	.80	.83	.84	6.7	16.5
14	439	1/2	.96	1.06	.92	.98	9.0	
	443		1.85	1.93	1.85	1.89	2.3	11.3
15	346		.62	.60	.61	.61	5.0	
	471		.98	.92	.98	.96	4.8	9.8
	Urine wasted							
17	344		.62	.62	.61	.62	6.0	
	800		.73	.80	.66	.73	11.9	17.9
18	510		.77	.68	.75	.73	7.5	
	1000		.88	.82	.90	.86	10.3	17.8
19	543		.77	.78	.75	.76	8.2	
	986		1.21	1.13	1.25	1.20	9.1	17.3
20	800		.67	.67	.61	.65	11.8	
	X771		1.34	1.27	1.42	1.34	6.4	18.2
21	457	1/20	.70	.67	.72	.70	145.0	
	632	1/20	.52	.51	.53	.52	116.0	261.0

Average daily excretion 15.7 mgm. Average daily excretion per 10 st. body weight 14.6 mgm. One day to become saturated.

Nov.								
14	552		1.06	1.09	1.08	1.05	6.9	
	255		1.52	1.48	1.50	1.50	16.0	22.9
15	628		.54	.56	.53	.55	13.3	
	624		1.18	1.11	1.18	1.13	5.2	18.5
16	934		.54	.54	.54	.54	19.1	
	1029		2.13	2.15	2.18	2.15	5.4	24.5
17	800		1.51	1.52	1.54	1.52	5.8	
18	257	1/2	.64	.66	.64	.65	4.4	
	586		1.84	1.88	1.85	1.86	6.0	10.4
19	371	1/2	.98	.97	.97	.97	8.4	
	429		.60	.60	.58	.59	8.1	16.5
20	629		1.04	1.06	1.04	1.05	6.6	
	X586		.52	.52	.53	.52	124.0	
21	486		1.31	1.30	1.33	1.31	41.0	165.0
	286	1/60	.61	.60	.62	.61	282.0	
22	286	1/60	.85	.85	.86	.85	228.0	500.0

Average daily excretion 18.5 mgm. Average daily excretion per 10 stone body weight 17.2 mgm. Two days to become saturated.


Blackwell
mgm of ascorbic acid excreted / day
First Test
Average daily excretion of ascorbic acid / 10 stone body weight — 14.6 mgm
Saturation in 1 day.
70 mgm / stone body wt. given from - - - -
½ day's urine wasted
Second Test.
Average daily excretion of ascorbic acid / 10 stone body weight — 17.2 mgm
Saturated in 2 days
70 mgm / stone body wt. given from
½ day's urine wasted.
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 2 3 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

Harrop.

Summary of history: 7.1.37--27.2.37. 1.7.37. onwards. Pleurisy 1 year ago. Cough some time before that. Zss- Cavitation L. side. L. A.P.T. with clear effusion. B. S.R. 14.

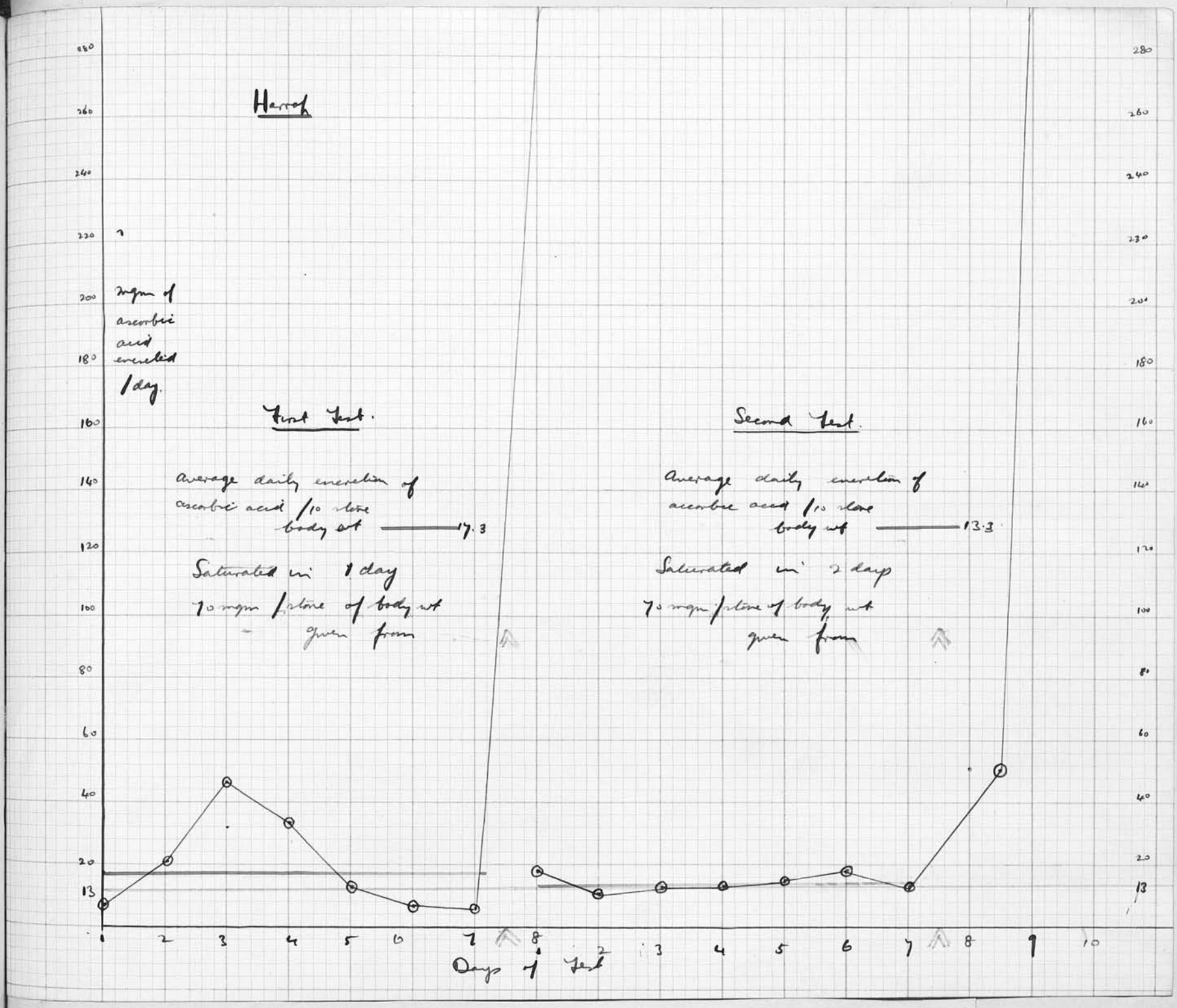
Weight 10 st. 11-lbs. Dose of ascorbic acid 700 mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
19	850	.5cc	.91	.92	.92	.92	5.1	
	500	"	1.30	1.25	1.25	1.27	2.5	7.6
21	1025	"	1.26	1.26	1.27	1.26	4.1	
	1387	1cc	.84	.84	.88	.85	16.3	20.4
22	575	1/3 .5cc	.92	.91	.94	.92	9.8	
	775	1/5 "	.66	.63	.60	.63	34.0	43.8
23	600	1/3 "	.77	.77	.76	.77	12.9	
	740	1/3 .5cc	1.18	1.21	1.13	1.17	21.1	34.0
24	800	.5cc	1.20	1.01	.99	1.07	4.5	
	860	1cc	1.22	1.18	1.20	1.20	8.0	12.5
25	520	"	.91	.91	.89	.90	6.5	
	348	.5cc	1.77	1.81	1.82	1.80	1.2	7.7
27	600	1cc	1.49	1.50	1.52	1.50	4.3	
	998	.5cc	.93	.96	.95	.95	2.9	7.2
28	600	"	.94	.91	.96	.93	6.1	
	✱ 712	1/20	.60	.57	.57	.58	260.0	
29	826	1/25	1.27	1.30	1.31	1.29	120.0	380.0

Average daily excretion 19.5 mgm. Average daily excretion per 10 stone body weight 17.3 mgm. Days taken to become saturated - 1.

Sept.								
22	257		.76	.75	.78	.76	14.3	
	757		1.73	1.77	1.77	1.75	4.8	19.1
23	686		1.29	1.28	1.30	1.29	5.8	
	571		1.22	1.27	1.26	1.25	5.2	11.0
24	914		1.31	1.34	1.30	1.32	7.7	
	686		1.64	1.64	1.68	1.65	4.5	12.2
25	514		.92	.89	.91	.91	6.2	
	457		.80	.75	.78	.78	6.5	12.7
26	914		.84	.85	.83	.84	11.6	
	286		.83	.83	.82	.83	3.8	15.4
27	629		.77	.77	.77	.77	9.1	
	629		.74	.77	.78	.76	9.3	18.4
28	686		1.02	.96	.98	1.08	7.1	
	400		.78	.79	.78	.78	5.7	12.8
29	857		.82	.80	.84	.82	11.6	
	✱571	1/10	.88	.87	.89	.88	36.0	
30	457	1/5	1.67	1.63	1.64	1.65	15.0	51.0
	686	1/10	.50	.50	.52	.51	149.0	
Oct1	771	1/20	.69	.65	.68	.67	256.0	405.0

Average daily excretion 14.3 mgm. Average daily excretion per 10 stone body weight. 13.3 mgm. Two days to become saturated.


Harrop
mgm of ascorbic acid excreted / day.
First Test.
Average daily excretion of ascorbic acid / 10 kilos body wt ——— 17.3
Saturated in 1 day
70 mgm / kilos of body wt given from
Second Test.
Average daily excretion of ascorbic acid / 10 kilos body wt ——— 13.3
Saturated in 2 days
70 mgm / kilos of body wt given from
Days of Test

Woodall.

Summary of history: 18.2.37. onwards. TB+2. No sputum now. Extensive disease throughout L. lung with cavitation. Sl. infiltration rt. Artificial pneumothorax 4.3.37. Fair collapse. B.S.R. 6.

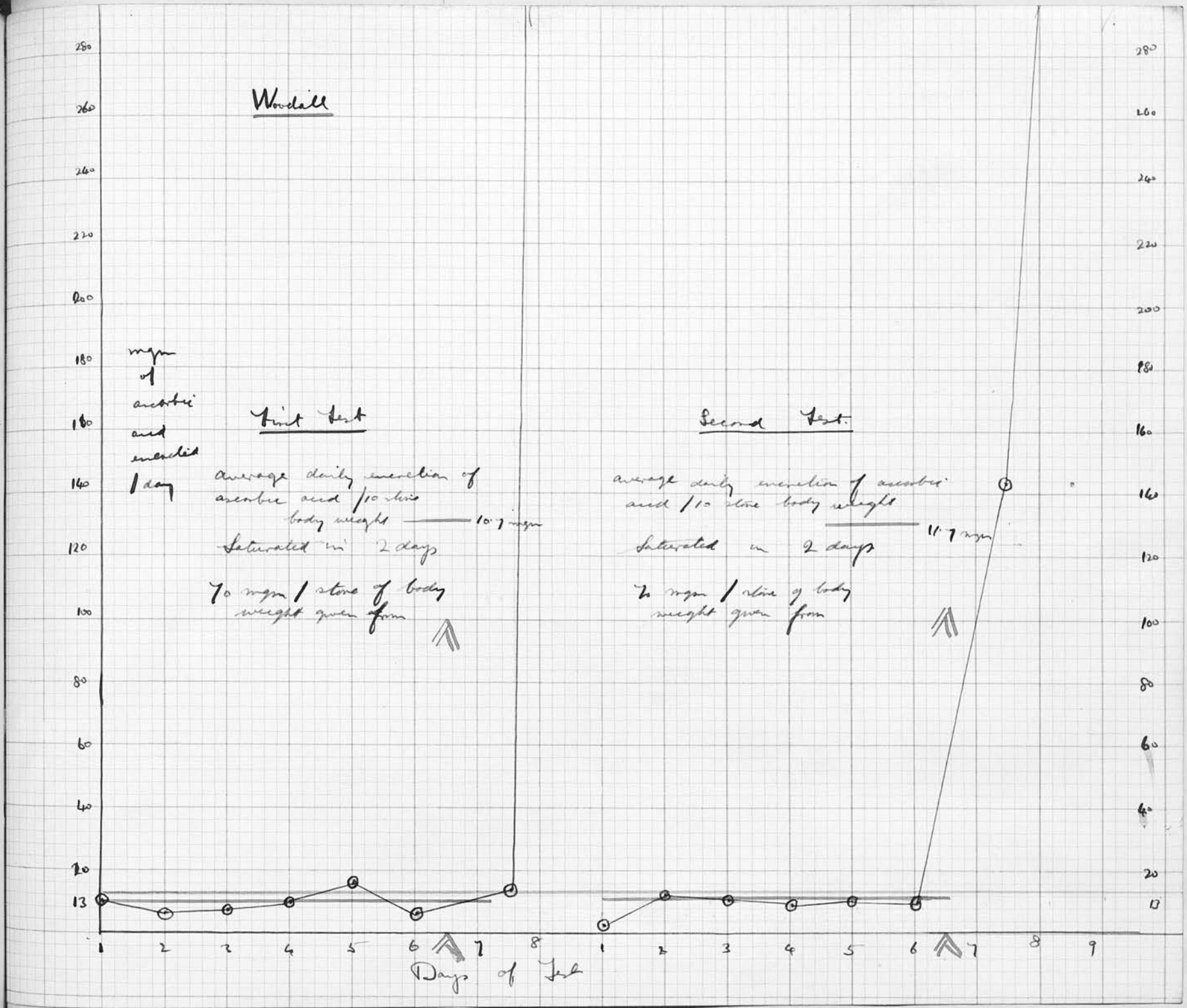
Weight 8st. 5lbs. Dose of ascorbic acid 550.mgm. Diet++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
17	776		2.03	2.00	2.07	2.03	4.3	
	440		.97	.94	.95	.95	5.1	9.4
18	600	.5cc	1.08	1.03	1.09	1.07	3.1	
	725	"	1.42	1.47	1.46	1.44	2.5	5.6
19	750	"	1.01	1.00	1.03	1.01	4.2	
	1200	"	1.72	1.63	1.69	1.68	3.2	7.4
21	675	"	.81	.77	.76	.78	4.8	
	600	1cc	1.38	1.42	1.41	1.40	4.4	9.2
22	805	"	.64	.64	.67	.65	13.7	
	950	.5cc	2.24	2.21	2.22	2.22	2.5	16.2
23	200	1cc	1.10	1.09	1.08	1.09	2.1	
	540	"	1.78	1.78	1.76	1.77	4.5	6.6
24	600	.5cc	.65	.67	.68	.67	5.0	
	¥768	1/3	1.69	1.68	1.70	1.69	15.3	
25	Nil							
	1000	1/25	1.24	1.23	1.22	1.23	625.0	
26	600	1/10	1.29	1.30	1.33	1.30	51.0	676.0

