THE LEUCOCYTOSIS OF PERTUSSIS

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BY

THOMAS B. TIERNEY, M.B., Ch.B. (Glasgow)

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ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

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INTRODUCTION

In spite of the attention which has been devoted, not only to the subject of leucocytosis in general, but also to the estimation of the number of white corpuscles in the blood of various pathological conditions, a minute or detailed investigation of the leucocytosis of Whooping Cough has not been conducted by observers. As I had under my care, in an infectious diseases hospital, a considerable number of cases, and so had facilities for the work, I was led to undertake an inquiry into this subject. The result of these examinations I now submit.

In searching the literature of haematology I only find four references dealing with the leucocytosis of Whooping Cough. Two of these - Frolich and Meunier, and Stengel and White - I have secured in their original

form. The other two - Amicis and Pacchioni, and Westall - I have been unable to obtain, and am indebted to Da Costa's "Clinical Haematology" for an abstract of their work.

There would seem to be little necessity for a blood examination as an auxiliary to the diagnosis of Whooping Cough, as it is an affection which, if at all characteristic, can be easily recognised even by the laity. In the initial or catarrhal stages, however, its detection is not so easy, and at this period it is usually assumed that the child has a common cold, or is suffering from bronchitis. A means of diagnosing the disease at this stage, when it is probably very infectious, would therefore be of service. Meunier claims for a leucocyte count at this period a distinct value inasmuch as "in no "other apyretic affection of the respiratory apparatus "is there so high a leucocytosis ..... which has never "failed in the cases submitted to my observation". In conclusion he says "The constancy of the leucocytosis of "Whooping Cough, the disproportion which it shows with "what one finds sometimes in other affections with spas-"modic cough (Bronchitis - Adenopathic tracheo bronchi-"tis, Pseudo-pertussis by imitation or simulation), in "short, the early appearance before the typical cough

"gives to the examination of the blood a real importance "in the cases of doubtful diagnosis, and lends us a prec- "ious auxiliary for the prophylaxis of this affection in "houses of refuge and schools".

I believe from my own work Meunier's statements may be substantially correct, but the obtaining of early cases of Whooping Cough has been one of my difficulties. When admitted to hospital the cases are usually well defined. Though the child may have been suffering from a cough for some time, the true nature of the disease may not be suspected until whooping and vomiting begin.

Again, as the disease is not compulsorily notifiable to the Sanitary Authorities, usually only those patients are sent to hospitals whose parents have not the means nor the accommodation to nurse them at home. Such being the case, the children as a rule are drawn from the poorer classes of the community. As a result many of them are badly nourished from inadequate or improper feeding combined with bad hygienic surroundings. Some, in addition, are actively suffering from rickets or tubercle, while others only too readily fall victims to the complications of Whooping Cough.

CASES SELECTED FOR EXAMINATION

The cases chosen for examination were those who were well nourished and in good general condition when admitted to hospital, and who were, so far as could be ascertained, suffering from no other disease.

METHOD OF EXAMINATION

In the first series of cases, which are twelve in number, the blood was examined systematically from admission to hospital until dismissal. While the illness was acute this was done every second or third day. When convalescence was approached, or was well established, less frequent examinations were made. A differential as well as a wet count was done in each instance. The number of differential and wet counts, in each case, varied from 26 to 43, according to the duration of the illness. The number of observations made in this series amounted to 338.

After this was completed it was thought that, though the individual observations were very numerous, the cases were too few in number to permit of accurate conclusions

being drawn. This was the case particularly with regard to the behaviour of the white cells during the earlier stages of the disease. As a result the examination of a supplementary series of fifteen cases was undertaken, those being chosen who seemed to be in the beginning of their illness. Three wet and three differential counts were done in each instance at weekly intervals. The number of observations in this series amounted to 45. In addition, 24 observations were made in six fatal cases who died of a complication of Whooping Cough.

The leucocytes were enumerated in the usual way by means of the Thoma Zeiss leucocytometer. The same hour was selected for examination of the blood on every occasion, viz., 11.30 a.m., half an hour before dinner, so that, as far as possible, any error from digestion leucocytosis might be avoided. It was found most convenient to take the blood from the lobe of the ear by means of a puncture from a bayonet-shaped needle. The blood was allowed to run freely. At the same time six or eight blood films were made. Two of the best were subsequently selected for detailed examination. They were fixed by heat for 35 minutes in an oven, kept at a temperature of between 112° and 115° C. Ehrlich's triacid stain was employed throughout. In each specimen a differential

count of 400 cells was made.

LITERATURE BEARING UPON THE LEUCOCYTOSIS OF WHOOPING COUGH

The most important of the papers on the subject is one by Henri Meunier (1) entitled "De La Leucocytose "dans Le Coqueluche". This author carried out his researches on 30 cases of true Whooping Cough, making 102 wet counts and 10 differential counts. As a result he comes to the following general conclusions:-

(1) That there is in this disease an intense leucocytosis of a constant and remarkable kind which never failed in the cases submitted to observation, and that this leucocytosis is much greater than that which one sees in other apyretic affections of the respiratory apparatus.

(2) This leucocytosis appears early; in some cases, where circumstances permitted the examination of the blood, it was found before the characteristic cough, i.e., in the catarrhal stage.

(3) The leucocytosis rapidly reaches its height, and diminishes in proportion to the behaviour of the disease; its complete subsidence is only seen after the cessation of the cough.

(4) This leucocytosis is relatively and absolutely greatest among young children, especially in those between two and three years of age. It is somewhat less marked in children between four and seven years, although even at this age it reaches two or three times the usual number of white cells.

Meunier's counts average 27,000 cells per cm. of blood. During the first week of cough they give an average of 25,500. On several occasions the number of 40,000 has been exceeded. The highest count was 51,500; the lowest obtained during the acme of the disease was 15,500.

These numbers refer to cases without fever and without complications. Fever and complications, when they occur (i.e. Broncho-pneumonia - vulvitis, otitis media and impetigo), have an indifferent influence on the leucocytosis already acquired. Sequelae on the other hand, such as tuberculosis and tubercular meningitis, have not exalted the leucocytosis already obliterated.

This high increase in the leucocyte count is due to a great preponderance of lymphocytes. To such a degree is this the case that the proportion of the lymphocyte to the polymorphonuclear cell is inverted. Thus, in a case three years of age, the following results were noted:-

Whooping Cough

Polymorphs	Lymphocytes	Large Mono.	Eosinophiles
39%	53.8%	6.4%	0.8%

Normal Blood

Polymorphs	Lymphocytes	Large Mono.	Eosinophiles
54%	39%	6%	1%

Meunier deduces the opinion that, for a total increase to triple of the normal number (30,000 instead of 10,000), the lymphocytes are more than quadrupled, the intermediary lymphocytes tripled, the polynuclear cells doubled, and the eosinophiles almost stationary. He believes that these cells have their origin in the lymphatic glands, and he attributes a leucopoietic or diapedetic role to the inflammatory hypertrophy, and doubtless to the functional hyperactivity of the tracheo-bronchial glands in this affection.

Stengel and White (2) quote the result of the examination of three cases in the "Archives of Pediatrics". The following is a brief summary of their report:-

	Total Leucos.	Polymorphs	Lymphs.	Mono.	Eos.	My.
Case I	12,145	40.8%	24%	27.8%	5.6%	1.8%
Case II	34,667	29.2%	52.6%	17.4%	0.8%	0.1%
Case III	16,128	41.4%	36.9%	19.5%	2.2%	—

Case I, aet. $1\frac{10}{12}$ - rachitic - sibilant rales in both lungs - developed characteristic whoop in few days. Case II was admitted suffering from Whooping Cough. Case III developed the disease in the course of malaria.

In a note the authors say, "In the three cases the "most striking peculiarity was the marked increase in "the lymphocytes. This may be of interest in connection "with the supposed disease of the lymphatic glands in "this affection".

De Amicis and Pacchioni have corroborated Meunier's observation, though they consider that the increase in leucocytes is somewhat less, having found an average count of 17,943 for their cases - Abstract from Da Costa.

THE METHOD OF THIS INQUIRY

In presenting the result of this inquiry I give, in the first place, a general summary of the results obtained from the blood examinations, appending certain general conclusions. The cases are then given in detail. The clinical history of each is summarised, and a table is added showing the dates on which the observations were made, the number of white cells per cm. of blood, and the relative percentages of each class of cell obtained as the result of the differential count. The percentages have been reduced to absolute numbers. To facilitate the reading of the tables, a chart has been made of each case in which the absolute numbers of each class of cell are plotted out.

The normal line for the total number of leucocytes has been placed across the chart at 10,000, for, if the total count does not exceed that number, the condition can scarcely be called pathological, no matter what the age of the child may be. The normal lymphocyte line is placed at different levels, depending on the age of the child.

Ehrlich's classification of the white cells has

been adopted throughout, viz., polymorphonuclear cells, lymphocytes, large mononuclears, eosinophiles and myelocytes. The transitional cells have been included in the large mononuclear group. As a rule no difficulty was experienced in separating the lymphocytes from the large mononuclear cells, though forms intermediate in size between the two classes were often encountered. The relative staining of the nucleus and protoplasm was taken as a guide. A cell with a deeply staining nucleus and scanty protoplasm was regarded as a lymphocyte, while a cell with faintly staining nucleus with a relatively large amount of protoplasm was placed in the large mononuclear group.

PRELIMINARY STATEMENT
REGARDING LEUCOCYTOSIS IN CHILDREN

The normal number of these cells in the blood of adults is given as from 7,500 to 10,000 per cm., of which polymorphonuclear cells constitute from 62% to 70%, small lymphocytes from 20% to 30%, large lymphocytes from 4% to 8%, and eosinophiles from ½% to 4%. In children, however, these cells differ qualitatively and quantitatively. These differences become less marked as the

child grows older, till from the sixth to the tenth year the condition of the blood as regards the white cells is practically the same as in adults. In children up to five or six years there is usually a slight or moderate increase in the total number of white cells per cm., while the relative proportions of the different classes are altered. "A differential count of the leucocytes in "the child shows that the relative percentage of lympho- "cytes is more than twice as great, and of polynuclear "neutrophiles half as great, while the proportion of "eosinophiles is frequently much higher than that which "obtains in adults' blood." (Da Costa p. 282).

The following figures are given by Cabot based on the work of Schiff, Gundobin etc. They relate to the total number of leucocytes per cm. for the different ages:-

At birth	17,000 to 20,000	leucocytes	per cm.
End of 1st day	24,000	"	"
End of 7th day	15,000	"	"
End of 10th day	10,000 to 14,000	"	"
12th to 18th day	12,000	"	"
6th month	12,000	"	"
6th year and upwards	7,500	"	"

The following table is given by Da Costa based upon data of Gundobin, in which the relative percentages of the different white corpuscles in the blood of a child

is contrasted with that found in the blood of an adult:-

	Child	Adult
Small Lymphocytes	50% to 70%	20% to 30%
Large Lymphocytes and transitional forms	6% to 14%	4% to 8%
Polymorphonuclear	28% to 40%	60% to 75%
Eosinophiles	0.5% to 10%	0.5% to 5%

A physiological leucocytosis may lead to variations in number, and in the relative proportions of the different cells in children as in adults, but these variations may be greater in degree. For infants under two years of age, shortly after a meal, Cabot (p. 86) regards a count of 30,000 leucocytes per cm. as not unduly high. Stengel and White observe that a physiological leucocytosis is constant in infants on account of frequent feeding.

When a leucocytosis in children is pathological, all observers seem to be agreed upon several peculiarities both in its amount and character. Cabot (p. 335) says, "All the signs by which sickness is shown in the "blood of adults are exaggerated in children. This is "due," this author explains, "to the fact that their "blood is apparently more sensitive to the action of any "morbific influence, and that any cause which leads to "but slight anaemia or leucocytosis in the adult, may

"produce grave anaemia or marked leucocytosis in chil-
"dren."

Da Costs (p. 282) holds somewhat similar views, and declares that a leucocytosis is to be regarded as of less significance in children than in adults. The cells concerned in an increase may be either polymorphonuclear cells or lymphocytes. The polymorphonuclear cells are said to preponderate usually in any leucocytosis of a physiological origin, but an increased number of lymphocytes may ensue as the result of pathological processes.

Eosinophile cells are said to be found in greater number, normally, in the blood of children than in adults. V. Limbech (p. 208) (7) says that "relatively high values "are physiological in children up to 13 or 14 years of "age." Cabot (p. 100) also states that "in infancy the "percentage of eosinophiles is very often higher than in "adults, so that in them eosinophilia may be regarded as "physiological".

Zappert is quoted as being the first to call attention to the fact that eosinophilia may occur in children without apparent cause. In 46 cases examined, he found the percentage of eosinophiles fairly high, one case showing as much as 19%. Zappert's statements have not, however, been confirmed by other observers. Boycott (5)

thinks that some at least of the cases examined by Zappert may have been suffering from some parasitic worm infection, as these were not excluded, and their presence would lead to an eosinophilia. This observer examined the blood of ten children for eosinophiles, carefully excluding the presence of parasites, and he found the percentage of these cells present varied from 0.0% and 0.6% to 5.4%; average for the ten cases was 3%.

Myelocytes, it is agreed by most observers, are more frequently found in the blood of children than in adults, and their presence need not be regarded as of the same grave significance, "though their presence in "increasing numbers in diphtheria or pneumonia is a bad "prognostic sign" - (Stengel and White), (6). Da Costa (p. 283) also observes that "they are present in larger "percentages and in less severe pathological conditions "than in the adult".

In estimating at their proper value, the results arrived at from the blood examinations in Whooping Cough, these various peculiarities of the white cells in children's blood have been borne in mind. Briefly recapitulated these are:-

(1) The normal number of leucocytes per cm. is somewhat higher than that obtaining in adults,

more especially in very young children. As the sixth year approaches the tendency to an increased number is lessened

(2) The relative proportion of polymorphonuclear cells to lymphocytes is altered, an inverse ratio obtaining; this feature is more pronounced the younger the child, and diminishes gradually to the sixth year, when the adult type is approached

(3) A leucocytosis of a high degree may occur from trifling causes, involving the polymorphonuclear or lymphocyte elements

(4) From frequent feeding there may be a constant physiological leucocytosis due to digestion

(5) A higher percentage of eosinophiles is normally present, and an eosinophilia is said to occur without apparent cause, though this is disputed

(6) The presence of myelocytes is not of the same grave significance in children as when found in adult blood

THE ARRANGEMENT OF THE OBSERVATIONS ON LEUCOCYTES

It is proposed to sum up the results of the observations made, first, regarding the behaviour of the leucocytes as a whole, and then of each type of cell separately. As the changes in the white blood corpuscles in Whooping Cough, about to be described, affect the lymphocytes and eosinophiles particularly, these will be taken next in order; and, finally, the polymorphonuclear cells, the large mononuclear cells, and the myelocytes.

THE LEUCOCYTES

STANDARDS USED IN THESE OBSERVATIONS

The leucocytosis which occurs in Whooping Cough appears to be of all grades of intensity. For reasons already explained, the normal leucocyte count is fixed in this inquiry at 10,000 cells per cm. of blood for all ages. For convenience of description the following nomenclatures have been adopted, depending upon the num-

ber of white cells per cm. of blood obtained as the result of the wet count, "Slight", "Moderate", "High", "Very High", "Intense", and "Very Intense" leucocytosis. The following table gives the numbers to which these terms are applied:-

Leucocytosis

Slight	between	10,000 & 15,000	cells	per cm.	of blood
Moderate	"	15,000 & 25,000	"	"	"
High	"	25,000 & 35,000	"	"	"
Very high	"	35,000 & 45,000	"	"	"
Intense	"	45,000 & 65,000	"	"	"
Very intense	above	65,000	"	"	"

The above designations are given to the maximum count obtained in the series for a particular case. Except in a few cases to be referred to later, this maximum count usually coincides in point of time with what may be called the specific leucocytosis of Whooping Cough.

In the 27 non-fatal cases examined, the maximum count of the white blood corpuscles has shown a

Slight	leucocytosis in	4	cases
Moderate	"	9	"
High	"	5	"
Very high	"	4	"
Intense	"	4	"
Very intense	"	1	"

Thirteen cases thus showed a slight to moderate leucocy-

tosis, and fourteen showed a high to very intense leucocytosis.

THE ONSET AND DURATION OF LEUCOCYTOSIS IN THE SUBJECTS OF THIS INQUIRY

The onset of leucocytosis in Whooping Cough is variable, but there seems little doubt that it appears in its maximum form during the first month of the disease. When the specific leucocytosis, already referred to, has ceased, a residuary form sometimes remains which is usually slight to moderate in degree, and which depends, as will be seen later, entirely on the behaviour of the polymorphonuclear elements.

In six of the twelve cases examined systematically to a conclusion, leucocytosis was absent, or only slightly present at the beginning of the observations. An analysis of the remaining cases would seem to indicate that the characteristic blood picture may be absent before the end of the first month.

In the remaining six cases the following was the condition observed:-

(1) Case V - High leucocytosis on 18th day; rising to intense on 36th day; declining to normal on 54th day;

thereafter fluctuating within moderate to high limits.

(2) Case IV - High leucocytosis on 9th and 18th days to almost normal on 32nd day; fluctuations slight to moderate to conclusion.

(3) Case I - Very high leucocytosis on 15th day to moderate on 25th; normal on 42nd; fluctuations thereafter slight.

(4) Case III - Moderate leucocytosis on 21st day; rising to intense on 27th and 29th days; moderate 41st; normal 51st; fluctuations from normal to moderate leucocytosis thereafter.

(5) Case II - Intense leucocytosis on 29th and 31st days; declining to moderate on 37th; slight on 47th; normal, to slight and moderate fluctuations to conclusion.

(6) Case VI - High on 22nd day to moderate 34th; slight 39th; slight to moderate fluctuations thereafter.

In the supplementary series the patients were all suffering from characteristic attacks of Whooping Cough, and, so far as could be ascertained, had no complication. They were all well nourished. Three examinations were made in each case at weekly intervals from the date of admission, the object being to still further elucidate

the blood condition in the early stages. In four of the fifteen cases, however, the examinations were made late in the disease. The first observation corresponds with the day of admission, and the dates of the other two are given in tabular form.

1st Observation	2nd Observation	3rd Observation
7th day - 1 case		
(1) Slight leucocytosis	14th day, high	21st day, very high
10th day - 3 cases		
(1) Intense leucocytosis	16th " moderate	23rd " moderate
(2) Very intense leucocytosis	17th " moderate	26th " slight
(3) Slight leucocytosis	17th " very moderate	24th " slight
12th day - 2 cases		
(1) High leucocytosis	19th " high	26th " slight
(2) Slight leucocytosis	19th " very high	26th " high
15th day - 2 cases		
(1) Slight leucocytosis	22nd " moderate	29th " slight
(2) High leucocytosis	22nd " slight	29th " normal
18th day - 1 case		
(1) Moderate leucocytosis	25th " high	31st " slight
19th day - 1 case		
(1) Slight leucocytosis	27th " slight	33rd " slight

1st Observation	2nd Observation	3rd Observation
20th day - 1 case		
(1) Moderate leucocytosis	27th day, slight	34th day, slight
27th day - 1 case		
(1) Moderate		42nd " normal

During convalescence or late in the disease - four cases - in which leucocytosis was practically absent.

The maximum leucocytosis has been observed:-

On	9th day of disease	in 3	cases
"	15th "	1	"
"	17th "	1	"
"	19th "	3	"
"	20th "	1	"
"	22nd "	3	"
"	25th "	1	"
"	27th "	2	"
"	31st "	1	"
"	38th "	1	"

Ten cases are omitted from this list - six in the long series and four in the short, in which the specific reaction was not noted.

From the foregoing it would appear that the leucocytosis which is to be expected may only be present in a slight or moderate degree as early as the 7th, 10th,

12th, or 15th days; in these cases an increase may be looked for later. One case shows only a slight reaction throughout. It may occur in its maximum form as early as the 9th day, but usually from the 15th to 27th days - rarely between the 31st and 38th days. It may disappear as a specific leucocytosis from the 30th to the 45th days, and occasionally as late as the 54th.

RELATION OF THE LEUCOCYTIC REACTION TO SEVERITY OF DISEASE

In uncomplicated cases little relationship can be discerned between the severity of the attack of Whooping Cough and the intensity of the leucocytic reaction. At one period the most intense leucocytosis may be found in a patient suffering from an ordinary or even mild attack, while the severe cases may show only a moderate or slight reaction. Case XIV gave a wet count of 65,000 white cells per cm., yet it seemed of quite ordinary severity.

The most severe and, at the same time, the most prolonged cases were perhaps the three following:-

(1) Case V, in which the leucocytosis was very intense, and persisted until the 54th day

(2) Case III, in which the leucocytosis was intense, and ended as late as the 51st day, and

(3) Case IV, where the leucocytosis was very high, and ended on the 30th day

Characteristic and severe cases of Whooping Cough were Cases XI, XII, VIII, and X. The paroxysms were violent and frequent, blood was present in the sputum in three of them, and in all the frequent vomiting led to marked loss of flesh. The wet counts showed that the leucocytes were little in excess of normal. A reference has already been made in these particular cases, however, to the strong probability that the period of specific leucocytosis was already passed before the observations had been begun.

In Case XXV three observations were made in the 9th, 10th, and 11th weeks. At this period the paroxysms of Whooping Cough were so frequent and so alarming that the child seemed in imminent danger of asphyxiation, yet only a slight leucocytosis was present.

These results would appear to show that the leucocytic reaction may be absent or slight, while the disease is still clinically active, or even very severe. Out of eleven cases which, clinically, seemed of the ordinary type, one gave a slight leucocytosis, three gave moderate, two gave high, three gave very high, and two gave intense reactions in white cells.

RELATION OF AGE TO THE LEUCOCYTOSIS OF WHOOPING COUGH

Age seems to have little influence on the course or on the amount of leucocytosis which may develop. The two oldest children examined were Cases V and XX, both six years. The first mentioned showed the most intense leucocytosis of all the cases on whom observations were made; the second gave a high reaction. The character of the leucocytosis was of the specific kind associated with this affection.

At the next age period, five years, there are three cases. One of these (Case IV) gave a high count, the second (Case XIX) gave a moderate count, and the third (Case VII) gave a high count which, however, was on differential analysis, not characteristic. On the other hand, two of the cases examined, which were two years of age, viz., Case XXIV and Case XVI, gave only a moderate count, while in Case XXVI, a child of three years of age, only a slight reaction was observed.

The conclusions which one may draw from these observations regarding the behaviour of the white cells as a whole, in Whooping Cough, are the following:-

(1) That there is a leucocytosis in Whooping Cough

(2) That it may be of all grades from slight or moderate to the most intense kind

(3) That it usually occurs in its maximum form from the 9th to the 30th days

(4) That its amount seems to bear little relationship to the severity of the disease, or the age of the child

(5) That after the maximum has been reached, a decline begins, and the specific leucocytosis usually disappears between the 30th and 45th days; though the disease may continue clinically active or even severe for some time after this period

THE LYMPHOCYTES

In estimating the part played by the various cells in the leucocytosis referred to, the lymphocytes will now be considered.

We have already noted the fact that a lymphocytosis exists in the blood of children normally, this being the less marked as age advances. This normal lymphocytosis in children is both relative and absolute. Lymphocytosis is defined by various authorities as follows:-

"An increase, whether relative or absolute, in the lymph-"ocytes above the normal number in health" (Da Costa p. 196). Cabot's definition (p. 98) is similar, "A rela-"tive increase of the lymphocytes or young cells in the "blood with or without an increase in the total leuco-"cyte count", and "when a lymphocytosis and an increase "in the total leucocyte count are present, we cannot dis-"tinguish the blood from that of lymphatic leukaemia; "the distinction must depend upon the course and symptoms "of the case". Some haematologists, notably Drysdale (9) would, with some justification, confine the term to that condition in which the lymphocytes are increased in absolute number, as a relative increase may occur through a decline in the number of polymorphonuclear cells, viz., a leukopaenia. In this inquiry the term is used in the sense that Drysdale prefers.

The following table has been compiled by Hutchison, and is quoted by Bushnell (10). It gives what is considered to be the normal number of lymphocytes per cm. of blood for the different age periods.

Age	Lymphocytes	Other Forms	Total Cells per cm.
New born	5000 per cm.	16,000	21,000
6th month	9000 "	2,000	11,000
1st year	8000 "	2,000	10,000
3rd year	4,500 ""	3,000	7,500
6th year	2000 "	5,500	7,500

Taking the figures quoted above as being approximately normal for the different age periods, it may be stated that, in Whooping Cough, a lymphocytosis is almost constant. It may be of a slight kind, or it may be very intense. It occurs so constantly and at such a definite period that it might be called specific. It is present in almost equal intensity at all ages in which the blood was examined, and coincides in its degree with the initial leucocytosis already referred to.

In 27 non-fatal cases examined, this condition was present in 18, leaving nine cases in which it was absent. The following table gives the name of case, age, normal number of lymphocytes, maximum number found, and the day of illness on which this occurred.

	Case	Age	Normal No. of Lymph. per cm.	Max. No. obtained	Day of occurrence
(1)	XXI	1½	7,000	11,664	25th
(2)	XIV	2	6,500	41,192	9th
(3)	*XXIV	2	6,500	8,960	27th
(4)	II	3	6,000	28,552	31st
(5)	XVII	3	6,000	21,280	19th
(6)	XVI	3	6,000	7,400	17th
(7)	XIII	3	6,000	20,979	22nd
(8)	XV	3	6,000	25,305	9th
(9)	XVIII	4	5,000	12,480	12th
(10)	*XXIII	4	5,000	6,816	19th
(11)	*XXII	4	5,000	13,068	20th
(12)	III	4	5,000	23,558	31st
(13)	*I	4	5,000	22,143	15th

	Case	Age	Normal No. of Lymph. per cm.	Max. No. obtained	Day of occurrence
(14)	IV	5	3,500	11,128	11th
(15)	XIX	5	3,000	8,520	15th
(16)	XX	6	3,000	16,384	15th
(17)	V	6	3,000	43,624	36th
(18)	VI	4	4,000	8,784	25th

In the cases marked with an * the highest count of lymphocytes coincided with the first observation made. It is not unlikely that, had an earlier observation been possible, a greater number of lymphocytes would have been obtained.

In the following nine cases a lymphocytosis was absent or slight:-

Case	Age Yrs.	Normal No. of Lymph. per cm.	No. obtained on 1st observation	Day of illness
XXV	1½	7,000	7,955	9th week
VIII	2	6,000	5,589	28th day
XI	3	6,000	7,020	28th day
XXVI	3	6,000	3,465	Indefinite
X	3	5,000	7,035	Abt. 6th week
XII	4	4,000	5,550	37th day
IX	4	5,000	2,703	30th day
VII	5	3,500	3,996	26th day
XXVII	5	3,500	1,805	12th week

In four of the cases, viz., Cases XXV, XXVI, X, and XXVII, as results show, a lymphocytosis could not be ex-

pected, as the observations were made too late in the disease. In the others, viz., Cases VII, VIII, IX, XI and XII, it is probable that the specific leucocytosis associated with Whooping Cough had disappeared before the observations were begun, as we have seen from other cases that this may occur before the 30th day.

ONSET AND TERMINATION OF THE LYMPHOCYTOSIS

What has already been said about the white corpuscles, as a whole, may be repeated almost exactly regarding the lymphocytes, which are, in the main, the cause of the leucocytosis described. This lymphocytosis may be present in a degree on the 7th day, or may not be seen till the 15th. It attains its maximum as early as the 9th day, usually before the 22nd day, occasionally from 25th to 27th. In one case it presented itself on 38th day. When the maximum has been attained, a gradual decline to normal numbers usually occurs, this level being reached usually between the 30th and 45th days. In one instance, Case V, it was not reached till the 54th day. When the decline is fully established, subsequent examinations have shown that the small mononuclear cells are about the normal line for the particular age

period, the disease remaining active or even severe after the lymphocytosis has disappeared. A reference to the charts of the twelve long cases shows this. The six charts in which no lymphocytosis was present at the beginning of the examinations serve a useful purpose in helping to confirm this statement. One exception, however, occurs, that of Case V. Though the lymphocytic fall is seen on the 54th day, the lymphocytes take part in the irregular leucocytosis which is afterwards present to the 106th day.

INTENSITY OF THE LYMPHOCYTOSIS

The actual increase of these cells in a particular case may vary from one and a half times the number normal for the age period to fifteen times. Excluding the cases referred to where the condition was absent, the lowest maximum obtained was 7,400 (6,000 normal), the highest 43,624. Between these two numbers there are great variations. Age, as remarked when discussing leucocytosis, seems to have little influence. It is noteworthy that the highest absolute number obtained - 43,624 - was found in a child of six years whose normal number of lymphocytes is 2,000 to 3,000 per cm. The

next highest - 41,192 - was present in a child of two years, equal to seven times the normal value. In four cases of three years of age the number 20,000 per cm. was exceeded, equal to from three to four times normal value; and in two cases of four years a similar excess was noted, equal to from four to five times normal value. In the other cases they reached in absolute numbers from 8,000 to 16,000 cells per cm., the last-named figure being observed in a child of six years, equal to eight times normal value.

RELATION TO THE SEVERITY OF THE DISEASE

The statements made in the section on Leucocytosis in this connection apply equally to the lymphocytes.

OTHER CONDITIONS IN WHICH LYMPHOCYTOSIS IS OBSERVED

Lymphocytosis is comparatively rare in adults, a leucocytosis when it occurs being usually due to an increase in the polymorphonuclear elements. When a lymphocytosis is present in an adult, it is often relative and not absolute, due to a leucopenia. In lymphatic leukaemia, however, the lymphocytes may be enormously

increased. In two of the exanthemata a lymphocytosis has been found to be characteristic, viz., smallpox and enteric fever. In the former an absolute increase in these cells has been found by Ferguson. In enteric fever their increase is relative, although an absolute increase is said to occur during the 5th and 6th weeks (Ewing p. 266). In other acute infections their absolute increase is rare. Cabot, however, has recorded a case of pneumonia in a girl of six where, in a count of 72,100 cells per cm., he found 66% to be lymphocytes, the increase disappearing in ten days after the crisis. Houston (15) also records a great increase in a case of croupous pneumonia, a man of 54, where, in a count of 96,000 cells per cm., 86% or 82,560 were lymphocytes. The same observer found 9,930 per cm. in a count of 24,000 cells in a case of phosphorous poisoning. Secondary anaemias due to tubercle or syphilis are also said to cause this condition, but probably the increase is in percentage only.

In children a lymphocytosis, according to the various authorities, is of commoner occurrence. It is said to be present in the severe anaemias which are the result of gastro enteritis, rickets, syphilis, and tubercle. In poorly developed and anaemic or cachectic children,

the lymphocytes are said to be increased as the result of the retardation of the change in the proportion of these cells. In the constitutio lymphatica, where there is hyperplasia of many lymph nodes, developmental anomalies, and rickets, they may be greatly increased in number. Diphtheria is also mentioned as a disease in which an increase occurs.

These conditions are of interest, inasmuch as they would have affected the result if they had been present in any of the patients on whom this inquiry was conducted. Careful examination, however, showed that they might safely be excluded.

THE EOSINOPHILES

The eosinophiles are normally present in adult human blood to the extent of 1% to 4% of the total white cells. In absolute numbers Zappert is said to give the following:-

Lowest normal value,	50 to 100	cells per cm.
Mean value	100 to 200	"
High normal value	200 to 250	"
Eosinophilia	Above 500	"

In the cases under review an eosinophilia is spoken

of when in absolute numbers these cells amount to more than 500 per cm.

In all the cases examined to a conclusion an eosinophilia has been found, an eosinophilia so marked that it is strange that hitherto it has not attracted attention. In only one of the twelve cases was this condition absent. This patient (Case VI), however, differed from the eleven others in so far that she suffered from one of the complications of Whooping Cough, viz., a chronic broncho-pneumonia, which was possibly of a tubercular nature.

An eosinophilia is often relative. Under normal conditions, any percentage up to 5 is not remarkable. Above 5% it is abnormal. But a relatively small percentage in a high count may give a high absolute number. The following were the maximum percentages in the eleven cases which showed an eosinophilia:-

Case	II	3.75%
"	I	4%
"	IX	6.25%
"	V	7.5%
"	VIII	8.25%
"	VII	8.25%
"	IV	11%
"	XII	12.25%
"	X	12.25%
"	III	13.25%
"	XI	17.25%

The highest percentages obtained in a given case did not necessarily coincide with the highest absolute number. These were in the cases under review as follows:-

Case	II	1,296 cells per cm.*
"	I	915 " *
"	VII	900 "
"	IX	900 "
"	V	2,400 "
"	VIII	1,400 "
"	IV	2,800 "
"	X	2,500 "
"	III	1,800 "
"	XII	2,000 "
"	XI	3,000 "

*In these two cases the highest absolute number obtained corresponded with the primary eosinophilia, to be mentioned below.

DATE OF ONSET OF EOSINOPHILIA

An analysis of the above cases shows that the date of onset of eosinophilia is uncertain.

PRIMARY EOSINOPHILIA

Occurs in four of the eleven cases just mentioned, i.e., the absolute number of these cells exceeds 500 but, occurring as it does in the earlier stages of the illness

when the total leucocyte count is high, the percentages of eosinophiles obtained are not necessarily also high. With regard to the four cases in which a primary eosinophilia occurs, the date of onset, percentage and absolute number of eosinophiles are shown in the following table:-

Cases showing Primary Eosinophilia

Case	Eosinophiles		Total Leuco. Count	Day of Illness
	Abs. No.	Per Cent.		
I	915	2.5	36,600	15th
II	1,296	3.	48,600	29th
V	1,386	2.75	50,400	24th
III	1,624	3.5	46,400	27th

In the above cases this early or primary eosinophilia soon disappears, and these cells are absent from the blood except in very small numbers for some time; they, however, reappear again later in the disease, when a secondary eosinophilia occurs.

SECONDARY EOSINOPHILIA

occurs in all the cases which showed a primary eosinophilia. The date of the beginning of the eosinophilia and

the date of its termination are shown in the following table:-

Cases showing Secondary Eosinophilia

Case	Onset	Termination	Highest Abs.No.	Per Cent.	Total Cells
I	52nd day	63rd day*	630	4.5	14,000
II	70th "	78th "	668	3.75	17,800
III	84th "	122nd " *	1,794	11.75	15,200
V	81st "	106th " *	2,490	7.5	32,200

NO PRIMARY EOSINOPHILIA

occurs in the remaining seven cases, these cells, in the earlier stages of the disease, remaining in absolute numbers within normal limits. In each, however, a rise has to be recorded later. These cases are shown in the following table:-

Cases showing no Primary Eosinophilia

Case	Onset of Eosin.	Termination of Eosin.	Highest Abs.No.	Per Cent.	Total Cells per cm.
IX	43rd day	82nd day	921	4.75	19,400
VII	44th "	52nd "	945	7.5	12,600
IV	20th "	96th " *	2,904	9.25	31,400
XI	28th "	63rd "	3,185	16.25	19,600
XII	41st "	102nd " *	2,123	12.25	17,400
X	Indefinite	Present over one month*	2,278	12.25	18,600
VIII	56th day	76th day	1,535	8.25	18,600

*In each of the cases marked * the Eosinophilia persisted until dismissal, and continued sometimes in a high form at the time of dismissal, so that the date of the termination of the eosinophilia is not known.

