

IRON THERAPY in NUTRITIONAL ANAEMIA of INFANTS

T H E S I S

SUBMITTED for the DEGREE of DOCTOR of MEDICINE of the
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by

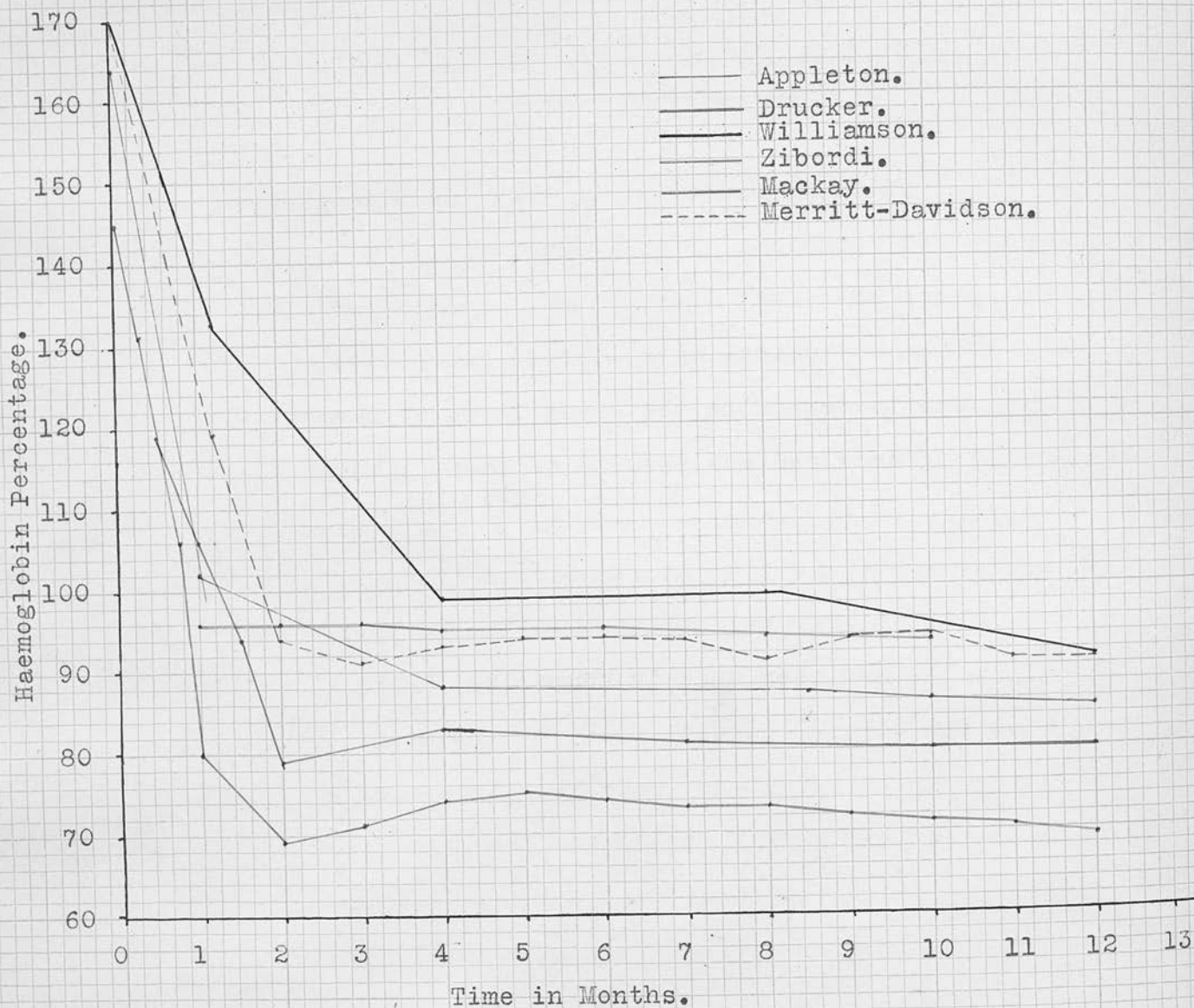
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GRAPH I. The haemoglobin level during the first year of life as reported by different workers.

THE HAEMOGLOBIN LEVEL IN INFANCY.

It is generally known that the haemoglobin content of the blood of the normal child is considerably below the adult level of one hundred per cent. Several investigators have carried out series of estimations to determine the exact level of haemoglobin during infancy and the results of their labours show considerable variations. MACKAY⁽¹⁾ has made a careful survey of the literature on this subject and has tabulated the figures obtained by the various writers. This table has been used in compiling GRAPH I which shows the varying results found by Appleton, Drucker, Williamson, Zibordi and MACKAY. In a very extensive investigation, MACKAY found that the haemoglobin fell rapidly during the first few months to 68 per cent at the end of the third month, rose slightly to 73 per cent at the end of the fifth month and then, for the remainder of the first year, fluctuated between 68 per cent and 71 per cent. MACKAY used Haldane's method for estimating the haemoglobin and has recently published⁽²⁾ corrections for the above figures so that the corrected figures represent readings on the/

the Price-Jones-Haldane haemometer which has a slightly paler standard tube than the Haldane haemometer used by her. The brown line in GRAPH I shows the haemoglobin level according to these corrected figures.

The investigation by ELVEHJEM and ⁽³⁾ PETERSON was extensive, 2000 estimations being made. Their figures are given in grams of haemoglobin per 100 cc. but converted to haemoglobin percentage so that 100 per cent = 13.8 gms. hb. per 100 cc. they are:- birth 145 per cent, 85 per cent at two months and varying between 78 and 93 per cent for 2½ years. They say that the lowest level is reached at 15 months and that there is a gradual increase to 100 per cent which is reached at 3 - 4 years. Their estimations were made on healthy children attending welfare clinics and were made by the Newcomer method.

MERRITT and DAVIDSON ⁽⁴⁾ have also made observations showing the average haemoglobin level for children during the first year of life. They determined the haemoglobin level by Wong's method using a Duboscq colorimeter. The children used were of different nationalities, the chief races being American or West Indian negroes, Italians, Jews, Irish/

Irish and Scots. They express their results in grams of haemoglobin per 100 cc. but the results they obtained have been converted to haemoglobin percentage (100 per cent = 13.8 gms. hb. per 100 cc.) and are shown in GRAPH I by the interrupted red line.

The variation in all these reports at first seems remarkable but there are several possible reasons for this:-

- (i) Different methods of estimating the haemoglobin have been used by various workers.
- (ii) The nutrition of the infants used has varied considerably.
- (iii) Children of different races have been used by different workers.
- (iv) The site chosen for obtaining the blood has varied. Some used the ear, some the heel, some the finger and some the toe. Estimations made on blood taken from the ear have been found to be ten per cent higher than those on blood taken from the heel during the first six months of life. (MACKAY⁽¹⁾) (DRUCKER⁽⁵⁾). The variation is much less marked in subsequent/

subsequent years being only 3.5 per cent after the second year.

- (v) The number of cases published by some authors has been too small for statistical purposes.
- (vi) The temperature of the foot or ear is important. If blood is taken from a cold foot a high reading for the haemoglobin is obtained owing to stasis of the blood.
- (vii) The degree of sharpness of the instrument used for cutting the skin is of importance. A blunt instrument causes too much injury to the tissues with the result that serum is exuded and a low reading is obtained.
- (viii) When an infant has its skin pricked, it naturally cries and struggles. This may cause congestion of the part and a high reading.

It is thus evident that great care must be taken in obtaining the specimen of blood for examination if the reading for the haemoglobin is to be reliable. I think that the heel is the most satisfactory/

satisfactory site to used during the first year of life. The foot must be warm, care must be taken that it is not congested and a sharp razor or triangular needle should be used.

In this investigation, an effort has been made to determine the haemoglobin level for the first four years of life. Averages have been worked out at monthly intervals during the first year, at three monthly intervals during the second year and at yearly intervals for the two subsequent years.

The material used has been derived from two sources:-

I. WESTERN GENERAL HOSPITAL, EDINBURGH.

The children used in this hospital were mostly children who had been sent to the hospital through the Public Assistance Officer. The children were not actually ill, but the parents were too poor to keep the children or the home conditions were unsuitable. Some of the children were illegitimate and were sent to the hospital by their mothers who were anxious to have the children off their hands. The dietary of all/

TABLE I.

DIET USED for CHILDREN under
INVESTIGATION in WESTERN GENERAL HOSPITAL.

AGE of CHILD.	FOOD GIVEN.
2 weeks.	Milk $\frac{3}{4}$ water $\frac{1}{4}$ $\frac{1}{2}$ teaspoonful of sugar Some orange juice.
5 months.	The feeds were gradually increased to milk $\frac{3}{4}$ and water $\frac{1}{4}$
6 months.	One feed daily thickened with oat flour.
8-9 months.	Infant mixed diet started. <u>Breakfast</u> Rusk and milk <u>Dinner</u> Clear soup or gravy. Thin pudding or custard. <u>Tea</u> Rusk and milk. The children were also given a bottle in the morning and at night. They were also given yolk of egg once daily.
12 months.	Bottle stopped.
14 months.	Fine mince instead of soup. Bread and butter.
18 months.	Strained porridge in morning. Pounded fish occasionally. A little cabbage. Prune juice and orange juice was also given during the whole of this period.

all these children was arranged on the lines shown in TABLE I but was varied to suit individual children.

Most of the children were artificially fed from their very early days. It will be seen that although the diet consisted mainly of milk until the child was 9 months old, a mixed diet was started after that and the iron content of this diet was fairly good. The yolk of egg added at this period contains a considerable quantity of iron namely 0.0076 gms. per 100 gms. of undried material. (PETERSON and ELVEHJEM⁽⁶⁾). Most of these children were in wards situated on the first floor of the hospital and as there were no balconies on this floor, the children were not out in the open air as much as would have been desirable.

II. DAY NURSERIES AT VIEWFORTH AND LEITH.

The children investigated at these nurseries were all healthy except for minor infections such as 'colds'. They could be divided into two classes.

- (a) Resident children who were kept in the nursery both day and night.
- (b) Non-resident children who were brought to the/

the nursery at about 8 a.m. and remained there until about 6 p.m.

Except in the case of very young children, the diet was a mixed one and as the nurseries were situated on the ground floor with shelters in the gardens, the children were outside as much as possible.

TECHNIQUE.

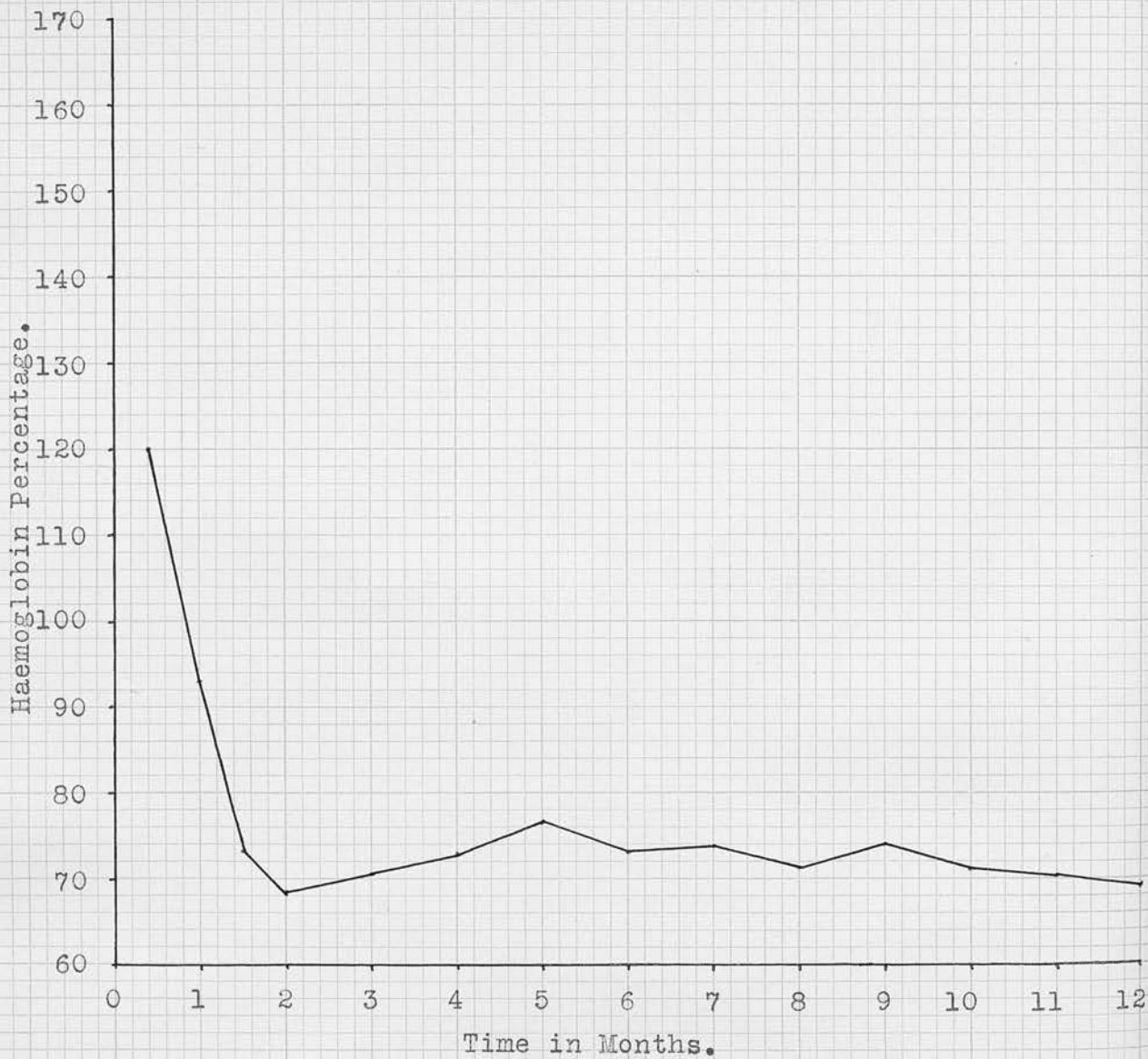
Haemoglobin estimations were usually made in the afternoons, the blood being taken from a cut made in the heel with a sharp tri-angular needle. In the case of children over two years of age, the blood was taken from a cut in the lobe of the ear as it was found that by that time the skin of the heel had become hard and the blood did not flow so freely.

Haemoglobin estimations were made on all the children in both Western General Hospital and the Day Nurseries provided that they were not suffering from any definite infections. In some cases only one estimation was made but in others estimations were made at intervals for some considerable time.

GRAPH/

GRAPH II shows the average haemoglobin level for each month of life during the first year and up till 15 months. In compiling the data for this graph, all twins were excluded as were all children suffering from definite anaemia. It was considered that definite anaemia was present if the haemoglobin level was below 60 per cent after the first three months of life. This figure is purely arbitrary. The American workers ELVEHJEM and PETERSON⁽³⁾ excluded all below 8.5 gms. Haemoglobin which corresponds to 61 per cent haemoglobin on the Sahli haemoglobinometer used by me.

The data for this graph consist of 169 estimations on 140 different children and are shown in TABLE II. It will be noticed that after falling from a high level at birth, the haemoglobin reaches 68 per cent at two months and then rises gradually to 76 per cent at five months and then fluctuates between 74 and 69 per cent until the end of the first year. After that there is a gradual rise to 78 per cent at the end of the fourth year. This average curve corresponds very closely to that constructed by MISS H. M. MACKAY⁽²⁾ for London children. Both these curves are at a considerably lower/



GRAPH II. The average haemoglobin level during the first year of life.

T A B L E II.

THE FIGURES ON WHICH GRAPH II. IS BASED.

AGE IN MONTHS.	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3	4	5	6	7	8	9
HAEMOGLOBIN PERCENTAGE.		120	93	73	68.3	70.5	72.6	76.5	73.1	73.7	70.9	73.9
NUMBER OF CASES.		1	2	3	3	9	11	19	13	14	10	9

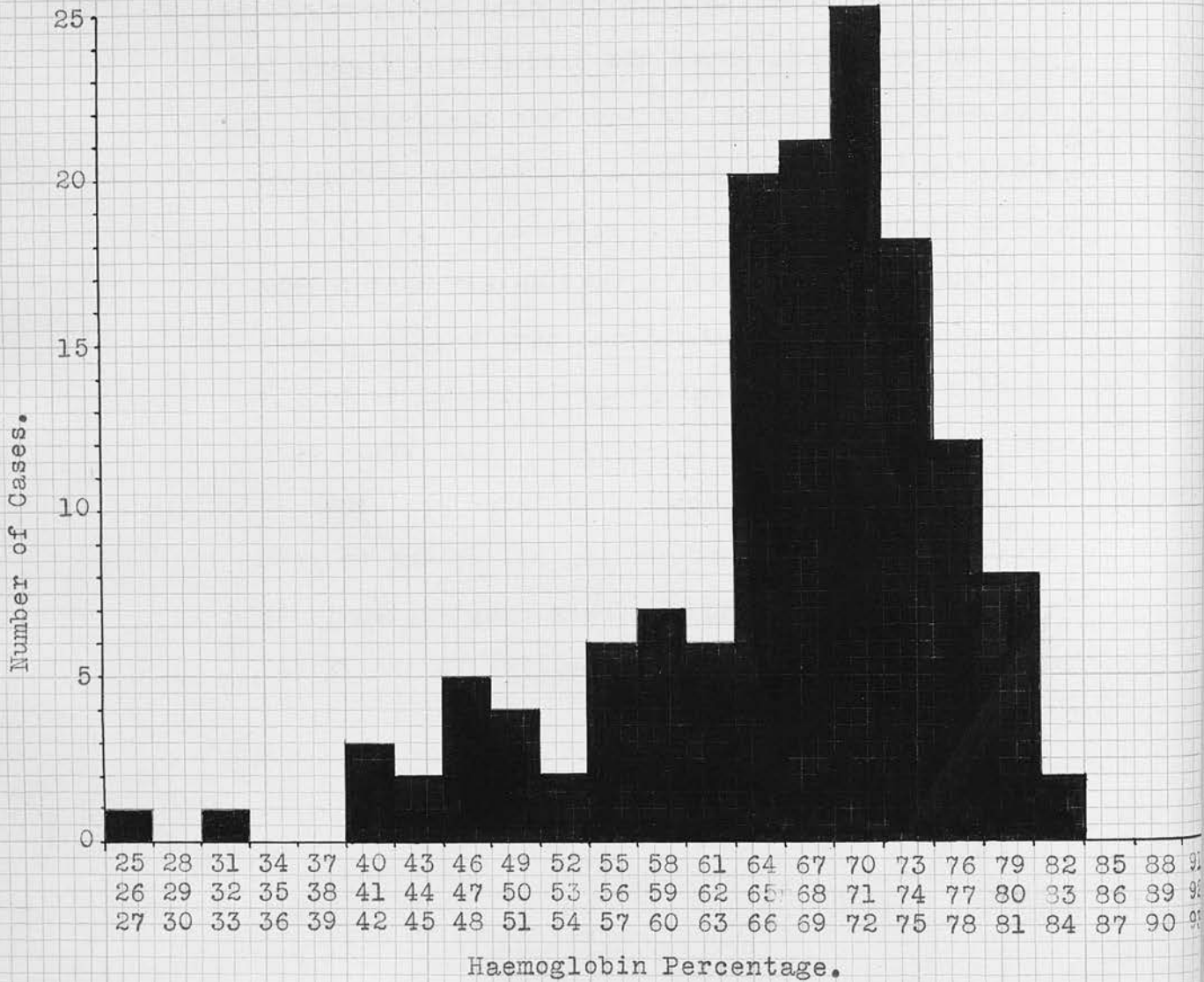
9a.

AGE IN MONTHS.	10	11	12	12-15	15-18	18-21	21-24	2-3 yrs.	3-4 yrs.	4-5 yrs.
HAEMOGLOBIN PERCENTAGE.	70.8	69.7	69.1	69.1	72.1	69.6	76	74.4	74.5	78.1
NUMBER OF CASES.	6	8	7	11	12	10	5	18	10	6

lower level than that obtained by MERRITT and DAVIDSON on American children. MISS MACKAY used Haldane's Haemoglobinometer and I used Sahli's. Although measuring different compounds of haemoglobin both instruments are calibrated so that 100 per cent haemoglobin = 13.8 grams haemoglobin per 100 cc. As already stated, MERRITT and DAVIDSON used a different method for estimating the haemoglobin but their high results on American children of mixed races are confirmed by the high results of the other American workers ELVEHJEM and PETERSON who used yet another method of estimating the haemoglobin. It therefore seems probable that the average haemoglobin level of American infants is higher than that of British infants.

It is probable that it is more accurate to take the predominant figure for haemoglobin instead of the average figure. A very large number of estimations would be required to do this for every month of life. From GRAPH II we see that after the fall in haemoglobin which occurs in the first two months the haemoglobin level fluctuates between 69 per cent and 76 per cent until the end of the second year. This variation is only 7 per cent.

GRAPH /



GRAPH III. The distribution of haemoglobin in children between three months and two years. This shows that the predominant figure is 70%.

GRAPH III is made up from 143 estimations on different children between the ages of three months and two years and shows the predominant figure for the haemoglobin level during this age period. In using an instrument such as the haemoglobinometer which depends on matching colours, it is not possible for the eye to be certain that an estimation read off as 65 per cent should not have been 64 per cent or 66 per cent and preference is liable to be given to certain figures. To obviate this error, cases have been grouped in groups of three per cent haemoglobin, all cases reading 64, 65 and 66 going together. GRAPH III has been constructed in this manner and shows that the group 70, 71 and 72 is predominant.

HISTORY OF NUTRITIONAL ANAEMIA

⁽⁷⁾
HEUBNER speaking at a congress at Munich in the year 1899, said:-

"For many years, physicians have recommended that a purely milk diet should not be continued too long towards the end of the suckling period".

This statement shows that the idea that milk is an inadequate diet for all but young infants is not a new one. These physicians realized that when the child had been growing for some six months other foodstuffs should be added to the dietary to make up for deficiencies in the milk. In 1889,
⁽⁸⁾
BUNGE conducted some experiments which directed the attention of physiologists and physicians to the subject and placed the deficiencies of milk on a more scientific basis. He found that the inorganic constituents contained in the ash of a five day old puppy, were present in the same proportion as those in the ash of a dog's milk. The only exception to this was iron which he found to be six times as plentiful in the puppy ash as in the ash of the dog's milk/

milk. He ⁽⁷⁾ also demonstrated by ashing the bodies of rabbits at different ages, that the iron in the rabbit was laid down towards the end of pregnancy, that the ratio of iron to body weight was at its highest at term and that after birth it fell until the third week. The diet of the rabbit consists almost entirely of milk up to the third week when it starts to eat green food. From the third week the amount of iron in the ash of the rabbits rose, the extra iron being derived from the green food. He also showed that the guinea pig is not born with a reserve store of iron but as the guinea pig eats vegetables from the first day such an iron store would be unnecessary.

Hausermann working in BUNGE'S laboratories showed that rats, rabbits and dogs could be rendered anaemic by keeping them on a diet of milk or milk and rice for a prolonged period and that this anaemia could be cured by giving other foods especially foods rich in iron such as yolk of egg or spinach.

HUGOUNENQ ⁽⁹⁾ showed that the ash of the human foetus contained a store of iron which was laid down during the last three months of pregnancy and BUNGE ⁽⁷⁾ knowing the poverty of milk in iron and bearing in mind/

mind the duration of lactation customary in human beings, pointed out that children would probably become anaemic if kept for too long on a diet consisting of milk only. He recommended the addition of yolk of egg or spinach to the infants diet after the age of six months. In spite of the reports of physicians that inorganic iron cured chlorosis, BUNGE did not recommend the giving of iron in this form to infants because he did not think that it was absorbed. This view was supported by the fact that Hausermann had failed to cure the anaemia produced in laboratory animals by prolonged milk feeding by adding ferric oxide to their diet while the anaemia had responded readily to mixed feeding. Many years later ⁽¹⁰⁾ this experiment was repeated and the same result obtained but the anaemia was found to respond to doses of ferrous sulphate. ⁽¹¹⁾ This result could only be interpreted as due to the solubility of the ferrous sulphate compared to the ferric oxide.

Since the experiments of BUNGE and Hausermann, anaemia has been produced in laboratory animals on many occasions by prolonged milk feeding or by feeding on a diet deficient in some factor necessary/

necessary for blood formation. HAPP⁽¹²⁾ was unable to produce anaemia in rats in the first generation by prolonged milk feeding but SCOTT⁽¹³⁾ produced anaemia in the second generation in this way, and found that this anaemia responded to treatment with ferrous chloride.⁽¹⁴⁾ This method of producing anaemia in rats in the second generation was also used by MITCHELL and SCHMIDT⁽¹⁵⁾ and MITCHELL and VAUGHAN.⁽¹⁶⁾ They found that the anaemia responded to mixed feeding especially with foods rich in iron and also to feeding with various iron salts.

McGOWAN and CRICHTON⁽¹⁷⁾ in the Rowett Institute, Aberdeen, found that a severe disease in young pigs, characterized by listlessness, anaemia and severe respiratory failure was caused by feeding the sows during the three weeks immediately prior to farrowing, on a diet poor in iron. The disease could be prevented by adding ferric oxide⁽¹⁸⁾ to the feeds. They noticed that young pigs which were growing rapidly were most liable to develop the disease and this suggested that they used their iron store more rapidly than the slow-growing pigs. The fact that the anaemia developed if the sows were fed/

fed with food deficient in iron during the three weeks before farrowing, suggests that the iron is stored in the young pig during those three weeks and gives support to the work of BUNGE on rabbits, which has already been described.

Returning to anaemia in infants, we find that anaemia caused by keeping children on diets deficient in materials for blood formation has been described by various physicians under different names. Attention was first drawn to this subject in 1771 by the French writer, Sauvage. He and other French workers described the anaemia under the name of 'Chlorotic anaemia of infants' and they advocated iron for its treatment, either in the form of organic iron or in the form of iron-rich foods. CZERNY and KLEINSCHMIDT⁽¹⁹⁾ described cases under the name 'alimentary anaemia' and they took the view that iron deficiency did not explain the disease because some cases could not be cured by giving iron either in the inorganic or food form. They ascribed the condition to a constitutional anomaly and to some toxic factor in the milk and advocated reduction of the amount of milk and the giving of a mixed diet for the treatment of the condition./

condition.

In 1910, CAUTLEY⁽²⁰⁾ described the anaemia as 'Simple Infantile Anaemia'. He considered that infants had an inborn tendency to anaemia but explained this anaemia on the theory of iron deficiency recommending inorganic iron, organic iron or iron-rich food for its treatment. He found that children placed on this treatment recovered in 3 - 4 months.

In 1920, SCHWARTZ and ROSENTHAL⁽²¹⁾ described the condition in New York under the name of chlorotic anaemia of infants. They recognised that this was the same anaemia as that described by the French workers. As many previous writers had done, they emphasized the fact that the anaemia was most common in premature infants and twins and they obtained good results by the administration of inorganic iron. They claimed that the anaemia could be prevented by giving cod-liver-oil or by placing the child in fresh air.

More recently MACKAY⁽²²⁾ recorded some cases of 'nutritional anaemia of infants' and in an extensive and exhaustive report⁽¹⁾ showed that about 50% of London infants were anaemic, that this anaemia/

anaemia was due to prolonged milk feeding and that it was particularly liable to develop in twins and infants which had been born prematurely. She found that the anaemia could be cured or prevented by giving Iron and Ammonium Citrate in doses of grs. $4\frac{1}{2}$ - 9 daily. These results have been confirmed (23) by PARSONS.

During the course of this summary, instances have been mentioned, both in the case of laboratory animals and in the case of infants, where iron has failed to have any beneficial effect upon the haemoglobin level. In some cases this was attributed to the poor absorption of the iron and in others to a constitutional defect of the blood forming organs of the child or to a toxic effect produced by the milk.

More recently experiments have been conducted which throw more light on this problem. A group of research workers at the University of Wisconsin found that a nutritional anaemia produced in rabbits by keeping them on milk-sodium citrate diet could be cured by feeding with an iron-free extract of cabbage together with inorganic iron, while they could/

could not be cured by iron alone. ⁽¹⁰⁾ Further, they showed that if the vegetable extract was ashed to destroy the organic material in it, it still produced cure of the anaemia in both rabbits and rats and so they concluded that the factor in the ash which caused this cure was inorganic. ^{(11), (24)}

Continuing their experiments with rats rendered anaemic by feeding on a milk-iron diet, they found that both liver extract and the ash of liver extract cured the anaemia. They found that copper was present in the ash of the liver extract and that this element was active in curing the anaemia in the rats. ⁽²⁵⁾ While these experiments were being carried out, MITCHELL and SCHMIDT ⁽¹⁵⁾ and BEARD and MYERS ⁽²⁶⁾ reported cases of anaemia in rats by feeding pure iron salts. HART and his colleagues in the light of their own experiments thought it probable that these results were due to copper being present in the iron as an impurity. They showed that nearly all iron salts contained a small quantity of copper ⁽²⁷⁾ and demonstrated that large doses of iron salts such as are used in the treatment of anaemia in human beings, were quite effective in curing anaemia in rats, but that even these/

these large doses became ineffectual when the iron salt used was freed from the traces of copper which it contained. ⁽²⁸⁾ BEARD and MYERS published re-

sults showing that several other metals were also effective in erythropoiesis ⁽²⁶⁾ and TITUS, CAVE, and HUGHES ⁽²⁹⁾ showed that manganese gave almost as good results as copper in curing anaemia in rats.

WADDELL then published results confirming the fact that the anaemia produced in rats on a whole milk diet was due to a deficiency of copper and that copper and no other metal was effective in curing the anaemia. ^{(30), (31)}

These results have been confirmed by ORTEN, UNDERHILL and LEWIS. ^{(32), (33), (34)}

While the results of BEARD and MYERS can be explained as being due to the presence of copper in their iron salts, it is difficult to explain the positive result for manganese reported by TITUS, CAVE and HUGHES. WHIPPLE and ROSCHEIT-ROBBINS ⁽³⁵⁾ in experiments carried out on dogs rendered anaemic by prolonged bleeding reported irregular responses with manganese which were sometimes favourable for haemoglobin production, sometimes not. They also report that copper is uncertain in its action in this type of experiment.

The/

The discovery that copper was a potent factor for the production of haemoglobin did not cause surprise, for in 1925, McHARGUE⁽³⁶⁾ had shown that copper was widely distributed in the vegetable kingdom and that it was present in the blood of certain molluscs and also in calves and cows. He showed that the tissues of calves at birth have a relatively high concentration of copper compared with mature animals, and he suggested that like iron, it might be laid down during the last few months of pregnancy. More recently he has shown that anaemic rats fed with an extract of calves liver which contained copper, recovered from their anaemia, while rats treated with the same extract from which the copper had been removed, did not.⁽³⁷⁾

The actual mode of action of copper is unknown. The experiments of MUNTWYLER and HANZAL⁽³⁸⁾ support the theory that it acts as a catalyst. They found that rats suffering from nutritional anaemia stored iron in their livers when they were fed with iron and that this iron store became depleted and the percentage of haemoglobin in their blood raised when, subsequently, they were given doses of copper. They concluded that copper mobilised/

mobilised the iron store with the production of haemoglobin and red blood corpuscles.

Following upon the successful treatment with copper of nutritional anaemia in laboratory animals it was natural that an attempt should be made to apply these results to the treatment of nutritional anaemia in infants. MORRISON and NASH found that the copper content per Kg. of fresh tissue of 25 infants was six times that of adults, ⁽³⁹⁾ and PARSONS has shown in both rats and infants that the copper content per Hg. liver tissue falls progressively during lactation. ⁽⁴⁰⁾ Like MCHARGUE he compares it to iron. A number of workers have recorded cases of nutritional anaemia treated with iron and copper. ⁽⁴¹⁾ JOSEPHS, ⁽⁴²⁾ CALDWELL and DENNETT, ⁽⁴³⁾ LEWIS and MAURER, ⁽⁴⁴⁾ GREENGARD and KLUVER, all agree that the rate of haemoglobin formation is rather more rapid when copper and iron are used together than when iron is used alone. PARSONS thinks that haemoglobin formation is hastened by the administration of copper in some cases but not in others, ⁽⁴⁵⁾ and MACKAY ⁽⁴⁶⁾ in recording a small series of cases comes to the conclusion that while copper deficiency may play a part in the production of/

of isolated cases, it plays no part in the majority of cases of nutritional anaemia in infants. These results are disappointing but it must be remembered that the rats used for experiments in nutritional anaemia were kept in cages made either of glass or galvanised iron wire so that there was no chance of the animals obtaining a supply of iron or copper from any source other than their diet. Infants are not kept under conditions that are at all comparable and most of them are able to obtain the very small quantity of copper which they require for the synthesis of haemoglobin.

In 1929, WHITEHEAD and BARLOW⁽⁵²⁾ showed that an anaemia, produced in rats by feeding them on a diet of polished rice could be cured by yeast and PARSONS⁽²³⁾ found that nutritional anaemia produced in rats by keeping them on a milk-iron diet can be cured by exhibiting yeast. He also produced this cure with anaemic yeast a form of yeast containing very little iron and copper and he thinks that it is probable that the effect of yeast is due to its amino-acid content. DRABKIN and MILLER⁽⁴⁸⁾ had shown previously that the injection of copper free amino-acids would cure nutritional anaemia.

Following/

Following upon his successful results with yeast used in laboratory animals, PARSONS⁽⁴⁵⁾ tried the effect of yeast in nutritional anaemia in infants but so far the results have been inconclusive.

CLINICAL/

CLINICAL FEATURES OF NUTRITIONAL ANAEMIA.

Nutritional anaemia is more common in twins and in premature infants. Of the 52 cases described in this paper, 11 were twins. It is equally common in the two sexes. It usually develops about the seventh to ninth months of life but it may develop before this in premature infants and twins. If milk feeding is prolonged, it may develop after the ninth month. If the anaemia is of slight degree, there may be no pallor but in severe anaemia with haemoglobin below 40% the child looks pale, and the skin has a peculiar transparent appearance. The child may be quite well-nourished and the weight may be average for the child's age though more frequently the child is considerably below the average weight. There are no special symptoms of this anaemia but frequently the mother complains that the child is not thriving. MACKAY has shown that these children are more liable to infections of various kinds than healthy children.

Physical examinations reveal no abnormality but in some cases the spleen is slightly enlarged.
Examination/

Examination may reveal some infection such as otitis media and it may be thought that the anaemia is due to the infection. While this may be the case, there are many instances where the infection is developed after the appearance of nutritional anaemia.

THE BLOOD.

Examination of the blood shows that there is some reduction in the haemoglobin level and in severe cases this may be considerable. The lowest reading obtained in this series of cases was 25%. There is usually but slight reduction in the number of red cells unless the anaemia is severe. The reduction of the number of red corpuscles is always of much less degree than the reduction of haemoglobin level so that the colour index is low, 0.5 or 0.6 being a common value. The cells are reduced in size and the Price-Jones curve shows a shift to the left and broadening of the base. ⁽⁴⁵⁾ Reticulocytes are usually about 0.5 per cent and the white blood cells are within normal limits unless there is a superadded infection.

The blood film shows considerable anisocytosis/

anisocytosis and poor filling of the red corpuscles,
and occasionally poikilocytes are seen. (FIG. I)

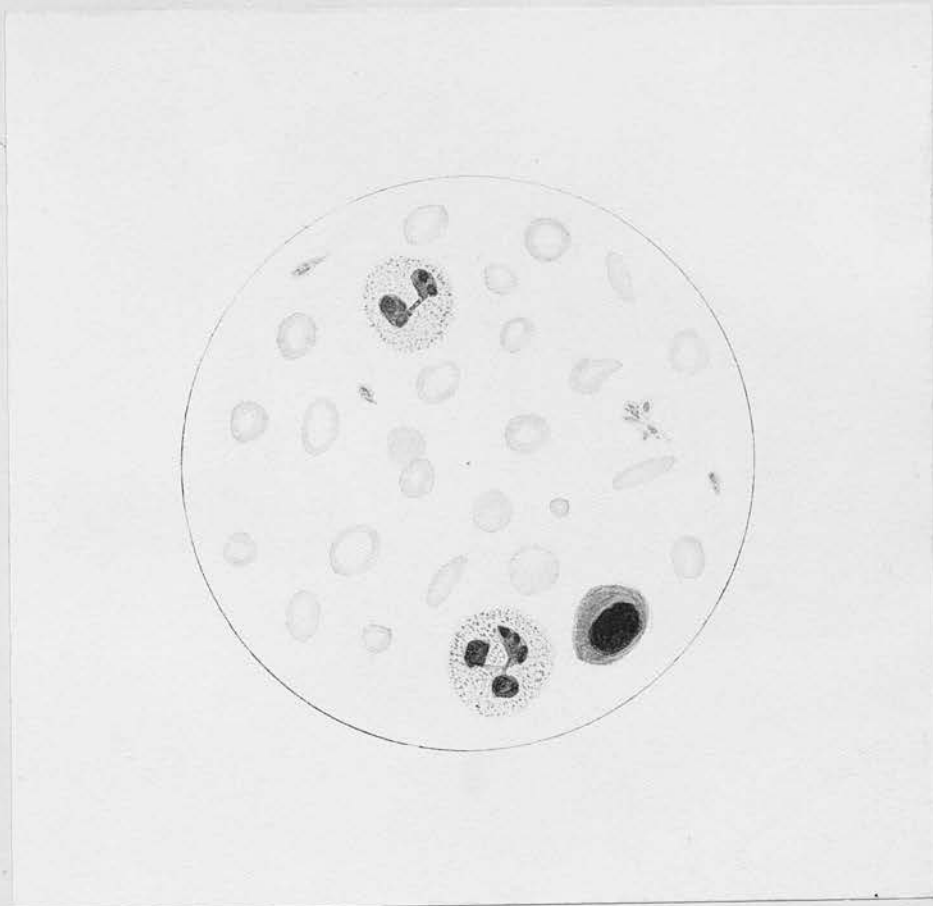


FIG. I. Blood from case 52 of Nutritional
Anaemia of Infants. x 980.
(Jenner-Giemsa).

THE PHARMACY OF IRON SALTS.

There are very many preparations of iron in the Pharmacopeia from which the physician may take his choice. Iron has been used in medicine for hundreds of years and the literature on all its different aspects is vast. CLARK in a recent review of the subject entitled 'Iron Therapy in Anaemia'⁽⁴⁹⁾ gave an excellent summary of the literature and defined the position of various iron salts and compounds in therapeutics in the light of present day knowledge.

BUNGE⁽⁷⁾, in 1890, revived interest in the pharmacology of iron salts and from then until 1910 a controversy raged as to whether inorganic iron salts were of any value in the treatment of secondary anaemias. Even as recently as 1921 WHIPPLE⁽⁵⁰⁾ reported that inorganic iron had no action on the synthesis of haemoglobin in dogs rendered anaemic by bleeding. The anaemia produced in these dogs was not of long duration and the period of treatment was short. It is likely that these are the causes of this contradictory report for in 1928 WHIPPLE⁽⁵¹⁾ published/

published the results of further experiments. This time the dogs were rendered anaemic by bleeding at intervals over a long period so that the iron store of the body was depleted. When these dogs were treated with inorganic iron, haemoglobin formation took place much more rapidly than in control dogs. Since these results were published there have been many reports of iron having definite action in chronic secondary anaemias.

Having shown that iron is of definite value for haemoglobin formation the problem of which was the most potent form of iron for haemoglobin formation presented itself. CLARK⁽⁴⁹⁾ classifies iron preparations as follows:-

1. Insoluble Preparations.

- (a) Iron. e.g. Reduced Iron (yields ferrous ions).
- (b) Those yielding ferric salts on solution. e.g. Magnetic Iron oxide.
- (c) Those yielding ferrous salts on solution. e.g. Ferr. carb. sace.

2. Colloidal Preparations. e.g. dialysed iron (yields ferric ions).

3./

3. Soluble Preparations.

- (a) Ferrous. e.g. ferrous sulphate.
- (b) Ferric. e.g. Tr. Ferri. Perchlor.
- (c) Scale preparations which yield complex
irons. e.g. fer. et ammon. cit.

4. Organic iron compounds. e.g. Haemoglobin.

(52)
RIEMANN and FRITSCH report negative results for haemoglobin administration. The other preparations shown in the above classification may be divided into those yielding ferrous ions in solution and those yielding ferric ions in solution. The fate of scale preparations is uncertain but it is likely that they yield both ferrous and ferric salts in the alimentary tract.

There is considerable evidence that ferrous salts are more potent than ferric salts in the treatment of secondary anaemia.

In 1931, AMATSU⁽⁵³⁾ showed that divalent iron was of great value in causing blood regeneration in rabbits rendered anaemic by prolonged and repeated bleeding until the iron store of the liver was depleted. Ferric salts also produced some regeneration but less than the ferrous salts. AMATSU claims/

claims that the small effect produced by the former was not due to ferric iron but to the fact that a small proportion of trivalent iron was reduced to the ferrous state in the alimentary tract and then absorbed. He showed that some tissues, especially brain, lung and liver will cause this reduction in vitro and he thinks that this change takes place in the gut. He also records that ferrous salts are much more toxic to rabbits than ferric salts.

(52)
RIEMANN and FRITSCH tested the relative merits of many iron salts. They used cases of chronic secondary anaemia due to various causes and they found that ferrous salts namely ferrous chloride produced an effective result in much smaller doses than ferric salts or reduced iron. They used the increase of the quantity of haemoglobin and the reticulocytic response as indicators. They found that Ferrous Chloride in 0.1 gms. dosage produced a strong and rapid response but as small a dose as .02 gm. gave fairly satisfactory results.

(54)
In 1933, DAVIDSON recorded a number of cases of microcytic hypochromic anaemia which were successfully treated with Ferrous Chloride (Ferronyl)/

(Ferronyl). All this goes to show that ferrous salts are the most satisfactory forms of iron to use, as they produce a response when given in a much smaller dose. On looking in the British Pharmacopeia the only ferrous preparations are:-

- (i) Insoluble preparations such as Ferr. Carb. Sacc. and Bland's Pills.
- (ii) Soluble salts in solutions such as Syrup Ferrous Iodide. Syrup ferri Phosph. Co. (Parrish). Syr. Ferr. Phosph. \bar{e} Quinine et Strychnine (Easton).

Easton's Syrup contains only a small dose of iron (35 mg. in a full dose). This dose is rather small to act in anaemia for RIEMANN and FRITSCH⁽⁵²⁾ found that 40 mg. ferrous iron was a suitable dose. If the dose of Easton's syrup is increased above this, danger might result from the amount of strychnine which would be given. Therefore owing to the rather inadequate quantity of iron present, Easton's Syrup is not a very satisfactory preparation for use in anaemia.

Parrishes Syrup contains a similar quantity of iron to Easton's Syrup and being devoid of strychnine the dosage can be increased so that an adequate quantity/

quantity of iron is given and so the preparation can be used in anaemia with some prospect of success.

Syrup of Ferrous Iodide contains about 50 ngms. ferrous iron in a teaspoonful dose so that it is a satisfactory preparation. The only disadvantage is that the iodine which is also given at the same time may cause iodism in some sensitive patients. Also it may be undesirable to exhibit iodine over a long period as would be the case if Syrup of Ferrous Iodide were used in chronic anaemia.

Having discussed the suitability of these preparations from the point of view of their iron content, there is another aspect which should be considered; that is the stability of the ferrous iron in them. One of the chief reasons that there are so few preparations containing ferrous salts in solution is the readiness with which these ferrous salts oxidise to ferric salts. With a view to seeing how long ferrous preparations will remain unoxidised some experiments have been carried out. It was not possible to estimate the ferrous iron direct so the ferric iron present was determined and subtracted/

subtracted from the total iron which was found to be present. The difference represented the ferrous iron present. First of all, an ordinary solution of ferrous sulphate was made and then an acid solution as the acid solution was reputed to keep better. Bottles of Parrish's, Easton's syrups and syrup of Ferrous Iodide were obtained from a reputable chemist in Edinburgh and were tested for their ferrous content in the above manner.

THE METHOD.

The following solutions were prepared.

- (1) Potassium Thiocyanate 3 normal.
- (2) Solution of ferric iron 1cc = 0.1 mgm. Fe.

20 cc. graduated flasks were then taken.

Into one was put 1 cc. of the standard iron solution and into the other 1 cc. of the solution under investigation. To each was then added 0.5 cc. concentrated HNO_3 and 4 cc. of the 3 n. solution of Potassium Thiocyanate. Distilled water was then added to each to bring the total volume to 20 cc. The solutions were then compared in a colorimeter and thus the amount of ferric iron determined in the/

34a.

T A B L E III.

FERRIC IRON. Mgms. Per 100 cc.

PREPARATION.	TOTAL IRON IN Mgms. Per 100 cc.	DATE MADE UP	6.6.33	7.6.33	13.6.33	30.6.33	3.7.33	12.7.33	19.7.33	20.7.33	25.7.33	31.8.33	6.9.33
Acid Sola. Ferrous Sulphate.	1340	6.6.33	10.2	14.3	33.3	88.89	97.2	93.75	Precipitate of Ferric Oxide.				
Sola. Ferrous Sulphate.	395	6.6.33	2.56	2.50	6.45	Precipitate of Ferric Oxide.							
Syr. Fer. Iodide.	960	6.6.33	1.30	1.73	1.85	2.35	3.08	2.90	4.25	4.0	5.5	4.75	4.17
Syr. Fer. Phosph.	875	16.5.33	40.	40.	38.	Ppt. 45.5	Ppt. 49.6	-	Ppt. 48.78	Ppt. 51.28	Ppt. 50.	Ppt. 20.	Ppt. 33.33
Easton's Syrup (1)	850	16.5.33	28.6	28.6	Precipitate Falling.								
Easton's Syrup (2)	850	7.6.33							25.	31.25	Ppt. 36.36	Ppt. 17.4	Ppt. 16.66

the unknown. In the case of Parrish's syrup the normal reddish colour of the syrup due to the presence of Tincture of Cocci although not rendering the solutions incomparable has probably raised the figure for the amount of ferric iron in the solution.