Average daily excretion 8.9 mgm. Average daily excretion per 10 stone body weight 10.7 mgm. Two days to become saturated.

Aug.								
19	200		1.00	.97	1.00	.99	2.0	
	1068		7.50	7.50	7.10	7.40	166	3.6
20	472		.50	.50	.50	.50	10.5	
	972		5.85	5.80	5.80	5.82	1.9	12.4
21	472		.61	.64	.64	.63	8.1	
	656		2.01	1.99	2.00	2.00	3.6	11.7
22	200		.55	.55	.54	.55	4.1	
	200	1/2	.90	.92	.91	.91	4.8	8.9
23	900		.85	.85	.86	.85	11.8	
	Nil							11.8
24	200		.73	.75	.76	.75	2.9	
	1100		1.65	1.70	1.72	1.69	7.3	10.2
25	200		1.20	1.22	1.21	1.21	1.8	
	¥ 954	1/4	.61	.59	.58	.59	61.6	
26	400	1/20	1.09	1.10	1.07	1.09	81.6	143.2
	1220	1/20	1.49	1.53	1.51	1.51	180.0	
27	920	1/10	.51	.52	.53	.52	195.0	375.0

Average daily excretion 9.7 mgm. Average daily excretion per 10 stone body weight 11.7 mgm. Two days to become saturated.


Woodall
mgm of ascorbic acid excreted / day
First Test
average daily excretion of ascorbic acid / 10 stone body weight
10.7 mgm
Saturated in 2 days
70 mgm / stone of body weight given from
Second Test
average daily excretion of ascorbic acid / 10 stone body weight
11.7 mgm
Saturated in 2 days
70 mgm / stone of body weight given from
Days of Test

Petts.

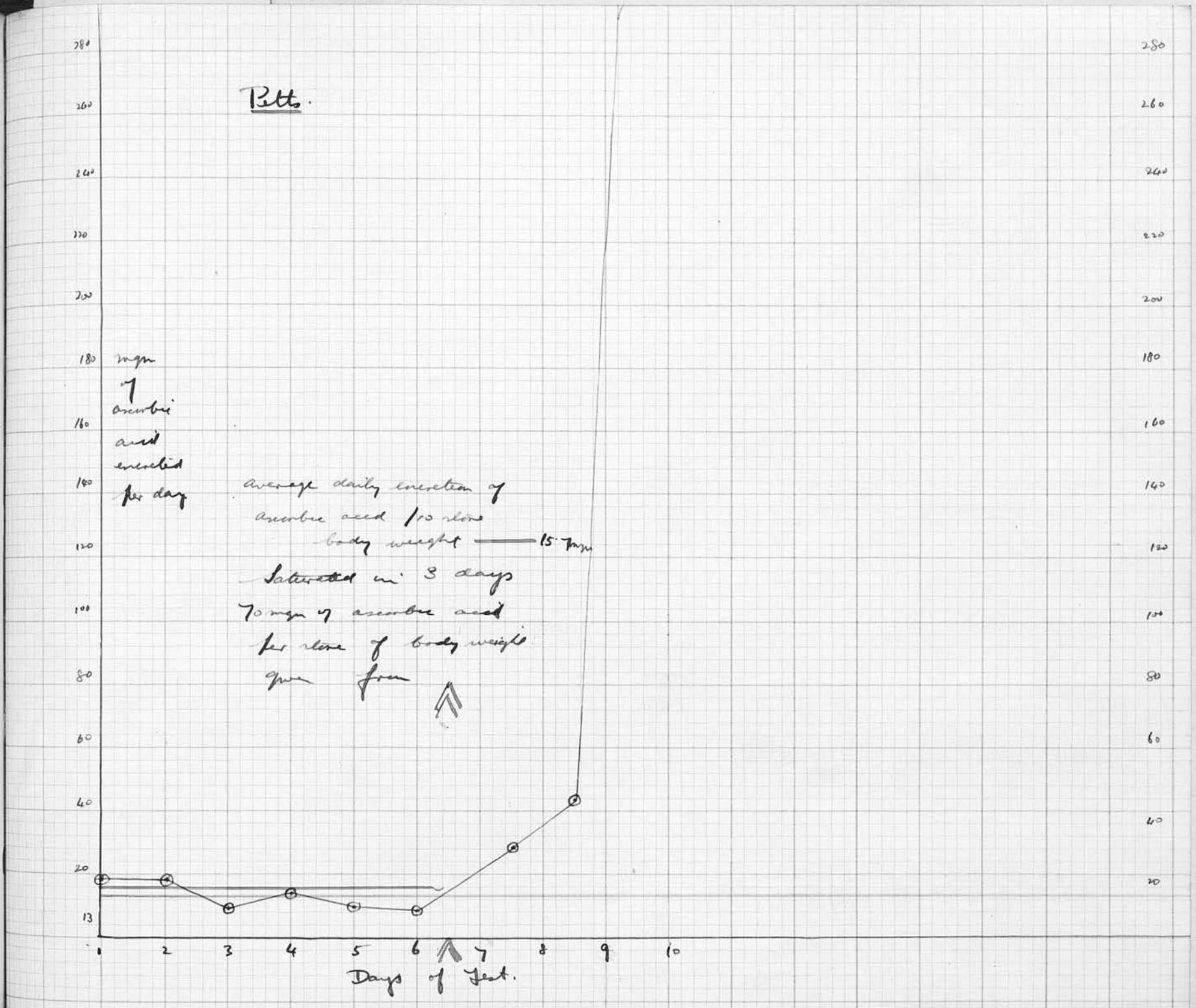
Summary of history: Admitted 30.5.38. Cough 5 months. Haemoptysis ?v 21.3.38. Sputum+ Nil now. Infiltration and cavitation right upper lobe. Infiltn. mid zone. Artificial pneumothorax induced 5.7.38. Good collapse. Absolute rest. Afebrile. No enteritis. B.S.R. 24.

Weight 8st. Dose of ascorbic acid 550 mgm. Diet ++

1938. Oct.	Amount urine per 12 hours c.c.	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day mgm	Total
13	700		.56	.60	.57	.58	13.5	
	980		1.89	1.92	1.93	1.90	5.2	18.7
14	936		.76	.78	.75	.76	13.8	
	820		1.07	1.09	1.09	1.08	4.3	18.1
15	360		.53	.53	.52	.53	7.6	
	400		1.02	1.03	1.04	1.03	1.9	9.5
16	500		.98	.96	.95	.96	5.9	
	940		1.31	1.34	1.31	1.32	7.9	13.8
17	320		.64	.65	.62	.64	5.6	
	372		1.08	1.14	1.12	1.11	3.7	9.3
18	172		.62	.65	.64	..64	3.0	
	320		1.50	1.57	1.51	1.52	6.0	9.0
19	412		1.12	1.14	1.10	1.12	4.1	
	*540		1.60	1.62	1.62	1.61	3.7	
20	460		1.07	1.02	1.05	1.05	24.5	28.2
	Nil							
21	200	1/20	.98	.98	.99	.98	44.0	44.0
	340	1/50	.84	.84	.84	.84	275.0	
22	480	1/20	.90	.89	.90	.89	119.0	394.0

Average daily excretion 12.6 mgm. Average daily excretion per 10 stone body weight 15.7 mgm. Days to become saturated - 3.

Pitts.


mgm of ascorbic acid excreted per day
average daily excretion of ascorbic acid / 10 lbs body weight ——— 15. mgm
Saturated in 3 days
70 mgm of ascorbic acid per lbs of body weight given from
Days of Test.

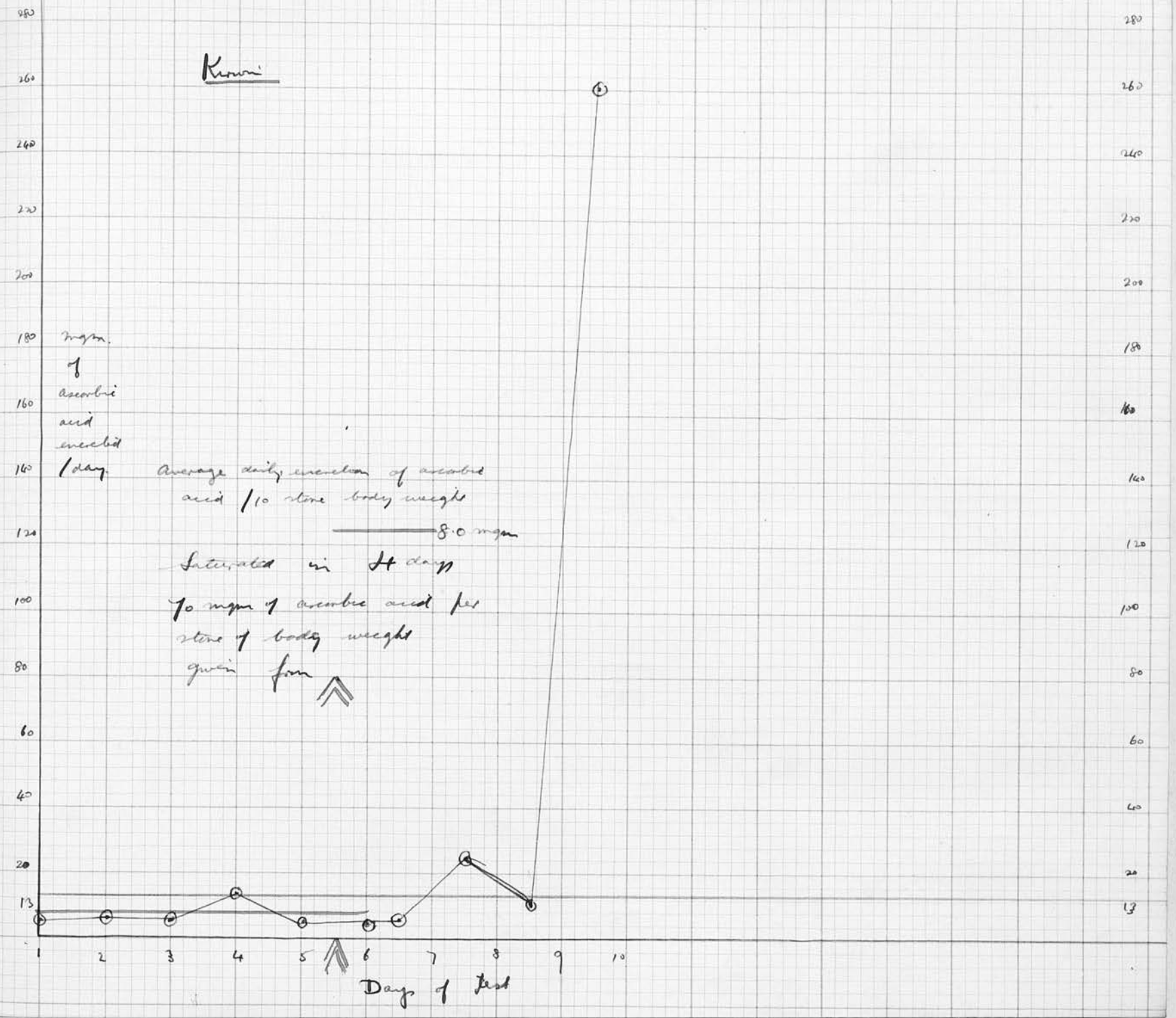
Kirwin.