An analysis of the foregoing cases shows that the onset of eosinophilia varies considerably in point of time. It has occurred -

Between	20th and 30th	days	in 2	cases
"	40th and 50th	"	3	"
"	50th and 60th	"	2	"
On 70th day			in 1	"
After 80th day			2	"
Indefinite*			1	"

*Occurred, however, during convalescence, lasted one month, and was still present in high form on dismissal.

DURATION OF EOSINOPHILIA

In two cases this was not of long duration, viz., Case II and Case VII, in each of which it was present for eight days. In neither of these cases was it so pronounced as in the others. In three cases it lasted respectively for 20, 35, and 39 days. In the six remaining cases it was still present on dismissal, but, until that period, it had been present respectively for 11, 25, 30, 38, 61, and 76 days.

CONCLUSIONS REGARDING EOSINOPHILIA

(1) There may be an absolute increase in the number

of eosinophile cells in the early stages of pertussis, coinciding with the high leucocytosis usually present. This form disappears early. Percentages low

(2) An eosinophilia occurs early or late in the disease, which may be short in its duration, eight to ten days, but which usually persists for long periods, and is often present in a high form when patient shows no sign of disease

(3) Though eosinophilia may be present in a moderate degree, a high grade is usual

(4) The appearance of eosinophilia usually coincides with the approach of convalescence or its establishment, though, at first, the disease still appears active

(5) The appearance of eosinophilia occurs after the lymphocytic fall is established

OTHER CONDITIONS IN WHICH EOSINOPHILIA OCCURS

An eosinophilia of the blood was at one time thought to be pathognomonic of leukaemia, but of late years eosinophilia has been recorded as occurring in a number

of diseases of different pathogenesis and clinical significance. Many of these instances of the reported increase of eosinophiles, however, are said by Da Costa to lack verification. From the work of various observers it would appear that eosinophilia of a very high grade is a constant phenomenon under the following circumstances:-

(1) Diseases of the Skin
(2) Helminthiasis
(3) Bronchial Asthma
(4) Post Febrile conditions in a lesser degree
(5) Sporadically

DISEASES OF THE SKIN

With regard to the first group, eosinophilia has been recorded in Pemphigus and Dermatitis Herpetiformis with the greatest unanimity. Though it is mentioned as occurring in various other skin affections, Boycott (11) has found negative results in eleven cases of widespread urticaria, and though French (12) has recently examined 90 cases of skin disease for the presence of eosinophilia, he has recorded that it does not seem to be characteristic of skin affections in general, except in the two diseases first mentioned, and possibly also in Xanthoma Diabeticorum.

HELMINTHIASIS

The second group presents a great variety of conditions in which eosinophilia is a constant feature. Of these a full record can be obtained in a paper by Boycott (11). According to the work of this observer and various others of late years, an extremely high grade of eosinophilia is characteristic of Ankylostomum Duodenalis, Bilharzia Haematobium, Trichina Spiralis, Taenia Echinococcus, and Filaria Sanguinis. In the commoner worm affections, and in those most likely to occur in children in this country, viz., Oxyuris, Ascaris Lumbricoides, and the various forms of Taenia, eosinophilia has not been observed so constantly, and its presence is disputed.

The only interest that these diseases possess in connection with the present inquiry is the possibility of their presence affecting the results. But none of the children was suffering from cutaneous disease nor, though repeated careful examination was made, did any of them appear to be suffering from any form of Helminthiasis.

BRONCHIAL ASTHMA

The third group would seem to be of much more importance in regard to the present inquiry. Paroxysmal asthma was the first disease in which an eosinophilia was observed other than in leukaemia. On this subject the only papers to which I have had access are those of Billings (13), and French (14). Billings reports a case in which there was a history of nocturnal attacks of sudden onset ending with violent paroxysms of coughing, with scanty viscid expectoration. These attacks had lasted for six months, occurring latterly in the daytime as well as at night. A differential count of 1,000 leucocytes showed -

Polymorphs	- 36.1%)	
Lymphocytes	- 5.1%)	Total white cells per cm.
Large Monos.	- 5.2%)	8.300
Oxyphiles	- 53.6%)	

French quotes one case in which the diagnosis of Paroxysmal Asthma was made by means of a differential count of leucocytes; 1,000 cells were enumerated, and the following was the result:-

Small lymphocytes	13%)	
Large "	4%)	White Corpuscles
Polymorphonuclear cells	24%)	10,625 per cm.
Eosinophile cells	59%)	

Further references to this subject are found in the paper by Billings, from which it seems that the percentages of eosinophiles in this disease vary from 8.77 to 33.1/3. Two of these authorities, Grabitschewski and Schwerschewski, assert that eosinophiles are most numerous at the time of the attack, the latter also stating that an increase in the eosinophiles takes place some time previously to the onset of a paroxysm. Boycott (11) has stated that he has examined a number of cases of Paroxysmal Asthma with negative results, but in no case could a secondary infection of pulmonary origin be excluded.

Billings found that one half of the leucocytes entangled in the meshes of the sputum were oxyphiles.

POST FEBRILE CONDITIONS

In (4) the post febrile form, the eosinophilia is usually moderate in degree, and is noted to occur as a sequela of pneumonia, scarlet fever, articular rheuma-

tism, etc.; 5% to 9% have been found reaching in absolute numbers 430 to 970.

(5) SPORADIC CASES

Eosinophilia is usually moderate in degree in sporadic cases.

THE POLYMORPHONUCLEAR CELLS

An increase beyond the normal number of these cells in the blood has been noted in a large variety of conditions. Chief among these may be mentioned various acute and infectious processes - pneumonia, erysipelas, diphtheria, and the like, exceptions occurring in the case of enteric fever and measles. Among other conditions in which these cells are increased are the acute and chronic anaemias - cachexias following malignant tumours and phthisis - physical states due to the administration of certain drugs, chlorate of potash, phenacetin, etc., and in most suppurative affections.

In children's blood these cells are relatively and absolutely decreased; the younger the child the more pronounced is the decrease. Their normal number at differ-

ent age periods may approximately be given as under:-

About	6th month,	less than	2,000	per cm.
"	1st year	"	2,000	"
"	3rd year	"	3,000	"
"	6th year	"	5,500	"

For convenience, we take the above figures as representing the normal number of polymorphonuclear cells per cm. of blood in children of these respective ages. Adopting this as the standard of comparison, it may be stated that, in Whooping Cough, there is an Active Leucocytosis. The behaviour of the polymorphonuclear cells throughout the disease will be readily understood by referring to the charts of the first twelve cases described, where their curve is coloured red. We have already discussed the specific leucocytosis which occurs in the earlier stages of the disease and which ceases, so far as these observations go, at the latest the 54th day. During this period, though the polymorphonuclear cells may be decreased relatively towards the lymphocytes, yet in absolute numbers they may show a great increase over their normal standard. An irregular decline in their number has to be recorded corresponding to the lymphocytic fall. The latter cells, after touching normal, however, subsequently show little inclination to an in-

crease in number. The polymorphonuclear cells, on the other hand, show fluctuating tendencies to a slight or moderate increase in number throughout the affection, and even during convalescence. This increase may be present in a somewhat high degree, as in the Cases V, IV, and III. The slight to moderate leucocytosis which is recorded in Cases VIII, XII, IX, and X, is entirely a polymorphonuclear one. A similar observation may be made regarding Case XI, although a slight lymphocytosis exists at the beginning. In Case VII a high leucocytosis is present on the 26th day of illness, which is entirely a polymorphonuclear one, the lymphocytes being normal in number. Case V shows a residual leucocytosis in which both classes of cell take part.

LARGE MONONUCLEAR CELLS

Included in this category are large lymphocytes, large mononuclear or hyaline cells, and transitional forms. The first named have, it is believed, a similar origin to the small mononuclear cells or lymphocytes, while the two last mentioned have their source mainly in the bone marrow. In the blood of adults in health this

group is present in small percentage, 4 to 8, but, in children's blood, as in the case of the small non-granular forms, a larger percentage is the rule, any figure between 6% and 14% being considered normal. This is approximately between 600 and 1,400 cells per cm.

Taking these figures as a standard, these cells are relatively, i.e., in percentage, not much increased, the highest average percentage in any case being 12.58 (Case XXV). This is, however, somewhat fallacious as it only comprises the average of three observations made in 9th, 10th, and 11th weeks. An average of 12.41% is seen in Case XVI (three observations), but in the long series the average percentage is 6 to 9; highest average (Case II), 10,04%. The highest percentage observed was in Case XVIII, 19.25, but percentages of 18, 16, and 15 have been seen in several cases.

In absolute numbers, however, these cells are very greatly increased. This absolute increase, in its highest form, occurs usually in the early stages when the general leucocytosis is high. Numbers of 2,000 to 3,000 cells per cm. are quite common. Case V gives an absolute number of 6,804 per cm. on his 81st day. In a total count of 42,000 leucocytes per cm. the large mononuclear cells numbered 16.25%. Case II, in a count of 22,600

white cells per cm., in his 58th day, gives a percentage of 18, in absolute numbers 4,068. These were the highest absolute numbers obtained in the whole series.

In the charts, the curve of the large mononuclear cells is coloured brown. From these it will be seen that, in absolute numbers, their behaviour is irregular; but, on the whole, a decrease in their number towards the end of the observations is the rule. Their maximum period of increase usually corresponds with the increase in the general leucocytosis.

In the following table will be found for each case the average percentage and absolute number, the highest percentage obtained, the highest absolute number with its equivalent percentage, the date on which it occurred with the total count of white cells:-

Case	Avge. %	Avge. Abs. No.	Highest % obtained	Highest Abs.No. obtained	Per Cent.	Date	Total Count
I	8.05	1,499	11.	3,420	9.5	19th	36,000
II	10.04	2,440	18.	4,068	18.	53rd	22,600
III	9.	1,738	15.25	3,944	8.5	27th	46,400
IV	8.25	1,460	12.25	3,160	10.	11th	31,600
V	8.54	2,614	16.25	6,804	16.25	81st	42,000
VI	8.53	909	13.5	2,212	7.	22nd	31,600
VII	9.14	1,289	12.	2,982	10.25	30th	28,400
VIII	9.18	1,271	15.25	2,623	15.25	32nd	17,200
IX	8.53	1,333	12.75	1,868	12.75	41st	14,600
X	7.68	1,182	11.	1,920	10.	last ob.	19,200
XI	8.3	957	15.25	1,891	15.25	30th	12,400
XII	6.1	824	8.	1,087	7.25	55th	15,000

Case	Avge. %	Avge. Abs. No.	Highest % obtained	Highest Abs.No. obtained	Per Cent.	Date	Total Count
XIII	5.1	1,197	6.	1,512	4.	22nd	37,800
XIV	8.8	2,485	9.25	3,800	6.25	9th	60,800
XV	6.91	1,912	8.25	2,175	4.75	9th	45,800
XVI	12.41	1,770	16.5	2,310	16.5	24th	14,000
XVII	5.91	1,405	9.	1,980	9.	26th	22,000
XVIII	9.41	1,663	19.25	3,003	19.25	26th	15,600
XIX	9.5	1,625	10.25	2,070	10.25	22nd	20,200
XX	8.58	1,219	12.	1,392	12.	29th	11,600
XXI	7.41	1,599	9.25	2,304	8.	25th	28,800
XXII	7.12	1,423	8.75	1,890	8.75	20th	21,600
XXIII	11.58	1,457	12.75	1,556	12.75	33rd	12,200
XXIV	11.75	1,854	17.75	2,201	17.75	34th	12,400
XXV	12.58	1,508	15.5	1,679	11.5	9th wk.	14,600
XXVI	6.5	667	7.5	725	7.25	Indef.	10,000
XXVII	7.08	537	8.25	577	8.25	Conval.	7,000

MYELOCYTES

Although these cells were seen on occasion in the blood films of almost every case examined, their number was so small as to be of no importance in regard to the present inquiry.

CORRELATION OF RESULTS

In reviewing the results of this inquiry into the leucocytosis present in Whooping Cough, it would be well

to consider how far these are in agreement with the conclusions arrived at by M. Meunier, who is the authority chiefly mentioned in this connection. A summary of his results has already been given. My observations would seem to confirm his statement, that the leucocytosis in Whooping Cough rapidly reaches its maximum.

Regarding its subsidence, however, we are not in agreement. So far from this leucocytosis subsiding completely only after the cessation of the cough, as he asserts, these cases show that the specific leucocytosis with which a lymphocytosis is associated, disappears fairly early in the affection, and is altogether absent when the disease is not only clinically active, but even very severe. Most of the cases worked to a conclusion show, however, that a leucocytosis may remain during remainder of illness, and even during convalescence, but in this leucocytosis the lymphocytes take little part; only one case was an exception.

Regarding the onset of the leucocytosis, we have seen that it is sometimes present in its maximum form as early as the 9th day of disease, and rarely as late as the 38th. It has, however, been found present in a slight degree only, on 7th, 10th, 12th, and 15th days, and moderate on 18th day. In all these cases a higher

count was seen on next observation - a week later. Under these circumstances it is doubtful if a blood examination would really give much assistance in the diagnosis of a doubtful case in the early stages.

Regarding the effect of age on the leucocytosis which may develop, these observations do not confirm Meunier's statement that the amount is in direct proportion to the youth of the child; as already stated in another section, there was little variation in the amount at different age periods, those at five or six years showing a high count, while some of those at two and three years gave only a moderate or slight reaction. I have not attempted to make an average of the leucocyte counts for the series here presented. This would be of no value, as counts taken during the acute stage of illness would be added to those taken in convalescence; such averages would require to be taken from counts for definite periods. An average is given for each particular case.

Meunier's table giving the relative increases of the different classes of cells is very much in accordance with what has been seen in some of my cases. The latter, however, takes no note of any eosinophilic increase. On the contrary, he states that these cells are

decreased in percentage, although in absolute numbers they are normal. This may be owing to the fact that his observations were few in number in each case, and were probably made in the acute stages of the affection when an eosinophilia is usually not present. Eosinophiles are only observed in increased numbers when the case is followed to a conclusion systematically. The observations of Stengel and White are too few in number to admit of comparison, though Case I in his group gives an eosinophilia of 5.6% in a count of 12,145.

The conclusions of this inquiry may be briefly summarised as follows:-

(1) There is a leucocytosis of a specific character in Whooping Cough, which may be of all grades from slight to moderate to the most intense kind. It is characteristic of the earlier stages of the disease particularly

(2) This specific leucocytosis depends for its intensity on the numbers of lymphocytes present; the polymorphonuclear cells are relatively decreased, but absolutely increased during this period

(3) Its amount seems to bear little relationship to the severity of the disease, or to the

age of the child

(4) It occurs in its maximum form as early as the 9th day, usually between the 15th and 27th days, rarely between the 31st and 38th days

(5) After the maximum has been attained, a decline more or less rapid begins, and the specific leucocytosis disappears from the 30th to 45th days, rarely as late as the 54th, though the disease may continue clinically active or even severe for some time after this period

(6) After the specific leucocytosis has disappeared, a residual leucocytosis, which is usually slight to moderate in degree, may be present throughout the illness and into convalescence. This is almost entirely a polymorphonuclear one

(7) There may be an absolute increase in the eosinophile cells in the early stages of Whooping Cough coinciding with the high leucocytosis usually present. This form disappears early; percentages low

(8) An eosinophilia occurs early or late in the disease, which may be short in its duration,

8 to 10 days, but which usually persists for long periods, and is often present in a high grade when the patient shows no signs of the disease

(9) This eosinophilia may be of moderate degree, but a high grade is usual

(10) Its appearance usually corresponds with the approach of convalescence or its establishment, and after the lymphocytic fall is established

(11) The large mononuclear cells are sometimes present in increased percentage, though this is usually normal. The absolute numbers may be much increased, corresponding with the high leucocytosis present

(12) Myelocytes are sometimes seen in very small numbers

LYMPHOCYTOSIS

The peculiarities of the blood picture in Whooping Cough are interesting in two particulars, viz., the lymphocytosis which exists, and the eosinophilia. The

significance to be attached to the lymphocytosis is difficult to estimate. The causes of a pathological lymphocytosis in children are variously explained. The one oftenest assigned is that there is a constant inclination in children's blood to revert to the embryonic type. Drysdale (9), however, believes that the polymorphonuclear cells and lymphocytes are two independent types of cell, and avers that the first named are increased in number in the blood of children under the same conditions as in adults. The large numbers of lymphocytes present in the blood of healthy children corresponds with the age period when the lymphatic tissues are most active, and at the same time most subject to disease. Their increase in disease he attributes to the expression of an increased stimulus or call upon already active tissue, and in no sense to a reversion. Houston (15) gives as a possible explanation that there may be a greater tendency in children for these cells to find their way into the blood than in the adult.

Haematologists, at present, differ widely in their views, not only regarding the origin of the lymphocyte, but also regarding its function. Meunier has attributed the great increase in numbers of these cells in Whooping Cough to the hyperplasia of the tracheo bronchial glands

which is said to occur in this affection. This accords with Ehrlich's view that lymphocytosis, when it does occur, is a mechanical process, and is not due to any specific chemiotactic reaction. The presence of lymphocytes in the blood in increased numbers is called by Ehrlich a "passive leucocytosis". Other haematologists would appear to oppose this view. In the "Discussion on "the Role of the Lymphocyte" which took place before the meeting of the British Medical Association last autumn, the views of our leading authorities are fully set forth. Some of these would give to the lymphocyte a more than passive role.

Gulland (16) asserts, in opposition to Ehrlich, that lymphocytes are formed in the bone marrow, and that they have their uses in infections due to non-virulent, attenuated, or saprophytic organisms. Similar views are held by McCallum (17), and the result of work by that author and Longhope would seem to indicate that they have an origin in the bone marrow, and that in certain diseases, e.g., typhoid fever, they respond to a distinct chemiotactic influence by wandering out of the vessels into the tissues. Muir also gives to these cells a wide range of activity; while he thinks that their chief seat of production is in the germ centres of

lymphoid tissue, and that any substance causing increased multiplication in these tissues would produce a lymphocytosis, he regards them as the preponderating variety of cell in chronic and sub-acute conditions. Exceptions to this are enteric fever and smallpox, acute infections which attract non-granular and not polymorphonuclear cells.

Is the lymphocytosis of Whooping Cough an active or a passive phenomenon? In absence of any proof it is difficult to say. It seems unlikely to be caused by a reversion to the foetal type of blood. Presuming that such a tendency exists in young children, its occurrence could hardly be so constant as it is in this affection, and should be absent in cases which have reached the age of five or six years when the adult type of blood exists or is approached. Yet as we have seen, there may be lymphocytosis of a marked kind in these patients. In favour of Ehrlich's (19) theory that this lymphocytosis is a passive phenomenon might be advanced, its sudden onset, short duration, and early disappearance. The fact that there is no lymphocytosis present in the blood while the disease is in full progress, discourages attributing to these cells any active role or response to definite chemiotaxis in the disease. Hyperplasia of the

tracheo-bronchial glands is believed to be present in the early stages. That this may be due to the catarrhal condition frequently then present is not unlikely. The theory might be advanced that, in presence of hyperplasia and increased activity of the tracheo-bronchial glands, the increased intrathoracic pressure induced by the expiratory paroxysms might assist in squeezing an undue amount of lymphocytes into the blood. It must also be borne in mind that the polymorphonuclear cells are often greatly increased in absolute numbers in the earlier stages, and are frequently present in some excess in the later stages of disease. To these an active role might be attributed.

The later views of some of our leading haematologists, however, must not be disregarded. Maximow and Wolff have declared that the lymphocytes are capable of active movement. McCallum and Longhope seem to have proved that they respond to chemiotaxis in enteric fever. Muir and Gulland are both agreed that lymphocytes offer a sufficient line of defence towards non-virulent organisms, while virulent organisms may be met by polymorphonuclear cells.

Lymphocytes are thus likely to preponderate in subacute and chronic affections. Whooping Cough is a dis-

ease to which this description, to some extent, would seem to apply. It is subacute in character; tedious in its course. In an uncomplicated case it is non-febrile or only slightly so in the earlier stages. The lymphocytosis present may be a specific response to the virus of the infection.

EOSINOPHILIA OF WHOOPING COUGH

Haematologically, Whooping Cough would seem to bear some resemblance to syphilis, in which there is said to be a lymphocytosis associated with eosinophilia.

Clinically, however, Whooping Cough bears no resemblance to any of the affections in which eosinophilia is found except paroxysmal asthma, but no observer has recorded in connection with paroxysmal asthma an associated lymphocytosis. Both are affections characterised by dyspnea - respiratory paroxysmal attacks and bronchial cough followed by a viscid expectoration. In both diseases the morbific factor is still undefined, though an organism has been described as having been found in the sputum of Whooping Cough.

Grabitschewski quoted by Billings attributes their

abundance in the blood of the former affection to a pathological alteration of the protoplasm of the polymorphonuclear cells which, from being finely granular and neutrophilic, become coarsely granular and oxyphilic. Leyden, on the other hand, holds that their abundance is due to local new formation, i.e., that they are formed in the mucous membranes of the bronchioles. Ehrlich again holds that their increase is due to a specific chemiotaxis resulting from destruction of epithelial and epithelioid tissue.

The eosinophilia of Whooping Cough is, however, rarely so intense as that found in asthma. It differs also in its onset, in so far that, at the fastigium of the disease, it is usually absent, and appears when a manifest improvement is setting in. In asthma, on the contrary, it is present in greatest intensity at the height of the paroxysm, and begins early.

The eosinophilia of Whooping Cough is remarkable in two respects - (1) The lateness of the onset; and (2) Its persistence after it has become established. Regarding the latter, it is often present in high degree when patient is dismissed from hospital. This behaviour of the eosinophile cells is in agreement with what Boycott has found to be the case in Ankylostomiasis. Here the

eosinophilia appeared sometimes within twenty days after infection, but it persisted in many cases after the disease had been under treatment for a very considerable time, and when ova could no longer be found in the faeces.

The presence of eosinophilia is recognised as of good prognosis in disease. Especially is this the case in the specific fevers, viz., pneumonia, typhus, scarlet etc. The same has also been asserted for other diseases, such as pernicious anaemia and leukaemia by Reckzeh (20), and surgical tuberculosis by Granasso (21). In Whooping Cough in the very severe cases the presence of eosinophiles in increasing numbers in the blood would appear to be a favorable sign, as recovery then begins. In milder cases they appear in smaller number.

The percentages and absolute numbers of eosinophile cells in the blood in Whooping Cough seem to be too great to classify the reaction as analogous to the post febrile one. Muir's remarks about the fact that he had been struck by the frequent association of eosinophilia with lymphocytosis in sub-acute affections in rodents, would appear to apply to Whooping Cough in children. The disease is a sub-acute one, and the blood condition is a lymphocytosis followed by an eosinophilia.

In estimating, finally, the importance of the presence of eosinophilia in cases of Whooping Cough, it must be remembered that it has been said that there is a particular tendency in the blood of children to show an increase in these cells. An eosinophilia, however, was present in none of the cases when the observations were begun.

In conclusion, the eosinophilia of Whooping Cough would appear to be a result of a specific haematological reaction on the part of blood-forming tissues.

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In presenting the cases for detailed examination, a short clinical history is given with each, and, as far as possible, the history of the progress of the disease during their stay in hospital is outlined. Accompanying each case is a table giving dates of counts, the number of leucocytes obtained, with percentages and absolute numbers of each class of cell, together with a chart in which the absolute numbers of each class of cell are plotted out. The total number of leucocytes is charted in black ink, the polymorphonuclear cells in red, the lymphocytes in green, the large mononuclear cells in brown, and the eosinophiles in blue. The myelocytes are not charted.

During the course of the observations, four of the cases in the long series developed measles. Case IX, who was responsible for the outbreak, was incubating the disease when admitted to hospital, and rash appeared on 5th day of stay in hospital. From contact with Case IX, Case II developed the disease on his 47th day of illness; Case III on her 61st day of illness; and Case VIII on the 83rd day.

CASE I - J. McM., aet. 4 years

The patient was well nourished child. Admitted on the 15th day of illness, with well defined Whooping Cough. The paroxysms at first were frequent and severe, and after two or three days, vomiting sometimes followed the cough. On the whole, however, the case was a mild one, the illness running a short course. The boy was dismissed well on the 63rd day. The temperature throughout was normal. The chest contained for first two or three days a few sonorous rhonchi, which soon disappeared. No complications occurred. There was never any blood in the sputum, and expectoration was not copious at any time.

Character of Leucocytosis

Average			Polymphs. Per cent.	Lymphos. Per cent.	L.Monos. Per cent.	Eos. Per cent.	My. Per cent.
Leuco. per c.m. during residence	First 8 obs.	Last 13 obs.					
18,620			49.16	40.35	8.05	2.25	.19
	25,580		39.5	49.6	9.	1.5	.4
		14,170	55.11	34.65	7.45	2.72	.07

No. of observations - wet counts and differential counts - 21

Case I Contd.

In the first observation a great increase is noted in the lymphocytes, which constitute 60.5% of the total white cells, and are present in absolute number of 22,143. They gradually decline in number, and by the ninth observation, 40th day, have practically attained normal limits, and remain so thereafter. The polymorphonuclear cells are much increased in absolute number during the first six observations, but are almost normal on seventh. Thereafter they show an irregular increase to the end of the observations, and to the behaviour of these cells any subsequent increase beyond normal in the total leucocyte count is due. The large mononuclear cells show high absolute numbers in the first four observations, after which there is a rapid decline towards normal, which is reached on the 34th day. The eosinophiles are absolutely increased during the first two observations, corresponding with the high leucocyte count, but they rapidly fall to normal. A slight eosinophilia is to be noted on 52nd day, which is more marked on 63rd day, the last observation taken.

CASE I - J. McM., aet. 4 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
15	36,600	29	10,614	60.5	22,143	7.5	2,745	2.5	915	.5	183
17	28,000	38	10,640	52	14,560	7.75	2,170	2	560	.25	70
19	36,000	42.5	16,560	46	15,300	9.5	3,420	1	360	1.	360
21	26,000	40.75	10,595	48	12,480	10.	2,600	1.25	325		
25	25,400	39	9,906	50.5	12,827	9	2,286	.5	127	1.	254
27	21,200	48.5	10,282	41	8,692	10	2,120	.5	106		
29	16,800	38	6,384	49	8,232	11	1,848	2	336		
32	16,800	40	6,720	51	8,568	7	1,176	2	336		
34	15,600	56.5	8,814	37	5,772	5	780	1.5	234		
36	14,200	51	7,242	39	5,538	7	994	2.25	319	5.75	106.5
38	15,200	51.5	7,828	41	6,232	5	760	2.5	380		
40	16,200	57	9,234	34.5	5,589	7	1,134	1.5	243		
42	10,000	51	5,100	37	3,700	8.75	875	3.25	325		
45	11,400	56	6,384	32.5	3,705	7.75	883	3.5	399	.25	
47	13,400	55	7,370	33	4,422	9	1,206	3	402		
49	12,200	49.5	6,039	38	4,636	9	1,098	3.5	427		
52	12,800	52	6,656	36.5	4,672	7.5	960	4	512		
54	18,200	64	11,648	28	5,096	6	1,092	2	364		
56	14,800	65	9,620	24.5	3,626	8.5	1,258	2	296		
61	15,800	60	9,480	31	4,898	7.25	1,145	1.75	277		
63	14,000	48	6,720	38.5	5,390	9	1,260	4.5	630		

CASE I - J. McM., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000.

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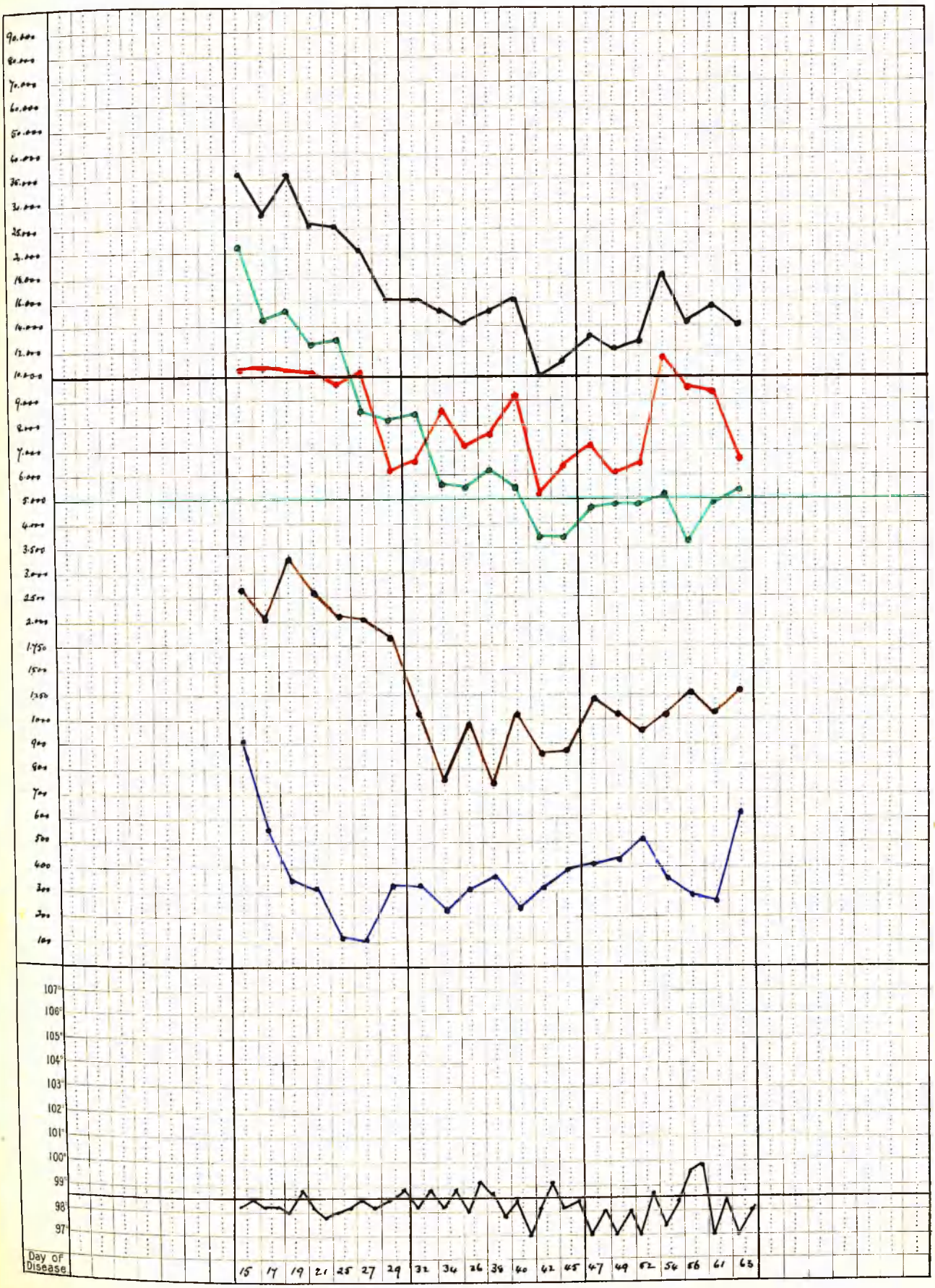
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Day of Disease
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CASE II - G. M., aet. 3 years

This was a well nourished child; admitted in his 29th day of illness. Temperature was 98.6; pulse 108; respirations 32; physical examination revealed a few muco-crepitant rales over both sides of the chest, more marked over right base. The heart was normal. The cough at this period was severe, the paroxysms being frequent, and the whoop which followed, resonant. Expectoration was abundant. On the 33rd day vomiting followed the more violent paroxysms. By the 43rd day a slight improvement in these symptoms was noticeable, but on this date a rise in temperature was recorded. Prodromal symptoms of measles were in evidence the following day. The rash appeared on 47th day. Marked exacerbation of the previous symptoms resulted. For a few days respirations were accelerated to 60 per minute, and, on physical examination, there were well marked signs of a capillary bronchitis, which, however, had disappeared by 55th day. On 72nd day patient was allowed up, and was dismissed from the ward well on his 88th day.

Case II Contd.

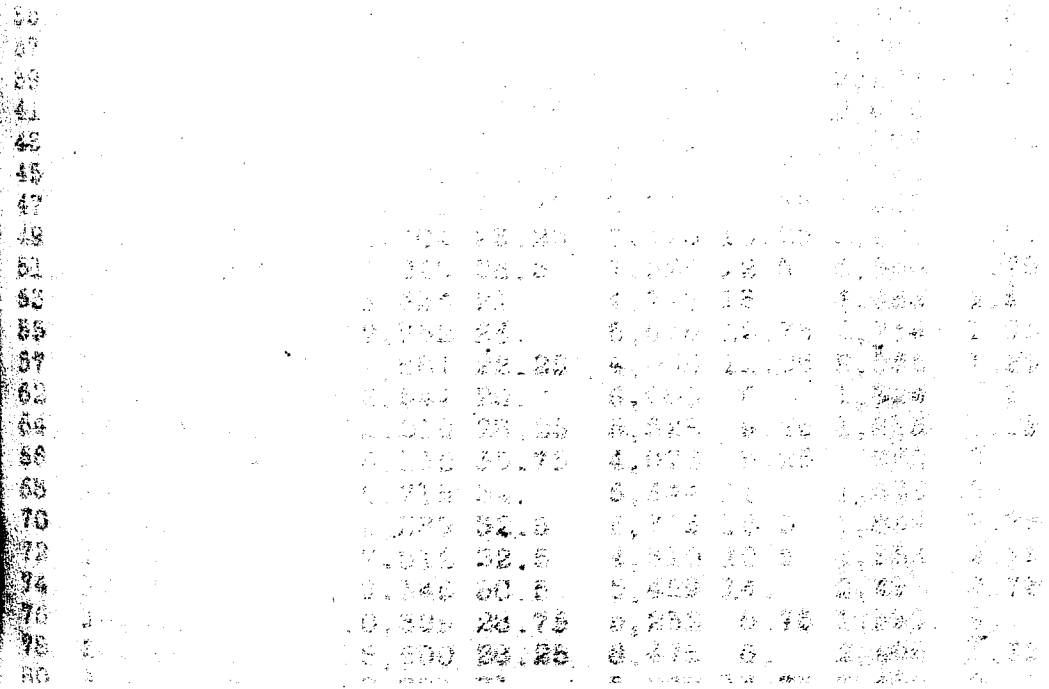
Leucocytosis - No. of differential and wet counts, 27

Leuco. per c.m. during residence	Average First 8 obs.	Average Last 19 obs.	Polymphs. Per cent.	Lymphos. Per Cent.	L.Monos. Per Cent.	Eos. Per cent.	My. Per cent.
24,309			52.90	34.92	10.04	1.74	.4
	35,222		43.30	47.	7.84	1.58	.28
		19,715	56.93	29.84	10.97	1.82	.44

The normal line for lymphocytes is fixed at 6,000 cells per cm. These cells are present in high absolute numbers in the first two observations, viz., 23,673 and 28,552 per cm., the percentages being respectively 54.8 and 58.75. From the last observation a decline takes place till normal numbers are reached on 47th day. The curve remains at the normal line till end of observations. The polymorphonuclear cells are increased to a considerable degree in absolute numbers for the first three observations; thereafter great fluctuations in number ensue, and their curve very closely approximates to the general leucocytic curve. The curve of the large mononuclear cells is a very irregular one, high absolute numbers being present after the lymphocytic fall is established. As in the previous case, the eosinophiles

Case II Contd.

are present in high absolute numbers in the first two observations, corresponding with the high leucocyte count, but normal numbers are reached on 4th observation. An eosinophilia of slight degree, however, is present from the 70th to 78th days.