The total Iron was measured by ashing the syrup, then dissolving the ash in hydrochloric acid, oxidising by boiling with Hydrogen Peroxide and then measuring the ferric iron by the above method. As all the iron had been oxidised, the figure for ferric iron represents the total iron.

TABLE III shows the amount of ferric iron in the solutions at different intervals. It also shows the amount of ferrous iron present. The bottles were kept in a cupboard away from the light but the weather was warm during most of the time that the estimations were made and this probably hastened oxidation. The bottles were taken out occasionally and the stoppers removed and then replaced to simulate the conditions under which a bottle of medicine is used.

An ordinary solution of ferrous sulphate kept well for a week and then a precipitate of ferric oxide was found. An acid solution of ferrous sulphate/

sulphate kept fairly well for five weeks then the iron fell out of solution in a precipitate of ferric oxide. Once the precipitate had formed, it was not possible to estimate the total ferric iron in the solution by the colorimetric method but it seemed that once the iron began to precipitate it fell out of solution fairly rapidly.

Syrup of Ferrous Iodide kept very well and even after three months, the amount of oxidation which had taken place was infinitesimal.

Parrish's syrup kept well for one month. During this month the proportion of ferric iron present had risen slowly and when it reached about 50 mgms. per 100 cc. a precipitate began to form, and the amount of ferric iron in solution remained constant for some time, beginning to fall when the syrup was three months old. The precipitate consisted of ferric phosphate. At the end of one month, 100 cc. of the syrup had 10.2 mgms. ferric iron precipitated and at the end of three months 49.2 mgms. ferric iron. On this date there were a further 33 mgms. iron in the 100 cc. solution oxidised to ferric salt making 82 mgms. ferric iron in all. The total iron being 875 mgms. per 100 cc, there was thus/

thus 793 mgms. ferrous iron left in solution at the end of three months. From these results it is apparent that Parrish's syrup is a satisfactory preparation to use if fairly freshly prepared. Even when it is three months old and a heavy precipitate has formed, there is still a considerable quantity of iron in solution in the ferrous state.

Easton's syrup did not keep so well as Parrish's. The amount of oxidised iron gradually rose and in six weeks had reached 31 mgms. per 100 cc. solution and a precipitate which contained ferric phosphate started to form. At this stage 16 mgms. ferric iron were precipitated for every 100 cc. solution. At the end of three months 194.2 mgms. ferric iron per 100 cc. solution had been precipitated. At this stage the solution above the precipitate contained 16 mgms. ferric iron per 100cc. The total ferric iron in 100 cc. mixture was thus 210 mgms. leaving 640 mgms. ferrous iron in solution, actually about $\frac{3}{4}$ of the amount originally present. From these figures it is apparent that Easton's syrup is useful if used within a reasonable period after its preparation; as already mentioned it does not contain much iron/

iron, a full dose just giving a sufficiency and as $\frac{1}{4}$ of this is precipitated or oxidised after three months, it is not desirable to use the syrup after it has been kept for that time.

A number of ferrous salts were then tried to see if a solution of a ferrous salt would remain stable for a sufficient length of time for it to be suitable for treatment. Ferrous Sulphate was tried but as seen above it oxidised fairly rapidly, the iron being precipitated. Ferrous Chloride was tried and was actually used for treatment of cases but it had to be made up daily, as when used in the wards, it could not be relied upon to remain ferrous for more than two days. When it oxidised, the iron fell out of solution as ferric oxide.

Ferrous ammonium sulphate was then tried first in acid solution, as the acid solution of ferrous sulphate had kept better than the ordinary solution, and made up with syrup so that the sugar would act as a reducing agent.. This solution kept for about three weeks in the laboratory but oxidised more readily when in actual use. Ferrous ammonium sulphate was then made up with a minimum of water, a quantity of syrup and a small quantity of hypophosphorous acid/

TABLE IV.

DATES.

TOTAL IRON mgms. Per 100 cc.	DATE MADE UP.	6.9.33	8.9.33	11.9.33	12.9.33	18.9.33	20.9.33	25.9.33	29.9.33	
278 mgms. 100 cc.	6.9.33	4.28	6.66	9.55		13.33	12.9	13.33	16.33	Precipitate forming (Ferric Oxide)
248 mgms. 100 cc.	12.9.33				4.9	8.57		8.57	9.3	Precipitate ferric oxide forming.

(1) Syr. Ferrous
Ammon.
Sulphate(2) Syr. Ferrous
Ammon.
Sulphate

acid in the same manner as syrup of ferrous iodide. It was found that this would keep for about 14 days and that, provided it was dispensed weekly, was quite satisfactory for the treatment of anaemia.

TABLE IV shows the speed of oxidation of these two mixtures.

SUMMARY

The rate of oxidation of Easton's syrup, Parrish's syrup and Syr. of Iodide of Iron was estimated and was found to be slow. Easton's and Parrish's syrup should be used within one month of preparation. A reasonably stable preparation of Ferrous Ammonium Sulphate was made.

THE TREATMENT OF NUTRITIONAL ANAEMIA
WITH IRON SALTS.

THE OBJECTS OF THE INVESTIGATION.

Having shown that the average haemoglobin level of infants is 70 per cent, a number of infants and very young children suffering from various degrees of nutritional anaemia or having haemoglobin levels only slightly below the average have been treated with iron salts, with the following objects.

- (1) To show that inorganic iron salts, when given in adequate doses, will cure cases of nutritional anaemia.
- (2) To see whether treatment with iron salts would raise the average haemoglobin level above 70 per cent.
- (3) To determine, if possible, which type of iron salt would give the best result and to compare the action of Ferrous salts with that of scale preparations.
- (4) To determine the value of iron therapy as judged by its effect upon the child's general health and body weight.

THE INVESTIGATION.

Three different iron salts have been used representing two groups of iron preparations.

(1) Scale preparations - Ferr. et Ammon.

Citrate.

(2) Soluble Ferrous Salts.

(a) Ferrous Chloride.

(b) Ferrous Ammonium Sulphate.

At first sight, an investigation of this nature appears to be easy but in practice several difficulties present themselves. Most writers are agreed that iron therapy in nutritional anaemia is a matter of months rather than weeks and it is desirable that cases receiving treatment should be observed over a period of three months. In addition to this, a preliminary control period of about one month is necessary to ascertain whether the level of haemoglobin is stationary, rising or falling before treatment is commenced. This means that a child must be available for observations over a period of four months in all. The children should all be under the same conditions of diet and environment/

environment and no change must be made in the conditions during the observation period. It is desirable that the children should be in hospital and if possible under the care of the same nursing staff, for if the children are at home, it is impossible to be sure that a child receiving treatment is having a similar diet to another child being used as a control. In dealing with out-patients it is not easy to be certain that medicine is given carefully and regularly while this can be relied upon in hospital. Then it must be remembered that children are not like laboratory animals. After a child has been under observation for some time, the parents may wish to take him home and only a few cases of nutritional anaemia are of such severity that it is possible to persuade the mother to leave the child in hospital. Thus the child may be taken away after many observations have been made and much time and labour are wasted. Finally, it is not easy to keep a childrens' Ward in a general hospital free from infection for very long and once an epidemic begins to spread through a ward, the investigation becomes very much disorganised.

In the following description of the treatment
of/

of infants with iron, it will be noticed that some cases made very small gains in haemoglobin which could be accounted for by experimental error. In considering an individual case, little importance can be attached to a small increase unless the estimations show that this increase is progressive or the figures for both the initial and final levels of haemoglobin are supported by several estimations. In comparing the results of treated cases and control cases all results have been included because both groups are equally liable to show increase due to experimental error.

CASES AT WESTERN GENERAL HOSPITAL
TREATED WITH FERR. ET AMMON. CITRATE.

The children who formed the material for this group have already been described in the section on the haemoglobin level in infancy. The ages of the children varied from three months to two years and except for variations according to their age, they were on the same dietary. All cases received a preliminary control period of about one month before treatment was commenced. Estimations of the haemoglobin/

TABLE VI.

TABLE SHOWING CONTROL CASES AT WESTERN GENERAL HOSPITAL.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of OBSERVATION in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
15.	W. Grady	72	4.59	70	4.93	-2	+0.34	1 $\frac{1}{2}$
16.	Anne Gallacher	65	-	64	-	-1	-	4 $\frac{1}{2}$
41.	Albia Osborne	70	-	70	-	0	-	4
13.	E. Davies	70	4.65	68	4.75	-2	+0.1	1 $\frac{1}{2}$
14.	T. Mill	49	4.68	53	4.54	+4	-0.14	1 $\frac{1}{2}$
11.	Mgt. Gallacher	68	-	54	-	-14	-	4 $\frac{1}{2}$
17.	J. Macdonald	60	-	52	-	-7	-	2
17.	J. Macdonald	60	4.6	53	3.71	-7	-0.9	4
18.	I. Dobie	72	-	60	-	-12	-	2
19.	B. Reading	50	4.1	38	3.94	-12	-0.2	4
20.	G. Kerr	67	-	70	-	+3	-	2 $\frac{1}{2}$
21.	J. Keane	63	4.73	57	4.52	-6	-0.21	1 $\frac{1}{2}$
22.	W. Munro	67	-	71	-	+4	-	1 $\frac{1}{2}$

Average gain or loss in Haemoglobin = -4%

Average duration of Control period = 2.8 months.

TABLE V.

TABLE SHOWING WESTERN GENERAL HOSPITAL CASES
TREATED WITH FERR. ET AMMON. CITRATE GRS. $4\frac{1}{2}$ - 9 DAILY.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE.		DURATION of TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
1.	Lorna McGrath	64	4.5	74	4.8	+10	+ .3	3 $\frac{1}{2}$
2.	Ian Dupré	65	4.5	78	4.56	+13	0	4
3.	Evelyn Falconer	47	-	62	-	+15	-	1 $\frac{1}{2}$
4.	Walter Hunter.	68	-	73	-	+5	-	4
5.	Ian Paterson	63	4.2	84	4.2	+21	0	6
6.	Gerald Coffey	66	4.09	80	4.38	+14	+ .29	4
7.	Anne Wilson	69	-	70	-	+1	-	1 $\frac{1}{2}$
8.	Robert Symons	68	4.65	75	4.69	+7	0	4
9.	Mae Murray	65	-	75	-	+10	-	4
10.	C. Reading	40	-	43	-	+3	-	1 $\frac{1}{2}$
11.	Mgt. Gallacher	54	4.5	56	4.81	+2	+ .31	3
12.	C. Robertson	68	4.35	73	4.43	+5	+ .08	2
13.	E. Davies	70	4.65	80	4.81	+10	+ .16	4
14.	Thomas Mill	58	4.25	75	4.67	+17	+ .42	3

Average gain in Haemoglobin = +9.5%

Average duration of Treatment = 3.3 months.

haemoglobin were made with Sahli's haemoglobinometer at intervals of a fortnight. Counts of the red blood corpuscles were made at less frequent intervals and showed that the anaemia was always of a low colour index. The children were divided into two groups, one group to receive treatment, the other to act as a control group. The selection of children for each group was made at random. The dose of Ferr. et Ammon. Citrate was adjusted so that approximately gr. $\frac{1}{2}$ was given for every pound of body-weight and varied between grs. $1\frac{1}{2}$ and grs. 3, three times daily.

TABLE V shows the result of this treatment. It will be seen that the average gain in haemoglobin is 9.5 per cent. and that most of the cases show some small increase in the number of red corpuscles.

These figures should be compared with the control series shown in TABLE VI in which the haemoglobin level fell in all but three cases and the average fall in haemoglobin was 4 per cent. The data from which these tables have been compiled and graphs of individual cases are given in full detail in the appendix.

CASES/

TABLE VIII.

SHOWING DAY NURSERY CASES USED AS CONTROLS.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of OBSERVATION in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
26	N. Hyslop.	25	-	28	-	+3	-	1
29	I. Corbett.	69	4.55	70	4.44	+1	-.1	3
30	W. Blaikie.	63	4.56	59	4.55	-4	0	2½
31	W. Woodworth.	63	-	62	-	-1	-	1

Average gain or loss in Haemoglobin = 0

Average Duration of Observation Period = 2 months.

TABLE VII.

SHOWING DAY NURSERY CASES
TREATED WITH FERR. ET AMMON. CITRATE GRS. $4\frac{1}{2}$ - 9 DAILY.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
23	B. Philip.	50	4.59	77	4.86	+27	+0.27	$1\frac{1}{2}$
24	N. Gunn.	67	4.67	77	4.79	+10	+0.12	$1\frac{1}{2}$
25	N. Smythe.	68	4.65	82	4.9	+14	+0.25	$1\frac{1}{2}$
26	N. Hislop.	28	2.96	64	4.91	+36	+1.95	3
27	F. Hislop.	33	4.06	70	5.05	+37	+1.0	4
28	K. Spence.	57	3.92	77	4.59	+20	+0.67	3

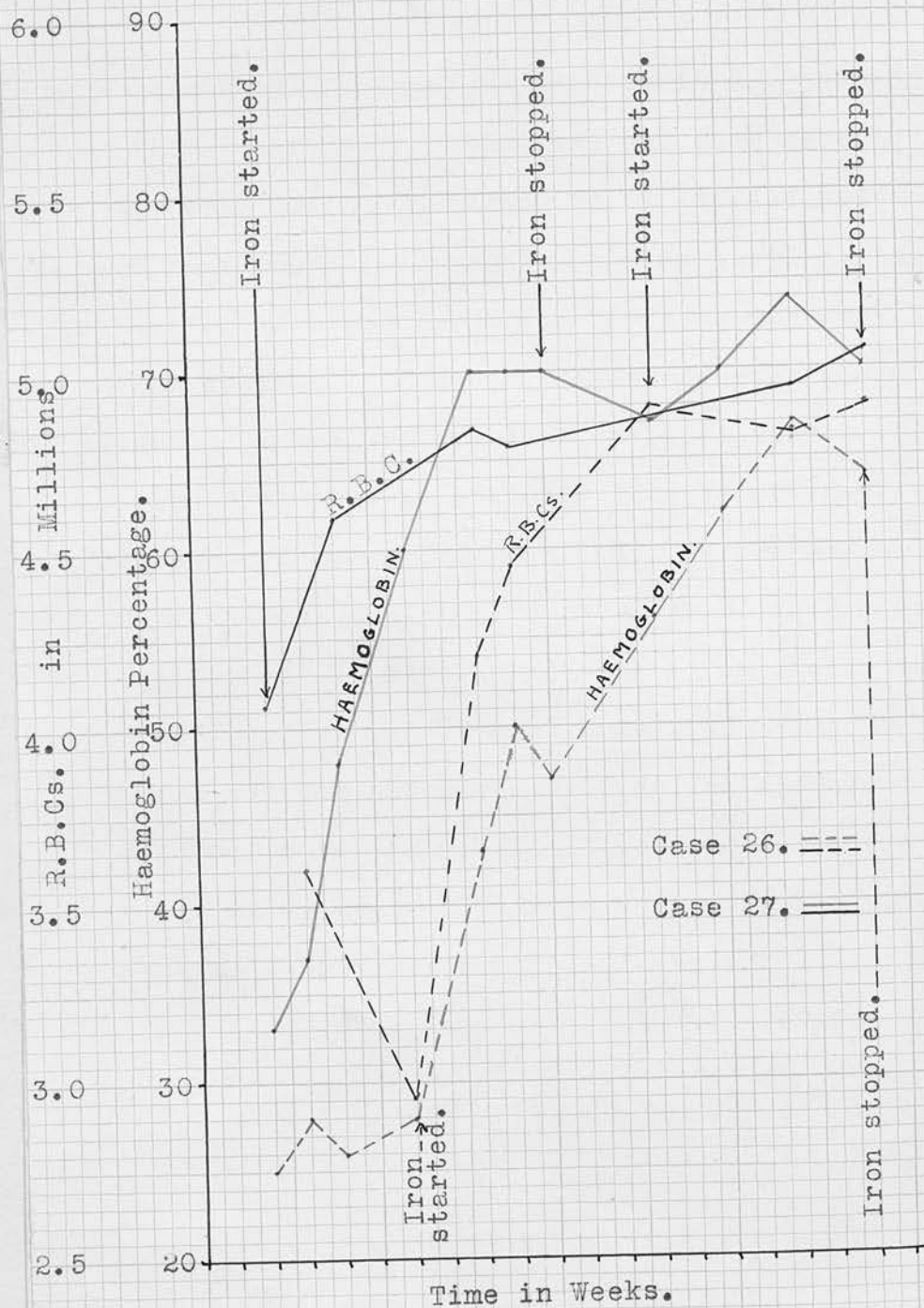
Average gain in haemoglobin = 24%

Average duration of treatment = $2\frac{1}{3}$ months.

CASES AT DAY NURSERIES
TREATED WITH FERR. ET AMMON. CITRATE.

The children who make up this group have already been described. They were slightly older than the former group, their ages varying between 1 and $3\frac{1}{2}$ years. The dose varied between grs. $1\frac{1}{2}$ and grs. 3 three times daily. TABLE VII shows the results in cases treated in this way and should be compared with TABLE VIII which shows control cases which were also attending the day nurseries and were under similar conditions. It will be noticed that there was a substantial increase in the haemoglobin in every one of the treated cases, giving an average rise of 24 per cent, and in all cases there was some increase in the number of red corpuscles. Two of the control cases show slight gains in haemoglobin and two slight falls, the average figure for the group remaining the same throughout.

Of these cases, numbers 26 and 27 are of particular interest. These children were twins aged 14 months. Both were bottle fed and no mixed feeding/



GRAPH IV. The result of Iron therapy in cases 26 and 27 (twins).

feeding was given until an egg was added when the children were one year old. They were still having bottles at 15 months. Pallor developed when the children were 6 - 7 months old and when brought for treatment at 14 months of age, the haemoglobin levels were 33 and 25 per cent. In order to pacify the mother, treatment of one child was commenced without delay, the other being used as a control for one month. During that month, the haemoglobin of the child under treatment rose from 33 to 60 per cent, while the haemoglobin of the control child fluctuated between 25 and 28 per cent. Subsequently the control child was treated and the haemoglobin rose to 64 per cent. There can be no doubt that iron was the cause of the improvement in these cases. The results of cases 26 and 27 are shown in GRAPH IV.

CASES AT WESTERN GENERAL HOSPITAL
TREATED WITH FERROUS CHLORIDE.

The children who make up this group are similar to those already described at Western General Hospital and they were treated at the same time as/

TABLE IX.

TABLE SHOWING WESTERN GENERAL HOSPITAL CASES
TREATED WITH FERROUS CHLORIDE GRS. $1\frac{1}{2}$ DAILY.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
16	A. Gallecher.	64	-	68	-	+4	-	$1\frac{1}{2}$
32	A. Osborne.	70	4.8	78	4.81	+8	0	3
33	E. Mair.	70	4.61	80	4.91	+10	+0.3	4
34	I. Hyslop.	72	4.39	80	4.38	+8	0	4
35	T. Goddard.	66	-	73	-	+7	-	$2\frac{1}{2}$
36	A. McMillan.	42	3.97	80	4.64	+38	+0.67	4
37	G. Eagle.	67	-	69	-	+2	-	$2\frac{1}{2}$
38	J. Ritchie.	50	4.33	70	4.47	+20	+0.14	2
39	S. Cuthbert.	70	4.5	78	4.92	+8	+0.42	$2\frac{1}{2}$
40	J. Johnstone.	55	-	61	-	+6	-	2

Average gain in Haemoglobin = +11%

Average duration of Treatment = 3 months.

as observations were being made on the control group in TABLE VI. Observations of haemoglobin and red corpuscles were made as for those treated with Ferr. et Ammon. Citrate. The dose of ferrous chloride used was gr. $\frac{1}{2}$ three times daily. At first, this was given in gelatin capsules but this did not prove practicable so a solution of ferrous chloride was made up daily with a quantity of syrup which acted as a reducing agent. The daily supply of this mixture was put into three small bottles, care being taken that the bottles were completely filled. Separate bottles were thus used for morning, mid-day and evening doses and the necessity of recorking a bottle after it had been exposed to the air was avoided. There can be no doubt that the iron was given in an unoxidised state.

TABLE IX shows the results obtained with this form of treatment. It will be seen that all cases show some gain in haemoglobin and that some of the cases show increase in the number of red corpuscles. The average gain in haemoglobin was 11 per cent. These results should be compared with the controls shown in TABLE VI where there was an average fall in haemoglobin of 4 per cent.

The/

The method of giving ferrous chloride described above was obviously impracticable for general use, as the mixture had to be dispensed daily. A description of the various ferrous mixtures investigated has already been given in the section on the Pharmacy of Iron Salts. The following mixture was found to be satisfactory.

Ferrous Ammon. Sulphate	gr. i
Ac. Hypophos.	℥. $\overline{\text{ii}}$
Aq.	℥. $\overline{\text{v}}$
Syrupus.	ad. ℥^{ss} .

A minimum of water was used, only sufficient to dissolve the ferrous salt being taken. Cases treated with this mixture were at Western General Hospital and Victoria Park House and these will be discussed separately.

CASES AT WESTERN GENERAL HOSPITAL
TREATED WITH FERROUS AMMONIUM SULPHATE.

The children used for this group and the accompanying control group were similar to those already described at this hospital. The control group were observed simultaneously with the treating of/

TABLE XI.

SHOWING WESTERN GENERAL HOSPITAL CASES
USED AS CONTROLS DURING THE PERIOD OF TREATMENT OF ABOVE CASES.

NUMBER	NAMES	INITIAL		FINAL		DIFFERENCE		DURATION of OBSERVATION PERIOD in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
43	James Dickson.	68	4.12	68	4.20	0	+08	2
44	R. Humphries.	70	4.39	61	4.72	-9	+33	2
45	A. Cummings.	67	4.32	73	4.54	+6	+22	2

Average gain or loss of Haemoglobin = -1%

Average period of observation = 2 months.

TABLE X.

SHOWING WESTERN GENERAL HOSPITAL CASES
TREATED WITH FERROUS AMMONIUM SULPHATE GRS. 3 - 6 DAILY.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
41	John Dickson	68	4.65	83	5.04	+15	+.39	2
19	B. Reading.	30	3.16	45	4.03	+15	+.87	2
17	J. Macdonald.	51	4.08	80	4.69	+29	+.61	3
42	C. Mitchell.	71	4.4	75	4.75	+4	+.35	1½

Average gain in Haemoglobin = 16%

Average duration of treatment = 2 months.

of the iron group. All cases in the iron group with the exception of case No. 41, were observed for a preliminary control period. TABLE X shows the result of this treatment. All four cases showed some gain in haemoglobin and some increase in the number of red corpuscles. In the case of Barbara Reading, No. 19, the gain is not as great as would be expected when the low initial haemoglobin level is considered. This child was one of twins both of whom were anaemic. They were tried, at various times with all forms of treatment but with no substantial improvement. From the lack of response to treatment, it seems that they should be classed as examples of the 'constitutional anaemia' described by KLEINSCHMIDT⁽¹⁹⁾.

The average increase in haemoglobin in those cases shown in TABLE X is 16 per cent and should be compared with the results shown for control children in TABLE XI. Only three control children are shown but no case showed a marked increase in haemoglobin and actually when taken together, they show an average fall of 1 per cent in haemoglobin.

CASES/

CASES AT VICTORIA PARK HOUSE
TREATED WITH FERROUS AMMONIUM SULPHATE.

The children comprising this group require special description. They originate from the same social stratum as the children in Western General Hospital and the day nurseries. The children taken into this home are usually in a poor state of nutrition from various causes, ranging from poor feeding to the effects of infections and debilitating diseases. The conditions in the home are ideal and the children receive every possible attention. It is obvious that there is a marked change in environment when a child is admitted to the home. This change is particularly marked when the child is admitted from poor surroundings but is not so marked when the child is admitted from Western General Hospital or a Day Nursery. Owing to the fact that children are not kept in this home for very long periods, preliminary control periods were very short in the case of four out of the five children. Three out of these four children, however, had had previous observations on their blood. An haemoglobin estimation was made in/

TABLE XIII.

SHOWING CASES AT VICTORIA PARK HOUSE USED AS CONTROL CASES.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION OF TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
51	M. Archibald	57	3.95	45	4.21	-12	+0.26	1 $\frac{3}{4}$
52	E. Oliver	60	4.73	68	4.76	+8	+0.03	1 $\frac{3}{4}$
50	G. Reid	51	4.78	48	4.97	-3	+0.19	1 $\frac{1}{4}$

Average gain or loss of Haemoglobin = -2%

Average duration of observation period = 6 weeks.

TABLE XII.

SHOWING CASES AT VICTORIA PARK HOUSE
TREATED WITH FERROUS AMMONIUM SULPHATE GRS. 3 - 6 DAILY.

NUMBER	NAME	INITIAL		FINAL		DIFFERENCE		DURATION of TREATMENT in MONTHS.
		H.B.	R.B.C.	H.B.	R.B.C.	H.B.	R.B.C.	
46	N. Smythe	68	4.7	70	4.6	+2	-.1	2
47	G. Johnson	45	4.58	72	5.49	+27	+0.91	2
48	L. O'Neil	50	4.76	84	4.92	+34	+0.16	2
49	R. O'Neil	60	4.95	82	5.04	+22	+0.09	2
50	G. Reid	48	4.97	70	5.34	+22	+0.37	1½

Average gain in Haemoglobin = 21%

Average Duration of Treatment = 2 months.

in case 47 two months before the preliminary observation in the home. In the interval, there was a slight fall in the haemoglobin level. Cases 48 and 49 were transferred to the home from Western General Hospital and observations made on the haemoglobin while the children were there agreed with those made one month later at Victoria Park. Nevertheless, it must be admitted that it is possible that the extra care given in this home had some effect in raising the haemoglobin level of these two children. Case 52 received an adequate control period. The ferrous ammonium sulphate was given in the same way as already described for the children in TABLE X. TABLE XII shows the results obtained in this group of children. All but one made substantial gains in haemoglobin, the average gain being 21 per cent. There was also some increase in the number of red corpuscles. This result should be compared with the control cases shown in TABLE XIII, where there was an average fall in haemoglobin of 2 per cent. When this comparison is made it becomes certain that the improvement in haemoglobin level shown by the iron group must be due to the iron therapy and not to the change of environment already discussed.

TABLE XVI.

Showing the LATENT PERIOD in all cases which
RESPONDED TO TREATMENT
WITH FERROUS AMMONIUM SULPHATE.

NUMBER	NAME	LATENT PERIOD in WEEKS.
41	John Dickson	4
19	B. Reading	1
17	J. Macdonald	2
42	C. Mitchell	1
47	G. Johnson	$\frac{1}{2}$
48	L. O'Neil	$\frac{1}{2}$
49	R. O'Neil	2
50	G. Reid	1

It will be seen from this table that the
average latent period was one week or less.

TABLE XV.

SHOWING THE LATENT PERIOD
in all cases which
RESPONDED TO TREATMENT WITH FERROUS CHLORIDE.

NUMBER	NAME	LATENT PERIOD IN WEEKS
16	A. Gallacher	3
32	A. Osborne	5
33	E. Mair	6
34	T. Hyslop	3
35	T. Goddard	2
36	A. McMillan	4
37	G. Eagle	2
38	J. Ritchie	4
39	S. Cuthbert	14

Of the total nine cases in this table six have latent periods of 2 - 4 weeks giving a mean figure of three weeks.

TABLE XIV.

Showing the DURATION OF THE LATENT PERIOD
in all cases which
RESPONDED TO TREATMENT WITH
FERR. ET AMMON. CITRATE.

NUMBER	NAME	LATENT PERIOD IN WEEKS.	
1	L. McGrath	4	Treated at Western General Hospital.
2	I. Dupré	8	
3	E. Falconer	4	
5	I. Paterson	8	
6	G. Coffey	4	
9	M. Murray	2	
12	C. Robertson	2	
13	E. Davies	3	
14	T. Mill	2	
23	B. Philip	2	
24	N. Gunn	2	Treated at Day Nur- series.
25	N. Smythe	2	
26	L. Hislop	1	
27	F. Hislop	2	
28	K. Spence	1	

The mean figure for the latent period of cases treated at Western General Hospital was three weeks.

The latent period for cases treated at Day Nurseries was two weeks.

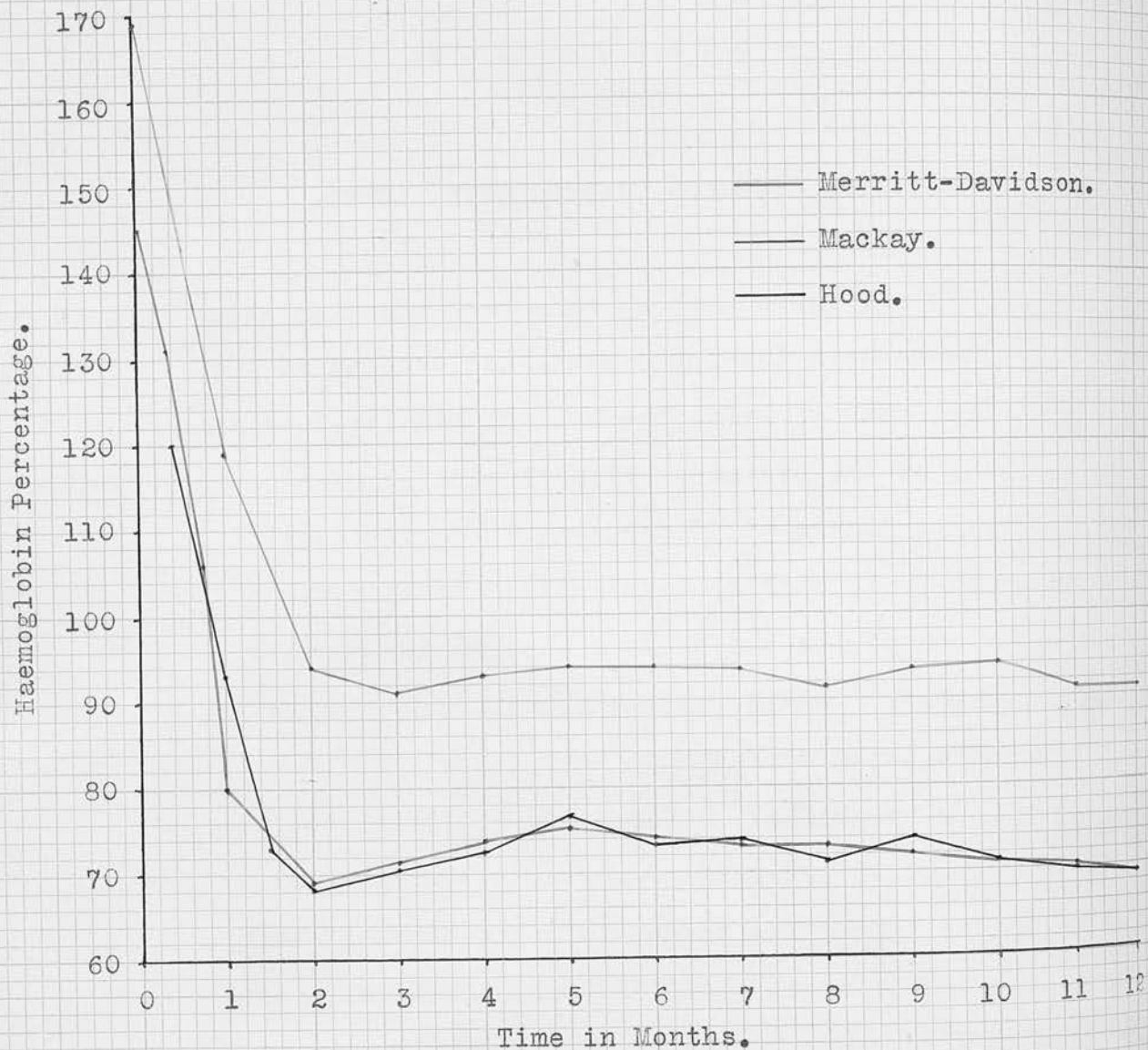
THE "LATENT PERIOD".

The latent period may be defined as the interval between the commencement of iron therapy and the appearance of a response. For purposes of investigation, a response will be defined as a gain in haemoglobin of 5 per cent or more.

A study of TABLE XIV shows that the cases which were treated at Western General Hospital show longer latent periods than those treated at the day nurseries. Of the 9 cases treated at Western General Hospital, seven show latent periods of between two and four weeks with a mean figure of three weeks. These nine cases should be compared with the cases treated with ferrous chloride shown in TABLE XV. When this comparison is made it is evident that Ferrous Chloride and Iron and Ammonium Citrate have similar latent periods. If TABLES XIV and XV are compared with TABLE XVI it will be seen that the latent period of Ferrous Ammonium Sulphate is considerable shorter than that of either of these drugs.

DISCUSSION /





GRAPH V. The average haemoglobin level during the first year of life. This compares the results obtained in this investigation with those obtained by Mackay for London children and Merritt and Davidson for American children.

DISCUSSION.

THE AVERAGE HAEMOGLOBIN LEVEL.

The first part of this investigation shows that, between the third month and the end of the second year of life, the haemoglobin level of the blood of the ordinary child fluctuates round the average figure of 70 per cent. These fluctuations reach their highest level at the fifth month and at the end of the second year when 76 per cent is reached. GRAPH V shows that this average haemoglobin level corresponds very closely to that obtained by MACKAY⁽²⁾ for London children but is lower by about 20 per cent haemoglobin than the levels obtained in the two recent investigations of the American workers MERRITT⁽⁴⁾ and DAVIDSON, and ELVEHJEM⁽³⁾ and PETERSON. Both the Haldane haemoglobinometer used by MACKAY and the Sahli haemoglobinometer with which the estimations in the present investigation were made, were calibrated so that one hundred per cent represented a concentration of 13.8 gms. haemoglobin per 100 c.c. To be sure that/

that the calibration of this instrument was correct, it was compared by the oxygen combining method of Van Slyke for estimating haemoglobin and it was found to be correct, one hundred per cent representing an oxygen combining power of 18.5 volumes per 100 c.c.

The American workers used different methods for estimating the haemoglobin and while it is probable that this variation in technique accounts for some of the difference between the American and the British results, it is unlikely that this can account for the whole twenty per cent difference. Some writers have suggested that racial differences play a rôle in causing this variation. As the 'American' children consisted of negroes, Italians, Jews, Irish and Scots, it seems more probable that environment is the chief factor in causing the difference. MERRITT and DAVIDSON⁽⁴⁾ suggest that sunlight may be a factor as there is more sunlight in New York than in London.

THE EFFECT OF IRON THERAPY ON THE HAEMOGLOBIN LEVEL.

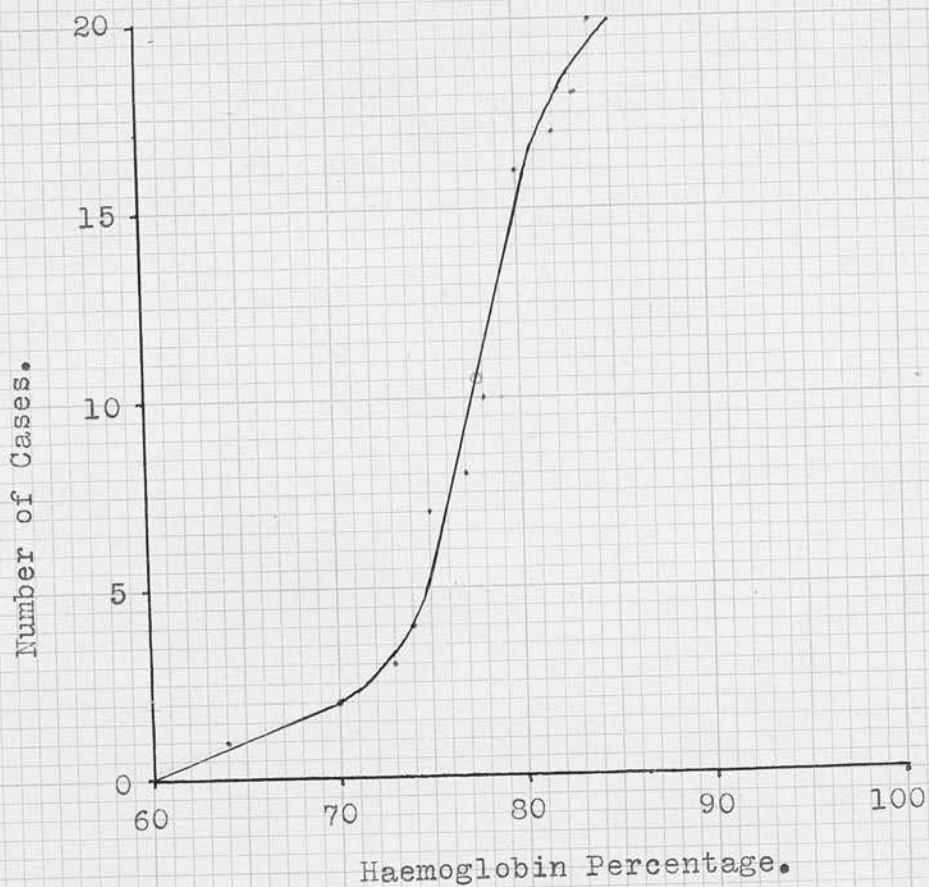
Study of the tables in the section on iron therapy show that children suffering from various grades/

that the calibration of this instrument was correct, it was compared by the oxygen combining method of Van Slyke for estimating haemoglobin and it was found to be correct, one hundred per cent representing an oxygen combining power of 18.5 volumes per 100 c.c.

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THE EFFECT OF IRON THERAPY ON THE HAEMOBLOBIN LEVEL.

Study of the tables in the section on iron therapy show that children suffering from various grades/



GRAPH VI. The characteristic curve for children who have responded to prolonged treatment with Iron.

TABLE XVII.

This shows all cases which responded to iron therapy and were treated for at least two months with Ferr. Ammon. Sulphate or at least three months with either Ferrous Chloride or Ferr. et Ammon. Cit.

CASES	INITIAL	FINAL
1	64	74
2	65	78
4	68	73
5	63	84
6	66	80
8	68	75
13	70	80
14	58	75
33	70	80
34	72	80
36	42	80
32	70	78
41	68	83
17	51	80
42	71	75
48	50	84
49	60	82
28	57	77
26	28	64
27	33	70

Cases which did not respond to iron therapy and those cases who developed definite infections during the treatment have been omitted.

grades of definite nutritional anaemia and children having haemoglobin levels only slightly below the average are cured of their anaemia when they are treated with iron salts while control children remain anaemic. The cure of the anaemia is shown by a regeneration of haemoglobin, a rise in the colour index and in some cases by an increase in the number of erythrocytes in the circulation. This regeneration was particularly marked when ferrous salts were used. If we make a list of all children with initial haemoglobin level of 72 per cent or less who showed response to adequate iron therapy and in whom no infection developed which might have prevented full response to treatment we have a series of cases in which the haemoglobin level has been raised as far as it is possible for iron to raise it. TABLE XVII shows such a list and GRAPH VI shows the characteristic curve constructed from that table. It will be seen that the modal figure for this curve is 78 per cent. Thus it is evident that it is possible to raise the modal figure for haemoglobin of infants to 78 per cent by adequate treatment with iron. If we assume that iron therapy will not raise the haemoglobin level above 'normal', it appears/

appears that the normal haemoglobin level for children is above 70 per cent. and is probably near 80 per cent.

THE DOSE OF IRON NECESSARY.

In obtaining these results the following doses of iron were used:-

DRUG.	DAILY DOSE.	DAILY DOSE OF IRON.
Ferr. et Ammon. Citrate.	grs. $4\frac{1}{2}$ -9	58-116 mgms.
Ferrous Chloride.	grs. $1\frac{1}{2}$	43 mgms.
Ferrous Ammonium Sulphate.	grs. 3	28 mgms.

While it is not certain that $4\frac{1}{2}$ grains of Ferr. et Ammon. Citrate is the minimum effective dose, it is near it for it was found that this dose could be increased with advantage in many cases. Both MACKAY⁽¹⁾ and PARSONS⁽⁴⁵⁾ used this dose or a larger one to obtain good results. PARSONS⁽⁴⁵⁾ reported that more rapid haemoglobin regeneration occurred when ferrous iron was used than when a dosage of Ferr. et Ammon. Citrate containing a similar quantity/

quantity of iron was given. He used 144 mgms. ferrous iron daily. It is apparent from the above results that a comparatively small dose of ferrous iron will produce a response as good as that obtained with a dose of Ferr. et Ammon. Citrate containing twice the amount of iron.

When 9 grains Ferr. et Ammon. Citrate and 3 grains Ferrous Ammonium Sulphate are given to a 20 lb. child, the doses of iron given, expressed in terms of body weight, are 12 mgms and 3 mgms. per kilogram. When 60 grains Ferr. et Ammon. Citrate and 0.1 gramme. Ferrous Chloride are given to an adult weighing $9\frac{1}{2}$ stones the doses of iron given are 13 mgms. and 2 mgms. per kilogramme body weight respectively. Thus the doses of iron salts used in the treatment of infantile anaemia correspond to the doses of iron salts which are recommended for the treatment of Chronic Microcytic anaemia in adults. In treating infantile anaemia, ill effects of iron are most unusual and the absolute amount of drug is so small that the mixture is quite palatable and there is no object in endeavouring to reduce the dose.

THE DURATION OF TREATMENT NECESSARY.

The /

The rate of haemoglobin regeneration varied with different children and with different initial haemoglobin levels. In a case uncomplicated by infections complete cure of the anaemia usually took place in six weeks to two months with Ferrous Ammonium Sulphate and in about three months with Ferr. et Ammonium Citrate.

THE RATE OF ACTION OF IRON.

In the section on the 'Latent Period', it is shown that the average time between the giving of Ferrous Ammonium Sulphate and the appearance of a rise of haemoglobin is one week. With either Ferr. et Ammon. citrate or Ferrous Chloride the duration of this latent period is two weeks or more. Thus, not only will Ferrous Ammonium Sulphate act in smaller dosage than Ferr. et Ammon. Citrate but it acts more rapidly.

A rise in the haemoglobin level means that new cells having a high haemoglobin content have been put into the circulation and it is certain that a considerable number of these cells must be delivered from the haemopoietic centres before a significant rise occurs in the haemoglobin. In case No. 48 which/

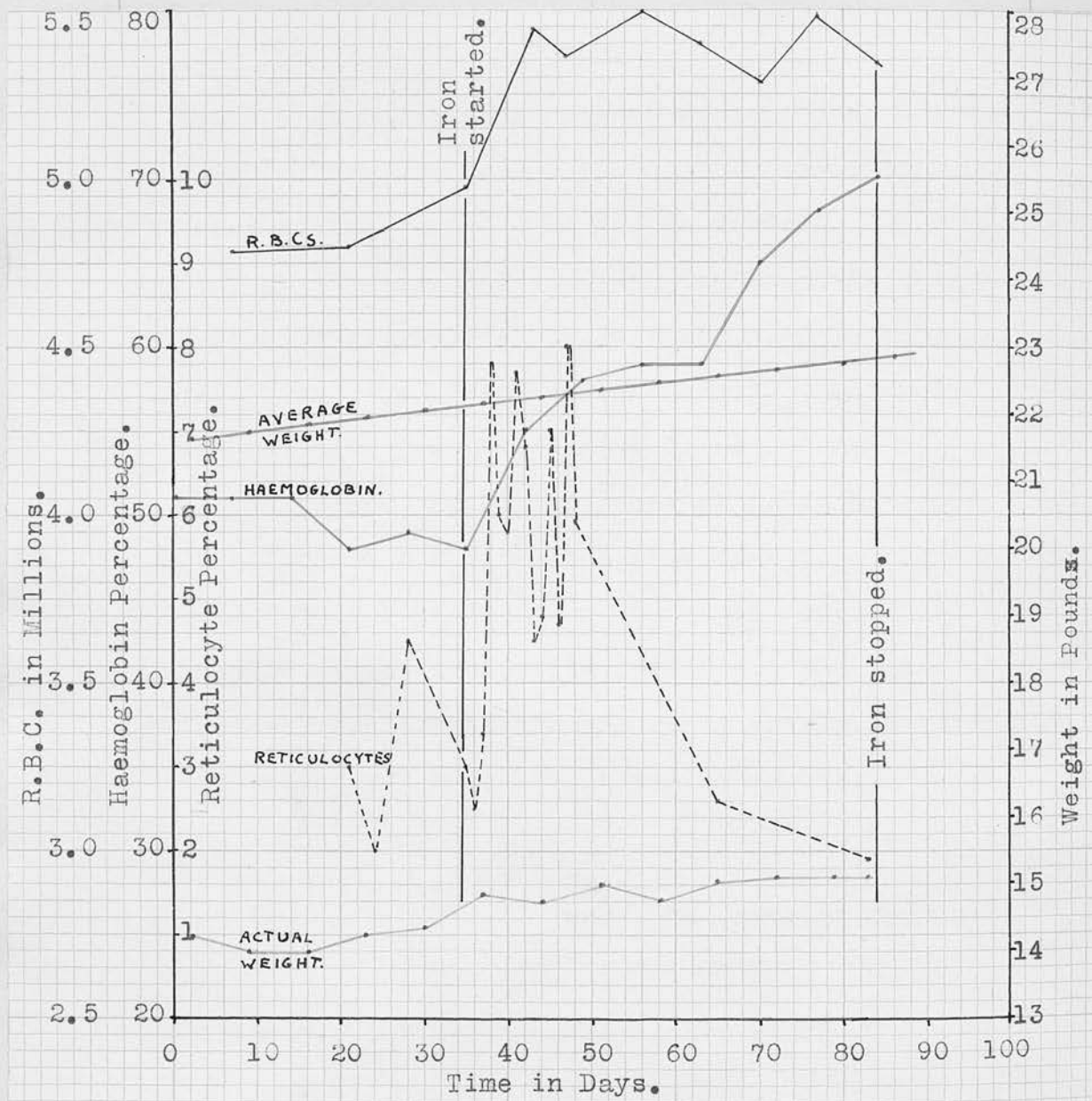
which is an example of iron producing rapid and successful cure of anaemia, blood examination before treatment showed:-

R.B.C's 4.75 millions; HB. 50%; C.I. 0.5
and after full treatment:-

R.B.C's 4.9 millions; HB. 84%; C.I. 0.85

The latter figures may be presumed to be 'normal' for this child. After three weeks treatment with iron, the blood showed:-

R.B.C's 5.0 millions; HB. 72%; C.I. 0.72
and at this time the blood must have contained a mixture of corpuscles containing a certain proportion of corpuscles of the original type having a colour index of 0.5 and a number of new corpuscles having a colour index of 0.85. A mixture consisting of 37 per cent of R.B.C's with C.I. 0.5 and 63 per cent R.B.C's with C.I. 0.85 has colour index of 0.72 so that after three weeks treatment 63% of the corpuscles had been replaced. If the average life of a red corpuscle is three weeks, then 100% of the corpuscles could be replaced with the new type of corpuscle in that time if the iron acted immediately. As has been shown only 63 per cent were so replaced and/



GRAPH VII. The effects of iron therapy in case 52.

and it is therefore evident that iron acted after about one week.