Summary of history:- Admitted 13.9.37. with history of cough, loss of weight etc., for two years. Photograph showed complete blood spread through right side with soft walled apical vomica. Left clean. Right artificial pneumothorax 6.10.37. Fair collapse, cavity remains. Spread to left mid zone 9.4.38. which remains. Course of cadium in May onwards. Afebrile. TB+2. Sputum ℥ss-℥i positive. B.S.R. 15.

Weight 9st. 3lbs. Dose of ascorbic acid 750 mgm. Diet ++

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
July	c.c.						mgm	
18	525	.5cc	1.76	1.82	1.78	1.77	1.7	
	725	"	1.42	1.47	1.46	1.44	2.7	4.4
19	675	"	1.14	1.14	1.55	1.27	3.3	
	1500	1cc	4.54	4.67	4.70	4.62	3.6	6.9
21	750	.5cc	1.08	1.06	1.04	1.06	3.5	
	925	"	1.93	1.93	1.96	1.94	2.3	5.8
22	725	1cc	.68	.70	.71	.69	11.7	
	475	.5cc	1.38	1.38	1.33	1.36	1.8	13.5
23	700	"	1.78	1.75	1.79	1.78	4.3	
	500	"	1.62	1.60	1.59	1.60	2.2	6.5
24	248	1cc	.70	.70	.66	.69	4.0	
	500	.5cc	1.60	1.50	1.50	1.53	.9	
25	660	"	.95	.97	.92	.94	4.0	4.9
	660	1cc	.60	.58	.59	.59	12.3	
26	1000	.5cc	.62	.57	.58	.59	12.2	24.5
	476	"	.98	.98	.96	.97	2.7	
27	572	1cc	.83	.82	.84	.83	7.6	10.3
	1300	1/20	1.73	1.66	1.75	1.71	216.0	
28	740	1/5	1.38	1.43	1.40	1.40	55.0	271.0

Average daily excretion 7.4 mgm. Average daily excretion per 10 stone body weight 8.0 mgm. Days to become saturated - 4.


Known
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
mgm. of ascorbic acid excreted / day.
Average daily excretion of ascorbic acid / 10 stone body weight
8·0 mgm
Saturation in 4 days
70 mgm of ascorbic acid per stone of body weight given from
1
2
3
4
5
6
7
8
9
10
Days of test

Gordon.

Summary of history: Pleurisy 1928. 11.7.38. 1934 treatment for small gastric ulcer. Indigestion troublesome. Thin. Weight low for height. General condition poor. No sputum. Afebrile. Absolute rest. TB+3 Bilateral fibroid phthisis. Larynx badly ulcerated. B.S.R. 7.

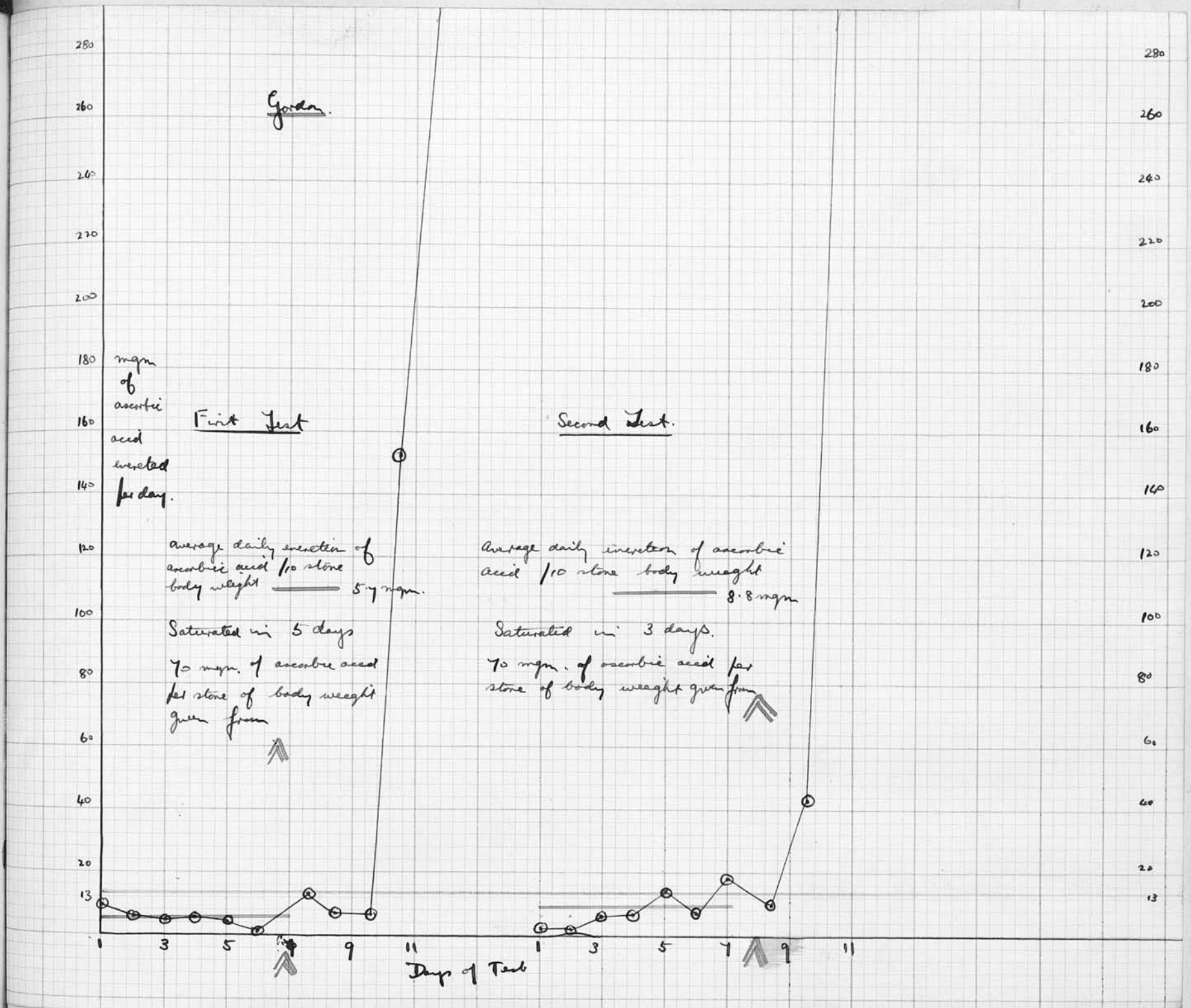
Weight 9st. 9lbs. Dose of ascorbic acid 650 mgm. Diet slightly deficient.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Jly.	c.c.						mgm	
29	752	.5cc	1.03	1.00	.97	1.00	4.2	
	400	"	.80	.79	.81	.80	5.5	9.7
30	792	"	1.40	1.43	1.43	1.42	3.0	
	1772	"	3.20	3.13	3.30	3.21	3.1	6.1
31	400	"	1.36	1.33	1.32	1.34	1.7	
	1200	"	2.20	2.25	2.24	2.23	3.0	4.7
Augl	824	"	2.81	2.85	2.80	2.82	1.2	
	1680	"	2.13	2.09	2.16	2.13	4.4	5.6
2	1628	"	3.00	3.06	2.96	3.01	2.5	
	1000	"	3.20	3.40	3.60	3.40	1.65	4.1
3	400	"	2.83	3.10	3.30	3.08	.7	
	532	"	3.70	3.80	4.10	3.87	.7	1.4
4	1220	1cc	2.60	2.70	2.70	2.67	5.0	
	*1000	.5cc	1.45	1.51	1.38	1.45	4.6	
5	860	"	.57	.57	.59	.58	8.5	13.1
	732	"	3.68	3.71	3.80	3.73	1.0	
6	760	"	.76	.77	.79	.77	5.5	6.5
	572	"	.58	.57	.57	.57	5.6	
7	400	"	1.84	1.81	1.85	1.83	1.3	6.9
	772	1/2	1.82	1.80	1.83	1.82	96.0	
8	400	1/20	1.44	1.47	1.47	1.46	57.0	153.0
	1600	1/20	1.46	1.50	1.50	1.48	246.0	
9	1052	1/10	1.02	.99	1.01	1.00	106.0	352.0

Average daily excretion 5.5 mgm. Average daily excretion per 10 stone body weight 5.7 mgm. Days to become saturated - 5.

Sept.								
23	1029		3.45	3.40	3.49	3.45	3.3	
	343		5.30	5.60	5.48	5.46	.6	3.9
24	343		3.53	3.62	3.48	3.53	1.0	
	971		4.10	3.90	3.85	3.93	2.6	3.6
25	514		2.55	2.55	2.52	2.54	2.2	
	971		26.4	2.85	2.69	2.73	3.9	6.1
26	971		1.82	1.93	1.86	1.87	5.7	
	343		3.52	3.51	3.49	3.51	1.1	6.8
27	1371		1.68	1.65	1.65	1.66	9.2	
	628		1.28	1.25	1.29	1.27	5.5	14.7

-continued


Gordon.
First Test
Second Test.
mgm of ascorbic acid excreted per day.
average daily excretion of ascorbic acid 1/10 stone body weight 5.7 mgm.
Saturated in 5 days
70 mgm. of ascorbic acid per stone of body weight given from
Average daily excretion of ascorbic acid 1/10 stone body weight 8.8 mgm
Saturated in 3 days.
70 mgm. of ascorbic acid per stone of body weight given from
Days of Test
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
3
5
7
9
11

Fielden.

Summary of history: 20.6.29--10.9.36. 4.10.37. Cough 2 years. ++ sputum. Bilateral fibrotic disease. B.S.R. 12.5

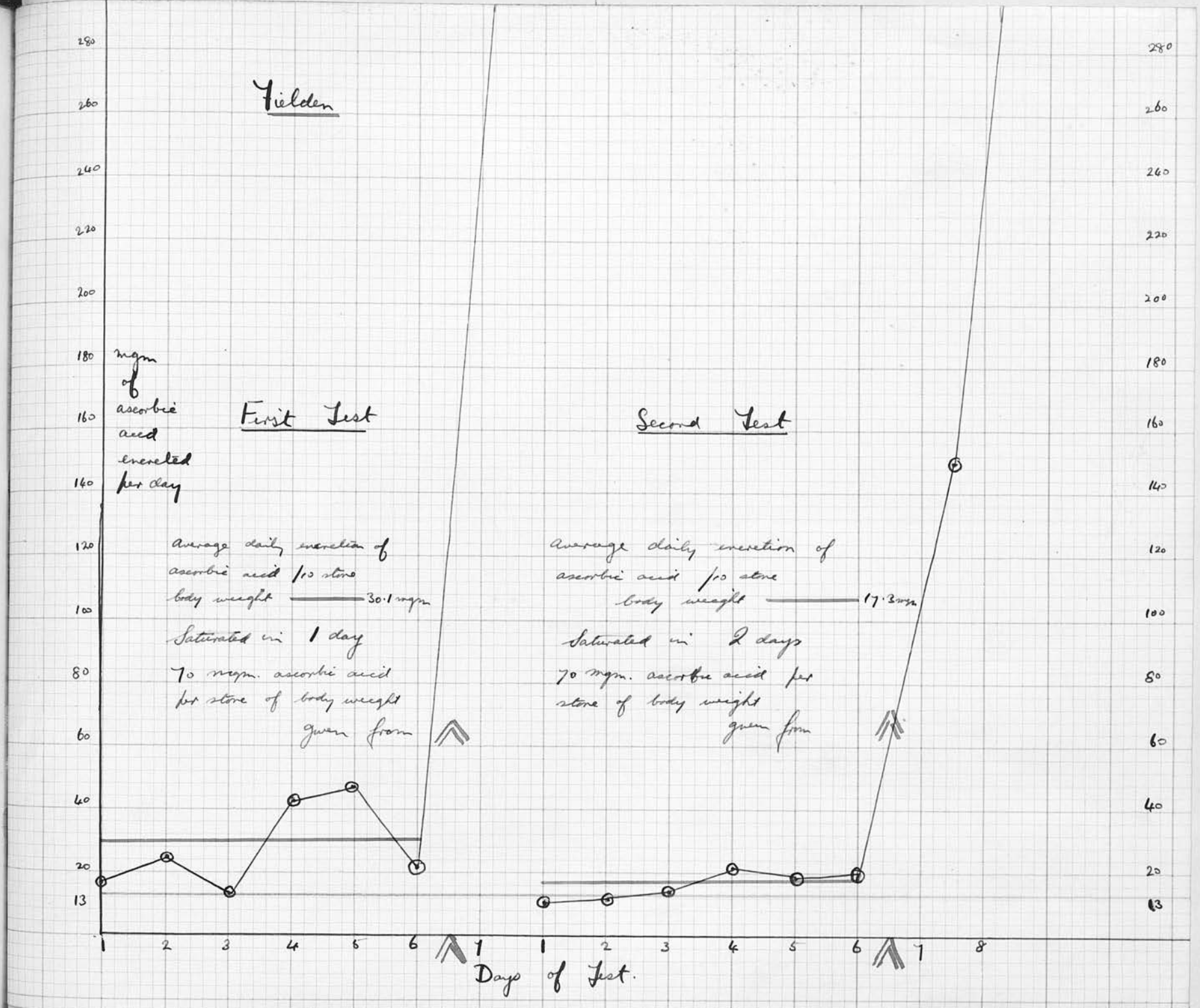
Weight 9st. 2lbs. Dose of ascorbic acid 650 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excrtn per day	Total
Aug.	c.c.						mgm	
21	600		.94	.92	.95	.94	7.0	
22	486		.62	.63	.61	.62	8.8	
22	686		.78	.78	.81	.79	9.6	18.4
23	829		.64	.65	.65	.65	14.3	
	914		.97	.99	.98	.98	10.4	24.7
24	343		.76	.75	.75	.75	5.1	
	571		.73	.73	.74	.73	8.7	13.8
25	914		.75	.75	.77	.76	13.6	
	800	1/2	.64	.60	.66	.63	29.8	43.4
26	1371		.56	.55	.53	.55	27.9	
	857	1/2	.96	.94	.98	.96	19.8	47.7
28	385		.64	.63	.62	.63	6.9	
	1143		.97	.91	.94	.94	13.5	20.4
29	1057		.75	.74	.79	.76	15.5	
	X1143	$1/10^{0}$	.96	.98	.96	.97	149.0	
	629	1/20	.96	.96	.99	.97	144.0	293.0