CASE II - G. M., aet. 3 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos Per cent.	Large Monos Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
29	43,200	35.8	15,465	54.8	23,673	6.4	2,764	3.	1296		
31	48,600	31.	15,066	58.75	28,552	8.	3,888	2.25	1093		
35	40,800	37.25	15,198	52.	21,216	8.5	3,468	1.5	612	.75	306
37	23,000	39.25	9,039	52.25	12,006	7.75	1,782	.75	172		
39	25,800	38.	9,804	52.25	13,481	8.25	2,128	1.5	387		
41	33,600	52.	17,472	39.25	13,188	6.	2,016	2.25	756	.5	168
43	36,200	54.25	19,638	37.	13,394	8.	2,896	.25	90	.5	181
45	30,600	58.5	17,901	30.25	9,256	9.75	2,983	1.	306	.5	153
47	15,000	64.5	9,675	25.25	3,787	9.75	1,462			.5	75
49	32,200	64.25	20,704	23.25	7,470	10.25	3,302	.75	241	1.5	483
51	28,400	60.	17,040	26.5	7,526	12.5	3,550	.75	213	.25	71
53	22,600	59.	13,334	21.	4,746	18.	4,068	1.5	339	.5	113
55	21,600	59.5	12,852	26.	5,616	12.75	2,754	1.25	270	.5	108
57	18,200	65.25	11,881	22.25	4,036	11.25	2,055	1.25	227		
62	30,400	73.5	22,344	20.	6,080	6.	1,824	.5	152		
64	19,600	62.25	12,210	28.25	5,528	9.25	1,813	.25	49		
66	11,400	54.	6,156	35.75	4,076	8.25	940	2.	228		
68	16,600	52.5	8,715	34.	5,644	11.	1,826	2.	332	.5	83
70	17,800	52.75	9,389	32.5	5,785	10.5	1,869	3.75	667	.5	89
72	14,800	52.75	7,812	32.5	4,810	10.5	1,554	3.75	550	.5	74
74	17,800	52.5	9,345	30.5	5,429	14.	2,492	2.75	489	.25	44
76	18,200	59.5	10,829	28.75	5,232	8.75	1,592	3.	546		
78	30,000	62.	18,600	28.25	8,475	8.	2,400	1.75	525		
80	17,000	52.25	8,891	31.	5,270	14.75	2,499	2.	346		
82	9,200	32.25	2,970	50.75	4,666	13.	1,196	3.	276	1.	92
84	19,000	55.5	10,545	30.	5,700	10.25	1,947	2.25	380	2.	380
88	14,800	47.25	7,000	40.25	5,956	9.75	1,443	2.25	333	.5	74

CASE II - G. M., aet. 3 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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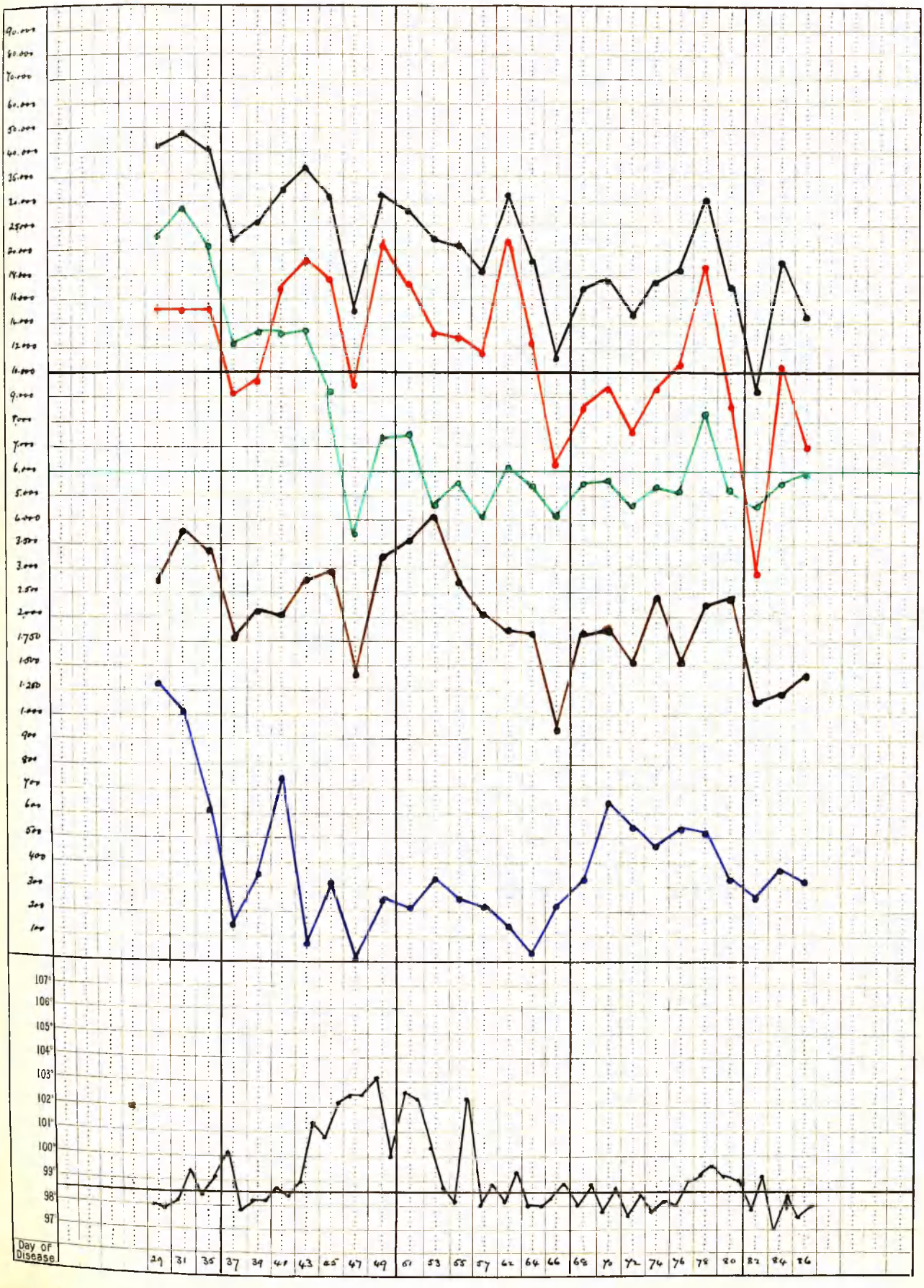
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CASE III - J. N., aet. 4 years

This was a severe and protracted case of Whooping Cough. The patient was admitted approximately on 21st day of illness, well nourished. Temperature was 97.8, pulse 96, and respirations 26. The examination of the chest was negative. Paroxysms were frequent and severe at this date, and often followed by vomiting. About the 26th day there were signs of bronchitis. The paroxysms gradually increased in severity and frequency. From 35th day during their occurrence there was marked lividity, the face had become puffy, expectoration was copious and contained blood. A decline in the severity of the symptoms was noted by the 61st day. At this time the child developed measles from contact with a previous case. As in Case II, there was an exacerbation of the severity of the Whooping Cough till the 68th day. A gradual improvement then set in. Patient was allowed up on the 120th day when cough was practically well, and was dismissed shortly afterwards. During her residence there was no pyrexia, excepting during the attack of measles above referred to.

Case III Contd.

Character of Leucocytosis - No. of observations - wet and differential counts - 43

Leuco. per cm. during residence	Average First 10 obs.	Average Last 33 obs.	Polymphs. Per cent.	Lymphos. Per Cent.	L.Monos. Per Cent.	Eos. Per cent.	My. Per cent.
19,306			54.	33.2	9.	3.6	.15
	29,720		41.6	48.9	7.3	2.2	
		16,151	57.8	28.3	9.5	4.2	.2

A high degree of lymphocytosis did not occur in this case till the fourth observation, or 27th day, when the high absolute number of 20,552 cells was recorded. On the 29th and 31st days still higher values are present, the percentages on these dates being respectively 53.25 and 58.75. A gradual decline in absolute numbers then begins, and normal is touched by the 51st day, to be seldom exceeded again during the remainder of the observations. The polymorphonuclear cells show a great increase in absolute number during the first ten observations, and after the 51st day they follow closely the general leucocytic curve, showing an irregular polymorphonuclear leucocytosis of a moderate degree. The curve of the large mononuclear cells behaves in an irregular

Case III Contd.

manner, but an absolute increase is present during the greater part of the observations. The eosinophiles are absolutely increased during the 4th, 5th, and 6th observations, corresponding with the high leucocytosis. They then decline to normal limits, and remain there till the 84th day, when a slight eosinophilia is noted. In the subsequent observations, this eosinophilia becomes more marked, until a high grade is reached on 110th to 122nd days, absolute numbers of 1,794, 1,752, and 1,649 being recorded - corresponding percentages 11.75, 12, and 13.25.

CASE III - J. N., aet. 4 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos Per cent.	Large Monos Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
21	19,200	50.25	9,648	40.	7,680	8.	1,536	1.25	240	.5	96
23	19,400	50.25	9,748	38.	7,372	8.	1,552	3.5	679	.25	49
25	26,200	46.5	12,183	46.	12,052	5.25	1,375	2.25	589		
27	46,400	43.75	20,276	44.25	20,555	8.5	3,944	3.5	1,624		
29	44,200	39.75	17,547	53.25	23,558	5.	2,210	2.	884		
31	39,800	35.25	14,049	58.75	23,362	4.	1,592	2.	796		
35	29,200	29.5	8,614	62.65	18,177	7.	2,044	1.	292	.25	73
37	32,000	40.	12,816	49.75	15,904	8.75	2,800	1.5	480		
39	23,400	48.5	11,349	40.5	9,477	9.25	2,164	1.75	409		
41	17,400	41.75	7,265	40.	6,960	14.5	2,523	1.25	217	2.5	435
43	23,200	48.75	11,298	38.	8,816	11.25	2,622	2.	464		
45	15,600	46.	7,176	40.	6,240	10.25	1,606	3.75	577		
47	17,800	59.5	10,591	33.	5,874	6.75	1,202	.75	133		
51	11,400	47.	5,358	39.	4,446	9.5	1,083	4.5	513		
53	21,400	68.75	14,702	22.25	4,771	7.75	1,659	1.25	266		
55	11,200	55.75	6,244	36.	4,032	4.5	504	3.75	420		
57	20,400	63.5	12,954	25.25	5,140	8.25	1,694	3.	612		
59	21,200	83.	17,596	10.25	2,173	4.	848	2.	424	.75	159
61	16,600	66.25	11,000	21.25	3,525	11.	1,826	1.5	249		
63	22,400	84.75	18,972	10.25	2,308	4.75	1,064	.25	56		
65	13,200	81.25	12,350	11.	1,672	6.5	988	.5	76	.75	114
67	15,400	84.5	13,013	7.5	1,155	7.75	1,193	.25	38		
69	13,200	49.	6,566	27.25	3,659	21.25	2,840	2.	268	.5	67
78	15,400	60.5	9,317	29.5	4,543	8.75	1,348	1.25	192		
80	11,600	51.	5,916	34.5	4,002	10.25	1,189	4.	464	.25	29
82	10,600	50.25	5,327	34.5	3,657	13.	1,378	1.5	159	.75	79
84	17,200	44.25	7,603	35.25	6,063	15.25	2,631	3.75	545	1.5	258
86	13,200	40.5	5,340	38.75	5,108	14.25	1,887	5.5	726	1.	132
88	11,400	43.25	4,930	37.75	4,309	11.25	1,276	7.5	855	.25	28
90	9,400	53.	4,982	27.	2,538	13.75	1,285	6.25	595		
92	16,000	48.	7,728	34.75	5,552	11.75	1,872	5.25	848		
94	12,800	56.	7,168	30.5	3,904	7.25	928	6.25	800		
96	22,000	60.	13,200	27.75	6,105	8.5	1,870	3.25	715	.5	110
98	17,200	54.75	9,419	30.75	5,280	10.25	1,770	4.	688	.25	43
100	21,200	67.25	14,246	17.5	3,710	13.75	2,925	1.5	318		
102	20,400	52.5	10,710	34.	6,936	9.5	1,938	4.	816		
104	19,000	56.25	10,688	29.5	5,605	8.	1,520	6.	1,140	.25	47
106	17,200	55.	9,460	30.25	5,203	9.75	1,677	4.25	731	.75	129
108	16,600	49.5	8,217	30.5	5,063	11.25	1,868	8.75	1,452		
110	16,400	51.	8,364	32.	5,248	8.	1,312	8.75	1,435	.25	41
112	15,200	61.5	9,348	21.75	3,298	5.	760	11.75	1,794		
120	14,600	34.5	5,037	48.	7,008	5.5	803	12.	1,752		
122	12,400	38.	4,712	41.75	5,171	6.75	837	13.25	1,649	.25	31

CASE III - J. N., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000

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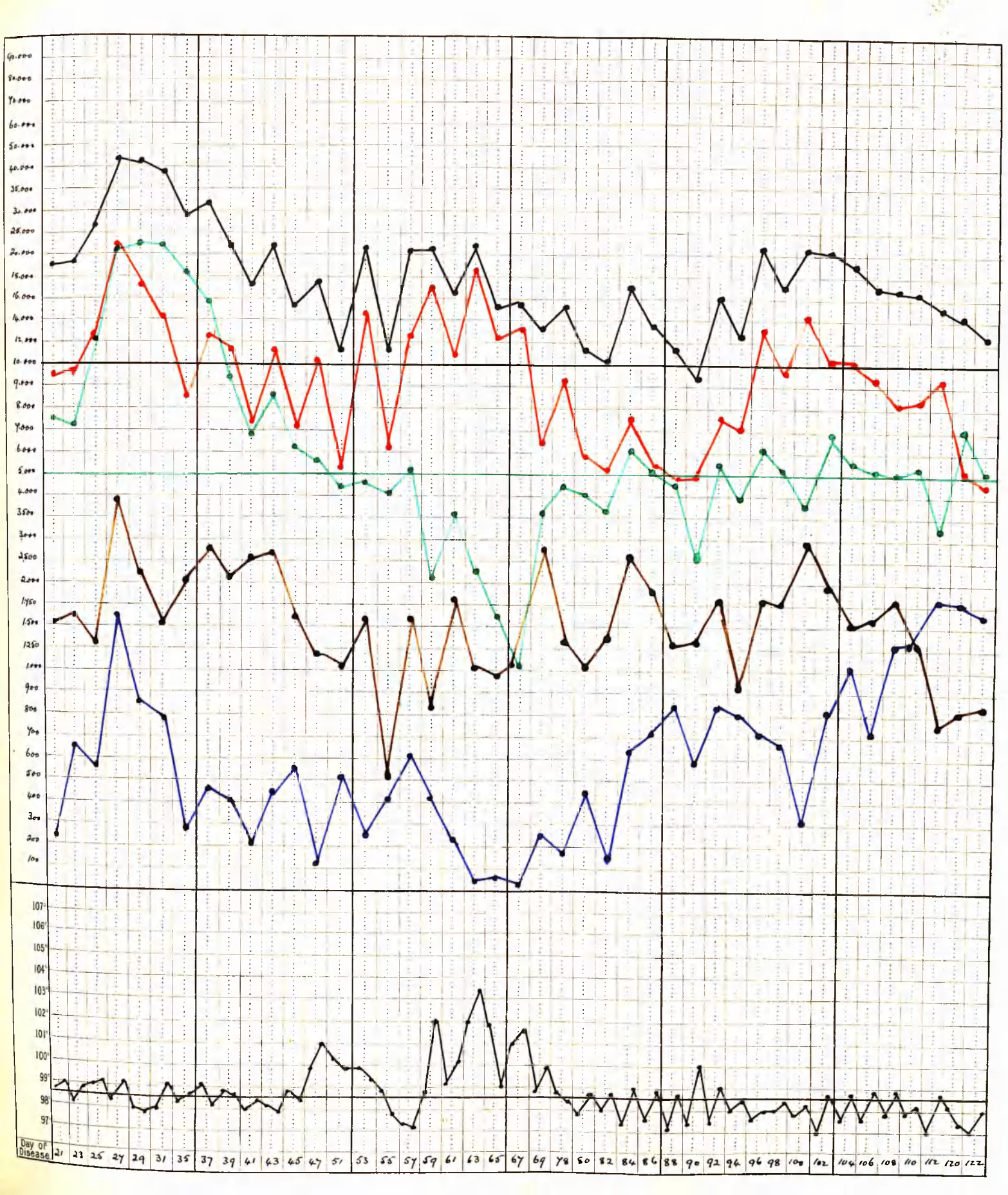
Day of Disease
21 23 25 27 29 31 35 37 39 41 43 45 47 51 53 55 57 59 61 63 65 67 69 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 120 122

CASE IV - A. G., aet. 5 years

This patient was admitted early in her illness, probably about the 9th day. Her case was not only unusually severe, but also very prolonged. On admission her temperature was 98.6, pulse 100, and respirations 40. The examination of the chest revealed a slight bronchitis, indicated by a few sonorous rales of general distribution. Cough was frequent and spasmodic, and sometimes followed by vomiting. Its severity and frequency increased, the fastigium being reached about the 50th day. At this time paroxysms were frequent and violent, expectoration was copious and often contained blood in considerable quantity, and patient had lost flesh markedly. There were, however, no chest complications. From this period a gradual amelioration of the symptoms began, and by the 68th day, though whooping and vomiting were still present, the paroxysms were of a milder type, and there was no longer haemoptysis. On 83rd day patient was allowed up, and she was dismissed well on her 99th day. Throughout her stay in hospital there was no pyrexia excepting on one occasion, when temperature registered 104° to drop again to normal a few hours afterwards.

Case IV Contd.

No. of observations - wet and differential counts - 39

Average leuco. per cm. during residence	Polymphs. Per cent.	Lymphos. Per cent.	L. Monos. Per cent.	Eos. Per cent.	My. Per cent.
17,574	56.5	28.6	8.25	6.4	.25

Lymphocytosis in this case was only observed for a short period, and did not reach the high limits observed in other cases. It is present in its maximum form on the 9th and 11th days of illness, when absolute numbers of 11,218 and 10,773 cells are obtained. Normal numbers are reached on 18th day, and are much exceeded only on three occasions during the rest of the observations. Throughout, however, these cells betray a tendency to a slight increase in absolute number. A leucocytosis is present in this case throughout the observations. On only one occasion was a count of less than 10,000 obtained. After the 22nd day it will be observed from the chart that this leucocytosis is mainly polymorphonuclear. These latter cells are much increased in absolute number at the beginning of the illness, and show irregular increases during the whole period. The large monomuclear

Case IV Contd.

cells are increased absolutely during the first seven observations, but except on two or three occasions they are usually about the higher physiological level thereafter. An eosinophilia of moderate grade begins on the 22nd day, and is present in an irregular form till the 68th day. From this period it remains at a constant higher level, and is present in its maximum form on the last observation made, 99th day, when absolute numbers of 2,111 cells per cm. are present, constituting 10.25% of the total white cells. Myelocytes were present in very small percentages in most of the observations made; their figures are given in the accompanying table.

CASE IV - A. G., aet. 5 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
9	37,000	69.5	25,715	21.75	8,048	7.	2,590	1.5	555	.25	92
11	31,600	53.75	16,985	35.5	11,218	10.	3,160	.75	237		
13	22,800	44.	10,032	47.25	10.773	7.5	1,710	1.	228	.25	57
15	19,800	64.25	12,721	25.	4,950	10.	1,980	.75	148		
18	14,200	61.5	8,733	27.75	3,940	9.5	1,349	1.25	177		
20	30,200	63.75	19,252	27.5	8,305	7.	2,114	1.75	528		
22	17,400	61.25	10,657	24.	4,176	9.5	1,653	5.25	913		
24	17,200	57.5	9,890	27.	4,644	8.75	1,505	6.75	1,161		
28	17,800	51.75	9,211	28.	4,984	12.	2,136	8.25	1,468		
30	13,400	62.75	8,415	20.	2,680	11.75	1,568	5.5	737		
32	10,600	51.25	5,438	32.75	3,465	10.5	1,113	5.	530	.5	53
34	12,000	48.5	5,820	34.25	4,110	12.	1,440	5.25	510	1.	120
36	13,400	50.75	6,807	36.25	4,851	7.	938	4.5	603	1.5	201
38	15,800	58.75	9,282	25.5	4,029	7.5	1,185	7.75	1,224	.5	79
40	17,400	60.75	10,579	22.75	3,950	5.5	957	11.	1,914		
42	31,400	57.5	18,055	26.75	8,399	6.5	2,041	9.25	2,904		
44	11,800	59.75	7,056	29.75	3,505	4.5	531	6.	708		
46	8,000	52.75	4,220	30.	2,400	9.	720	8.	640	.25	20
48	16,800	56.25	9,458	29.25	4,906	7.25	1,218	7.	1,176	.25	42
50	16,600	56.25	9,338	29.	4,814	4.75	788	10.	1,660		
52	16,400	55.	9,020	25.5	4,182	9.25	1,517	9.	1,476	1.25	205
54	15,400	46.	7,084	36.	5,544	12.25	1,886	5.75	885		
56	15,000	48.25	7,245	31.25	4,680	11.25	1,680	9.25	1,395		
58	20,000	50.5	10,100	32.75	6,550	10.5	2,100	6.25	1,250		
60	14,400	55.75	8,035	24.5	3,528	11.25	1,613	8.5	1,224		
62	12,200	58.	7,076	27.25	3,324	9.5	1,159	4.75	579	.5	61
66	12,200	47.25	5,770	35.25	4,295	10.	1,220	7.5	915		
68	18,400	59.	10,856	23.5	4,324	7.75	1,426	8.75	1,610	1.	184
70	12,800	59.	7,557	25.5	3,264	7.25	928	8.	1,024	.25	32
74	21,200	64.25	13,621	23.5	4,982	6.5	1,378	5.5	1,166	.25	53
76	17,400	57.5	10,005	23.5	4,089	9.5	1,653	9.	1,566	.5	87
79	15,000	60.5	9,075	26.25	3,937	5.75	862	7.	1,050	.5	75
81	15,800	55.75	8,816	27.75	4,377	6.5	1,027	9.5	1,501	.5	79
83	17,200	47.	8,084	40.25	6,923	4.	688	8.75	1,505		
86	16,400	56.	9,184	27.25	4,469	6.5	1,066	10.25	1,681		
88	12,800	59	7,552	23.	2,944	7.75	992	10.	1,280	.25	32
90	18,200	56.	10,192	28.5	5,187	7.75	1,410	7.75	1,410		
92	20,600	50.25	10,351	31.5	6,489	8.	1,648	10.25	2,111		

CASE IV - A. G., aet. 5 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,500

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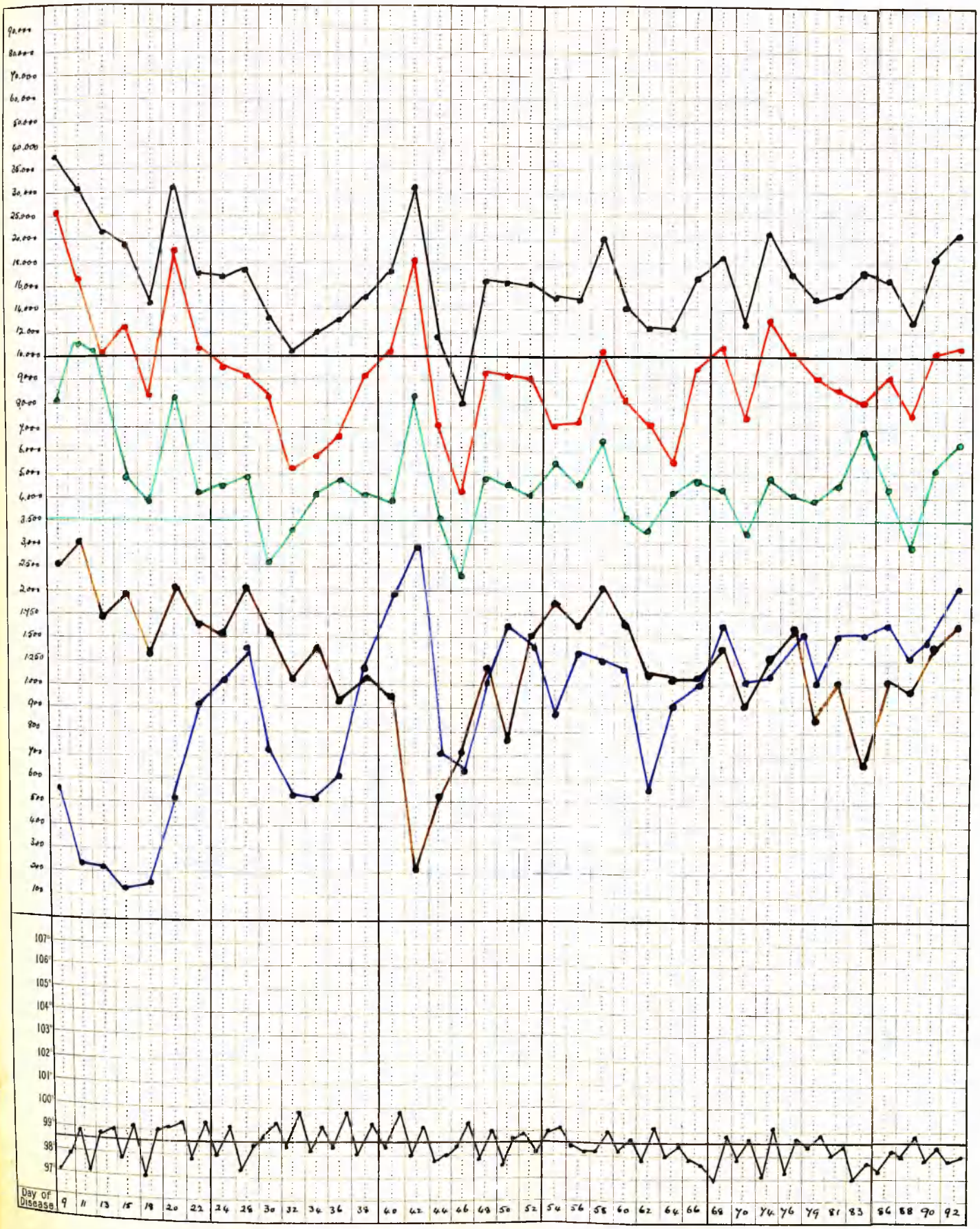
Day of Disease
9 11 13 15 18 20 22 24 26 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 74 76 79 81 83 86 88 90 92

CASE V - D. B., aet. 6 years

This was the most severe and at the same time the most prolonged case of Whooping Cough in the series under review. Admitted on 18th day of illness, with normal temperature and pulse, the patient was well nourished, and in fair general condition, though long bones and ribs bore evidence of rickets earlier in life. His cough was typically spasmodic and very severe, often followed by vomiting, though no whoop was then heard. The whoop appeared after a few days. An increase in the severity of his symptoms was noted for the first six weeks. By 56th day there was puffiness of eyelids, some slight subconjunctival haemorrhage, and marked loss of flesh. Paroxysms of coughing were very violent, vomiting was frequent, and expectoration copious and often bloody. Ten days later there was a slight improvement, which continued. The patient was allowed up on 98th day, and dismissed well after a residence of four months in hospital.

During his stay temperature seldom rose above normal limits. A bronchial catarrh was present till convalescence was advanced.

Case V Contd.

No. of observations - wet and differential counts - 40

Leuco. per cm. during residence	Average First 14 obs.	Average Last 26 obs.	Polymphs. Per cent.	Lymphos. Per cent.	L.Monos. Per cent.	Eos. Per cent.	My. Per cent.
30,609			48.22	40.44	8.54	2.44	.36
	42,628		39.7	52.4	6.4	1.2	.3
		24,138	52.8	34.	9.7	3.1	.4

The lymphocytes are present in the high absolute number of 16,159 on the first observation. There is a gradual increase, however, until the maximum of 43,624 is present on 36th day, when they constitute 53.25% of the total white cells in a count of 82,000. On 38th day there is a sharp fall to 17,739. This decline continues till normal figures are touched on 56th day. An irregular lymphocytosis is present throughout, being more marked after the 78th day. The polymorphonuclear cells are greatly increased in absolute numbers, corresponding with the high leucocytosis; they touch normal values on the 59th day, and fluctuate in a remarkable degree afterwards to end of observations. The large mononuclear cells are absolutely increased throughout, reaching a maximum of 6,804 on 81st day, equal to a percentage of

Case V Contd.

16.25. A moderate degree of eosinophilia is present on the 24th day - 1,386 cells per cm. A gradual fall in their number subsequently occurs until they altogether disappear by the 61st day. They reappear again suddenly in high numbers between the 78th and 81st days, rising from 310 per cm. to 2,415 per cm., and from 2.25% to 5.25%. They continue present in high numbers to the end of the observations, the maximum being reached on 85th day when they constitute 7.5% of the total cells, and reach an absolute number of 2,490.

The features of this case are, first, the irregular and often very high leucocytosis present in the later stages of the disease, in which lymphocytes as well as polymorphonuclear cells take a prominent part; and, second, the sudden onset of the eosinophilia.

CASE V - D. B., aet. 6 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
18	28,600	33.75	9,633	56.75	16,159	8.	2,280	1.5	427		
20	28,000	31.75	8,904	60.75	16,996	5.	1,400	2.25	630	.25	70
22	34,600	32.25	11,175	56.75	19,619	8.25	2,854	2.5	865	.25	865
24	50,400	43.25	21,798	48.	24,192	5.75	2,898	2.75	1,386	.25	126
26	36,000	34.25	12,348	57.75	20,772	7.25	2,610	.75	270		
28	43,800	39.	17,082	52.75	23,104	7.25	3,175	.5	219	.5	219
30	45,400	44.25	20,089	50.	22,700	5.	2,270	.75	340		
32	72,000	51.5	37,080	42.25	30,420	5.25	3,780	1.	720		
36	82,000	39.75	32,636	53.25	43,624	6.75	5,535	.25	205		
38	29,200	36.	10,512	60.75	17,739	2.75	803	.5	146		
40	31,400	35.	10,990	56.5	17,741	6.75	2,119	1.5	471	.25	78
42	49,400	34.5	17,043	58.75	29,023	5.25	2,593	1.25	617	.25	123
44	30,800	42.75	13,182	47.25	14,538	8.75	2,695	1.25	385		
46	35,600	51.	18,156	38.25	13,617	9.25	3,293	..75	267	.75	267
48	41,200	50.	20,600	39.5	16,274	9.25	3,811	1.	412	.25	103
52	46,000	49.5	22,770	41.	18,860	8.5	3,910	1.	460		
54	20,800	52.75	10,972	38.5	8,008	8.25	1,716	.5	104		
56	15,600	65.5	10,218	22.25	3,471	10.75	1,677	.75	117	.75	117
57	18,200	51.	9,282	36.	6,552	12.	2,184	.75	136	.25	45
59	8,000	64.5	5,160	26.75	2,140	8.25	660	.5	40		
61	23,200	53.5	12,412	33.75	7,830	11.75	2,726	.25	58	.75	174
64	18,200	55.75	10,155	32.	5,824	10.75	1,947			1.5	273
66	18,800	58.25	10,951	30.5	5,734	9.5	1,786	1.75	329		
68	22,600	54.	12,204	32.5	7,345	12.75	2,826	.75	169	.25	56
70	17,200	65.5	11,266	23.25	3,999	10.	1,720	1.	172	.25	43
72	17,000	54.	9,180	33.5	5,695	10.5	1,785	1.5	255	.5	85
75	16,600	44.	7,304	43.	7,138	10.75	1,784	1.75	290	.5	83
78	13,800	42.5	5,865	46.	6,348	9.	1,242	2.25	310	.25	34
81	42,000	49.	20,580	28.25	11,886	16.25	6,804	5.75	2,415	.25	315
85	32,200	43.25	14,359	42.	13,944	7.25	2,407	7.5	2,490		
87	15,000	56.	8,400	29.5	4,425	8.25	1,237	5.75	862	.5	75
89	22,800	57.5	13,110	29.5	6,726	7.	1,596	5.75	1,311	.25	57
91	44,000	61	26,840	28.25	12,430	4.5	1,980	5.5	2,420	.75	330
93	19,200	56.5	10,848	31.5	6,048	5.75	1,104	6.	1,152	.25	48
95	30,000	53.25	15,975	32.	9,600	9.25	2,775	5.5	1,650		
97	20,000	48.25	9,650	34.5	6,900	10.75	2,150	5.75	1,150	.75	150
99	15,400	48.	7,392	37.	5,698	8.5	1,309	5.5	847	1.	154
103	36,200	54.75	19,837	27.75	10,028	14.	5,068	3.5	1,267		
106	18,000	52.	9,360	37.	6,660	6.5	1,170	4.	720	.5	90

CASE V - D. B., aet. 6 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,000

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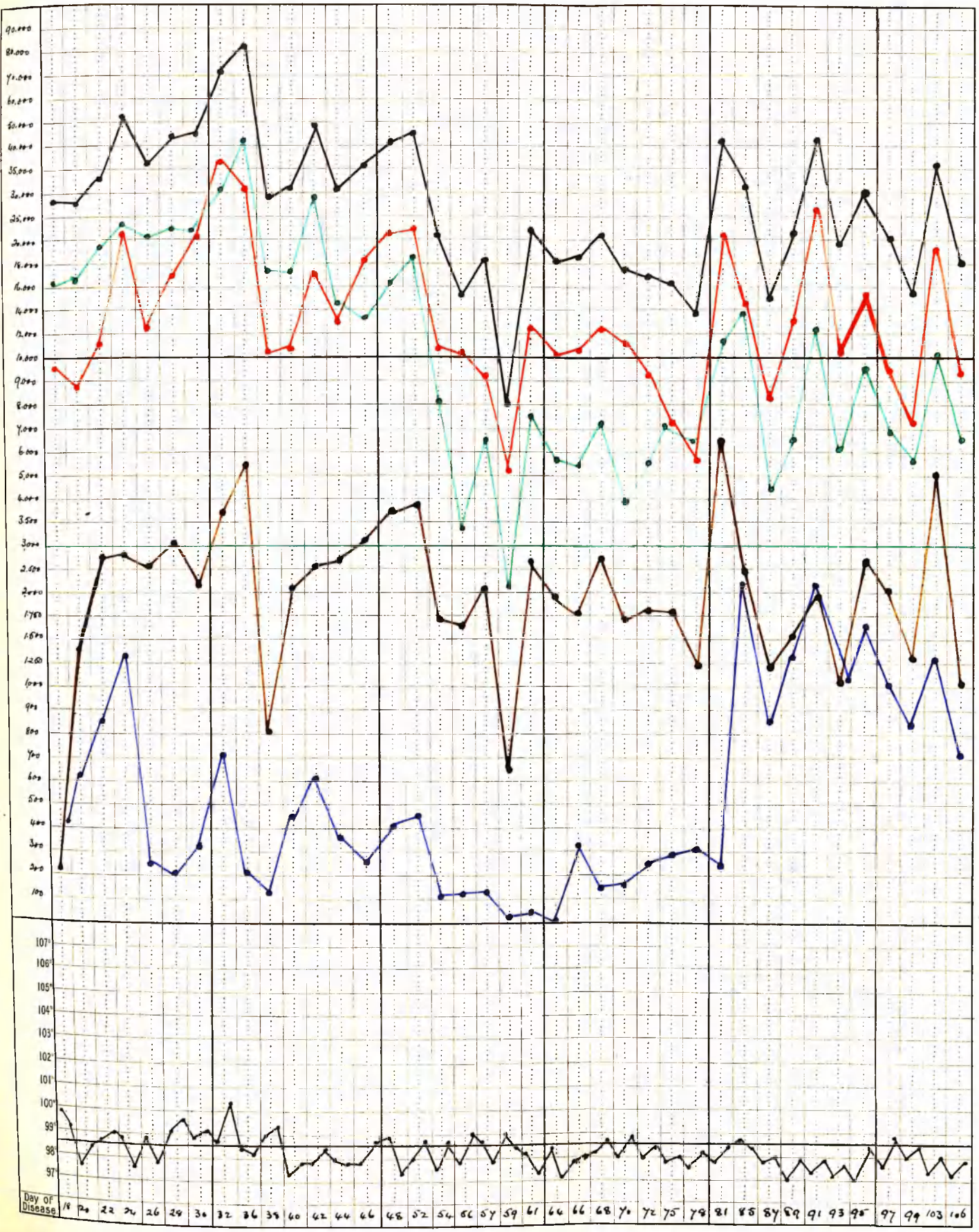
90,000
80,000
70,000
60,000
50,000
40,000
35,000
30,000
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15,000
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9,000
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900
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600
500
400
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100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 57 59 61 64 66 68 70 72 75 78 81 85 87 89 91 93 95 97 99 103 106

CASE VI - M. E., aet. 4 years

This child was admitted on her 22nd day of illness. Her case differs from the others inasmuch as no characteristic whoop was heard, although a history of whooping was obtained, and the cough was of a spasmodic character. She had also a definite broncho pneumonia. Temperature on admission was 103, pulse 178, and respirations 76. The patient was a pale but moderately well nourished child. She was sharply ill. Physical examination revealed impairment of percussion note over right apex; elsewhere percussion was normal. Over the dull area respiratory murmur was tubular, expiration was prolonged, and fine consonating rales were heard both on inspiration and expiration. Tubularity and crepitating rales were audible over a small area at the right base, while over the right lower lateral region and the right back there were numerous muco-crepitant rales. Over the left back and the left lateral region moist rales were also abundant.

