UNIVERSITY OF GLASGOW.

THESIS FOR THE DEGREE
OF
DOCTOR OF MEDICINE.

SUBJECT.

An investigation into the clinical value of the enumeration of the nuclei in the neutrophile polymorpho-nuclear leucocytes of the blood.

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Early in 1904 Dr J.Arneth, from von Leube's clinic at Wurzburg, published a contribution on the Neutrophile Leucocytes in Infectious Diseases, viz.: "Die Neutrophilen Leukozyten bei Infektionskrankheiten." (1)

In this article Arneth states that many of the existing ideas of positive and negative chemiotaxis for the neutrophile polymorpho-nuclear leucocytes are based on false conceptions. He states that the destruction of the neutrophile polymorpho-nuclear leucocytes, which occurs in varying degree according to the severity of the infection, or intoxication, resisting powers of the organism, etc., provides the explanation of the phenomena observed.

He states further that the number of leucocytes present in the blood is no criterion as to their actual condition, normal or abnormal, but that this is dependent upon the condition of the nucleus.

In another contribution, also issued from von Leube's clinic at Wurzburg in 1904, viz.: "Zum Verhalten der Neutrophilen Leukozyten bei Infektionskrankheiten."(2) Arneth reiterates the points of his previous paper, and from a study of these papers, it would appear that he considers

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(1) "Deutsche Medicinische Wochenschrift", (XXX, No.3, commenced in No. 2). Berlin and Leipsic. Also Folia Haematologica I.492,also VII. 83.

(2) "München Medicinische Wochenschrift" 1904. LI. 1097 - 1102.

that those neutrophile polymorpho-nuclear leucocytes with one or two nuclei are younger and less able to combat an infection, than those with more nuclei.

On this theorem, he counted the nuclei of the neutrophile polymorpho-nuclear leucocytes, and divided these leucocytes into 5 classes, accordingly.

These classes are as follows :-

Class I. Neutrophile polymorpho-nuclear leucocytes containing one nucleus; there are three sub-divisions of this class -

(a) M. myelocytes.

(b) W. leucocytes with a slightly hollowed-out, or indented nucleus.

(c) T. leucocytes with a deeply indented nucleus.

Class II. Neutrophile polymorpho-nuclear leucocytes possessing two nuclei; there are three sub-divisions of this group -

(a) 2K. nucleus in two parts.

(b) 2S. nucleus in two loop-like parts.

(c) 1K,1S. nucleus with one of (a) and one of (b).

Class III. Neutrophile polymorpho-nuclear leucocytes possessing three nuclei; there are four sub-divisions of this class -

(a) 3K.

(b) 3S.

(c) 2K, 1S.

(d) 2S, 1K.

Class IV. Neutrophile polymorpho-nuclear leucocytes possessing four nuclei; there are five sub-divisions of this class -

(a) 4K.

(b) 4S.

(c) 3K, 1S.

(d) 3S, 1K.

(e) 2K, 2S.

Class V. Neutrophile polymorpho-nuclear leucocytes with five or more nuclei; there are five sub-divisions of this class -

(a) 5K.

(b) 4K, 1S.

(c) 3K, 2S.

(d) 4K, 2S.

(e) 3K, 3S.

Placing the numbers obtained by this method of counting in a horizontal row, beginning on the left with Class I, and ending on the right with Class V., he formed what he called the Neutrophilic Blood Picture.

This from a series of 15 healthy individuals whose neutrophile polymorpho-nuclear cells he counted as described, Arneth formed his normal neutrophile blood-picture.

(Normales Neutrophiles Blutbild).

This arranged in horizontal tabular form is :-

I.	II.	III.
M. W. T. 0: 0.2: 5	2K: 2S: 1K,1S 0.27: 23.46: 11.6	3K: 3S: 2K,1S: 2S,1K 2.27: 5.6: 16.66: 16.4
5.2%	35.33%	40.93%

IV.	V.
4K: 4S: 3K,1S:3S,1K:2K,2S 3.8:0.07: 6.4: 1.6: 4.73	5K:4K,1S:3K,2S:4K,2S:3K3S 1.0: 0.4: 0.4: 0.07:0.07
16.6%	1.94%

Or, as Arneth states, in round numbers,

I.	II.	III.	IV.	V.
5%.	35%.	41%.	17%.	2%.

This is his Normal Neutrophile Blood Picture.

Arneth's technique is as follows:

The leucocytes are enumerated in the ordinary way by means of the Thoma-Zeiss blood-counting apparatus.

Then blood-films are made, and the differential neutrophile polymorpho-nuclear leucocyte count is made, following the classification given. An oil-immersion lens, and a microscope with a movable stage are used, and 100 neutrophile polymorpho-nuclears are counted. The

stain used for the blood-films was Ehrlich's triple stain.

The details of this technique are set forth in a monograph published by Arneth in 1905[3] in which he sets forth the results of further work upon the neutrophile polymorpho-nuclear leucocytes, with regard to pulmonary tuberculosis.

As the three papers by Arneth to which I have referred all deal with the same subject, and are simply continuations of each other, it may be convenient here to summarise the findings from all three, together.

Numerous diseases were investigated, including pulmonary tuberculosis, pneumonia, varicella, morbilli, mumps, and erythema nodosum. In all of these, considerable alteration of the neutrophile blood-picture took place. Even where the total leucocyte count was normal this alteration sometimes occurred. Therefore, taking into account the number of leucocytes per cub. mm. along with the neutrophile blood-picture, Arneth describes the following conditions, using a term "Cytosis", (Ger. "Zytose"), instead of leucocytosis.

I. Hypercytosen: Vermehrte Leukocytenzahl. (Increased leucocyte count).

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(3) Die Lungenschwindsucht auf Grundlage Klinischer und Experimenteller hämatologischer Untersuchungen. (Dr Jos. Arneth).

(a) Isohypercytose: mit normalen neutrophilen Blutbilde. (With normal neutrophile blood-picture).

(b) Anisohypercytose: mit pathologisch veränderten neutrophilen Blutbilde. (With a pathologically altered neutrophile blood-picture).

II. Normocytosen: Normale Leukocytenzahl. (Normal leucocyte count).

(a) Isonormocytose: mit normalen neutrophilen Blutbilde. (With normal neutrophile blood picture).

(b) Anisonormocytose: mit pathologisch veränderten neutrophilen Blutbilde. (With a pathologically altered blood-picture.

III. Hypocytosen: Verminderte Leukocytenzahl. (Diminished leucocyte count).

(a) Isohypocytose: mit normalen neutrophilen Blutbilde.

(b) Anisohypocytose: mit pathologisch veranderten Blutbilde.

Arneth concludes that the condition in most infective diseases is always an aniso---cytosis, never an iso---cytosis.

In cases which were unfavourable, clinically, from a prognostic view, he found that there was an increase

from normal in the number of cells of Classes I and II, and a decrease in the number of those in Classes III, IV and V. This alteration was greater or less according to the severity of the disease, and was called by Arneth a "drift" or "dislocation" (Verschiebung) to the left, and was interpreted by him as an indication of lowered resistance on the part of the patient to the disease.

This hypothesis was supported by ~~that~~ the fact that if the case improved clinically, the neutrophile polymorpho-nuclear picture returned to the right. If the case became worse, the drift or dislocation of the picture went further to the left.

These findings he states to be independent of the total leucocyte count.

As an aid to prognosis, and a guide in therapeutics, Arneth lays great stress upon the value of his differential neutrophile polymorpho-nuclear leucocyte enumeration, and even goes so far as to state that if the neutrophile blood-picture be unfavourable, i.e., if it is dislocated to the left, then the prognosis is correspondingly grave, even where clinically there may be no signs pointing to that conclusion, and vice versa.

In one case of miliary tuberculosis he found that nearly all the neutrophile polymorpho-nuclear leucocytes belonged to Classes I and II, and remained in these

classes at every examination throughout the course of the disease, the picture becoming more and more dislocated to the left as the fatal end approached.

Special attention is drawn to the fact that in this case the ordinary quantitative leucocyte enumeration was normal all the time.

On the other hand, Arneth mentions a case of tetanus following trauma, in which the neutrophile blood-picture corresponded to the normal average even after the exhibition of Tizzoni's anti-tetanus serum.

Arneth is strongly of opinion that the methods of blood examination in common use do not go far enough. He thinks that every case should be investigated on the lines laid down by him, and that the findings so obtained are of very great value from the prognostic and therapeutic points of view.

His method, however, on the whole, has been adversely criticised. His assumption that the cells of Classes I and II are younger than those in Classes III, IV and V has caused many to disagree with him.

On p. 66 of "The Blood" by Gulland and Goodall (1912: Wm.Green & Sons, Edinburgh and London) it is stated that "there is a pretty general agreement that any clinical information that can be gained by the use of this method is not commensurate with the trouble involved". This at

first sight seems a somewhat harsh criticism, for no method of clinical research which yields valuable information - as Arneth's undoubtedly does - can really be termed worthless, however arduous its performance may be.

I do not propose to discuss his theories concerning the age and the resisting powers of the neutrophile polymorpho-nuclear leucocytes, according to the number of their nuclei. Two points on which I should like to lay emphasis, after some experience of his method, are :-

(1) Whatever be the explanation, the degree of severity of certain diseases, and their prognosis, as determined by Arneth's method, coincide with remarkable exactness with the findings arrived at by ordinary clinical methods, and with future progress of the cases.

(2) The method is undoubtedly arduous. It is indeed so laborious that its performance as a routine piece of work is well-nigh impracticable on account of the time required.

I have therefore sought to devise a method which, based on Arneth's method, is so simple that it comes within the category of routine clinical work, and at the same time is accurate in its findings.

Therefore, my sole objection to Arneth's method is that it is too complicated, and too laborious, ever to be generally employed as a routine method of examination.

My own experience is that all that ~~it~~ is necessary is to classify the neutrophile polymorpho-nuclear leucocytes in columns, as described above, but only according to the number of their nuclei; that is, the sub-divisions of the various classes described by Arneth, are unnecessary.

Some results have been published by Schilling-Torgau (4) on the results obtained from a simplification of Arneth's method, for he also found the original method too complicated.

This method, while somewhat simpler than Arneth's, seems to me still to be too cumbrous to bring it within the category of convenient and rapid methods of routine clinical examination.

The technique employed by Schilling-Torgau is as follows:-

The air-dried blood-films are stained by Pappenheim's method of combined May-Grűnwald and Giemsa stain, the film being fixed with the May-Grűnwald solution for three minutes. Then an equal quantity of distilled water is run on, left for one minute, and then the film is rinsed. Giemsa stain, diluted, (10 drops to 10 cubic centimetres of distilled water) is then poured on, left

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(4) Folia Haematologica: Leipz. 1911. XII. I. pp. 130 - 177.

for at least 15 minutes, rinsed in distilled water, blotted with fluffless blotting paper, and dried. An oil-immersion microscope with a movable stage is employed to make the count, according to the classification given below.

To my mind, this method of staining is too elaborate, for the purpose required, and is a waste of time. Jenner's stain is much more convenient, more rapid in its action, and gives better nuclear differentiation.

In any method of clinical research intended for routine work, simplicity of technique, where possible, should be a sine qua non, and it is very possible here by the use of Jenner's stain.

Schilling-Torgau makes the following classification,

(1) Segmented-Nucleate Polymorpho-nuclear leucocytes, those with two, three, four or more separate clumps of nuclear matter, united or not by threads.

(2) Rod-Nucleate Polymorpho-nuclear leucocytes, those possessing a ribbon-like nucleus, without any marked nodosities.

(3) Juvenile Polymorpho-nuclear leucocytes, those with an S-shaped nucleus, with the ends of the S thickened. Some of these forms may possess a reniform nucleus, with the indentation deep.

(4) Myelocytes; these are similar to the latter class,

but are a little larger, have a slightly indented nucleus, possess granules in the plasma, and have one (or more) nucleolus.

(5) Large mononuclears, including the "transitional" and "hyaline" cells.

(6) Lymphocytes.

(7) Basophile cells. (Mast cells).

(8) Eosinophile cells.

It is held that this method is much simpler than that of Arneth, and gives equally accurate results.

His deductions are, that if the "picture" is displaced to the left, there is regeneration of leucocytes (neutrophiles); if to the right, degeneration of neutrophiles. Extreme displacement to the left indicates hyperplasia in the bone marrow.

In the following diseases it is found that the blood-picture is not altered: viz., aplastic anaemia, sometimes pernicious anaemia, chlorosis, pseudo-leukaemia, splenic tumours, ordinary tumours, and chronic protozoal diseases.

Many acute infectious diseases, especially enteric fever, and tuberculosis, displace the blood picture to the right.

Septic infections, such as septicaemias, appendicitis, secondary infections in tuberculosis, scarlatina,

new growths, pneumonia, and acute protozoal diseases, displace the picture to the left. Extreme displacement to the left is produced by very marked septicaemia, and by leukaemia.

It is held that to neglect the examination of the leucocytes by the Schilling-Torgau method is a great mistake, as it is an indicator for, or against (as the case may be) operations, serum treatment, tuberculin, or X-rays. It is also claimed that the condition of the patient, at the time of the examination, can be accurately estimated by this means, and that improvement, retrogression, or a stationary condition may be diagnosed. Also, relapses may be foretold, within limits.

With all these claims I am in entire agreement.

With the method, I have the same fault to find as with Arneth's, namely, that while for an isolated observation the method may be of service, for ordinary clinical use it is too cumbersome, and too laborious, though not to the same extent as Arneth's method.

One point may be observed here.