Average daily excretion 28.2 mgm. Average daily excretion per 10 stone body weight 30.1 mgm. One day to become saturated.

Sept.								
22	686		1.79	1.83	1.84	1.82	4.2	
	514		.82	.88	.84	.84	6.5	10.7
23	686		1.39	1.46	1.48	1.44	5.3	
	400		.87	.90	.91	.89	5.0	10.3
24	1600		1.68	1.60	1.62	1.63	10.7	
	Wasted							
25	1200		1.35	1.36	1.31	1.34	10.0	
	1200		1.06	1.12	1.08	1.09	3.2	13.2
26	320		1.28	1.29	1.30	1.29	2.8	
	1720		1.00	1.00	.99	1.00	19.1	21.9
27	880		.80	.81	.82	.81	12.0	
	800		1.23	1.27	1.26	1.25	7.1	19.1
28	360		.92	.96	.94	.94	4.2	
	760		.56	.52	.53	.54	15.5	19.7
29	1600		1.93	1.93	1.98	1.95	9.2	
	X 505	1/20	1.01	1.02	1.00	1.01	111.0	
30	90	1/2	2.10	2.09	2.08	2.09	9.6	129.8
	250	1/40	.59	.58	.58	.58	176.4	
31	228	1/40	.79	.79	.78	.79	128.0	304.4

Average daily excretion 15.9 mgm. Average daily excretion per 10 stone body weight 17.3 mgm. Two days to become saturated.


Yielden
First Test
Second Test
mgm of ascorbic acid excreted per day
average daily excretion of ascorbic acid /10 stone body weight 30·1 mgm
Saturated in 1 day
70 mgm. ascorbic acid per stone of body weight given from
average daily excretion of ascorbic acid /10 stone body weight 17·3 mgm
Saturated in 2 days
70 mgm. ascorbic acid per stone of body weight given from
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 2 3 4 5 6 7
1 2 3 4 5 6 7 8
Days of Test.

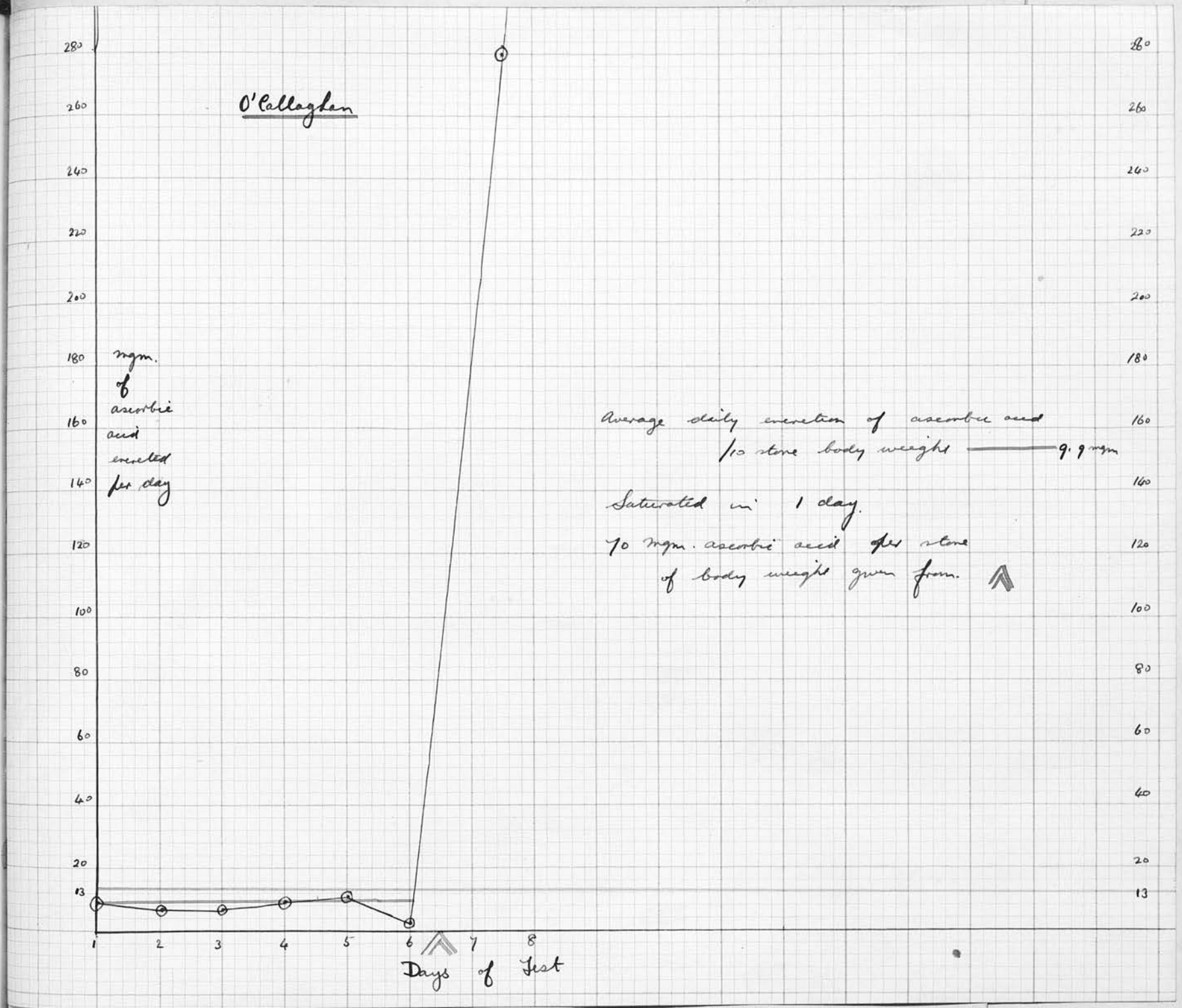
O'Callaghan.

Summary of history: 3.6.20.-14.4.21. 27.6.29.
History of cough etc. from 1916. 3i+ sputum
Bilateral fibrotic disease. B.S.R. 25.5

Weight 8st 11lbs. Dose of ascorbic acid 550 mgm. Diet - av.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
14	828		1.46	1.46	1.48	1.47	6.4	
	229		1.12	1.16	1.15	1.14	2.2	8.6
15	686		1.98	2.01	2.00	2.00	3.8	
	343		1.03	1.02	1.02	1.02	3.7	7.5
16	714		2.32	2.40	2.42	2.38	3.4	
	629		1.70	1.75	1.73	1.73	4.1	7.5
17	571		1.97	1.94	2.00	1.97	3.1	
	457		.84	.86	.86	.85	5.9	9.0
18	829		1.41	1.45	1.46	1.44	6.4	
	428		1.11	1.12	1.13	1.12	4.3	10.7
19	657		3.20	3.27	3.25	3.24	2.2	
	257		1.75	1.75	1.77	1.76	1.6	3.8
20	Lost							
21	114		2.04	2.04	2.02	2.03	.6	
	✱ 571	1/20	.59	.59	.61	.60	212.0	
22	800	1/10	1.47	1.50	1.48	1.48	68.0	280.0

Average daily excretion 7.9 mgm. Average daily excretion per 10 stone body weight 9.9 mgm. One day to become saturated.


O'Callaghan
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
mgm. of ascorbic acid excreted per day
Average daily excretion of ascorbic acid /10 stone body weight ——— 9.9 mgm
Saturated in 1 day.
70 mgm. ascorbic acid per stone of body weight given from.
1
2
3
4
5
6
7
8
Days of Test

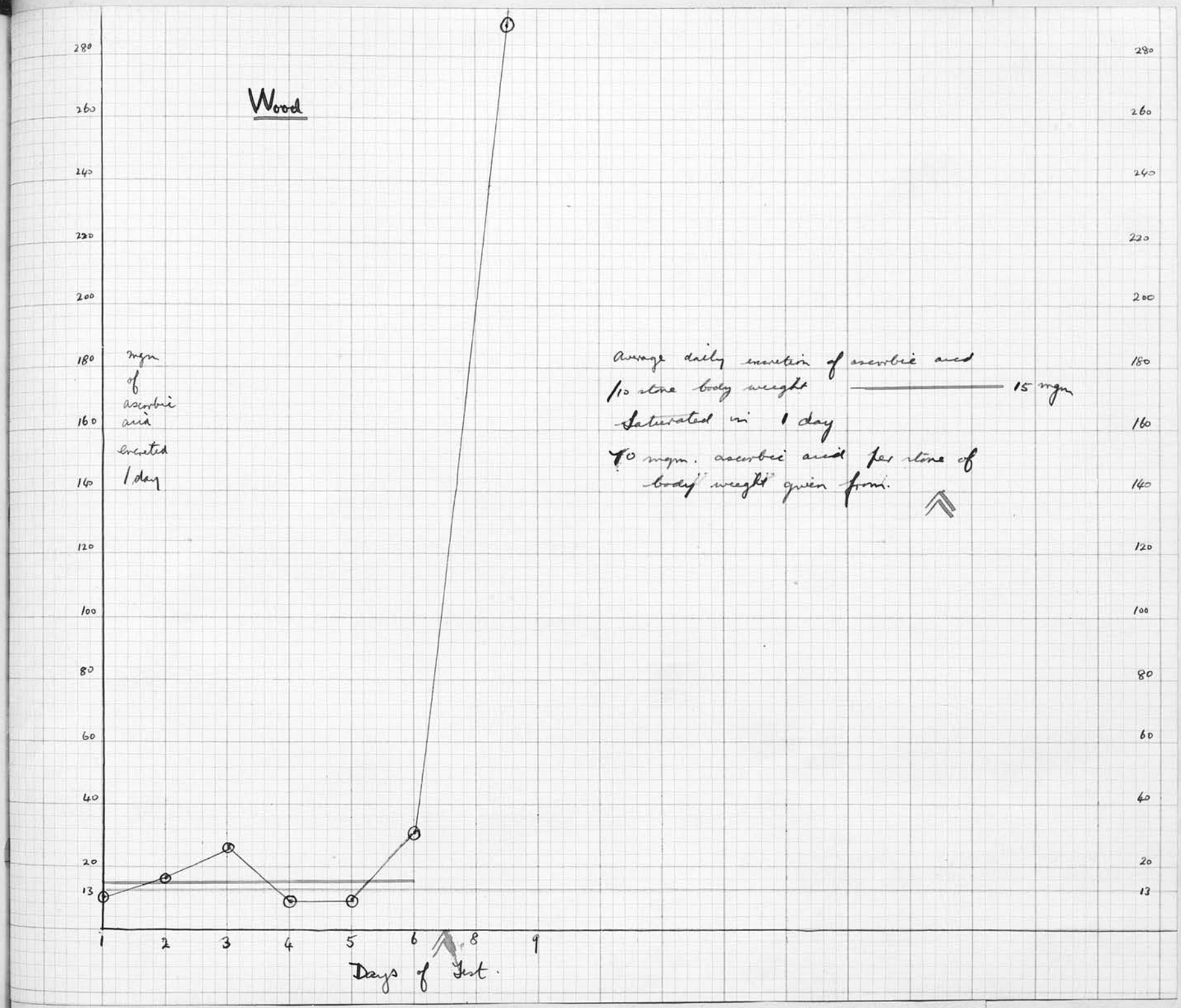
Wood.