Pyrexia was continuous until 30th day when normal temperature was present, to again rise the same evening.

Case VI Contd.

On 36th day the temperature was normal on the morning observation; after this date it was of a remittent type, the evening temperature being usually about 100, and morning temperature normal. By the 43rd day there was still dulness at right apex extending downwards to between third and fourth rib, with increased vocal resonance and vocal fremitus. Respiratory murmur was harsh and tubular, and expiration was much prolonged, but little or no rale was audible. The chest otherwise was clear. The temperature continued of remittent type till dismissal on 124th day. There were still physical signs of consolidation at right apex, impairment of percussion note remained, respiratory murmur was still harsh, and expiration was prolonged. A tuberculous condition was suspected, but the child left hospital much improved in health. During residence the patient did not whoop once; cough was spasmodic and paroxysmal at outset, and vomiting occurred once or twice.

Leucocytosis - No. of wet counts and differential observations - 23

Average leuco. per cm. during residence	Polymphs. Per cent.	Lymphos. Per cent.	L. Monos. Per cent.	Eos. Per cent.	My. Per cent.
10,659	63.3	27.07	8.53	1.05	.05

Case VI Contd.

There is a high leucocytosis during the first three observations, which becomes moderate on fourth, and is extinct by 48th day. From 53rd day the white cells vary from normal numbers to slight and moderate increases. The polymorphonuclear cells are those mostly concerned in the increases, and their curve follows very closely that of the general leucocytic one. There is a lymphocytosis from the 25th day to the 46th day, never, however, of very high degree, and these cells are not increased relatively to the polymorphonuclear. The increase above normal numbers of lymphocytes ceases on the 46th day, and keeps within these limits thereafter. The large mononuclear cells absolutely increased till the 48th day, showed high physiological numbers until the last observation when, in accordance with the low leucocyte count, they were much decreased. An eosinophilia was never present in this case. Myelocytes were observed on two occasions.

CASE VI - M. E., aet. 4 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
22	31,600	67.	21,172	25.5	8,058	7.	2,212	.5	158		
25	28,800	63.	18,144	30.5	8,784	6.	1,728	.5	144		
27	25,200	69.	17,388	23.	5,796	7.75	1,953	.25	63		
29	24,000	68.	16,320	25.5	6,120	6.25	1,500	.25	60		
32	26,800	72.	19,296	21.5	5,762	6.5	1,742				
34	15,800	60.5	9,590	30.	4,740	9.	1,422	.5	79		
36	14,800	57.5	8,510	29.25	4,329	13.	1,924	.75	111		
39	12,400	42.	5,208	45.5	5,642	12.	1,488	.5	62		
41	13,600	53.	7,208	39.	5,304	7.5	1,020	.5	68		
43	17,200	55.	9,460	35.5	6,106	9.5	1,634				
46	13,800	66.	9,108	25.	3,450	8.	1,104	1.	138		
48	8,900	62.5	5,562	27.	2,403	8.75	779	1.5	134	.25	22
50	8,600	62.5	5,375	22.	1,892	13.5	1,161	2.0	172		
53	11,600	62.	7,192	27.5	3,190	7.5	870	3.0	348		
55	12,400	62.5	7,750	28.	3,472	8.	992	1.5	186		
57	11,400	55.	6,270	34.	3,876	9.	1,026	2.	228		
59	15,600	64.	9,984	26.	4,056	8.5	1,326	1.25	195	.25	
62	19,800	68.	13,464	22.5	4,455	9.5	1,881				
64	12,600	67.	8,442	23.	2,898	9.5	1,197	.5	63		
67	13,000										
70	11,200										
75	11,000										
78	13,000	60.	7,800	28.	3,640	10.5	1,365	1.5	195		
82	12,800										
84	14,200										
88	10,400										
94	19,000	73.5	13,965	18.5	3,515	7.	1,330	1.	190		
108	8,400										
116	16,800	76.	12,768	16.	2,688	6.	1,008	2.	336		
124	6,000	70.	4,200	20.	1,200	6.	360	3.25	195	.75	45

CASE VI - M. E., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 4,000

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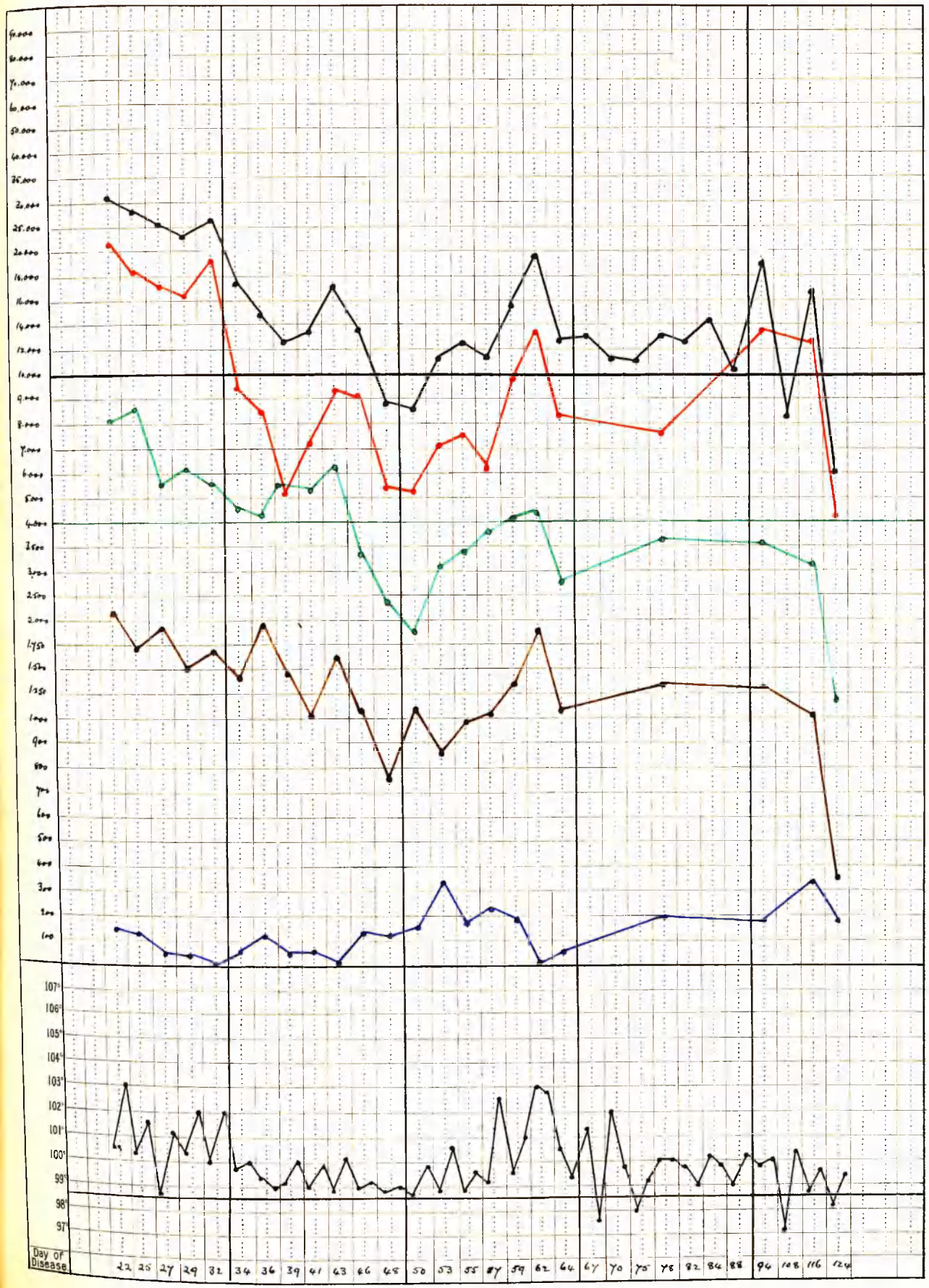

107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
22 25 27 29 32 34 36 39 41 43 46 48 50 53 55 57 59 62 64 67 70 73 78 82 84 88 96 108 116 124

CASE VII - J. E., aet. 5 years

This patient was admitted to hospital approximately on 26th day of illness. A fairly sharp case of Whooping Cough, but not a prolonged one. Temperature on admission was 99.4, pulse 112, respirations 24. The boy was well grown and well nourished. Beyond a slight bronchial catarrh, examination of the chest was negative. The paroxysms of cough were typical, followed by a resonant whoop and sometimes by vomiting. The acme of disease was approached about 32nd day; at this time expectoration was copious but never tinged with blood. Haemorrhages were absent. The chest was clear. Vomiting had ceased about 39th day. Improvement thereafter was gradual but continuous. The patient was allowed up on 68th and dismissed well on 81st days. The temperature throughout seldom rose above normal limits, and there were no complications.

No. of observations - wet and differential - 21

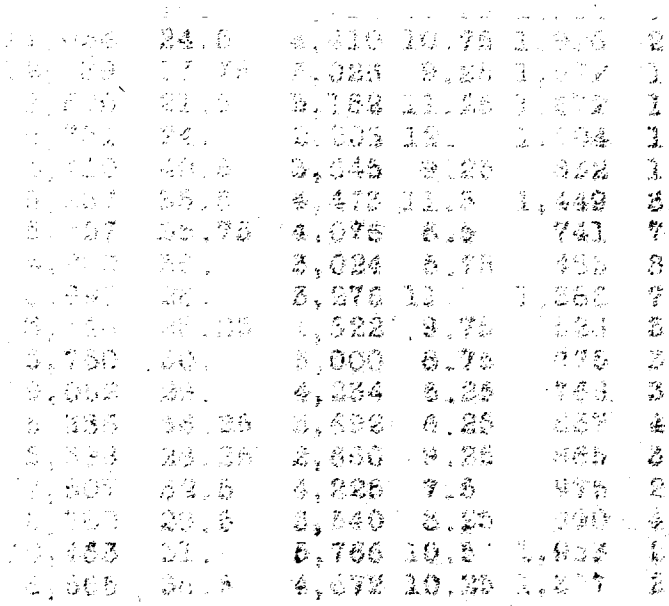
Leuco. per cm. during residence	Average First 5 obs.	Average Last 16 obs.	Polymphs. Per cent.	Lymphos. Per cent.	L.Monos. Per cent.	Eos. Per cent.	My. Per cent.
14,095			59.33	28.04	9.14	3.25	.25
	23,200		70.03	17.7	9.9	1.3	.8
		11,250	55.81	31.3	8.9	3.9	.09

Case VII Contd.

A leucocytosis of high degree was present in this case during the first three observations; a gradual decline then begins, and normal numbers are reached on 40th and 42nd days of illness. A leucocytosis of moderate degree is occasionally seen during the remainder of the illness. The polymorphonuclear cells are much increased absolutely and relatively during the first three observations. This increase, however, is followed by a decline, the curve closely approximating throughout to that of the leucocytes. The curve of the lymphocytes shows that these cells were seldom present in excess, for it seldom rises much above the normal line. The usual lymphocytosis, if present, had ceased before the observations were begun. The large mononuclear cells are absolutely increased at first, but show a gradual decline, reaching their lowest point on 48th day. Thereafter they tend to higher figures. The eosinophiles are present in normal numbers until the 46th day, when 826 cells per cm. are present, equal to a percentage of 7.25. A percentage of 8.25 is obtained on the 48th day with an absolute number of 693. On the 50th day the highest value is obtained, viz., 945 cells per cm. equal to a

Case VII Contd.

percentage of 7.5%. After that date normal numbers are again present, though a high mean value is exceeded on two occasions.



CASE VII - J. E., aet. 5 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
26	27,000	72.5	19,575	14.75	3,996	10.75	2,889	.75	202	1.25	337
28	25,600	76.75	19,660	12.75	3,251	8.5	2,176	1.	256	1.	256
30	28,400	69.25	19,681	18.75	5,310	10.55	2,982	1.5	426	.25	71
32	18,000	61.25	11,034	24.5	4,410	10.75	1,926	2.25	405	1.25	225
34	17,000	71.75	12,189	17.75	3,026	9.25	1,572	1.	170	.25	43
38	14,800	65.	9,620	21.5	3,182	11.25	1,672	1.75	260	.5	74
40	9,200	62.25	5,731	24.	2,208	12.	1,104	1.75	161		
42	9,000	49.	4,410	40.5	3,645	9.25	832	1.25	112		
44	12,600	49.5	6,237	35.5	4,473	11.5	1,449	3.5	441		
46	11,400	50.5	5,757	35.75	4,076	6.5	741	7.25	826		
48	8,400	50.	4,200	36.	3,024	5.75	483	8.25	693		
50	12,600	55.5	6,993	26.	3,276	11.	1,386	7.5	945		
52	5,400	58.25	3,148	28.25	1,522	9.75	526	3.75	202		
54	10,000	57.5	5,750	30.	3,000	8.75	875	3.75	375		
56	14,600	62.	9,052	29.	4,234	5.25	766	3.75	547		
58	10,200	52.75	5,386	36.25	3,692	6.25	637	4.75	485		
62	9,400	59.5	5,598	28.25	2,660	9.25	865	3.	282		
65	13,000	57.75	7,507	32.5	4,225	7.5	975	2.25	293		
73	12,000	56.5	6,780	29.5	3,540	8.25	990	4.75	570	1.	120
76	18,600	56.25	10,463	31.	5,766	10.5	1,953	2.25	418		
79	12,800	51.25	6,565	36.5	4,672	10.25	1,307	2.	256		

CASE VII - J. E., aet. 5 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,500

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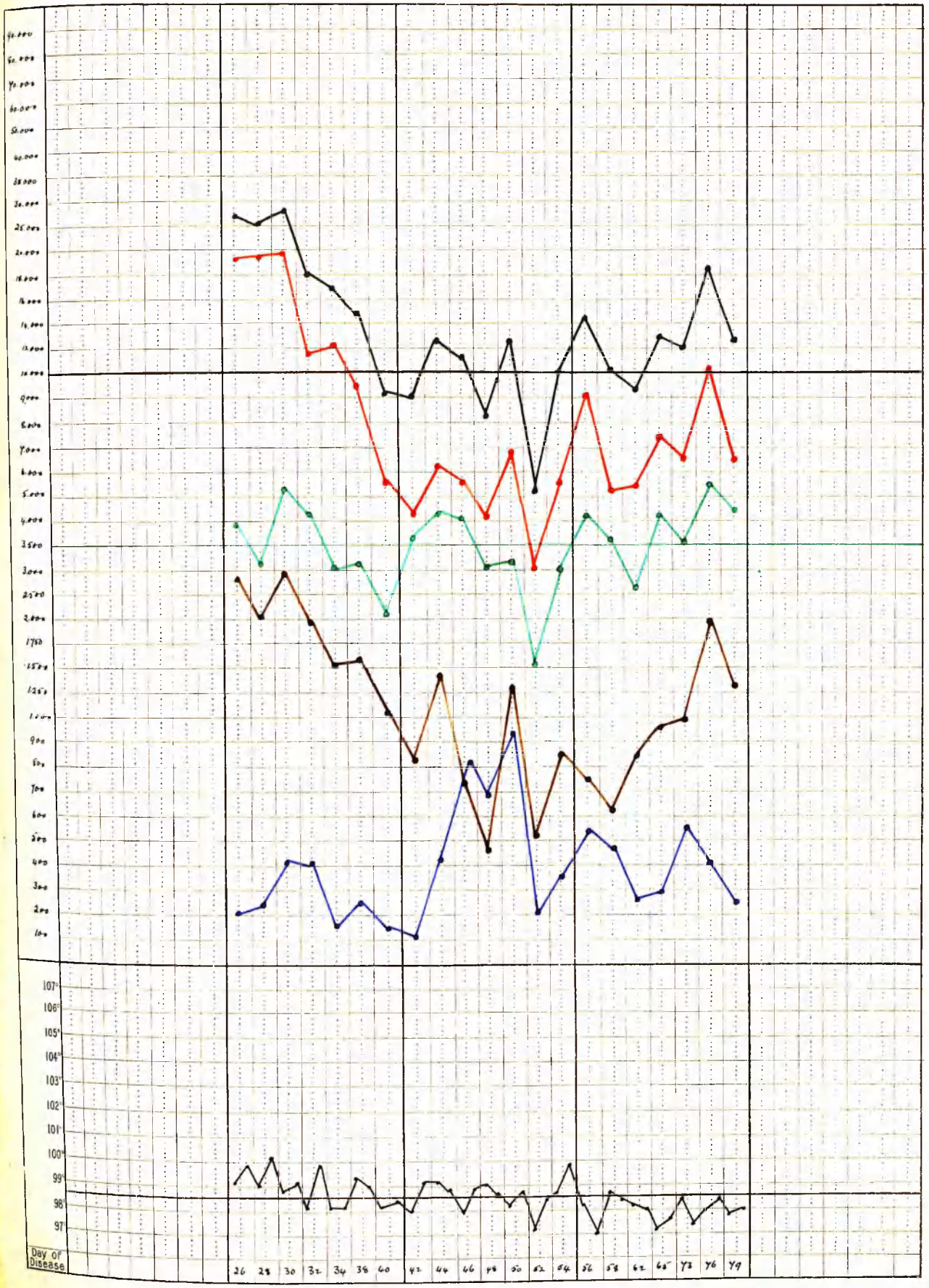
107
106
105
104
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102
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98
97
Day of Disease
26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 62 68 72 76 79

CASE VIII - G. P., aet. 2 years

This case was of ordinary severity. The patient was admitted approximately on 28th day of illness. On admission temperature was 98.2, pulse 100, and respirations 30. The child was well nourished. The cough was frequent and severe, spasmodic in character, and followed by a loud whoop. Physical examination of chest revealed a slight amount of catarrh. The symptoms increased in severity until 38th day. At this time paroxysms were violent, vomiting frequent, and expectoration copious, while bronchial catarrh still existed. There was, however, no haemoptysis. By 56th day a manifest improvement was noted. The cough was still spasmodic, but whooping and vomiting had ceased, and no rale was audible. About 83rd day the patient developed measles from contact with a previous case, and an exacerbation of his symptoms occurred. He was, however, dismissed well on his 106th day. Except during the attack of measles, there was no pyrexia, and no complications were noted.

Case VIII Contd.

No. of observations - wet and differential counts - 26

Leuco. per cm. during residence	Average First 13 cnts.	Average Last 13 cnts.	Polymphs. Per cent.	Lymphos. Per cent.	L.Monos. Per cent.	Eos. Per cent.	My. Per cent.
13,692			51.9	35.72	9.18	3.02	.18
	14,460		44	42.75	11.04	2.03	.18
		12,924	59.80	28.69	7.32	4.02	.16

A slight leucocytosis is present on the first two observations, which increases to moderate during the succeeding five. The normal is reached in next observation on the 44th day. In subsequent counts the numbers of the white cells vary from normal to a slight or very moderate excess. The lymphocytes are present in very slightly increased numbers from the 30th to 40th days, but thereafter their curve seldom rises above the normal line. They show rather a tendency to much decreased numbers. The large mononuclear curve shows an absolute increase in these cells from the 30th to 42nd days; in subsequent observations they vary within physiological limits. The eosinophiles are present in normal numbers till the 56th day, when they are present in the blood to the extent of 8.25%, in absolute numbers of 1534.5. By

Case VIII Contd.

the next observation they are again within normal limits. From the 60th day they gradually increase in number till 6.5% is reached with an absolute number of 741. A rapid fall ensues corresponding with the attack of measles, but in the last observation made a slight eosinophilia is again present. Myelocytes were seen in very small numbers in the blood on four occasions.

CASE VIII - G. P., aet. 2 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
28	13,800	45.	6,210	40.5	5,589	13.25	1,828	.5	69	.75	103
30	13,600	36.	4,896	50.5	6,868	12.25	1,666	1.25	170		
32	17,200	43.	7,396	38.5	6,622	15.25	2,623	2.5	430	.75	129
34	17,600	40.	7,040	44.75	7,876	12.75	2,244	2.5	440		
36	17,400	47.	8,178	40.	6,960	11.	1,914	1.75	304	.25	43
40	17,000	47.75	8,117	40.5	6,885	9.5	1,615	2.25	382		
42	16,200	40.5	6,561	43.5	7,047	13.	2,106	3.	486		
44	9,400	46.	4,324	43.5	4,089	9.5	893	1.	94		
46	12,600	52.5	6,615	37.5	4,725	8.	1,008	2.	252		
48	15,800	40.5	6,399	47.75	7,544	9.25	1,461	2.5	395		
50	13,000	40.25	5,232	46.5	6,045	10.75	1,397	2.	260	.5	65
52	10,800	47.	5,076	43.	4,644	7.75	837	2.25	243		
54	13,600	49.	6,664	40.25	5,474	8.5	1,156	2.25	306		
56	18,600	50.75	9,439	37.25	6,928	3.75	697	8.25	1,534		
58	11,600	68.75	7,975	18.5	2,146	9.25	1,073	3.5	406		
60	8,000	56.25	4,500	33.	2,640	7.25	580	3.	240	.5	40
62	13,400	57.25	7,671	32.75	4,388	6.75	904	3.25	435		
64	14,600	55.25	8,066	33.5	4,891	7.5	1,095	3.75	547		
66	13,800	65.	8,970	22.25	3,070	7.75	1,069	5.	690		
68	12,200	59.5	7,259	27.5	3,355	8.	976	5.	610		
72	10,400	54.	5,616	32.	3,328	7.75	806	6.25	650		
76	11,400	60.25	6,862	26.25	2,998	7.	798	6.5	741		
85	10,400	77.25	8,039	13.5	1,404	8.25	852	.5	52	.5	52
87	12,800	76.	9,728	15.5	1,984	6.75	864	1.75	224		
101	16,600	51.75	8,598	38.75	6,424	9.	1,494	.25	41	.25	41
106	14,200	54.5	7,739	32.75	4,657	7.75	1,100	4.	568	1.	142

CASE VIII - G. P., aet. 2 years

EXPLANATION OF CHART

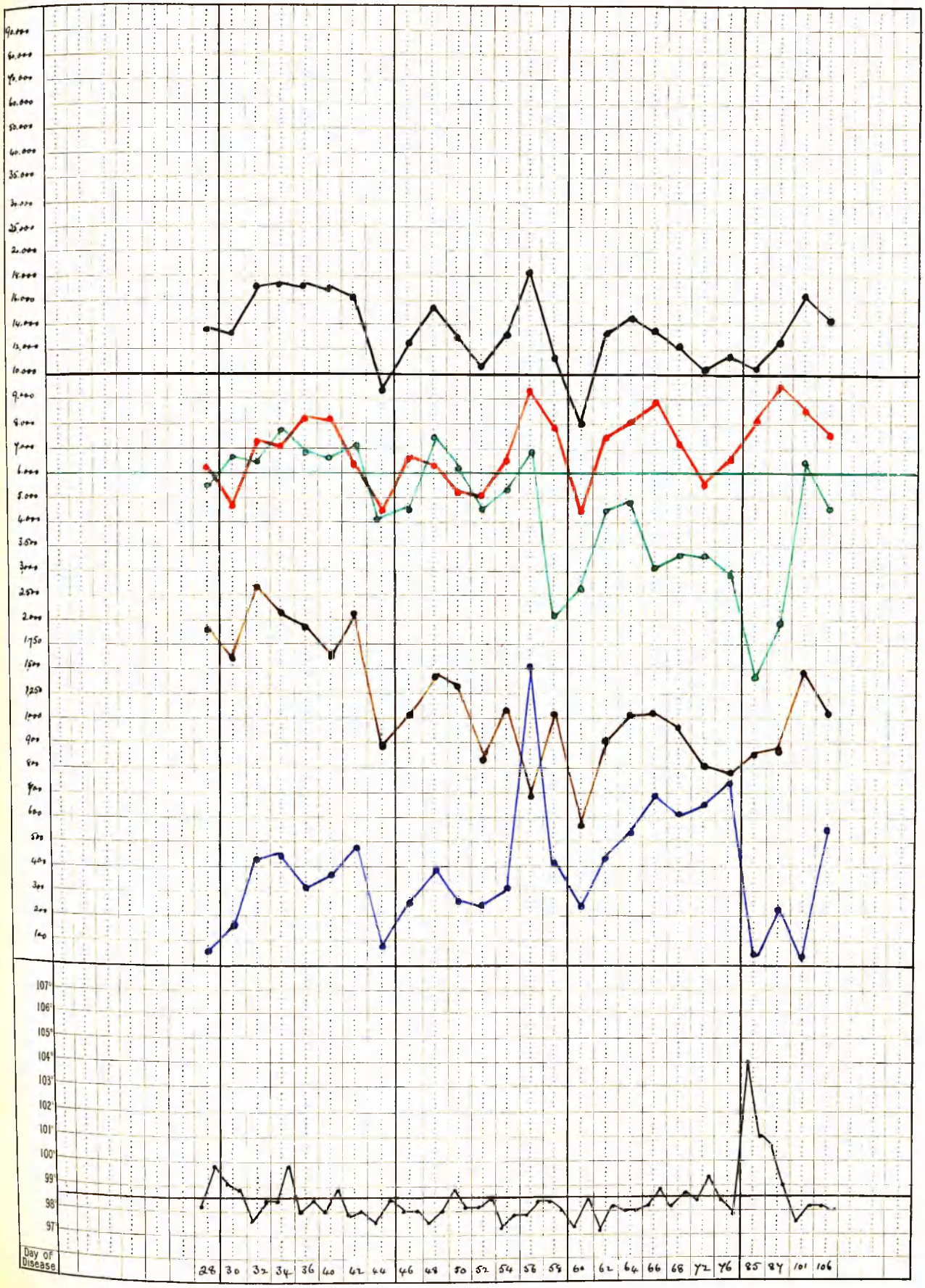
-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

--------oOo--------


107°
106°
105°
104°
103°
102°
101°
100°
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98°
97°
Day of Disease
28 30 32 34 36 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 72 76 85 87 101 106

CASE IX - J. G., aet. 4 years

This patient, a well nourished child, was admitted to hospital approximately on 30th day of illness. Temperature was 97.6, pulse 96, respirations 20. The paroxysms at this time were very frequent and severe, vomiting was frequent, expectoration was copious and often contained blood. Four days after admission prodromal symptoms of measles were noted, and on the following evening the rash appeared. Pertussis in the meantime had been increasing in severity. By the 43rd day an improvement in the Whooping Cough was noted, though there was still occasional vomiting. On the 74th day patient was allowed up, and he was dismissed well on 87th day. Except during the attack of measles, there was never any pyrexia. The chest was clear on admission, but a slight catarrh was observed when measles was at its height.

No. of observations - wet and differential counts - 24

Average leuco. per cm. during residence	Polymphs. Per cent.	Lymphos. Per cent.	L. Monos. Per cent.	Eos. Per cent.	My. Per cent.
15,633	63.27	24.97	8.53	3.03	.20

Case IX Contd.

On the first two observations the number of total white cells was within normal limits. A slight leucocytosis is noted on 35th day, rising to moderate on 39th day. A slight to moderate leucocytosis is then present until 70th day, when normal numbers are reached, but variations occur till end of the illness. The lymphocytic curve is slightly above the normal line on only two occasions throughout the illness. The polymorphonuclear curve closely follows that of the total white cells, and the leucocytosis present mainly depends on their behaviour. During most of the observations the large mononuclear cells show an absolute increase. A slight eosinophilia is noted on the 43rd day; a higher eosinophilia on the 59th day. On the 80th day these cells are present to the extent of 921 per cm., and constitute 6.25% of the total white cells. A gradual decline in their total number then ensues to the end of the observations. Myelocytes were seen in small numbers on eight occasions.

A lymphocytosis, if present in this case, must have disappeared before observations were begun.

CASE IX - J. G., aet. 4 years

ay of il- ess	Total Leuco- cytes per cm.	Polymorphs		Lymphocytes		Large Monos.		Eosino- philes		Myelo- cytes	
		Per cent.	Abs. No.	Per cent.	Abs. No.	Per cent.	Abs. No.	Per cent.	Abs. No.	Per cent.	Abs. No.
30	10,200	60.25	6,146	26.5	2,703	9.25	943	3.5	357	.5	51
32	9,200	61	5,612	27.5	2,530	10.	920	1.5	138		
35	15,800	63.	9,954	31.5	4,977	2.75	750			.75	117
37	14,200	74.25	10,554	13.5	1,917	10.5	1,491	1.75	248		
39	17,600	61.25	10,771	27.75	4,893	8.5	1,496	2.5	440		
41	14,600	65.25	9,519	19.	2,774	12.75	1,868	3.	438		
43	16,000	65.5	10,480	19.	3,040	9.5	1,520	4.5	720	1.5	240
45	16,000	71.	11,360	16.25	2,600	11.	1,760	1.75	280		
49	21,200	73.25	15,529	18.	3,816	7.	1,484	1.75	371		
53	15,400	62.75	9,656	23.5	3,619	11.25	1,740	1.75	269	.75	155
57	21,800	59.5	12,971	32.25	7,031	7.25	1,580	1.	218		
59	22,400	67.75	15,176	21.5	4,816	6.75	1,512	4.	896		
62	17,600	65.75	11,564	24.25	4,276	5.5	968	4.5	792		
64	21,000	72.5	15,225	16.	3,360	8.5	1,785	3.	630		
68	15,600	63.75	9,952	23.25	3,619	9.75	1,521	3.25	507		
70	9,000	59.25	5,328	29.25	2,637	9.	810	2.5	225		
72	18,800	67.75	12,737	23.	4,324	6.25	1,175	2.5	470	.5	94
74	11,200	60.75	6,799	29.75	3,337	5.25	588	4.	448	.25	29
76	12,000	54.25	6,510	33.	3,960	7.75	930	5.	600		
78	19,400	64.75	12,551	22.25	4,328	8.25	1,600	4.75	921		
80	15,000	63.25	9,480	23.25	3,495	9.	1,350	4.5	675		
82	12,800	60.5	7,744	25.5	3,264	7.25	928	6.25	800	.5	64
84	14,200	44.75	6,354	43.	6,106	9.5	1,349	2.5	355	.25	35
86	14,200	56.25	7,981	30.5	4,331	10.25	1,462	3.	426		

CASE IX - J. G., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 4,000

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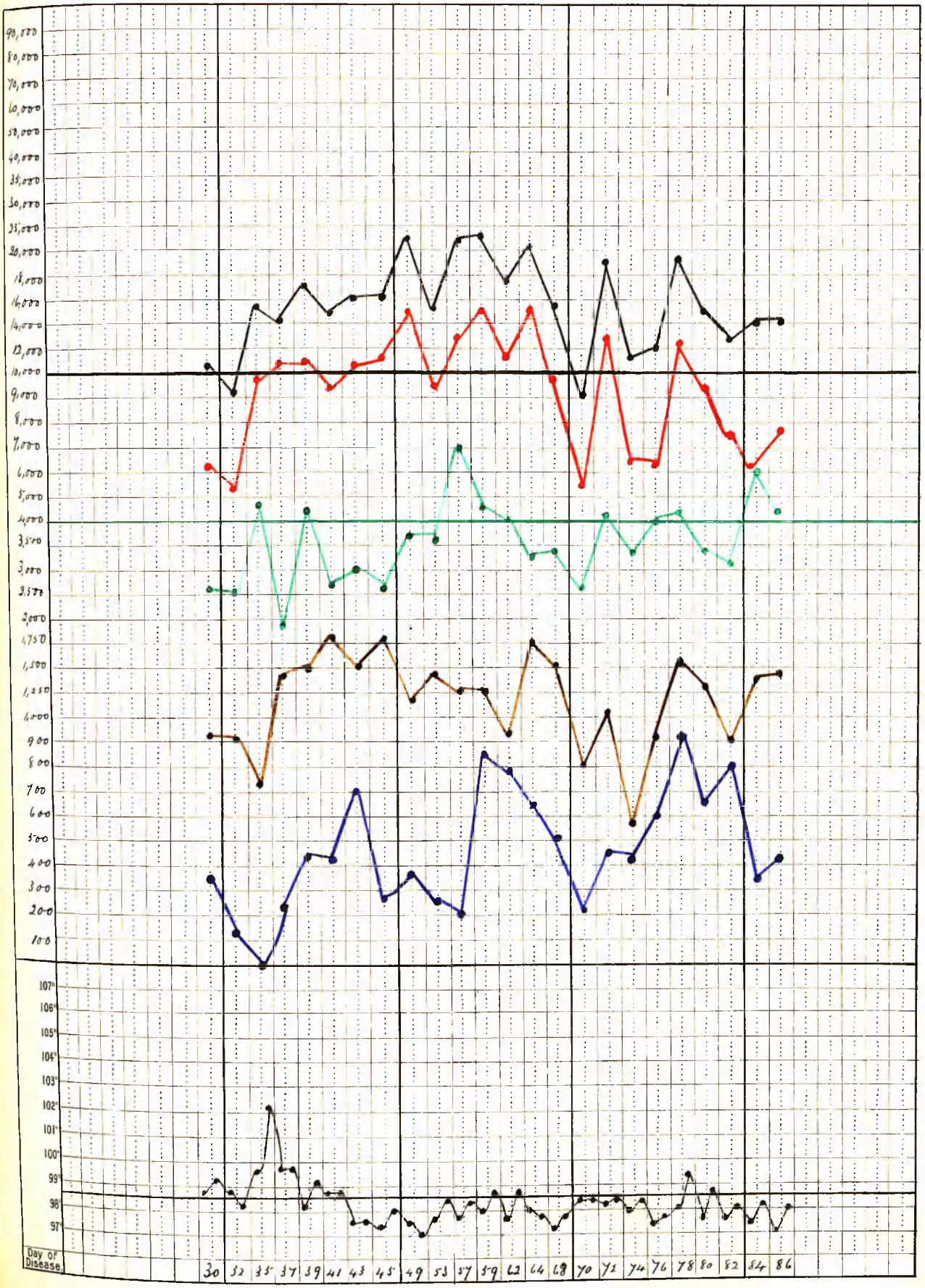
90,000
80,000
70,000
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100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98
97°
Day of Disease
30 32 35 37 39 41 43 45 49 53 57 59 62 64 68 70 71 74 76 78 80 82 84 86

CASE X - J. M., aet. 3 years

No definite date of onset of illness could be ascertained in this case, which was admitted to City Hospital and transferred to Belvidere as a case of Whooping Cough. Probably the patient was in 5th or 6th week of illness. On admission to Belvidere temperature was 98, pulse 100, and respirations 28. The child was well nourished, and well developed. At this time she had frequent and violent paroxysms of coughing followed by a resonant whoop. Expectoration was copious, often containing blood, and vomiting was occasional. At the end of her 2nd week of residence a slight improvement in the symptoms was noted. This steadily continued. Vomiting had ceased by the end of the 4th week of stay in hospital, when paroxysms were less frequent and less severe. She was allowed up on the 6th week of residence, and dismissed well on the 8th week. The temperature was normal throughout, and no complications occurred.