Another method of determining the rate of action of iron is by noting the time when an increase occurs in the proportion of reticulocytes to red corpuscles. Reticulocyte counts were not carried out in many cases of this series, but case 52, the result of which is shown in GRAPH VII, shows this method. In this case a rise in the proportion of reticulocytes occurred on the third day of treatment showing that iron acted after three days. From the evidence given, it is certain that, in a favourable case, a ferrous salt will commence its action in one week or less.

THE UTILISATION OF IRON.

It is recognised that in the treatment of chronic microcytic anaemia of adults, large doses of iron must be given to obtain a cure of the anaemia but it is not known why such large doses are necessary when the body utilises only a few milligrammes for the synthesis of haemoglobin. The following three examples show the amount of iron utilised in the successful/

successful treatment of infantile anaemia and these results are compared with the amounts of iron given.

CASE NO. 48

Body weight = $15\frac{1}{2}$ lbs = 7.05 kilogrammes.

The blood volume at 1 yr. = 85×7.05 cc = $\frac{600 \text{ cc}}{(55)}$

100% Haemoglobin = 48 mgms. Fe per 100 cc.

Therefore with 50% Haemoglobin the blood of child contains -

24×6 mgms. Fe = 144 mgms. Fe.

After three weeks, 72% HB. was reached so that blood then contained $\frac{48 \times 72}{100} \times 6 = 203$ mgms. Fe.

Therefore $203 - 144 = 59$ mgms. iron utilised in three weeks. The quantity of iron given was 28 mgms. daily for three weeks = 567 mgms.

Therefore $\frac{59}{567} \times \frac{100}{1} = \underline{10.4\%}$ iron was utilised

When case No. 27 is considered in a similar manner it is found that 54 mgms. iron were utilised in four weeks and that 2156 mgms. iron were given in this time giving percentage of utilisation of 2.4 per cent.

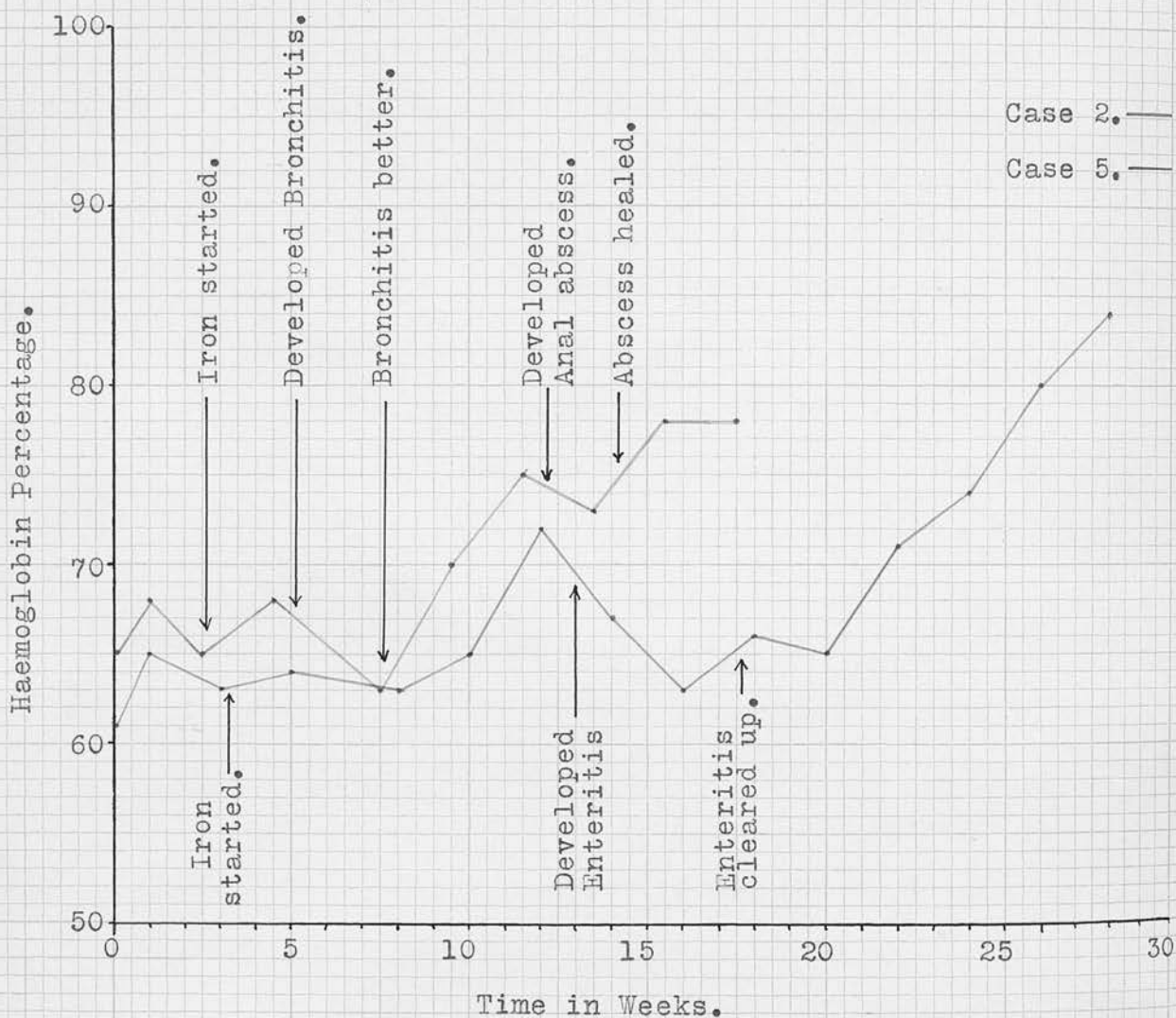
When case No. 26 is considered it is found that 72 mgms. iron were utilised in three weeks out of/

of a total amount of 1617 mgms. given in this time. Thus 4.4 per cent of iron given was utilised.

These examples show that when iron is given to a case of nutritional anaemia of infants, the utilisation of the drug is quite good and the wastage of iron is not nearly so great as in the treatment of anaemia in adults.

THE VALUE OF IRON THERAPY AS JUDGED BY ITS
EFFECT ON GENERAL HEALTH AND BODY WEIGHT.

Much has been written about the ill-effects produced by nutritional anaemia in infants. While it is certain that a severe degree of anaemia with haemoglobin below 40 per cent is an illness, it is difficult to assess the amount of harm caused in children by haemoglobin levels of 65 - 70 per cent. In many of the cases in this series a small rise in haemoglobin was accompanied by improvement in the general health as shown by the child's greater liveliness. Such a change is merely an impression and its degree is difficult to assess. In estimating benefit from iron therapy, the effect of infection on a child being treated with iron must be borne in mind/



GRAPH VIII. The effects of infection on children undergoing treatment with iron salts.

mind. MACKAY⁽¹⁾ drew attention to the fact that when an infection is present iron therapy fails to raise the haemoglobin level. Out of eleven children in this series of cases, which did not respond to treatment with iron, five showed evidence of infection such as otitis, blepharitis and bronchitis. There are several cases in the groups receiving iron salts where the improvement in haemoglobin level was delayed by the presence of an infection and where further improvement did not take place until the infection was eradicated. GRAPH VIII shows two such cases. In cases where an infection is present the anaemia and general health will improve when the infection is cured and although the infection may be superimposed on a nutritional anaemia, this improvement should not be put down to the iron therapy.

A more reliable estimate of the effect of iron on the general health may be made by noting the effect of iron therapy on the body weight. There is considerable evidence that iron stimulates metabolism of the body generally. (ROBSCHUIT - ROBBINS,⁽⁵⁶⁾ WHIPPLE and ROBSCHUIT - ROBBINS.⁽³⁵⁾). GREIG⁽⁵⁷⁾ described the effect of iron therapy on young cattle suffering from Pine, in the island of Tyree. Pine is/

is a disease which develops on iron poor diet and cattle suffering from that disease are ill thriven, underweight and anaemic. When the cattle were treated with iron the general condition and weight improved but the haemoglobin level did not rise.

McGOWAN and CRICHTON⁽¹⁷⁾ found that when pigs were fed on an iron poor diet, not only did anaemia develop but the general metabolism became upset and the pigs had a tendency to die of acute respiratory disease. MACKAY⁽¹⁾ found that iron treated infants were slightly heavier than control infants of the same age. There are many factors which may influence a child's weight and it is not easy to estimate the effect of iron. In the present series of cases, thirty three children who received iron therapy were weighed regularly. These weights are recorded in the charts in the appendix. In estimating the effect of iron, in some cases the relation of the actual weight to the average weight curve before treatment was compared with that after treatment and in other cases, the rate of gain in weight during the period of iron therapy was compared with the rate of gain in weight before iron therapy was commenced. In none of these cases was the haemoglobin/

haemoglobin at such a figure that improvement in its level could not be expected. The results of this investigation are as follows:-

In 15 cases, iron caused a gain in both haemoglobin and body weight.

In 11 cases, iron caused a gain in haemoglobin but not in weight although the weight was below the average.

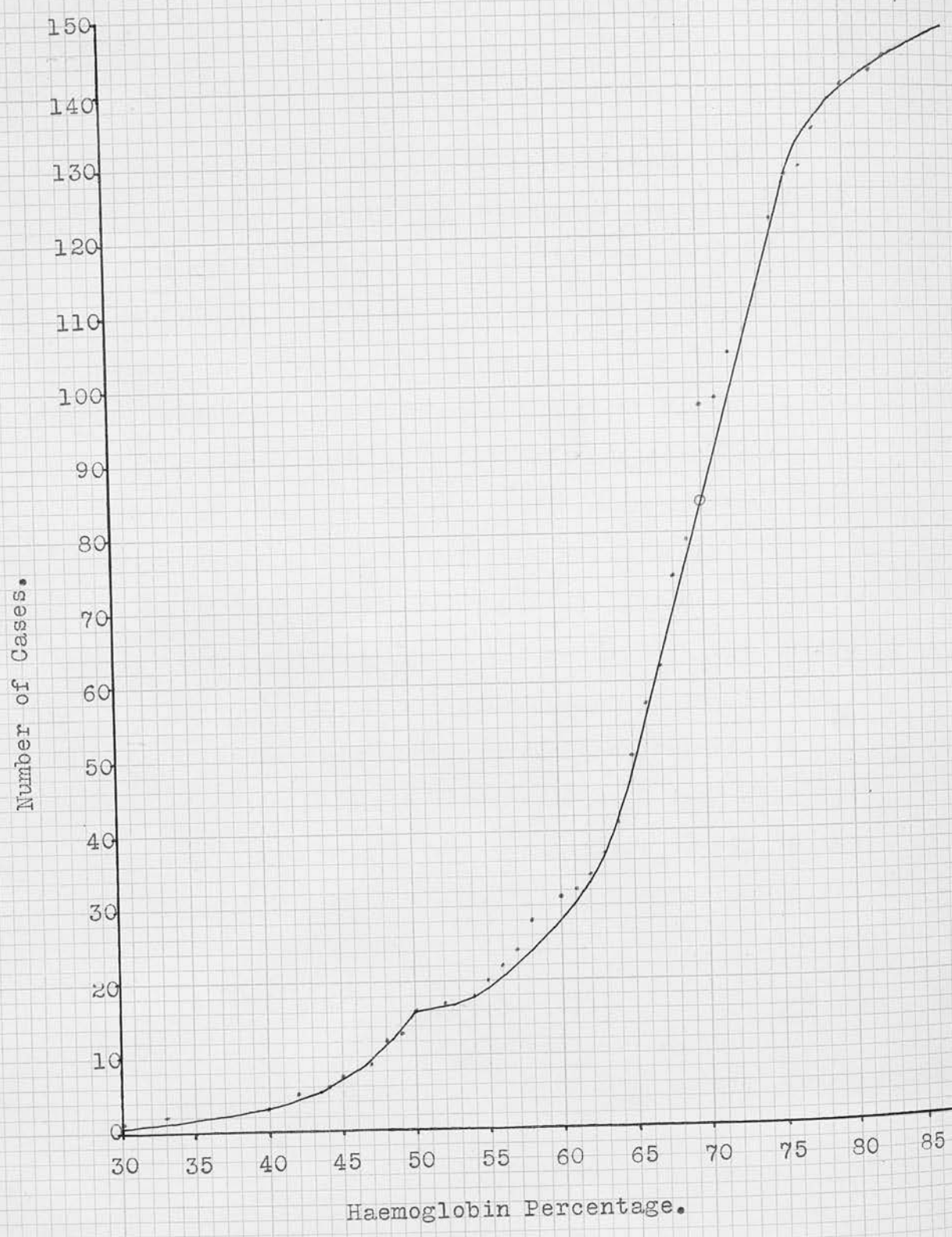
In 4 cases, iron caused no gain in either haemoglobin or weight although both were subnormal.

In 2 cases, iron caused no gain in haemoglobin but a rise in weight.

In 1 case, the weight was normal and iron caused a gain in haemoglobin.

It is thus evident that while 81 per cent. of cases showed some gain in haemoglobin only 53 per cent. showed a gain in weight although the weight of all was subnormal.

ANAEMIA/



GRAPH IX. The characteristic curve for the distribution of haemoglobin in children between three months of age and the end of the second year.

"ANAEMIA".

Various estimates of the incidence of anaemia in infants have been made and MACKAY⁽¹⁾ considered that 50 per cent. of London children were anaemic. Such estimates are based, of necessity, on the assumption of some arbitrary figure separating haemoglobin levels which are physiological from those that are considered pathological. In this investigation, figures for haemoglobin below 60 per cent. of the 'normal' adult value were considered to be pathological. GRAPH IX has been constructed from GRAPH III and shows the characteristic curve for variation of haemoglobin levels in 144 children aged between three months and two years. It is apparent that a vertical line could be drawn in GRAPH IX at almost any level for haemoglobin and all cases to the left of such a line would be classed as suffering from anaemia. It would seem reasonable to suppose that a patient suffers from anaemia when symptoms which are attributable to the poverty of the blood become apparent, but the level of haemoglobin which corresponds to the production of symptoms, varies in different individuals and it is not possible to find a dividing line between 'anaemia' and 'normality' in this way.

OSGOOD/

(58)
 OSGOOD studied the distribution of haemoglobin amongst 100 healthy adult males. A characteristic curve constructed from his results showed that the variation of haemoglobin levels round a mean was roughly symmetrical but the figure above the mean were more strung out than those below. A curve constructed from the results of a similar study on 137 healthy adult males by WINTROBE and MILLER (59) showed that the haemoglobin level varied almost symmetrically around the mean but the figures below the mean were more strung out than those above. Taking these two results together it seems probable that the curve showing the distribution of haemoglobin amongst healthy adult males shows symmetrical variation about a mean.

Inspection of GRAPH IX shows that the bulk of the population varies round 70 per cent haemoglobin which is the centre point of the steepest part of the graph, and there is a tail of low figures. The upper part of the graph looks symmetrical. Taking 70 per cent haemoglobin as the mean we find that there are 65 cases spread in the range 70 - 84 per cent haemoglobin. If the variation is symmetrical, there should be 65 cases in the range 55 - 69. Actually/

Actually there are 60 cases showing that the variation is almost symmetrical. If we regard all those children with haemoglobin 70 - 84 per cent as 'normal' then it is only reasonable to regard the group 55 - 69 per cent as equally normal and only those having haemoglobin levels below 55 per cent. can be thought to be pathological.

It has been pointed out already that the 'normal' haemoglobin level is higher than 70 per cent. and is probably nearer 80 per cent. If a curve showing the distribution of haemoglobin amongst healthy children who were under optimum conditions, was constructed, it would probably fall somewhat to the right of the curve shown in GRAPH IX and therefore the figure dividing physiological from pathological haemoglobin levels would be rather higher than 55 per cent.

This work was carried out in the Departments of Pharmacology and Therapeutics. I am indebted to the University of Edinburgh for a Crichton Research Scholarship and to Professor McNeil and Dr T. Y. Finlay for allowing access to the clinical material.

C O N C L U S I O N S.

1. In the group of children studied, who were between the ages of three months and two years, the haemoglobin level ranged from 25 per cent. to 83 per cent. and the predominant figure or mode was 70 per cent. of the 'normal' adult value.

The term anaemia is applied to children with haemoglobin below 60 per cent.

2. Treatment with iron salts for 2 - 3 months of a group of twenty children with haemoglobin levels of 72 per cent. or less resulted in raising the mode to 78 per cent. Iron therapy therefore, raised the haemoglobin level not only in children suffering from definite anaemia but also in those with a haemoglobin level only slightly below the average.

3. The number of children with haemoglobin levels of 72 per cent. or less was 39, and 77 per cent. of these responded to treatment with iron salts.

4. /

4. The full beneficial action of iron salts in nutritional anaemia of infants was only produced after six weeks to three months.
5. Infections interrupt or delay the cure of nutritional anaemia with iron salts.
6. The following doses of iron were effective:-

COMPOUND	DAILY DOSE of COMPOUND	DAILY DOSE of IRON
Ferr.et Amm.Cit.	grs. $4\frac{1}{2}$ -9	58-116 mgms.
Ferrous Chloride	grs. $1\frac{1}{2}$	43 mgms.
Ferrous Ammon. Sulphate.	grs. 3	28 mgms.

7. The average latent period with ferrous ammonium sulphate was one week while with ferrous chloride and Iron and ammonium citrate it was 2 - 4 weeks.
8. These facts show that ferrous salts are more effective than Iron and ammonium citrate in the treatment of nutritional anaemia.
9. /

9. In cases treated successfully with iron salts, from $2\frac{1}{2}$ to 11 per cent. of the iron given was utilised for the production of haemoglobin.
10. In a group of 33 children with haemoglobin levels of 70 per cent. or less, iron therapy caused:-
- (a) an increase in the rate of gain in weight, in 53 per cent, and
 - (b) a rise in the haemoglobin level in 81 per cent. of this group of cases.
11. Since iron therapy raised the weight as well as the haemoglobin in so many cases, it appears that in the majority of children studied, there was a deficiency in the iron supply sufficient to retard growth.
12. It appears that the true 'normal' haemoglobin for infants between three months and two years is certainly above 70 per cent and is probably nearer 80 per cent.
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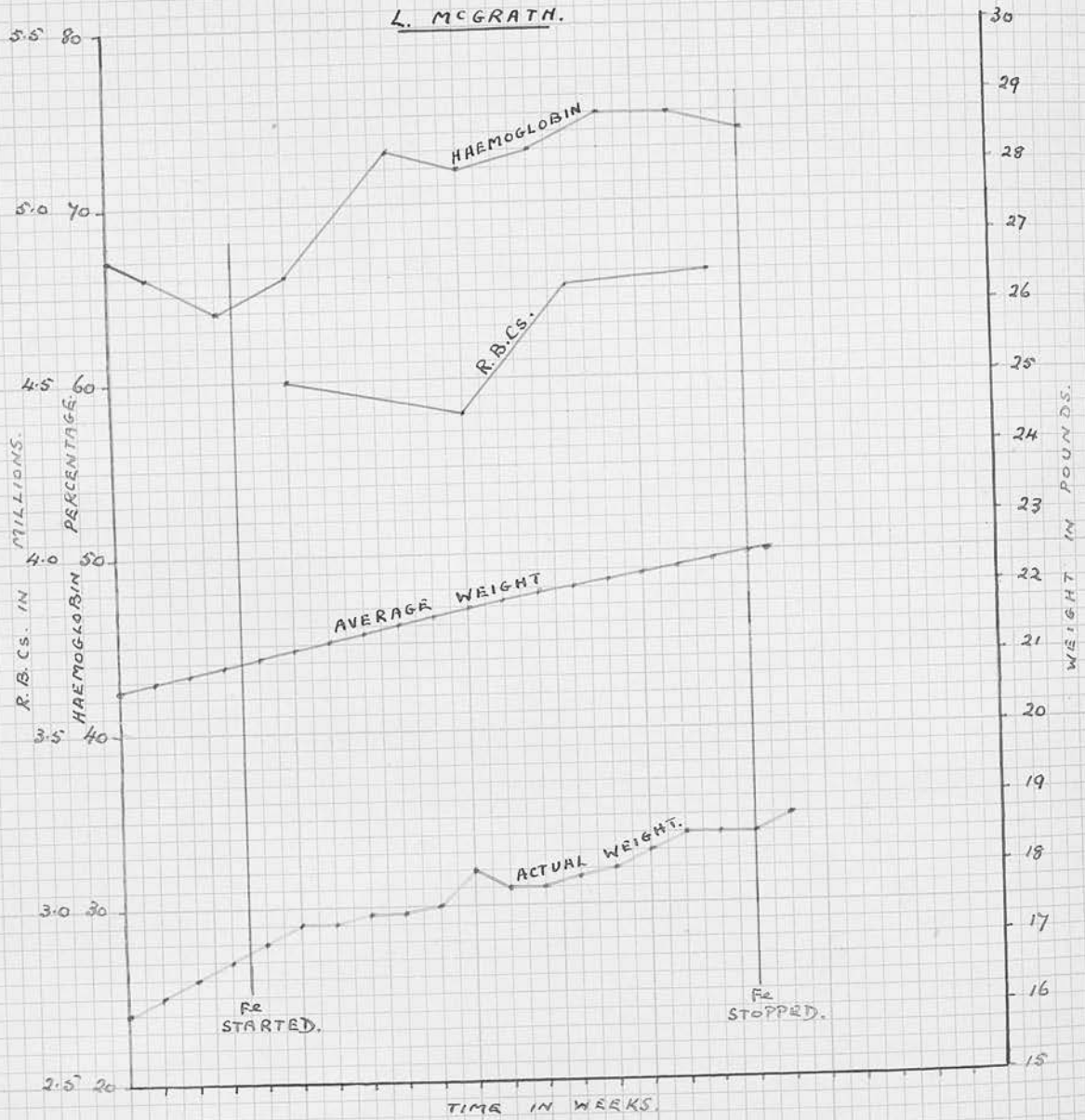
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APPENDIX

CASES I - III.

L. McGRATH.



CASE I.

CASE NO. I.

WESTERN GENERAL HOSPITAL.

LORNA MCGARTH.

Aet. $1\frac{2}{12}$ Date of Birth - 4.10.31. Admitted - 22.10.31.Full-time Twin.

HISTORY.

The child was one of twins and was somewhat underweight at birth. When 18 days old she weighed 5 lbs. She was fed on the bottle all the time until spoon feeding was commenced. She has not had any infections and although she is somewhat below the normal weight curve, the weight has risen fairly satisfactorily.

EXAMINATION - 5.12.32.

The child is rather small for age. She is rather pale and has a slightly yellow look. Examination does not reveal any abnormality. There is no splenomegaly.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
5.12.32	67					
14.12.32	66					
27.12.32	64		Poorly filled red cells.			
30.12.32						
1. 1.33					Fe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	
3. 1.33					" " " " $\frac{1}{2}$ t.i.d.	
5. 1.33					" " " " $\frac{1}{2}$ t.i.d.	
11. 1.33	66	4.50		0.73		Making good progress.
19. 1.33						No ill effects of iron.
31. 1.33	73				Fe.et Am.Cit.gr. $2\frac{1}{4}$ t.i.d.	
13. 2.33	72	4.40		0.81		Some nasal discharge.
28. 2.33	73					Nasal discharge less.
6. 3.33		4.76		0.76		Very bright and active.
13. 3.33	75					
14. 3.33					Copper Sulphate gr. $\frac{1}{50}$ t.i.d.	
28. 3.33	75					The child looks very well and is very active
4. 4.33		4.8		0.78		
11. 4.33	74					Removed to City Hospital with chickenpox.
28. 4.33						

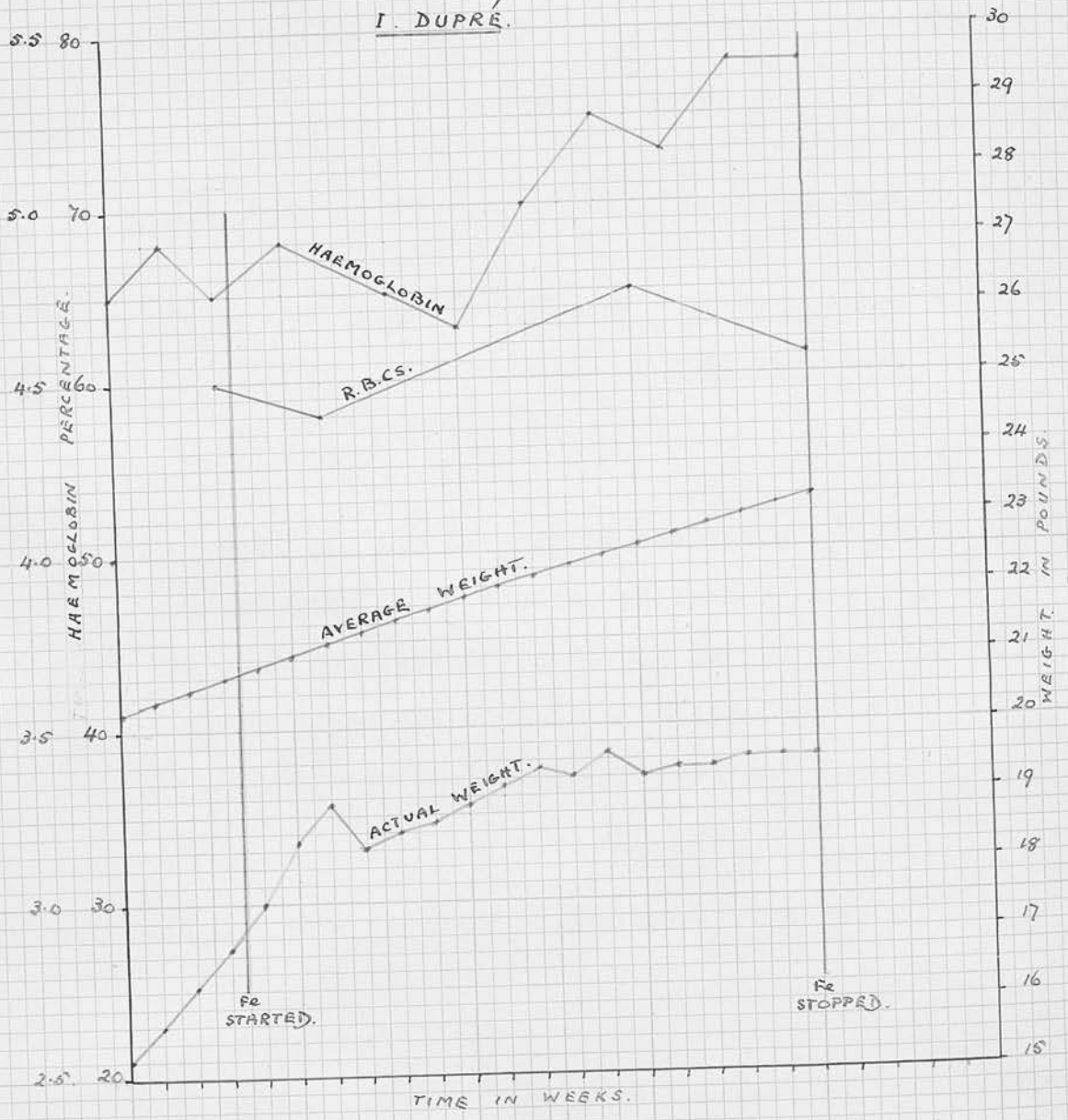
RESULT.

During a period of treatment with Iron and Ammonium Citrate lasting $3\frac{1}{2}$ months, the haemoglobin rose from 64 to 74 and the general condition of the child improved markedly.

WEIGHT.

The weight curve was parallel to but below the normal weight curve throughout the period of treatment and there is no evidence of any effect on the weight which might be attributed to the iron therapy.

I. DUPRÉ.



CASE II.

CASE NO. II.

WESTERN GENERAL HOSPITAL.

IAN DUPRÉ.

Aet. $1\frac{3}{12}$ Date of Birth - 3.8.31Admitted - 22.11.32.Premature Baby.

HISTORY.

The child was bottle-fed all his life. He was the son of healthy parents. He was admitted to the R.H.S.C. on 7.6.32 suffering from rickets. He had a cough before admission but he is quite all right now. He has not had any infectious diseases.

EXAMINATION - 26.11.32.

The nutrition of the child is good but he is rather pale. There is no enlargement of tonsils, glands or adenoids. He has no otorrhoea or blepharitis. There is some swelling of epiphyses but there is no rickety rosary. X-ray examination of wrist and ankle shows no sign of active rickets. No splenomegaly.

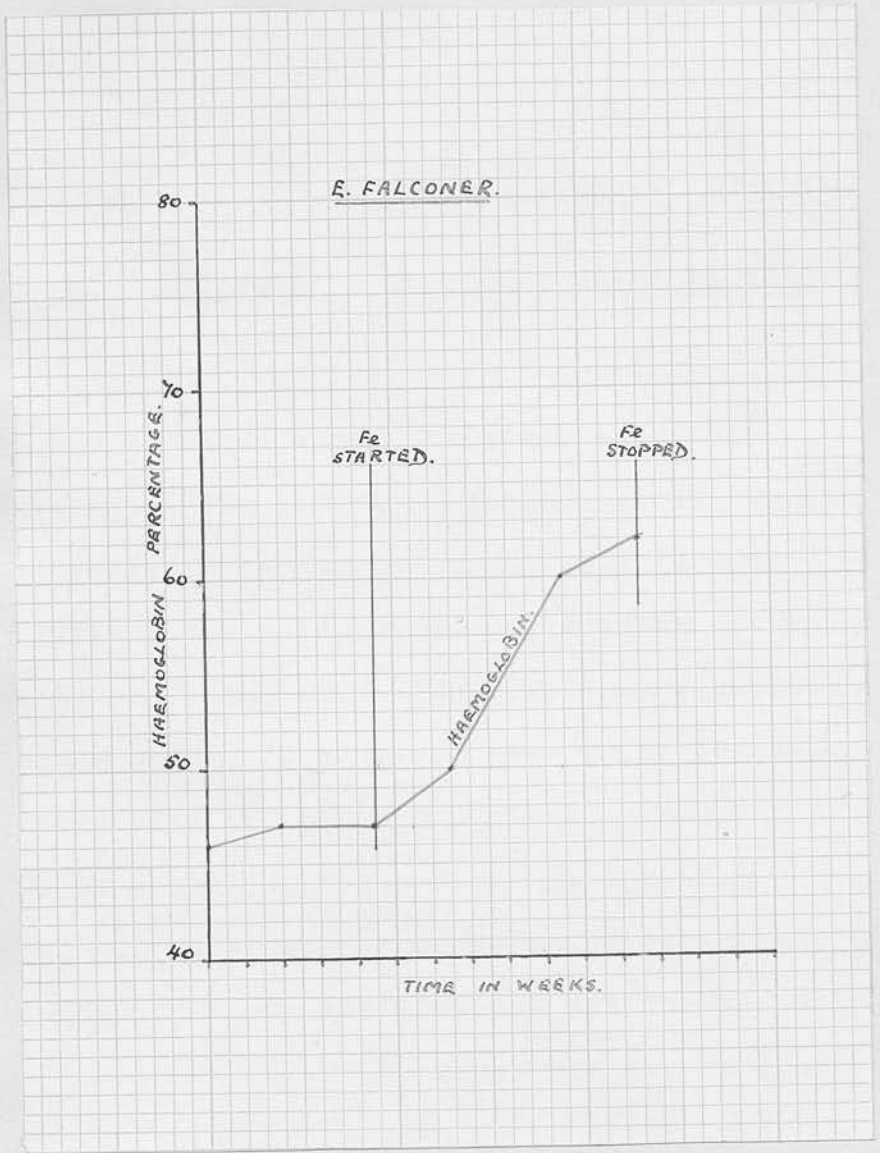
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
9.12.32	65					
18.12.32	68					
28.12.32	65	4.50	Poorly filled R.B.C's, some anisocytosis.	072		Taking feed well.
30.12.32					Fe. et Am. Cit. gr. $\frac{1}{4}$ t.i.d.	
1. 1.33					" " " " $\frac{1}{4}$ t.i.d.	
3. 1.33					" " " " $\frac{3}{4}$ t.i.d.	
5. 1.33					" " " " $\frac{3}{4}$ t.i.d.	
11. 1.33	68				" " " " miss t.i.d.	
19. 1.33		4.40		075	" " " " illi t.i.d	Some bronchitis. Has severe cold in head.
21. 1.33						Chest has rhonci. Some nasal discharge
31. 1.33	65					Taking food well, cold better.
14. 2.33	63					Has some nasal discharge.
28. 2.33	70					
13. 3.33	75					
14. 3.33					CuSO ₄ gr. $\frac{1}{50}$ t.i.d.	
22. 3.33	73	4.75		079		Has anal abscess. Wound healing up. Doing well.
26. 3.33						
3. 4.33	78					
11. 4.33	78					
1. 5.33		4.56		086		Transferred to City Hospital with Chickens
10. 5.33						

RESULT.

The child received treatment with iron over a period lasting four months. During this time the haemoglobin rose from 65 to 78 per cent. For the first two months this improvement was slow as the child suffered from infections. During the second two months the improvement was more marked but received a slight set-back at the end of the third month when the child developed an anal abscess.

WEIGHT.

The weight was rising before the iron was started. This rise was continued after the administration of iron was started but the iron did not seem to cause any marked increase in the rapidity of the gain in weight.



CASE III.

CASE NO. III.

WESTERN GENERAL HOSPITAL.

EVELYN FALCONER.

Aet. $1\frac{8}{12}$ Date of Birth - 27.3.31Admitted - 18.4.31.

HISTORY.

The early history of this child is not obtainable. It is uncertain whether she was a premature or full time child. She was admitted to hospital three weeks after birth and after admission the feeding was artificial. The child was late in being weaned being over one year old. She was difficult to wean. She had a cough for some time and this became worse in September 1932, signs of capillary bronchitis being present. At this time pallor was noticed and the conjunctivae had a bluish tint. The blood showed the signs of simple secondary anaemia.

EXAMINATION - 26.11.32

The child looks pale, there is now only a slight cough. No abnormal physical signs in chest. The spleen is not palpable. There is no otorrhoea. The nutrition is very poor and the child is very much below the average weight.

DATE.	HB.	R.B.C. in MILLIONS.	FILM.	C.I.	DRUG.	PROGRESS NOTES.
26.11.32	46					
12.12.32	47					
28.12.32	47	3.90	Anisocytosis marked. Poorly filled R.B.C's.	0.6	Ferr.et Amon.Cit.gr. $\frac{1}{4}$ t.i.d. Ferr.et Amon.Cit.gr. $\frac{1}{2}$ t.i.d. Ferr.et Amon.Cit.gr. $\frac{3}{4}$ t.i.d. Ferr.et Amon.Cit.gr.i ss. t.i.d.	Reticulocytes 0.5%
30.12.32						
1. 1.33						
3. 1.33						
5. 1.33						
11. 1.33	50					Beginning to sit up. Some increase in weight this week.
19. 1.33						
21. 1.33					Ferr.et Amon.Cit.gr.iii t.i.d.	Moved to Group A. No change in feeding.
31. 1.33	60					
12. 2.33	62					Removed to City Hospital with whooping cough.

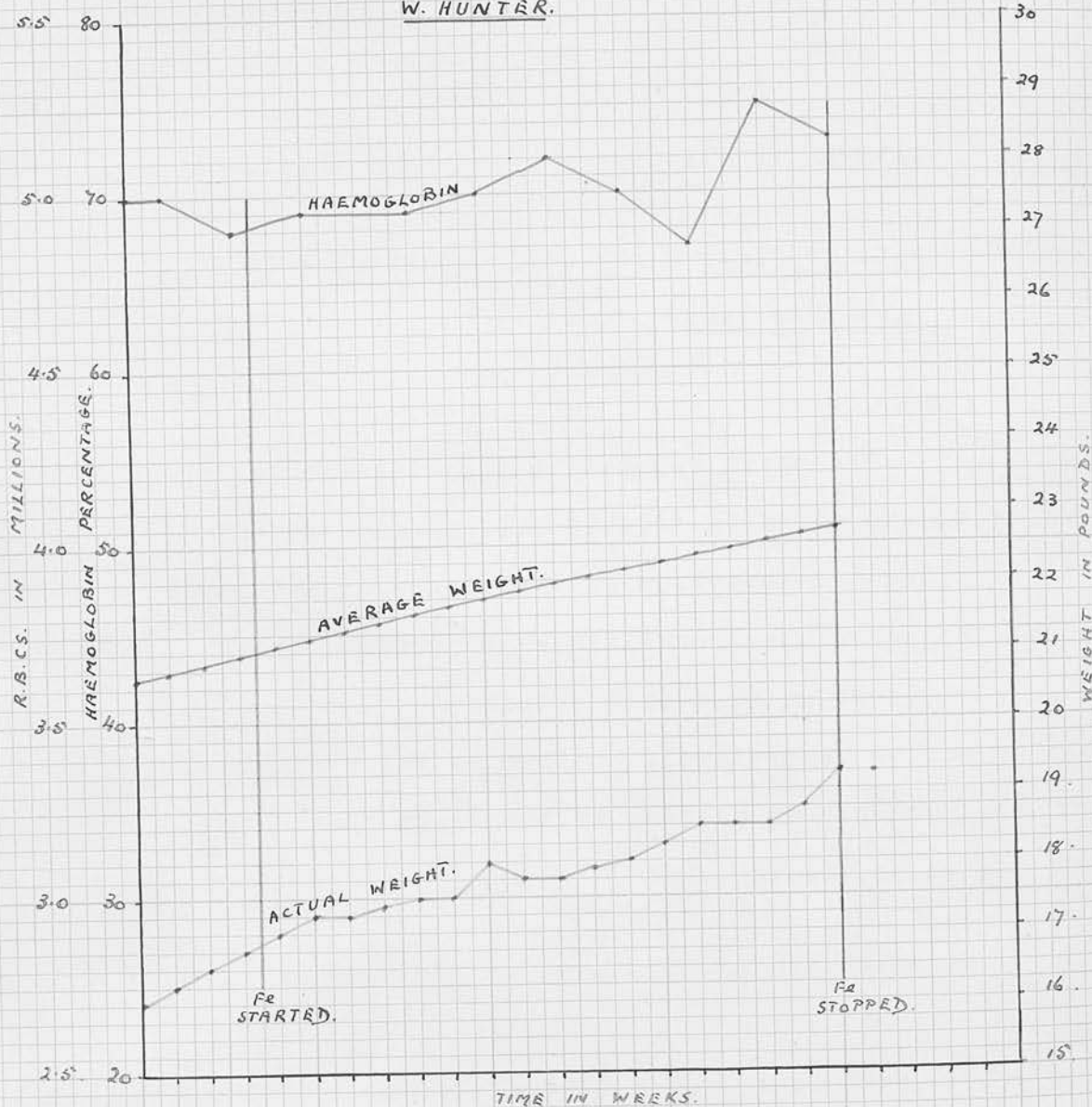
RESULT.

During a period of six weeks treatment with iron, the haemoglobin rose from 47 to 62 per cent. The child was then discharged and further observations could not be made.

WEIGHT.

Weights were not recorded after the child was moved to group A.

W. HUNTER.



CASE IV.

CASE NO. IV.

WESTERN GENERAL HOSPITAL.

WALTER HUNTER.

Aet. $\frac{11}{12}$ Date of Birth - 3.1.32. Admitted - 24.2.32.Full-time baby.

HISTORY.

The child received artificial feeding from birth and at times trouble was experienced with vomiting and looseness of the stools. The child developed acute bronchitis when five months old and had further attacks of bronchitis at 9 months and 10 months respectively. When he was 9 months old, he developed an abscess of the right forearm which had to be opened.

EXAMINATION - 8.12.32.

The child is rather pale and he is $3\frac{1}{2}$ lbs. below the normal weight curve. He is beginning to lift his head. There is no sign of rickets. The spleen is not enlarged. The right elbow and forearm are now normal again.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG.	PROGRESS NOTES.
8.12.32	70					
17.12.32	70					
29.12.32	68		Rather poorly filled R.B.C's			
30.12.32					Fe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	Gaining weight well.
1. 1.33					" " " " $\frac{1}{2}$ " "	
3. 1.33					" " " " $\frac{3}{4}$ " "	
5. 1.33					" " " " 1 ss. "	
11. 1.33	69				Fe.et Am.Cit.gr. $2\frac{1}{2}$ t.i.d.	Weight not so satisfactory
19. 1.33	69					Is bright and active.
31. 1.33	70					No sign of any infection.
14. 2.33	72	4.90		0.73		Doing very well
28. 2.33	70					Looking better.
13. 3.33					CuSo ₄ gr. $\frac{1}{50}$ addul. t.i.d.	To City Hospital with chickenpox.
14. 3.33	67	4.69		0.71		
28. 3.33	75					
11. 4.33	73	5.08		0.72		
1. 5.33						
10. 5.33						

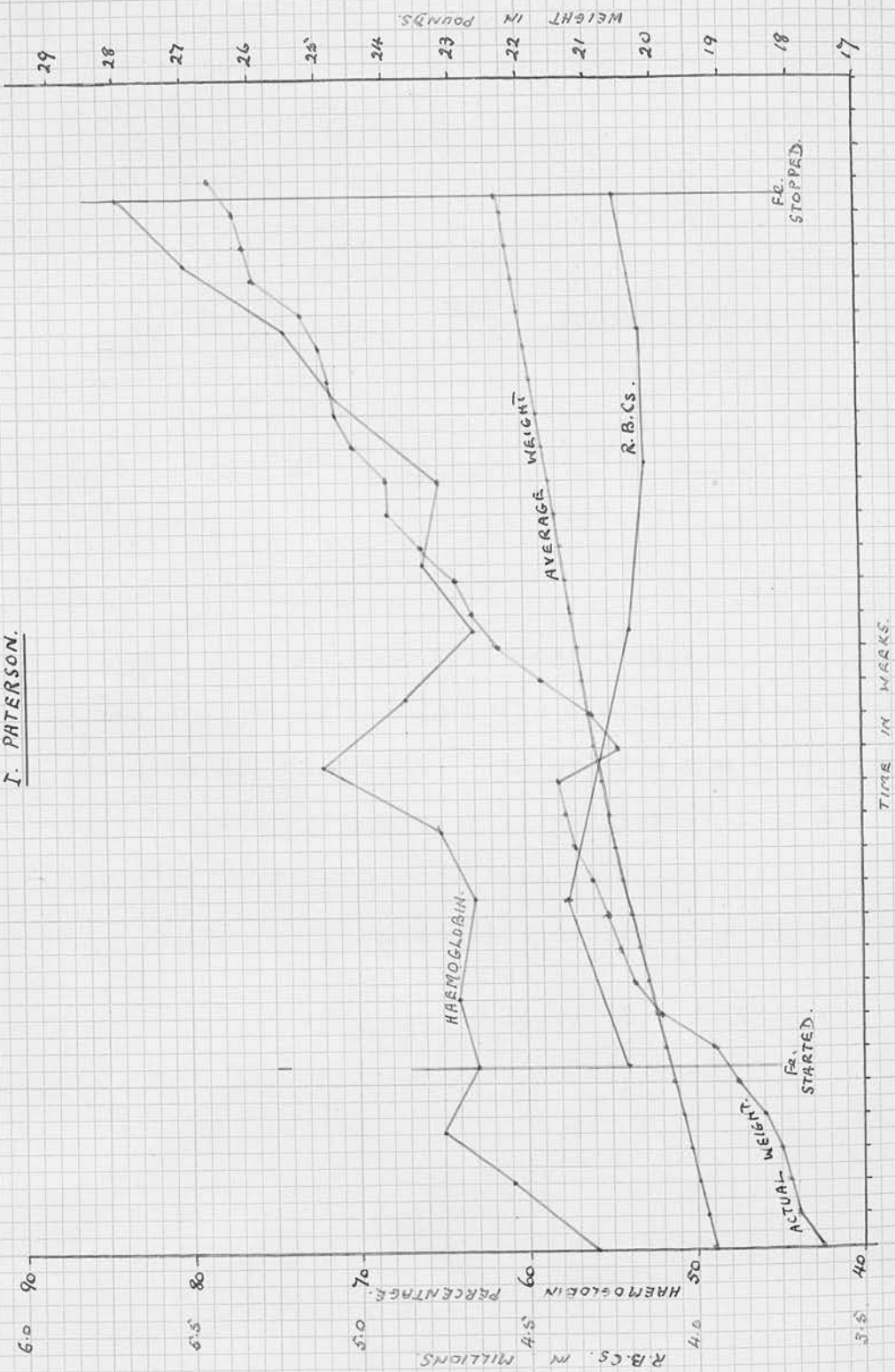
RESULT.