Summary of history: Patient from 24.9.34--9.2.35. 11.4.38--12.9.38. TB+2. Haemoptysis Aug. 1934. Slight cough. Gaining weight. afebrile. Fibrotic apical disease - no cavities. BSR. 8.

Weight about 11 stone. Dose of ascorbic acid 600 mgm. Diet average.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
8	628		1.16	1.18	1.19	1.18	2.8	
	628		.89	.93	.91	.91	7.7	10.5
9	742		.83	.80	.82	.82	10.2	
	510		.90	.93	.91	.91	6.2	16.4
10	857		.62	.62	.61	.61	15.3	
	942		.79	.80	.83	.81	11.3	26.6
11	457		.91	.89	.91	.90	5.6	
	686		2.15	2.00	2.00	2.05	3.7	9.3
12	171		1.17	1.15	1.19	1.17	1.6	
	1028		1.49	1.52	1.53	1.52	7.1	8.7
13	On pass							
14	457	1/2	.80	.84	.80	.81	6.2	
	1371		.67	.63	.61	.64	24.5	30.7
15	486	1/3	.91	.87	.88	.89	18.3	
	✱1057	1/5	.48	.51	.50	.49	118.0	
16	571	1/20	.72	.74	.71	.73	175.6	293.6

Average daily excretion 17 mgm. Average daily excretion per 10 stone body weight 15 mgm. One day to become saturated


Wood
mgm of ascorbic acid excreted / day
Average daily excretion of ascorbic acid / 10 stone body weight — 15 mgm
Saturated in 1 day
70 mgm. ascorbic acid per stone of body weight given from.
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
2
3
4
5
6
8
9
Days of Test.

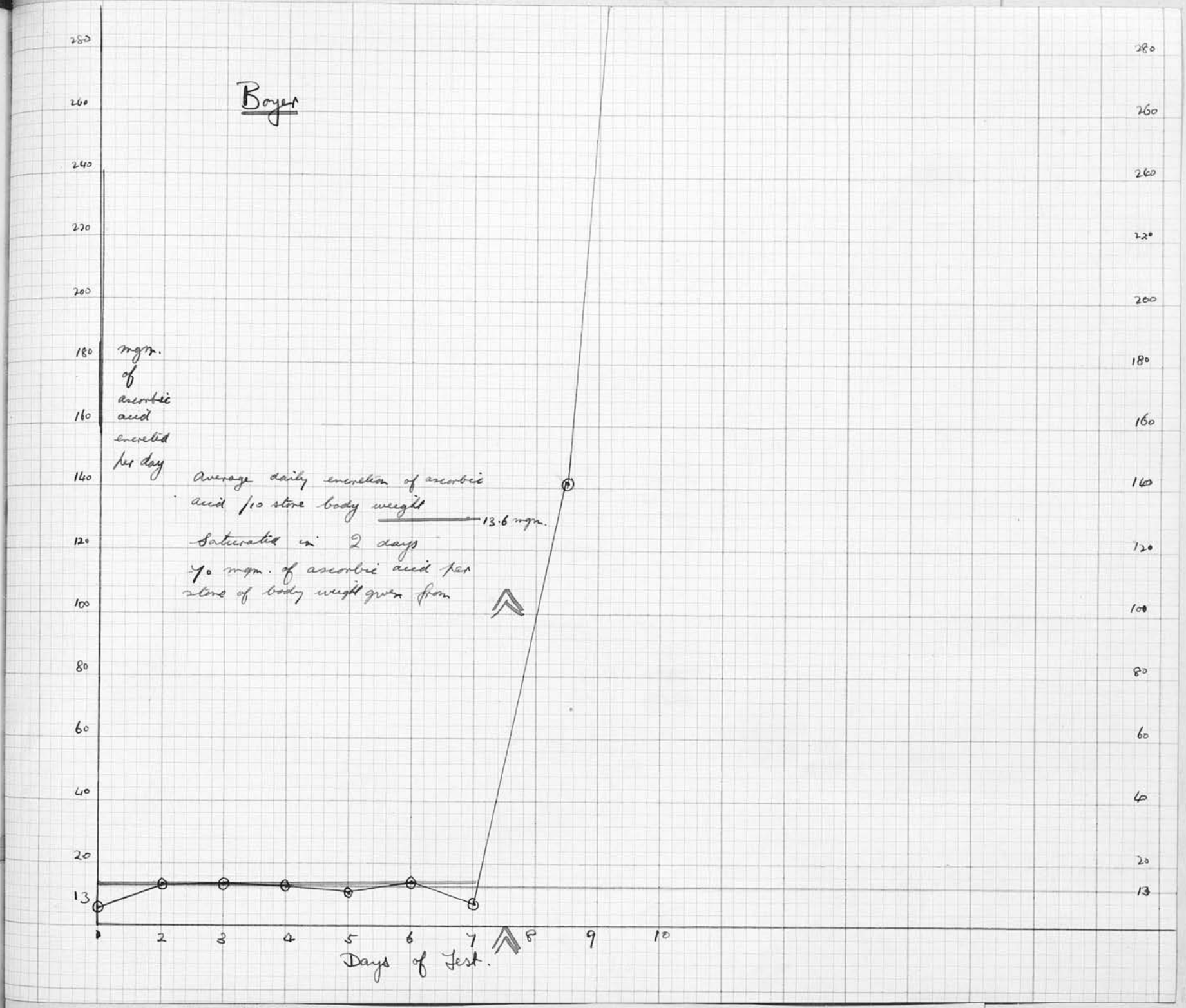
Boyer.

Summary of history: Patient from:- 26.9.32.-- 7.11.32. 28.10.37.-- 20.12. 37. 3.2.38 onwards. Cough one year. Loss of weight. No sputum. Chronic bronchitis, with infiltrated apices. TB- B.S.R. 8.5

Weight 8st. 3lbs. Dose of ascorbic acid 550 mgm. Diet: av. fruit

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
15	640		1.65	1.68	1.63	1.66	4.3	
	300		1.58	1.62	1.61	1.60	2.1	6.4
16	200	1/2	.86	.84	.86	.85	5.0	
	980		1.26	1.27	1.26	1.26	8.7	13.7
17	400		.54	.54	.55	.54	8.0	
	860		1.78	1.74	1.77	1.76	5.6	13.6
18	760		1.49	1.46	1.48	1.48	5.7	
	912		1.50	1.51	1.55	1.52	6.6	12.3
19	732		.98	.99	.98	.98	8.4	
	440		2.30	2.37	2.34	2.33	2.0	10.4
20	1320		1.34	1.36	1.32	1.34	11.0	
	640		2.81	2.85	2.87	2.84	2.8	13.8
21	360		.90	.88	.90	.89	4.5	
	600		2.21	2.27	2.33	2.27	2.9	7.4
23	200		.91	.91	.89	.90	2.4	
	* 880	1/10	.81	.80	.81	.80	119.0	
24	200	1/10	1.02	1.01	1.02	1.02	22.0	141.0
	852	1/20	.65	.63	.63	.64	296.0	
25		1/20	1.84	1.80	1.78	1.81	83.0	379.0

Average daily excretion 10.9 mgm. Average daily excretion per 10 stone body weight 13.6 mgm. Two days to become saturated.


Boyer
mgm. of ascorbic acid excreted per day
Average daily excretion of ascorbic acid /10 stone body weight
13.6 mgm.
Saturation in 2 days
70 mgm. of ascorbic acid per stone of body weight given from
Days of Test.
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
2
3
4
5
6
7
8
9
10

Goldsby,

Summary of history: 18.2.37. - 18.4.37. 23.12.37 onwards.
3 years cough etc. TB+2.
Very extensive disease. B.S.R. 17.2

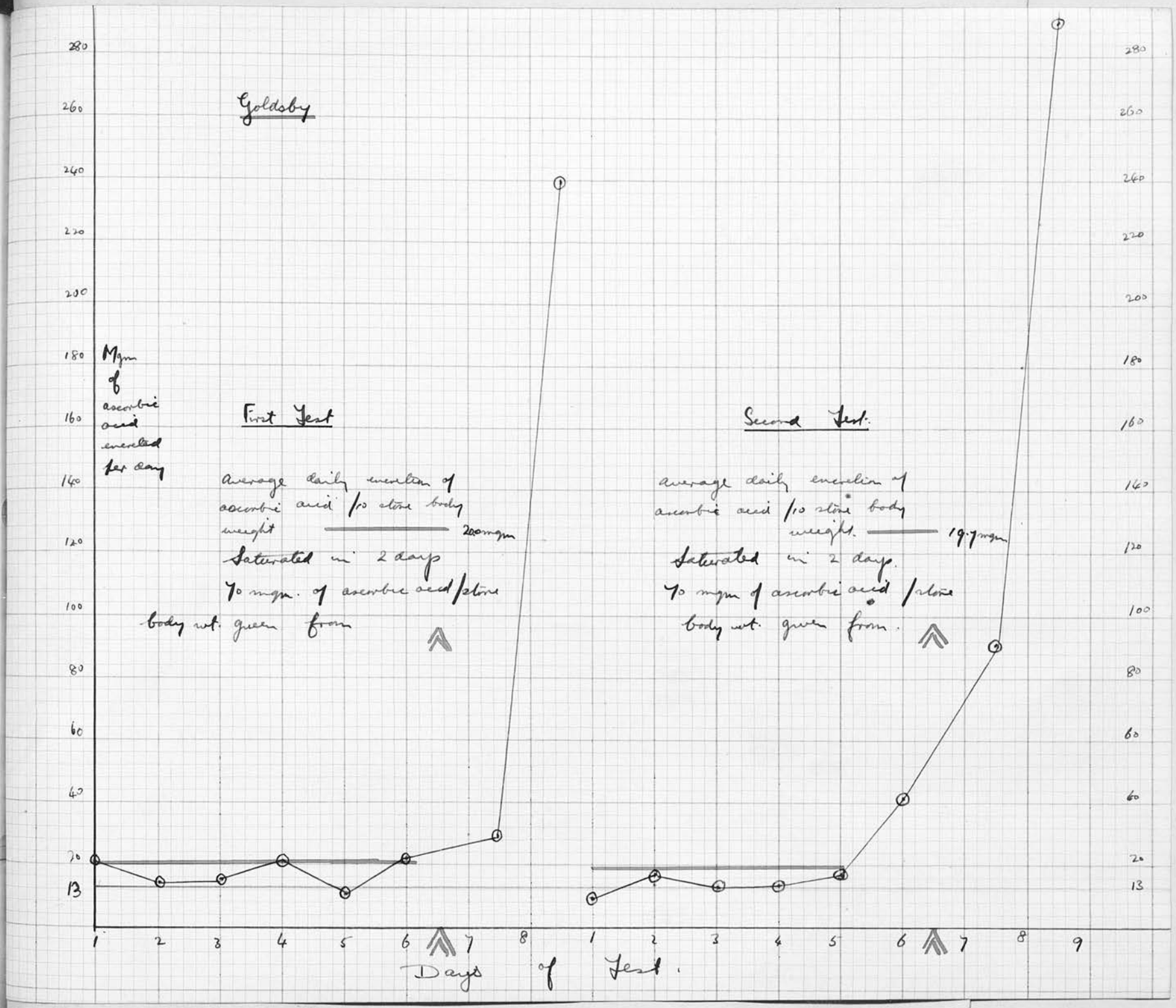
Weight 8st. 9lbs. Dose of ascorbic acid 600 mgm. Diet+

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
22	714		.54	.52	.54	.53	14.7	
	486		.95	.95	.93	.94	5.7	20.4
23	343		.53	.54	.52	.53	7.3	
	800		1.02	1.00	.97	.99	6.7	14.0
24	457		.61	.63	.64	.63	8.2	
	514		.77	.75	.76	.76	7.5	15.7
25	600		.88	.90	.88	.89	7.5	
	857		.65	.68	.70	.68	14.0	21.5
26	371		1.04	1.06	1.06	1.05	3.9	
	628		.95	.97	.95	.96	7.3	11.2
28	343	1/2	.88	.92	.92	.91	8.4	
	971		.70	.67	.69	.69	13.7	22.1
29	514		.75	.74	.79	.76	7.5	
	X229	1/3	1.24	1.23	1.26	1.24	6.3	
30	514	1/5	1.50	1.49	1.49	1.49	23.0	29.3
	514	1/20	.98	1.00	1.00	.99	128.0	
31	343	1/50	1.66	1.70	1.74	1.70	112.0	240.0

Average daily excretion 17.5 mgm. Average daily excretion per 10 stone body weight 20 mgm. Days to become saturated 2.