No. of observations - wet and differential counts - 22

Average leuco. per cm. during residence	Polymphs. Per cent.	Lymphos. Per cent.	L. Monos. Per cent.	Eos. Per cent.	My. Per cent.
15,382	58.63	28.9	7.68	4.79	

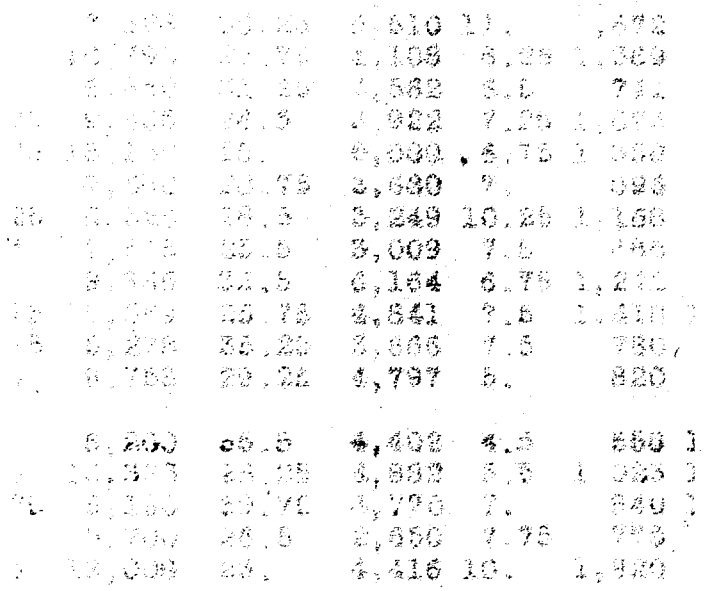
Case X Contd.

A moderate degree of leucocytosis is present on the first observation, which falls to slight in the next three. On the fifth observation a moderate degree is again present, and from this point onwards a slight to moderate leucocytosis is the rule, though normal figures are touched on two or three occasions. The curve of the polymorphonuclear cells shows that the latter are the main factor in any leucocytosis which may exist. A slight lymphocytosis is present in the first count, but the curve of these cells only twice rises above the normal line. The large mononuclear cells are seldom present above high physiological figures. Eosinophile cells are normal in number until 18th December, when a slight eosinophilia occurs. This, however, becomes high on 26th December when eosinophiles constitute 10% of the total white cells, and reach absolute numbers of 1,880 per cm. Maximum eosinophilia is reached on 4th January when 12.25% of these cells are present, and the high absolute number of 2,278 is reached. A decline is gradual thereafter, but eosinophilia of a moderate grade was present when the patient was on the point of being dismissed well.

The slight lymphocytosis present on the first ob-

Case X Contd.

servation suggests there may have been a lymphocytosis of a higher grade earlier in the disease, and that only the termination or recession of this lymphocytosis came within the scope of examination. Myelocytes were not observed in any of the blood films examined.



CASE X - J. M., aet. 3 years

Date	Total Leuco. cytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
Nov.											
24	21,000	58.75	12,337	33.5	7,035	7.	1,470	.75	157		
26	14,800	65.5	9,694	24.	3,552	9.	1,332	1.	148		
30	15,600	61.25	9,555	26.75	4,173	9.5	1,482	2.5	390		
Dec.											
2	14,800	62.25	9,213	26.	3,848	10.75	1,591	.5	74		
4	22,000	67.25	14,795	24.5	5,390	6.5	1,430	1.75	385		
6	15,200	51.5	7,828	36.25	5,510	11.	1,672	1.25	190		
8	16,600	65.	10,790	24.75	4,108	8.25	1,369	2.	332		
12	11,400	60.	6,840	31.25	3,562	6.5	741	2.25	256		
14	14,800	63.75	9,435	26.5	3,922	7.25	1,073	2.5	370		
16	20,000	65.75	13,150	25.	5,000	6.75	1,350	2.5	500		
18	12,800	60.	7,680	28.75	3,680	7.	896	4.25	544		
20	11,400	57.25	6,526	28.5	3,249	10.25	1,168	4.	456		
22	11,800	62.5	7,375	25.5	3,009	7.5	885	4.5	531		
24	18,400	54.	9,936	33.5	6,164	6.75	1,242	5.75	1,058		
26	18,800	56.75	10,669	25.75	4,841	7.5	1,410	10.	1,880		
29	10,400	50.75	5,278	35.25	3,666	7.5	780	6.5	676		
31	16,400	59.5	9,758	29.25	4,797	5.	820	6.25	1,025		
Jan.											
2	12,400	50.	6,200	35.5	4,402	4.5	558	10.	1,240		
4	18,600	55.5	10,323	26.25	4,882	5.5	1,023	12.25	2,278		
8	12,000	43.25	5,190	39.75	4,770	7.	840	10.	1,200		
12	10,000	57.	5,700	26.5	2,650	7.75	775	8.75	875		
17	19,200	62.5	12,000	23.	4,416	10.	1,920	4.5	864		

CASE X - J. M., aet. 3 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000

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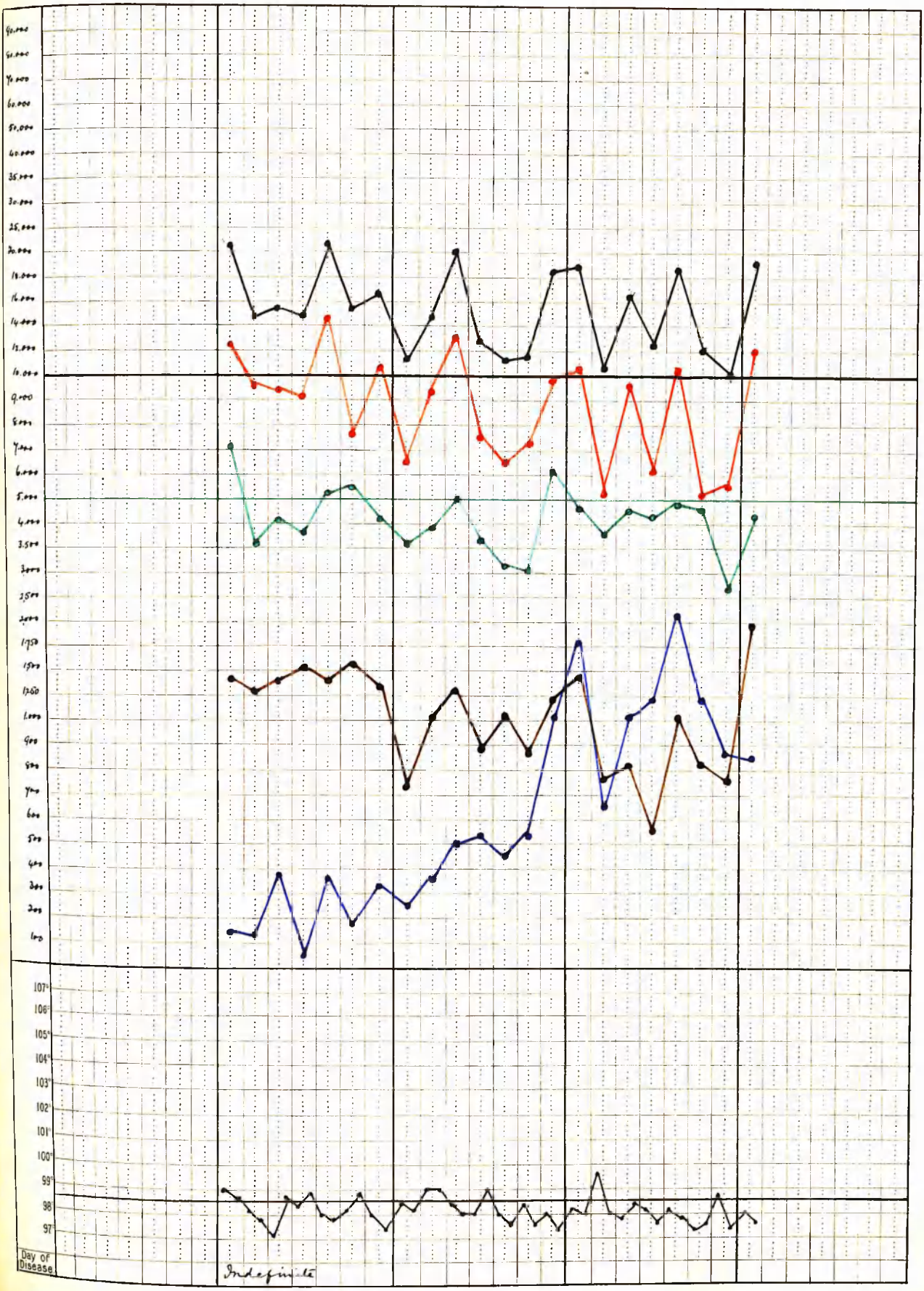
107°
106°
105°
104°
103°
102°
101°
100°
99°
98
97
Day of Disease
Indefinite

CASE XI - A. P., aet. 2 years

This was a case of severe but not of prolonged Whooping Cough. The patient was admitted approximately on 28th day of illness when temperature was 98, pulse 128, and respirations 44. The child was well grown and well nourished. Examination of the chest revealed no notable abnormality. Paroxysms of coughing were at first moderately frequent, and of a severe type. For some time afterwards an increase in severity occurred, and the acme of disease was attained about the 43rd day, when there were puffiness of face and eyes, a marked degree of cyanosis during paroxysms, and abundant expectoration which often contained fresh blood. Improvement appeared soon afterwards. About 56th to 60th days vomiting had ceased, and though whooping still continued, the cough was of a milder type. The patient was allowed up on 80th day, and dismissed well on 97th. While in hospital there were only two slight rises of temperature above normal limits. There were no complications, and convalescence was good.

Case XI Contd.

Leucocytosis - No. of observations - wet counts and differential counts - 26

Leuco. per cm. during residence	Average First 9 obs.	Average Last 17 obs.	Polymphs. Per cent.	Lymphos. Per cent.	L.Monos. Per cent.	Eos. Per cent.	My. Per cent.
11,528			39.8	42.	8.3	9.9	
	14,328		30.5	49.2	8.1	12.2	
		10,211	44.6	38.4	8.3	8.7	

There is leucocytosis slight in degree during the first six observations, which rises to moderate on 43rd day. On 53rd day it is absent, and variations from a normal condition to a leukopaenia are present till the 80th day, when a sudden rise occurs to moderate leucocytosis. There is a slight lymphocytosis from the 34th to the 43rd days, but during the remainder of the observations these cells are subnormal in absolute number. The polymorphonuclear cells follow the curve of the leucocytes very closely, and on only one or two occasions are they much increased in number. The large mononuclear cells show absolute increases on several occasions, but, as a rule, are within physiological limits. This case differs from the others in that an eosinophilia of a

Case XI Contd.

high grade is a feature from the commencement, these cells constituting 7.50% of the total white cells with absolute numbers of 1,080 on the first observations. A gradual absolute increase occurs till the 43rd day, when they are present as 16.25% of the leucocytes, and give an absolute number of 3,185 cells. From this date onwards there is a gradual but persistent decrease in absolute number, but normal figures are not reached until the 67th day. Myelocytes were not observed in any of the blood films.

In this case the lymphocytosis is slight, but a higher degree may have been present earlier in the illness.

CASE XI - A. P., aet. 2 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
28	14,400	35.50	5,112	48.75	7,020	8.25	1,188	7.50	1,080		
30	12,400	28.25	3,503	48.25	5,983	15.25	1,891	6.75	837		
34	14,000	31.0	4,340	52.	7,280	9.75	1,365	7.25	1,015		
36	13,800	21.25	2,932	59.25	8,176	7.	966	12.5	1,725		
39	15,400	28.75	4,427	52.25	8,046	6.	924	12.75	1,963		
41	14,800	25.75	3,811	50.5	7,474	7.75	1,147	16.	2,368		
43	19,600	35.5	6,958	42.25	8,281	6.	1,176	16.25	3,185		
45	10,200	37.	3,774	39.	3,978	6.5	663	17.5	1,785		
47	15,000	41.25	6,187	37.	5,550	9.25	1,387	12.5	1,875		
49	12,600	38.25	4,819	32.25	4,189	10.5	1,323	18.	2,268		
51	14,800	39.25	5,809	38.5	5,698	9.25	1,369	13.	1,924		
53	9,000	40.	3,600	39.75	3,577	6.	540	14.25	1,282		
55	9,400	34.	3,196	43.	4,042	6.5	611	16.5	1,551		
57	11,400	44.5	5,073	35.75	4,075	6.	684	13.75	1,567		
59	5,000	34.5	1,725	39.75	1,987	13.25	662	12.	600		
61	8,800	47.	4,136	36.25	3,190	8.	704	8.75	770		
63	12,400	48.75	6,240	36.	4,464	7.25	899	8.	992		
65	7,200	42.	3,024	41.25	2,970	10.25	738	6.5	468		
67	6,000	46.5	2,790	38.5	2,310	9.75	585	5.25	315		
69	6,800	40.5	2,754	47.	3,196	10.75	731	1.75	119		
71	7,400	50.25	3,718	36.5	2,701	8.75	647	4.5	333		
76	10,800	48.	5,184	41.75	4,509	6.75	729	3.5	378		
80	18,400	53.75	9,890	36.75	6,762	8.	1,472	1.5	276		
91	8,200	60.5	4,961	30.25	2,480	6.25	512	2.	164	1.	84
97	10,400	41.75	4,342	46.5	4,836	8.75	910	3.	312		

CASE XI - A. P., aet. 2 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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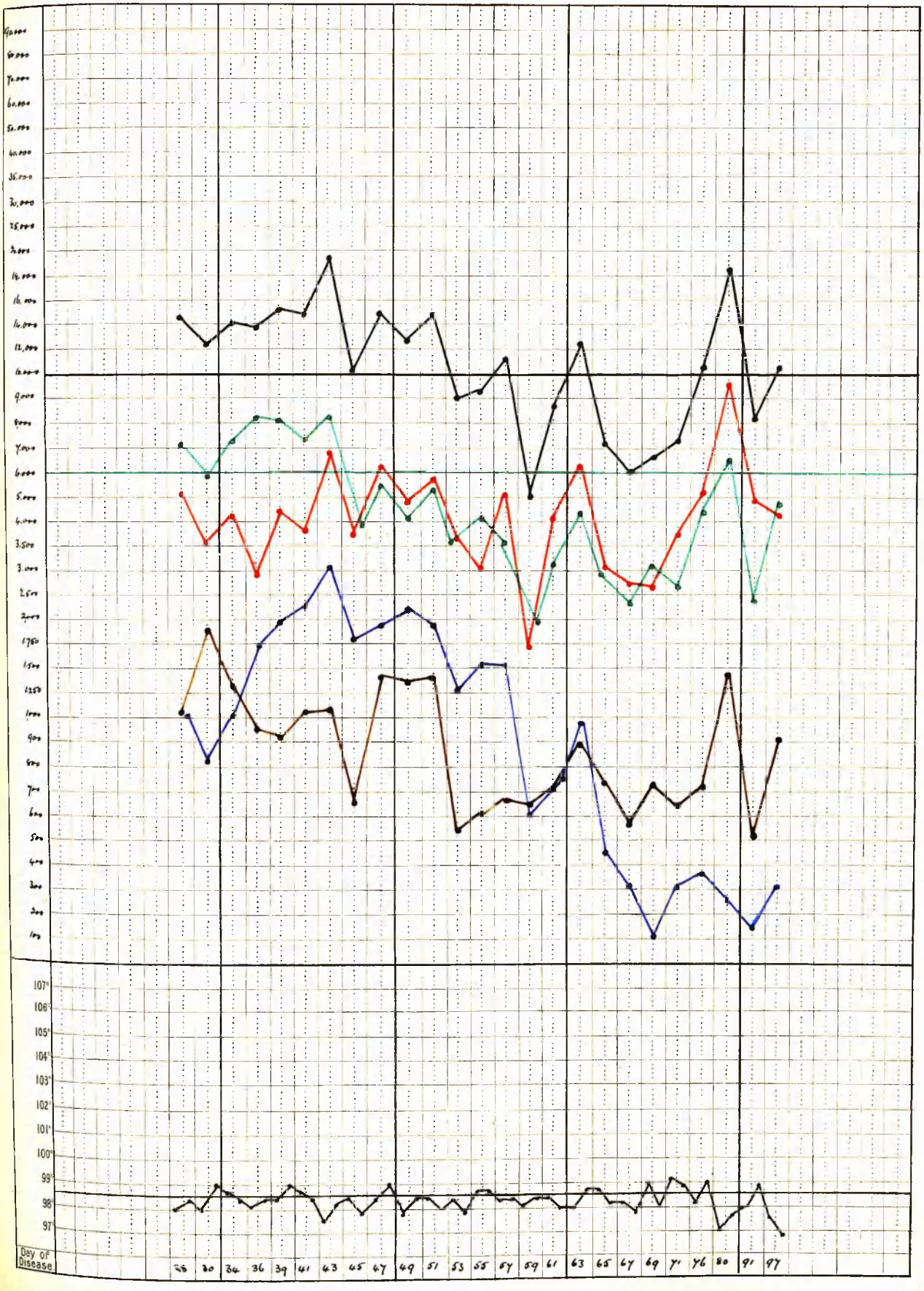
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Day of Disease
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CASE XII - J. P., aet. 4 years

This was a very severe case of Whooping Cough, which was admitted approximately on 35th day of illness, when temperature was 98.4, pulse 120, and respirations 28. At this period the cough was frequent and of a severe type, often followed by vomiting. A slight bronchial catarrh was noted on examination of the chest. The acme of illness was reached about 45th day. Puffiness of the face, oedema of both eyelids, and chemosis of both ocular conjunctivae were characters of this stage. There was marked cyanosis during the paroxysms which were frequent and violent; expectoration was abundant and often contained fresh blood. An improvement, however, set in soon afterwards. After 60th day vomiting no longer succeeded the seizures, though whooping still persisted. The patient was allowed up on 80th day, and was dismissed well on 102nd day. During his residence there was no pyrexia; no complications occurred, and convalescence was uninterrupted.

Case XII Contd.

Leucocytosis - No. of observations - wet and differential counts - 26

Average leuco. per cm. during residence	Polymphs. Per cent.	Lymphos. Per cent.	L. Monos. Per cent.	Eos. Per cent.	My. Per cent.
13,524	59.	28.4	6.1	6.15	.35

A slight to moderate leucocytosis is present in this case from the beginning of observations to 67th day, when normal figures are reached for some time. A recrudescence is present during the last days of residence. A very slight lymphocytosis is present till the 45th day when the normal line is touched. Lymphocytes continue subnormal in number till 85th day when a slight increase is seen. The polymorphonuclear cells, after the 45th day, are the prime factor in any leucocytosis that subsequently occurs. The curve of the large mononuclear cells, though of an irregular outline, seldom shows these cells in an abnormally high number. The eosinophile cells, though only present in very small numbers in the first three observations suddenly rise to a high level on the 41st day, when they are present in absolute numbers of 1,056, and a percentage of 6. A persistent

Case XII Contd.

and gradual increase occurs until a maximum of 2,123 cells per cm. is reached, giving a percentage of 12.25. A rather sudden decline to normal numbers occurs on the 65th day, but fairly high numbers are again reached on 69th day, a percentage of 8.5, and an absolute number of 1,139 being obtained. An eosinophilia of a moderate grade persists till dismissal.

As in some of the other cases it is possible that a lymphocytosis of a higher grade may have been present earlier in the illness.

CASE XII - J. P., aet. 4 years

Day of Illness	Total Leucocytes per cm.	Polymorphs Per cent.	Polymorphs Abs. No.	Lymphocytes Per cent.	Lymphocytes Abs. No.	Large Monos. Per cent.	Large Monos. Abs. No.	Eosinophiles Per cent.	Eosinophiles Abs. No.	Myelocytes Per cent.	Myelocytes Abs. No.
35	13,000	53.	6,890	36.5	4,745	8.	1,040	2.	260	.5	75
37	14,800	56.	8,288	37.5	5,550	4.75	703	1.5	222	.25	37
39	13,400	57.	7,632	35.25	4,730	7.	938	.25	33	.5	67
41	17,600	59.	10,384	29.75	5,236	4.75	836	6.	1,056	.5	88
43	16,600	60.75	10,092	27.75	4,598	5.	830	6.25	1,037	.25	41
45	16,800	56.75	9,534	33.5	5,628	3.75	630	5.75	966	.25	42
47	15,400	63.25	9,748	22.	3,388	6.25	961	8.25	1,264	.25	39
49	16,000	63.25	10,128	25.	4,000	5.	800	6.75	1,072		
51	15,000	55.	8,250	29.	4,350	6.25	937	9.75	1,462		
53	14,600	57.25	8,359	24.5	3,577	7.25	1,058	10.5	1,533	.5	73
55	15,000	56.5	8,475	24.5	3,675	7.25	1,087	11.25	1,688	.5	75
57	17,400	63.	10,962	19.75	3,445	5.	870	12.25	2,123		
59	11,200	58.	6,496	28.5	3,192	5.5	616	8.	896		
61	10,600	58.	6,148	29.	3,074	6.	626	6.5	689	.5	53
63	13,400	57.75	7,745	30.75	4,114	5.	670	6.5	871		
65	10,800	61.	6,588	29.5	3,186	8.25	891	1.25	135		
67	9,800	59.5	5,831	27.25	2,675	7.	686	6.25	608		
69	13,400	62.5	8,375	24.25	3,250	4.75	636	8.5	1,139		
71	8,400	68.	5,712	20.75	1,743	5.75	483	5.5	462		
73	10,000	68.75	6,875	20.25	2,025	7.25	725	3.75	375		
75	7,600	47.25	3,591	43.	3,268	6.25	475	3.50	266		
77	8,400	53.	4,452	33.75	2,835	5.75	483	7.5	630		
82	16,000	69.25	11,072	19.75	3,168	7.5	1,200	3.5	560		
85	16,800	51.75	8,686	34.75	5,846	6.5	1,092	7.	1,176		
96	12,000	50.5	6,060	34.	4,080	6.25	750	7.25	870	2.	240
102	17,600	66.5	11,704	23.	4,048	6.25	1,100	4.25	748		

CASE XII - J. P., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 4,000

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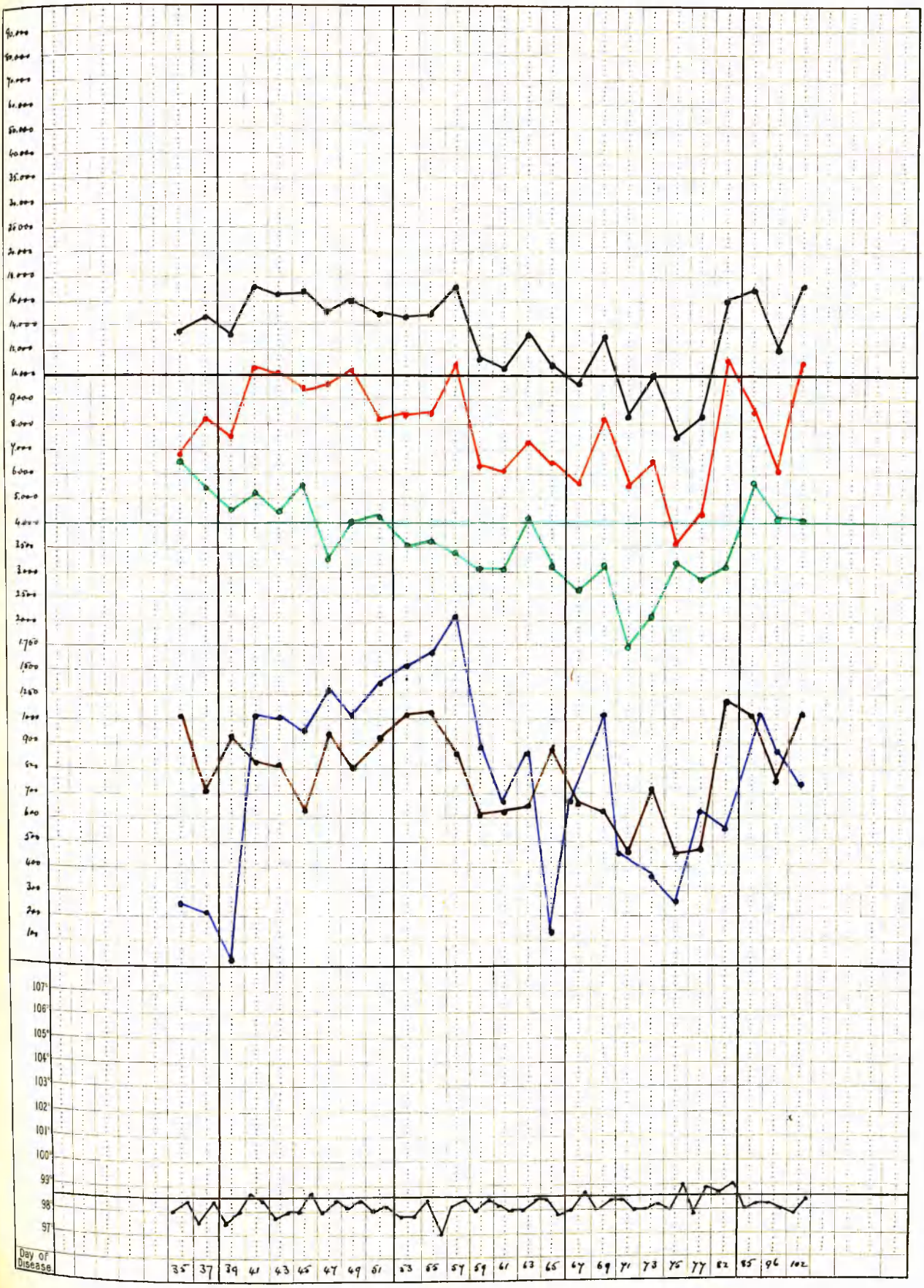
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Day of Disease
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The following table gives a summary of the results of the blood examinations in the series of twelve cases which have been examined systematically to a conclusion. In each case is given - the age - total number of observations made - the average leucocytosis during residence - with corresponding average percentages and absolute numbers of the various classes of cell obtained as the result of the differential examinations - the highest and lowest total leucocyte count, and the maximum absolute number of eosinophiles with the corresponding percentage. In addition, in Cases I, II, III, V, VII, VIII and XI, averages are given for the earlier and for the later groups of observations separately, as well as the average percentages and average absolute numbers of each class of cell, so that the changes which occur can be easily seen.

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Case	Name	Age Yrs.	No. of Cts.	Average Leucocytosis	Average Leucocytes 1st Cts.		Average Leucocytes Last Cts.		Polymorphs. %	Polymorphs. Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	Mononuclear %	Mononuclear Abs. No.	Eosinophiles %	Eosinophiles Abs. No.	Myelocytes %	Myelocytes Abs. No.	Highest Leuco. Count	Lowest Leuco. Count	Maxm. Eos.	Eos. %
I	J. McM.	4	21	18,620					49.16	9,154	40.35	7,513	8.05	1,499	2.25	419	.19	35	36,000	10,000	915	4.5
					8	25,580			39.5	10,211	49.6	12,822	9	2,326	1.5	388	.4	103				
							13	14,170	55.11	7,809	34.65	4,910	7.45	1,056	2.72	385	.07	10				
II	G. M.	3	27	24,309					52.90	12,859	34.92	8,488	10.04	2,440	1.74	425	.4	97	48,600	9,200	1,296	3
					8	35,222			43.30	15,251	47	16,554	7.84	2,762	1.58	556	.28	99				
							19	19,715	56.93	11,224	29.84	5,883	10.97	2,163	1.82	359	.44	86				
III	J. N.	4	43	19,306					54	10,425	33.2	6,410	9	1,738	3.65	704	.15	29	46,400	9,400	1,794	11.75
					10	29,720			41.6	12,379	48.9	14,529	7.3	2,184	2.2	628	-	-				
							33	16,151	57.8	9,343	28.3	4,580	9.5	1,527	4.2	663	.2	38				
IV	A. G.	5	39	17,574					56.5	9,920	28.6	5,030	8.25	1,460	6.4	1,120	.25	44	37.000	8,000	2,905	9.25
V	D. B.	6	40	30,609					48.22	14.760	40.44	12,378	8.54	2,614	2.44	747	.36	110	82,000	8,000	2,490	7.5
					14	42,628			39.7	16,923	52.4	22,337	6.4	2,728	1.2	512	.3	128				
							26	24,138	52.8	12,745	34	8,207	9.7	2,341	3.1	749	.4	96				
VI	M. E.	4	23	10,659					63.3	6,748	27.07	2,885	8.53	909	1.05	112	.05	5	21,172	4,200	348	3
VII	J. E.	5	21	14,095					59.33	8,362	28.04	3,952	9.14	1,289	3.24	457	.25	35	28,400	5,400	945	7.5
					5	23,200			70.3	16,309	17.7	4,107	9.9	2,297	1.3	302	.8	185				
							16	11,250	55.81	6,278	31.3	3,521	8.9	1,001	3.9	438	.09	12				
VIII	G. P.	2	26	13,692					51.9	7,046	35.72	4,945	9.18	1,271	3.02	406	.18	24	18,600	6,000	1,534	8.25
					13	14,460			44	6,362	42.75	6,182	11.04	1,596	2.03	294	.18	26				
							13	12,924	59.86	7,731	28.69	3,708	7.32	946	4.02	518	.16	21				
IX	J. G.	4	24	15,633					63.27	9,891	24.97	3,904	8.53	1.333	3.03	474	.20	31	22,400	9,000	921	4.75
X	J. M.	3	22	15,382					58.63	9,018	28.9	4,445	7.68	1,182	4.79	737	-	-	22,000	10,000	2,278	12,25
XI	A. P.	2	26	11,528					39.8	4,588	42	4,841	8.3	957	9.9	1,142	-	-	19,600	5,000	3,185	16.25
					9	14,328			30.5	4,370	49.2	7,049	8.1	1,165	12.2	1,744	-	-				
							17	10,211	44.6	4.555	38.4	3,910	8.3	853	8.7	893	-	-				
XII	J. P.	4	26	13,524					59	7,980	28.4	3,841	6.1	824	615	832	.35	47	17,600	7,600	2,123	12.25

CASE XIII - J. McC., aet. 3 years

The patient, a well nourished child, was admitted on 7th day of illness. Temperature 98.4, pulse 120, respirations 24. The cough was of a spasmodic character for the first two or three days. The whoop was first heard on the 10th day. The severity increased, and at the end of a fortnight, on the 21st day, paroxysms were severe, frequent, and often followed by vomiting. From 15th to 19th days there was moderate pyrexia, muco crepitant rales were present at both bases, but no definite signs of consolidation could be ascertained. These observations were made on 7th, 14th and 21st days.

Day	Avge. leuco per cm.	Polymphs. %	Polymphs. Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs.No.	Eosino. %	Eosino. Abs.No.	My. %	My. Abs.No
7th	11,000	65.5	7,205	25.75	2,832	6.	660	2.5	275	.25	28.
14th	25,800	39.5	10,191	53.	13,674	5.5	1,419	2.	516		
21st	37,800	37.5	14,175	55.5	20,979	4.	1,512	2.75	10,395	.25	94.5

At first observation leucocytosis is practically absent, but a high degree is present on 14th and a very high degree on 21st days. The lymphocytes are present

Case XIII Contd.

in subnormal number in first observation, but show great increases on second and third, when they reach absolute numbers of 13,674 and 20,979. The polymorphonuclear cells are absolutely increased in number throughout. The large mononuclear cells maintain a high physiological level in last two observations. There is an eosinophilia of an absolute kind on 21st day, corresponding with what has been seen in other cases.