In the work by Schilling-Torgau it is stated that many acute infectious diseases, especially enteric fever, and tuberculosis, cause a displacement of the picture to the right. Now if these examinations be made as I have suggested, solely with regard to the condition of the

neutrophile polymorpho-nuclear leucocytes, it will be found that the blood-picture is displaced, and frequently in no uncertain manner, to the left.

The reason of this apparent discrepancy is, however, clear. In the first instance (Schilling-Torgau) the examination includes the lymphocytes, in the second, it does not. Now in these diseases cited, of which enteric fever and tuberculosis are selected, there is a leucopenia, but also a relative lymphocytosis, and, as the lymphocytes are placed on the right-hand side of the "picture", when the figures are tabulated under their respective heads, it stands to reason that the picture is dislocated to the right.

This simply impresses upon me the desirability of avoiding confusion by adopting a method which is at once simpler in its classification, more uniform in its "dislocations", and, I hope to be able to show, accurate in its findings.

I am convinced that the same results may be obtained from a study of the neutrophile polynuclears alone, neglecting entirely all cells except the neutrophile polymorpho-nuclear leucocytes.

This elimination simplifies considerably the labour and time required in making an observation, and though undoubtedly it is most interesting to note the variations

in the numbers of the other cells in various diseases, nevertheless, in a method designed primarily for diagnostic and prognostic enlightenment, it is complicating the procedure, without, in my opinion, affecting the interpretations of the results, to do so.

That I am not alone in this opinion is evident from work published by Minor and Ringer(5) in 1911, where the conclusions drawn from the study of the blood by Arneth's method (modified) in a series of one hundred cases of pulmonary tuberculosis are given. They state that, (using their modified Arneth's method) "with increasing experience with this method we have been more and more forced to believe that, whether or not Arneth is right in his views as to the vitality of the neutrophiles of one or two nuclei as compared with those of three, four or five nuclei, the findings gotten by such counts agree remarkably well with the clinical facts, and that in his method we have a very useful means of drawing a prognosis in our cases of pulmonary tuberculosis."

Further: "In our cases we have found, with great, but not complete, uniformity, that favourable cases show a picture tending towards the right, unfavourable ones tending towards the left, very much in proportion to the

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(5) "The American Journal of the Medical Sciences" (May 1911), Vol. CXLI. No. 5.

severity of the case, and its outlook for a cure. In advanced and severe cases, where, unfortunately, the prognosis is sufficiently evident, the picture is uniformly very bad.

"But in much less advanced cases the method often gives us great assistance, and throws unexpected light upon the future course. Not only would an unfavourable picture in a new case, which otherwise seemed fairly favourable, justify a strong suspicion of its outlook, but changes in the picture occurring during treatment can give us valuable hints."

With regard to the technique employed, they state that while it is time-consuming, it is not difficult to anyone familiar with blood work. The blood-films were made on slides, and a thin portion selected for counting, so as to avoid super-imposition of one leucocyte upon another.

The stain employed, after trial of Wright's stain, and Ehrlich's tri-acid stain, was Jenner's, which was found to give the best nuclear differentiation.

The smears were allowed to dry in the air, and then immersed in the staining fluid for 3 minutes.

A movable stage was employed, and in every case the nuclei of two hundred neutrophiles were counted, the percentages being calculated accordingly.

(It is to be noted here that Arneth counted only one hundred leucocytes in his cases.)

Minor and Ringer state that their chief difficulty in making the counts was to determine exactly how many nuclei a given leucocyte contained, in order to classify it correctly, some cells being found whose nuclei were not clearly separated, or were only partially separated.

They accordingly formulated the following rules for their guidance :-

(1) Nuclei connected by a distinct isthmus are always to be counted as one nucleus.

(2) Nuclei connected only by a thread are always to be counted as two nuclei.

(3) Nuclei clearly super-imposed are to be considered as separate nuclei, but if the super-imposition is not definite, the nuclei are not to be considered as being separate.

These rules, on the whole, I consider to be admirable working rules. Of course, the essential point for those who would seek to disagree with them is, as Minor and Ringer point out, that all counts be done by the same system, following the same rules, whatever they be, and preferably, by the same individual.

From the average of ten healthy men, Minor and Ringer formed the following normal neutrophile blood-picture.

I.	II.	III.	IV.	V.
2.5%	18.2%	55.6%	18.6%	5.1%

This, as will be seen, differs somewhat from Arneth's normal blood-picture, which shows more cells in Classes I and II and less in III, IV and V.

Minor and Ringer explain this by saying that they have counted as multinuclear, cells which Arneth counted as mono- or bi- nuclear.

They do not consider, however, that this difference vitiates the conclusions drawn from the counts, in either case.

In 33% of their cases Minor and Ringer made ordinary leucocyte counts, and, on the whole, found themselves able to verify the statements made by Arneth, that the drift of the picture to the left is independent of the total number of leucocytes, though they found that, speaking generally, good blood-pictures were usually associated with the lower leucocyte counts, while the bad cases were usually associated with the higher counts.

On the whole, I am inclined to agree with Arneth, from my own observations on this point.

With reference to Arneth's sub-divisions of the five classes in his blood-picture, I agree heartily with Minor and Ringer when they state that "such an elaborate sub-division, while greatly increasing the complexity of the

"work, does not, we believe, bring compensating advantages, and we think that it can be neglected."

As a convenient method of rapidly comparing different blood-pictures, Arneth added the number of the cells in Classes I and II and took as his "Index", the percentage of the number so obtained to the whole picture, i.e., 5 + 35 = 40 per cent.

Minor and Ringer added the number of cells in Classes I and II, plus ½ of the number in Class III. Thus the index for Arneth's normal picture by this method would be 5 + 35 + ½ of 41 = 60.5 per cent, while for their own average normal picture the index would be 2.5 + 18.2 + ½ of 55.6 = 48.5 per cent.

This index although admittedly arbitrary, is recommended by Minor and Ringer as being convenient. A graphic chart is also recommended on which different counts may be plotted.

I shall refer to the question of an index again, but in the meantime I would point out that much useful information can be obtained from a simple comparison of the numbers of cells in the various classes without employing an index at all: and, particularly where a series of counts has been made in a case, by the use of special charts.

Minor and Ringer classed their series of cases of

pulmonary tuberculosis from the clinical and prognostic point of view, dividing them into good, bad, and very bad cases. Tabulating their hundred cases thus, they found that the findings obtained from the blood examinations coincided with remarkable exactness with the opinion formed on the case from the clinical and prognostic point of view. Some cases which were found to give an unfavourable picture, though apparently doing fairly well clinically, terminated fatally after varying periods, during which some exacerbation of the disease occurred, of which, clinically, no warning had been given.

Stress is laid upon the fact that small variations in successive counts should not be considered as of importance. Also, that the counts should not follow too soon upon each other, but should be made at intervals of at least 2 months. With this statement as regards pulmonary tuberculosis I am, on the whole, in agreement, though I have seen cases in which marked changes occurred in even shorter periods than one month, as in one case described by Minor and Ringer. With regard to other diseases, where perhaps even daily counts have been made, and especially in cases of acute illness, such as Lobar Pneumonia, I consider that small variations, especially if constant in one direction or the other, are of importance as indicating the progress of the disease, and the

manner in which the patient is standing up to it.

Minor and Ringer found that a haemoptysis raised the "index" of the patient's picture, and explain this rise by stating that it is due to the formation of many new leucocytes, produced by the haemorrhage.

Finally, they consider that a careful examination of the blood on the lines indicated by them affords a valuable means of prognosis in cases of pulmonary tuberculosis.

They state that there have been a few cases, but only a small minority, in which the method has failed them. By this I take it that they mean that they have seen cases in which the interpretations made from the blood-picture are not in accordance with the clinical happenings. Whether this is due to the picture being altered in such a way as to lead them astray as regards the prognosis, or to the picture not being altered sufficiently to enable conclusions to be drawn from it, they do not say. I have seen cases (though not cases of pulmonary tuberculosis) in which the patient was very ill indeed, and yet the neutrophile blood-picture did not vary much, if at all, from the normal. These cases, however, have been very rare indeed, and as I have said, have not been cases of pulmonary tuberculosis.

In conclusion, I would say that I consider that Minor

and Ringer, although limiting their observations to one disease, have made a great addition to the science of haematology by modifying a method of blood examination devised by Arneth, in such a way as to bring it within the bounds of ordinary clinical work.

Arneth's method, as I have already stated, is too elaborate for practical general use, and the same may be said of the modification by Schilling-Torgau (also already referred to) though the latter is simpler than Arneth's.

The method of Minor and Ringer, then, with a few slight time-saving and labour-saving modifications, is the method which I have followed in my investigations.

Minor and Ringer confined their observations to cases of pulmonary tuberculosis. While including cases of pulmonary tuberculosis in my series of observations, I have applied the method to other diseases, as was done by Arneth, and by Schilling-Torgau, by their respective methods. I hope, therefore, to be able to demonstrate a method of blood-examination, the performance of which is not laborious, and the details of which are not difficult, to anyone familiar with the ordinary methods of blood-examination, and is yet a method which, from the point of view of prognosis, is distinctly an advance on any of the ordinary accredited methods.

The method is as follows :-

I strongly recommend the use of cover-slips in making the blood-films. I have used cover-slips in all my observations, the size being $\frac{7}{8}$" No. I, square. These are prepared for use as follows: - an ordinary cylindrical urine-glass is filled with Nitric Acid, into which the cover-slips are dropped individually. They are allowed to remain in this for one minute, after which the Nitric Acid is poured back into the bottle, and all trace of it washed away by filling the urine-glass with water, and inverting it, after placing the palm of the hand over the mouth, the process being repeated several times until all trace of the acid is gone. Finally, the cover-slips are placed in a small wide-necked bottle, in absolute alcohol, and only require drying with a clean handkerchief to be ready for use. This method is simple, and gives results quite equal to those of more elaborate methods of preparation.

The blood is obtained from the lobe of the ear, or the finger. In almost all my cases I have obtained it from the lobe of the ear. The ear (or finger) is gently cleansed with methylated spirit, absolute alcohol, or ether. When the skin is perfectly dry, a puncture is made with a needle - one with a spear-shaped point I have found most convenient - and the first drop of blood is gently wiped away with cotton-wool. When a second drop has

accumulated, a dried cover-slip is depressed on to it, care being taken not to touch the skin with the cover-slip, and the cover-slip, charged with its drop of blood, is then allowed to drop on to another cover-slip, when the drop immediately begins to spread out. When this has occurred, the two cover-slips should be slipped gently and steadily apart, care being taken not to press them together, or to lift one off the other, in so doing.

When the cover-slips are being applied to each other, the application should be made in such a way that the corners of the squares do not coincide, but each corner of one should be overlapping the centre of a side of the other, so that a star-shaped appearance results. By doing so, when the blood has spread out between them, they may be slipped apart easily, holding the corners. The size of the drop required can only be estimated by experience, but when spread out the film should cover almost the whole of the cover-slip, evenly spread, without heaping-up at any part, if possible.

Cornet's forceps may be used to hold the cover-slips, and are convenient, but after some experience, these may be dispensed with, as the cover-slips can be held by their corners or edges, between the fingers, without soiling them. As a matter of fact, I think that if Cornet's forceps are used, they should be discarded when the moment

for sliding apart the cover-slips arrives, as better films can be obtained by sliding apart with the fingers than with the forceps.

The films made, then, are ready for staining. The stain which I have adhered to is Jenner's stain. This stain is undoubtedly the most rapid, most convenient, and simplest stain to use, and gives excellent differentiation of the nuclei of the neutrophile polymorpho-nuclear leucocytes.

I therefore recommend it in preference to any other stain, the majority of which, especially Pappenheim's and Ehrlich's, are much more elaborate in their technique, while the nuclear differentiation is not more marked than with Jenner's stain. Jenner's stain, made by Grűbler, then, is the stain I recommend.

My method of using it is as follows: - the films made are allowed to dry in the air. They should not be heated, as crenation and distortion of the corpuscles are apt to occur. The air-dried film is then placed on a smooth surface, and two or three drops of Jenner's stain dropped on. Then the preparation is covered with a Petri capsule, which I find to be very convenient, to prevent evaporation, and allowed to stain for 15 to 30 seconds. Then the film is seized with Cornet's forceps, and gently rinsed for 2 or 3 seconds in distilled water,

after which it is dried. The most rapid method of drying is to lay the cover-slip, film side up, on a soft towel, or piece of blotting paper, to remove the water from the under surface. Then the cover-slip is held firmly by the edges, between the finger and thumb of one hand, and the excess water blown off at once by one or two vigorous puffs of the breath. This causes almost instantaneous drying, and the preparation is ready for mounting.

The distilled water for rinsing the films in should be kept in a small wide-mouthed glass jar, with a stopper. The same water may be used for a long time, long after it has become coloured with the stain, and, in fact, I think it seems to give better results when it is so coloured then when fresh, so that when refilling the bottle I put in one or two drops of the stain as well.

When the film is stained and dried, I mount it/ film side up on a microscope slide, on a drop of cedar-wood oil, or water, the reason for this procedure being that one may be ready to mount the film before it has dried. If several are being stained at the same time, this is a very convenient method of working, as the film may be placed on the slide almost directly from the rinsing fluid and allowed to dry there, while others are being stained. This is also an economical method, as the same slide can be used practically

ad libitum, by simply wiping off the cover-slip when the examination is over. Of course, should a permanent preparation be desired, the ordinary methods of mounting must be employed.

The point of my method, then, is its rapidity. From the time that the film is ready for staining, I can place it stained, under the microscope, ready for examination, in one minute. This rapidity has, of course, only been attained to by considerable practice and by numerous experiments, but I can now with confidence, recommend the method I have described.