Sept.								
23	286		.59	.62	.62	.61	5.1	
	400		.92	.91	.94	.92	4.8	9.9
24	686		1.03	1.03	1.02	1.03	7.5	
	100		1.21	1.23	1.22	1.22	9.0	16.5
25	880		.84	.85	.80	.83	11.7	
	100		.56	.54	.54	.55	2.0	13.7
26	Nil							
	1120		.97	.98	.97	.98	14.3	14.3
27	380		1.20	1.20	1.24	1.21	3.5	
	1320		1.11	1.16	1.17	1.14	13.2	16.7
28	1040		.81	.80	.82	.81	14.2	
	1100	1/2	.82	.82	.86	.84	26.2	40.4
29	X 400		.78	.77	.74	.76	5.9	
	X 300	1/20	.78	.76	.77	.77	86.0	91.9
30	85	1/10	2.00	1.97	1.95	1.97	4.8	
	245	1/20	1.90	1.92	1.93	1.92	288.0	292.8

Average daily excretion 17.2 mgm. Average daily excretion per 10 stone body weight 19.7 mgm. Days to become saturated 2.


Goldsby
Mgm of ascorbic acid excreted per day
First Test
average daily excretion of ascorbic acid /10 stone body weight 20 mgm
Saturated in 2 days
70 mgm. of ascorbic acid /stone body wt. given from
Second Test.
average daily excretion of ascorbic acid /10 stone body weight. 19.7 mgm
Saturated in 2 days.
70 mgm of ascorbic acid /stone body wt. given from.
Days of Test.

Key.

Summary of history: Cough, loss of weight, since Jan. 1931. Extensive bilateral fibrotic disease.

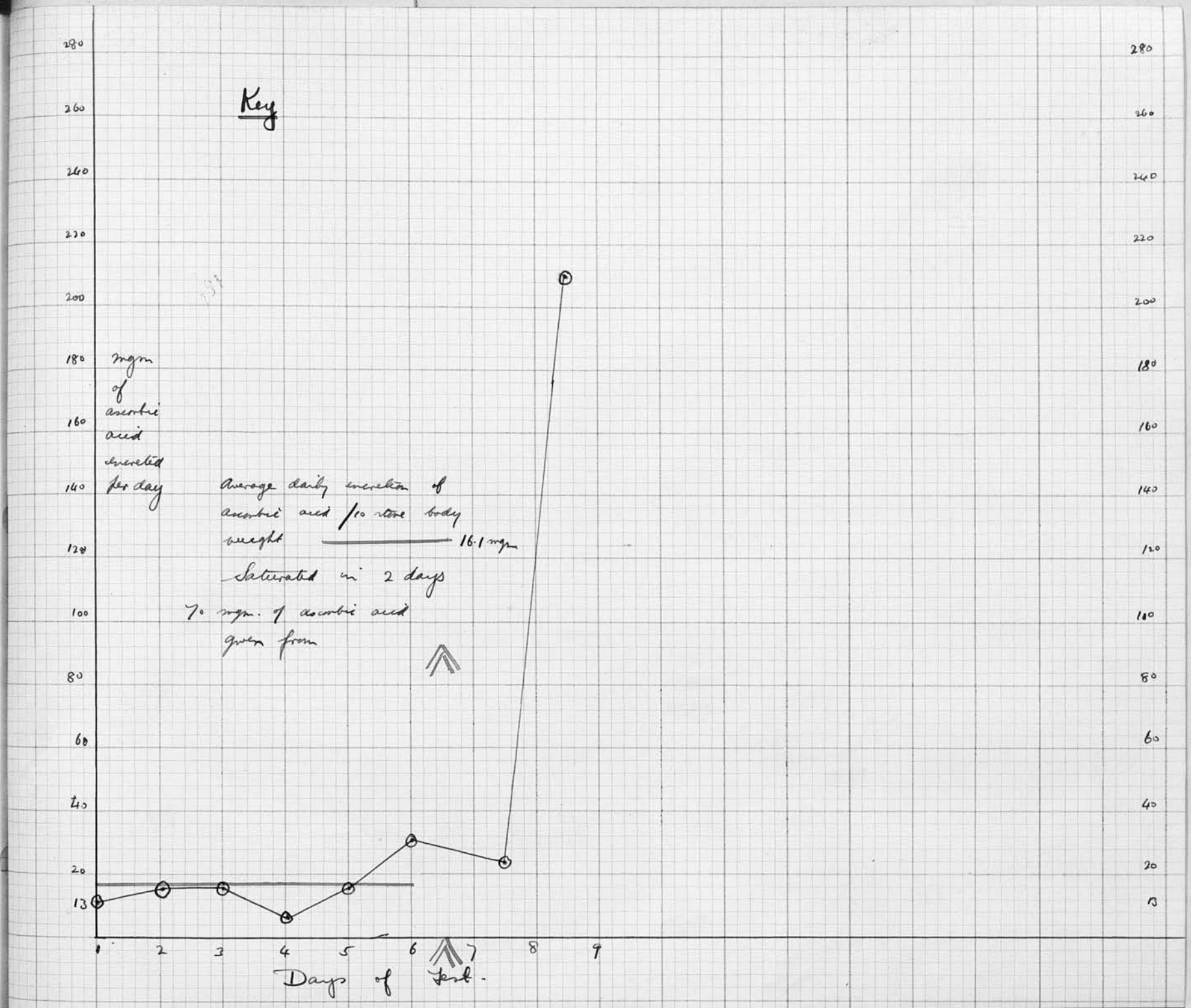
TB+2 B.S.R. 24.

Weight 9st 2lbs. Dose of ascorbic acid 650 mgm. Diet average.

1938.	Amount urine per 12 hours	Dilution of urine	Titration readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
8	1485		1.12	1.16	1.14	1.14	7.2	
	714		1.79	1.82	1.80	1.80	4.5	11.7
9	457		.83	.86	.82	.84	6.1	
	742		.88	.92	.94	.91	9.0	15.1
10	685		.93	.91	.95	.93	8.1	
	942		1.40	1.41	1.39	1.40	7.4	15.5
11	571		1.29	1.31	1.31	1.30	4.1	
	400		1.46	1.47	1.49	1.47	3.1	7.2
12	571		1.33	1.34	1.36	1.34	4.7	
	1085		1.16	1.13	1.18	1.16	10.4	15.1
13	On pass							
14	571		.84	.80	.84	.83	7.7	
	1028		.52	.48	.51	.50	22.8	30.6
15	629		1.07	1.06	1.06	1.06	6.5	
	* 486	1/3	1.38	1.44	1.41	1.41	11.7	
16	629	1/2	1.07	1.11	1.12	1.10	12.7	24.4
	714	1/20	1.32	1.33	1.30	1.32	121.0	
17	457	1/20	1.11	1.18	1.12	1.14	89.4	210.4

Went out against advice.

Average daily excretion 15.5 mgm. Average daily excretion per 10 stone body weight 16.1 mgm. Days taken to become saturated 2.


Key
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
mgm of ascorbic acid excreted per day
Average daily excretion of ascorbic acid / 10 stone body weight 16.1 mgm
Saturated in 2 days
70 mgm. of ascorbic acid given from
1 2 3 4 5 6 7 8 9
Days of test.

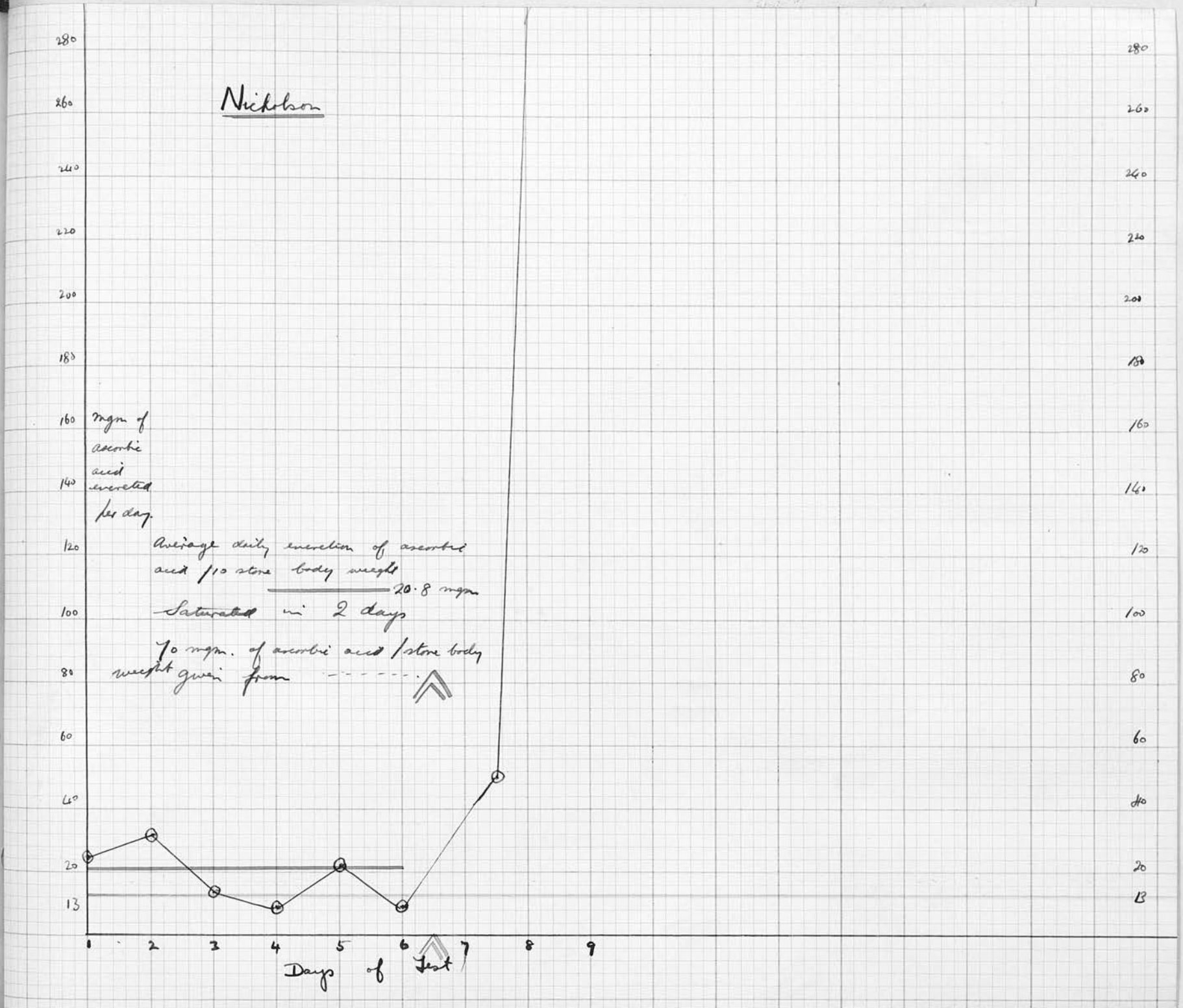
Nicholson.

Summary of history: 3 years history. Left artifical pneumothorax, with effective collapse with cavity being shut down. Ready for discharge. B.S.R. 8.

Weight: 8st. 11lbs. Dose of ascorbic acid 550 mgm. Diet: little +

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
16	400	1/5	1.27	1.26	1.27	1.27	17.5	
	260	1/2	.84	.84	.84	.84	6.8	24.3
17	1000		.59	.55	.54	.56	18.2	
	420	1/2	.67	.66	.67	.67	14.0	32.2
18	500		.65	.68	.66	.66	8.3	
	816		1.55	1.55	1.50	1.53	5.9	14.2
19	200		.78	.78	.79	.78	2.9	
	520		.95	.93	.98	.95	6.0	8.9
20	520		.58	.56	.56	.57	10.4	
	680		.63	.63	.62	.63	12.1	22.5
21	400		.80	.82	.78	.80	5.5	
	360		1.50	1.52	1.53	1.52	2.8	8.3
23	240		.53	.53	.54	.53	10.0	
	400¥	1/5	.97	.98	.98	.97	22.0	
24	480	1/5	.96	.98	.94	.96	28.0	50.0
	640	1/40	.65	.65	.66	.65	432.0	
25	740	1/20	2.20	2.15	2.12	2.15	78.0	510.0

Average daily excretion 16.7 mgm. Average daily excretion per 10 stone body weight 20.8 mgm. Two days to become saturated.