CASE XIII - J. McC., aet. 3 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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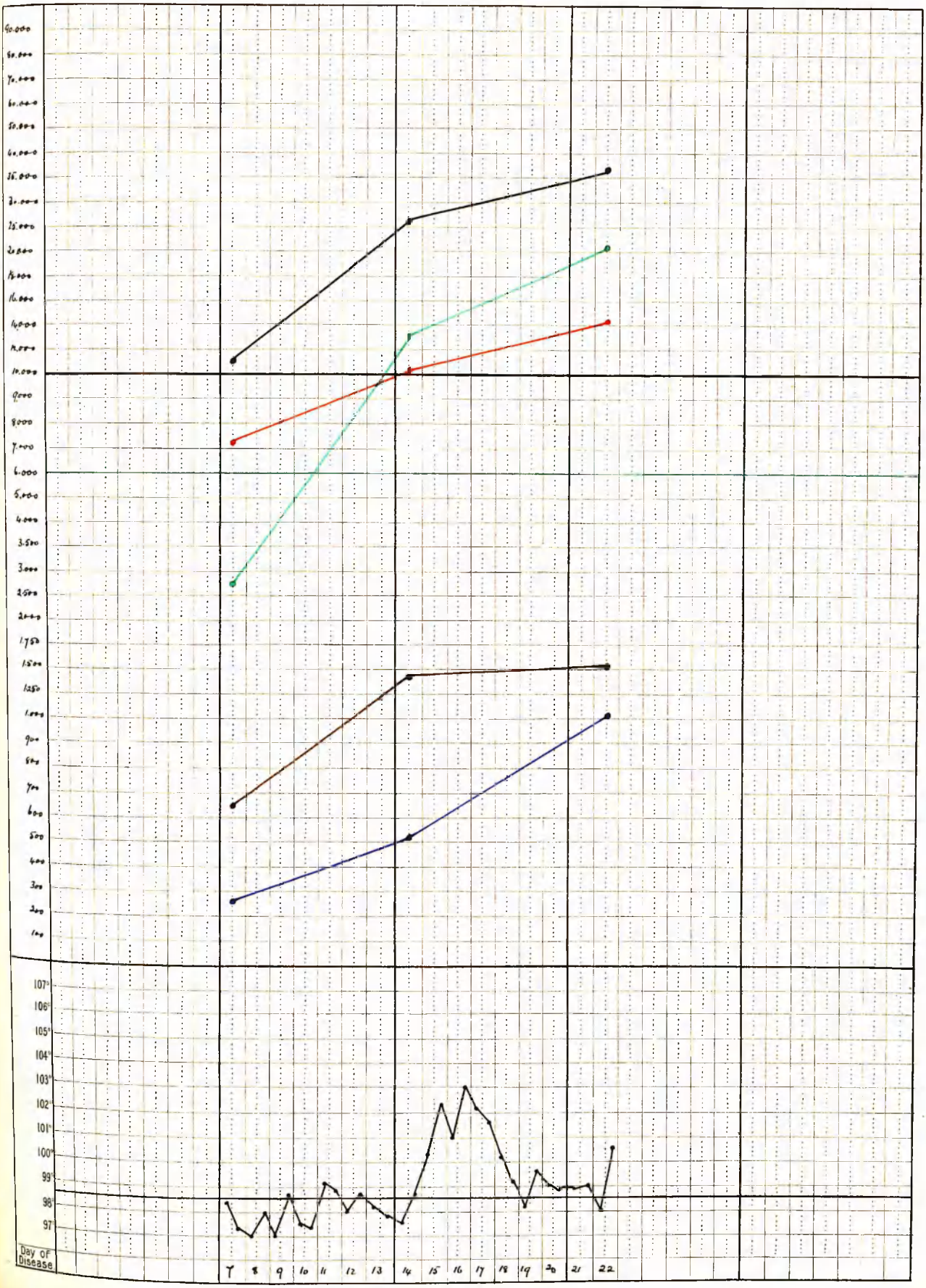
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CASE XIV - A. McM., aet. 2 years

This well nourished child was admitted on 9th day of illness. Temperature 98, pulse 120, and respirations 28. The examination of chest was negative. The cough was spasmodic in character, and a whoop was not heard till the second week of admission. Vomiting had, however, occurred several times before this date. The temperature remained normal, and no complications occurred when observations were made.

Leucocytosis

Day	Total white cells	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eos. %	Eos. Abs. No.	My. %	My. Abs. No.
9th	60,800	24.75	15,048	67.75	41,192	6.25	3,800	1.	608	.25	152
18th	24,200	25.75	6,232	64.	15,488	9.25	2,238	1.	242		
26th	16,200	72.25	11,704	19.	3,078	8.75	1,417				

This case shows, on first observation, a very intense leucocytosis which falls to moderate in the following week, and is almost slight within a fortnight. Corresponding with the intense leucocytosis in first observation is a great increase in lymphocytes, which become subnormal in number within 14 days. The polymorpho-

Case XIV Contd.

nuclear cells are absolutely increased in first and last counts. The other types of cells call for no comment.

CASE XIV - A. McM., aet. 2 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

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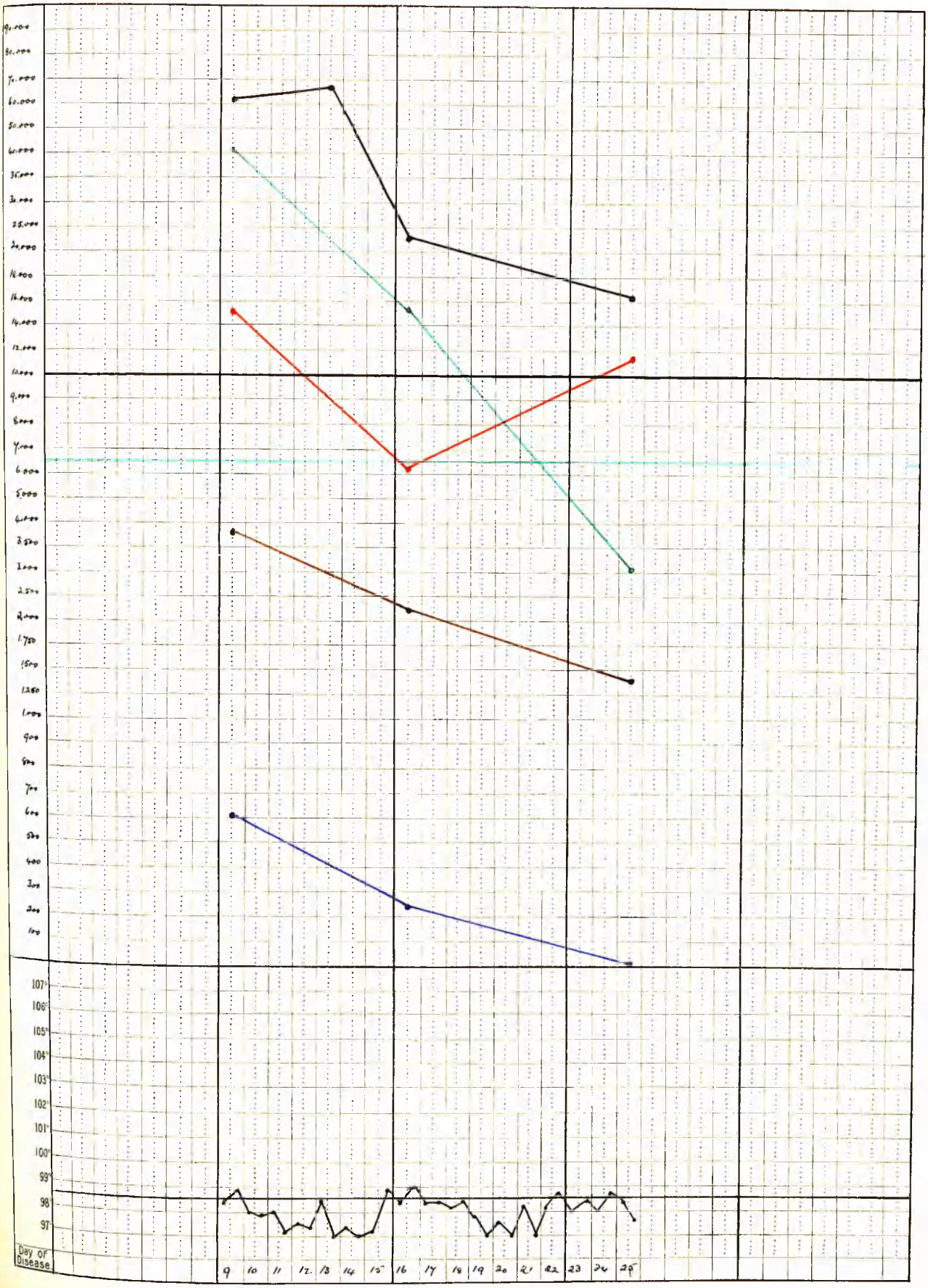
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CASE XV - R. McI., aet. 3 years

This well nourished child was admitted about her 9th day of illness. Temperature was 98, pulse 128, and respirations 46. The examination of chest revealed a small amount of crepitant rale at the right apex, and at the scapular angle over a small area there was bronchial breathing. The cough was characteristic, and was followed by whooping and occasional vomiting, but on the whole it was not of a severe type. Towards the end of second week of residence an improvement was noticed. There was no pyrexia.

Observations made on 9th, 17th and 23rd days

Day	Total leuco. per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
9th	45,800	36.5	16,717	55.25	25,305	4.75	2,175	2.25	1,031	1.25	572
17th	26,800	50.75	13,601	39.5	10,586	7.75	2,077	1.75	469	.25	67
22nd	18,000	41.5	7,470	46.25	8,325	8.25	1,485	3.75	675	.25	45

On 9th day an intense leucocytosis is present, which has declined to high on 17th and moderate on 22nd days. Lymphocytosis of a high degree corresponds with the intense leucocytosis, but a marked fall is present

Case XV Contd.

on 17th day, and normal numbers are being approached on 22nd day. The polymorphonuclear cells are increased in absolute numbers throughout, but are present, in a high degree, in first two observations. The large mononuclear cells show absolute increases on 9th and 17th days, but high physiological numbers are present on 22nd day. A slight eosinophilia, corresponding with what has been seen in other cases, is present on 9th day.

CASE XV - R. McI., aet. 3 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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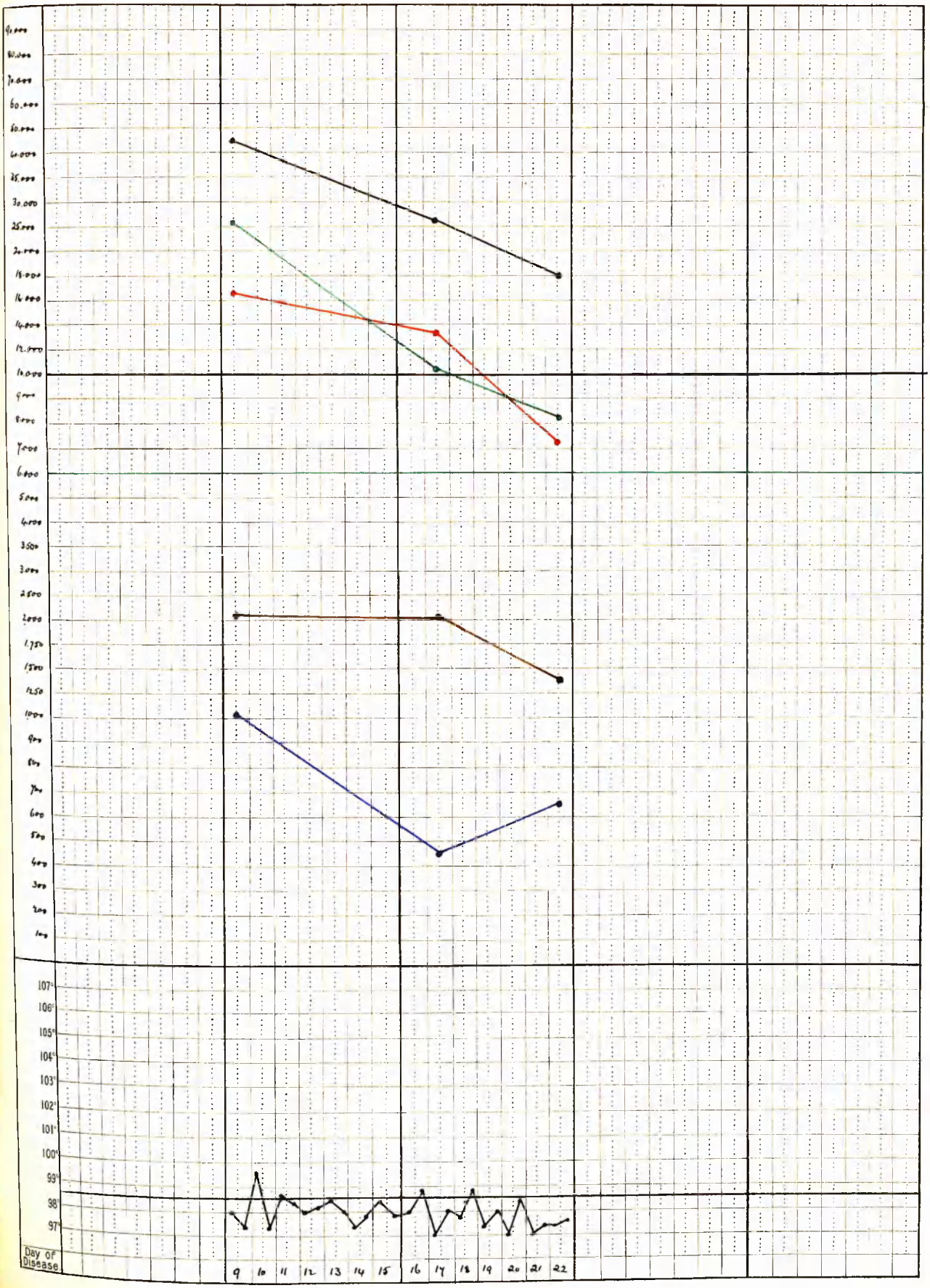
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CASE XVI, R. McE., aet. 3 years

This child, well nourished and well developed, was admitted on 11th day of illness. Her attack of Whooping Cough, though undoubted, was of a very mild type. The cough was spasmodic, and whoop was occasionally heard, but there was little or no vomiting. Temperature was 98.8, pulse 104, and respirations 36. Examination of the chest was negative. There were no complications. Three observations were made on 11th, 19th and 26th days of illness.

Day	Total white cells per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
11th	11,600	36.	4,176	55.	6,380	7.25	841	1.75	203		
19th	16,000	39.	6,240	46.25	7,400	13.5	2,160	1.0	160	.25	40
26th	14,000	38.75	5,425	43.	6,020	16.5	2,310	1.75	245		

The leucocytosis in this case was practically absent on first observation, but was present in a very moderate degree on 19th day, to become slight on 26th day. There is a very slight lymphocytosis on 19th day

Case XVI Contd.

which is absent on 26th day. The polymorphonuclear cells are moderately increased throughout. The large mononuclear cells are much increased in percentage and absolute number in last two observations. Eosinophiles are normal in number on all occasions.

CASE XVI - R. McE., aet. 3 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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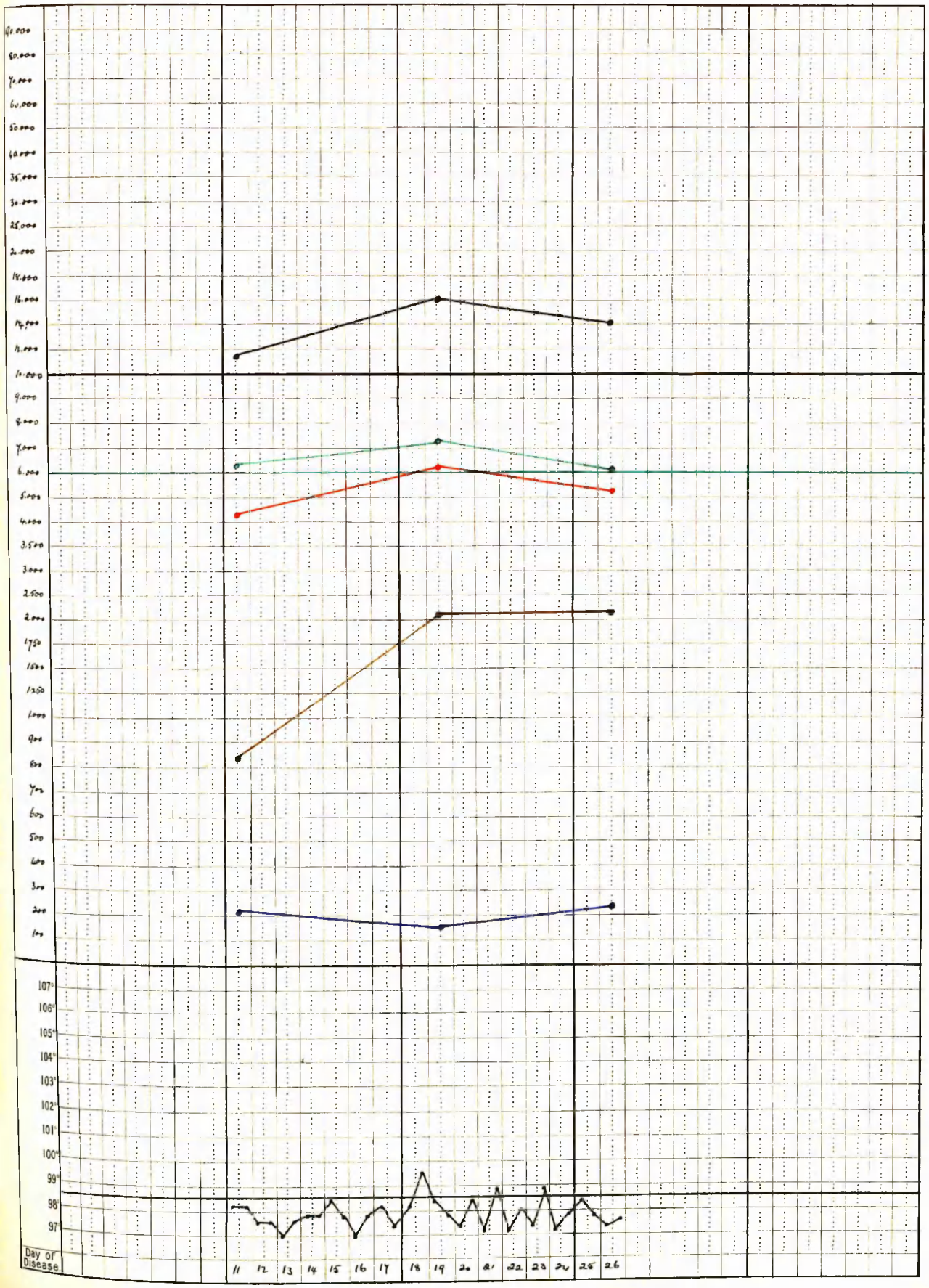
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Day of Disease
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CASE XVII - H. W., aet. 3 years

This child was admitted to hospital on 13th day of illness. His general condition was excellent. Temperature 99.8, pulse 134, and respirations 40. The examination of the chest was negative. No trace of rale was detected. His Whooping Cough was mild in type at first, but gradually increased in severity, and by 26th day paroxysms were frequent and severe, often followed by vomiting. Expectoration was abundant. Temperature was practically normal throughout. Three observations were made, on his 13th, 19th, and 27th days.

Day	Avge. leuco. per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
13th	12,400	33.25	4,123	61.25	7,595	4.25	527	1.	124	.25	31
19th	38,000	37.25	14,155	56.	21,280	4.5	1,710	1.75	665	.5	190
27th	22,000	36.75	8,085	52.5	11,550	9.	1,980	1.25	275	.5	110

A slight leucocytosis is seen on 13th day which becomes very high on 19th, and declines to moderate on 27th days. The lymphocytes, slightly increased at first, are greatly increased on 19th day, but decline in numbers on the 27th day. The polymorphonuclear cells are

Case XVII Contd.

also greatly increased in absolute numbers on 19th day. The large mononuclear cells are absolutely increased on the 2nd and 3rd observations, corresponding with the high leucocytosis. Eosinophiles are in normal numbers throughout.

CASE XVII - H. W., aet. 3 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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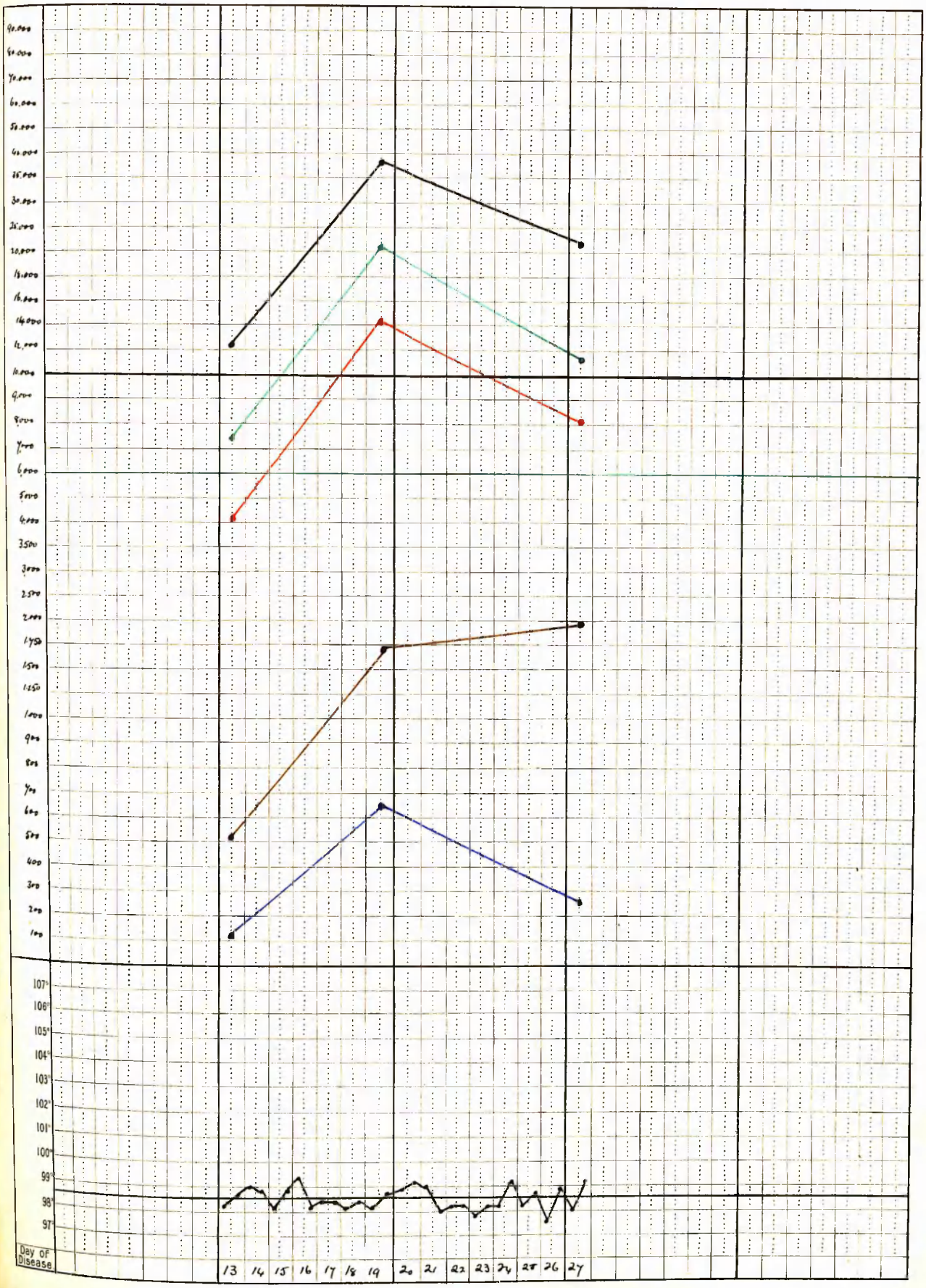
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CASE XVIII, B. McC., aet. 4 years

This well nourished patient was admitted approximately on 12th day of illness. Temperature 98.2, pulse 96, and respirations 28. The cough, at first of a spasmodic character, was severe, and was often followed by vomiting, but whoop was not heard till 16th day. Mucocrepitant rales were present over both sides of chest. Paroxysms became more severe while observations were made. There was no pyrexia, and no complications were observed. Three observations were made on 12th, 19th, and 25th days.

Leucocytosis

Day	Leuco. per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs No.
12th	20,800	30.25	6,292	60.	12,480	4.5	936	5.25	1,092		
19th	23,400	44.	10,926	47.5	11,115	4.5	1,053	3.75	878	.25	58
25th	15,600	47.5	7,410	32.75	5,109	19.25	3,003	.5	78		

A leucocytosis of moderate degree is present on the 12th and 19th days, which falls to smaller numbers on 25th day. The lymphocytes are much increased in absolute numbers on the first two observations, falling to

CASE XVIII - B. McC., aet. 4 years

EXPLANATION OF CHART

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Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000

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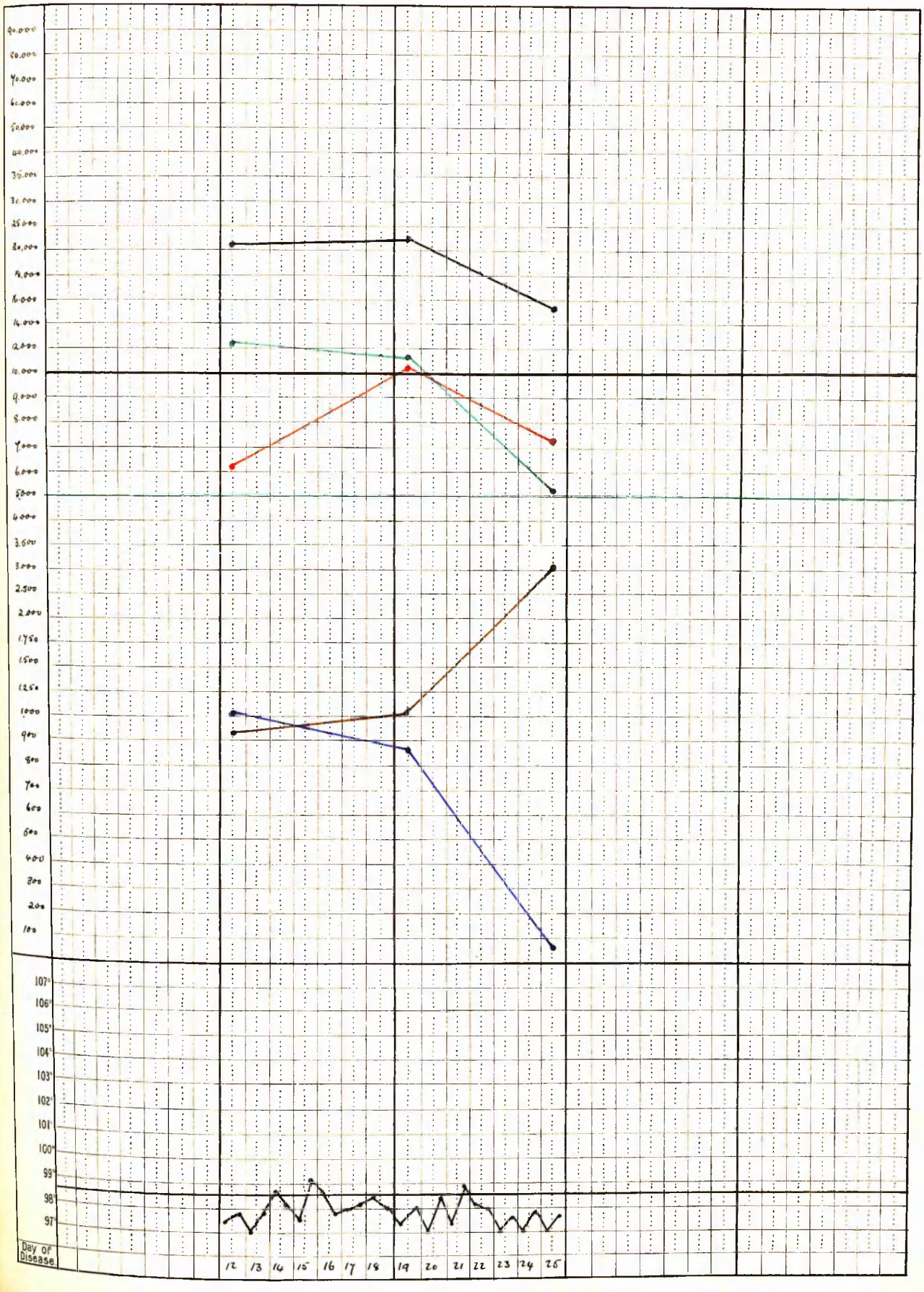
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CASE XIX, A. W., aet. 5 years

Admitted approximately on 17th day of illness, this was a well nourished and well developed child. Temperature on admission 99, pulse 130, and respirations 24. Examination of the chest was negative. The Whooping Cough was well defined, and vomiting sometimes followed the severer paroxysms, but an increase in its severity gradually ensued during the next fortnight. There was a no pyrexia, and no complications occurred. Three observations on 17th, 23rd, and 31st days.

Day	Leuco per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
17th	16,000	37.	5,920	53.25	8,520	8.75	1,400	.75	120	25	40
23rd	20,200	52.75	10,655	34.	6,868	10,25	2,070	2.	404	1	202
31st	14,800	47.5	7,030	41	6,068	9.5	1,406	2.	296		

A moderate leucocytosis is present on 17th and 23rd days, which falls to slight on 31st day. There is a lymphocytosis, though not of very high degree, during the whole period under observation. The polymorphonuclear cells show an absolute increase on the 23rd day, which is less marked on 17th and 31st days. The large

Case XIX Contd.

mononuclear cells are absolutely increased throughout. Eosinophiles and myelocytes call for no comment.

CASE XIX - A. W., aet. 5 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,000

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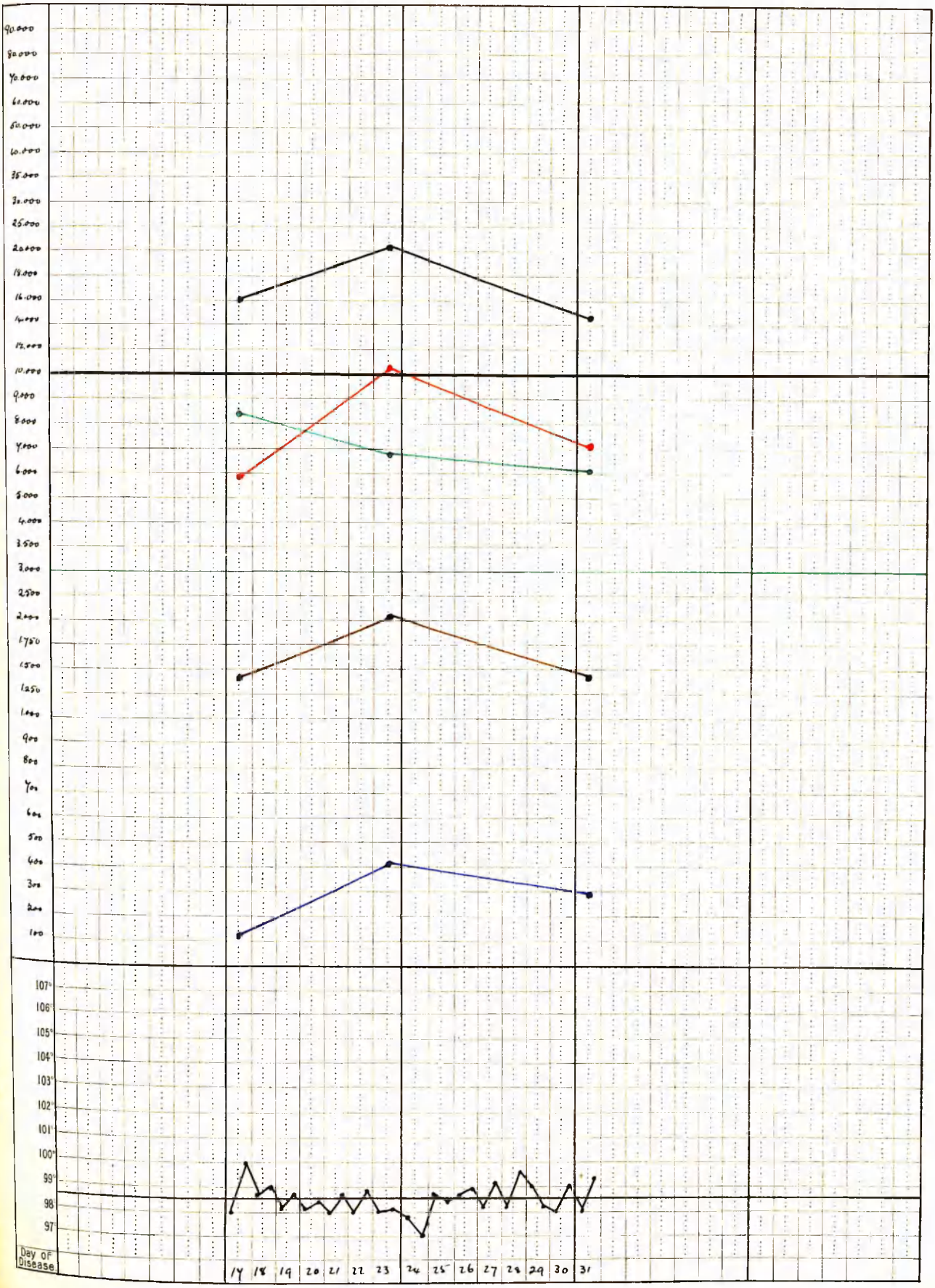
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CASE XX - E. McC., aet. 6 years

This patient was admitted approximately on the 15th day of illness; well nourished and in good general condition. Temperature was 99, pulse 96, and respirations 24. Examination of the chest revealed a bronchial catarrh. Paroxysms were severe but not frequent, and vomiting was occasional. An increase in the severity of the symptoms was noted during the next two weeks, and about 28th day there was some blood in the sputum. A slight evening rise of temperature occurred on 30th day. Otherwise there was no pyrexia. Complications were absent. Three observations were made - on 15th, 23rd and 32nd days.

Leucocytosis

Day	Leuco. per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
15th	25,600	29.75	7,616	64.	16,384	4.25	1,088	2.	512		
23rd	12,400	28.75	3,565	59.5	7,378	9.5	1,178	2.25	279		
32nd	11,600	31.25	3,625	51.25	5,945	12.	1,392	5.5	638		

A high leucocytosis is present on the 15th day, which becomes slight in subsequent observations. The

Case XX Contd.

lymphocytes for the age period are greatly increased in percentage and absolute number on 15th day, and, though a decline is manifest on 23rd and 32nd days, the last observation still gives an absolute increase. The polymorphonuclear cells are absolutely increased on 15th day, but are below normal numbers on 23rd and 32nd days. The large mononuclear cells call for no comment, but an eosinophilia of a slight degree is present on 32nd day.