The films should be made very carefully, as I have found, by making different films from the same case, that the better the film, the more accurate the count, and the more easy it is to perform. It may be thought, as only the neutrophile polymorpho-nuclears are being observed, that possibly a thicker film would enable the count to be made more quickly. That has not been my experience, which has, in fact indicated quite the contrary to be the case, and I would again lay emphasis on the fact that the better the film, the easier and the more accurate the count.

To make the count, a microscope with an oil-immersion lens, and a movable stage, is required. I have used the ordinary Zeiss 1/12 inch oil-immersion lens, and I would

suggest that the eye-piece be not too powerful, as a very strong eye-piece somewhat impairs the definition of the nuclei, and prolongs the time taken for the count, as fewer leucocytes are visible in the one field.

As regards the details of the actual counting. I have followed Minor and Ringer in entirely neglecting the sub-divisions of the five main classes of cells described by Arneth, and modified by Schilling-Torgau. Thus my neutrophile blood-picture is obtained by dividing the neutrophile polymorpho-nuclear leucocytes into 5 classes, according to the number of their nuclei. No attention is paid to the shape of the nuclei, as, from a comparison of the results of observations on the same cases by the methods of Arneth, and myself, I have found that there is very little difference between them. The method described by Schilling-Torgau yields somewhat different results, but it must be remembered that, by taking note of other than neutrophile polymorpho-nuclear leucocytes, he complicated his picture. As regards the interpretations to be drawn from his results, however, there is no real difference.

The classification which I employ, then, is :-

Class I. Neutrophile polymorpho-nuclear leucocytes possessing one nucleus.

Class II. Neutrophile polymorpho-nuclear leucocytes

possessing two nuclei.

Class III. Neutrophile polymorpho-nuclear leucocytes possessing three nuclei.

Class IV. Neutrophile polymorpho-nuclear leucocytes possessing four nuclei.

Class V. Neutrophile polymorpho-nuclear leucocytes possessing five or more nuclei.

This is similar to the classification employed by Minor and Ringer in their series of cases of pulmonary tuberculosis.

These classes are arranged horizontally, beginning on the left with Class I, and ending on the right with Class V.

In making the count, I have observed the rules laid down by Minor and Ringer, which, while arbitrary, and possibly requiring modifications for some workers, seem to me to be very serviceable guides. For convenience I repeat them here.

I. Nuclei connected by a distinct isthmus are always to be counted as one nucleus.

II. Nuclei connected only by a thread are always to be considered as two nuclei.

III. Nuclei clearly super-imposed are to be considered as separate nuclei, but if the super-imposition is not definite, the nuclei are not to be considered as being

separate.

In this method of blood examination, as in all similar methods of clinical research, there has always to be considered the question of the personal equation. I am convinced that in making these counts the question of the personal equation plays a very small part, as in the majority of cases there is no difficulty in determining whether a particular cell contains two, or three, nuclei. In doubtful cases one observer might say that it contained two nuclei, another three. So far, however, as the interpretation of the results is concerned, there is no difference, provided the same observer makes the observations each time.

As I have said, this applies to other methods of clinical work, and to a very small extent to this method.

Though this might lead to a trifling difference in the counts of the two observers, their interpretations would not differ, as each observer would make the same "mistake" (as his fellow-worker would call it) every time.

Therefore, while less necessary than in many other clinical methods of research, to ensure absolute accurary the counts should be made, at any rate in the same case, always by the same individual.

Arneth counted the nuclei of 100 cells to form his

"picture". Minor and Ringer counted 200.

In almost all of my cases I counted the nuclei of 200 cells for each count; in the remainder, those of 100 cells. As a result of this experience, I am of opinion that it is unnecessary to count the nuclei of more than 100 cells.

In many of my earlier cases I made two separate counts of the nuclei of 100 cells in each case, and found, as a result, that any difference which resulted between the percentages obtained from each individual count, and the percentage obtained by slumping them together, and dividing by two, was so trifling as to be negligible.

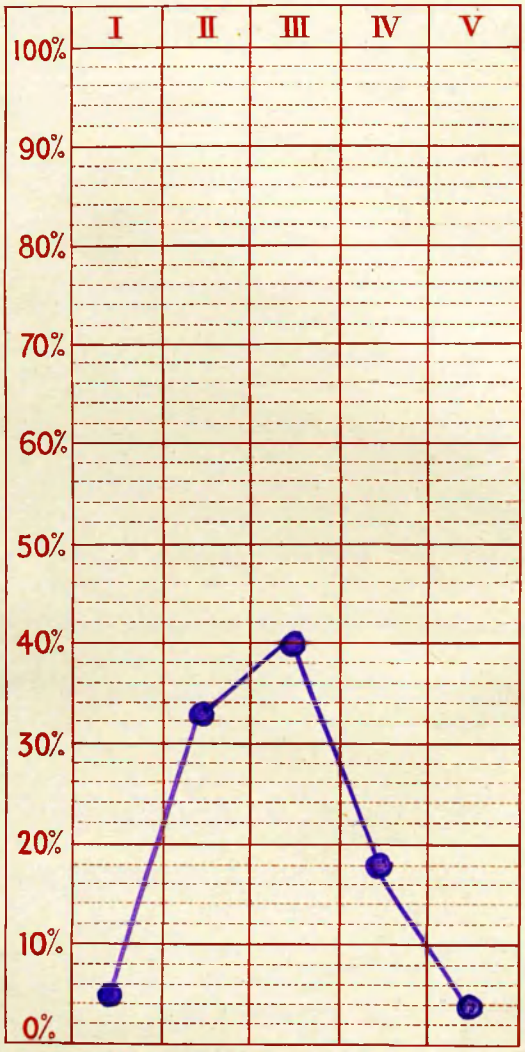
As a matter of fact, while making a count, by the time the nuclei of 50 cells have been enumerated, one can form a fairly correct opinion as to whether the picture will prove to be favourable or unfavourable, but for comparisons of different counts on the same case, this rough estimation would not be sufficient, and the nuclei of at least 100 cells should be counted. Where the variation in the picture is very slight, it is desirable to count 200 cells.

In order to obtain some standard picture with which to compare the abnormal pictures, I counted the nuclei of 200 neutrophile polymorpho-nuclear leucocytes in each of

Case ..... No. .....

Age ..... Disease .....

Normal Neutrophile Polynuclear Enumeration being the average of 20 Healthy Individuals.



Leucocytes per cub. m.m.

7,800

20 normal individuals, and took as my standard normal picture the average of these. This is as follows:-

I.	II.	III.	IV.	V.
5%.	33%.	40%.	18%.	4%.

This picture, then, was used as a standard count with which to compare abnormal pictures. In this respect I would point out that in classes II and III and to a less extent, IV, some variation in the numbers of the cells occurs in different healthy individuals, which is probably due to the fact that, numerically, the cells of these classes constitute the greater part of the picture. The findings in classes I and V are much more constant in healthy individuals, and any departure from normal limits in these classes should be viewed with suspicion.

In order to compare various "pictures", Arneth, and also Minor and Ringer, employed an "index" to which I have already referred. This index is numerical, and I do not consider it a satisfactory, or impressive method of comparing different counts.

Far more striking comparisons may be made by placing the figures of the various classes on charts, and for this purpose I have designed special charts. On these, any improvement, or deterioration, in successive pictures is made much more manifest than it would be by a statement that the "index" has increased, or decreased.

Also, striking departures from the normal receive on these charts the prominence which their importance deserves.

A study of the charts which illustrate all my cases will bear out these contentions.

For purposes of controls when dealing with cases of disease, ordinary leucocyte enumerations were made in these normal cases, by the Thoma-Zeiss blood-counting apparatus, and the results were found to conform to the accepted normal number, i.e., 5,000 to 9,000 per cubic millimetre. The actual figure obtained as the average of my 20 normal cases was 7,800 or, in round numbers, 8,000.

Proceeding on the lines already laid down, I have investigated the blood in the following diseases -

Pulmonary Tuberculosis.

Syphilis.

Malignant Disease.

Lobar Pneumonia.

Broncho-Pneumonia.

Broncho-Pneumonia with Empyema.

Bronchitis.

Puerperal Septicaemia.

Enteric Fever.

Measles.

Scarlet Fever.

Secondary Anaemia.

Pernicious Anaemia.

General Septic Peritonitis.

Acute Mastoiditis with Meningitis.

Cerebral Abscess.

Erysipelas.

Gall-Stones.

Gall-Stones with Acute Suppurative Cholecystitis.

Psoriasis.

Myxoedema.

I shall consider the cases of Pulmonary Tuberculosis first. I have examined the blood of 45 cases of this disease, and have divided them into 3 classes -

Class I. Unfavourable Cases.

Class II. Stationary Cases.

Class III. Favourable Cases.

Class I. Unfavourable Cases.

In this class the results are very striking, marked departures from the normal picture taking place. Some of the cases were obviously unfavourable from the time they came under observation, while some were doubtful. In all of them the examination of the blood carried out was of considerable value, affording in the obviously unfavourable cases confirmation of the clinical findings as

regarded prognosis, in the somewhat doubtful cases shedding a little light upon an outlook which was, perhaps, not altogether clear.

In all the cases the ordinary quantitative estimation of the leucocytes was carried out by means of the Thoma-Zeiss blood-counting apparatus.

Case: Florence Cowlishaw. Aet. 21.

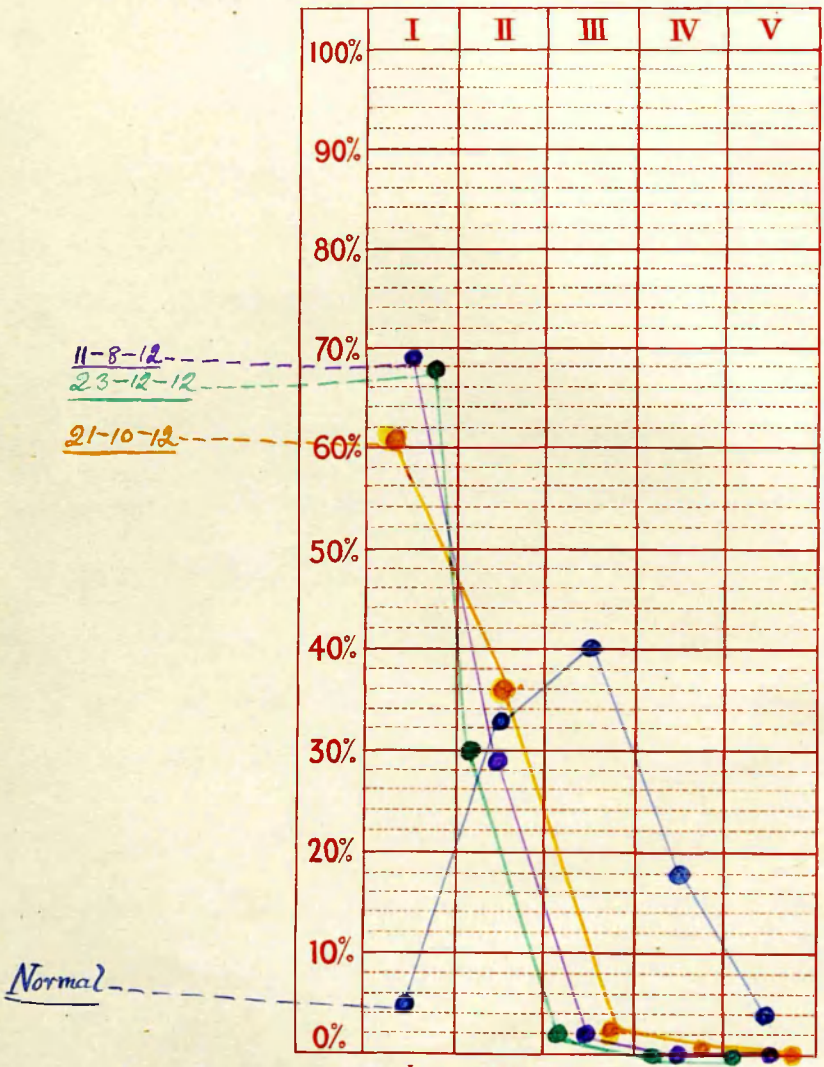
No. 1. Advanced case of pulmonary tuberculosis, progressive in type, of about 2 years' duration. Extensive solidification was present in both upper lobes of the lungs, and in the apices of both lower lobes, and a large cavity was present in the apex of the right upper lobe. From the time she came under observation, on 8-6-12, until her death, which occurred on 15-1-13, there was evidence of secondary septic infection. The temperature was almost constantly hectic, except for a few days occasionally, and in the last few days of her life. By 11-8-12 excavation had occurred in the apices of the right lower and left upper, lobes. She had an attack of left sided "dry" pleurisy at this time, and on 11-8-12 the blood was examined, and the following picture obtained, -

Leucocytes per cub. mm. = 10,000.

Differential neutrophile polymorpho-nuclear leucocyte enumeration :-

Case Florence Cowlishaw No. 1.

Age 21 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

11-8-12 = 10,000

21-10-12 = 10,000

23-12-12 = 11,000

I.	II.	III.	IV.	V.
69%	29%	2%	0%	0%

The pleurisy subsided in the course of a week, and a second count was made on 21-10-12, when the following figures were obtained -

Leucocytes per cubic mm. = 10,000.

Differential count :-

I.	II.	III.	IV.	V.
61%	36%	2.5%	0.5%	0%

During the interval between the first and second counts patient had steadily become worse, and a third count on 23-12-12 revealed the following picture -

Leucocytes per cub. mm. = 11,000.