During a period of four months treatment with iron, there was no significant rise in the haemoglobin and although the child had suffered from infections before the treatment began, there was no evidence of any persistent infections which might have prevented the action of the iron.

WEIGHT.

Gain in weight had been taking place in a satisfactory manner before the iron was started and the curve was approaching the average weight curve. After the iron was started the gain in weight continued but was no more rapid than before.

I. PATERSON.



CASE V.

CASE NO. V.

WESTERN GENERAL HOSPITAL.

IAN PATERSON.

Aet. $\frac{10}{12}$ Date of Birth - 20.1.32Admitted - 19.3.32Full-time baby.

HISTORY.

The child was breast-fed for the first two months of life but after admission to hospital, the feeding was artificial. The child did well and had no infection until September 1932 when he developed a small abscess on the scalp. This was incised and it soon cleared up.

EXAMINATION - 22.11.32

The child is well nourished but looks rather pale. He is quite bright and active. The weight is one pound below the normal weight curve. Nothing abnormal can be made out in any of the systems.

DATE	HB.	R.B.C in MILLIONS	FILM	C.I.	DRUGS.	PROGRESS NOTES.
22.11.32	56					
5.12.32	61					
15.12.32	65					
27.12.32	63	4.2	Normal but R.B.C's are not well filled	0.75		Gaining weight well.
30.12.32					Fe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	
1. 1.33					" " " " $\frac{1}{8}$ " "	
3. 1.33					" " " " $\frac{1}{4}$ " "	
5. 1.33					" " " " $\frac{1}{2}$ " "	
11. 1.33	64				" " " " iii "	
19. 1.33						
31. 1.33	63	4.37		0.74		Weight rising rapidly. Has slight cold in head. Cold not yet better. Still some nasal discharge. Has had some gastro-enteritis.
14. 2.33	65					
28. 2.33	72					
14. 3.33	67				Copper sulphate gr. $\frac{1}{50}$ t.i.d.	
27. 3.33	63	4.17		0.76		
10. 4.33	66					
28. 4.33	65					
3. 5.33		4.13				Taking food well
15. 5.33	71					
29. 5.33	74	4.15		0.89		Bright and active.
12. 6.33	80					
26. 6.33	84	4.21		1.0		

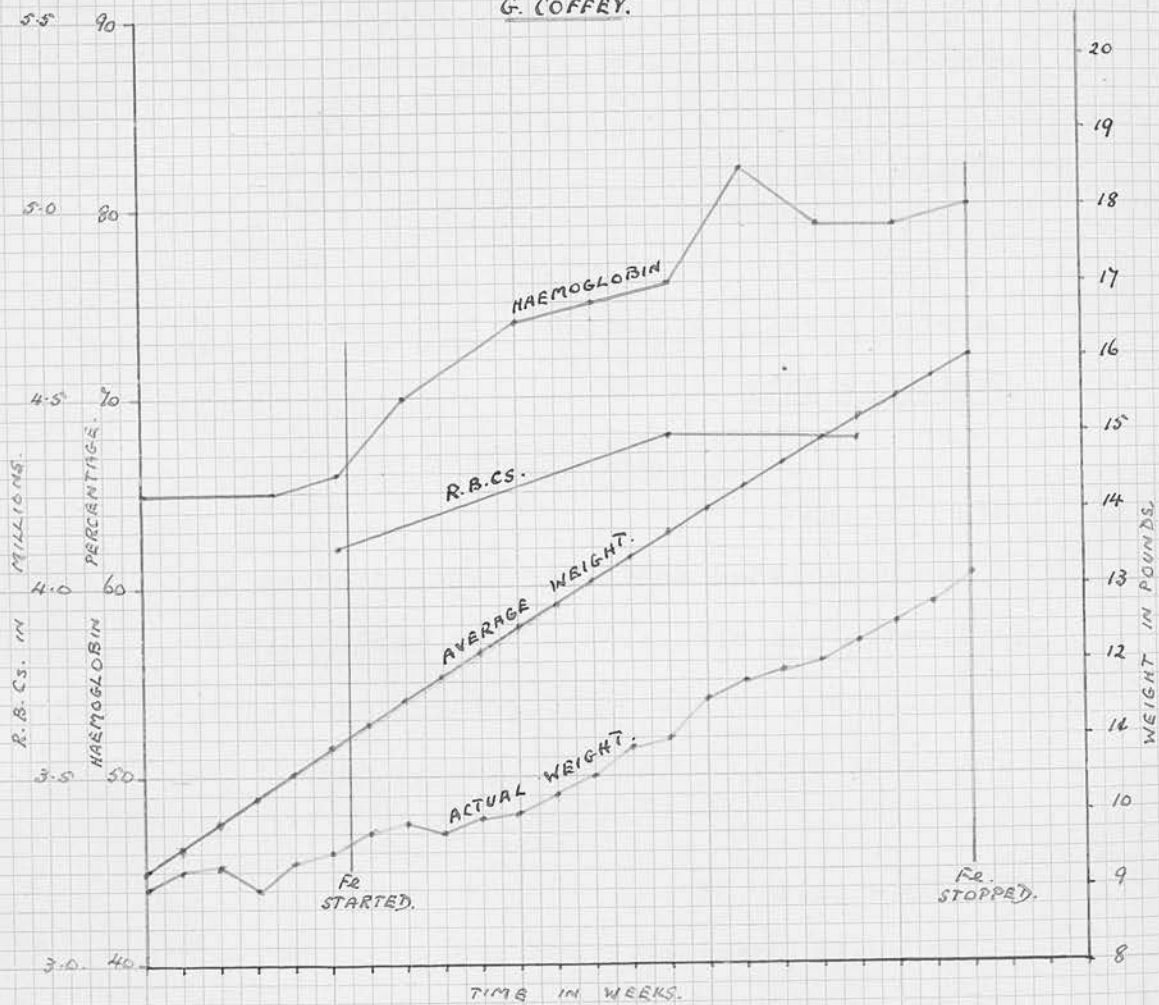
RESULT.

During treatment with iron lasting over a period of six months the haemoglobin rose from 63 to 84 per cent. It is difficult in this case to be certain that iron administration was the cause of this improvement because there was little improvement during the first four months. This may have been due to the fact that the child was troubled with colds and some gastro-enteritis during this period.

WEIGHT.

This was rising satisfactorily and child was one pound below average weight before the commencement of iron administration. After iron was started the weight continued to rise but with a set-back after $2\frac{1}{2}$ months treatment which was accompanied by a set-back in haemoglobin formation also. After that the weight rose rapidly, the child being four pounds over average weight at end of period of treatment. The iron has had a favourable influence on the weight in this case.

G. COFFEY.



CASE VI.

CASE NO. VI.

WESTERN GENERAL HOSPITAL

GERALD COFFEY.Aet. $\frac{1}{12}$ Date of Birth - 15.10.32. Admitted - 8.11.32Full-time baby.

HISTORY.

When admitted the child was suffering from conjunctivitis and blepharitis, but was otherwise healthy. He was breast-fed for the first fourteen days but since then he has been bottle fed.

EXAMINATION - 21.11.32

The child looks well and there is now no discharge from the eyes. There is no abnormality to be noted. No enlargement of the spleen. The weight is satisfactory.

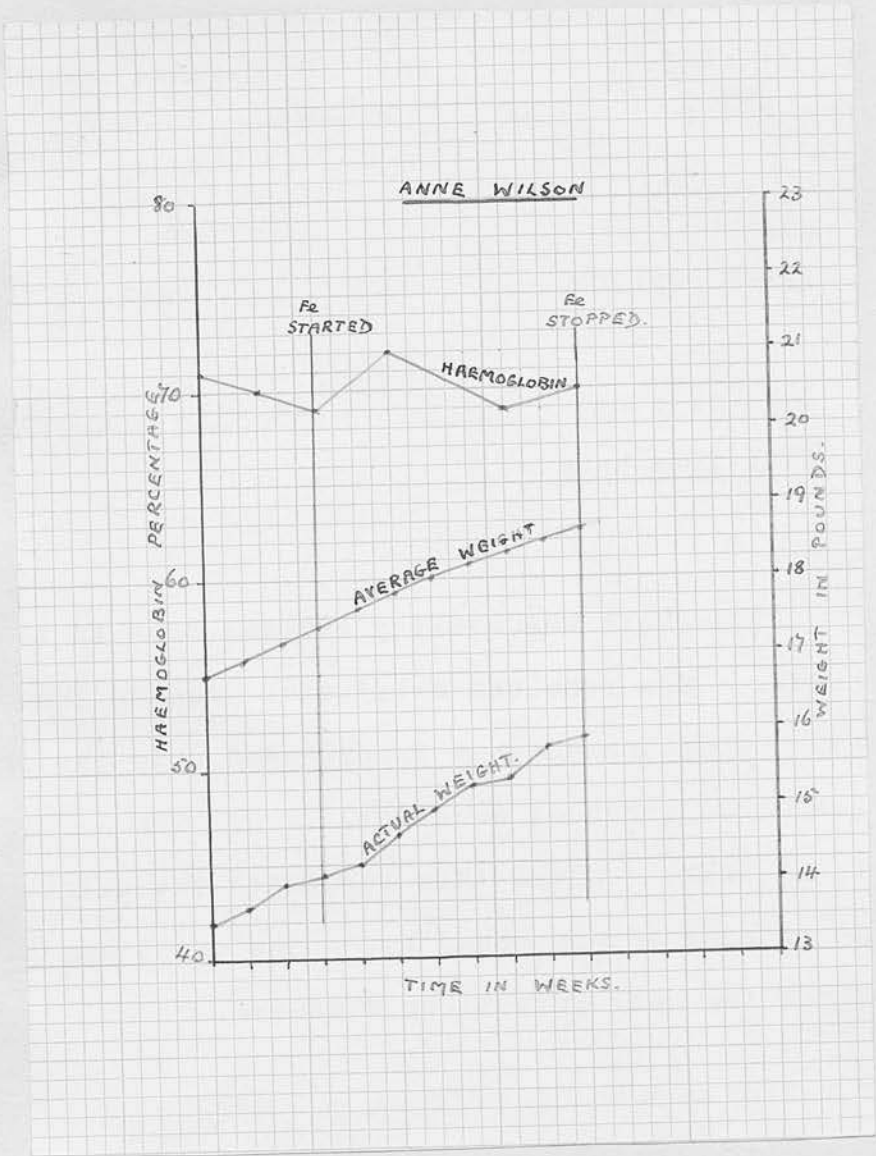
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
21.11.32	65					
16.12.32	65					
28.12.32	66	4.09	Rather poorly filled R.B.C.'s	0.8		Weight going up though not very rapidly. Is lagging being normal curve.
30.12.32					Pe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d	
1. 1.33					" " " " " " "	
4. 1.33					" " " " " " "	
7. 1.33					" " " " " iss "	
9. 1.33	70					
14. 1.33						
24. 1.33						Green stools.
30. 1.33	74					Stools normal.
13. 2.33	75					Doing well
27. 2.33	76					" "
1. 3.33						Looks bright. General con-
13. 3.33	82	4.39		0.8		dition is improving.
14. 3.33					CuSO ₄ gr. $\frac{1}{50}$ added. to iron mixture.	General condition good.
27. 3.33	79	4.38		0.9		
5. 4.33	79					Doing well.
11. 4.33	80					
28. 4.33						

RESULT.

With treatment carried out over a period of four months, the haemoglobin rose from 66 to 80 per cent. The addition of copper did not raise the haemoglobin any higher. The general condition also improved while the child was under treatment.

WEIGHT.

Before treatment was started the child was 24 ozs. below the normal weight curve. At the conclusion of treatment he was 44 ozs. below this curve. There is no marked change in the incline of the graph following the administration of iron.



CASE VII.

CASE NO. VII.

WESTERN GENERAL HOSPITAL.

ANNIE WILSON.

Aet. $\frac{7}{12}$ Date of Birth - 5.5.32 Admitted - 3.6.32Full-time baby

HISTORY.

The child was healthy and was born in the hospital. She received artificial feeding from birth. Some trouble was experienced with the feeding and diarrhoea developed during the second month of life. After this was ended the weight began to rise fairly steadily. The child has not suffered from any infectious diseases.

EXAMINATION - 6.12.32.

The child looks rather pale but the nutrition is good. There is some nasal discharge but no atorrhoea. There is no other abnormality to be made out on examination.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
6.12.32	71					
17.12.32	70					
29.12.32	69					
30.12.32					Ferr.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	Steady gain in weight.
1. 1.33					" " " " $\frac{1}{2}$ "	Lagging behind theoretic
3. 1.33					" " " " $\frac{3}{4}$ "	weight curve.
5. 1.33					" " " " iss. "	Good progress.
9. 1.33	72					
19. 1.33	69				Ferr.et Am.Cit.gr. $2\frac{1}{4}$ t.i.d.	No ill effects of iron.
30. 1.33	70	4.54		0.77		Bright and healthy.
13. 2.33						
20. 2.33						Developed mastoid abscess.

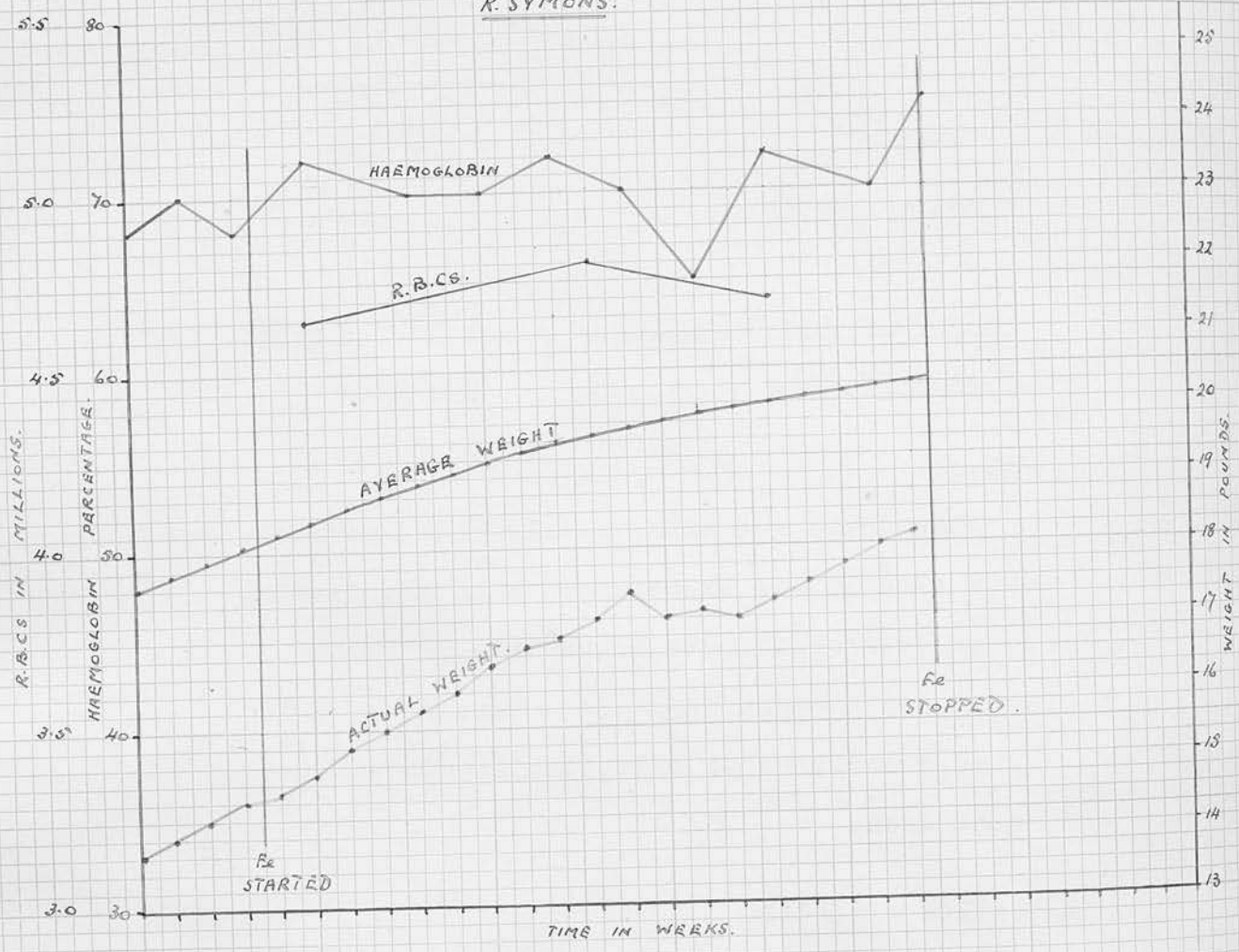
RESULT.

After a period of six weeks treatment with iron, the haemoglobin had not risen. This may be explained by the fact that the treatment was not continued for a sufficient length of time.

WEIGHT.

Before iron was started the child was 48 ozs. below the average weight curve, and the gain in weight for the previous six weeks was at the rate of $3\frac{2}{3}$ ozs. weekly. The rate of gain in weight during the six weeks of iron therapy was 4 ozs. weekly and at the end of that period, the child was 40 ozs. below the average weight curve. The iron has had a slight beneficial effect on the weight in this case.

R. SYMONS.



CASE VIII.

CASE NO. VIII.

WESTERN GENERAL HOSPITAL

ROBERT SYMONS.

Aet. $\frac{8}{12}$ Date of Birth. - 5.4.32 Admitted - 5.4.32Full-time baby

HISTORY.

The child was artificially fed from birth and some trouble was experienced with the feeding. The child developed acute bronchitis on 22.6.32, but this soon cleared up. In November the child developed a swelling of occipital glands but these soon went down.

EXAMINATION - 6.12.32

The child is pale and is somewhat below weight. He is having pure milk feeds. There is some swelling of the occipital glands but no other abnormality can be made out. The spleen is not enlarged. There is no sign of rickets.

DATE	HB.	R.B.G. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
6.12.32	68					
16.12.32	70					
28.12.32	68					
30.12.32						
1. 1.33					Fe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	
3. 1.33					Fe.et Am.Cit.gr. $\frac{3}{4}$ "	
5. 1.33					Fe.et Am.Cit.gr. $\frac{3}{4}$ "	
10. 1.33	72	4.65		0.77	Fe.et Am.Cit.gr. $1\frac{1}{2}$	Improving very much.
19. 1.33	70				Fe.et Am.Cit.gr. $2\frac{1}{4}$ t.i.d.	Has had a bad cold but is now better. Doing fairly well.
31. 1.33	70					
13. 2.33	70					
28. 2.33	72					
6. 3.33		4.79		0.75	Copper Sulphate added.	
14. 3.33	70					
28. 3.33	65					
10. 4.33	72	4.69		0.76		Has cold in head. Still has cold. Nose is dis- charging and he is losing weight.
1. 5.33	70					
10. 5.33	75					Still looks pale Removed to City Hospital with chickenpox.

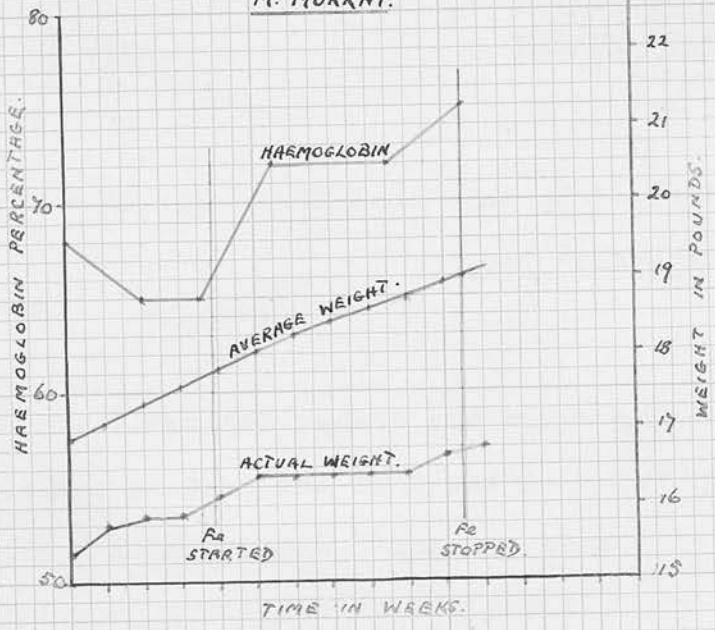
RESULT.

During treatment with iron which extended over a period of $4\frac{1}{2}$ months the haemoglobin fluctuated between 68 and 75 per cent. The rise was not steady so that some of the variations in readings of haemoglobin are probably due to experimental errors. It should be noted, however, that the fall to 65 per cent which occurred on 28.3.33 was accompanied by infection of upper respiratory tract and some loss of weight.

WEIGHT.

When treatment was started the child was about $3\frac{1}{2}$ pounds below average weight. During nine weeks previous to starting iron the gain in weight averages 3 ozs. weekly. From start of iron treatment to 14.3.33 a period of ten weeks, the gain in weight is $4\frac{1}{2}$ ozs. weekly and the weight curve is steeper and begins to approach the average weight curve, the child being two pounds below this curve at the conclusion of treatment. The iron has influenced the weight favourably in this case.

M. MURRAY.



CASE IX.

CASE NO. IX.

WESTERN GENERAL HOSPITAL

MAE MURRAY.

Aet. $\frac{8}{12}$ Date of Birth - 12.4.32Admitted - 30.6.32Full-time baby

HISTORY.

The child was breast-fed until admission to hospital. After that the feeding was artificial. Except for some bronchial catarrh when four months old, the child has not suffered from any infections. Some trouble has been experienced with the feeding from time to time and there was some vomiting in October 1932.

EXAMINATION - 5.12.32.

The child looks pale and is below the average weight. She has no cough, no otorrhoea and there is no sign of rickets.

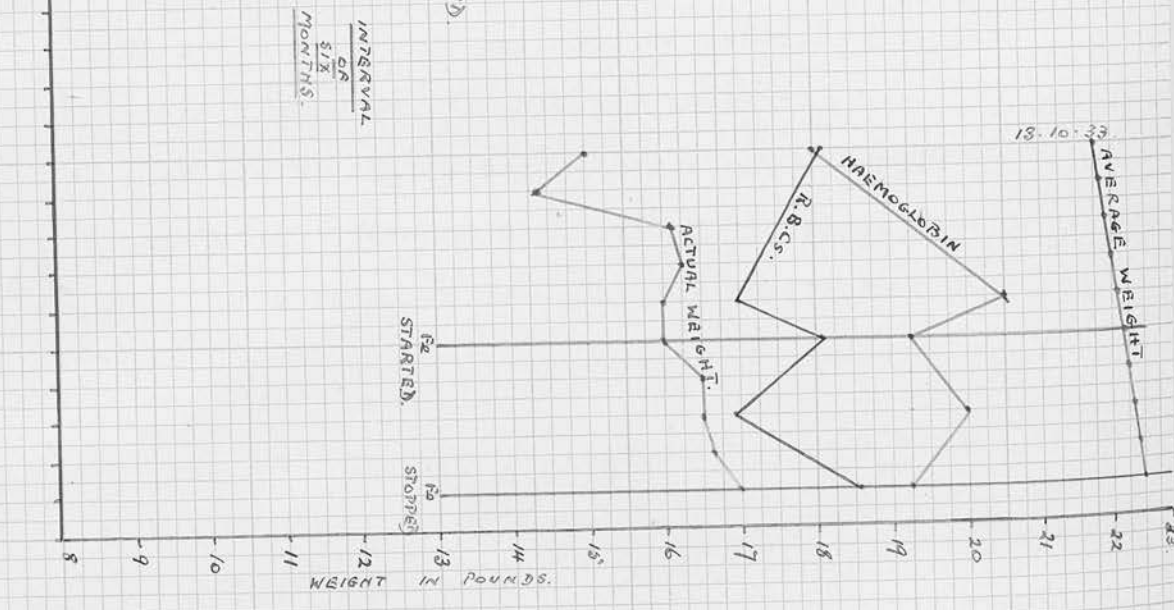
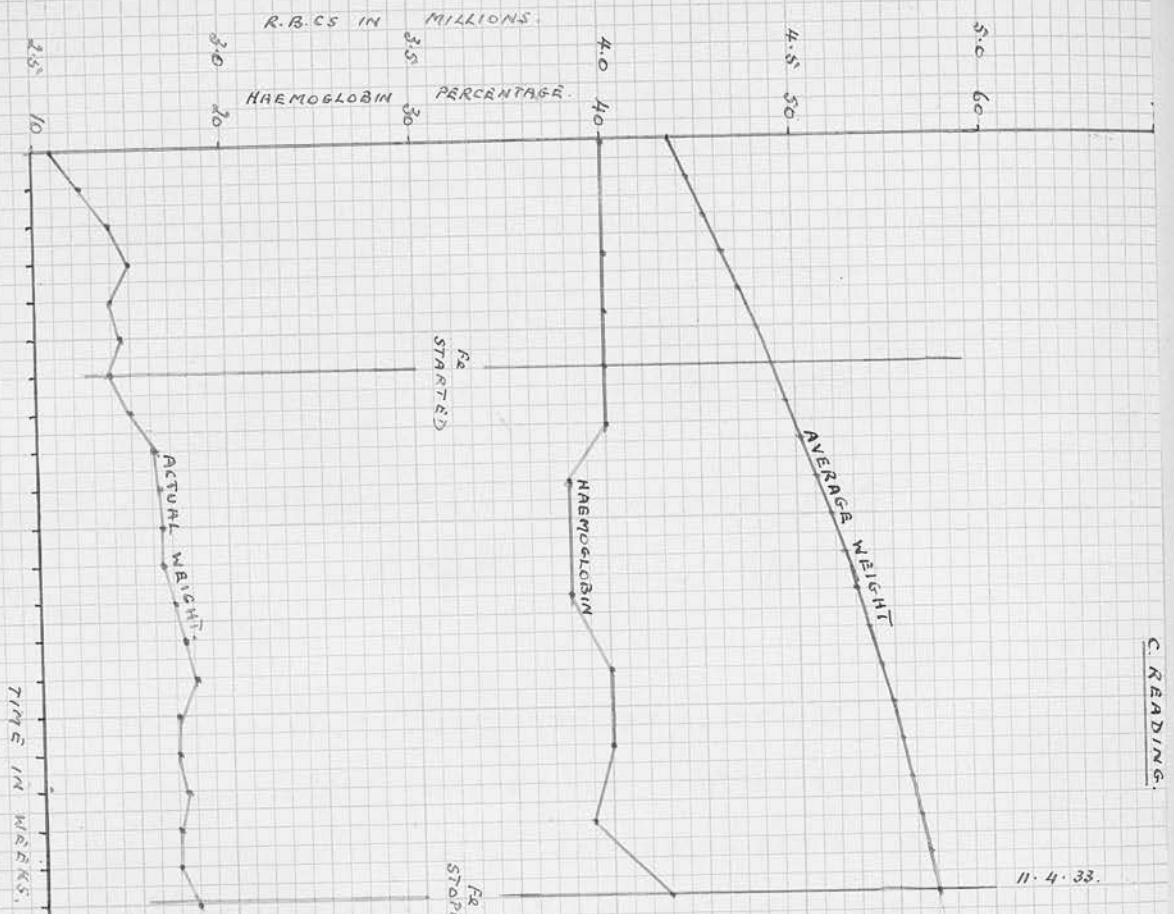
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.	
5.12.32	68						
19.12.32	65						
28.12.32	65						
30.12.32					Fe.et Am.Cit.gr. $\frac{1}{4}$ t.i.d. "		
10. 1.33.	72				Fe.et Am.Cit.gr. $2\frac{1}{4}$ t.i.d.	Has cold in head.	
19. 1.33	72					Looking better.	
30. 1.33	75					To City Hospital with whooping cough.	
13. 2.33							
20. 2.33							

RESULT.

During a period of treatment with iron lasting six weeks, the haemoglobin rose from 65 to 75 per cent.

WEIGHT.

During the six weeks prior to iron therapy the gain in weight was at the rate of 2 ozs. weekly. After the iron therapy was started, the gain was at the rate of 4 ozs. in six weeks, or $\frac{2}{3}$ ozs. weekly. In this case if the iron affected the weight at all, it did so adversely.



CASE X.

CASE NO. X.

WESTERN GENERAL HOSPITAL.

CAROLINE READING.

Aet. $\frac{7}{12}$ Date of Birth - 22.4.33 Admitted - 12.5.32Premature (2 weeks) baby, twin.

HISTORY.

The child weighed three pounds at birth. The mother suffers from pulmonary tuberculosis. The child was breast-fed for the first two weeks of life but since then the feeding has been artificial. She was admitted to hospital two weeks after she was born and marked pallor was noticed within two months of birth. The child gained weight fairly well, but the anaemia did not respond to Ferri Carb. Sacc. which was tried when she was two months old. She has not had any infections.

EXAMINATION - 16.11.32.

The child is poorly nourished and very pale indeed. There is no abnormality to be made out on examination. The fontanelle admits two fingers. Teeth $\frac{0}{1} / \frac{0}{1}$, no thickening of epiphyses. There is no enlargement of either liver or spleen. No otorrhoea. Motions normal.

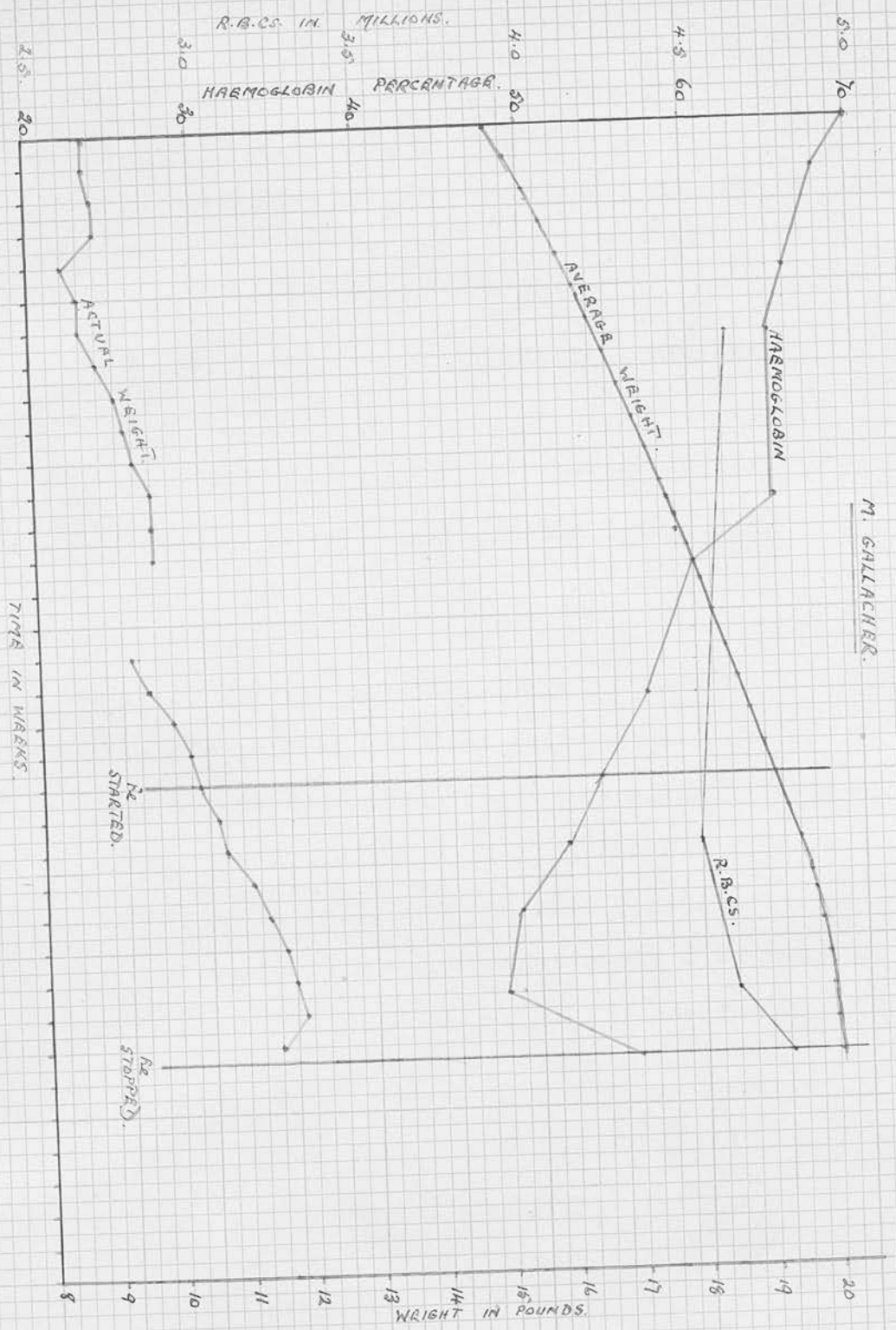
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
16.11.32	40					
5.12.32	40					
16.12.32	40					
27.12.32	40	3.93	Some anisocytosis. Some Poikilocytes & poorly filled R.B.C.'s. Reti- culocytes 0.8%	0.51		Weight increasing. Fairly good progress. Has been sick to-day. Has been vomiting re- cently. Better to-day Weight is stationary.
29.12.32						
30.12.32						
1. 1.33					Ferr.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	
3. 1.33					Ferr,et Am.Cit.gr. $\frac{1}{2}$ t.i.d.	
5. 1.33					Ferr.et Am.Cit.gr. $\frac{1}{4}$ t.i.d.	
9. 1.33	40				Ferr.et Am.Cit.gr.iss t.i.d.	Right ear is discharging profusely.
19. 1.33						
20. 1.33	38					
13. 2.33	38					
27. 2.33	40					
13. 3.33	40					
14. 3.33			W.B.C. 9,500		Copper Sulphate gr. $\frac{1}{50}$ added t.i.d.	

RESULT.

This case may be classed as an example of constitutional anaemia. There was no obvious cause for the anaemia. Although there was a family history of tuberculosis, the Von Pirquet reaction was persistently negative. $3\frac{1}{2}$ months treatment with Ferr. et Ammon. Citrate had no influence on the blood picture. Ferrous Ammonium Sulphate was tried for one month but was no more successful.

WEIGHT.

At the commencement of treatment with Ferr. et Ammon. Cit., the child was $8\frac{3}{4}$ pounds below average weight. There was only a slight gain in weight during the period of treatment with iron, the child being $9\frac{3}{4}$ pounds below the average at the conclusion of treatment. Iron did not have any beneficial effect on the weight in this case.



CASE XI.

CASE NO. XI.

WESTERN GENERAL HOSPITAL

MARGARET GALLACHER

Aet. $\frac{5}{12}$ Date of Birth - 1.7.32 Admitted - 29.7.32.Full-time - one of twins

HISTORY.

The child was breast-fed for the first three weeks of life. After that the feeding was artificial. Trouble was experienced with the feeding and the child did not gain in weight in a very satisfactory manner. She had an attack of coryza in October 1932 but otherwise she did not suffer from any infections.

EXAMINATION - 7.12.32.

The child is considerably below weight and is very small. She looks pale. There is no abnormality to be made out on examination. The spleen is not enlarged.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
7. 12. 32	70					Taking feeds well
17. 12. 32	68					
9. 1. 33	66					
24. 1. 33	65	4.62	Poorly filled red cells.			
27. 2. 33	65					Some cough to-day
13. 3. 33	60					Coughing severely - whooping cough.
14. 3. 33						Sent to City Hospital
10. 4. 33	57					
28. 4. 33	54				Fe.et Am.Cit.gr. $1\frac{1}{2}$ t.i.d.	
12. 5. 33	52	4.50		0.57		Weight going up.
25. 5. 33	49	4.6		0.52		
12. 6. 33	48	4.81		0.58		No infection to be found
26. 6. 33	56					

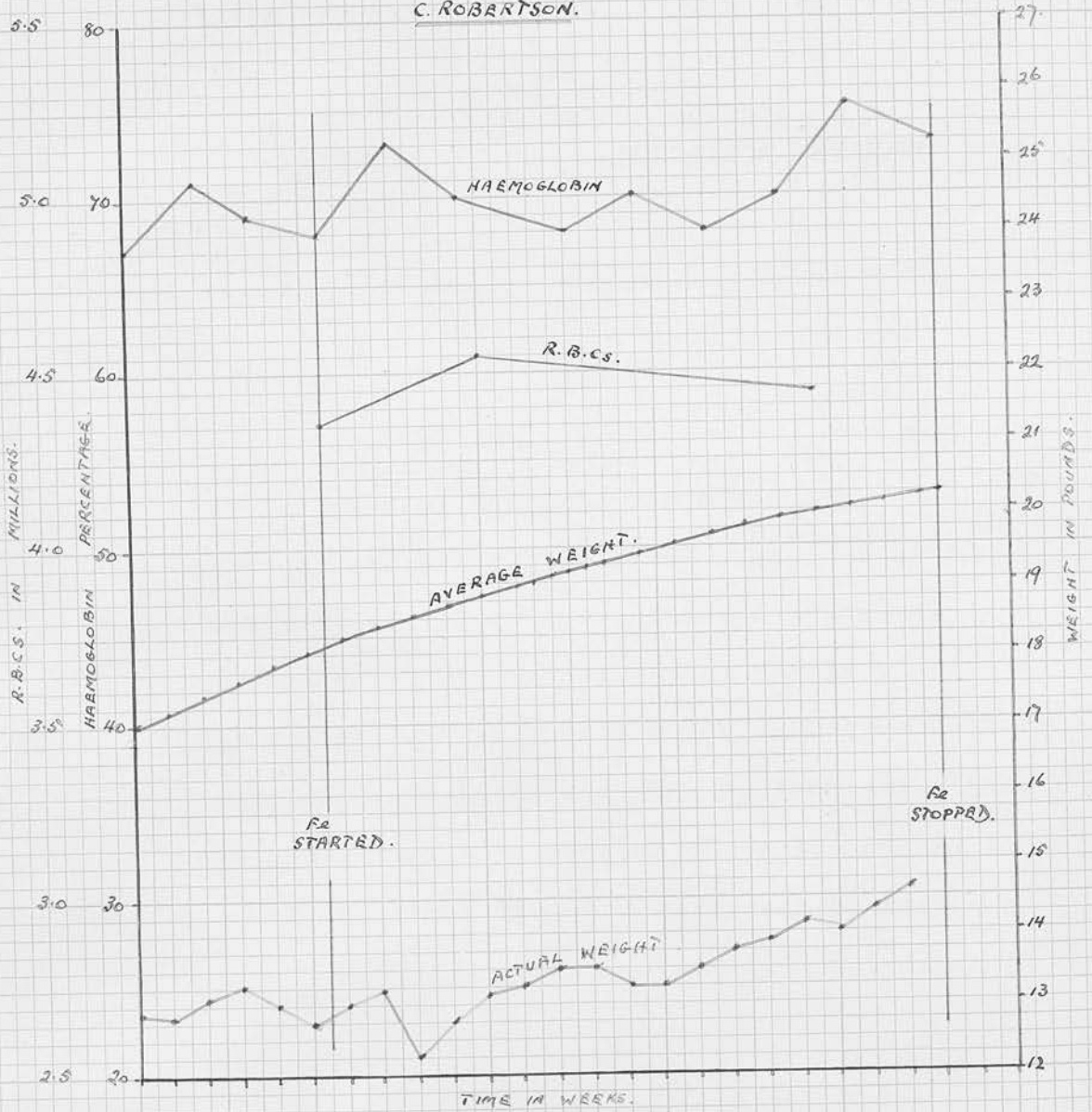
RESULT.

From 17.12.32 to 28.4.33, the child was used as a control. During this period of four months the haemoglobin fell 14 per cent. The child then received iron for two months but did not respond to the treatment, the haemoglobin continuing to fall but rising at the end of the two months to a similar level to that at which treatment was commenced.

WEIGHT.

The weight is rising steadily both before and during treatment with iron. There is no evidence that iron influenced the weight in any manner.

C. ROBERTSON.



CASE XII.

CASE NO. XII

WESTERN GENERAL HOSPITAL.

CHARLES ROBERTSON

Aet. $\frac{7}{12}$ Date of Birth - 3.4.32 Admitted - 21.5.32.Full-time baby.

HISTORY.

The child was admitted to hospital for domestic reasons. Some difficulty was experienced with feeding but weight went up fairly satisfactorily after the eighth week although remaining between two and three pounds below the normal weight curve. Pallor was noticed when the child was $2\frac{1}{2}$ months old. Had abscess of scalp incised at 4 months and had an attack of diarrhoea at seven months. No other illnesses.

EXAMINATION - 21.11.32.

The child is rather small for his age and is under weight. Some pallor. No enlargement of spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS.	PROGRESS NOTES.
21.11.32	67					
5.12.32	71					
15.12.32	69					
20.12.32						
23.12.32						Stools green & some vomiting Has slight cough but nothing in chest. Apparently well again; stools improved.
27.12.32	68	4.35	Small & poorly filled red cells	0.78		Stools normal; feeds better tolerated.
30.12.32						
3. 1.33					Fe. et Am. Cit. gr. $\frac{2}{4}$ t.i.d. " " " " $\frac{1}{12}$ "	
10. 1.33	73					
17. 1.33						
20. 1.33	70					Having green stools. Losing weight. Stools normal again.
24. 1.33	68					Very irritable. Temp. 103°. No abnormal physical signs anywhere.
13. 2.33						Looking bright and active again.
15. 2.33						
27. 2.33	70					Doing quite well but weight not rising rapidly.
2. 3.33		4.55	Some anisocytosis & poorly filled red cells.	0.78		

7. 3.33
13. 3.33
14. 3.33
28. 3.33
3. 4.33
10. 4.33
28. 4.33
28. 4.33

68

70

75

73

4.43

0.8

Copper sulphate gr. $\frac{1}{50}$
added to iron.

Vaccinated.

Arm sore from vaccination.
child out of sorts.
Some nasal discharge.

Looking well, attempting
to stand.

Removed to City Hospital
with chickenpox.

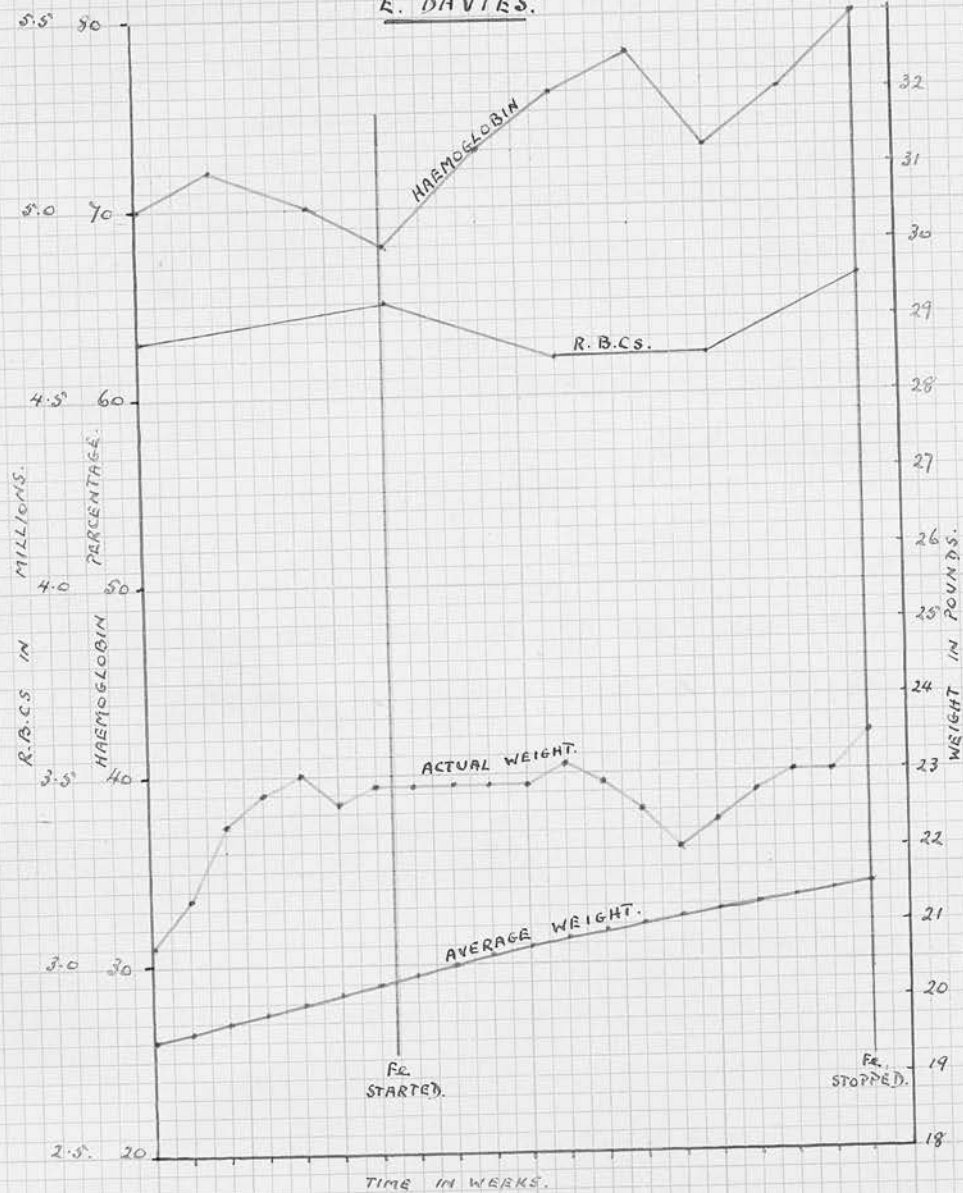
RESULT.