CASE XX - E. McC., aet. 6 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,000

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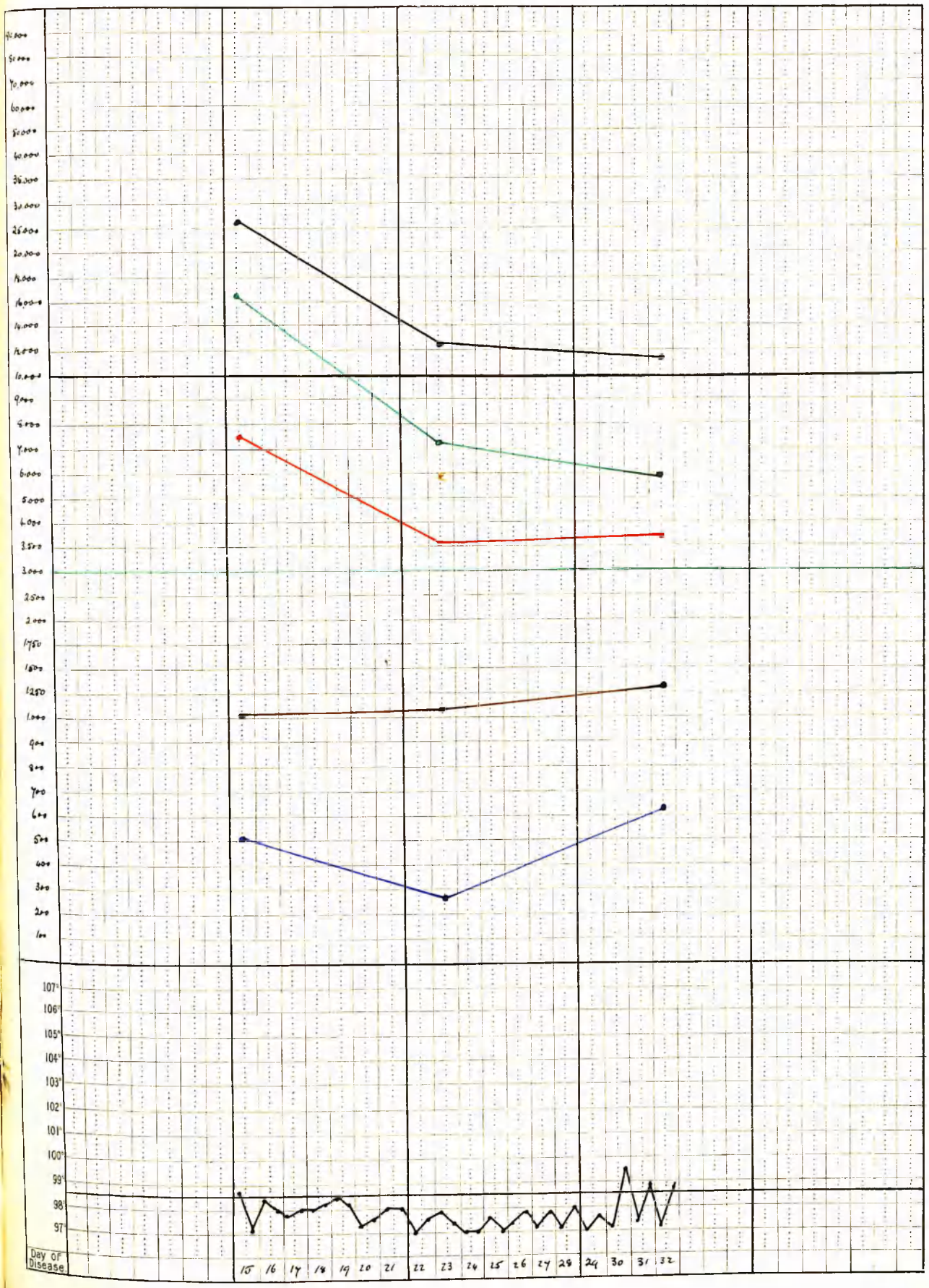
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CASE XXI - B. B., aet. 2 years

This child, fairly well nourished, though some rachitic deformities were present, was admitted approximately on 18th day of illness. Temperature on the evening of admission was 100.8. Examination of the chest was negative. Cough at this time was characteristic but not severe, and was only occasionally followed by vomiting. The cough increased in severity for the ensuing fortnight, when the observations were made. No complications occurred. Three observations - on 18th, 25th, and 31st days.

Leucocytosis

Day	Total white cells per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
18th	23,600	51.25	12,095	42.25	9,971	5.	1,180	.25	59	1.25	295
25th	21,800	50.25	14,472	40.5	11,664	8.	2,304	.75	216	.5	144
31st	14,200	50.25	7,135	40.	5,681	9.25	1,313			.5	71

A leucocytosis of moderate degree is present on 18th day, rising to high on 25th day, and declining on the last observation. There is a moderate lymphocytosis

Case XXI Contd.

present on first two observations, which, however, is absent on third. The polymorphonuclear cells are increased absolutely and relatively throughout, more especially on first two observations. The large mononuclear cells show an absolute increase in second observation.

CASE XXI - B. B., aet. 2 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

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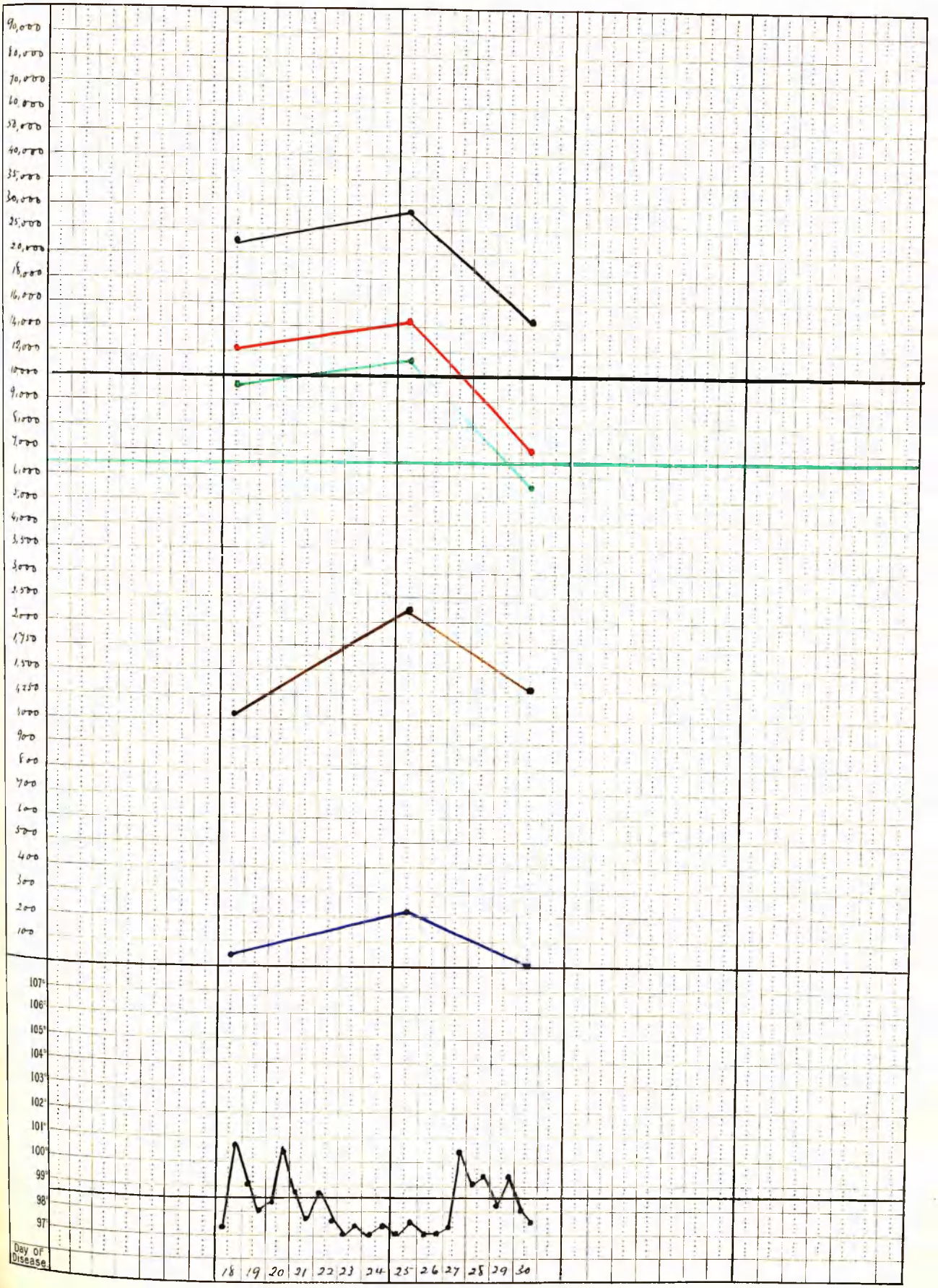
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Day of Disease
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CASE XXII - A. McK., aet. 4 years

This was a well nourished child, admitted approximately on the 19th day with well defined Whooping Cough. Temperature was 97.8, pulse 112, and respirations 24. Examination of the chest revealed rhonchi and sibilant rales of general distribution. During the fortnight under review there was occasionally blood in the sputum, and an increase in the severity of her paroxysms. No complications were present, and there was no pyrexia. Observations on the 19th, 27th and 34th days. The films for the last observation were destroyed by accident, so that for that day the wet count alone is given.

Day	Leuco. per cm.	Polymorphs		Lymphocytes		L. Monos.		Eosino.		Myelos.	
		%	Abs.No.	%	Abs.No.	%	Abs. No.	%	Abs. No.	%	Abs. No.
19th	21,600	29.	6,264	60.5	13,068	8.75	1,890	1.5	324	.25	54
27th	17,400	57.75	10,049	34.75	6,046	5.5	957	2.	348		
34th	13,600										

A moderate degree of leucocytosis is present on the 19th day, which has declined to slight on 34th day. Lymphocytes are present in fairly large numbers on the first observation, but are only slightly above normal on

Case XXII Contd.

second. The polymorphonuclear cells, on the other hand, are in greater numbers on second observation than on the first. The other types of cells require no comment.

CASE XXII - A. McK., aet. 4 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000

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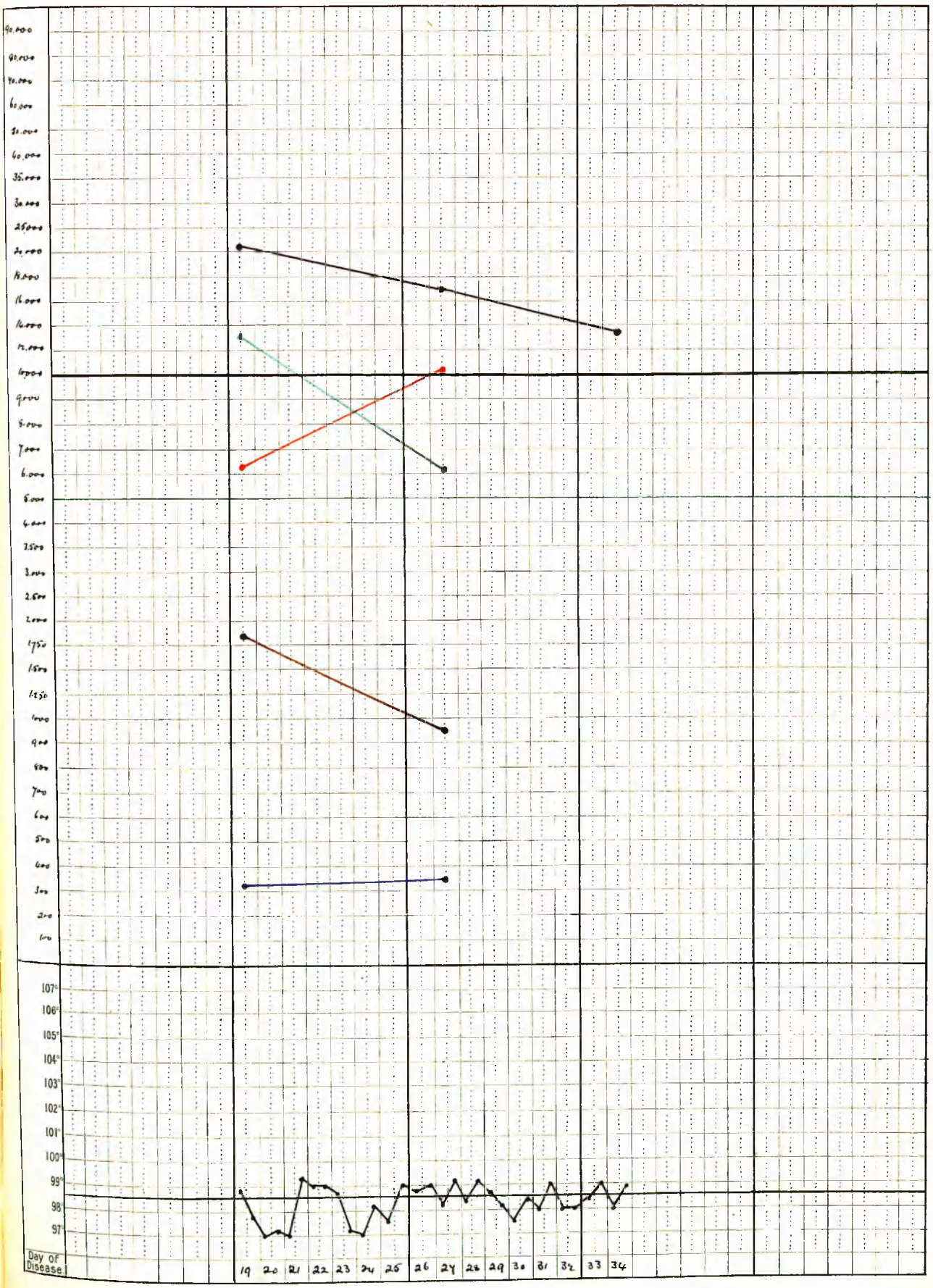
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Day of Disease
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CASE XXIII - H. W., aet. 4 years

The patient, admitted approximately on the 19th day of illness, was well developed and well nourished. Temperature was 98, pulse 130, and respirations 28. The Whooping Cough at this time was of a moderately severe type. There was frequent vomiting, and occasionally blood in sputum. After some days' residence, improvement begun, and, at the end of a fortnight, vomiting had ceased. Temperature throughout was usually normal, but a slight rise in the evening was frequent. No complications were detected. Three observations were made on 19th, 34th, and 42nd days.

Leucocytosis

Day	Leuco. per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
19th	12,800	32.75	4,192	53.25	6,816	12.	1,536	1.25	160	.75	96
34th	12,600	46.75	5,890	39.75	5,008	10.	1,280	3.5	441		
42nd	12,200	54.25	6,618	28.5	3,477	12.75	1,556	4.5	549		

A slight leucocytosis is present throughout. The lymphocytes are slightly increased in the first observation, but in second and third are normal and subnormal.

Case XXIII Contd.

The polymorphonuclears are increased absolutely in the second and third observations. A slight eosinophilia is present on the 42nd day. The large mononuclear cells call for no remark.

CASE XXIII - H. W., aet. 4 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 5,000

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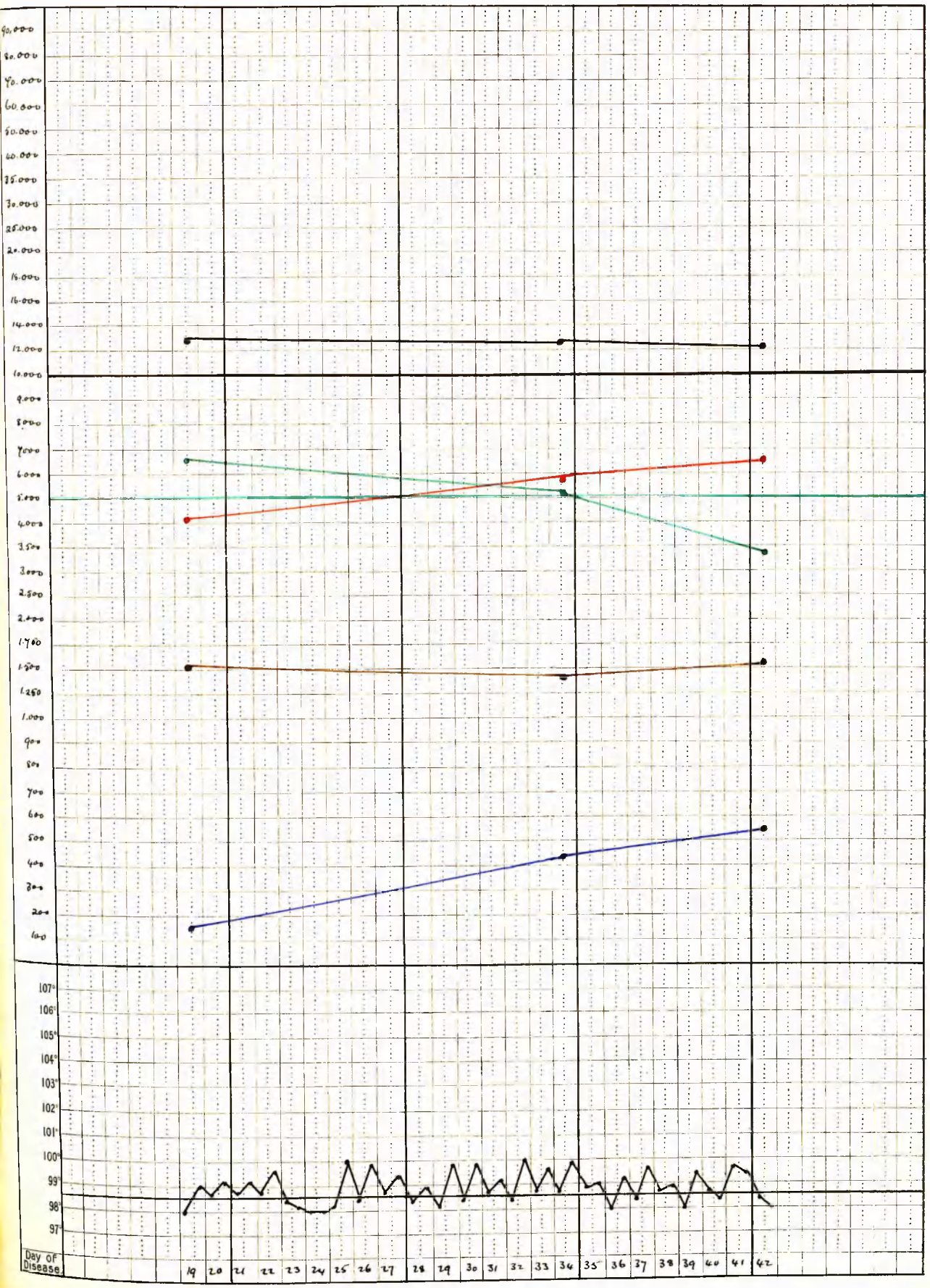
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Day of Disease
19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42

CASE XXIV - M. H., aet. 2 years

This patient, a well nourished and healthy child, was admitted approximately on 27th day of illness. Temperature 98.6, pulse 116, respirations 30. The cough was characteristic and frequent, but was seldom followed by whoop. Vomiting sometimes occurred while the patient was under review, but, on the whole, the attack of pertussis was a mild one. The chest was without adventitious sounds. No complications were present. Three observations were made - on 27th, 34th and 41st days.

Day	Total leuco. per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
27th	16,000	31.25	5,080	56.5	8,960	8.75	1,400	3.25	520	.25	40
34th	12,400	25.75	3,193	53.5	6,634	17.75	2,201	2.75	341	.25	31
41st	11,000	33.75	3,713	51.25	5,637	8.75	963	6.25	687		

There is a slight to moderate leucocytosis on 27th day, but the white cells are very little above normal numbers on 41st day. A moderate lymphocytosis is present on 27th day, but absent on 34th and 41st days. The polymorphonuclear cells show a slight absolute increase

Case XXIV Contd.

in first observation. An eosinophilia of slight degree is present in first and last observations.

CASE XXIV - M. H., aet. 2 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

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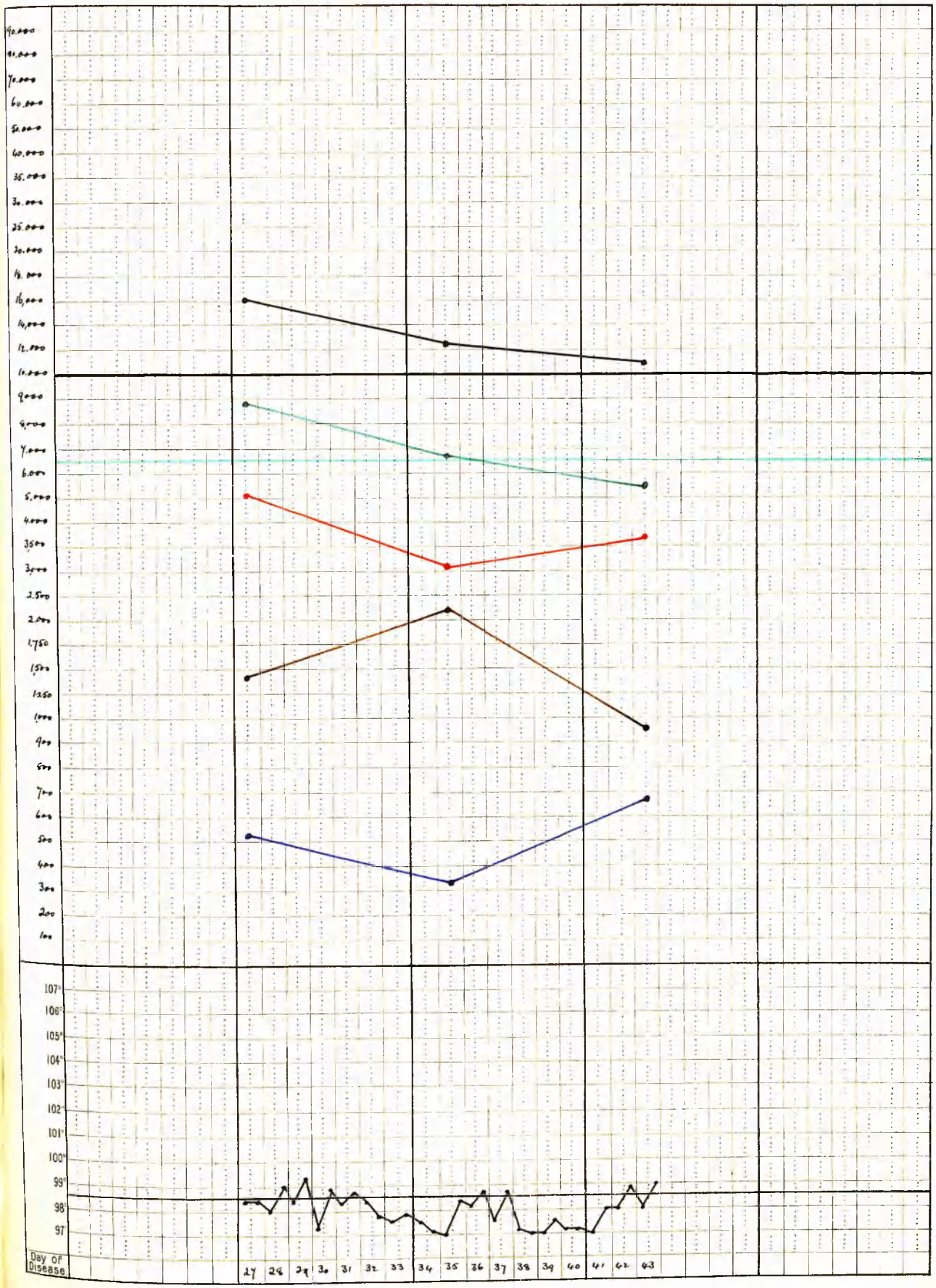
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CASE XXV - J. McA., aet. 2 years

Three observations were made in this case during the 9th, 10th and 11th weeks of illness. Though late in the disease, the patient was suffering so severely that a blood examination was thought to be of some instruction. This appeared to be about the acme of his illness. Paroxysms were of intense violence, cyanosis was so extreme that asphyxiation seemed imminent, and for some time thereafter the child was rigid and semi-conscious. No definite convulsions, however, occurred.

Leucocytosis

Week	Total white cells	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
9th	14,600	32.5	4,745	53.25	7,775	11.5	1,679	2.75	401		
10th	14,800	32.25	4,773	52.75	7,955	10.75	1,591	3.25	481		
11th	8,000	42.25	3,380	38.5	3,080	15.5	1,240	3.25	260		

A leucocytosis was found to be present in a very slight degree, and the lymphocytes were present in numbers only very slightly above normal in the first two observations, becoming markedly subnormal in the third.

Case XXV Contd.

The other types of cell call for no special comment, except in that an absolute increase of a moderate kind in the large mononuclears is present.

CASE XXV - J. McA., aet. 2 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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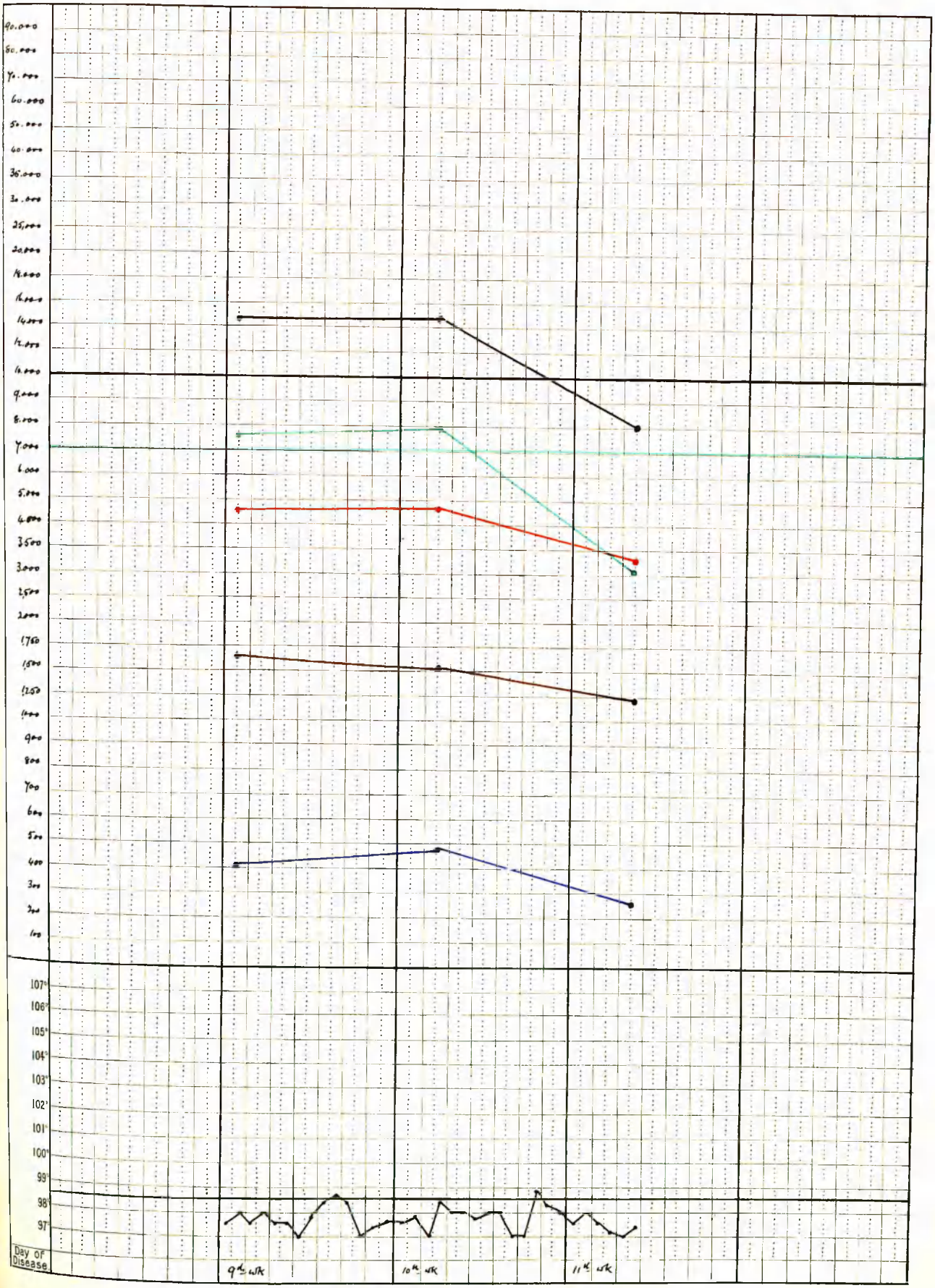
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Day of Disease
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11th wk

CASE XXVI - A. S., aet. 3 years

This well nourished child was admitted to hospital on 5th week of illness. The cough at this time was paroxysmal, but was not followed by whoop, and vomiting was absent. A sister in the same ward had a severe and quite typical attack. About 8th or 9th week, however, definite whooping and vomiting were present, and the child, who previously had been allowed up, was put back to bed. It was at this period that the observations were made. The chest had normal characters. No complications were present. Three observations were made about 8th, 9th and 10th weeks.

Week	Total leuco. per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L.Monos. %	L.Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
8th	13,600	72.	9,792	21.75	2,958	4.75	646	1.25	170	.25	34
9th	8,400	47.	3,948	41.25	3,465	7.5	630	4.25	357		
10th	10,000	55.75	5,575	33.	3,300	7.25	725	4.	400		

A leucocytosis of a slight degree is present in the first count, attaining the normal in the next two observations. Lymphocytes are subnormal in number throughout. Polymorphonuclear cells follow the leucocyte curve. Large mononuclear cells and eosinophiles call for no comment.

CASE XXVI - A. S., aet. 3 years

EXPLANATION OF CHART

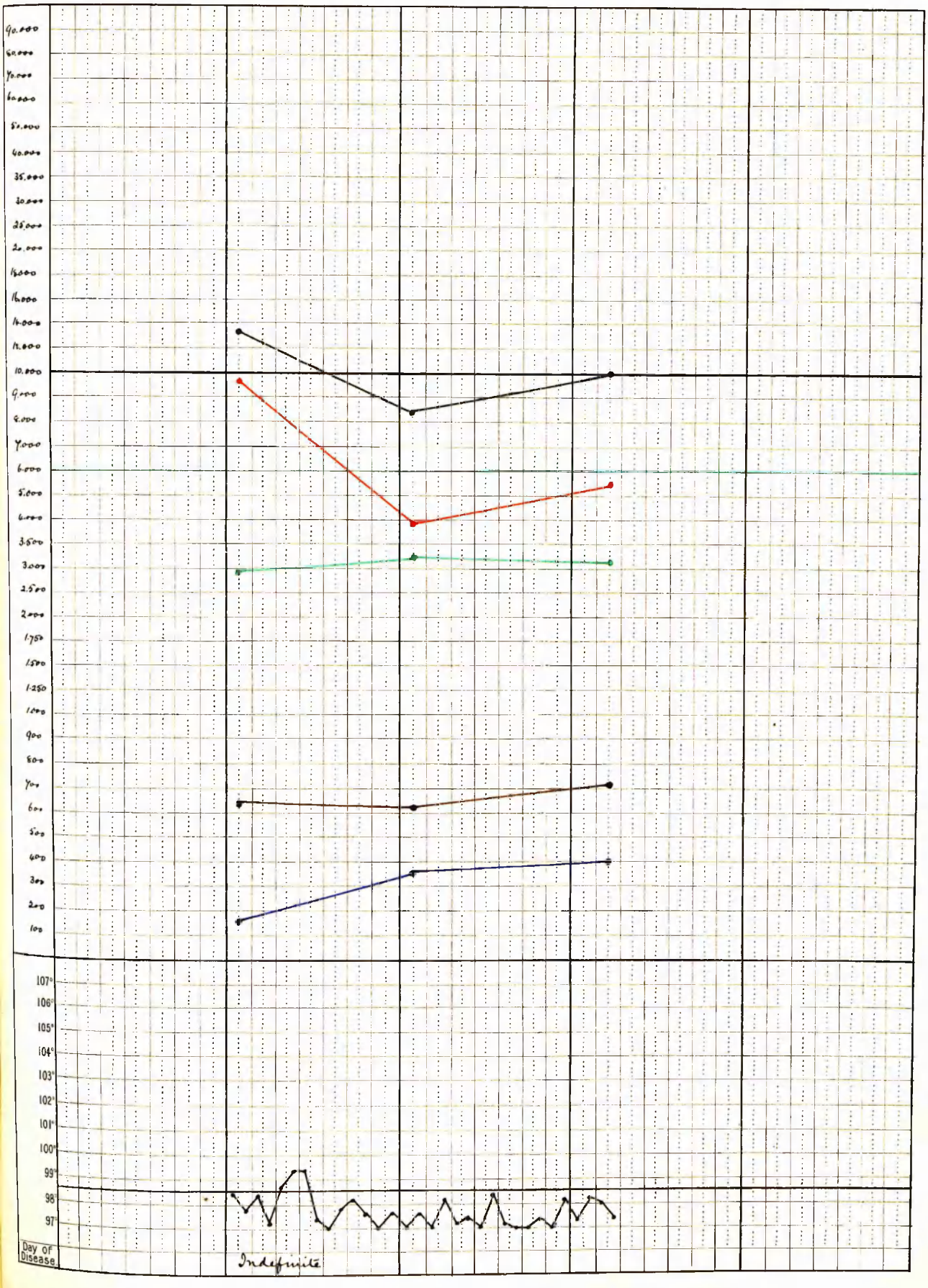
-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

--------oOo--------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104°
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102°
101°
100°
99°
98°
97°
Day of Disease
Indefinite

CASE XXVII - L. M., aet. 6 years

This patient was improving from an attack of Whooping Cough when observations were made. The paroxysms had declined in frequency and severity; the temperature was normal, and the chest was without rhonchi. Three observations were made about 60th, 68th and 82nd days.

Day	Leuco per cm.	Polymorphs %	Polymorphs Abs. No.	Lymphocytes %	Lymphocytes Abs. No.	L.Monos. %	L.Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
60th	7,600	65.5	4,978	23.75	1,805	7.25	551	2.75	209	.75	
68th	7,000	61.5	4,305	24.75	1,732	8.25	577	5.5	385		
82nd	8,400	74.5	6,258	15.25	1,281	5.75	483	4.5	378		

These observations call for no comment, as the white cells are normal in each class; although eosinophiles are increased beyond the normal percentage in the second observation. Their absolute number is within normal limits.