Differential count -

I.	II.	III.	IV.	V.
68%	30%	2%	0%	0%

Death occurred on 15-1-13.

The points to which I would seek to draw attention in this case are -

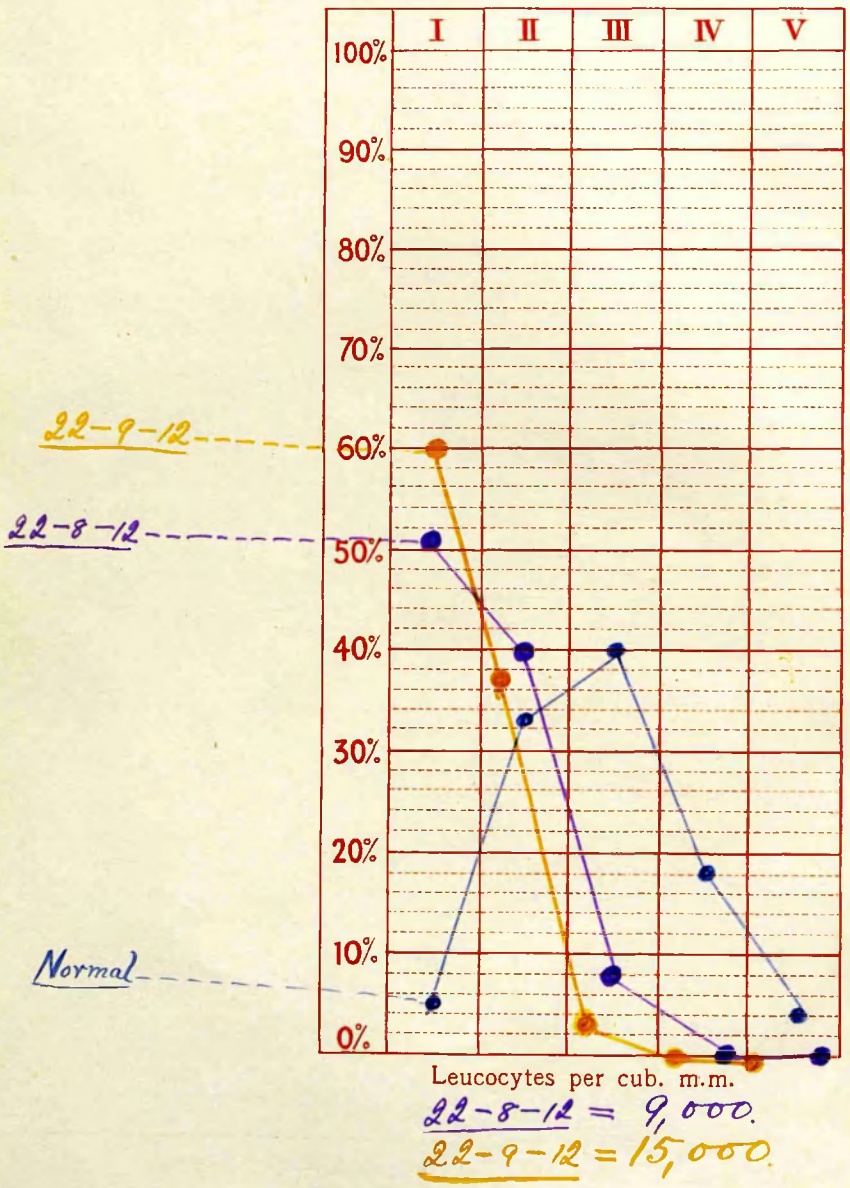
(1) The leucocytosis present. This I take to be the result of the secondary septic infection present.

(2) The very marked departure from normal of the "picture", the dislocation to the left being striking.

(3) The fact that the first "picture" shows a greater dislocation to the left than either of the other two,

Case Thomas Higgins No. 2

Age 32 Disease Pulmonary Tuberculosis.



in spite of the fact that the disease was progressive, This I consider to be due to the pleurisy from which she was suffering at the time of the first count (as I have seen on several occasions) causing a sudden increased dislocation of the picture to the left, i.e. unfavourably.

Case: Thos. Higgins. Aet. 32.

No. 2. Advanced case of pulmonary tuberculosis admitted on 30-5-12, cavities being present in both upper lobes, and consolidation in the apices of both lower lobes. There was also a tuberculous orchitis and epididymitis on the right side. The temperature, which had been normal for some weeks, became hectic, and on 22-8-12 examination of the blood revealed

Leucocytes per cub. mm. = 9,000.

Differntial count -

I.	II.	III.	IV.	V.
51%	40%	9%	0%	0%

On 22-9-12, the disease progressing rapidly,

Leucocytes per cub. mm. = 15,000.

And the picture -

I.	II.	III.	IV.	V.
60%	37%	3%	0%	0%

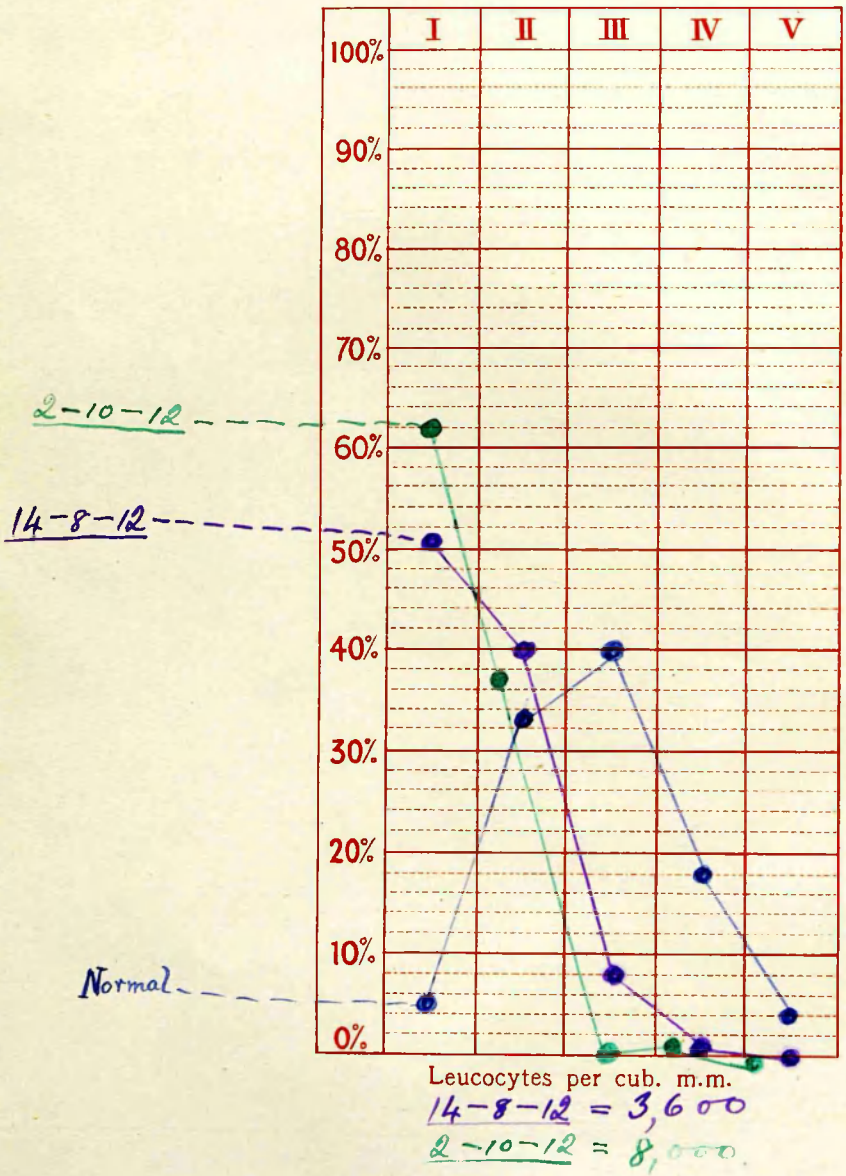
Three days later, he died.

The points to be noted in this are; again,

(1) The marked dislocation to the left of the picture,

Case Annie Baxter No. 3

Age 14 Disease Pulmonary Tuberculosis



and progressively so.

(2) The leucocytosis present in the second count. This may have been partly the terminal leucocytosis of the moribund, as the temp. had been normal at the time, for 2 days, and remained so until just before death.

Case: Annie Baxter. Aet. 14 years.

No. 3. Advanced Pulmonary Tuberculosis, and Tuberculous Peritonitis. Very emaciated child, with hectic temperature. A very large cavity was present in the left upper lobe, and solidification in the right upper lobe. The abdomen was slightly distended, doughy, and some free fluid was present. She was obviously seriously ill.

14-8-12. Leucocytes per cub. mm. = 3,600.

Differential count -

I.	II.	III.	IV.	V.
51%	40%	8%	1%	0%

She became steadily weaker, her hectic condition became more pronounced, and she suffered from abdominal pain and diarrhoea.

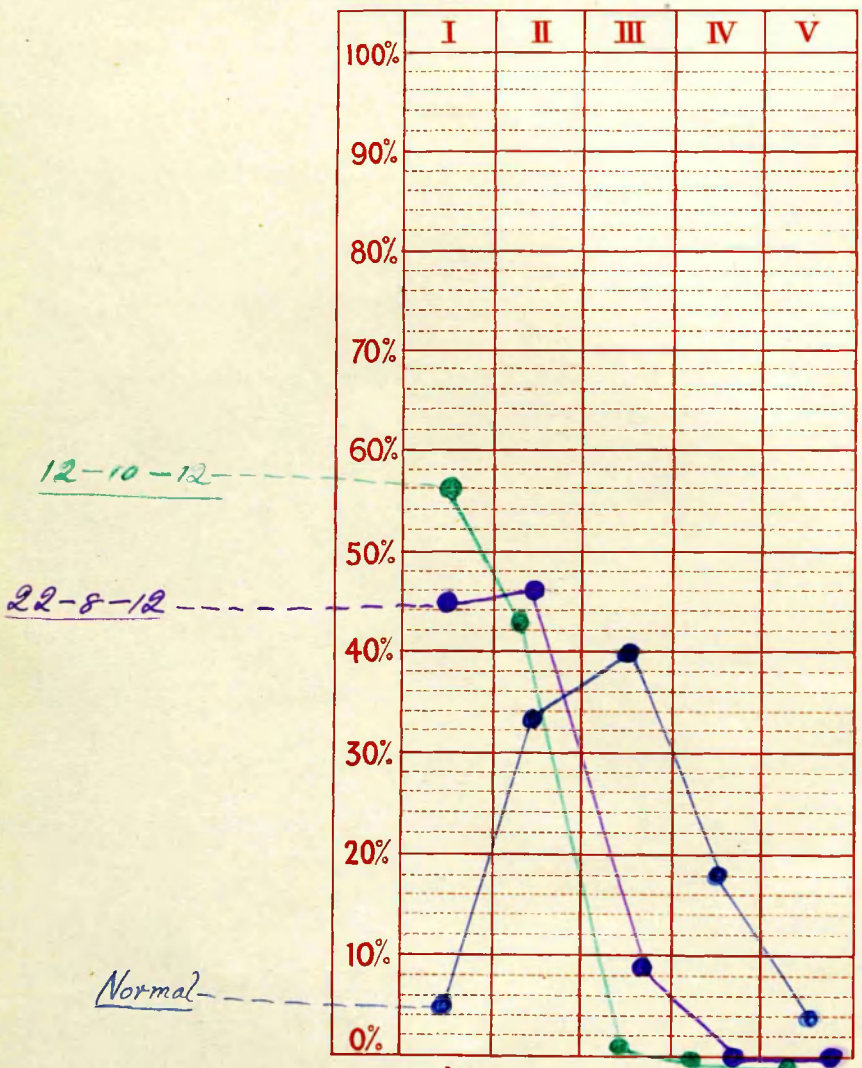
On 2-10-12 a second count was made, and the following figures obtained -

Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
62%	37%	0%	1%	0%

Case David Skerritt No. 4

Age 48 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

22-8-12 = 10,000.

12-10-12 = 9,000.

On 9-10-12, a week later, she died.

The points to be observed in this case are -

(1) The leucopenia present in the first count.

(2) The marked dislocation to the left of the picture, and the increase in the dislocation coincident with the advance of the disease.

Case: David Skerritt. Aet. 48.

No. 4. Advanced Pulmonary Tuberculosis. Very large cavities were present in both lungs, involving almost the whole of the upper lobes, and the apices of the lower. He had been fairly fit, but going downhill slowly for some months, when suddenly, 8 weeks before death, his temperature, previously normal, became hectic, and he failed rapidly.

22-8-12. Leucocytes per cub. mm. = 10,000.

Picture -	I.	II.	III.	IV.	V.
	45%	46%	9%	0%	0%

12-10-12. Leucocytes per cub. mm. = 9,000.