The haemoglobin rose from 68 to 73% during treatment. This result is really negligible. The enteritis and the vaccination may have prevented the rise in haemoglobin.

WEIGHT.

The weight curve had been running parallel to normal weight curve but about 5 pounds below it. After 20.12.32 when diarrhoea developed, weight became stationary and remained so until 7.3.33. The weight then began to rise again but after four months iron treatment the weight was 5 pounds below normal weight curve. Iron did not cause any improvement in weight.

E. DAVIES.



CASE XIII.

CASE NO. XIII.

WESTERN GENERAL HOSPITAL

ELIZABETH DAVIES

Aet. $\frac{11}{12}$.Date of Birth - 2.4.32Admitted - 22.2.33Full-time baby

HISTORY.

The child was healthy when born and has been bottle-fed since birth. There was no history of any infections. On admission, there was a seborrhoeic condition of the forehead and scalp.

EXAMINATION - 16.3.33

The child was pale but well-nourished, the weight being 20 ozs. above the normal curve. There was no blepharitis and no otorrhoea. No evidence of infections, T.B., or rickets. No enlargement of spleen.

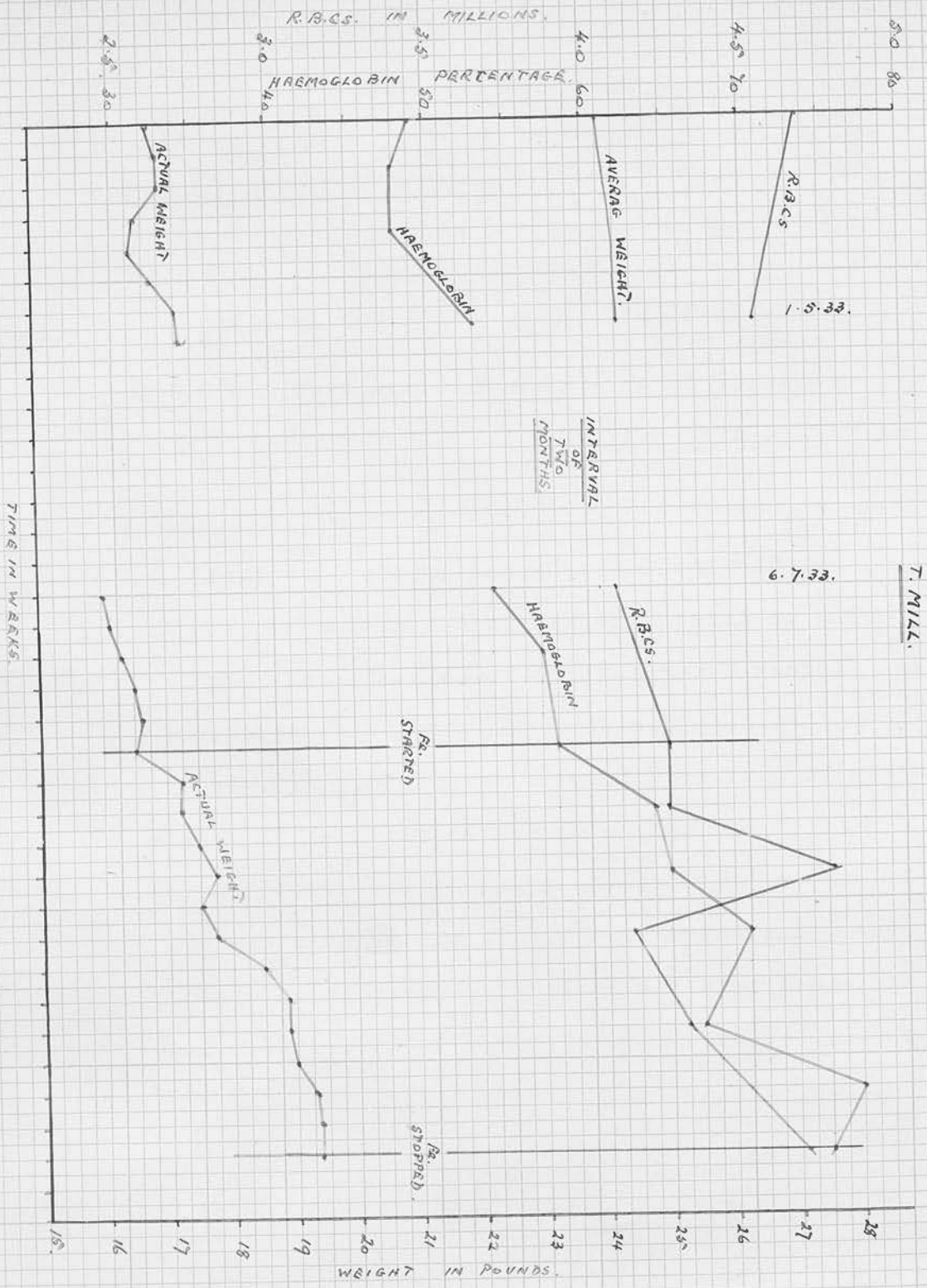
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG.	PROGRESS NOTES.
16. 3.33	70	4.65	Some anisocytosis & poorly filled red cells.	0.76		
27. 3.33	72					Doing quite well.
14. 4.33	70	4.75		0.76	Ferr.et Am.Cit.gr. $1\frac{1}{2}$ t.i.d.	Weight not increasing.
28. 4.33	68					Weight going up again.
15. 5.33	73	4.60		0.82		Not gaining weight, 'teeth
29. 5.33	76					ing'.
12. 6.33	78					
26. 6.33	73	4.61		0.8		
10. 7.33	76					Has not been gaining in
24. 7.33	80	4.81		0.83		weight, but general condition is good.

RESULT.

During a period of treatment lasting three months, the haemoglobin has risen from 68 to 80 per cent. The general condition of the child was good all the time.

WEIGHT.

When treatment was started, the child was 44 ozs. above the normal weight curve and until a month previously the weight had risen rapidly. During treatment with iron the weight failed to rise but at the conclusion of iron treatment the weight was still 24 ozs. above the normal weight curve. Iron did not have any influence on the weight in this case.



CASE XIV.

CASE NO. XIV.

WESTERN GENERAL HOSPITAL

THOMAS MILL.

Aet. $\frac{11}{12}$.Date of Birth - 19.4.31 Admitted - 3.8.31.Full-time baby

HISTORY.

The child was breast-fed for the first two months of life. He was then admitted to hospital, his mother being sent to an ^{Home} ~~asylum~~. Although he looked rather pale when admitted, his haemoglobin is said to have been 70 per cent. When admitted, the nutrition was very poor and he was much below the average weight for his age. After admission, the weight increased irregularly and trouble was experienced with the feeding. There is no history of any infections. On 12.3.33, he developed a discharging ear.

EXAMINATION - 16.3.33

The child is small and is very much under weight. He looks pale. He is active and has developed a habit of bumping head on the side of the cot and a median ridge has developed on the cranium. He screams frequently. He has got otorrhoea in right ear. Examination does not reveal any other abnormality. There is no enlargement of spleen. Both Wassermann and Von Pirquet reactions are negative.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16. 3.33	49	4.68	Anisocytosis is well marked. R.B.C's poorly filled.	0.55		Has discharging ear.
28. 3.33	47					Doing fairly well.
10. 4.33	47					Bright and active.
1. 5.33	53	4.54				To City Hospital with Chickenpox.
5. 6.33	54	4.09		0.66		Returned from City Hospital. Still very pale.
6. 7.33	57					
20. 7.33	58	4.25		0.68	Ferr.et Am. Cit.gr.ii t.i.d.	Child stands with help. He is beginning to talk.
9. 8.33				0.75		Weight going up.
24. 8.33	64	4.24		0.68		Weight satisfactory.
7. 9.33	65	4.77		0.85		
21. 9.33	70	4.13		0.77		Doing well
13.10.33	67	4.30				Mentality improving.
26.10.33	77		Less anisocytosis. Better filling of red cells.	0.8		
9.11.33	75	4.67				

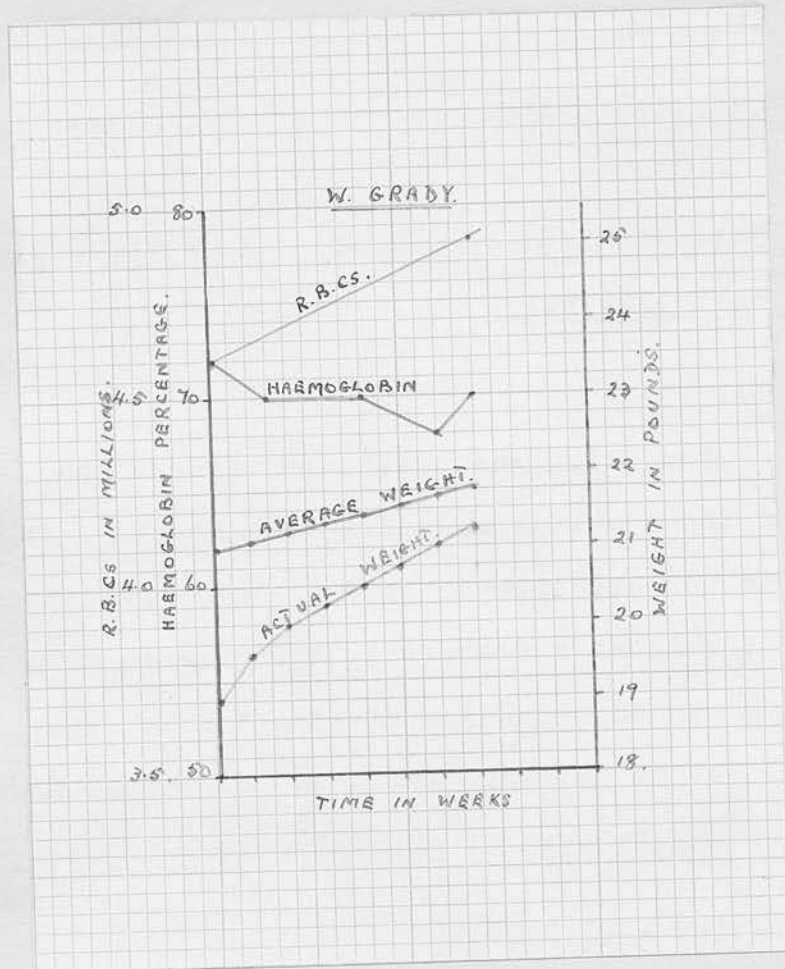
RESULT.

During the period of six weeks from 16.3.33 until 1.5.33, the child was used as a control and the haemoglobin rose from 49 to 53. Two months after the chickenpox developed the child was still anaemic, the haemoglobin level being the same as before the child was sent to the City Hospital. It is unlikely therefore, that the infection had any influence on the production of the anaemia present in July. For one month from 6.7.33 until 9.8.33, the child was used as a control, there being an increase of 4 percent in the haemoglobin level during this period. Three months treatment with iron was then started and the haemoglobin rose to 75 per cent in this period. This improvement was accompanied by an improvement in the general condition.

WEIGHT.

During the nine weeks prior to iron therapy the child gained 2 pounds in weight = $3\frac{1}{2}$ ozs. weekly average. During period of iron treatment lasting 13 weeks, the child gained three pounds in weight = $3\frac{3}{4}$ ozs. weekly average.

There is no evidence that the iron had any marked influence on the weight.



CASE XV.

CASE NO. XV.

WESTERN GENERAL HOSPITAL

WILLIAM GRADY.

Aet. $\frac{12}{12}$ Date of Birth - 14.1.32Admitted - 2.3.33Full-time baby.

HISTORY.

The child was bottle-fed from birth. He was in the hospital when six months old. At that time he had ampetigo of face. This cleared up under treatment and the wieght increased in a satisfactory manner. He was re-admitted in March 1933 as his mother had been admitted to another hospital. There is no history of any infections.

EXAMINATION - 16.3.33

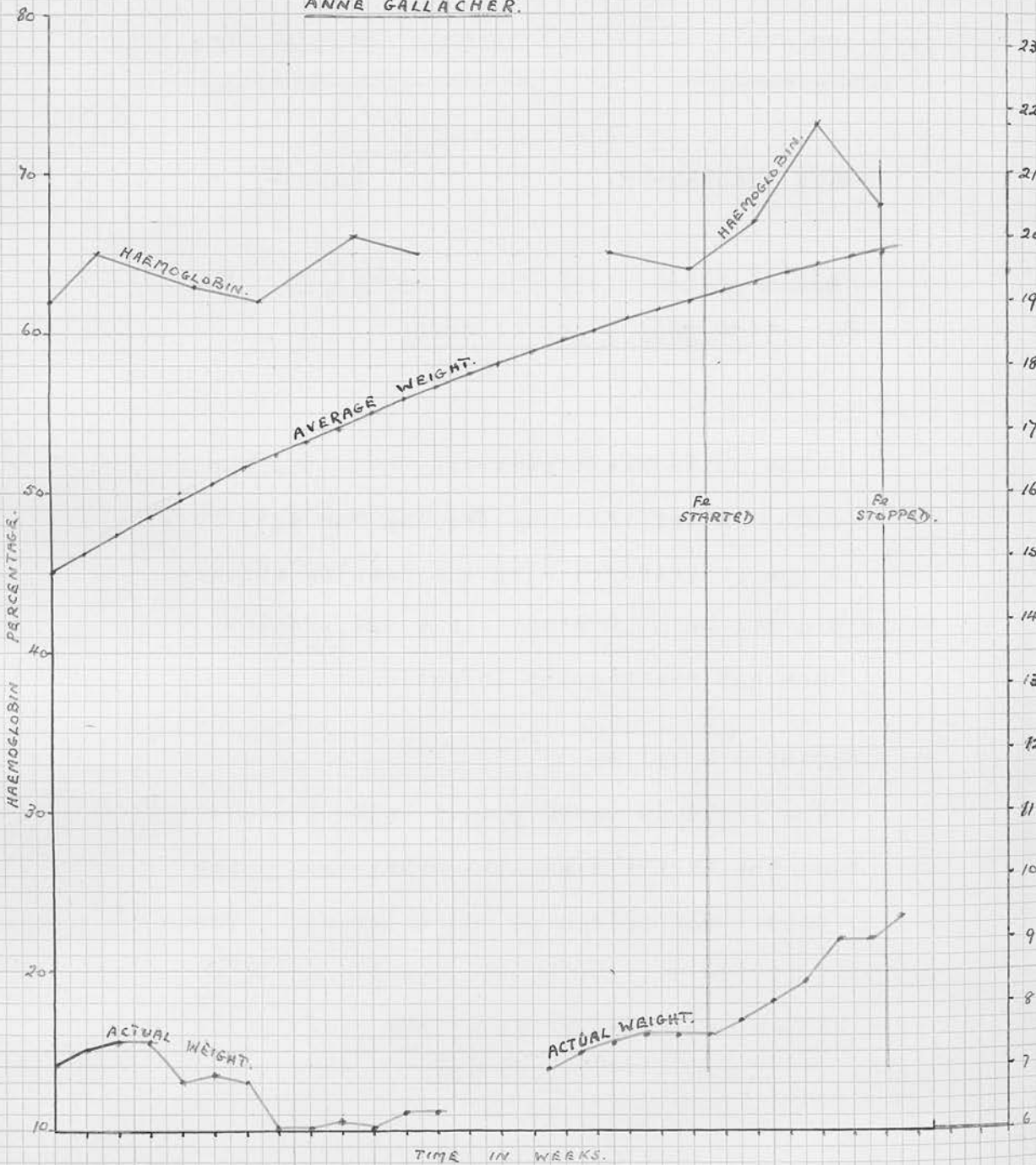
The child is fairly well nourished. He does not look pale. There is no evidence of otorrhea or blepharitis. There is no enlargement of either liver or spleen. Nothing abnormal to be made out on examination. No sign of rickets.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16. 3.33	72	4.59	Rather poorly filled R.B.C.'s.	0.79		Has slight cold. Has had some blepharitis. Doing well; weight increasing.
27. 3.33	70					
14. 4.33	70					
28. 4.33	68					
3. 5.33	70	4.93			0.75	

RESULT.

This child was used as a control. During the seven weeks observation of haemoglobin there was no significant change.

ANNE GALLACHER.



CASE XVI.

CASE NO. XVI.

WESTERN GENERAL HOSPITAL

ANNE GALLACHER.

Aet. $\frac{5}{12}$ Date of Birth - 1.7.32 Admitted - 29.7.32Full-time baby - one of twins.

HISTORY.

The child was breast-fed until she was three weeks old. After that the feeding was artificial. Trouble was experienced with the feeding and the child did not gain in weight in a satisfactory manner. She has not had any infections.

EXAMINATION - 16.11.32

The child is seven pounds below the average weight. She is small and ill-nourished. She is rather pale. The spleen is not enlarged. There is no abnormality to be made out on examination except for a congenital dislocation of the right hip.

31a.

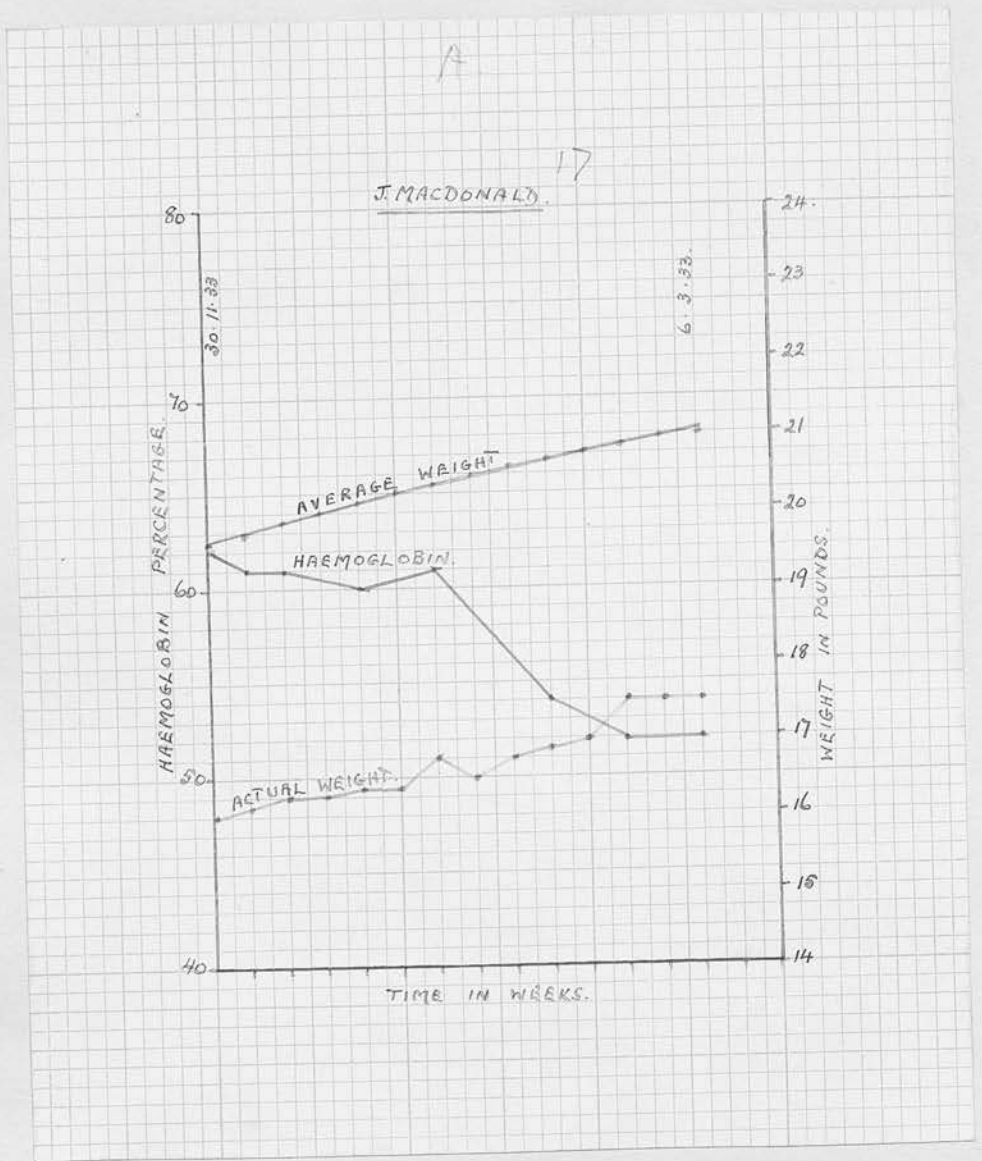
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16.11.32	58					Putting on weight slowly.
7.12.32	62					Gaining weight; some vomiting.
16.12.32	65					Still gaining weight.
9. 1.33	63					Taking feeds better.
24. 1.33	62					Nasal discharge.
13. 2.33	66					Discharging right ear.
28. 2.33	65					Still nasal discharge
3. 3.33						To City Hospital with Nasal Diphtheria. This was found to be avirulent. Re-admitted.
10. 4.33	65					
28. 4.33	64					
2. 5.33						
12. 5.33	67	4.92		0.68	Ferrous Chloride gr. $\frac{1}{2}$ t.i.d.	Taking feeds well
25. 5.33	73					
12. 6.33	68	4.26		0.8		Operation for dislocation of right hip.
14. 6.33						

RESULT.

From 16.12.32 until 3.3.33 the child was used as a control. The haemoglobin did not go up or down. On re-admission from City Hospital, the haemoglobin level was observed for three weeks and then the child was given ferrous chloride. After six weeks iron treatment the haemoglobin had only risen 4 per cent.

WEIGHT.

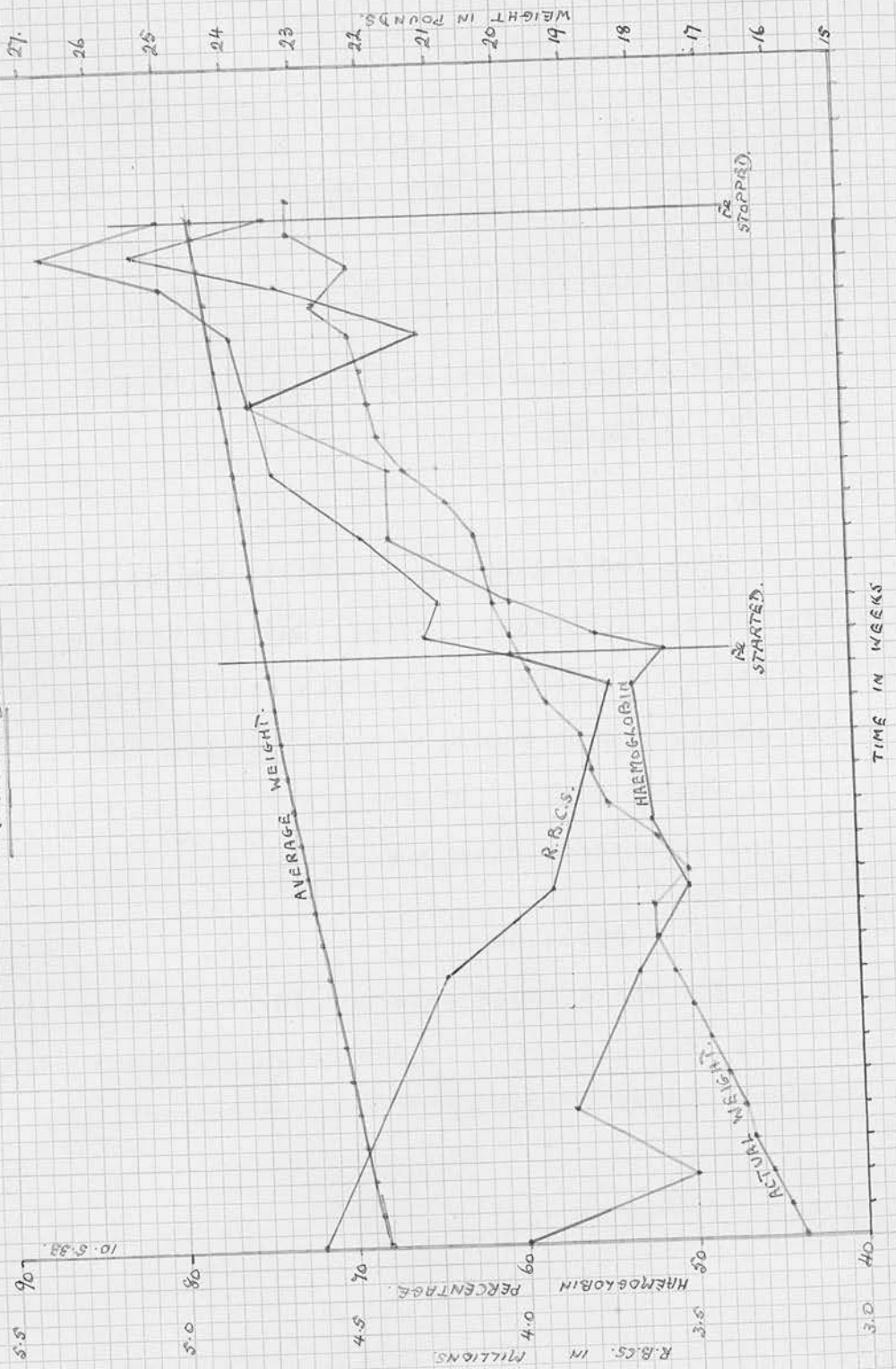
The child was much below weight when iron was started. During the five weeks prior to iron therapy the child gained 12 ozs., i.e. an average of $2\frac{1}{2}$ ozs. weekly. After iron was started the weight curve rose steeply and the child put on 28 ozs. in the six weeks of iron treatment, an average of $4\frac{2}{3}$ ozs. weekly. The iron appears to have had a beneficial effect on weight here.



CASE XVII.

17

J. MACDONALD.



CASE XVII.

CASE NO. XVII

WESTERN GENERAL HOSPITAL

JAMES MACDONALD.

Aet. 1

Date of Birth - 24.12.31. Admitted - 8.1.32Full-time baby

HISTORY.

The feeding during the first two weeks of life was by the breast. After that the feeding was artificial. Some difficulty was experienced with the feeding. Some vomiting occurred when the child was ten months old. The child has not suffered from any infectious diseases.

EXAMINATION - 30.11.32

The child looks pale and is not well-nourished. He is considerably under weight. Examination does not reveal any other abnormality.

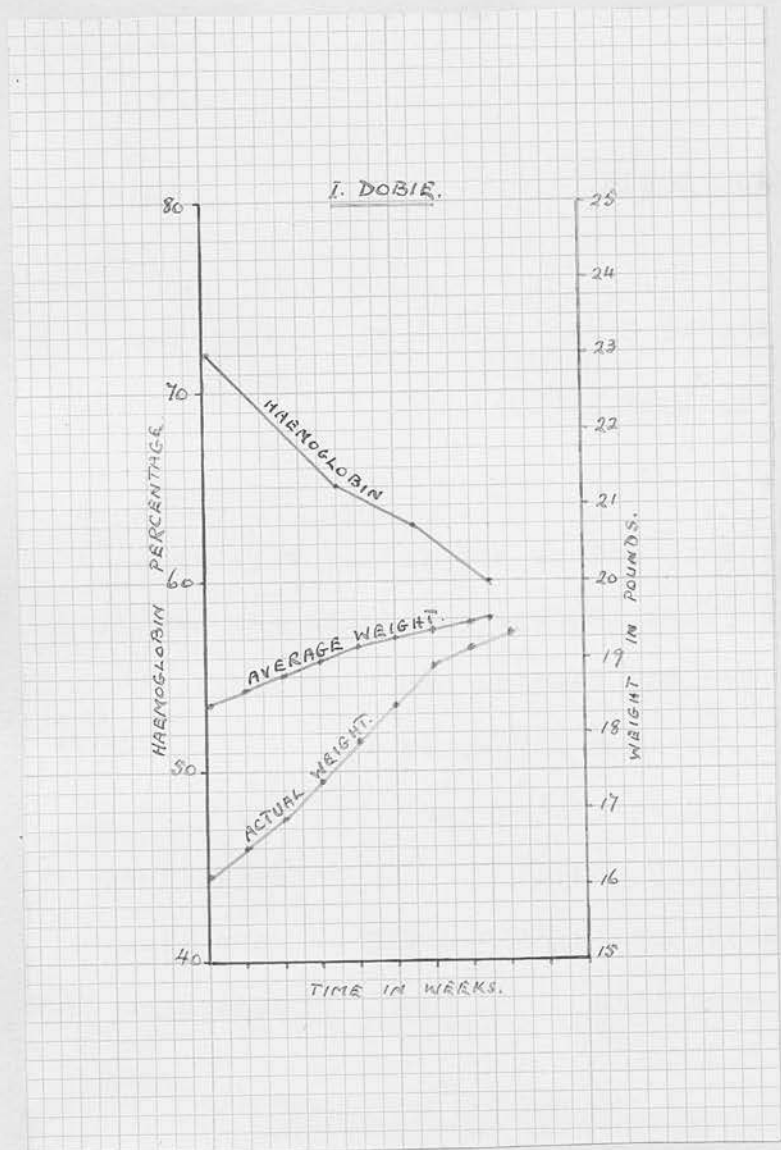
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUGS	PROGRESS NOTES.
30. 11. 32	62					
6. 12. 32	61					
13. 12. 32	61					
29. 12. 32	60					
10. 1. 33	61					
30. 1. 33	54					
13. 2. 33	52	4.39	Anisocytosis & poorly filled red cells.	0.6		Taking food but weight stationary.
27. 2. 33	52					
6. 3. 33						
8. 5. 33	60	4.60		0.65		
10. 5. 33	50					
24. 5. 33						
10. 6. 33	57					
6. 7. 33	53	4.22		0.63		
25. 7. 33	50	3.9		0.64		
9. 8. 33	52					
8. 9. 33	53	3.71		0.69		
13. 9. 33	51	4.08	Red cells, poorly filled.	0.64	Ferrous Ammon. sulph. gr. i t.i.d.	Reticulocytes 1%

RESULT.

The child was used as control for 8 weeks from 29.12.32. During this period haemoglobin fell by 8 percent. He was again observed for 4 months from 10.5.33 and during that period lost 7 per cent in haemoglobin. He then received three months treatment with ferrous ammonium sulphate, the haemoglobin rising by 29 per cent during this period of treatment. The R.B.C. also rose by 600,000.

WEIGHT.

The weight was rising before the iron was started but at that time, the child was $3\frac{1}{2}$ pounds below the average curve. At the conclusion of treatment the child was $1\frac{1}{4}$ pounds below average weight curve. This rate of gain in weight is no more rapid than before treatment. Iron does not appear to have had a favourable effect on the weight in this case.



CASE XVIII.

CASE NO. XVIII.

WESTERN GENERAL HOSPITAL.

IAN DOBIE.

Aet. $\frac{10}{12}$.Date of Birth - 14.3.32 Admitted - 11.10.32.Full-time infant.

HISTORY.

Both mother and father were in good health. For the first 10 days the child was breast-fed. Since then the feeding has been artificial.

Previous illnesses:-

Otorrhoea (right ear)	- March 1932
Whooping cough	- April 1932
Chickenpox & Bronchitis	- June 1932
Blepharitis	- September 1932

EXAMINATION - 6.1.33

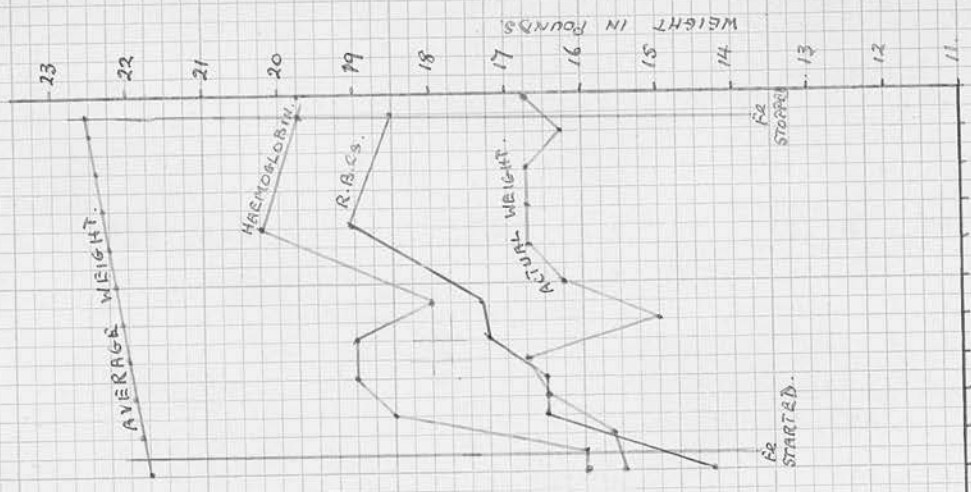
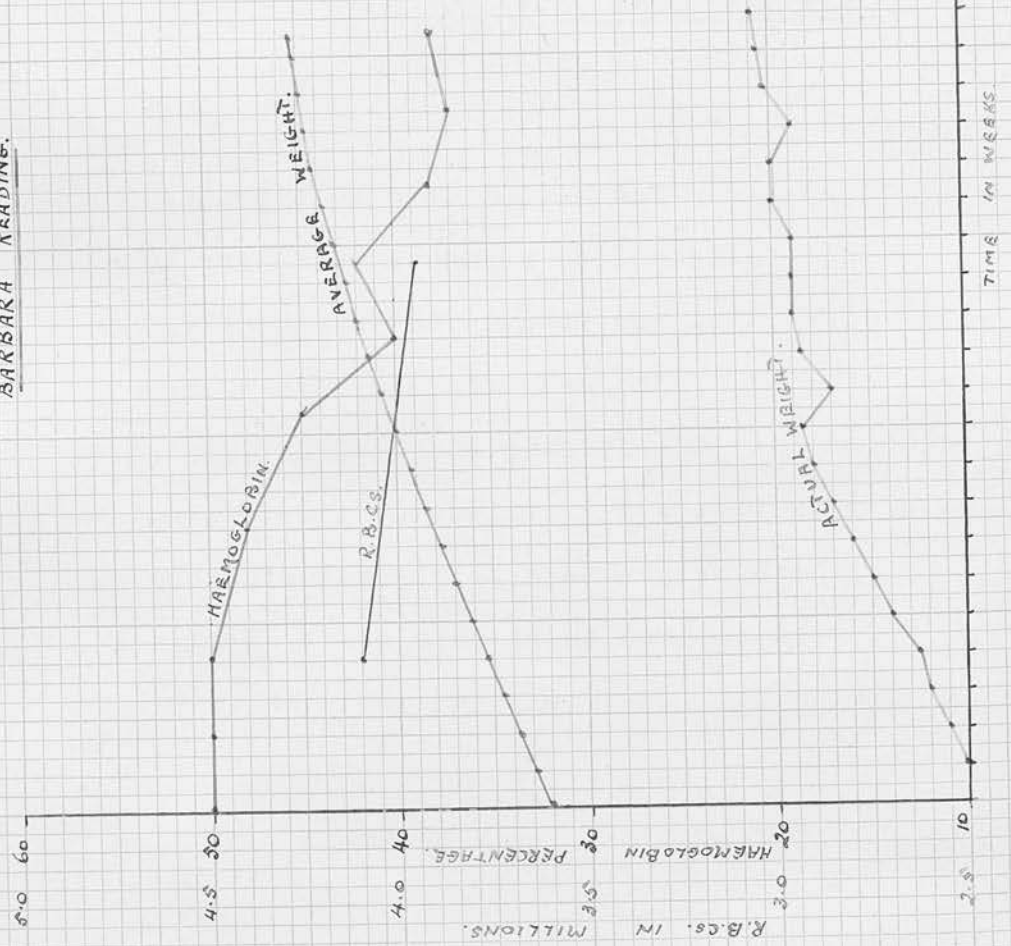
The nutrition is fairly good. He has recently had some dermatitis all over the body but this has now cleared up. There is no blepharitis and no otorrhoea. The fontanelle is not yet closed. No sign of rickets; no enlargement of liver or spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6. 1.33	72					Has some cough. Looks better. Weight going up. Improving. No infection.
31. 1.33	65					
14. 2.33	63					
28. 2.33	60					

RESULT.

The child was used as a control and only Haemoglobin estimations were made. During a period of seven weeks observation there was a loss of 12 per cent haemoglobin.

BARBARA READING.



CASE XIX.

CASE NO. XIX.

WESTERN GENERAL HOSPITAL

BARBARA READING

Aet. $\frac{7}{12}$ Date of Birth - 22.4.32Admitted - 12.5.32Premature Twin Baby.

HISTORY.

At birth the infant weighed 4 pounds 8 ozs. The mother suffers from advanced pulmonary tuberculosis. The child was breast-fed for the first two weeks of life. She was then admitted to hospital and since then the feeding has been artificial. Not much trouble was experienced with feeding and the infant gained weight in a fairly satisfactory manner. She has been noticed to be pale since she was about four months old. She has not suffered from any infections.

EXAMINATION - 16.11.32

The child is small and very pale. She is about five pounds below the average weight curve. No abnormality can be made out on physical examination. There is no enlargement of either liver or spleen. Wassermann Reaction negative.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16.11.32	50					Gaining weight quite well.
29.11.32	50					
14.12.32	50	4.10	Much anisocytosis & poor filling of red cells	0.60		
9. 1.33	48		W.B.C. 10,250			Von Pirquet negative. Doing well.
19. 1.33	45					Has not been well. C.S.F. under pressure.
30. 1.33	40			0.53		Fairly bright. No clinical improvement.
13. 2.33	42	3.94				To Victoria Park To City Hospital with chickenpox.
27. 2.33	38					
12. 3.33	37					
27. 3.33	38					
10. 4.33						
13. 4.33						
13.10.33	30	3.16	Red cells very poorly filled. W.B.C. 16,000.	0.47		Readmitted after being at home for one month.
16.10.33	30					
17.10.33	40	3.60		0.55	Ferr. Ammon. Sulphate gr. i t.i.d.	No ill-effects of iron.
26.10.33						

Taking feeds well.

Is looking better.

Fe. Am. Sulph. gr. ii
t.i.d.

0.56
0.55
0.51
0.55
0.56

3.61
3.75
3.77
4.11
4.03

42
42
38
47
45

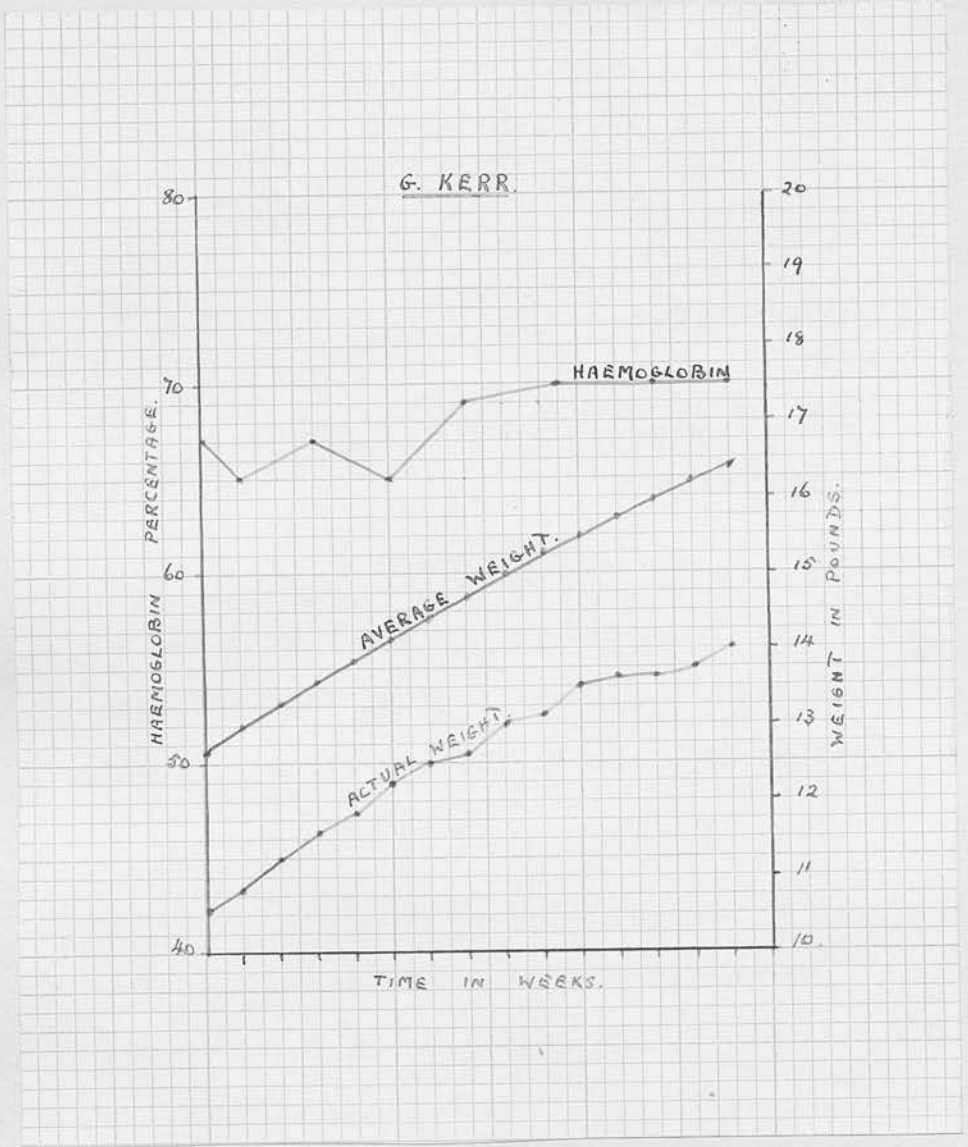
2.11.33
9.11.33
16.11.33
30.11.33
19.12.33

RESULT.

The child was a twin sister of case no. X. During $3\frac{1}{2}$ months observation, the haemoglobin fell by 12 per cent. During a period of two months treatment with ferrous ammonium sulphate the haemoglobin rose by 15 per cent.

WEIGHT.

At the commencement of iron therapy the child was $6\frac{1}{4}$ pounds below the average weight curve. At the conclusion of treatment, she was $5\frac{3}{4}$ pounds below the average weight curve. There has been some very slight gain in weight during the period of iron therapy.



CASE XX.

CASE NO. XX.

WESTERN GENERAL HOSPITAL

GORDON KERR.Aet. $\frac{4}{12}$ Date of Birth - 21.8.32Admitted - 25.11.32Full-time baby

HISTORY.

The child was fed on the breast for the first two weeks of life. After that the feeding was artificial. No difficulty was experienced with the feeding.

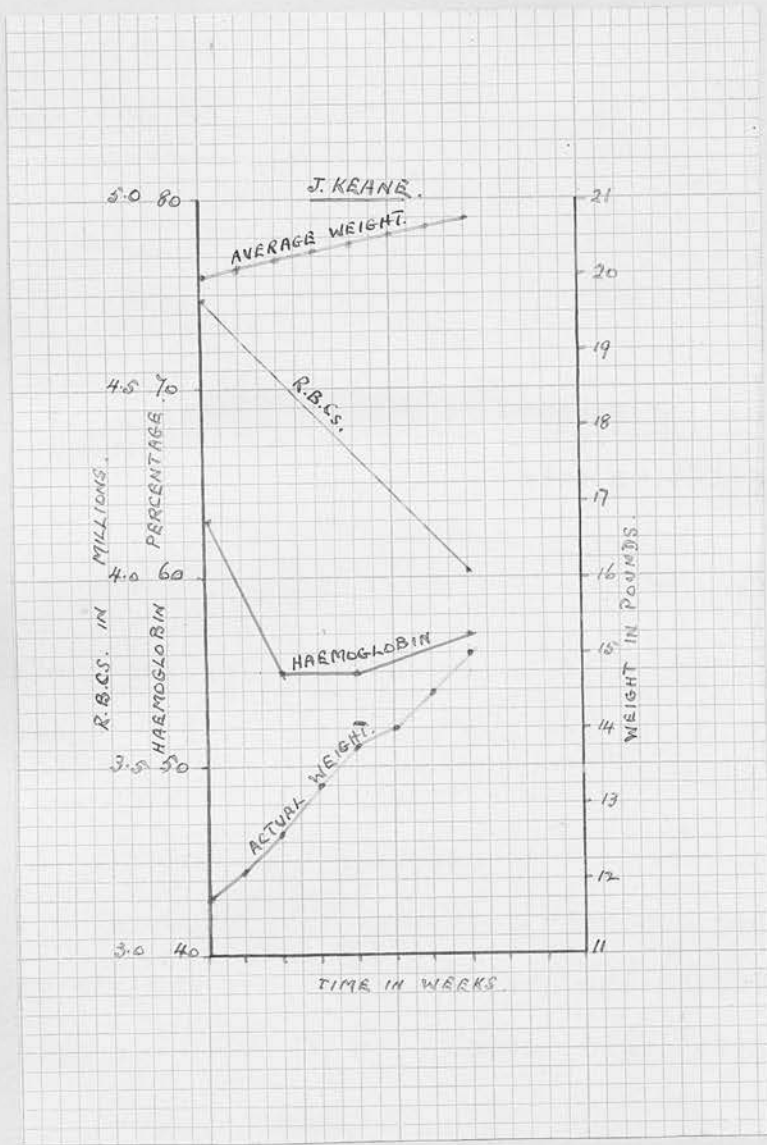
EXAMINATION - 6.12.32

The child is two pounds below the average weight curve but the nutrition is fairly good. There is no pallor. Physical examination does not reveal any abnormality. There is no otorrhoea. The spleen is not enlarged.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6. 12. 32	67					Vaccinated to-day. Making good progress. Doing well Quite healthy.
15. 12. 32	65					
29. 12. 32	67					
10. 1. 33	65					
24. 1. 33	69					
10. 2. 33	70					
27. 2. 33	70	4.07	Some anisocytosis and poorly filled red cells. Many of R.B.C's are well-filled.	0.9		Has some conjunctivitis.
13. 3. 33	70					Has developed otitis media. To City Hospital with nasal Diphtheria.
25. 3. 33						

RESULT.