Nicholson
280
260
240
220
200
180
160
mgm of ascorbic acid excreted per day.
140
120
100
80
60
40
20
13
Average daily excretion of ascorbic acid /10 stone body weight
20·8 mgm
Saturated in 2 days
70 mgm. of ascorbic acid / stone body weight given from
1
2
3
4
5
6
7
8
9
Days of Test

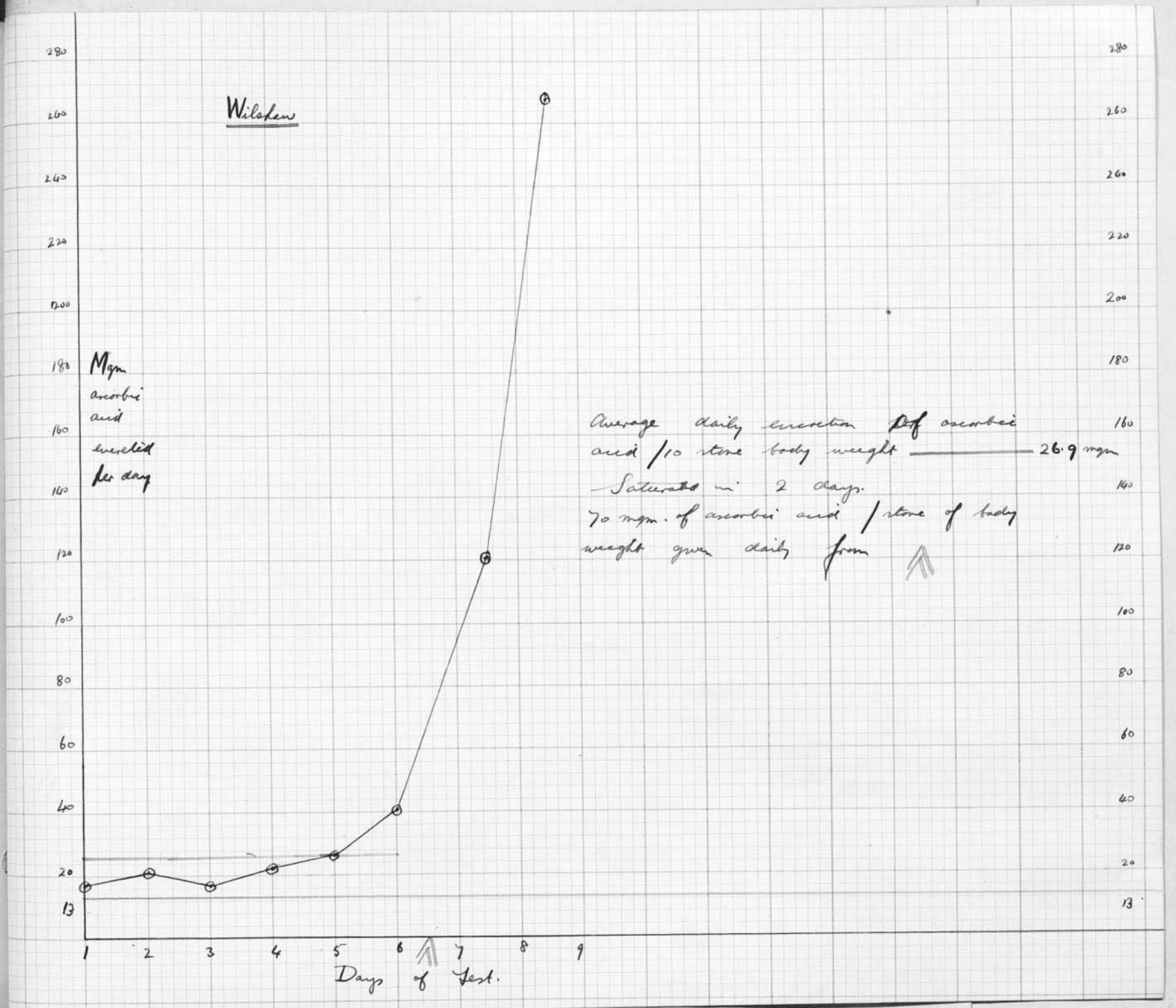
Wilshaw.

Summary of history: 29.7.37. 4 months history. Tuberculous larynx on admission. Bilateral fibrotic disease. ǯii+ Large cavity left side. B.S.R. 26.

Weight 9st. 11-1bs. Dose of ascorbic acid 650 mgm. Diet - average

1938.	Amount of urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac excretn per day	Total
Aug.	c.c.						mgm	
24	314		.56	.55	.57	.56	6.1	
	1143		1.13	1.14	1.13	1.13	11.1	17.2
25	1029		.78	.76	.79	.78	13.3	
	800		1.17	1.18	1.14	1.16	7.6	20.9
26	971		1.15	1.14	1.12	1.14	9.5	
	1285		1.87	1.91	1.91	1.90	7.6	17.1
29	571		.59	.58	.54	.57	11.2	
	1343		1.34	1.36	1.35	1.35	11.3	22.5
30	1143		1.01	1.01	1.02	1.01	12.5	
	1200		.95	.97	.96	.96	13.9	26.4
31	1029		.78	.80	.83	.80	14.3	
	✱ 314	1/5	.68	.68	.66	.67	25.9	40.2
Sept1	1029	1/5	.61	.62	.62	.62	94.5	120.4
2nd dose	1343	1/5	.72	.72	.72	.72	208.0	
2	943	1/3	.53	.53	.51	.52	60.0	268.0

Average daily excretion 22.6 mgm. Average daily excretion per 10 stone body weight 26.9 mgm. Two days to become saturated


Wilshaw
Mgm ascorbic acid excreted per day
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1
2
3
4
5
6
7
8
9
Days of Test.
Average daily excretion of ascorbic acid /10 stone body weight ——— 26.9 mgm
Saturated in 2 days.
70 mgm. of ascorbic acid / stone of body weight given daily from

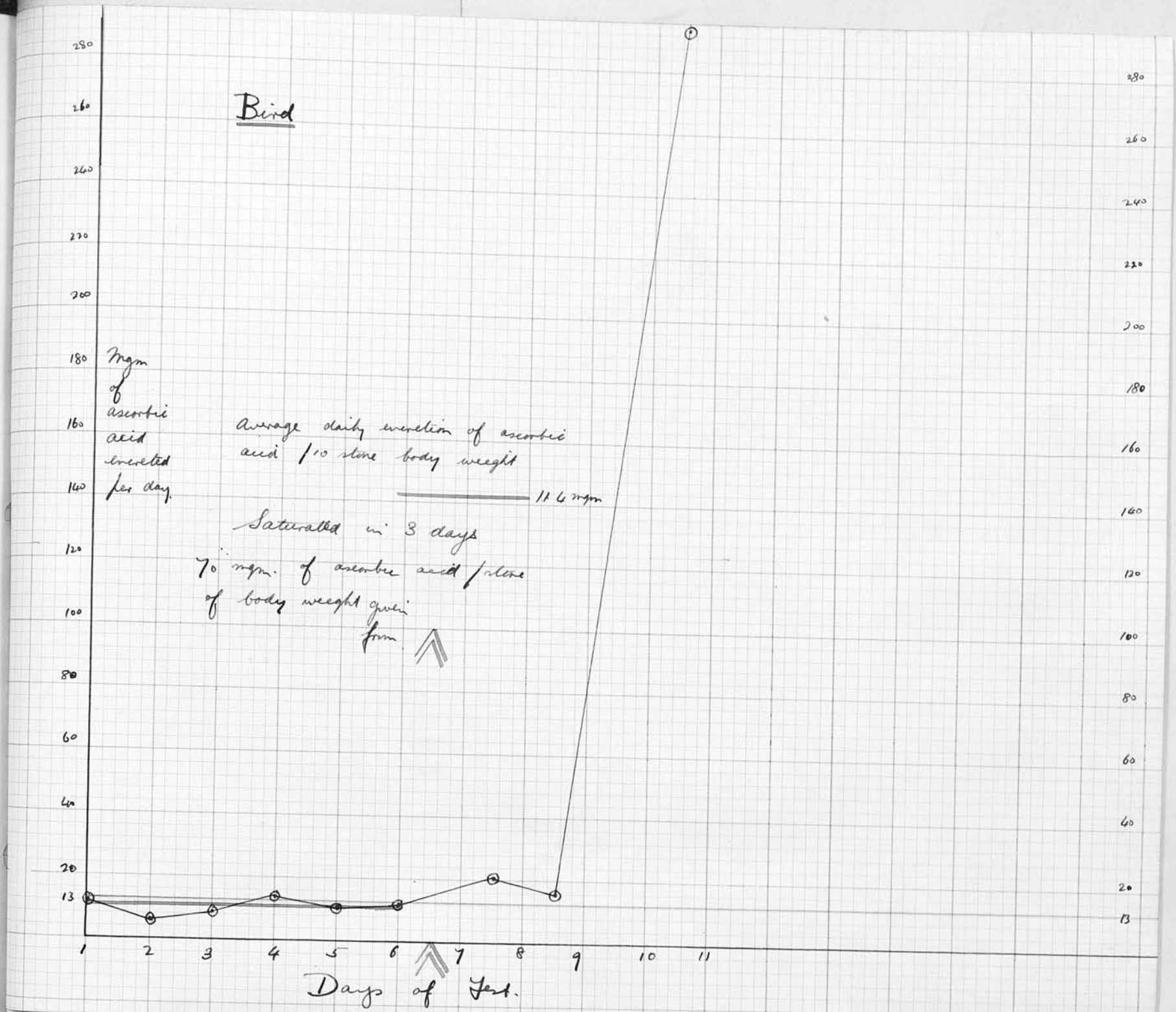
Bird.

Summary of history: 7.10.37. 3 years history left pleurisy. Little infiltration apices. ƺss- TB- B.S.R. 6.

Weight 9st. 8lbs. Dose of ascorbic acid 650 mgm. Diet average.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
7	371		.55	.53	.55	.54	7.6	
	628		1.43	1.43	1.40	1.42	4.8	12.4
8	400		1.49	1.52	1.52	1.51	ƺ.9	
	628		1.03	1.08	1.05	1.05	3.3	6.2
9	371		.85	.88	.85	.86	4.9	
	371		.87	.87	.89	.88	4.8	9.7
10	1229		.94	.97	.92	.94	14.4	
	800		.82	.79	.80	.81	9.6	14.0
11	657		1.61	1.65	1.65	1.64	4.4	
	800		1.63	1.63	1.64	1.63	5.3	9.7
12	1143		1.98	1.99	1.97	1.98	6.3	
	800		1.32	1.30	1.36	1.34	6.6	12.9
13	On pass							
14	229	1/2	1.02	0.98	.98	.99	5.8	
	¥600		.68	.64	.67	.66	10.0	
15	829		.89	.93	.93	.91	10.0	20.0
	571		.69	.71	.73	.71	8.9	
16	886		1.20	1.24	1.22	1.22	8.1	16.0
	1371	1/20	1.28	1.25	1.26	1.26	242.6	
17	1057	1/5	1.12	1.12	1.17	1.13	51.5	294.1
	943		.63	.60	.62	.62	17.3	

Average daily excretion 10.9 mgm. Average daily excretion per 10 stone body weight 11.4 mgm. Days to become saturated - 3.


Bird
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
Mgm of ascorbic acid excreted per day.
Average daily excretion of ascorbic acid / 10 stone body weight
11.4 mgm
Saturated in 3 days
70 mgm. of ascorbic acid / stone of body weight given from
1
2
3
4
5
6
7
8
9
10
11
Days of Test.

Wolstencroft.