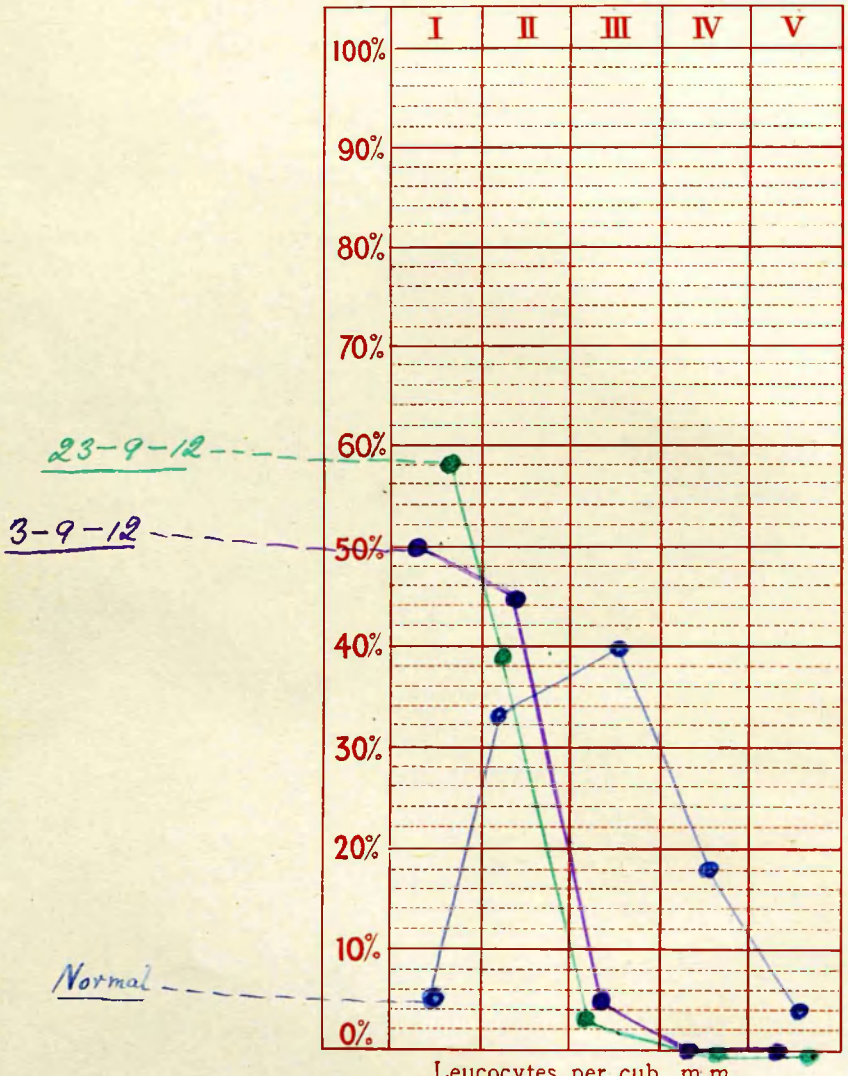
I.	II.	III.	IV.	V.
56%	42.5%	1.5%	0%	0%

Death occurred a week later, 19-10-12.

The same marked and progressively increasing dislocation to the left of the picture is present, in this case, corresponding with the increasing gravity of the patient's condition.

Case Harriet Richardson No. 5

Age 34 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

3-9-12 = 8,000

23-9-12 = 7,600

Case: Harriet Richardson. Aet. 34.

No. 5. Advanced Pulmonary Tuberculosis.

Feeble, emaciated woman, with the history of having been ill for 18 months. Both upper lobes, and the apices of both lower lobes were very dull to percussion, and active excavation was present in both upper lobes, at their apices. During the short period in which she was under observation her temperature was persistently hectic. The prognosis was obviously hopeless. On the day of admission, 3-9-12, the blood was examined and the results were -

Leucocytes per cub. mm. = 8,000.

Differential count, -

I.	II.	III.	IV.	V.
50%	44.5%	5.5%	0%	0%

A second count was made on 23-9-12.

Leucocytes per cub. mm. = 7,600.

Differential count -	I.	II.	III.	IV.	V.
	58%	39.5%	2.5%	0%	0%

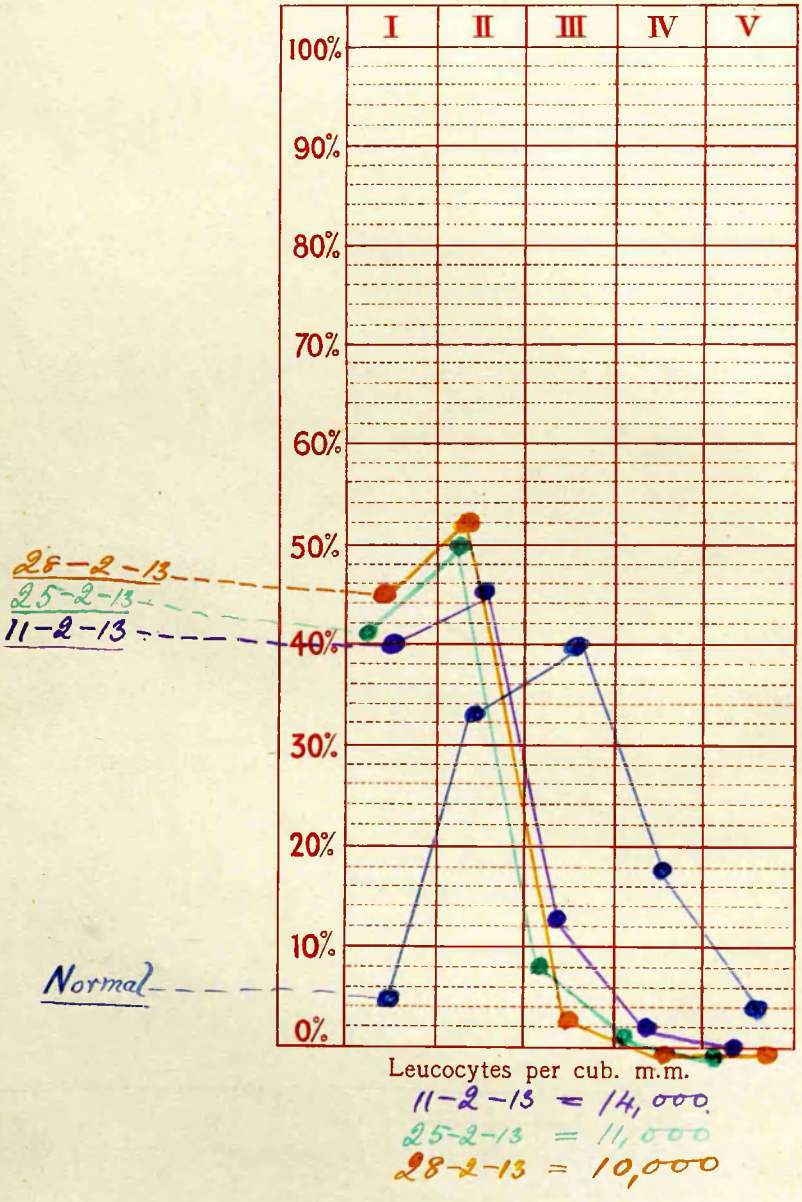
On the following day, 24-9-12, she died.

The points to be noted in this case are -

(1) As in the previous cases, the marked displacement of the picture to the left, increasing as the fatal termination approached. The increase is marked in Class I, in Class II a diminution has occurred, as also

Case Edward Dean No. 6

Age 29 Disease Pulmonary Tuberculosis



Leucocytes per cub. m.m.

11-2-13 = 14,000

25-2-13 = 11,000

28-2-13 = 10,000

in Class III, which makes the "drift" even more striking.

(2) The low leucocyte count on the day before death when one might expect that the leucocytosis of the moribund would have commenced. Her vitality was very low on this day, and the temperature subnormal.

Case: Edward Dean. Aet. 29.

No. 6. Advanced Pulmonary Tuberculosis. This patient had been discharged from a Sanatorium 2 years before, and had been at home since, fairly well, apparently. On the day before admission he suddenly had a fairly profuse haemoptysis, and on the day of admission, another slight one. Extensive consolidation was present in both lungs, in the R. involving the upper, middle, and apex of lower lobes, in the left, the upper half of the upper lobe. In the apex of the R. upper lobe a cavity was present, and all over the lobe numerous moist râles were present. He came under observation on 10-2-13, and on 11-2-13 his blood-examination revealed the following -

Leucocytes per cub. mm. = 14,000.

Differential count -	I.	II.	III.	IV.	V.
	40%	45.5%	12.5%	2%	0%

On the evening of the day on which this count was made, another haemoptysis occurred, just over 2 pints of blood being measured.

On 25-2-13, no haemoptysis having occurred in the interval, though the sputum was sometimes tinged with blood, another count was made -

Leucocytes per cub. mm. = 11,000.

Differential count -	I.	II.	III.	IV.	V.
	41%	50%	8%	1%	0%

On 28-2-13 another large haemoptysis occurred, about 1½ pints being measured. This subsided, and during its incidence another count was made and the results were -

Leucocytes per cub. mm. = 10,000.

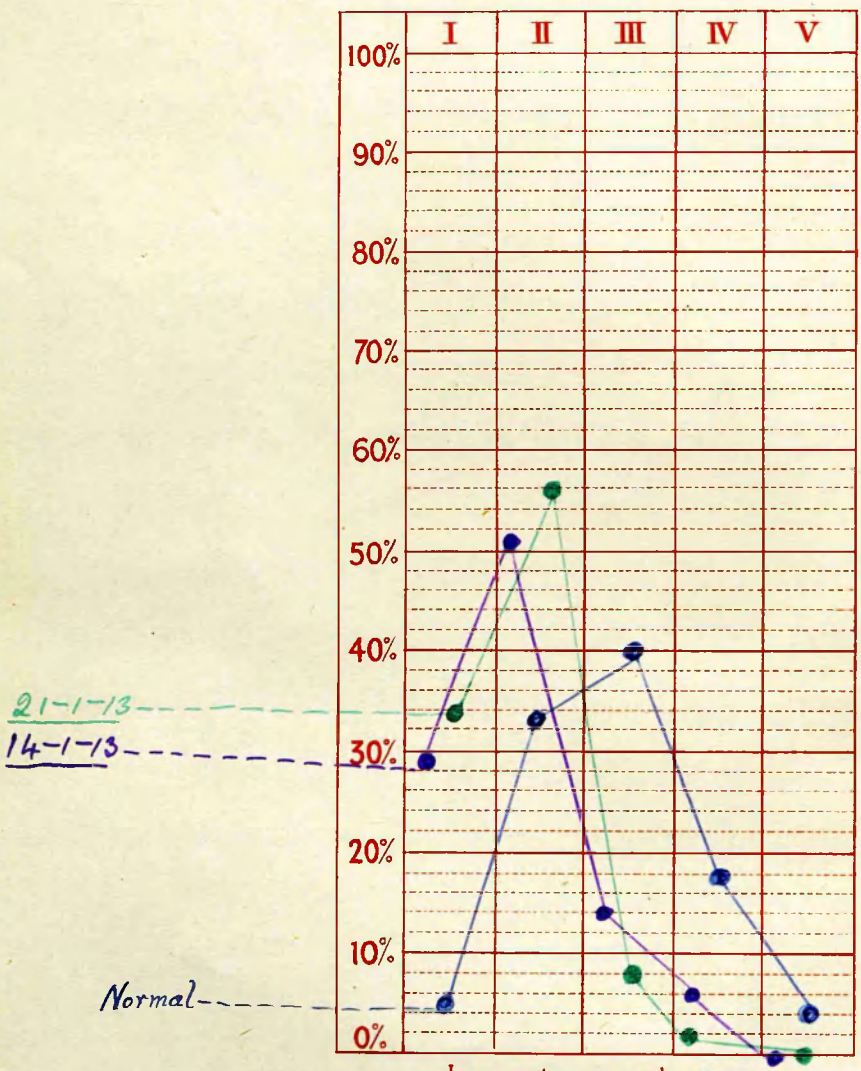
Differential count -	I.	II.	III.	IV.	V.
	45%	52%	3%	0%	0%

He never rallied from the haemoptysis, and died 9 hours later, with a recurrence.

This case presents several interesting features, the first being the extent of the dislocation of the picture to the left. Minor and Ringer publish a case in their series of pulmonary tuberculosis where a haemoptysis caused a sudden accession to the numbers in classes I and II. Unfortunately, in this case, the patient came under observation after having had a haemoptysis, so that one cannot be sure, but I am inclined to the opinion that in this case the marked dislocation was partly due to the haemoptysis. For, during the short period of his residence, his temperature was persistently subnormal, and

Case James Truswell No. 7. (Chart I)

Age 42 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

14-1-13 = 16,000.

21-1-13 = 12,000.

latterly, he was not dying from pulmonary tuberculosis, per se, but from the haemoptysis. To support fully my theory I should have liked to have seen a fall in the number of cells in Class I at any rate, in the second count. The leucocytosis however, had certainly diminished, and I conclude that either the effects of the haemoptysis on the differential neutrophile polymorphonuclear leucocyte count is slower in passing off than in the case of the quantitative leucocyte count or that the increasing dislocation is to be accepted as a warning of further haemoptysis. That the effects are quickly evident is clear from the third count, where the dislocation to the left has increased, although the haemoptysis had not passed off at the time of the examination.

Case: James Truswell. Aet. 42.