This child was used as a control. During a period of observation lasting three months, the haemoglobin rose from 67 to 70 per cent. The child did not receive any form of treatment.



CASE XXI.

CASE NO. XXI.

WESTERN GENERAL HOSPITAL

JANE KEANE.

Aet. $1\frac{1}{12}$ Date of Birth - 29.2.32Admitted - 7.3.33Full-time twin.

HISTORY.

The child was breast-fed for two months but after that the feeding was artificial. There is no record of previous infectious diseases but she was admitted to this hospital from the City Hospital where she had been suffering from whooping cough. On admission the nutrition was poor and the child had a discharging nose.

EXAMINATION - 16.3.33

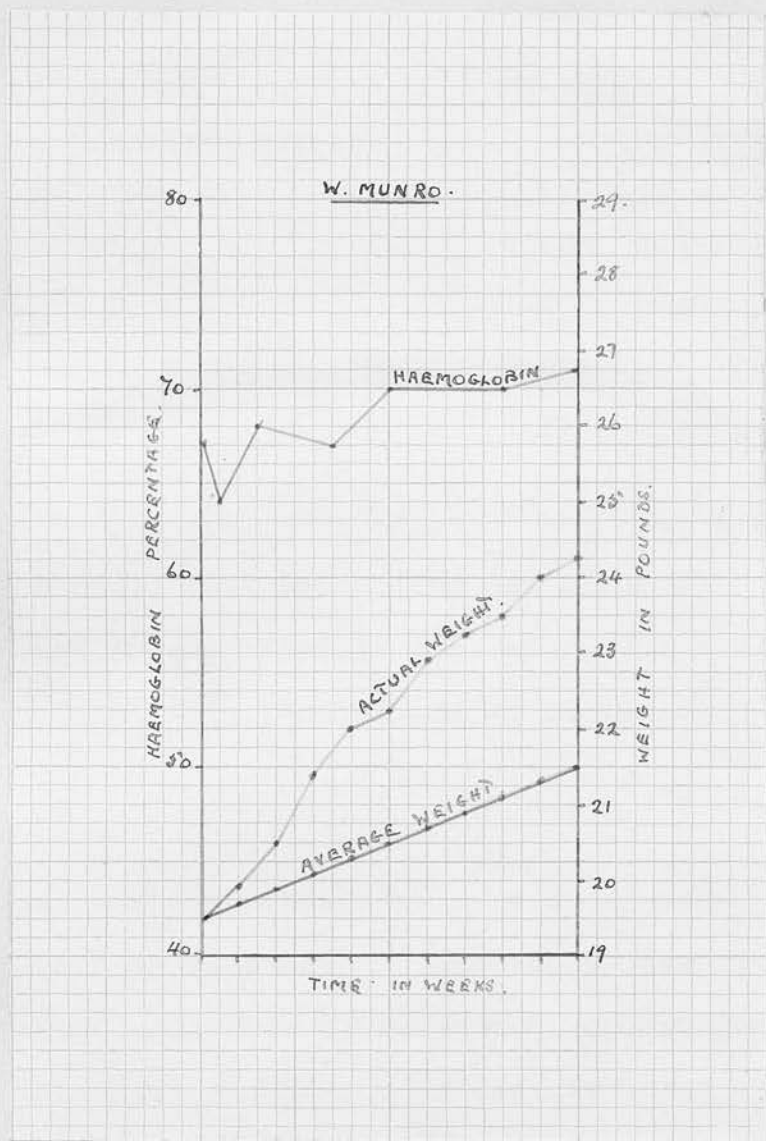
The child does not look at all well. She is pale and has herpes at the right nostril. The weight is very much below the average for age. Her nose is still discharging. There is no otorrhoea. No other abnormality noticed on examination.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16. 3.33	63	4.73	Anisocytosis & poor filling of red corpuscles.	0.68		
28. 3.33	55					Has a bad cough and cold. Rhonci audible in chest.
11. 4.33	55					
2. 5.33	57	4.52		0.63		Feeding well, weight going up.

RESULT.

The anaemia in this case was probably partly due to iron deficiency as the child was a twin but was also post infective.

From 16.3.33 until 2.5.33 the child was used as a control. During this period of six weeks, the haemoglobin went down by 5 per cent.



CASE XXII.

CASE NO. XXII

WESTERN GENERAL HOSPITAL

WINIFRED MUNRO.

Aet. $\frac{11}{12}$ Date of Birth - 8.1.32Admitted - 8.1.32Full-time baby.

HISTORY.

The child was bottle-fed from birth and the weight increased in a satisfactory manner. There is no record of any infection.

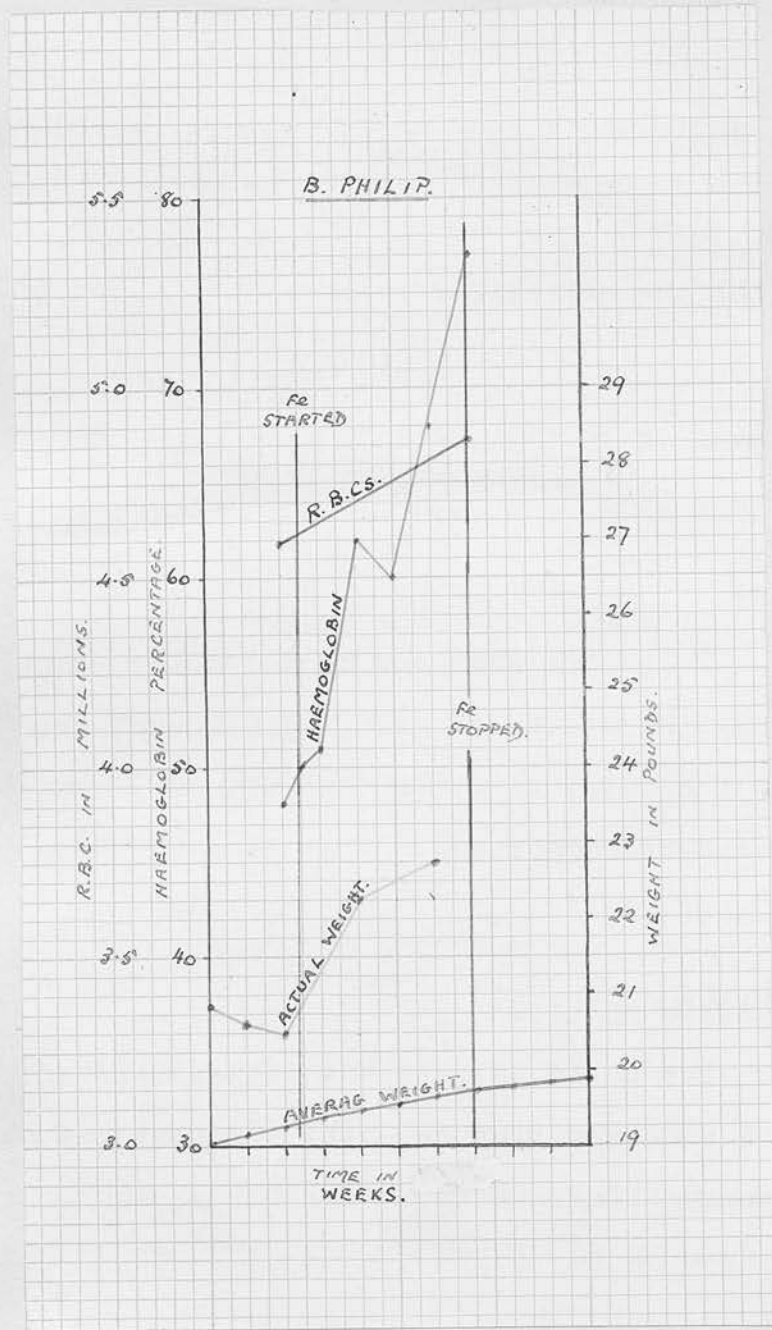
EXAMINATION - 6.12.33

There is no sign of rickets and the child is fairly well-nourished. There is no blepharitis and no otorrhoea, but there is some nasal discharge. The fontanelle admits one finger.

DATE	HB.	R.B.C. in MILLIONS.	PROGRESS NOTES.
6. 12. 32	67		Nasal discharge less.
8. 12. 32	64		Making good progress.
15. 12. 32	68		Standing very well.
29. 12. 32	67		Getting on well
10. 1. 33	70		Discharged to City Hospital with whooping cough.
30. 1. 33	70		
14. 2. 33	71.		

RESULT.

The child was used as a control. During a period of nine weeks the haemoglobin rose 4 per cent. The child did not receive any treatment.



CASE XXIII.

CASE NO. XXIII

LEITH DAY NURSERY.

BERNARD PHILIP.

Aet. $\frac{11}{12}$.Date of Birth - 30.7.32Premature baby (8th month)

HISTORY.

The child was born in Maternity Hospital. Birth weight 5 lbs, 12 ozs. Was breast-fed and weight increased in a very satisfactory manner. No record of infections. Has been pale for about three months.

EXAMINATION - 7.7.33

The child is pale but well-nourished. He has had some vomiting recently but that has stopped. No enlargement of epiphyses or other sign of rickets. No enlargement of spleen or liver. No otorrhoea or nasal discharge.

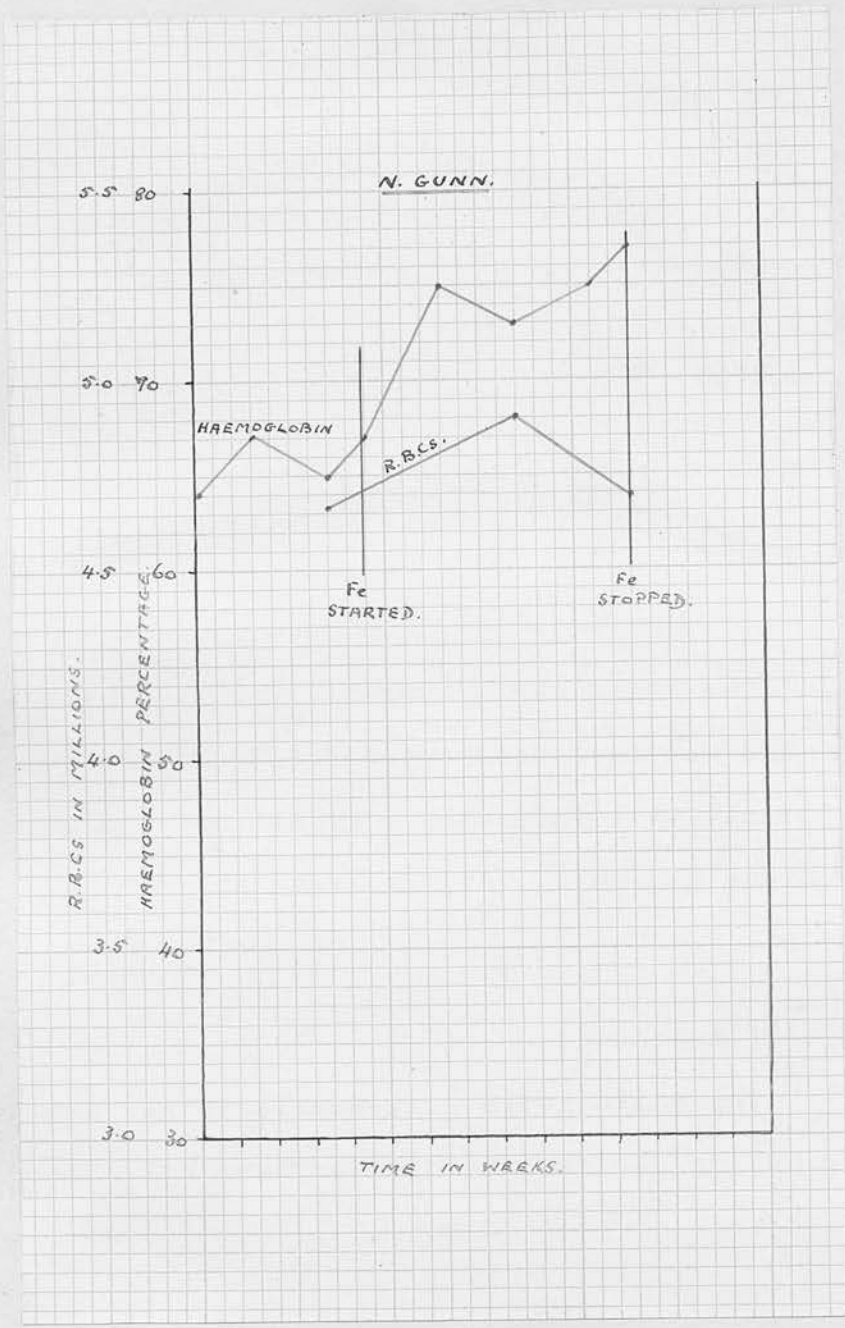
DATE	HB.	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES.
7. 7.33	48	4.59	Some anisocytosis & poor filling of R.B.C.'s.	0.52		
10. 7.33	50				Fe. et Ammon. Cit. grs.ii t.i.d.	
14. 7.33	51					No ill effects of iron.
21. 7.33	62					Weight has gone up
28. 7.33	60					Has had rash on body and legs - urticaria.
4. 8.33	68					Much better, rash gone.
12. 8.33	77	4.86		0.80		Looking well. Pallor gone

RESULT.

During a period of treatment with iron and ammonium citrate lasting five weeks, the haemoglobin rose from 50 to 77 per cent. and R.B.C.'s from 4.59 to 4.86 millions. There was an accompanying improvement in the appearance and general condition of the child.

WEIGHT.

At the commencement of treatment the child was 1 pound 4 ozs. above the average weight for his age. At the conclusion of treatment he was 3 pounds above the average weight for his age. The iron appears to have had a beneficial effect upon the weight in this case.



CASE XXIV.

CASE NO. XXIV.

VIEWFORTH DAY NURSERY.

NORMAN GUNN.

Aet. $1\frac{5}{12}$ Date of Birth - 23.12.31Full-time baby.

HISTORY.

The child was breast-fed for about a fortnight and was then bottle-fed for $9\frac{1}{2}$ months. He was weaned at 10th month. He has not had any infectious diseases, but has frequently had inflamed tonsils.

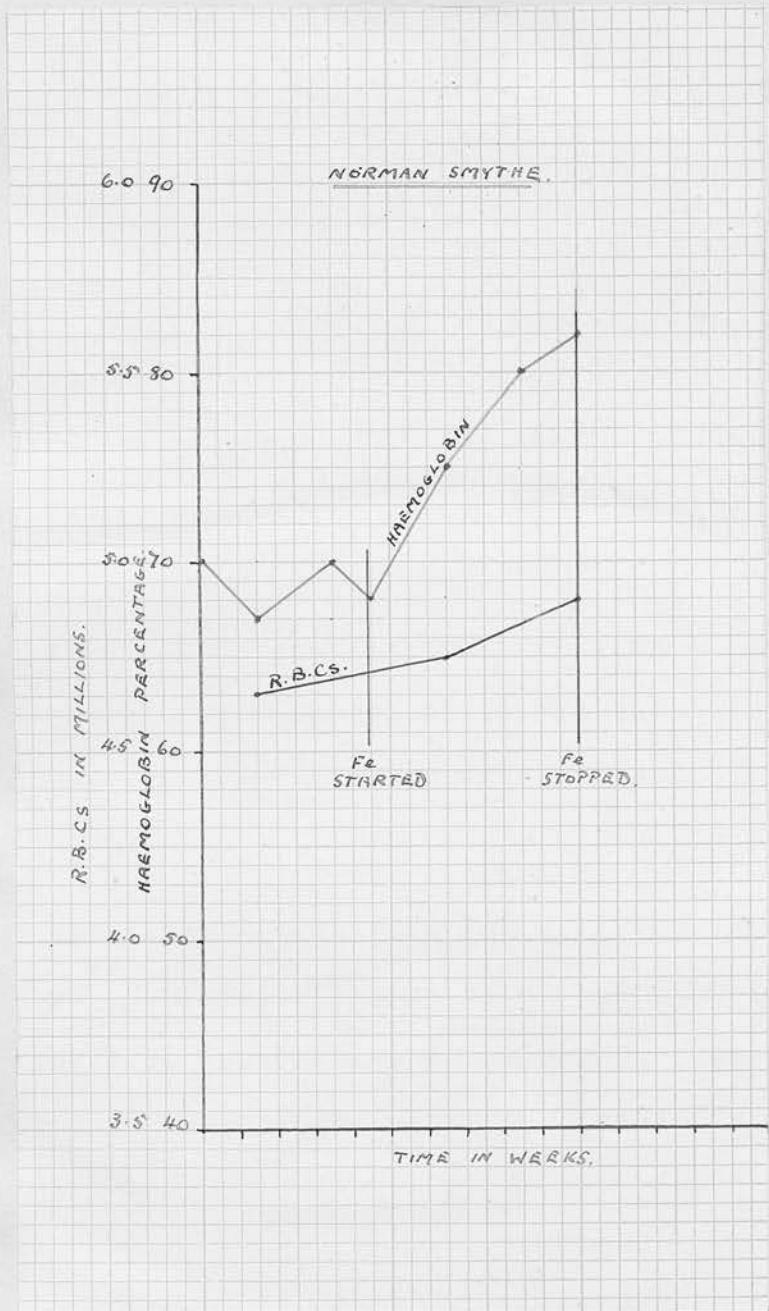
EXAMINATION - 25.4.33

The child looks well-nourished and there is no pallor. There is no otorrhoea but his nose is discharging. No abnormality can be made out on examination.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
25. 4.33	64					
4. 5.33	67					
19. 5.33	65	4.67	Some aniso- cytosis.	0.7		Foot rather cold.
26. 5.33	67				Fe. et Ammon. Cit. gr. iss t.i.d.	
8. 6.33	75	4.9		0.74		Improving generally
20. 6.33	73					
6. 7.33	75					Now attending less regu- larly, so mixture to be stopped.
13. 7.33	77	4.79		0.80		

RESULT.

After a preliminary control period of one month in which the haemoglobin rose 3 per cent, the child received treatment with iron for 7 weeks and during that period the haemoglobin rose from 67 per cent to 77 per cent. There was no significant rise in the red blood count.



CASE XXV.

CASE NO. XXV.

VIEWFORTH DAY NURSERY.

NORMAN SMYTHE

Aet. 2 years.

Date of Birth - 19.4.31Full-time twin.

HISTORY.

The child was breast-fed. There is no history of any infectious diseases. He is dark-skinned as he has some negro-blood.

EXAMINATION - 25.4.33

The child is not well-nourished but is quite active. There is no sign of rickets. No otorrhoea. There is no enlargement of either spleen or liver.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
25. 4.33	70	4.65		0.72		
4. 5.33	67					
19. 5.33	70					
26. 5.33	68	4.70		0.80	Fe.et Am. Cit. gr.iss t.i.d.	
8. 6.33	75					
20. 6.33	80					
29. 6.33	82	4.90		0.83	Mixture stopped.	No ill effects of iron. Looks much better.

RESULT.

The child was used as a control for a preliminary period of one month. During this month the haemoglobin varied between 70 and 67 per cent. This variation was probably due to experimental error. Five weeks treatment with iron was then given and the haemoglobin rose to 82 per cent, a total rise of 14 per cent. The colour index also rose from 0.72 to 0.83.

CASE NO. XXVI.LEITH DAY NURSERY.

NAN HISLOP.

Aet. $\frac{12}{12}$ Date of Birth - 15.5.32Full-time twin. Birth weight - 4 lbs. 15 ozs.

HISTORY.

The child was bottle-fed after the first nine days of life until she was 15 months old. An egg was added to the diet when the child was one year old. She had an attack of diarrhoea in Summer 1932. In January 1933, she became very pale and this pallor has persisted since. She has not had any infections except for a discharging ear when three months old. She has frequent 'colds'.

EXAMINATION - 28.7.33

The child is very pale and is very fretful. The fontanelle admits two fingers. There is no enlargement of the epiphyses. Neither liver or spleen is enlarged. There is no blepharitis and no otorrhoea.

47a.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
28. 7.33	25					
4. 8.33	28	3.61	Anisocytosis Poikilocytosis & poorly filled red cells. No nucleated R.B.C.'s.	0.39		To be used as control for a few weeks.
12. 8.33	26					
25. 8.33	28	2.96		0.46	Fe.et Am.Cit. gr.ii t.i.d.	
29. 8.33	43	4.18		0.52		Stools rather loose.
5. 9.33	50	4.44		0.56		Has rash on legs and thighs
12. 9.33	47					Screams a considerable amount.
19. 9.33	56	4.94		0.57		
10.10.33						
24.10.33	62			0.70		Has had some vomiting. Give
7.11.33	67	4.84				Hydarg. \bar{c} Cret.
21.11.33	64	4.91	Less anisocytosis & cells are better filled.	0.65		

RESULT.

For four weeks this child was used as a control while the other twin was treated. During this period, the haemoglobin remained at a practically constant level.

Three months treatment with iron was then given. During this period the haemoglobin rose from 25 to 64 per cent. The colour index also rose from 0.46 to 0.65.

WEIGHT.

Unfortunately the child was not weighed at regular intervals during the period of treatment.

CASE NO. XXVII.

LEITH DAY NURSERY.

FAY HISLOP.

Aet. $1\frac{2}{12}$ Date of Birth - 15.5.32Full-time twin. Birth weight - 4 lbs. 10 ozs.

HISTORY.

The child was breast-fed for about nine days but even during these nine days she had some bottle feeds also. She was artificially fed from then until 14-15 months old. At 11 months gravy was added and at 12 months she was given an egg. There was never much trouble with vomiting and she took her feeds quite well.

In January 1933, when the child was seven months old, she began to get very pale and she has been pale ever since.

The child is very much troubled with colds in the head.

EXAMINATION - 28.7.33.

The child is small and very much below weight. She has marked pallor. The fontanelle admits two fingers. There is no thickening of epiphyses. There is no otorrhoea or blepharitis. There is no enlargement of liver. The spleen is just palpable below the left costal margin.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
28. 7.33	33	4.06	Anisocytosis, Poikilocytosis and poorly filled red cells	0.40	Fe.et Am.Cit.gr.ii t.i.d.	No ill effects of iron. Doing well. The other twir which has had no treat- ment has not improved. Has good colour now.
4. 8.33	37	4.59		0.52		
12. 8.33	48			0.72		
25. 8.33	60			0.72		
5. 9.33	70	4.83				
12. 9.33	70	4.79				
19. 9.33	70					
10.10.33	67				Fe.et Am.Cit. started a- gain.	Having loose stools, so iron stopped.
24.10.33	70	4.94		0.74		
7.11.33	73					
21.11.33	70	5.05		0.7	Mixture stopped.	Looks well. Bowels inclin- ed to be constipated.

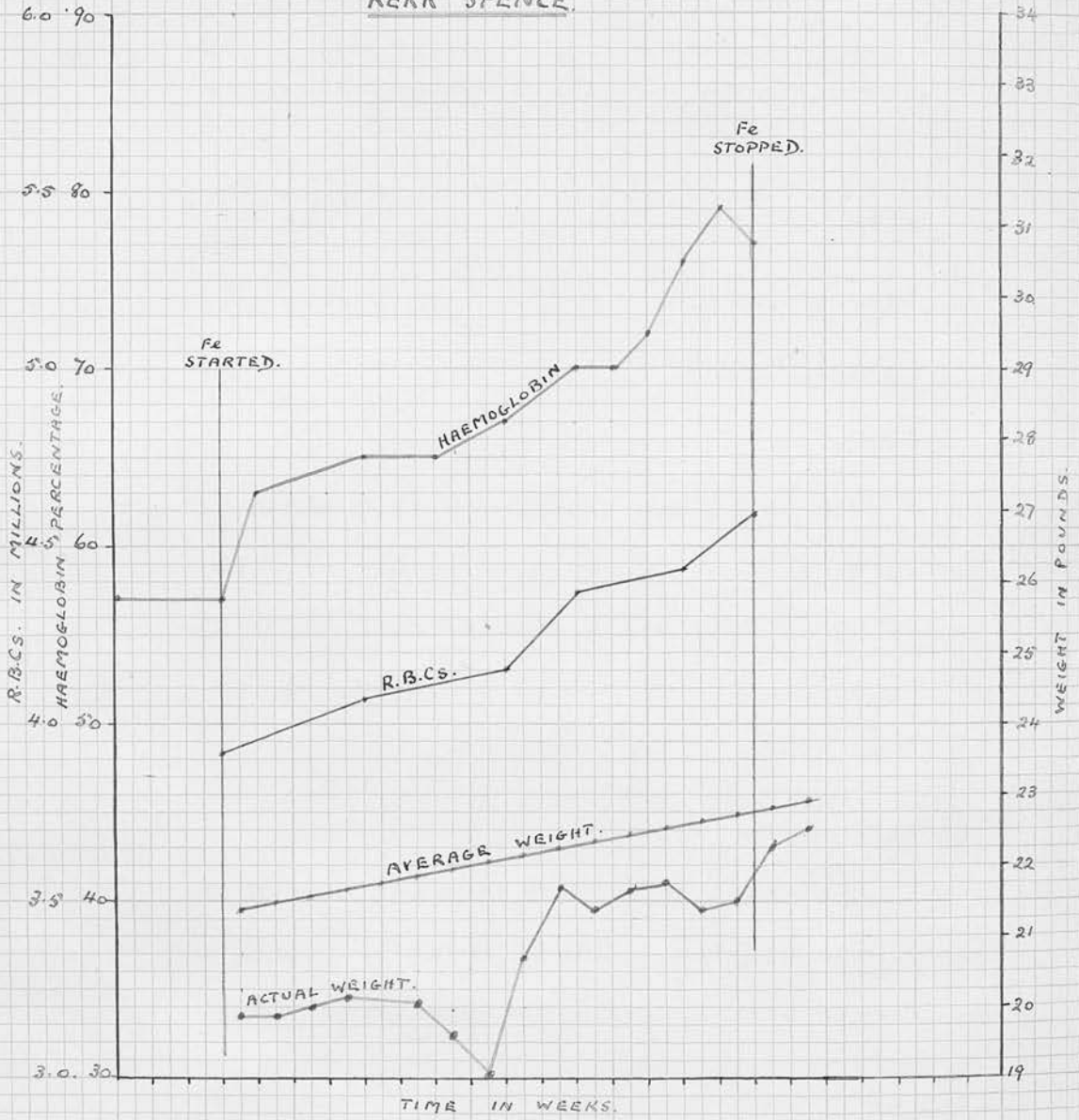
RESULT.

This was a typical case of nutritional anaemia. The child was treated with iron for four months and the haemoglobin rose from 33 to 70 per cent. The colour index also rose from 0.4 to 0.7.

WEIGHT.

Unfortunately the child was not weighed regularly during the period of treatment.

KERR SPENCE.



CASE XXVIII.

CASE NO. XXVIII

LEITH DAY NURSERY.

KERR SPENCE.

Aet. $1\frac{2}{12}$ Date of Birth - 2.5.32Admitted - 14.7.33Full-time baby.

HISTORY.

The child was breast-fed from birth until the fourth month. Since then he has been bottle-fed and he is now having a mixed diet. He has not had any illnesses except an operation for umbilical hernia 7 months ago.

EXAMINATION - 14.7.33

The child is rather pale but otherwise he looks quite healthy. He is about $1\frac{1}{2}$ pounds below the average weight. The fontanelle is almost closed. No sign of rickets. There is no enlargement of either liver or spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
14. 7.33	57	3.92		0.73	Ferr.et Am.Cit. gr.ii t.i.d.	Admitted to Victoria Park. Taking food well.
4. 8.33	57					
9. 8.33	63			0.81		Has been transferred to Leith Day Nursery again.
11. 8.33	65	4.07				Has had diarrhoea. Iron to be stopped.
30. 8.33	65					
12. 9.33	65					
22. 9.33	67	4.15		0.80	Iron re-started.	
26. 9.33	70	4.37		0.80		
10.10.33	70					
17.10.33	70					
24.10.33	72					
31.10.33	76	4.44		0.85		Looks much better.
7.11.33	79					Is quite well.
14.11.33	77	4.59		0.84	Iron stopped.	

RESULT.

During a period of 3 months treatment with iron the haemoglobin rose from 57 to 77 per cent. and the red cells from 3,900,000 to 4,590,000. The colour index also rose from 0.73 to 0.84. This improvement in the blood picture was accompanied by an improvement in the general health of the child as judged by appearance and activity.

WEIGHT.

At the commencement of iron therapy, the child was $1\frac{1}{2}$ pounds below the average weight curve. At the conclusion of iron therapy he was $\frac{1}{2}$ pound below the average weight curve. Iron had a beneficial effect on the weight in this case.

CASE NO. XXIX.

VIEWFORTH DAY NURSERY.

IAN CORBETT.Aet. $1\frac{1}{12}$ Date of Birth - 10.3.32Full-time baby

HISTORY.

The child was breast-fed for the first two weeks of life and from then until 9th month, the feeding was artificial. He was weaned at 9th month. He has not had any illnesses. No otorrhoea.

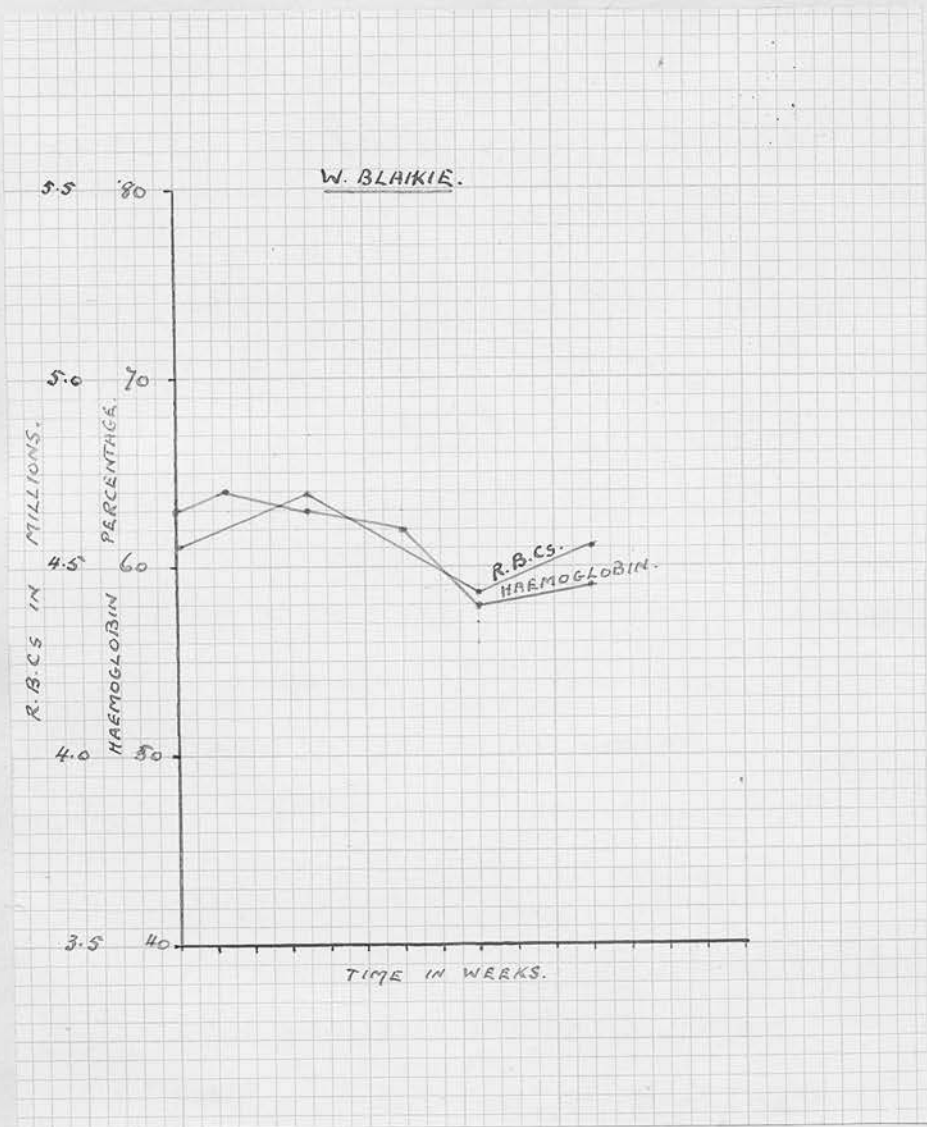
EXAMINATION - 25.4.33.

The child is fairly well-nourished and no abnormality can be made out. There is no sign of rickets, no enlargement of liver or spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
25. 4.33	69					
5. 5.33	70					
19. 5.33	69	4.55		0.75		
8. 6.33	67					
20. 6.33	65	4.35		0.74		
6. 7.33	66					
20. 7.33	70	4.44		0.78		Has been having diarrhoea.

RESULT.

This child was used as a control. Observations were made over a period lasting three months and there was no significant change in the haemoglobin percentage.



CASE XXX.

CASE NO. XXX.

VIEWFORTH DAY NURSERY

WILLIAM BLACKIE.

Aet. 1 year.

Date of Birth. - 12.4.32Full-time baby.

HISTORY.

The early history of this child is not available. He was breast fed for some months but from six months onwards he was artificially fed. He has not had any infections.

EXAMINATION - 25.4.33.

The child has a discharging nose. There is no abnormality to be made out. There is no sign of rickets.

R.B.C. in
MILLIONS.

DATE HB. FILM C.I. DRUG PROGRESS NOTES.

25. 4.33	63	4.56	Red cells are not well filled. No other abnormality.	0.69		
4. 5.33	64	4.79		0.65		
22. 5.33	63					
8. 6.33	62	4.43		0.66		
20. 6.33	58	4.55		0.65		
13. 7.33	59					

RESULT.

The child was used as a control for 11 weeks.

During that period, haemoglobin fell from 63 to 59

and red blood corpuscles remained stationary.

CASE NO. XXXI.

VIEWFORTH DAY NURSERY.

JAMES WOODWORTH.

Aet. $\frac{3^2}{12}$ Date of Birth - 28.4.30.Premature baby (2 months)

HISTORY.

The child was breast-fed until he was seven months old. He was then bottle-fed until he was weaned at 14 months. He has not had any infectious diseases.

EXAMINATION - 20.6.33

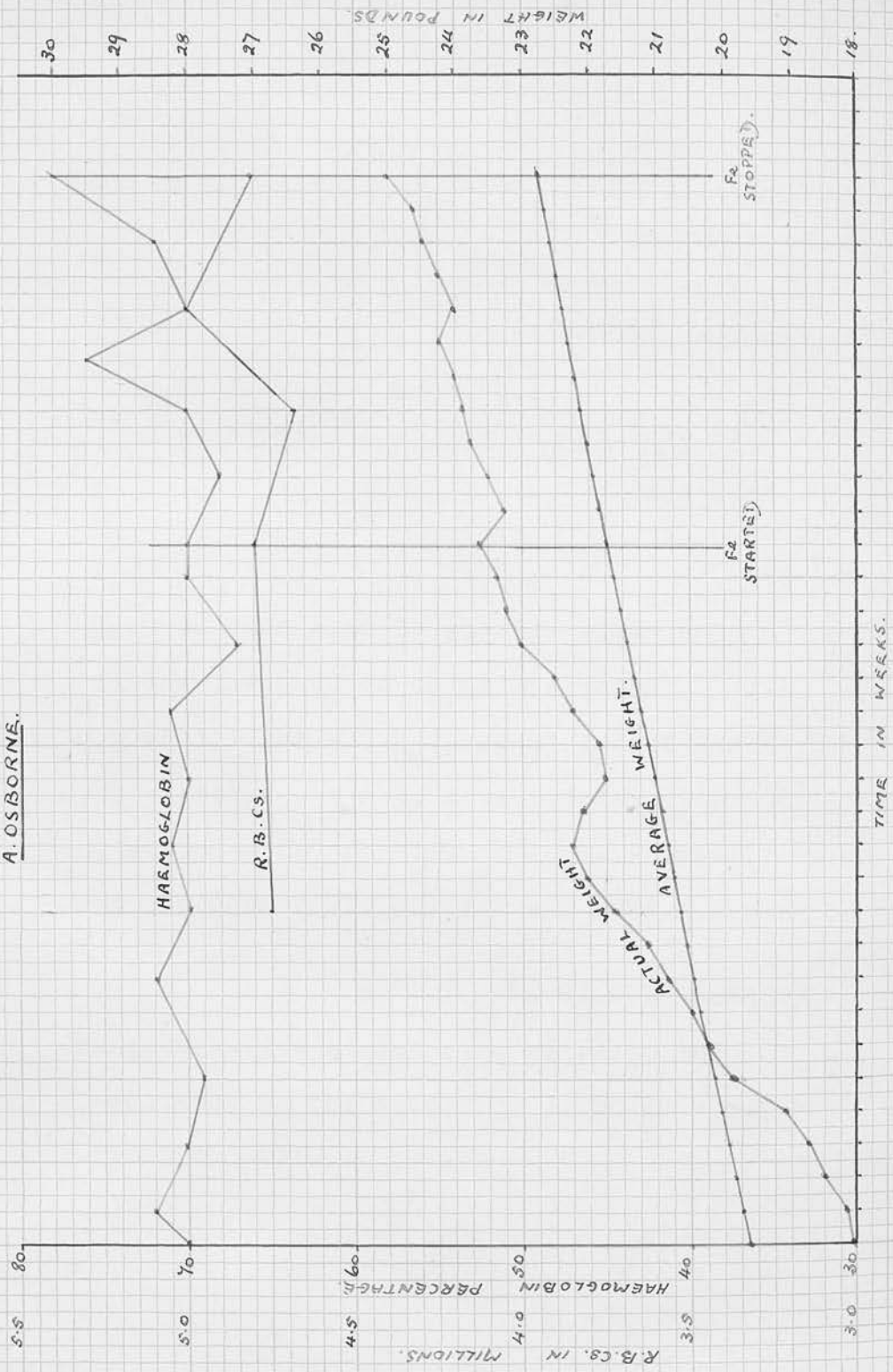
The child looks rather pale. He has no discharging ears. No other infections present. He is not well-nourished.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
20. 6.33	63	4.73	Red cells are not well filled	0.66		Has had some diarrhoea.
6. 7.33	62					
21. 7.33	62					

RESULT.

This child was used as a control. During the period of observation which lasted for one month, the haemoglobin remained at a constant level.

A. OSBORNE.



CASE XXXII.

CASE NO. XXXII.

WESTERN GENERAL HOSPITAL

ALBIA OSBORNE.

Aet. $\frac{11}{12}$.Date of Birth - 24.1.32Admitted - 7.4.32Full-time baby.

HISTORY.

The early history of this case is not obtainable. After admission to hospital she received artificial feeding. The child made good progress until October 1932 when she suffered from some digestive upset. This caused a marked loss of weight. She has not had any infectious diseases.

EXAMINATION - 6.12.32

The child is pale but is well-nourished. There is some nasal discharge but no otorrhoea. There is nothing abnormal to be made out on examination.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6. 12. 32	70					Some nasal discharge.
15. 12. 32	72					Quite well - gaining weight
27. 12. 32	70					Good progress.
11. 1. 33	69					
31. 1. 33	72					
13. 2. 33	70	4.74	W.B.C. 16,000	0.74		Whooping cough.
28. 2. 33	71					Still whooping, has septic spot on nose.
14. 3. 33	70					
27. 3. 33	71					
11. 4. 33	67					
28. 4. 33	70					
3. 5. 33	70	4.8	Poor filling of red cells.	0.71	Ferrous Chloride gr. $\frac{1}{2}$ t.i.d.	Has impetigo of scalp and face.
17. 5. 33	68					
1. 6. 33	70					
12. 6. 33	76	4.68		0.8		
23. 6. 33	70	5.0		0.7		
10. 7. 33	72					
24. 7. 33	78	4.81		0.81.		Scalp much better

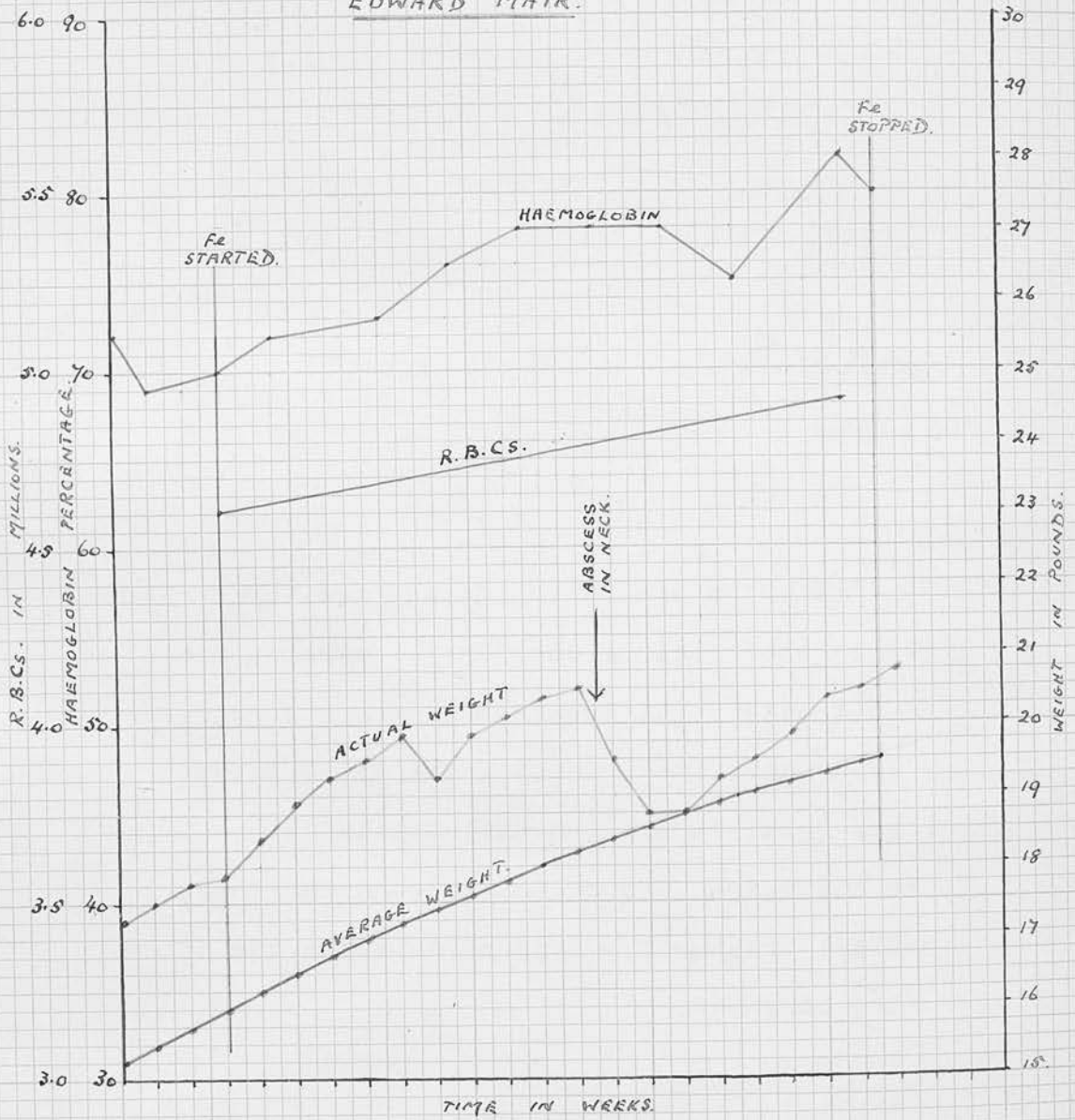
RESULT.

From 6.12.32 until 28.4.33, the child was used as a control. During that time there was no significant rise in haemoglobin. The child was then treated with iron for a period of three months. During this period the haemoglobin rose from 70 to 78 per cent. The isolated figure at the end makes this result untrustworthy.

WEIGHT.

Before administration of iron, the gain in weight was more rapid than the average curve. After iron was started, the weight continued to rise but no more rapidly than before the iron was commenced.

EDWARD MAIR.



CASE XXXIII.

CASE NO. XXXIII.

WESTERN GENERAL HOSPITAL

EDWARD MAIR.

Aet. $\frac{6}{12}$ Date of Birth - 9.5.32Admitted - 1.11.32Full-time baby

HISTORY.

The child was full-time and healthy. He was fed on the breast alone for the first three months but after that the feeding was with artificial milk. He was quite healthy until 21.10.32 when he developed bronchitis. He was admitted to hospital because his mother was admitted to another hospital for medical treatment. After admission the cough gradually improved.

EXAMINATION - 23.11.32.

The child looks quite healthy and the nutrition is good, the weight being above the normal for the child's age. No blepharitis or otorrhoea. There is no enlargement of spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
23. 11. 32	71					
6. 12. 32	72					
14. 12. 32	69					
27. 12. 32	70	4.61	Red cells poorly filled. No mark- ed anisocytosis	0.76		Tolerating feeds well & gaining in weight.
30. 12. 32						
9. 1. 33	72				Ferrous Chlor. gr. $\frac{1}{2}$ t.i.d.	Doing well
20. 1. 33					Iron given in solution.	Has a cold in head.
31. 1. 33	73					
14. 2. 33	76					
28. 2. 33	78					
14. 3. 33	78				CuSO ₄ gr. $\frac{1}{50}$ to iron. t.i.d. added	Some vomiting after food. Swelling of left side of neck.
28. 3. 33	78					
11. 4. 33	75					
1. 5. 33	82					
10. 5. 33	80	4.91		0.83		Has had abscess of neck.