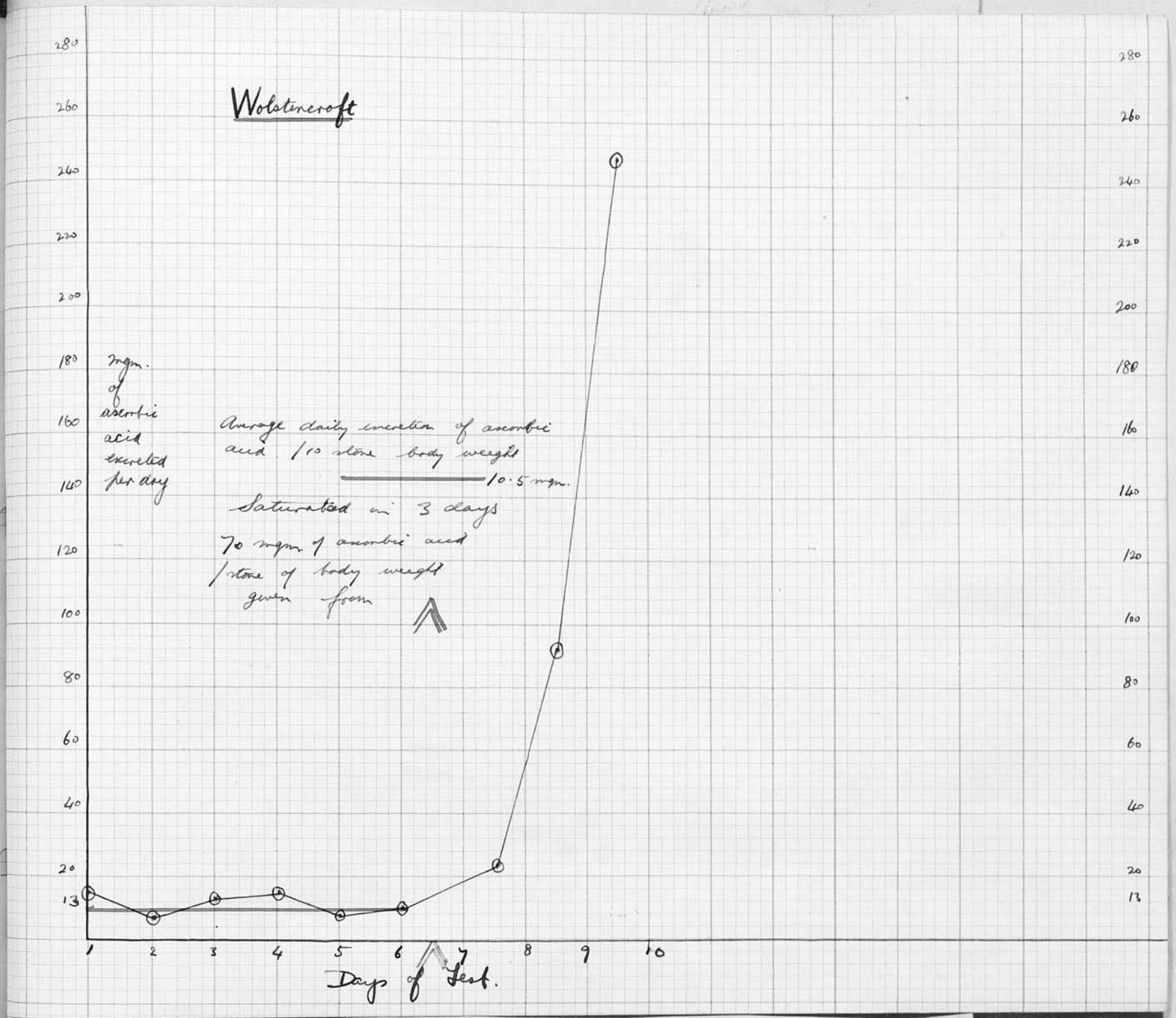
Summary of history: 5.7.37. onwards. 2 years history. Zi+ Bilateral fibrolic disease with cavitation.

B.S.R. 21.

Weight about 11 st. Dose of ascorbic acid 750 mgm. Diet - No fruit.

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
8	571		.60	.64	.62	.62	10.2	
	1142		2.37	2.41	2.38	2.38	5.4	15.6
9	971	.5cc	1.73	1.71	1.72	1.72	3.2	
	400		1.19	1.19	1.21	1.19	3.8	7.0
10	714		1.27	1.30	1.30	1.29	6.2	
	1028		1.78	1.82	1.77	1.79	6.4	12.6
11	400		.84	.84	.87	.85	5.3	
	1143		1.22	1.21	1.20	1.21	10.3	15.6
12	457	.5cc	1.27	1.26	1.20	1.24	2.1	
	1600		3.30	3.13	3.15	3.19	5.5	7.6
13	457		1.28	1.25	1.28	1.27	4.0	
	914		1.69	1.73	1.75	1.72	6.0	10.0
14	On pass							
15	* 914	1/2	.92	.92	.95	.93	11.0	
	1028		.90	.88	.88	.89	12.8	23.8
	714	1/3	.72	.70	.70	.71	33.4	
16	514	1/20	1.93	1.96	1.94	1.94	58.8	92.2
	686	1/20	1.03	.99	.97	1.00	152.4	
17	514	1/20	1.44	1.51	1.50	1.48	97.0	249.4

Average daily excretion 11.5 mgm. Average daily excretion per 10 stone body weight 10.5 mgm. 3 Days to become saturated.


Wolstencroft
mgm. of ascorbic acid excreted per day
Average daily excretion of ascorbic acid /10 stone body weight
10·5 mgm.
Saturated in 3 days
70 mgm of ascorbic acid /stone of body weight given from
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 2 3 4 5 6 7 8 9 10
Days of Test.

Graupman.

Summary of history: In hospital 5.7.34-25.10.34. 2.12.35-4.6.36. 3.10.36-3.6.38. Cough past year. Bilateral fibrotic disease with cavitation. Sputum+ General condition rather poor. Up 12 hrs. B.S.R. 11.

Weight 9st. 9lbs. Dose of ascorbic acid 650 mgm. Diet - Deficient

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Aug.	c.c.						mgm	
6	1120	.5cc	2.15	2.10	2.00	2.08	2.9	
	400	"	4.20	4.20	4.40	4.27	.5	3.4
7	216		1.38	1.34	1.33	1.35	1.8	
	820		2.19	2.13	2.17	2.16	4.3	6.1
8	424		1.82	1.85	1.86	1.84	2.6	
	272	.5cc	1.95	1.95	1.05	1.65	..8	3.4
9	400	"	1.08	1.05	1.06	1.06	2.0	
	1312		1.28	1.28	1.26	1.27	11.5	13.5
10	208	.5cc	1.36	1.39	1.38	1.38	.9	
	472		2.20	1.96	2.09	1.99	2.8	3.7
11	128		1.10	1.12	1.09	1.10	1.9	
	400		6.23	6.20	6.40	6.28	.7	2.6
12	320	.5cc	2.10	2.10	2.20	2.13	1.6	
	Not saved							
13	On pass							
14	200		1.61	1.64	1.58	1.61	1.4	
	* 272		1.04	1.01	1.03	1.04	1.4	
15	264		3.13	3.16	3.18	3.16	.9	2.3
	244		4.03	4.00	4.09	4.04	1.7	
16	572		3.71	3.68	3.76	3.72	1.7	3.4
	1172		.57	.54	.57	.56	28.6	
17	500		2.40	2.45	2.48	2.44	2.1	30.7
	640	1/10	.82	.84	.82	.83	86.5	
18	180	1/10	.68	.67	.67	.67	2.9	89.4
	1000		2.67	2.65	2.60	2.64	4.1	
19	280		1.40	1.41	1.40	1.40	2.2	6.3
	732	1/10	1.63	1.63	1.65	1.63	50.0	
20	300		.52	.54	.52	.53	20.0	70.0
	572		.52	.54	.52	.53	12.o	
21	660	1/5	.76	.96	1.00	.99	37.5	49.6
	800	1/20	.83	.82	.81	.82	216.0	
22	600	1/20	.65	.66	.66	.66	204.0	420.0

Average daily excretion 5.4 mgm. Average daily excretion per 10 stone of body weight 5.8 mgm. Days to become saturated 8.

-continued.

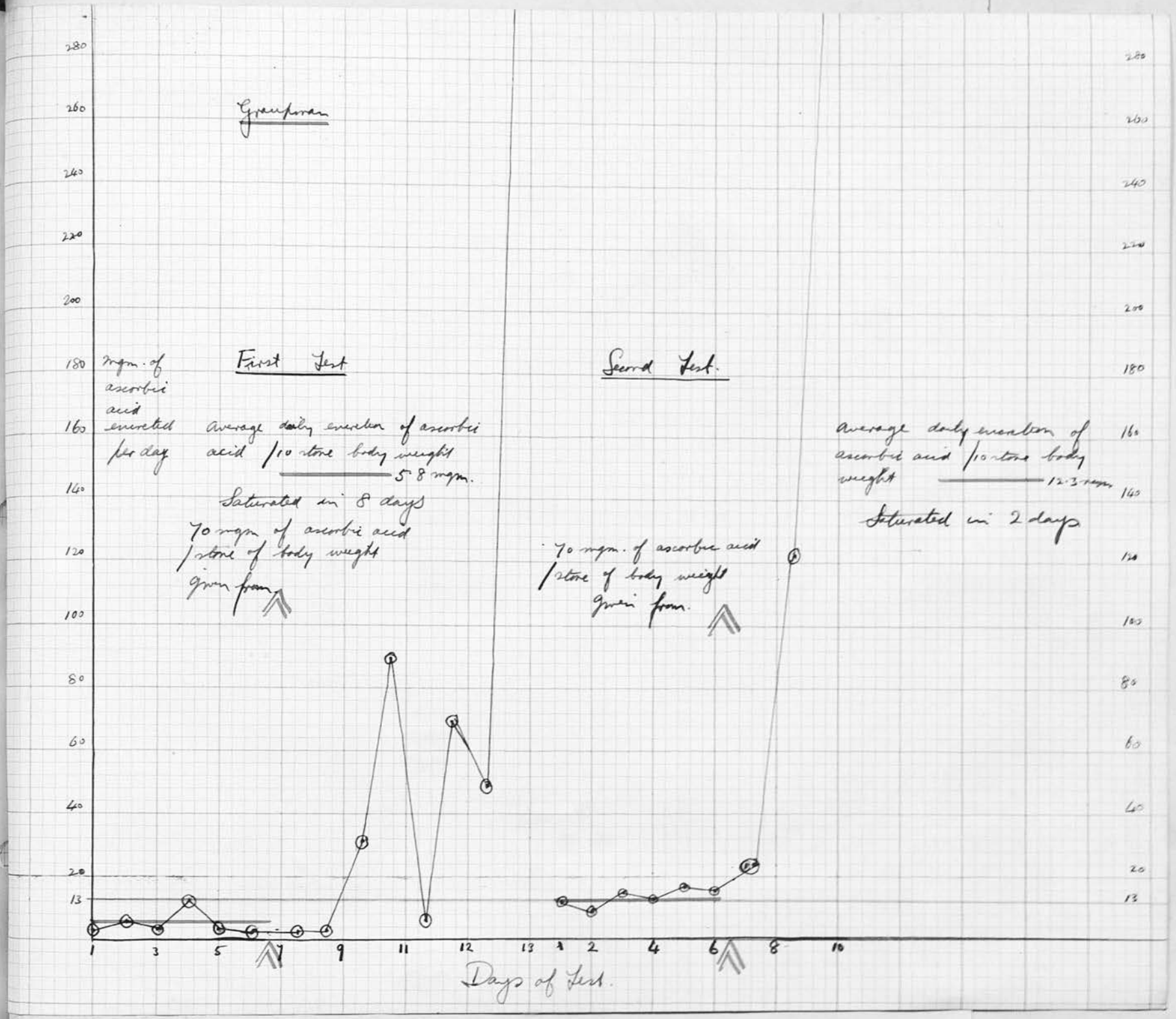
Graupman. -contd.

Summary of history: In hospital 5.7.34-25.10.34. 2.12.35-4.6.36. 3.10.36-3.6.38. Cough past year. Bilateral fibrolic disease with cavitation. Ziv+ General condition rather poor. Up 12 hrs. B.S.R.11.

Weight 9st. 9lbs. Dose of ascorbic acid 650 mgm. Diet - Deficient

1938.	Amount urine per 12 hours	Dilution of urine	Titration Readings			Average Titration	Ascorbic ac. excretn per day	Total
Oct.	c.c.						mgm	
9	771		1.41	1.43	1.38	1.41	6.0	
	1571		2.86	2.93	2.81	2.87	6.1	12.1
10	800		1.18	1.16	1.19	1.18	7.6	
	314		1.74	1.76	1.78	1.76	1.9	9.5
12	1086		1.27	1.26	1.22	1.25	9.7	
	1924		3.74	3.69	3.67	3.77	5.7	15.4
13	1057		1.28	1.28	1.29	1.28	9.2	
	1086		2.75	2.79	2.80	2.78	4.3	13.5
14	1057		1.24	1.26	1.19	1.23	9.5	
	1371		2.13	2.11	2.07	2.10	7.1	16.6
16	800		1.06	1.09	1.05	1.07	8.3	
	1599		2.47	2.50	2.49	2.48	7.4	15.7
17	1256		.92	.92	.91	.92	15.2	
	1148		1.54	1.50	1.58	1.54	8.3	23.5
18	914		1.14	1.15	1.12	1.14	8.9	
	X 385	1/5	.63	.64	.62	.63	33.5	
19	1200	1/20	1.63	1.65	1.61	1.63	89.0	122.5
	685	1/20	.73	.74	.73	.73	208.0	
20	857	1/20	.83	.85	.81	.83	228.0	436.0

Average daily excretion 11.0 Average daily excretion per 10 stone of body weight 12.3 mgm. Two days to become saturated.


Graefenan
First Test
Second Test.
mgm. of ascorbic acid excreted per day
average daily excretion of ascorbic acid /10 stone body weight
5·8 mgm.
Saturated in 8 days
70 mgm of ascorbic acid /stone of body weight given from
average daily excretion of ascorbic acid /10 stone body weight
12·3 mgm.
Saturated in 2 days
70 mgm. of ascorbic acid /stone of body weight given from.
280
260
240
220
200
180
160
140
120
100
80
60
40
20
13
1 3 5 7 9 11 12 13 1 2 4 6 8 10
Days of Test.