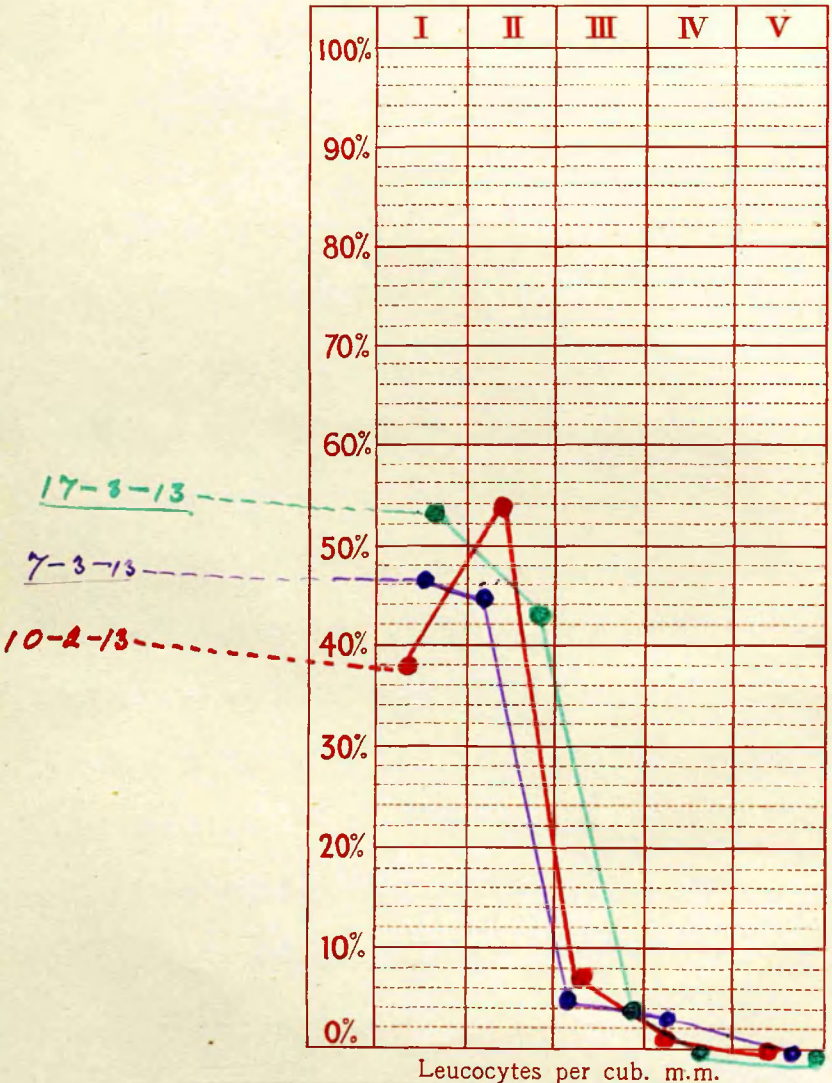
No. 7. Advanced Pulmonary Tuberculosis. A very large cavity was present in the right lung, involving the greater parts of the upper, middle, and lower lobes; and in the left upper lobe a smaller cavity was present, with consolidation in the apex of the left lower lower lobe. The temperature was hectic, especially during the last 6 weeks of his life. Admitted 7-1-13.

First Count. 14-1-13. Leucocytes per cub.mm. = 16,000.

Differential count -	I.	II.	III.	IV.	V.
	29%	51%	14%	6%	0%

Case James Truswell No. 7 (Chart II)

Age 42 Disease Pulmonary Tuberculosis.



Second Count. 21-1-13.

This was made during an attack of pleurisy.

Leucocytes per cub. mm. = 12,000.

I.	II.	III.	IV.	V.
34%	56%	8%	2%	0%

Third Count. 10-2-13.

Leucocytes per cub. mm. = 14,000.

I.	II.	III.	IV.	V.
38%	54%	7%	1%	0%

Fourth Count. 7-3-13.

Leucocytes per cub. mm. = 16,000.

I.	II.	III.	IV.	V.
46.5%	45%	5%	3.5%	0%

Fifth Count. 17-3-13.

Leucocytes per cub. mm. = 14,000.

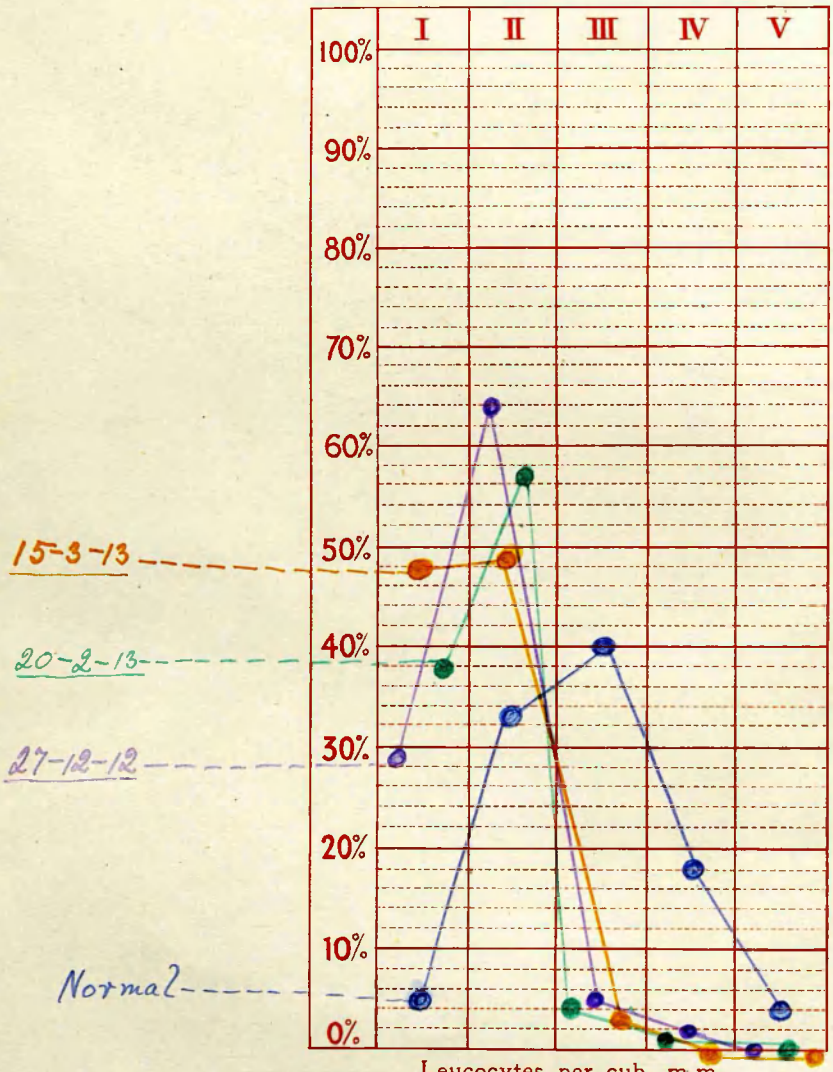
I.	II.	III.	IV.	V.
53%	43%	4%	0%	0%

On 5-4-13 he died.

The persistent leucocytoses in this case I attribute to the secondary infection present. The other points to be noted are, as before, the marked displacement to the left of the picture, becoming more marked as the case approached the fatal termination, and the comparatively sudden drift to the left at the second count, due to the pleurisy.

Case John Kirkham No. 8.

Age 45 Disease Pulmonary Tuberculosis



Leucocytes per cub. m.m.

27-12-12 = 12,000

20-2-13 = 13,000.

15-3-13 = 11,000.

Case: John Kirkham. Aet. 45.

No. 8. Advanced Pulmonary Tuberculosis of about 2 years' duration. Temperature hectic, steady progression of the disease till death.

27-12-12. Leucocytes per cub.mm. = 12,000.

I.	II.	III.	IV.	V.
29%	64%	5%	2%	0%

20-2-13. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
38%	57%	4%	1%	0%

15-3-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
48%	49%	3%	0%	0%

Death occurred a week later, 22-3-13.

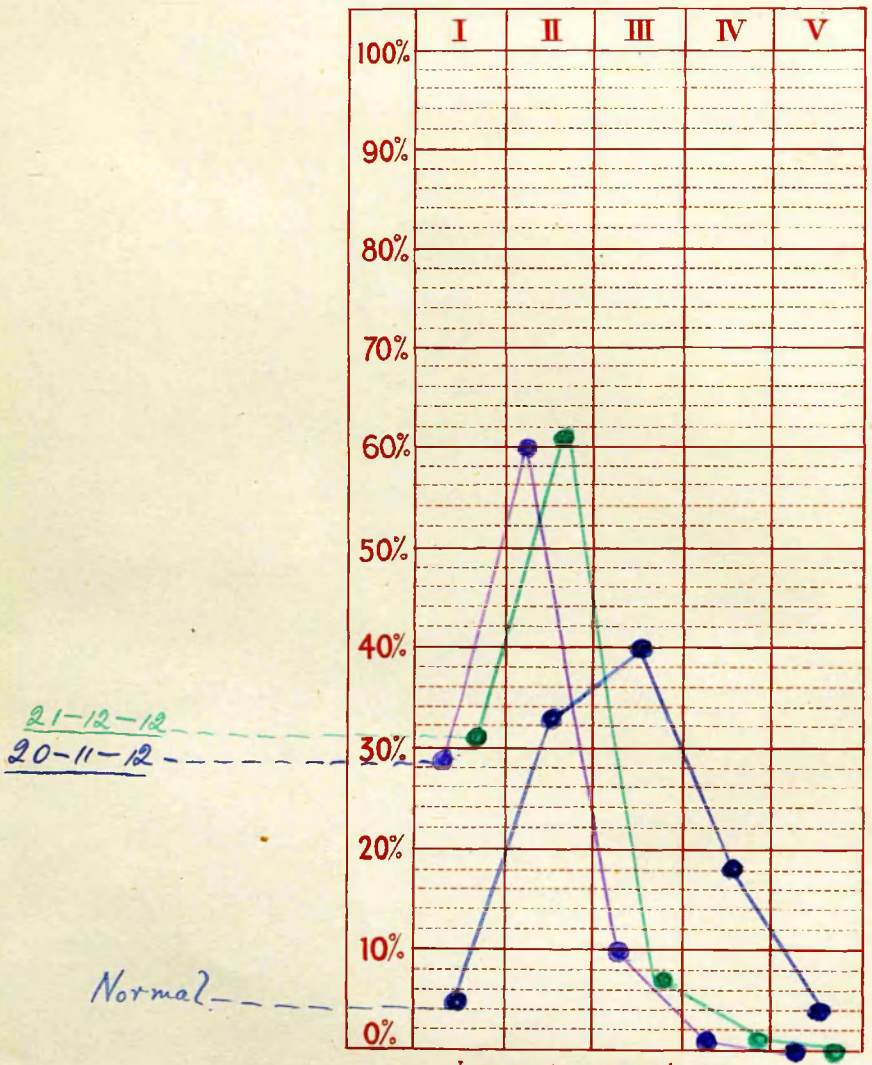
When the count was made on 15-3-13 patient had pleural friction in the right side, and the sudden increase in the cells of Class I at the expense of those of the other classes is attributable partly to this pleurisy. The steadily increasing dislocation of the picture to the left in accordance with the patient's failing condition, and the diminution in the final leucocytosis are the points to be observed in this case.

Case: Samuel Chadwick. Aet. 53.

No. 9. Advanced pulmonary tuberculosis of some years' duration. Large cavities in both lungs. The

Case Samuel Chadwick No. 9 (Chart I)

Age 53 Disease Pulmonary Tuberculosis.



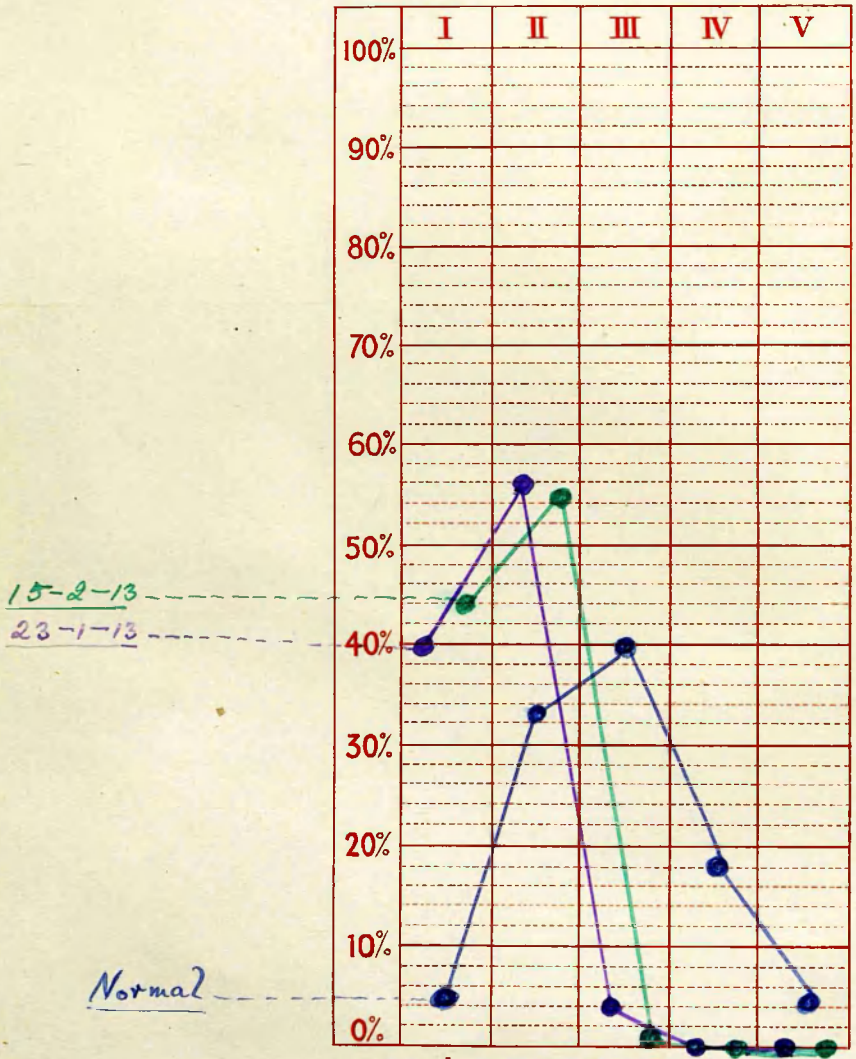
Leucocytes per cub. m.m.