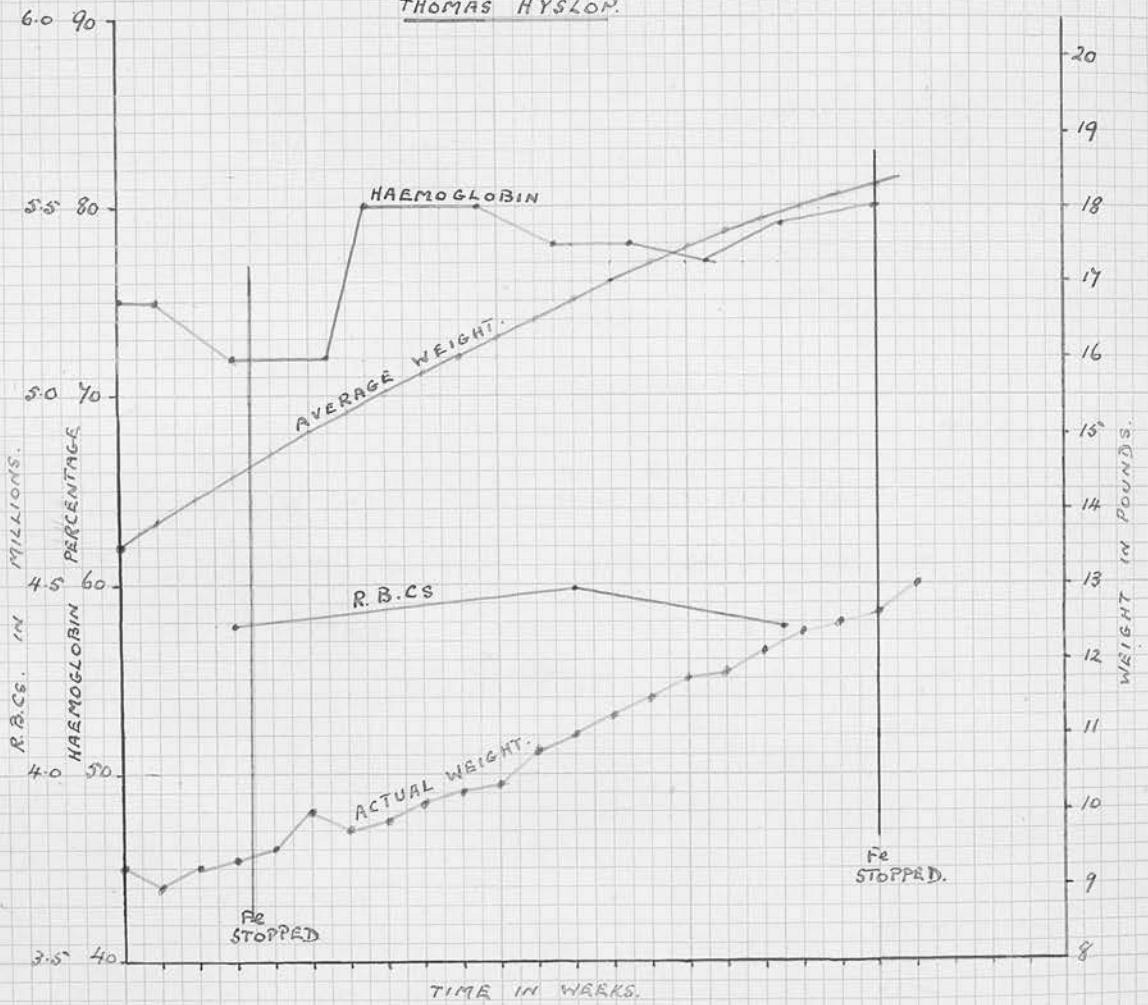
RESULT.

During a period of treatment lasting four months the haemoglobin rose from 70 to 80 per cent. The general condition was good at the start of treatment but continued to improve throughout except for a temporary set-back while the child had an abscess of the neck.

WEIGHT.

Before treatment commenced the weight was 28 ozs. above but parallel to average weight curve. Following the beginning of iron treatment the inclination of weight curve became more acute and six weeks after iron administration was started the weight was 44 ozs. above average weight curve. This improvement was not maintained, the weight declining when the abscess of neck developed. Iron had a beneficial effect on the weight in this case.

THOMAS HYSLOP.



CASE XXXIV.

CASE NO. XXXIV.

WESTERN GENERAL HOSPITAL.

THOMAS HYSLOP.

Aet. $\frac{5}{12}$ Date of Birth - 28.7.32. Admitted - 2.8.32.Full-time baby.

HISTORY.

The child was born in hospital where the mother was under treatment. Physical examination on admission did not reveal any abnormality. He was bottle-fed entirely and except for some trouble with the feeding when four months old he did not have any illnesses.

EXAMINATION - 7.12.32.

No abnormality was found. The child was rather small and under-weight.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
7. 12. 32	75	4.39	No abnormality	0.8	Ferrous chloride gr. $\frac{1}{2}$ t.i.d.	Ferrous chloride given in solution. Not taking feed very well. Some bronchitis. Much better.
15. 12. 32	75				" " " $\frac{1}{4}$ " "	
27. 12. 32	72				" " " $\frac{1}{2}$ " "	
30. 12. 32					" " " " " "	
4. 1. 33						
7. 1. 33						
14. 1. 33	72					
17. 1. 33						
24. 1. 33	80					Still looks rather pale.
13. 2. 33	80					Making satisfactory progress
27. 2. 33	78					
2. 3. 33		4.48		0.9	CuSO ₄ gr. $\frac{1}{50}$ t.i.d. added to iron.	
13. 3. 33	78					
14. 3. 33						
26. 3. 33						
27. 3. 33	77					Not well. Temp. 103° at night but appears bright and active. Some dullness at base of right lung.
28. 3. 33						Still slight dullness at base of right lung.
3. 4. 33						Profuse nasal discharge.
11. 4. 33	79					Dullness absent.
28. 4. 33	80	4.38		0.9		Bright & well again.
						Doing well; putting on weight

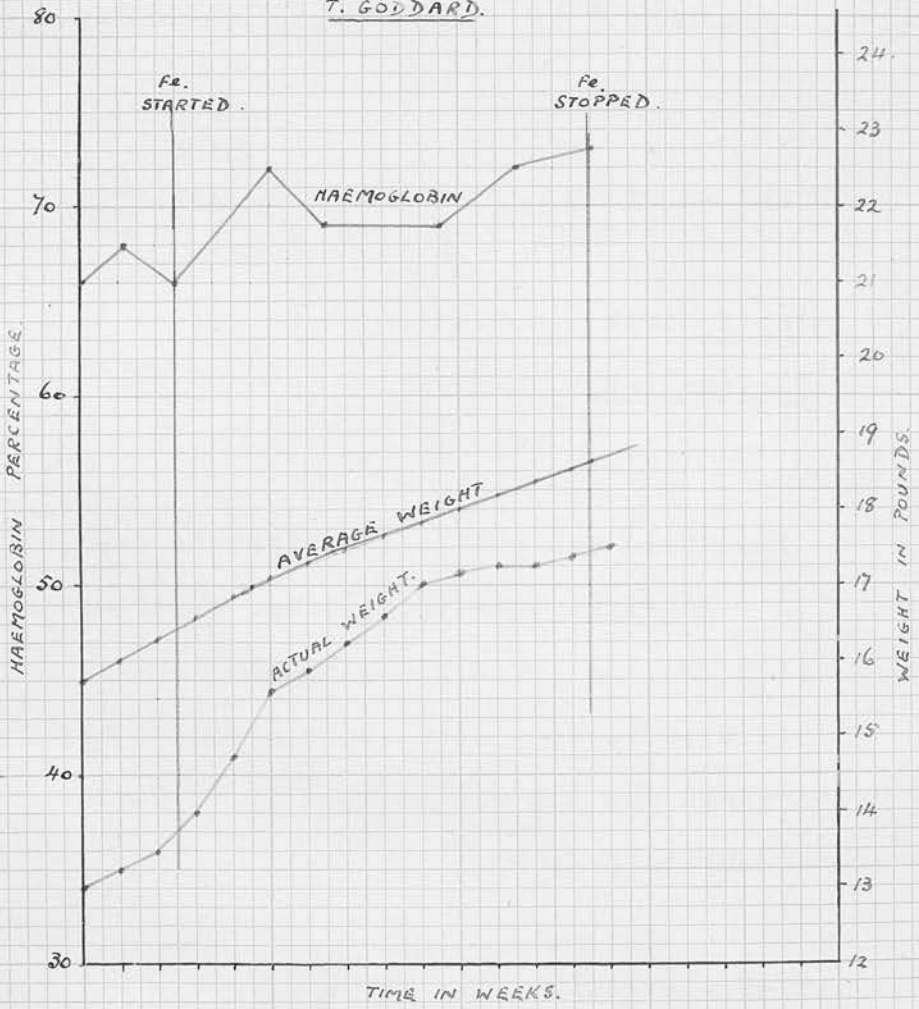
RESULT.

The haemoglobin rose from 72 to 80 per cent with iron treatment lasting over four months. The response was fairly rapid taking place within 24 days of starting the ferrous chloride.

WEIGHT.

The child was five pounds under the average weight curve when treatment was commenced. There is no sign of improvement of this weight with iron. The inclination of the curve is the same before and after treatment and the weight was still five pounds below the normal curve at the end of the period of treatment.

T. GOLDARD.



CASE XXXV.

CASE NO. XXXV.

WESTERN GENERAL HOSPITAL

THOMAS GODDARD.

Aet. $\frac{6}{12}$ Date of Birth - 4.6.32Admitted - 13.6.32Full-time baby

HISTORY.

The child was bottle-fed after he was one week old. At first some trouble was experienced with the feeding and the child did not gain in weight very satisfactorily. Afterwards however, the feeds were increased and the weight went up. There is no record of any infections.

EXAMINATION - 8.12.32

The child looks quite well and there is no sign of pallor. He has been vaccinated recently and his arm is now all right again. There is no sign of rickets and no splenomegaly.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
8.12.32	66					
17.12.32	68					
27.12.32	66		Poor filling of R.B.C's. No marked anisocytosis.			
30.12.32	72				Ferrous Chlor. gr. $\frac{1}{2}$ t.i.d.	
4. 1.33	69				" " "	No ill-effects from iron. Taking feeds well.
7. 1.33	69				" " "	Bright and active. Doing well
14. 1.33	72				" " "	Coughing a little.
24. 1.33	72				" " "	Removed to City Hospital with whooping cough.
13. 2.33	73					
27. 2.33	73					
14. 3.33						
17. 3.33						

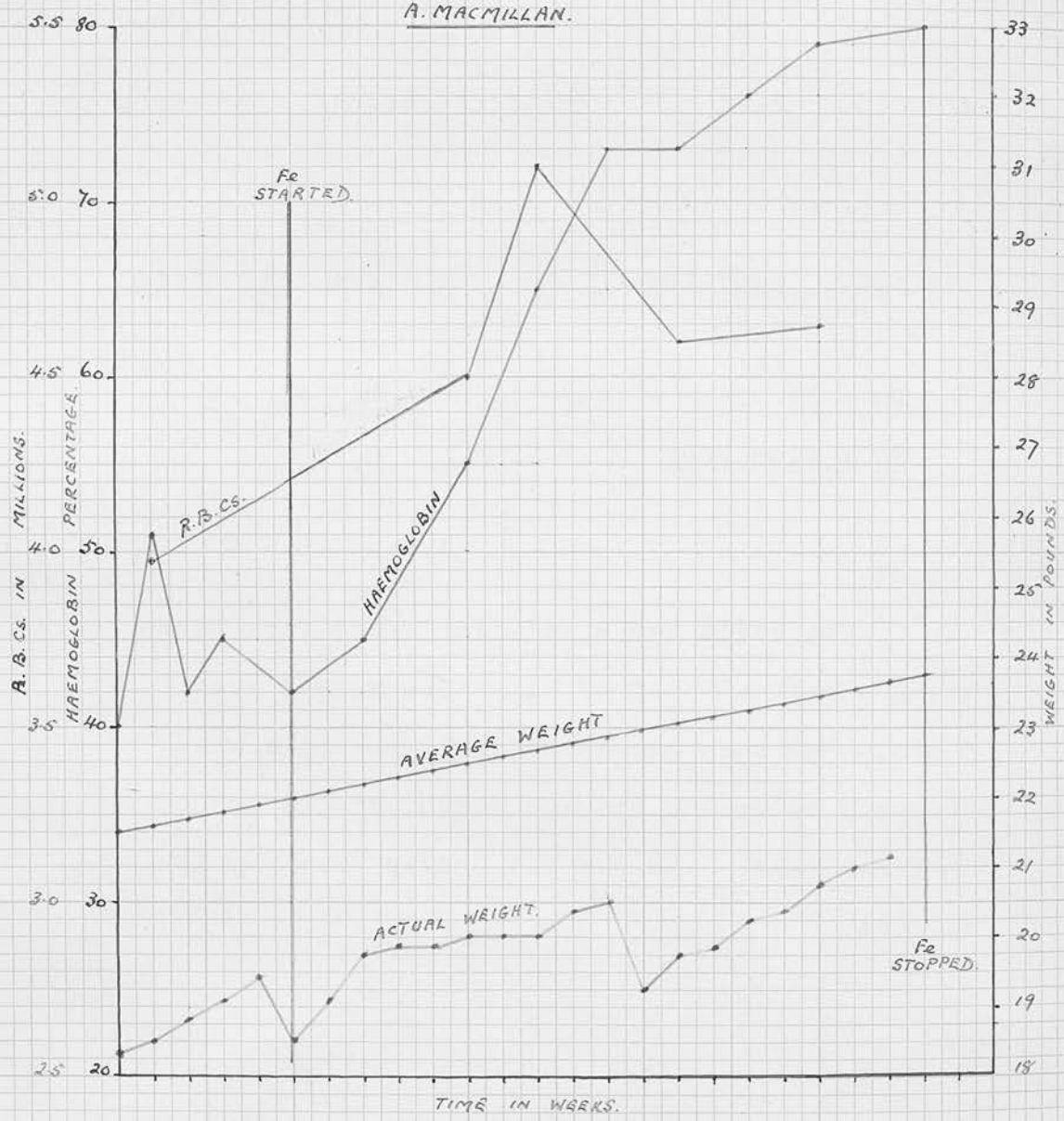
RESULT.

The child received treatment with ferrous salts for a period of $2\frac{1}{2}$ months. During that time the haemoglobin rose from 66 to 73 per cent and the general condition improved.

WEIGHT.

Before iron administration was started the weight curve was running exactly parallel to the normal weight curve but $2\frac{3}{4}$ pounds below it. Immediately after the iron treatment was commenced the weight curve began to rise more steeply and in five weeks the weight was only $\frac{3}{4}$ pound below the normal weight curve. This improvement in weight was not accompanied by any increased caloric intake and appears to be due to the iron.

A. MACMILLAN.



CASE XXXVI.

CASE NO. XXXVI

WESTERN GENERAL HOSPITAL.

ANGUS McMILLAN

Aet. $\frac{14}{12}$ Date of Birth - 20.7.31. Admitted - 17.8.31Full-time baby

HISTORY.

The child was artificially fed from birth. During the first year of life, the weight rose steadily but very slowly so that the child was considerably below the average weight at the end of the first year. He did not suffer from any infections.

EXAMINATION - 20.11.32

The child is small for his age but is bright and active. He is very pale, the skin having a transparent look. He has a cold in the head and some nasal discharge but there is no otorrhoea. There is no sign of rickets. The spleen is not enlarged.

DATE.	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
20.11.32	40					
30.11.32	51	3.97	Aniso & poikilo- cytosis. Poorly filled R.B.C.'s.	0.65		
6.12.32	42					
13.12.32	45					
27.12.32	42					
30.12.32						
4. 1.33					Ferrous chlor. gr. $\frac{1}{6}$ t.i.d.	
7. 1.33					" " " "	
11. 1.33	45				" " " "	
20. 1.33						
30. 1.33	55	4.50		0.61		Ferrous chloride given in solution.
14. 2.33	65					Has a 'cold'.
16. 2.33		5.10	W.B.C. 6,400.	0.65		
27. 2.33	73					
14. 3.33	73	4.6	Less anisococ- cytosis	0.79		Has some nasal discharge and 'cold in head' today.
28. 3.33	76					
11. 4.33	79					
14. 4.33		4.64				
1. 5.33	80					
4. 5.33						Making good progress. To City Hospital with chickenpox.

RESULT.

During a period of treatment with ferrous chloride lasting four months, the haemoglobin rose from 42 to 80 per cent. This was accompanied by an improvement in the general condition.

WEIGHT.

There was a fall in weight before the iron was started. The weight curve is satisfactory but the final weight is just as far below the average curve as before the fall in weight prior to iron therapy. The iron does not appear to have had any influence on the weight.

CASE NO. XXXVII

WESTERN GENERAL HOSPITAL

GEORGE EAGLE

Aet. 1 year.

Date of Birth - 28.11.31 Admitted - 9.12.31Full-time baby

HISTORY.

The child received artificial feeding after the third week and after some trouble the weight began to rise fairly satisfactorily. In October he developed osteomyelitis of the left femur and a redness and swelling of skin of the thigh which was so severe that the child was removed to the City Hospital with the diagnosis of erysipelas. Since re-admission on 15.11.32, he has made fairly good progress.

EXAMINATION - 6.12.32

He is rather pale and the nutrition is poor. He is about six pounds below the average weight for his age. The wound in left thigh has healed well. There is no otorrhoea. No other abnormality can be made out on examination.

DATE.	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6.12.32	65					
9.12.32	63					
18.12.32	68					
27.12.32	67					
30.12.32						
4. 1.33					Ferrous chloride. gr. $\frac{1}{2}$	t.i.d.
7. 1.33					" "	" "
14. 1.33	72				" "	" "
20. 1.33						
31. 1.33	67					
14. 2.33	70					
28. 2.33	64					
14. 3.33	69					

Has lost a little weight
this week.

Seborrhoea of scalp.
Ferrous chloride given in
solution.

Has had a bad cold.
Conjunctivitis.

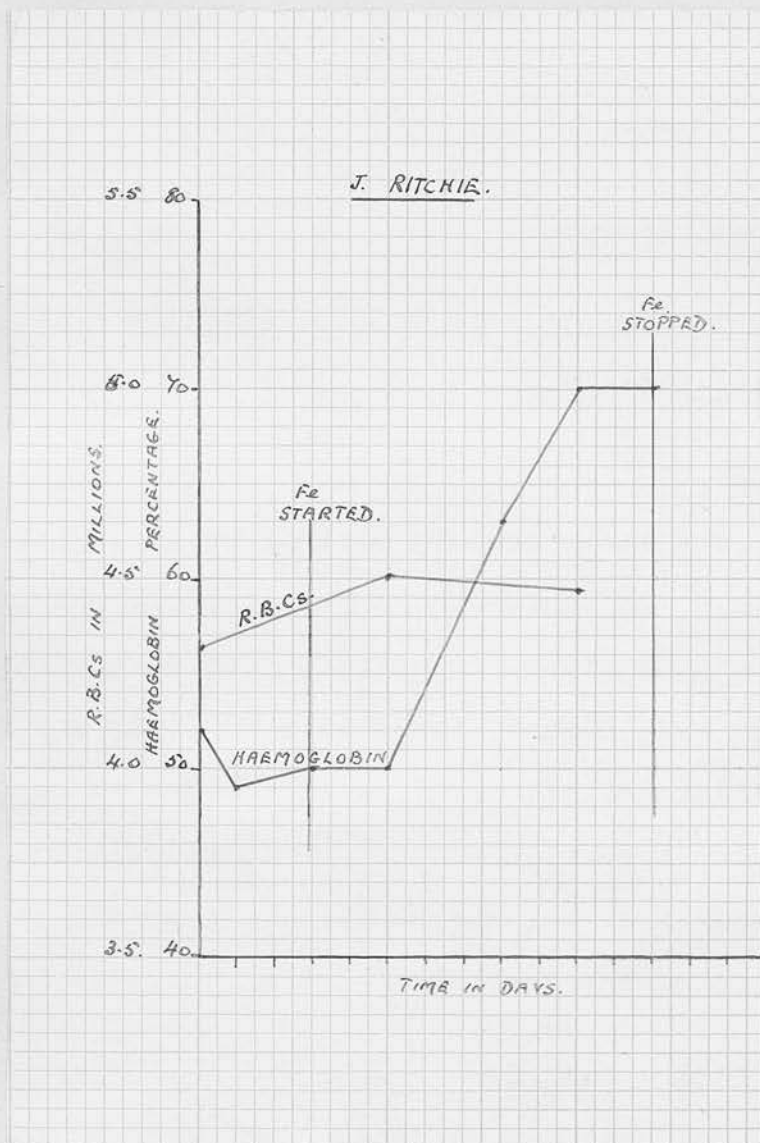
RESULT.

During a period of treatment with iron lasting $2\frac{1}{2}$ months, the haemoglobin rose from 67 to 69 per cent. This cannot be said to be of any significance as the gain might be due to experimental error.

WEIGHT.

For five weeks prior to iron therapy the average gain in weight is 3 ozs weekly. During four weeks after iron was started average gain is 5 ozs. weekly. This is the steepest part of the curve and is steeper than the normal curve. The child then developed a bad cold and conjunctivitis and this caused a fall in weight.

The iron seems to have influenced the weight favourably during the initial part of treatment.



CASE XXXVIII.

CASE NO. XXXVIII

WESTERN GENERAL HOSPITAL

JUNE RITCHIE

Aet. $1\frac{6}{12}$ Date of Birth - 15.6.31Admitted - 14.7.32Full-time twin.

HISTORY.

The early history of this child is not obtainable. On admission to hospital her nutrition was in a poor state. The epiphyses were enlarged, the ribs were headed, there were no teeth and the fontanelle admitted 2-3 fingers. The abdomen was not markedly enlarged. She received ostelin and later cod-liver oil and since admission the rickets has improved and there has been an increase in weight.

EXAMINATION - 6.12.32

The child is small and very much below the normal weight. She looks pale. Her head is large. The fontanelle is not yet closed and the epiphyses are enlarged. The abdomen is not enlarged. There is no enlargement of spleen. No otorrhoea.

Teeth $\frac{0}{1}$

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6. 12. 32	52	4.33		0.6	Ferrous chloride gr. $\frac{1}{8}$ t.i.d.	
14. 12. 32	49				" "	
28. 12. 32	50				" "	
30. 12. 32					" "	
4. 1. 33					" "	
7. 1. 33	50	4.5		0.55	" "	Has discharging nose. Patient moved to group A. Ferrous chloride continued in capsules.
11. 1. 33						
21. 1. 33						
31. 1. 33	63					
14. 2. 33	70	4.47	W.B.C. 10,200 Lymphocytes 58% Polymorphs 42	0.77		Looking much better. Her colour is better
27. 2. 33	70					Coughing a little; nose running.
1. 3. 33						Whooping quite definitely.

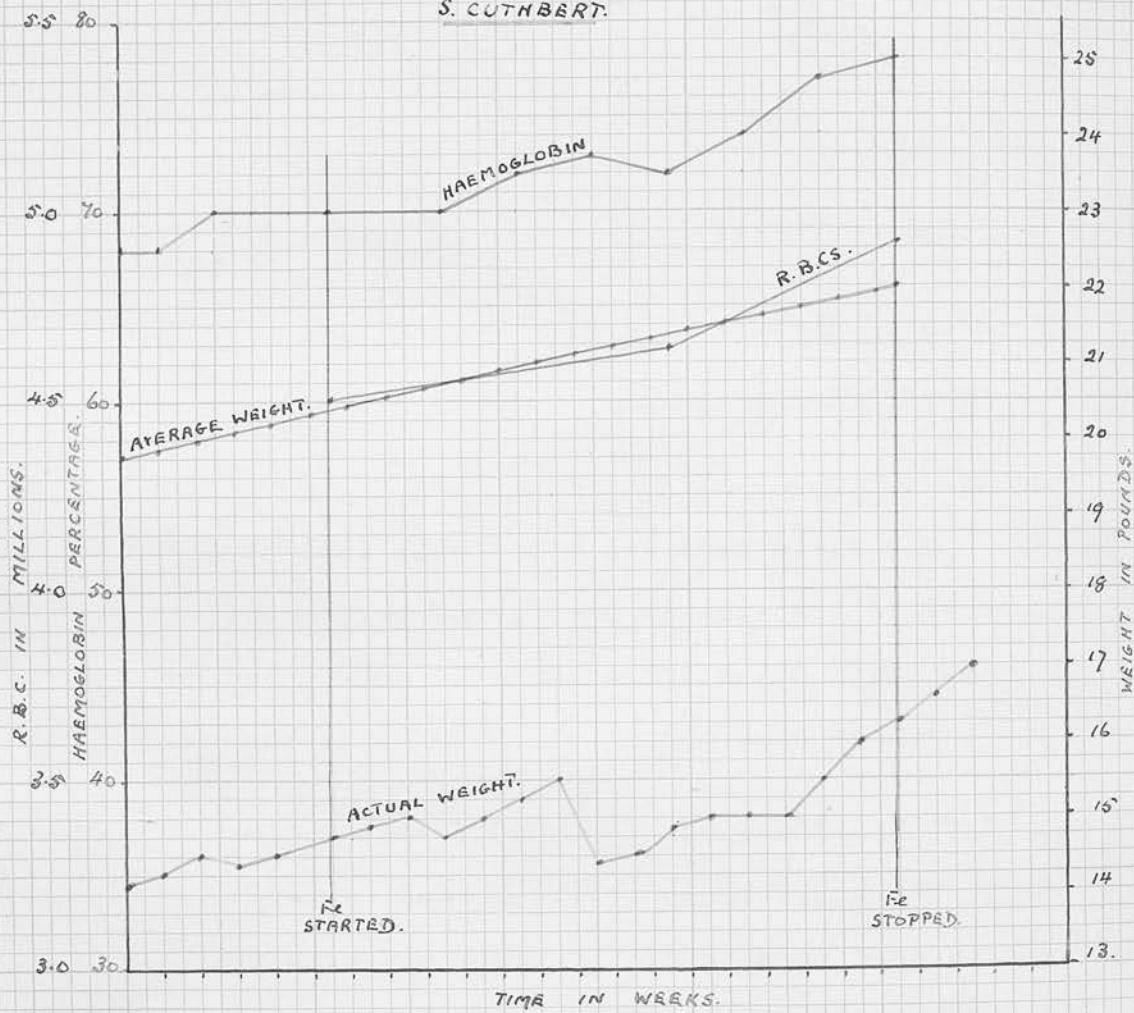
RESULT.

This patient had severe rickets and the anaemia may have been due to this or to iron deficiency. A diet deficient in anti-rackitic factors may well have been deficient in iron also. During a period of two months treatment with iron the haemoglobin rose from 50 to 70 per cent. and this improvement was accompanied by an improvement in colour and general condition.

WEIGHT.

Weights have not been recorded.

S. CUTHBERT.



CASE XXXIX.

CASE NO. XXXIX

WESTERN GENERAL HOSPITAL

SUSAN CUTHBERT

Aet. 1

Date of Birth - 1.12.31Admitted - 9.3.32Premature (one month)

HISTORY.

The child received artificial feeding after admission to hospital at the age of three months. She was always below the average weight. She had some otorrhoea this month.

EXAMINATION - 30.11.32

The child looks very pale and is very small. There is some bossing of the skull and some thickening of the costo-chondral junctions. The abdomen is rather swollen. The right ear is discharging slightly.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
30. 11. 32	68					
8. 12. 32	68					
17. 12. 32	70					
10. 1. 33	70	4.50	Some anisocytosis.	0.77	Ferrous chlor. gr. $\frac{1}{2}$ t.i.d. Ferrous chlor. given in solution.	
20. 1. 33						
30. 1. 33	70					
13. 2. 33	72					
20. 2. 33						
27. 2. 33	73					
14. 3. 33	72	4.63		0.78	CuSO ₄ added gr. $\frac{1}{50}$ t.i.d.	Some Blepharo-conjunctivitis. Whooping cough beginning Whooping cough still present.
27. 3. 33	74					
11. 4. 33	77					
28. 4. 33	78	4.92		0.79		Looking much better. Taking feeds well. Abdomen still swollen.

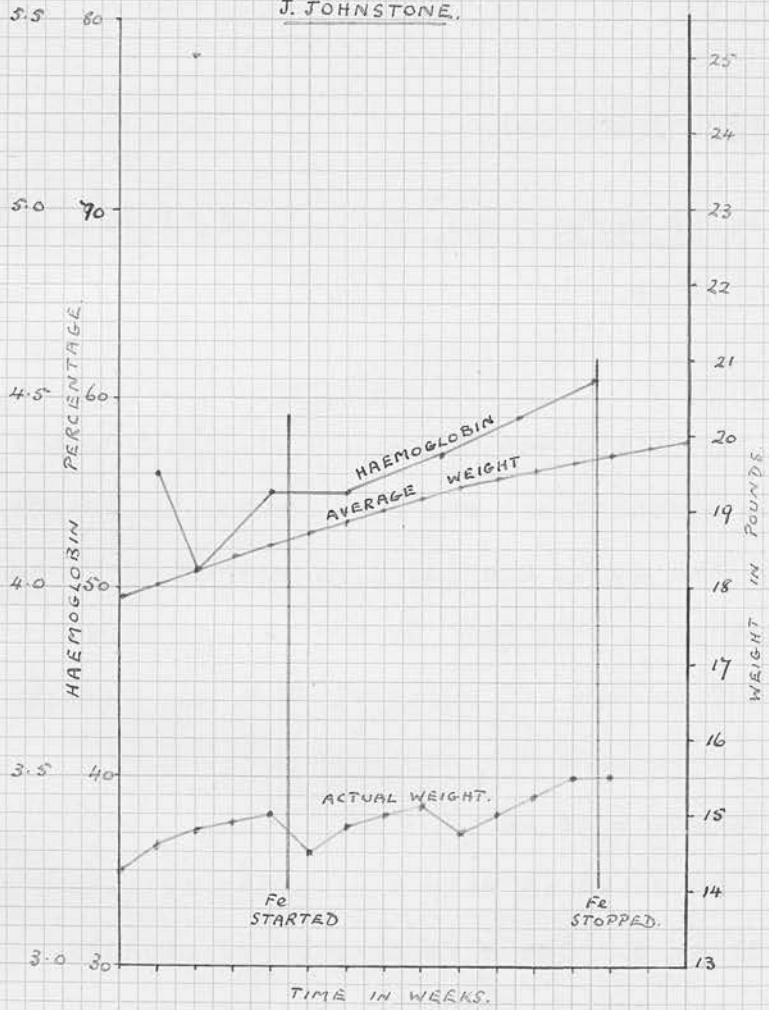
RESULT.

During a period of four months treatment with iron the haemoglobin rose from 70 to 78 per cent. The colour index rose from 0.77 to 0.79. Two and a half months passed before any response was obtained. This is probably to be explained by the infections from which the child suffered.

WEIGHT

The child was six pounds below weight and the gain in weight was very gradual both before and after the administration of iron. The iron did not appear to affect the weight.

J. JOHNSTONE.



CASE XL.

CASE NO. XL.

WESTERN GENERAL HOSPITAL

JAMES JOHNSTONE.

Aet. 9 months.

Date of Birth - 9.3.32Admitted - 9.3.32Full-time baby.

HISTORY.

The child was fed artificially from birth. For some months there was no increase in weight but from the 3rd month onwards, the weight curve is satisfactory. Except for some bronchitis in October 1933 he has not suffered from any infections.

EXAMINATION - 6.12.32

The child is very much under-weight. He is rather pale. There is no sign of rickets. No otorrhoea or other infection present.

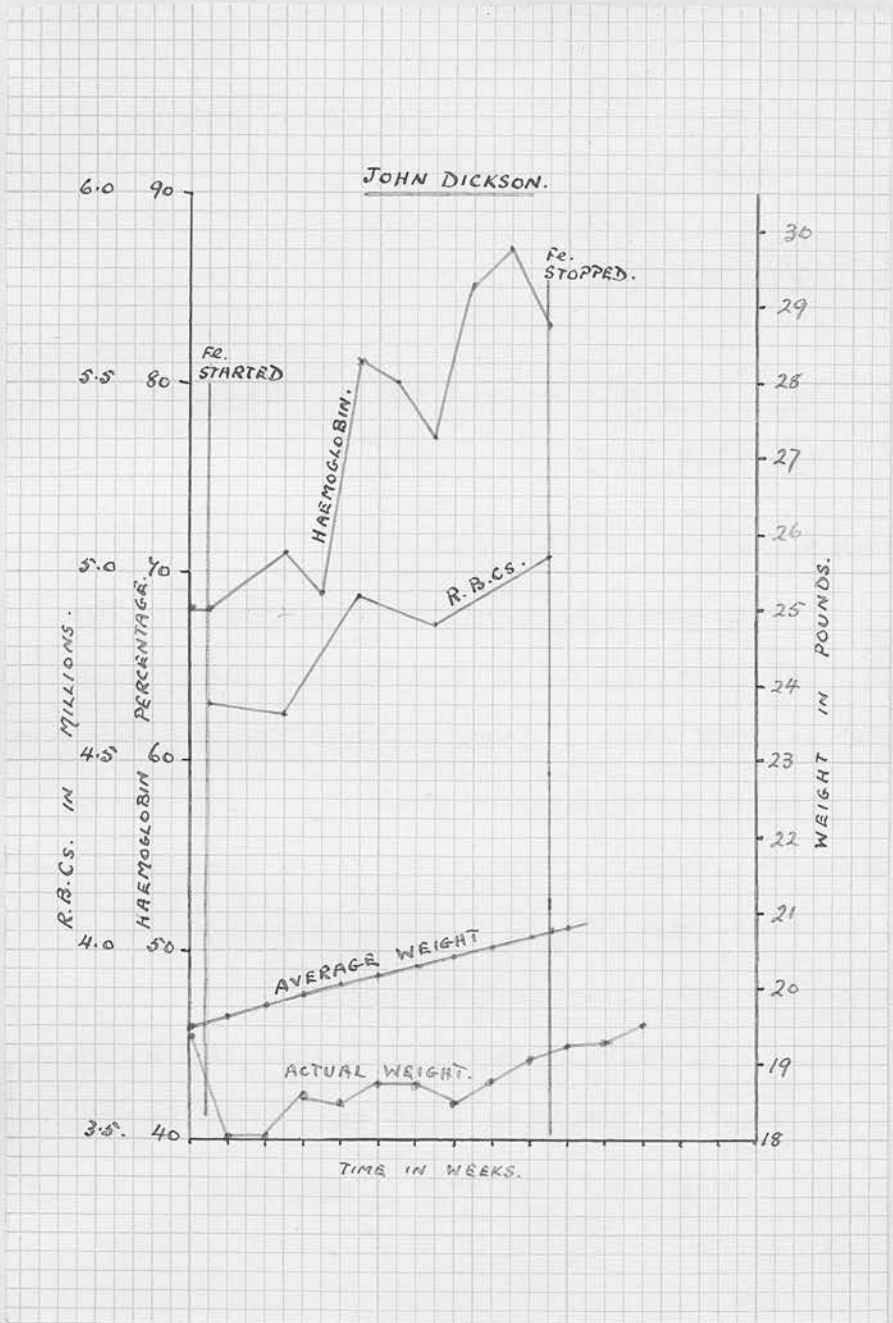
DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
6.12.32	56					
12.12.32	51			0.62		
27.12.32	55	4.20	Anisocytosis & poorly filled R.B.C's			
30.12.32					Ferrous Chlor. gr. $\frac{1}{2}$	Cold in nose
4. 1.33					" "	
7. 1.33					" "	
11. 1.33	55				" "	Cold much better. Ferrous chloride given in solution.
20. 1.33					" "	
30. 1.33	57					
13. 2.33	59					
27. 2.33	61					Discharged.

RESULT.

During a period of two months treatment with ferrous chloride gr. $\frac{1}{2}$ the haemoglobin rose from 55 to 61 per cent.

WEIGHT.

At the commencement of iron therapy the child was $3\frac{1}{2}$ pounds below the weight for his age. He did not gain in weight during period of treatment and at the end of that period he was four pounds below the average weight. Therefore iron did not have any beneficial effect on this child's weight.



CASE XLI.

CASE NO. XLI.

WESTERN GENERAL HOSPITAL

JOHN DICKSON

Aet. $1\frac{1}{12}$ Date of Birth - 11.9.32Admitted - 5.5.33Full-time baby.

HISTORY.

The early history is indefinite. The child was admitted to a hospital in Glasgow in November 1932 with bronchitis and there is no record of any other infection. Soon after admission to Western General Hospital, the child developed septic spots on abdomen. An abscess developed in right humerus in June 1933 and this had to be opened and drained. In July he developed whooping cough and was sent to the City Hospital. On re-admission he looked very pale but soon began to gain in weight again.

EXAMINATION - 13.10.33

The child looks rather pale but is fairly well nourished. He has some otorrhoea. No abnormality can be made out on examination. The spleen is not enlarged.

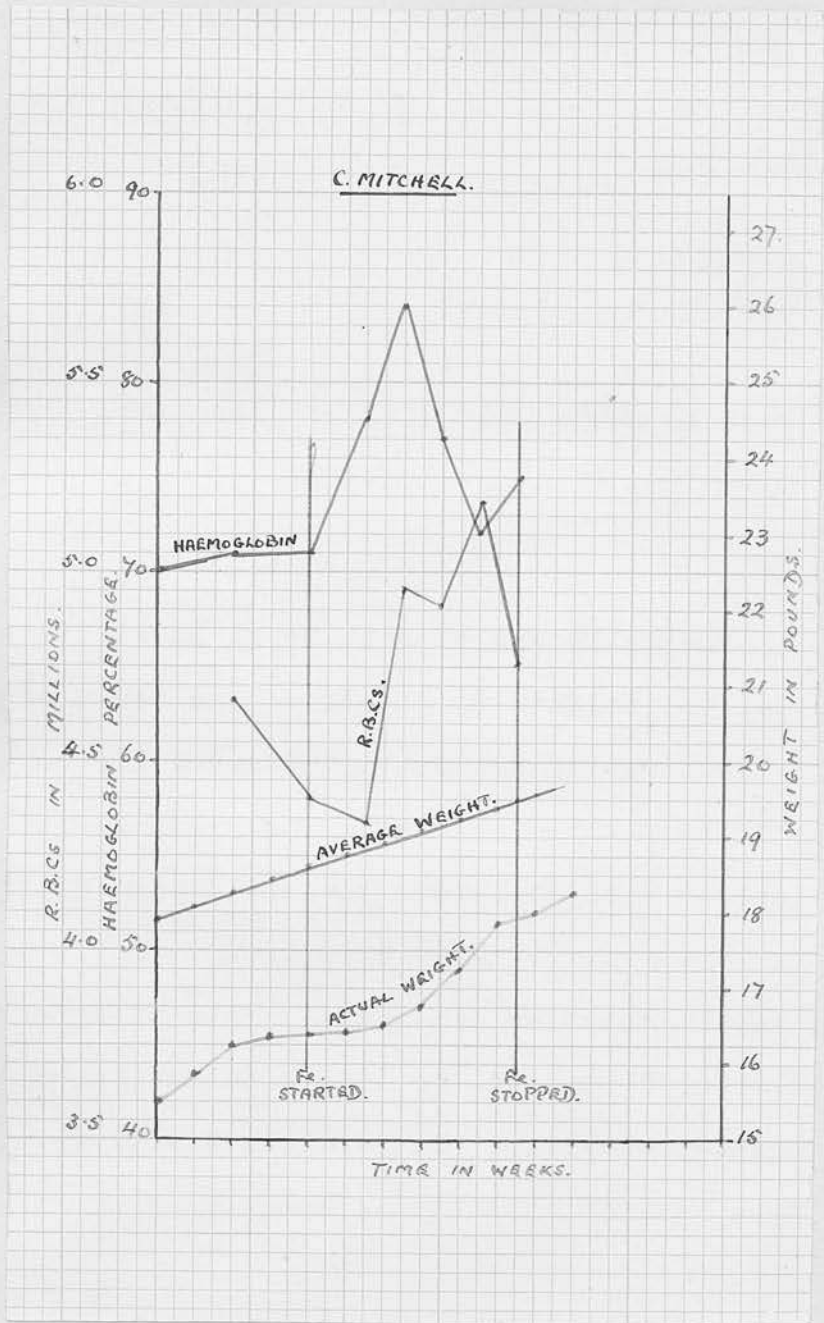
DATE.	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
13.10.33	68					
16.10.33	68	4.65	Rather poor filling of R.B.C.'s	0.73		Otorrhoea clearing up.
17.10.33					Ferrous Amon. Sulph. gr. i t.i.d.	
2.11.33	71	4.62		0.77		
9.11.33	69				Dose increased to gr. ii t.i.d.	
16.11.33	81	4.93		0.82		
23.11.33	80					Has had some vomiting this week. May be due to iron Vomiting stopped.
30.11.33	77	4.86		0.79		Doing well; no otorrhoea.
7.12.33	85					
15.12.33	87					
22.12.33	83	5.04		0.83		

RESULT.

This child received treatment with Ferrous Ammonium Sulphate grs. ii for 10 weeks. During this period, the haemoglobin rose by 15 per cent and R.B.C.'s by 400,000. There was also improvement in the general health of the child.

WEIGHT.

The child was $1\frac{1}{2}$ pounds below the average weight curve both before and after treatment. Iron did not have any influence on the weight in this case.



CASE XLII.

CASE NO. XLII.

WESTERN GENERAL HOSPITAL

CHRISTINA MITCHELL

Aet. $\frac{9}{12}$ Date of Birth - 12.1.33Admitted - 12.8.33Premature child (one month)

HISTORY.

The child was born in Royal Maternity Hospital and weighed $5\frac{1}{2}$ pounds. She received breast-feeding for one month and since then she has been bottle-fed. She has not had any infectious diseases. When admitted, the child was fairly well-nourished but not in good condition. There were many septic spots on the body. Soon after admission she developed pain in the left side and the urine contained pus cells. The diagnosis of pyelitis was made and the condition responded to treatment. On 20.9.33 a seborrhoeic condition of the scalp was noticed. This is now better.

EXAMINATION - 16.10.33

The child looks rather pale but is fairly well-nourished. Her weight is about 2 pounds below the average weight curve. There is no otorrhoea, the stools are normal, the urine is free from pus. No abnormality can be made out on examination. The spleen is not palpably enlarged.

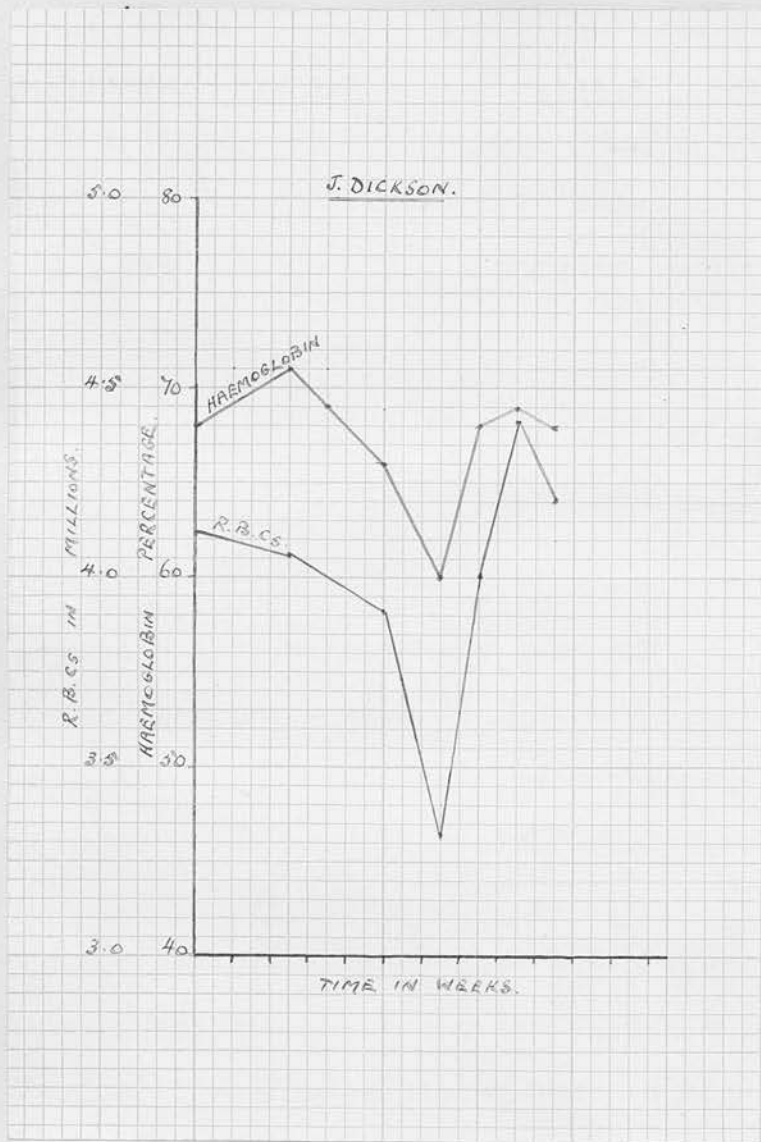
DATE.	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
16.10.33	70	4.66		0.76		
28.10.33	71	4.40		0.80		
10.11.33	71		slight anisocytosis. Poor filling of R.B.C.'s		Ferr. Ammon. Sulph. gr.i t.i.d.	Weight increasing.
20.11.33	78	4.37		0.89		General condition good.
28.11.33	84	4.95		0.85		General condition improved.
4.12.33	77	4.91		0.79		Taking food quite well.
11.12.33	72	5.19		0.70		Weight has gone up.
19.12.33	75	4.79		0.78		

RESULT.