CASE XXVII - L. M., aet. 6 years

EXPLANATION OF CHART

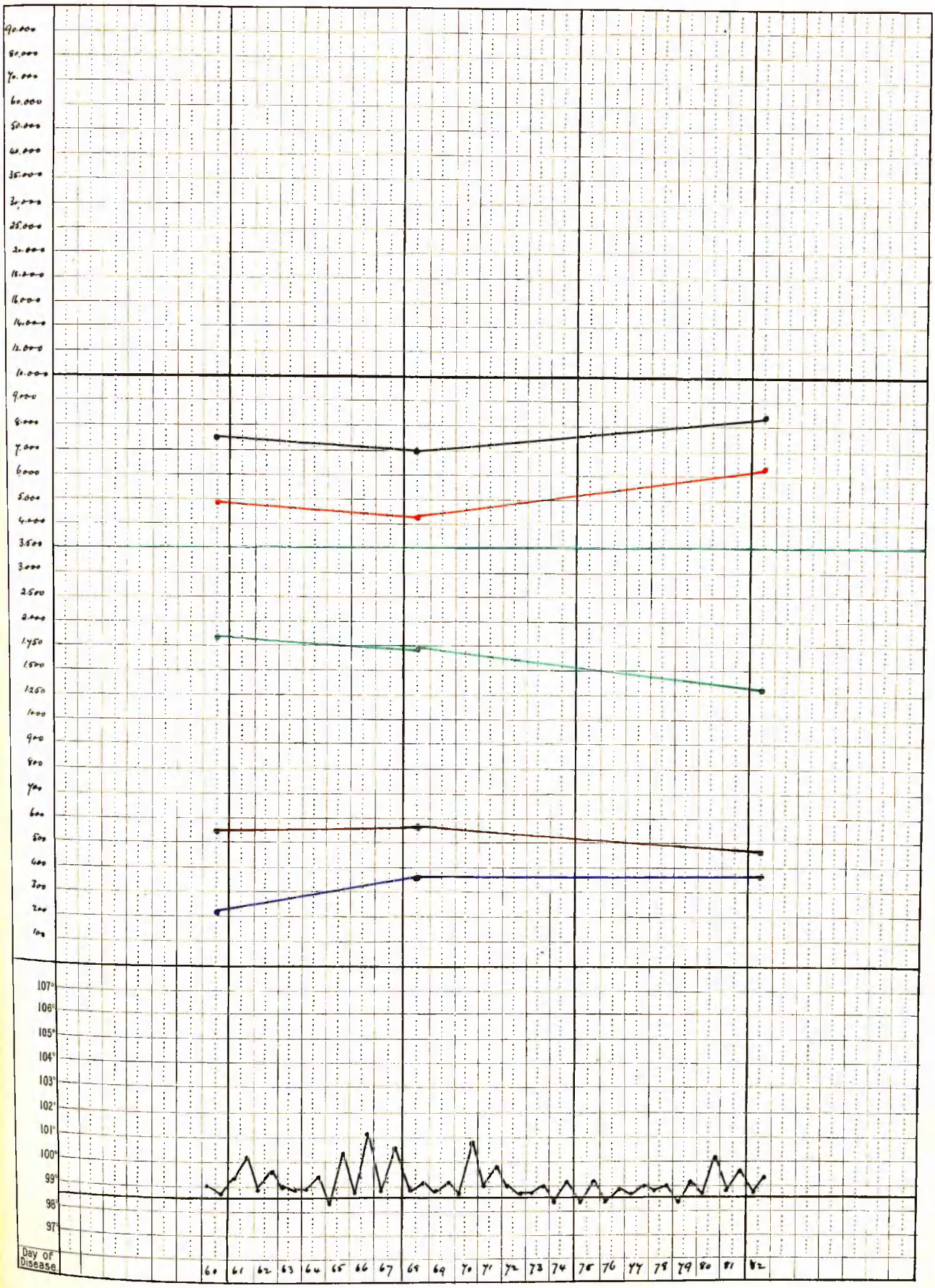
-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,500

--------oOo--------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98°
97°
Day of Disease
60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82

FATAL CASES

The interest of these cases lies in the comparison of their leucocytosis with that which obtains in uncomplicated Whooping Cough. The patients are six in number; the number of observations in each case varies from one to seven. One cannot foresee the occurrence of complications, and it so happens that none of the cases of this list were under review previous to the time at which the complication supervened.

The cases are of three groups:-

(1) Two cases of Whooping Cough in which death was due to convulsions. In these there was no broncho-pneumonia, as was verified by post mortem examination

(2) One case in which broncho-pneumonia and convulsions were the cause of death

(3) Three cases in which the cause of death was broncho-pneumonia of an extensive kind

In the first group where death was due to convulsions alone, the general leucocytosis and its character

resembled very closely that seen in uncomplicated Whooping Cough. Both cases showed lymphocytosis of a very marked kind, while the polymorphonuclear cells were increased in absolute numbers. The feature of these cases is the low number of eosinophiles present; and in Case XXVIII the presence of myelocytes in each observation in from .5 to 2.25%.

In the second group, in which death was due to convulsions and broncho-pneumonia, the blood picture also resembled that seen in uncomplicated Whooping Cough, but the leucocytosis was of the most intense kind encountered in all the observations made in this enquiry. There was here also an intense lymphocytosis which decreased in the two subsequent observations. The polymorphonuclear cells and large mononuclear cells are greatly increased in absolute number, and the first mentioned show an increase corresponding with the lymphocytic decrease. An eosinophilia, present in first two observations, is absent on last.

The cases in the third group in which broncho-pneumonia was the cause of death show only a moderate to high degree of leucocytosis. In Cases XXXI and XXXII there is a very marked fall in the reaction as death approaches. In the other case there is an increasing

leucocytosis during the same period. They each present a lymphocytosis, not however of a marked degree, the leucocytosis being mainly polymorphonuclear. Eosinophiles are again sparsely present, but myelocytes are found in every observation in percentages of 1 to 4.25

These cases are too few in number to admit of trustworthy conclusions, but it is significant that Cases XXVIII, XXIX and XXX in groups one and two show a much more pronounced leucocytosis than is ordinarily to be met with in an uncomplicated case of Whooping Cough. This is not in accordance with Meunier's view that, complications ensuing in the course of this affection do not exalt the leucocytosis already acquired.

These cases are now given in detail. A short clinical history is given of each, a table showing the dates, total numbers of leucocytes, with percentages and absolute numbers of each class of cell.

CASE XXVIII - W. P., aet. 1.3/12 years

This child, who was admitted to hospital on 5th week of disease, was very small and poorly nourished. The loose skin hung in folds. There were deformities of chest, and swelling at ends of long bones from rickets. The examination of the chest only revealed some catarrh. Paroxysms of Whooping Cough were very severe and frequent; the phenomenon popularly described as "dumb kinks" was noted on several occasions, and carpopedal spasm was present. On 2nd day of residence there was a convulsion lasting one minute. On 4th day there were five such seizures, each of one minute's duration. On the 5th day the number seven was attained, and on the 6th day the child was unconscious, with general rigidity of the limbs. On 9th day no less than fourteen convulsions were noted. Rigidity and unconsciousness supervened and continued till death on the following day. There were no chest complications. Four observations were made on 3rd, 5th, 7th and 9th days of residence.

Case XXVIII Contd.

Leucocytosis

Day of residence	Leuco. during residence	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
3rd	38,800	37.5	14,550	55.	21,340	6.75	2,619	.25	97	.5	194
5th	40,200	38.5	15,477	50.25	20,200	9.	3,618	.25	100	2.	804
7th	39,400	41	16,154	49.75	19,601	8.25	3,250	.25	98	.75	295
9th	42,200	32.5	13,715	57.75	24,370	7.5	3,165	.20		2.25	949

The leucocytosis is throughout at a very high and very uniform level, in which lymphocytes and polymorphonuclear cells are greatly increased. There is a marked lymphocytosis which shows no signs of abating. The polymorphonuclear cells show a pronounced absolute increase; the large mononuclear cells show a normal percentage but an increase in absolute number. Eosinophiles are very sparsely present, and are absent in last observation. Myelocytes are present in each observation, and in last observation show a percentage of 2.25, and an absolute number of 949.

CASE XXVIII - W. P., aet. 1.3/12 years

EXPLANATION OF CHART

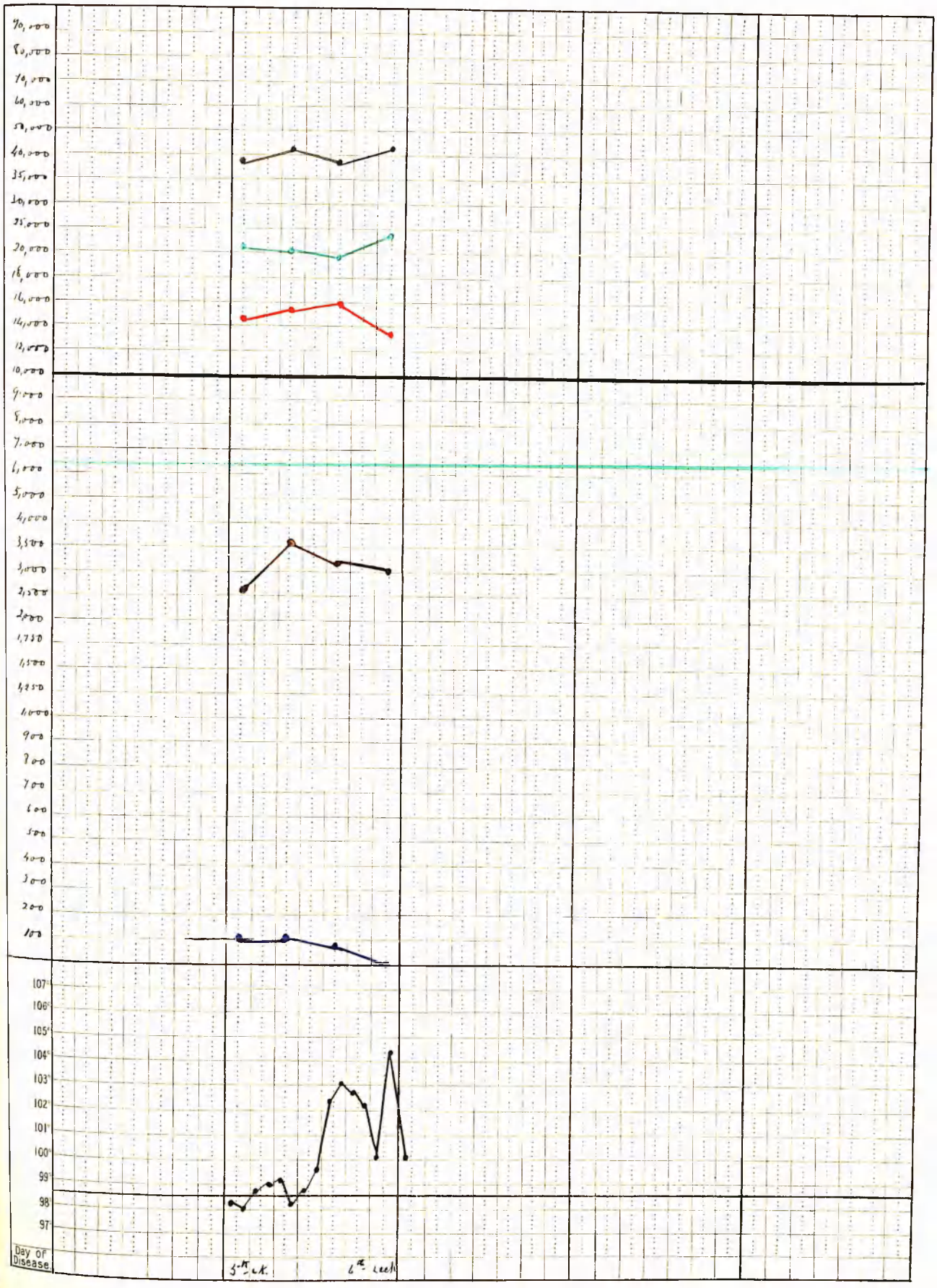
-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

---------oOo---------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107°
106°
105°
104°
103°
102°
101°
100°
99°
98
97
Day Of Disease
5th wk.
6th week

CASE XXIX,- Baby R., aet. 1.3/12 years

This child died of convulsions in the 8th week of illness. Only one observation was made, to wit, on the day before death. On admission, in the 3rd week, he was a well nourished child with a sharp attack of Whooping Cough. This increased in severity. Vomiting became frequent, and in the 8th week of the disease the child had lost flesh and general condition. Three days before death there was an evening rise of temperature to 102.8, whereas, up to this date, there had been no pyrexia. Two days later the child had six convulsions. Early on the following morning he had two more, the second fatal. Temperature had been rising gradually from the early hours, and one hour before death it registered 105. There was no broncho-pneumonia.

Leucocytes

Day before death	Polymorphs		Lymphocytes		L. Monos.		Eosino.		Myelos.	
	%	Abs.No.	%	Abs.No.	%	Abs. No.	%	Abs. No.	%	Abs. No.
69,200	31.25	21,625	60.25	41,693	8.25	5,709	.25	173		

The blood condition shows a very intense leucocy-

Case XXIX Contd.

tosis, and lymphocytes in very high numbers. Large mononuclear cells and polymorphonuclears show marked increases in absolute numbers, though relatively the polymorphonuclears are decreased. Eosinophiles are present in small numbers.

CASE XXX - J. D., aet. 2½ years

This child was admitted to hospital in approximately the 23rd day of illness, and died on the 39th of convulsions and double broncho-pneumonia. Temperature on admission, 100.2; pulse 160; and respirations 72. Cough was characteristic and frequent. Whoop was decided, but for the first few days there was little vomiting. Examination of the chest showed a pneumonic condition over the base of left lung, extending well upwards into the lateral region. Over this area there were fine crepitant rales, though respiratory murmur was without tubularity. Rales of a muco-crepitant kind were abundant over the right side and the front of the left. On his 29th day he had a very severe convulsion which lasted half an hour, and for which chloroform had to be administered. There was now evidence that the right lung was involved. Patches of crepitus were present in right mid-lateral region and at the base. From this date the child was gravely ill and restless, but no more convulsions occurred till the 34th day, when he had several rapidly following one another, each lasting from five to ten minutes. Previously there had been frequent twitch-

Case XXX Contd.

ings of the face and limbs with carpopedal spasm. The patient died on the morning of the 34th day of illness. Temperature for the last four days was of the remittent type, registering 103.2 to 103.4 in evening, and from normal to 100 in morning. The evening before death it began to rise into hyperpyretic registers, until just before death the following morning it was 108°. Three observations were made on 27th, 30th and 33rd days.

Leucocytosis

Day	Leuco. during residence	Polymphs. %	Polymphs. Abs.No.	Lymphs. %	Lymphs. Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
27th	101,200	39	39,468	52	52,624	6.25	6,325	1.25	1,265	1.5	1,518
30th	120,200	53	63,706	36	43,272	8.	9,616	1.75	2,103	1.25	1,503
33rd	94,000	53	49,820	37	34,780	9.25	8,695	.25	235	.5	470

In this case there is a most intense leucocytosis throughout the observations; the lymphocytes present as 52% of the total white cells, and reaching an absolute number of 52,624 on 27th day, show a declining tendency towards the end. A great increase in the polymorphonuclear cells is present throughout. The large mononuclears, though within normal percentages, also show

Case XXX Contd.

great increases in absolute number. The eosinophiles, present in high absolute numbers though low percentage, on 27th day, show a decline in the last observation. Myelocytes are present in appreciable numbers.

CASE XXX - J. D., aet. $2\frac{1}{2}$ years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,000

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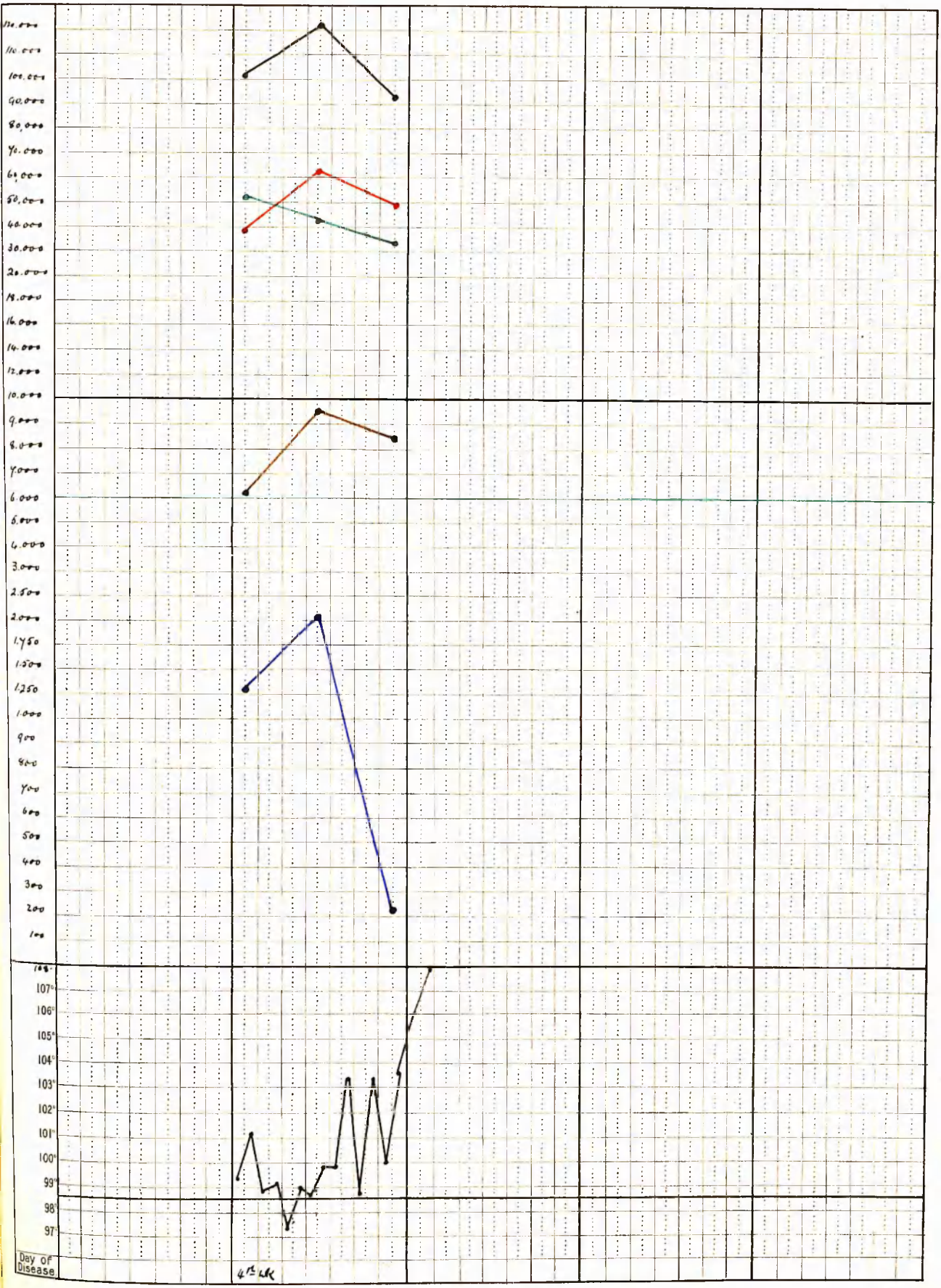
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106°
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101°
100°
99°
98°
97°
Day of Disease
4½ LR

CASE XXXI, D. G., aet. 5 years

Admitted on 22nd day of illness with well defined Whooping Cough, this was a fairly well nourished child at this period. After two or three days there was moderate pyrexia with acceleration of respirations, which, in addition, had become shallow. Physical examination revealed crepitant rale over the scapular angle on the left side. Pyrexia continued in the higher registers; tongue became dry and furred; there were marked cyanosis and restlessness, and the child showed the facies of grave illness. Physical signs of consolidation were soon evident. By 35th day numerous small areas of consolidation could be detected in both lungs, evidenced by tubular breathing and discrete crepitating rale. The child died from asthenia on approximately the 47th day of illness. Five observations were made on the 36th, 38th, 40th, 42nd and 45th days.

Case XXXI Contd.

Day	Leuco. during resi-dence	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs. No.	L.Monos. %	L.Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
36th	31,400	73.5	23,079	21.25	6,672	2.5	785	1.	314	1.75	550
38th	23,200	73.75	17,121	22.25	5,151	3.25	754	.25	58	.5	116
40th	28,600	74.5	21,307	19.5	5,577	3.25	929	.75	215	2.	572
42nd	24,000	78.	18,720	16.25	3,900	2.75	660	.25	60	2.75	660
45th	15,600	77.5	12,129	12.25	1,911	4.25	663	1.5	234	4.25	663

The leucocytosis on 36th day is of a high degree, subsiding to moderate from 38th to 42nd, and on 45th day (two days before death) it has almost become slight. The leucocytosis is almost entirely a polymorphonuclear one, although the lymphocytes show a slight increase in absolute number during the first three observations. The large mononuclear cells are of low percentage, but are in absolute number normal. Eosinophiles are present in very small numbers, and myelocytes show an increasing tendency towards the end of illness.

CASE XXXI - D. G., aet. 5 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 3,000

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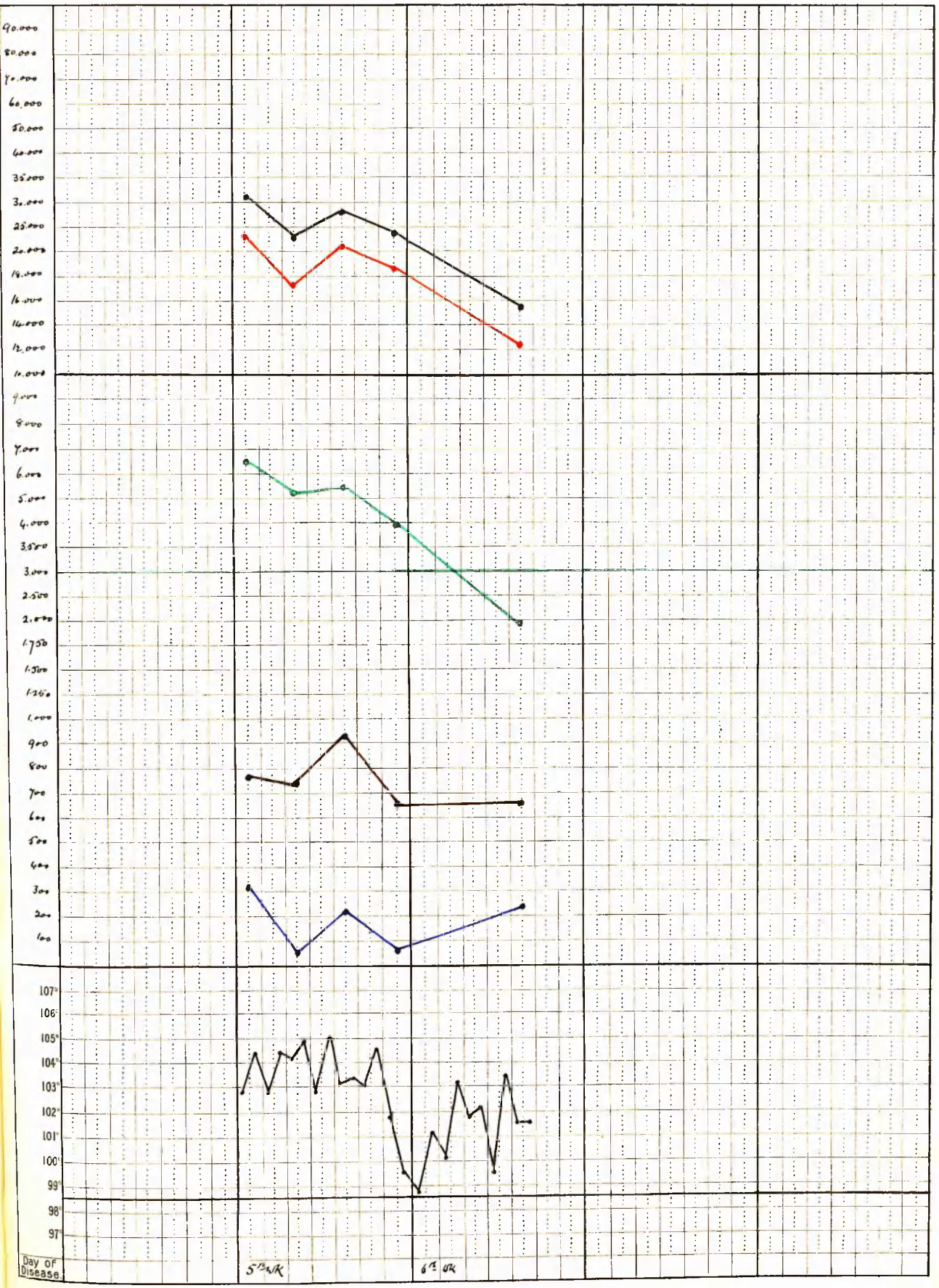
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Day of Disease
5th St/K
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CASE XXXII - M. G., aet. 2 years

This child was admitted on 15th day of illness approximately. On admission temperature was 97.6, pulse 144, and respirations 44. There was general catarrh evidenced by muco-crepitant rale over both sides of the chest. There were no percussion dulness, and no alteration of the quality of the respiratory murmur. On 22nd day the temperature began to ascend; previously whoop had become well defined. On the 24th day there was consolidation at the left base, and over left infraspinous region, while at the right base fine crepitating articulate rale suggested a similar condition. The child became still more gravely ill. The physical signs of broncho-pneumonia extended till both lungs were extensively involved. Emaciation progressed, and cyanosis was marked and continuous. Pyrexia from 25th day was uninterrupted, and the child died on 35th day of illness. Seven observations were made in this case on 25th, 26th, 27th, 28th, 29th, 32nd, and 34th days.

Case XXXII Contd.

Day	Leuco. per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
25th	36,000	52.	18,720	38.	13,680	8.	2,880	2.	720		
26th	38,000	50.5	19,190	42.	15,960	7.	2,660	.5	190		
27th	36,000	63	22,680	26.75	9,630	8.5	3,060	.25	90	1.5	720
28th	36,800	68	25,024	20.5	7,544	9.5	3,496			2.	736
29th	32,000	62	19,840	25.5	8,160	10.5	3,360			2.	640
32nd	44,000	64	28,160	26.5	11,660	7.5	3,300			2.	880
34th	11,200	83	9,296	10.	1,120	4.5	504			2.5	280

A high to very high degree of leucocytosis is present from 26th till 32nd days. A very abrupt fall occurs on the 34th day, the day before death, when the leucocytes are in normal numbers. Though there is a lymphocytosis of moderate degree in the first two observations, these cells are not much in excess in the succeeding four, the leucocytosis being mainly polymorphonuclear. The large mononuclear cells are absolutely increased, coinciding with the high leucocytosis, though their percentages are not abnormal. Eosinophiles are absent from last four observations, while myelocytes are present in from 2. to 2.5%. The feature of this case is the decrease in the number of leucocytes present on the day preceding death; a decrease in which all the cells participate.

CASE XXXII - M. G., aet. 2 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

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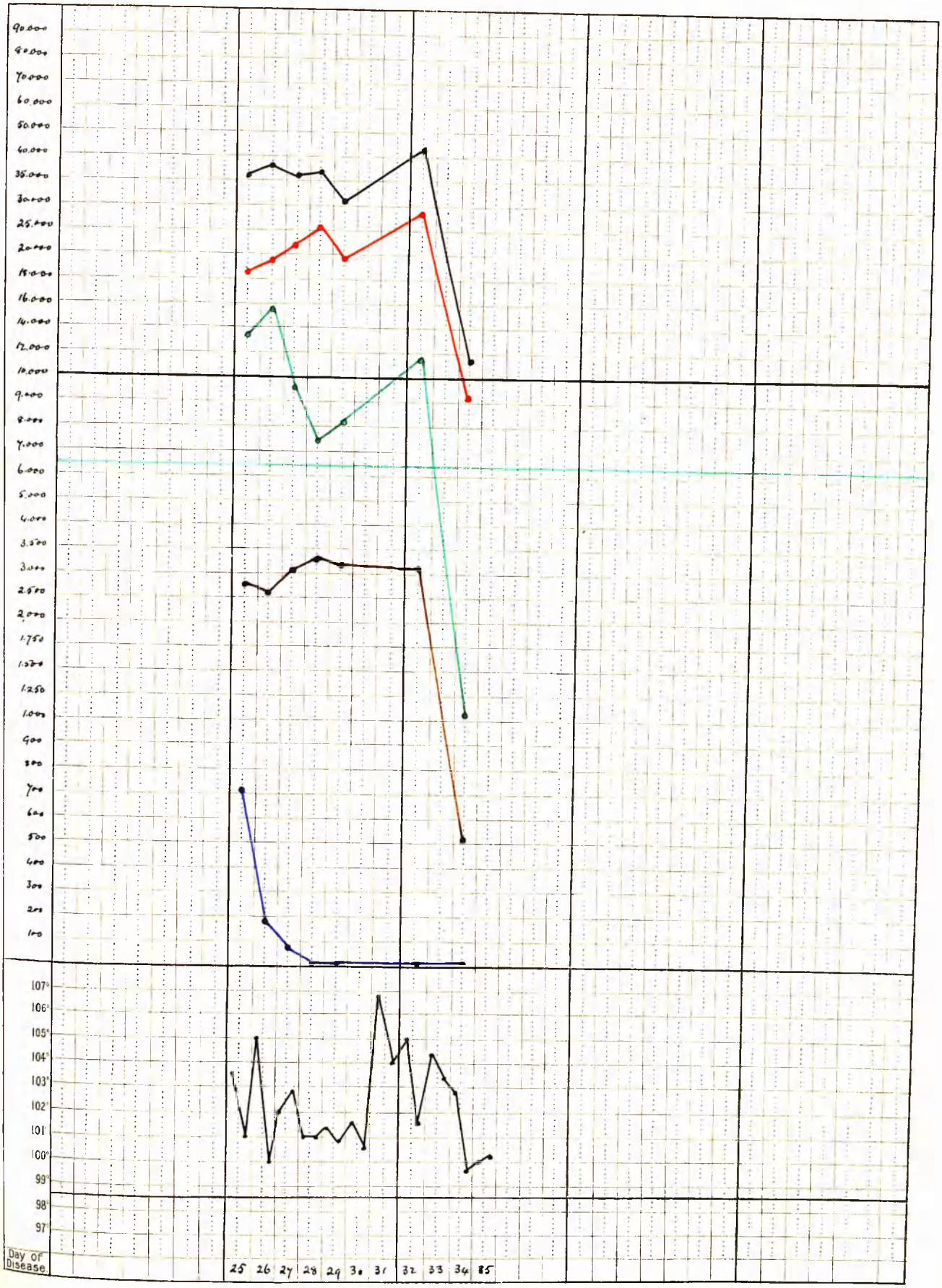
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Day of Disease
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CASE XXXIII - A. H., aet. 2 years

This child was admitted approximately on 13th day. Cough was spasmodic, but there was no whoop. Temperature was 99.4, pulse 134, and respirations 60. Physical examination revealed muco-crepitant rales of general distribution. The cough increased in severity; whooping and vomiting were frequent. There was a moderate degree of pyrexia on the 28th day, which continued. On the 32nd day there were signs of broncho-pneumonia. The temperature became normal on the 37th day, and remained so till the 49th day. In the interim the child had improved considerably. On the 50th day there was an extensive involvement of both lungs. Child now became gravely ill; there was marked cyanosis; the pulse became frequent and weak; and death occurred on 56th day. Four observations were made in last stages of illness, viz., 52nd, 53rd, 54th and 55th days.

Leucocytosis

Day	Leuco. per cm.	Polymorphs %	Polymorphs Abs.No.	Lymphocytes %	Lymphocytes Abs.No.	L. Monos. %	L. Monos. Abs. No.	Eosino. %	Eosino. Abs. No.	Myelos. %	Myelos. Abs. No.
52nd	17,200	41	7,052	44.75	7,697	13.0	2,236	.25	43	1.	172
53rd	18,600	48	8,982	39.	7,254	11.0	2,046	.5	93	1.5	279
54th	24,000	45	10,800	48.5	11,640	5.5	1,320			1.	240
55th	26,000	58	15,080	31.	8,060	8.5	2,210	1.0	260	1.5	390

Case XXXIII Contd.

The leucocytic reaction in this case is from slight to moderate in degree, the latter condition obtaining in the last two counts. The polymorphonuclear cells constantly show an increasing tendency, though very high figures are never reached. The lymphocytes are somewhat in excess of normal in all the observations. The large mononuclears show an absolute increase corresponding with the general excess of leucocytes. Eosinophiles are invariably at low normal value unless on 55th day, when they are slightly increased. Myelocytes were seen in small percentages throughout.

CASE XXXIII - A. H., aet. 2 years

EXPLANATION OF CHART

-----oOo-----

Total white cells	in black
Polymorphonuclear cells	in red
Lymphocytes	in green
Large Mononuclear cells	in brown
Eosinophile cells	in blue

Normal line for total leucocytes in black placed at 10,000

Normal line for lymphocytes in green placed at 6,500

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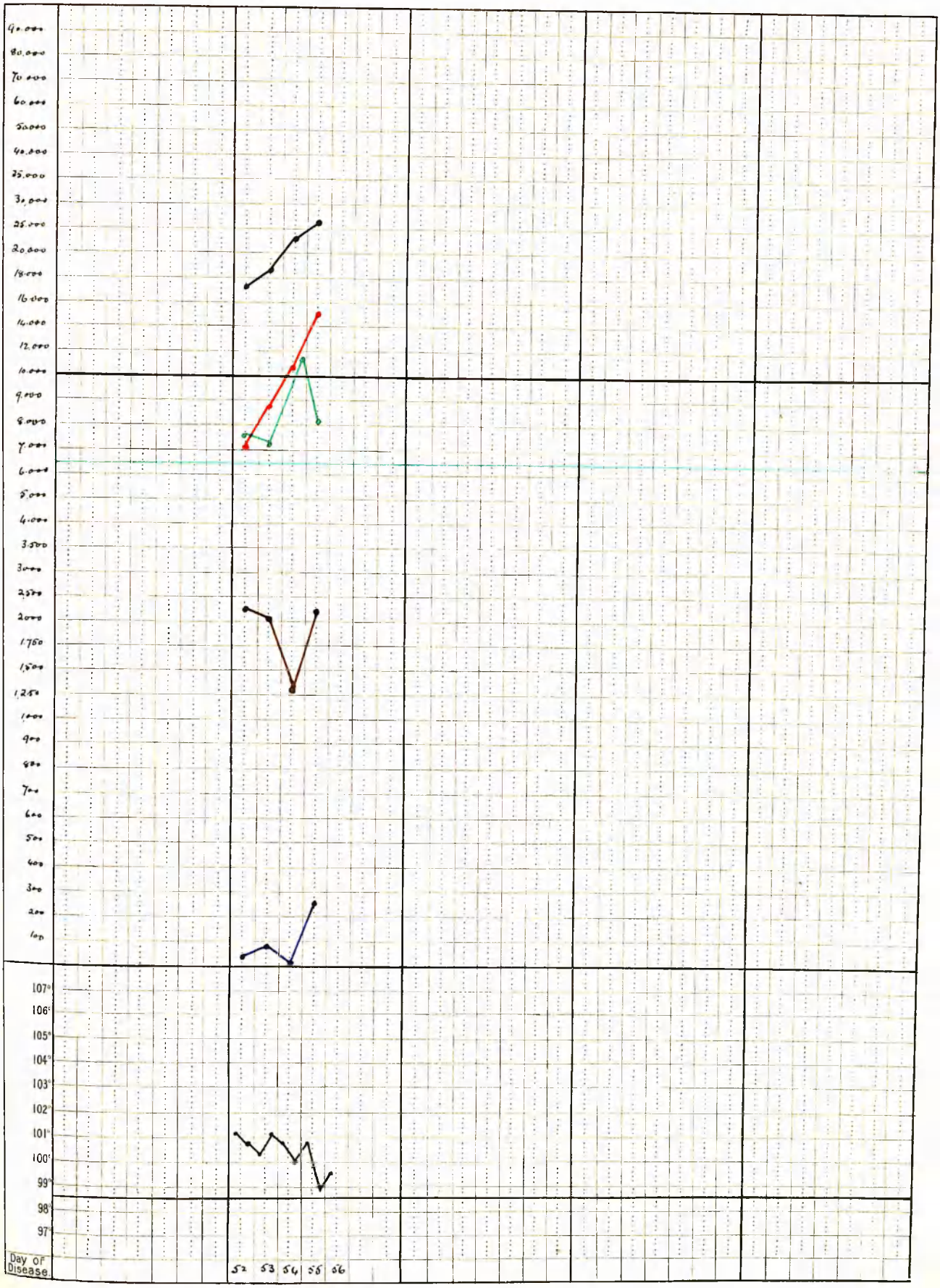
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900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day OF Disease
52
53
54
55
56

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