20-11-12 = 7,000

21-12-12 = 8,000.

Case Samuel Chadwick No. 9 (Chart II)

Age 53 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

23-1-13 = 11,000

15-2-13 = 9,000

first observation was made on 20-11-12, when he was able to be up and about outside, daily, though frail. Towards the end of the year he began to fail rapidly, and signs of secondary infection from which he had been remarkably, relatively free, became apparent.

20-11-12. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
29%	60%	10%	1%	0%

21-12-12. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
31%	61%	7%	1%	0%

23-1-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
40%	56%	4%	0%	0%

15-2-13. Leucocytes per cubic mm. = 9,000.

I.	II.	III.	IV.	V.
44%	55%	1%	0%	0%

Death occurred on 18-2-13, three days after the last count.

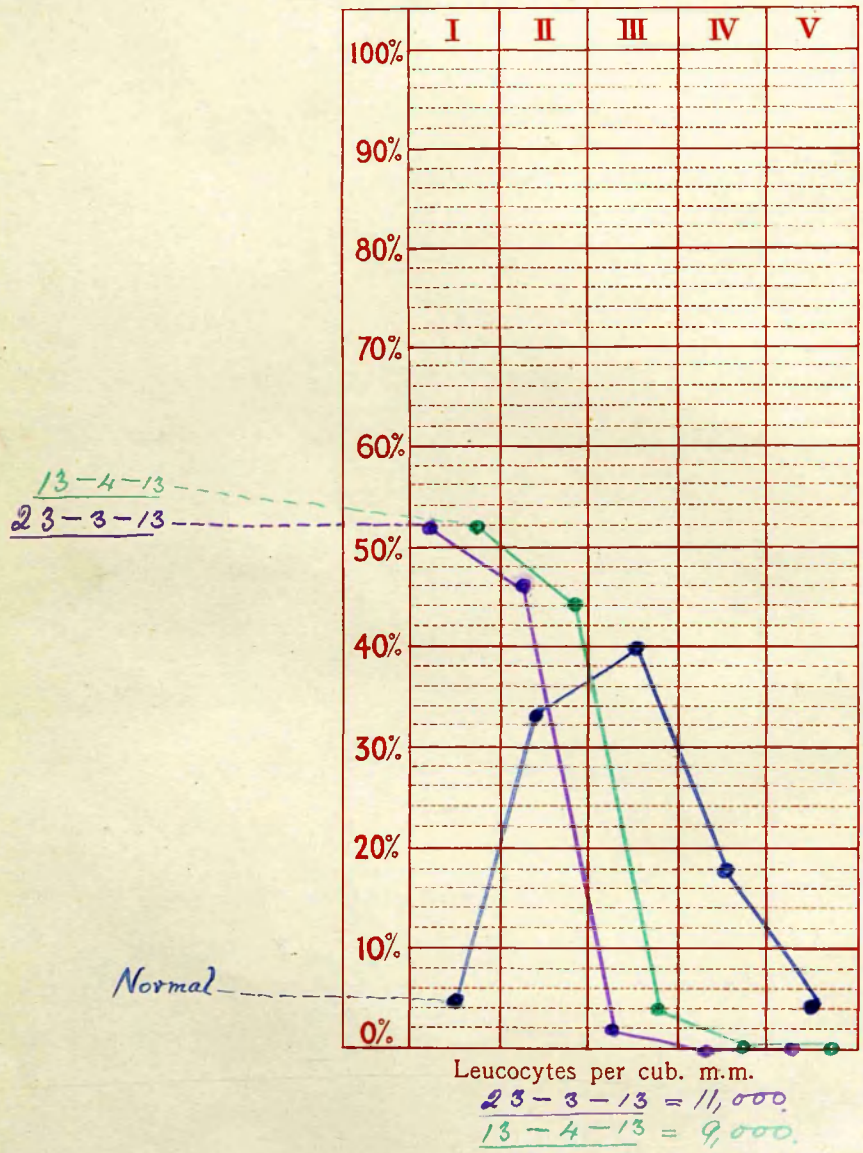
The marked and steadily increasing dislocation of the picture to the left is apparent in this fatal case, and the quantitative leucocyte enumeration per cub. mm. is also worthy of note.

Case: Lilian Roe. Aet. 23.

No. 10. Advanced Pulmonary Tuberculosis.

Case Lilian Roe No. 10

Age 23 Disease Pulmonary Tuberculosis.



Cavities were present in both lungs, and the illness was said to have followed the birth of her 2nd child. Temperature hectic.

23-3-13. Leucocytes = 11,000 per cub. mm.

I.	II.	III.	IV.	V.
52%	46%	2%	0%	0%

13-4-13. Leucocytes = 9,000 per cub. mm.

I.	II.	III.	IV.	V.
52%	44%	4%	0%	0%

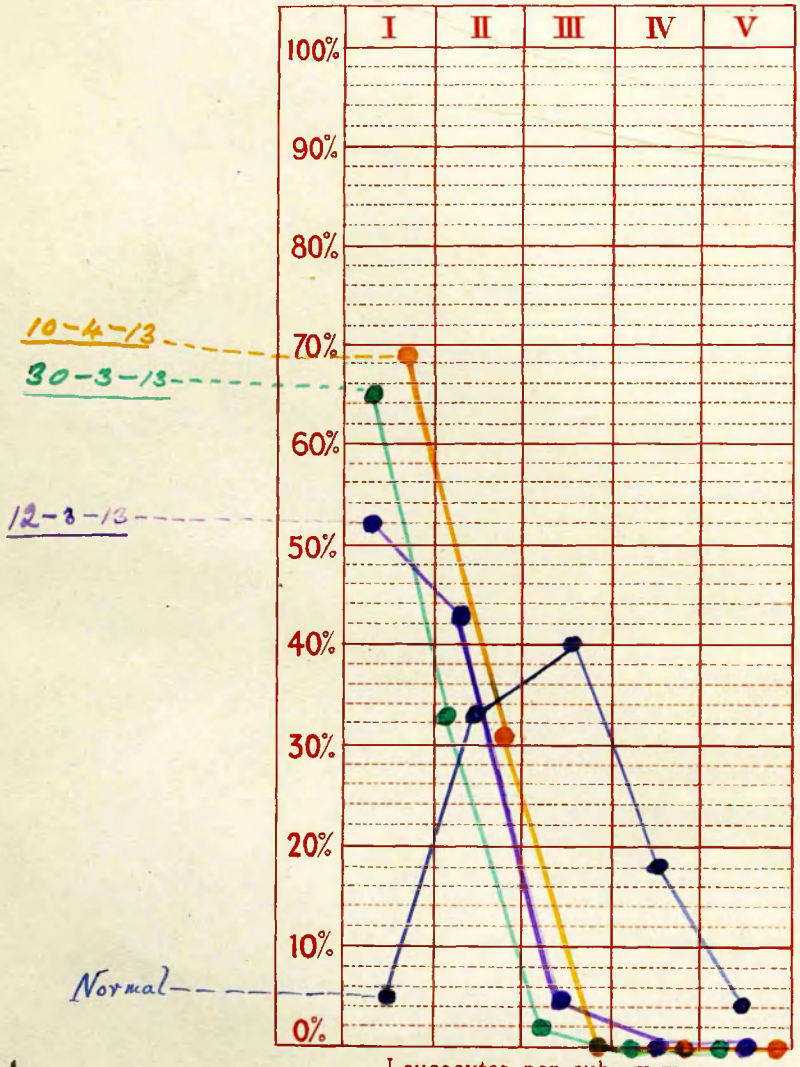
No appreciative change has occurred in these two counts. She died on 15-4-13.

Case: Emma Jane Hurst. Aet. 9.

No. 11. Advanced Pulmonary Tuberculosis. This was a case which, presenting only a small area of consolidation at the apex of the left upper lobe on 6-12-12, advanced rapidly, until on 17-3-13 large cavities were present in the apices of both upper and lower left lobes, and consolidation in the apex of the right upper lobe. Pulmonary disintegration progressed very rapidly, and on 28-3-13 all the lobes of the lungs were affected, breaking down being very rapid in the left upper lobe. The child was by now very feeble, showing signs of secondary infection, and the breaking down process continued, with markedly swinging temperature, until death occurred on 18-4-13. Examination of the blood on three occasions,

Case Emma Jane Hurst No. 11

Age 9 years Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

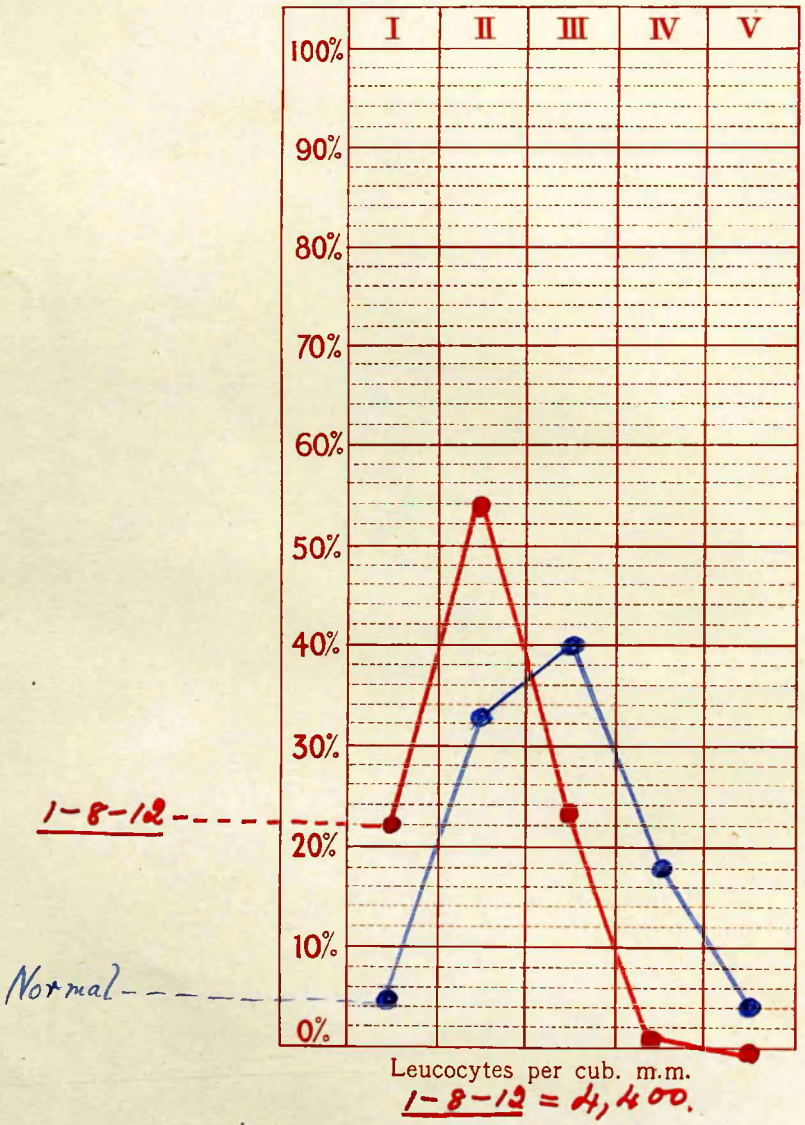
12-3-13 = 11,000.

30-3-13 = 13,000.

10-4-13 = 12,000.

Case Benjamin Grice No. 12

Age 39 Disease Pulmonary Tuberculosis.



gave the following results -

12-3-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
52%	43%	5%	0%	0%

30-3-13. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
65%	33%	2%	0%	0%

10-4-13. Leucocytes per cub. mm. = 12,000.

I.	II.	III.	IV.	V.
69%	31%	0%	0%	0%

One cannot but be struck by the marked changes presented by these pictures, the dislocations to the left coinciding with, and increasing with, the rapid advance of the disease, until at the last count all the cells were grouped under classes I and II.

Case: Benjamin Grice. Age 39.

No. 12. Pulmonary Tuberculosis. This was a case in which excavation had occurred in the left upper lobe, and was apparently not advancing rapidly. There was only occasionally a rise of temperature, and that very slight.