During a period of two months treatment with Ferrous Ammonium Sulphate, the haemoglobin rose by 4 per cent.

WEIGHT.

At the commencement of iron therapy, the child was 2 pounds below the average weight curve. At the conclusion of treatment, she was $1\frac{1}{2}$ pounds below the average weight curve. The iron had a beneficial effect on the weight in this case.



CASE XLIII.

CASE NO. XLIII.

WESTERN GENERAL HOSPITAL

JAMES DICKSON

Aet. $\frac{6}{12}$ Date of Birth - 11.4.33 Admitted - 11.4.33Full-time baby.

HISTORY.

The baby was born in this hospital. The mother was healthy but very young and rather poorly developed. Breast-feeding was started but owing to inability of mother to feed the child, supplementary feeds were commenced twelve days after birth. Five weeks after birth, the child was taken off the breast and since then has been difficult to feed. The child has not gained weight satisfactorily and is much underweight. There is no history of any infections.

EXAMINATION - 10.10.33

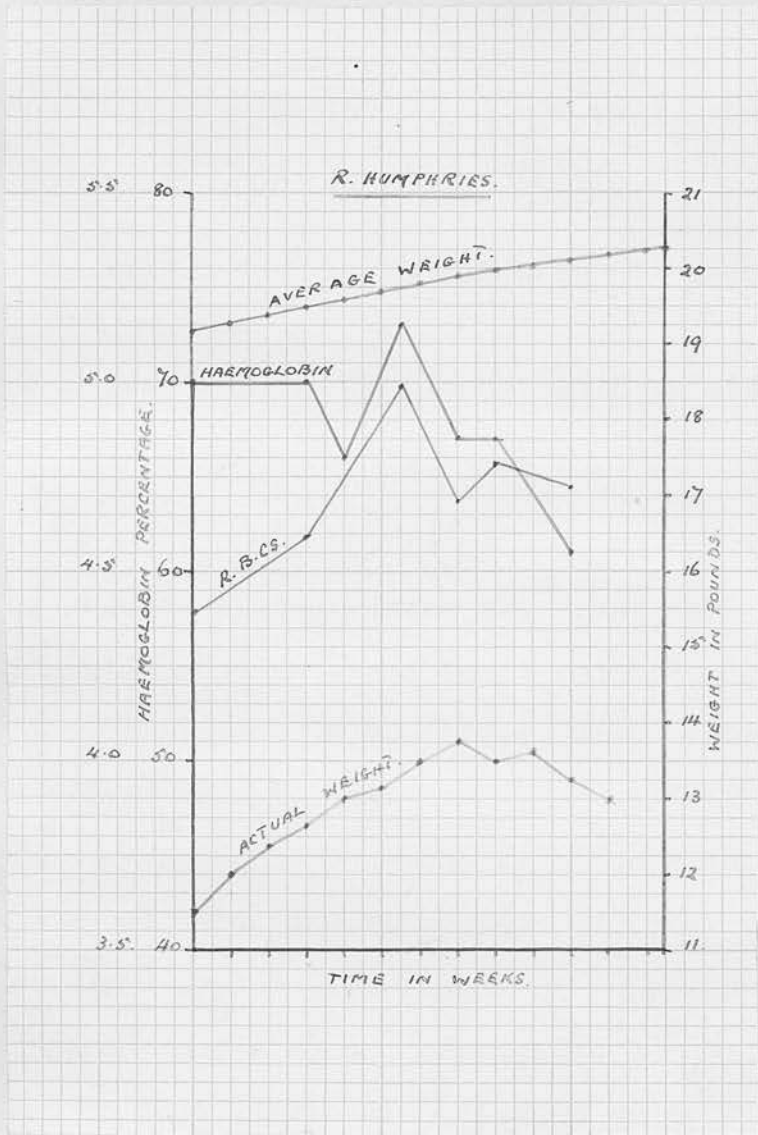
The child is very poorly nourished but no abnormality can be made out on examination.

R.B.C. in MILLIONS. C.I. DRUG PROGRESS NOTES.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
11.10.33	68	4.12	Some anisocytosis and poor filling of red corpuscles	0.8		The child is taking feeds much better.
28.10.33	71	4.06		0.88		
6.11.33	69			0.84		
17.11.33	66	3.91		0.9		
27.11.33	60	3.31		0.85		
4.12.33	68	4.03		0.78		
11.12.33	69	4.42		0.81		
19.12.33	68	4.20				

RESULT.

This child was used as a control. During the period of observation which lasted nine weeks there was no change in either haemoglobin or R.B.C. count.



CASE XLIV.

CASE NO. XLIV.

WESTERN GENERAL HOSPITAL

ROBERT HUMPHRIES

Aet. $\frac{9}{12}$ Date of Birth - 3.12.32Admitted - 21.1.33Full-time baby.

HISTORY.

The child was poorly nourished when admitted. For the first three weeks of life, the child was on the breasts but since then he has been on the bottle. He was difficult to feed and the weight remained stationary for some time. He was sent to Victoria Park House and began to gain weight there. He was re-admitted to this hospital on 8.7.33 and continued to gain weight until vaccination on 23.9.33. Since 7.10.33 he has been quite well. No history of infections.

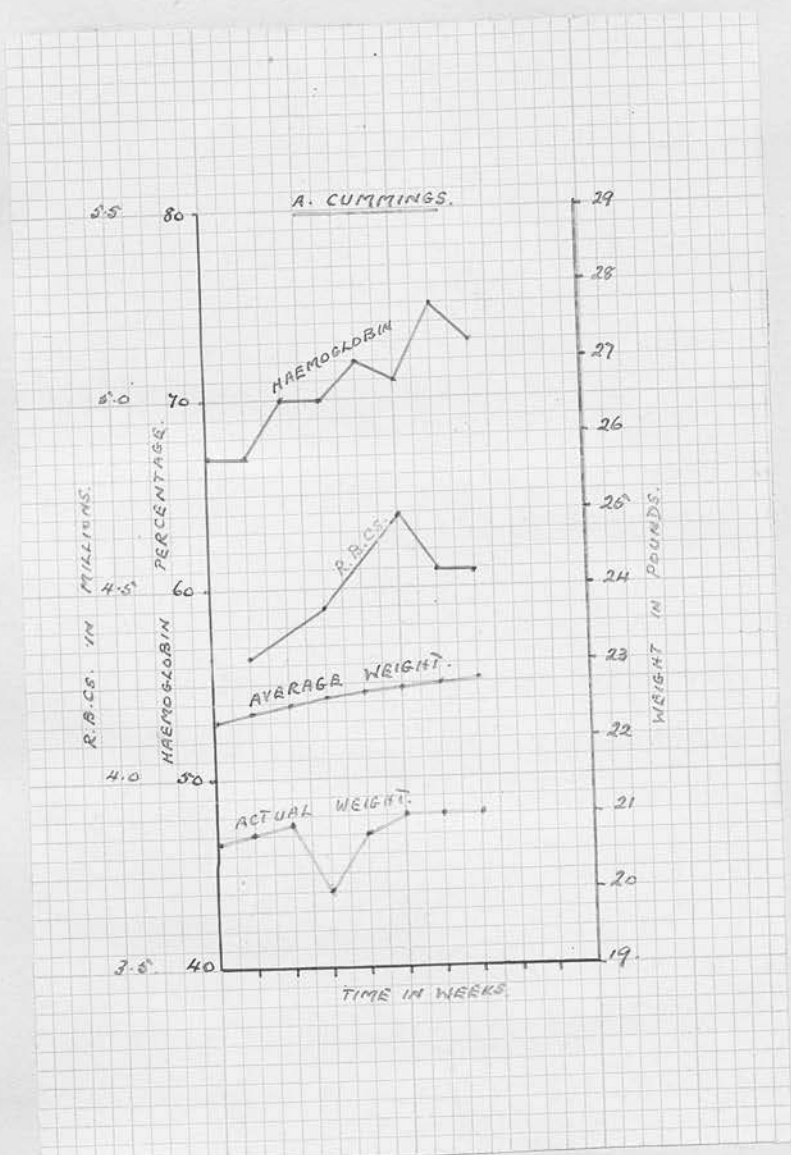
EXAMINATION - 10.10.33

The child is rather pale and is under weight but otherwise he appears to be well. There is no enlargement of spleen.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
10.10.33	70	4.39	No abnormality except for poor filling of red cells.	0.8		
11.10.33	70	4.59		0.76		
30.10.33	66	4.99		0.74		The child is taking food well.
6.11.33	73	4.69		0.71		
17.11.33	67	4.79		0.70		He looks very pale. Clinically HB. level of below 61 would be expected.
27.11.33	67	4.72		0.64		
4.12.33	61					
19.12.33						

RESULT.

This child was observed for nine weeks. During this period the haemoglobin fell 9 per cent and there was a slight rise in R.B.C count.



CASE XLV.

CASE NO. XLV.WESTERN GENERAL HOSPITAL

ANDERSON CUMMINGS

Aet. $\frac{16}{12}$ Date of Birth - 30.4.32Admitted - 11.10.33Full-time baby.

HISTORY.

The child was bottle-fed and has always been fairly healthy. Details of the early history are not obtainable. He had chickenpox in June 1933 and there is no record of any other infections.

EXAMINATION - 2.11.33

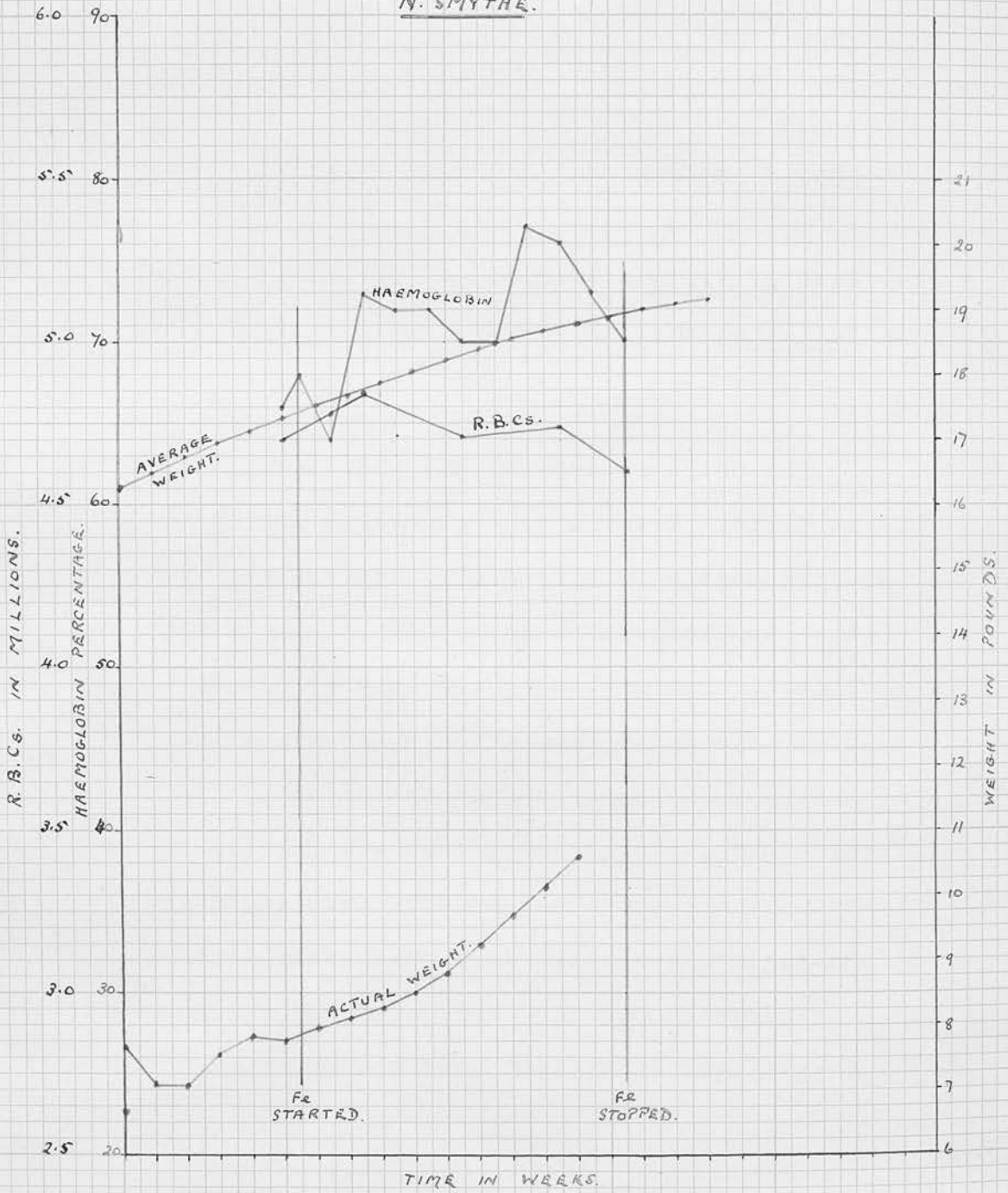
The child looks healthy and he is fairly well nourished. There is no abnormality to be made out. No nasal discharge or otorrhoea.

DATE	HB.	R.B.C. in MILLIONS.	FILM	C.I.	DRUG	PROGRESS NOTES.
2.11.33	67	4.32	Some anisocytosis.	0.78		Taking food well.
9.11.33	67	4.45		0.78		
16.11.33	70	4.69		0.75		
23.11.33	70	4.55		0.82		
30.11.33	72	4.54		0.81		
7.12.33	71					
14.12.33	75					
22.12.33	73					

RESULT.

During the period of 7 weeks observation the haemoglobin rose by 6 per cent and the R.B.C count by 200,000.

N. SMYTHE.



CASE XLVI.

CASE NO. XLVI.

VICTORIA PARK HOUSE.

NESSIE SMYTHE

Aet. $\frac{8}{12}$ Date of Birth - 13.2.33Admitted - 17.6.33Full-time baby

HISTORY.

The child is said to have been small and puny at birth. Details of the feeding during the first four months of life are not available. On admission to Victoria Park the nutrition was very poor indeed, the child weighing only $4\frac{3}{4}$ pounds. Except for the great emaciation there was no actual abnormality to be made out on examination. Since admission she has been bottle-fed and for the first two months there was a satisfactory gain in weight. On 22nd August, the child developed gastro-enteritis and this lasted until the third week of September. During this period she lost some weight, but is now gaining again. She has not had any other infections

EXAMINATION. - 11.10.33

The child is very emaciated and weighs only seven pounds. She is quite bright. There is no otorrhoea. No abnormality can be made out on examination. The spleen is not enlarged. As the child is coloured, it is not possible to detect pallor.

DATE	HB.	R.B.C. in MILLIONS	FILM	G.I.	DRUG	PROGRESS NOTES.
11.10.33	66	4.70				Taking feeds well.
13.10.33	68					
17.10.33						
20.10.33	64	4.78	Poorly filled red cells. Some variation in size.	0.67	Ferr. Am. Sulph. gr.i t.i.d	Has some cough. Has not gained in weight this week. Decided improvement. Now taking feeds very well.
27.10.33	73	4.85		0.75		Making good progress. She has now made up the weight lost during September
3.11.33.	72					Satisfactory gain in weight Still gaining in weight.
10.11.33	72					
17.11.33	70	4.71		0.74		
24.11.33	70					
1.12.33	77					
8.12.33	76	4.74		0.80		Still gaining in weight.
15.12.33	73					
21.12.33	70	4.60		0.76		Has discharging nose.

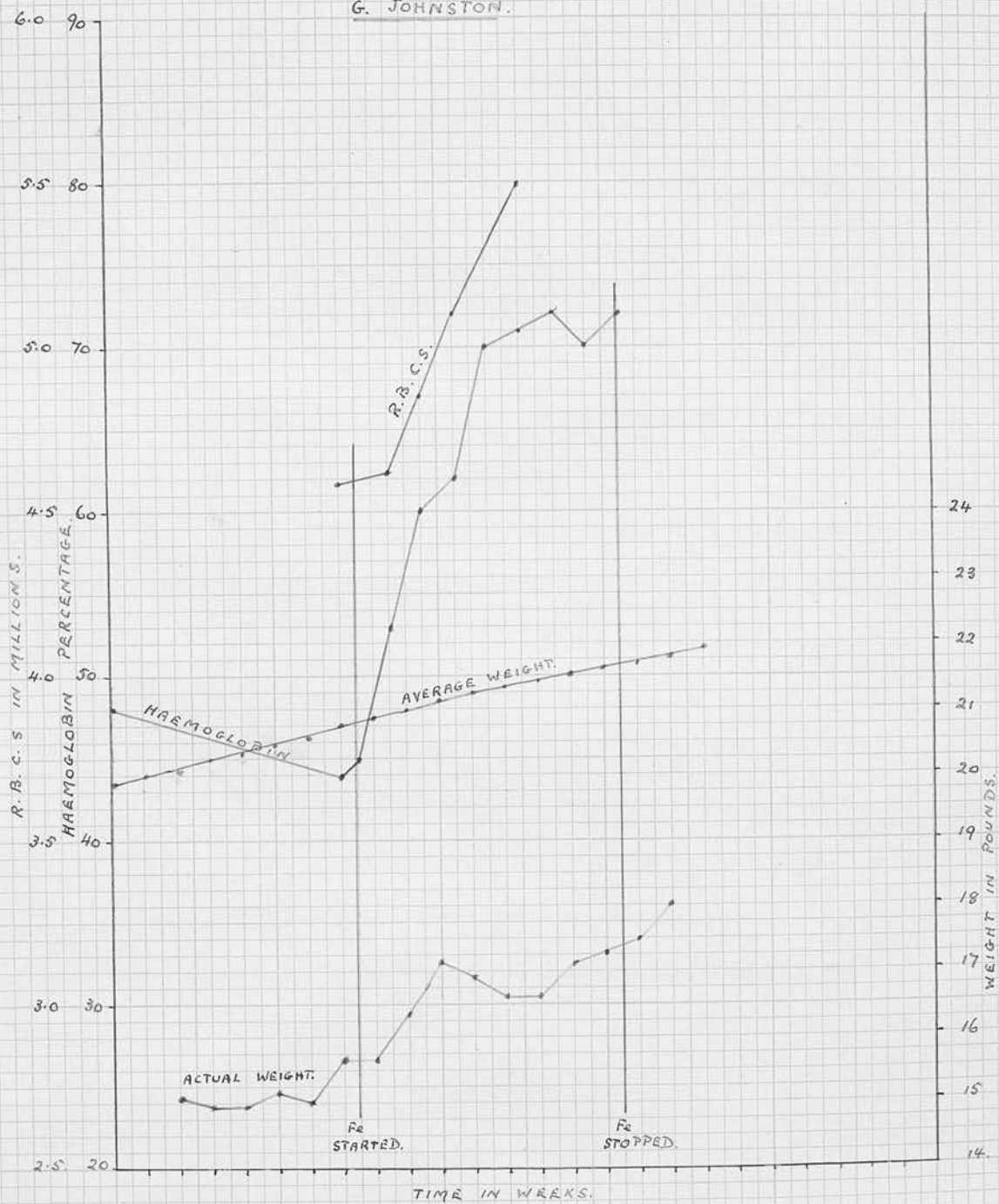
RESULT.

This child received treatment with ferrous ammonium sulphate gr. i over a period of 9 weeks. During the first 7 weeks the haemoglobin rose by 8 per cent. This improvement was not maintained as the child developed otitis media.

WEIGHT.

At the commencement of iron therapy this child was $9\frac{1}{2}$ pounds below the average weight curve. At the conclusion of treatment she was $8\frac{1}{2}$ pounds below the average weight curve. The iron appears to have had some influence on weight in this case.

G. JOHNSTON.



CASE XLVII.

CASE NO. XLVII.

VICTORIA PARK HOUSE.

GEORGINA JOHNSTON

Aet. $1\frac{2}{12}$ Date of Birth - 15.8.32. Admitted - 30.8.33.Full-time Baby.

HISTORY.

The child was breast-fed from birth until one month old. From then until 8 months the feeding was with diluted cow's milk. The child was weaned at 8 months. She has not had any severe illnesses. She has been pale for some time and was seen by me at Leith day nursery on 25 August, 1933. At that time the haemoglobin was 48 per cent.

On 28th August, the child was not well and had a temperature of 104° . This continued and on 30th August, she was transferred to Victoria Park House. She was fretful and vomited copiously but nothing could be made out on examination. The temperature gradually subsided, the vomiting ceased and on 27th September the weight began to rise again and it has continued to increase since.

EXAMINATION - 11.10.33

The patient looks pale. The general nutrition is poor and she is $4\frac{1}{2}$ lbs. below the average weight for her age. The skin is rather dry. There is no sign of rickets. The fontanelle is closed. Teeth $\frac{2|2}{2|2}$. There is no enlargement of either liver or spleen. No abnormality can be made out on examination.

DATE	HB	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES
25. 8.33	48					
11.10.33	44					
13.10.33	45	4.58	Considerable anisocytosis and poor filling of red cells	.49		In Leith Day Nursery. In Victoria Park. Weight not going up this week.
17.10.33						
20.10.33	53	4.62		.57	Ferrous Amm. Sulph. gr.i t.i.d.	
27.10.33	60	4.85		.60		Taking food well. Satisfactory gain in weight.
3.11.33	62	5.10		.60		Improvement generally. Weight increasing.
10.11.33	70					Weight stationary this week
17.11.33	71					Coughing ? whooping.
24.11.33	72	5.49		.64		Definitely whooping-cough. Appetite good. Weight stationary.
1.12.33	70					Getting on fairly well.
8.12.33	72					Still whooping
15.12.33						Has been discharged.

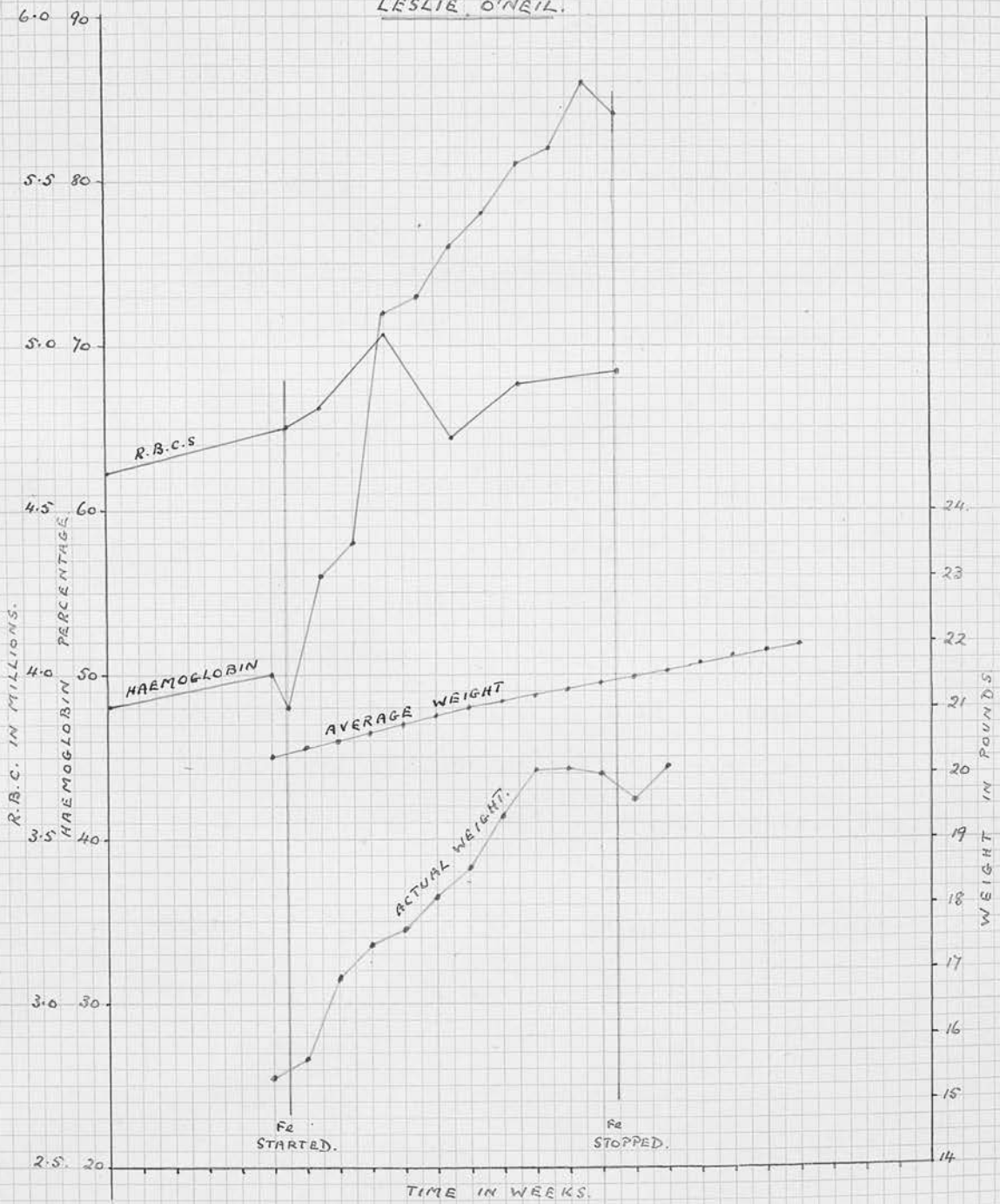
RESULT.

This child received 9 weeks treatment with Ferrous Ammonium Sulphate. During the first 4 weeks she gained 27 per cent haemoglobin and further gain was prevented by the child developing whooping-cough. The R.B.C. increased by 900,000.

WEIGHT.

Before iron was started, the weight was parallel to average weight curve but 5 lbs. below it. At conclusion of iron therapy, the child was 4 lbs. below the average curve. Iron had a beneficial effect on the weight.

LESLIE O'NEIL.



CASE XLVIII.

CASE NO. XLVIII.

VICTORIA PARK HOUSE.

LESLIE O'NEIL

Aet. 1 $\frac{1}{12}$ Date of Birth - 9.9.32 Admitted 9.10.33.Full-time Twin.

HISTORY.

The child weighed 5 lbs. 12 ozs. at birth. He has been breast-fed and is at present on a mixed diet. There is no record of previous infections. On 8.9.33, he was seen by me in Western General Hospital. At that time his haemoglobin was 48 per cent and red cells 4,610,000. The child vomited his feeds a great deal and he was moved to Victoria Park House.

EXAMINATION - 11.10.33.

The patient is very pale. The eyes are sunken and the skin dry and pinched. The state of nutrition is not good and he is $4\frac{1}{2}$ lbs. below the average weight. There is no sign of rickets. There is no enlargement of either liver or spleen. No otorrhoea. No other abnormality noticed. There is slight greenness of motions.

DATE	HB	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES
8. 9.33	48	4.61	Very small R.B.Cs. Some aniso-cytosis. No nucleated R.B.Cs.	.52		In Western General Hospital.
11.10.33	50					In Victoria Park House. Some vomiting.
13.10.33	48	4.76		.50	Ferrous Am. Sulph. gr. i t.i.d.	Motions normal. Not sleeping well.
17.10.33	56	4.82		.58		Taking food well. Weight going up.
20.10.33	58					No sickness. Satisfactory increase in weight.
3.11.33	72	5.04		.72		His colour is much improved. Satisfactory increase in weight.
10.11.33	73					Now up and playing part of day. Good progress.
17.11.33	76	4.72		.80		Good general improvement.
24.11.33	78					

1.12.33	81	4.87	Red cells are larger and there is less anisocytosis	.83	Colour much improved.
8.12.33	82				Pallor gone. Colour in cheeks.
15.12.33	86				Very lively.
21.12.33	84	4.92		.85	

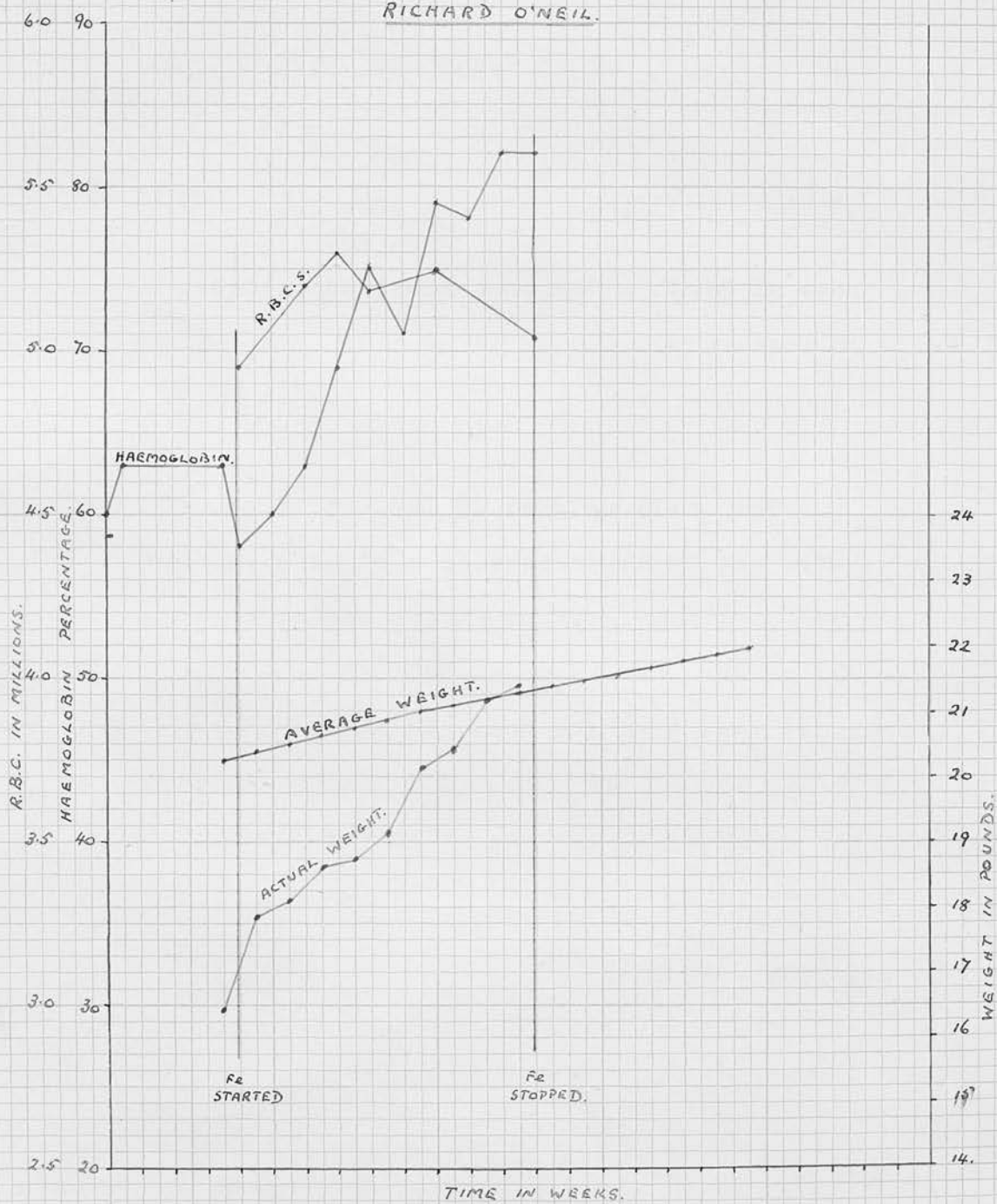
RESULT.

This child received $2\frac{1}{4}$ months treatment with Ferrous Ammonium Sulphate grs. i t.i.d. During this time the haemoglobin rose by 36 per cent and R.B.Cs. by 300,000.

WEIGHT.

The child was $4\frac{3}{4}$ lbs. below the average weight curve at the commencement of the period of iron therapy. At the conclusion he was $1\frac{1}{4}$ lbs. below the average weight curve. Iron appears to have had a beneficial effect on the child's weight but some increase in weight is also due to the better conditions under which the child was placed.

RICHARD O'NEIL.



CASE XLIX.

CASE NO. XLIX.VICTORIA PARK HOUSE.

RICHARD O'NEIL

Aet. $1\frac{1}{12}$ Date of Birth - 9.9.32 Admitted 9.10.33.

Full-time Twin.

HISTORY.

The child weighed $6\frac{3}{4}$ lbs. at birth. He was breast-fed and is at present on a mixed diet. There is no record of the patient having had infections. On 14.9.33, he was seen by me in Western General Hospital. At that time the haemoglobin was 60 per cent and the red count 4,447,000. Difficulty was experienced with the feeding and the child was moved to Victoria Park.

EXAMINATION - 11.10.33.

The patient has marked pallor of the face. The nutrition is very poor but the child is only 2 lbs below the average weight. There is no sign of rickets. There is no enlargement of spleen or liver. No other abnormality was noticed.

DATE	HB	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES
14. 9.33	60	4.447	Some anisocytosis. Poor filling up of red cells.	.68		In Western General Hospital
18. 9.33	63					
11.10.33	63					
13.10.33	58	4. 95		.59	Ferr. Amm. Sulph. Gr. i t.i.d.	In Victoria Park
17.10.33						
20.10.33	60					
27.10.33	63	5. 20		.60		Cold in head.
3.11.33	69	5. 30		.65		Motions not well digested. Cold now gone. Still some cough. Very active.
10.11.33	75	5. 19		.72		Taking food well. Weight is increasing.
17.11.33	71					Good general progress.
24.11.33	79	5. 25		.75		Weight is now up to average for age.
1.12.33	78					Looking much better.
8.12.33	82					Colour in cheeks.
15.12.33	82	5. 04		.81		Very well.
16.12.33						Has developed rash. To City Hospital with scarlet fever.

RESULT.

This child received treatment with Ferrous Ammonium Sulphate over a period of two months. During this time, the haemoglobin rose 24 per cent and Red Blood Corpuscles 100,000.

WEIGHT.

At the commencement of iron therapy the child was $3\frac{1}{4}$ lbs. below the average weight curve and at the conclusion the weight was equal to the average weight. Iron had a beneficial effect on the weight in this case but part of the gain in weight was due to the better conditions under which the child was placed.

CASE NO. L.

VICTORIA PARK HOUSE.

GORDON REIDAet. $1\frac{4}{12}$ Date of Birth - 9.7.32 Admitted - 28.10.33.Premature Baby (One Month)

HISTORY.

The child was partly breast fed and partly artificially fed. He takes his food well but does not put on weight. There is no record of any infections. He has been pale for some months. He has a bad cough.

EXAMINATION - 3.11.33.

The child is pale, the nutrition is poor. The fontanelle admits two fingers. The tonsils are both enlarged. There is no sign of rickets. There is no otorrhoea, but some discharge from the nose. There are a few rhonchi audible in the chest.

DATE	HB	R.B.C. in MILLIONS	FILM	RETICULO-CYTES	C.I.	DRUG	PROGRESS NOTES
3.11.33	51						
10.11.33	51	4.78	Small cells. Some poikilocytes Poorly filled R.B.Cs.		.53		Taking feeds quite well and is quite happy.
17.11.33	51				.50		Slight gain in weight.
24.11.33	48	4.8		3%			
27.11.33	49			2%			
1.12.33	48	4.97	Cells are small. Anisocytosis & poikilocytosis marked. W.B.C. 18,500	5%	.49	Ferr. Ammon. Sulph. grs i t.i.d.	Taking food well but there is no increase in weight.
8.12.33				3%			
9.12.33				2.5%			No ill-effects of iron.
10.12.33				3.2%			
11.12.33				7.8%			
12.12.33				6.0%			
13.12.33				5.8%			
14.12.33		1		7.7%			
15.12.33	55			6.8%			
16.12.33		5.44		4.3%	.51		
17.12.33				4.6%			
18.12.33				7.0%			
19.12.33				4.5%			Cough better, he looks well.

20.12.33	58	5.36	W.B.C. 11,750	8.0%	.51	
21.12.33	59	5.50		5.9%	.54	Dose Ferr. Ammon. Sulph increased ad grs. ii t.i.d.
28.12.33						Cough has developed again.
4. 1.34	59	5.39			.54	He looks well
11. 1.34	65	5.29			.61	Has good colour in cheeks.
18. 1.34	68	5.48			.62	Looks well but has not gained in weight.
25. 1.34	70	5.34		1.9%	.65	

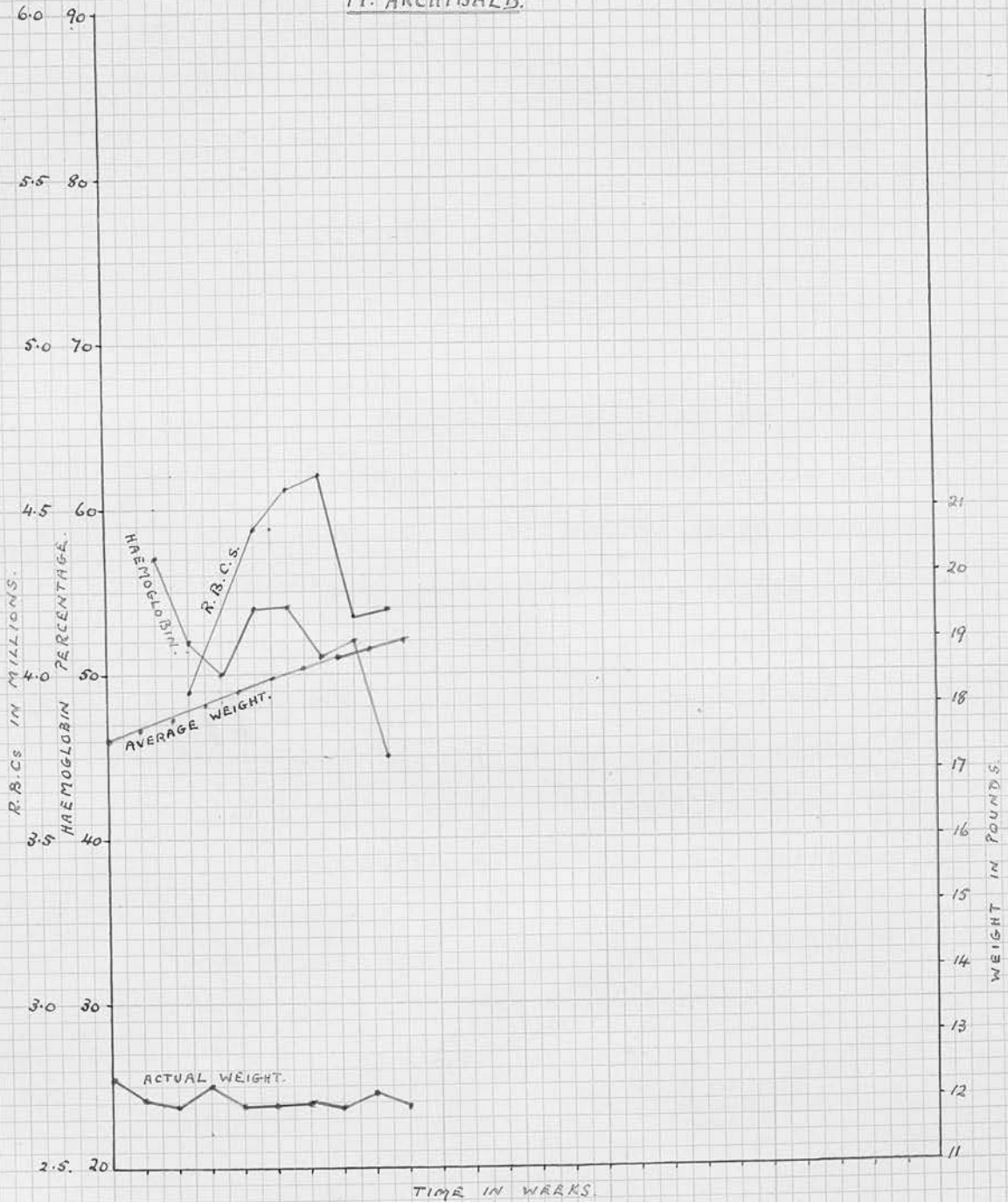
RESULT.

The child was kept under observation for five weeks. During that period he was used as a control child. There was no appreciable change in the haemoglobin or red count. Reticulocytes were found to be at a rather high level before iron was started. The child was then given Ferrous Ammonium Sulphate gr. i t.i.d. and the reticulocyte count rose on 4th day and persisted at a high level for some time. The rise of haemoglobin was not very rapid but it rose from 48% to 70% in 7 weeks. The red corpuscles increased in number soon after the iron was started there being an increase of 400,000 in the 7 weeks.

WEIGHT.

At the commencement of iron therapy, the child was 7 lbs. 10 ozs. below the average weight curve. At the conclusion of treatment he was 7 lbs. 6 ozs. below this curve. The iron does not appear to have had any influence on the weight.

M. ARCHIBALD.



CASE LI.

CASE NO. LI.

VICTORIA PARK HOUSE.

MARION ARCHIBALD

Aet. $\frac{9}{12}$ Date of Birth - 21.3.33 Admitted - 28.10.33.Full-time Baby.

HISTORY.

The child has always been artificially fed. She had bronchitis when three weeks old. She had bronchitis again two months ago and was in the Royal Hospital for Sick Children then. On admission, the nutrition was poor and she had a troublesome cough. She is inclined to be constipated. She takes her food fairly well and the weight has been increasing until the last fortnight. Recently the child has been cutting teeth and has been fretful.

EXAMINATION - 8.12.33.

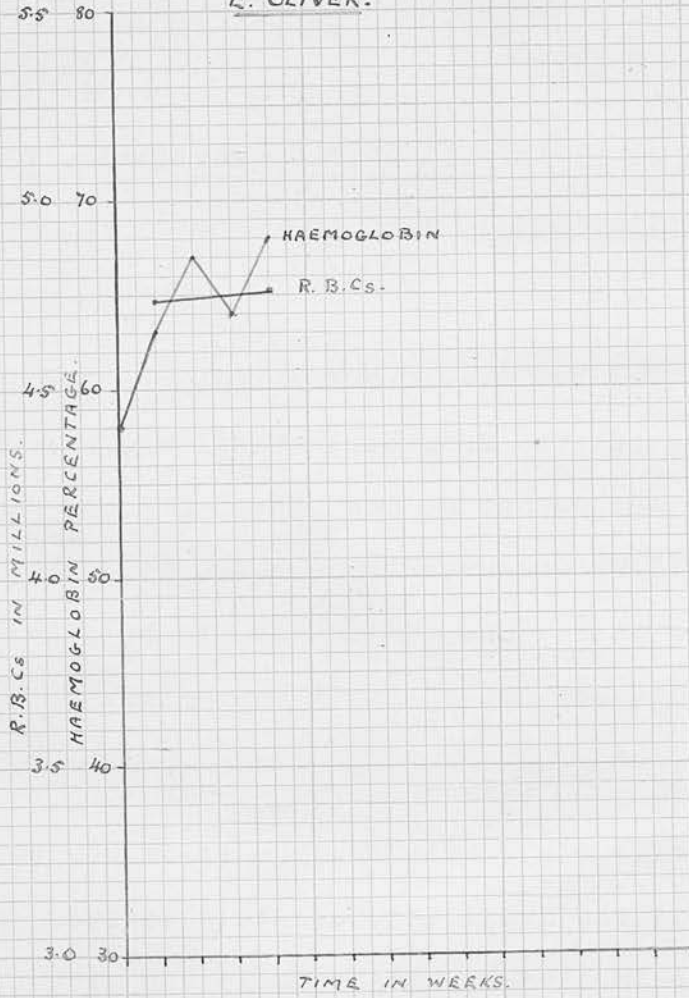
The child looks pale. She is considerably below weight. The fontanelle is open. There is no otorrhoea and no nasal discharge. She still has some cough and there are a few coarse crepitations audible over both lungs. There is no enlargement of either liver or spleen.

DATE	HB	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES
8.12.33	57					
15.12.33	52	3.95	Anisocytosis and poorly filled red blood cor- puscles.	.65		
21.12.33	50					
28.12.33	54	4.44		.60		Taking food all right.
4. 1.34	54	4.56		.55		Still looks very pale.
11. 1.34	51	4.61		.62		
18. 1.34	52	4.21		.54		
25. 1.34	45	4.21				Has discharging ear.

RESULT.

This patient was observed as a control child for a period of seven weeks. During this period there was a fall in haemoglobin from 57 to 45 = 12 per cent. There was no significant change in the red cell count.

E. OLIVER.



CASE LII.

CASE NO. LII.

VICTORIA PARK HOUSE.

ELLA OLIVER

Aet. 1

Date of Birth - 11.11.32 Admitted - 20.10.33.Full-time Baby.

HISTORY.

The patient is one of five healthy children. She was breast-fed from birth until she was one year old. She was weaned at one year. She has not had any infectious diseases. She has a good appetite and takes food well. She is inclined to be constipated. She does not get out of doors very much.

EXAMINATION - 3.11.33.

The state of nutrition is rather below the average but the child is moderately active. The fontanelle is closed. The tonsils are slightly enlarged. The epiphyses are not enlarged. There is some impetigo of scalp. No other abnormality was noticed.

DATE	HB.	R.B.C. in MILLIONS	FILM	C.I.	DRUG	PROGRESS NOTES
3.11.33	58					
10.11.33	63	4.73	Poorly filled R.B.Cs. Some anisocytosis. A few poikilocytes	.67		The impetigo of scalp is healed. Taking food well. The general condition is im- proving.
17.11.33	67					Good progress.
24.11.33	64					Has gained weight and is improving generally
1.12.33	68	4.76		.71		Has developed whooping- cough

RESULT.

The etiology of the anaemia in this case was probably nutritional as no other cause could be found. From 3.11.33 until 1.12.33, the child was used as a control. During this period of four weeks, the haemoglobin rose from 58 to 68 per cent and there was a rise in the colour index also. The child then developed whooping cough and was therefore unsuitable as a control.