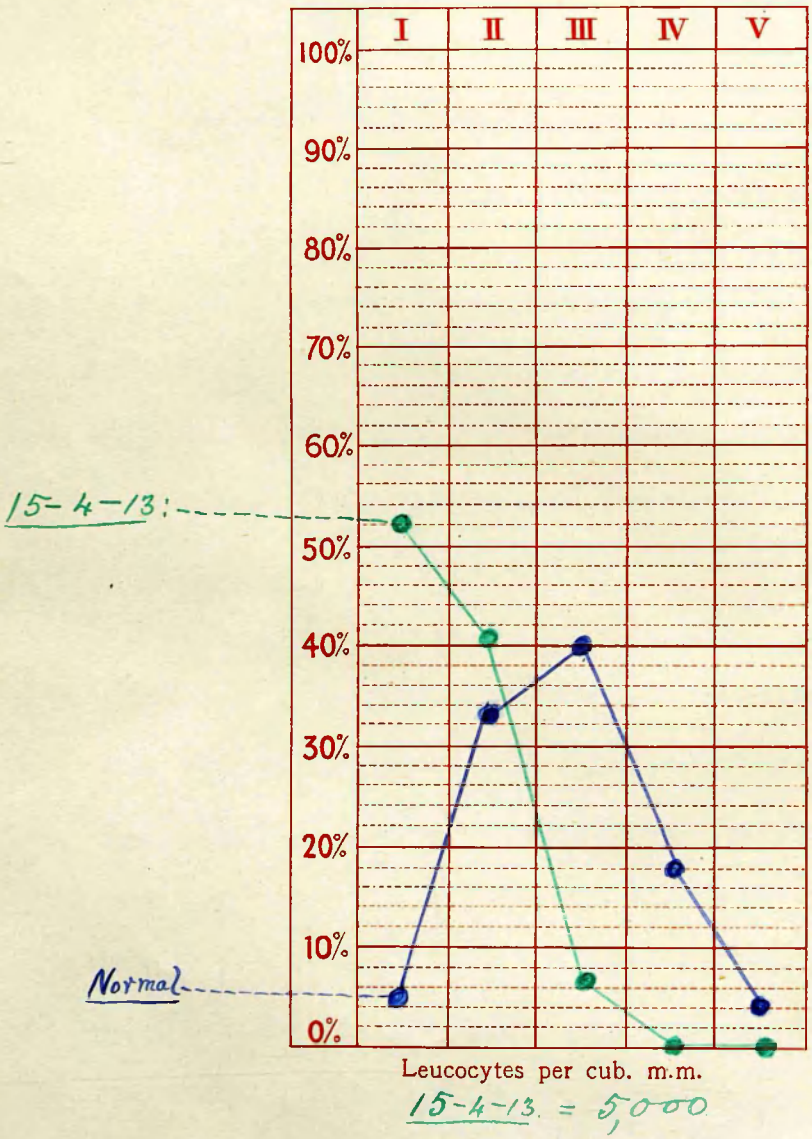
1-8-12. Leucocytes per cub. mm. = 4,400.

I.	II.	III.	IV.	V.
22%	54%	23%	1%	0%

Three days later, without any fresh sign, or symptom, he

Case Elizabeth Taylor No. 13.

Age 47 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

15-4-13. = 5,000

died suddenly.

I should not expect death to occur so soon in a case which yielded the above picture, and am inclined to think that some other cause, perhaps cardiac failure, was responsible for his death, which, as I have stated, occurred suddenly.

Case: Elizabeth Taylor. Aet. 47.

No. 13. Advanced Pulmonary Tuberculosis. This patient was ill at home for over 6 months and was brought under observation in hospital in a dying condition. Large cavities were present in the apices of both upper, and the left lower, lobes, the rest of which was solid. There was abundant collateral catarrh and bronchitis. On admission, 13-4-13, the counts were -

Leucocytes = 5,000 per cub. mm.

I.	II.	III.	IV.	V.
52%	41%	7%	0%	0%

Four days later, 19-4-13, she died.

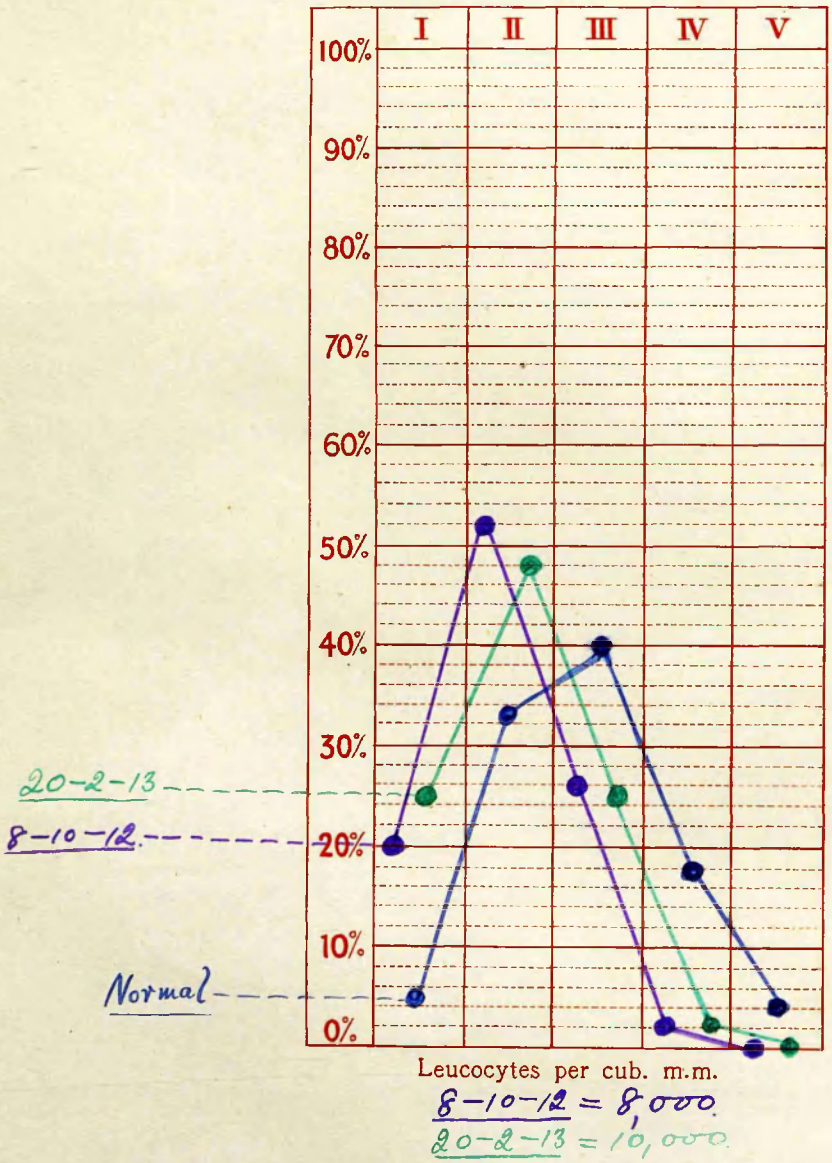
The extremely marked dislocation to the left is to be noted here, also, the low leucocyte count per cub.mm.

Case: Samuel Whittaker. Aet. 39.

No. 14. Pulmonary Tuberculosis with Psoas Abscess. This case came under observation on 3-9-12, when the left upper lobe was the seat of an extensive consolidation, signs of which were also present in the apex of the right

Case Samuel Whittaker No. 14. (Chart I)

Age 39 Disease Pulmonary Tuberculosis with Psoas Abscess.



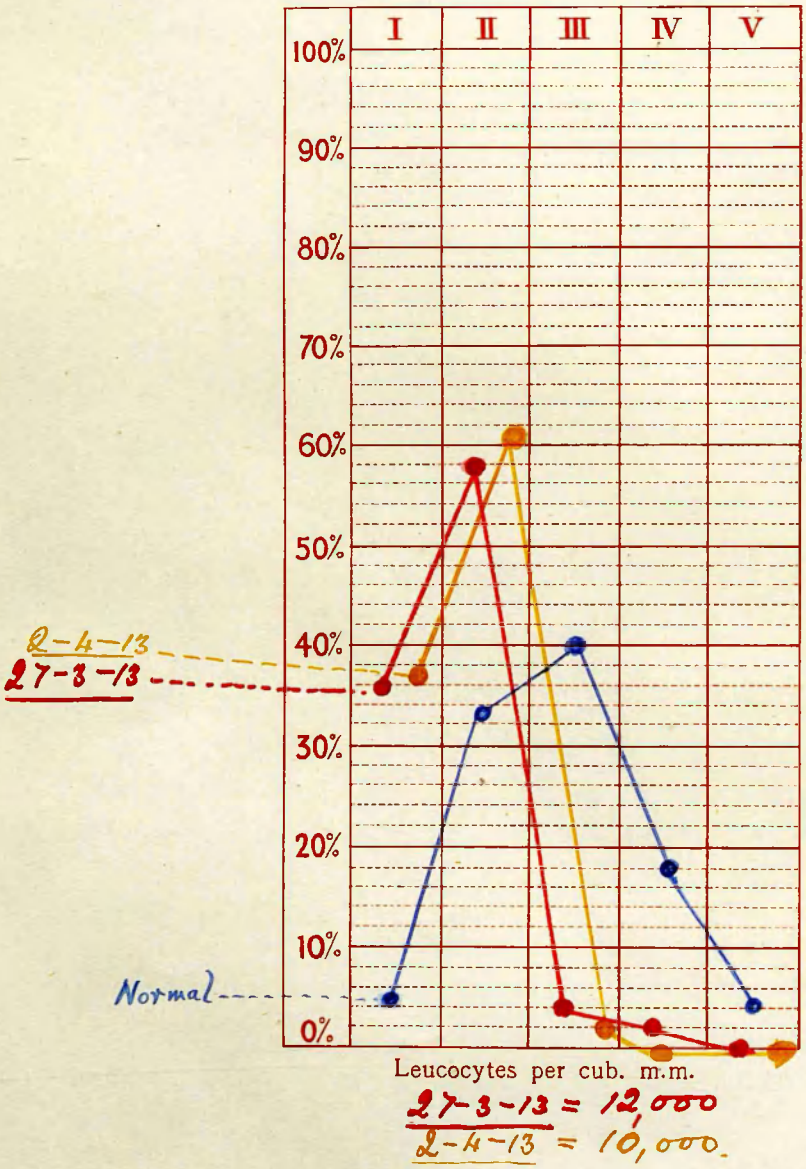
Leucocytes per cub. m.m.

8-10-12 = 8,000.

20-2-13 = 10,000.

Case Samuel Whittaker No. 14 (Chart II)

Age 39 Disease Pulmonary Tuberculosis.



upper lobe. There was also a right-sided psoas abscess which had ruptured externally 3 months previously, and was secondarily infected. The disease, slow at first, progressed rapidly later, and by January 1913, both upper lobes were breaking down, as was also the apex of the left lower lobe. The temperature, which at first was but slightly so, was by this time markedly hectic, and the psoas abscess was discharging freely. He died on 7-4-13.

The counts are as follows -

8-10-12. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
20%	52%	26%	2%	0%

20-2-13. leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
25%	48%	25%	2%	0%

27-3-13. Leucocytes per cub. mm. = 12,000.

I.	II.	III.	IV.	V.
36%	58%	4%	2%	0%

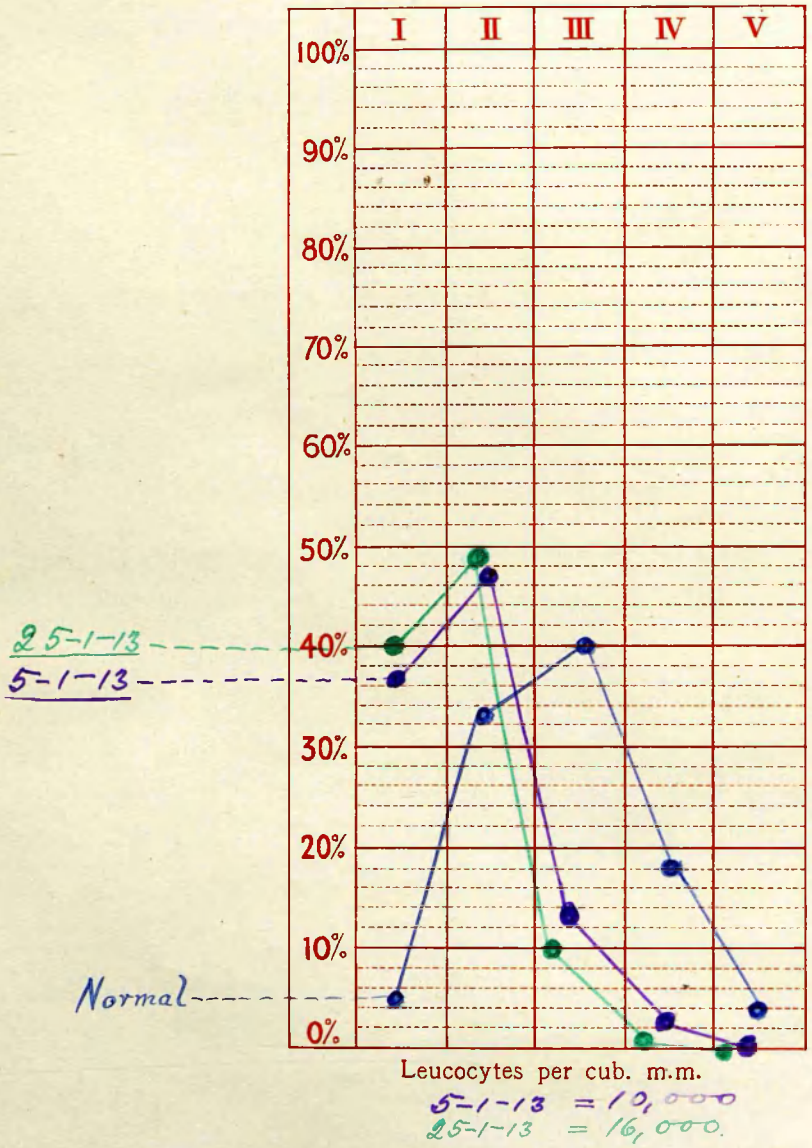
2-4-13. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
37%	61%	2%	0%	0%

This case brings out clearly several points. The comparatively trifling increase in the dislocation of the picture to the left in the two and a half months which

Case Mary Edwards No. 15 (Chart I)

Age 14 Disease Pulmonary Tuberculosis.



elapsed bteween the first and second counts corresponded with the slow progress of the disease. When the third count is studied evidence of a markedly increased dislocation to the left is present, although the period between it and the second count is only half of that between the first and second. Thus, ~~This~~ warning of the ultimate end of the case was clearly given, and the clinical facts bore out the correctness of the counts. A week later the final count was made, and though no striking change as in the previous count had occurred, still, what change there was, had unequivocably increased the dislocation to the left.

Case: Mary Edwards. Aet. 14.

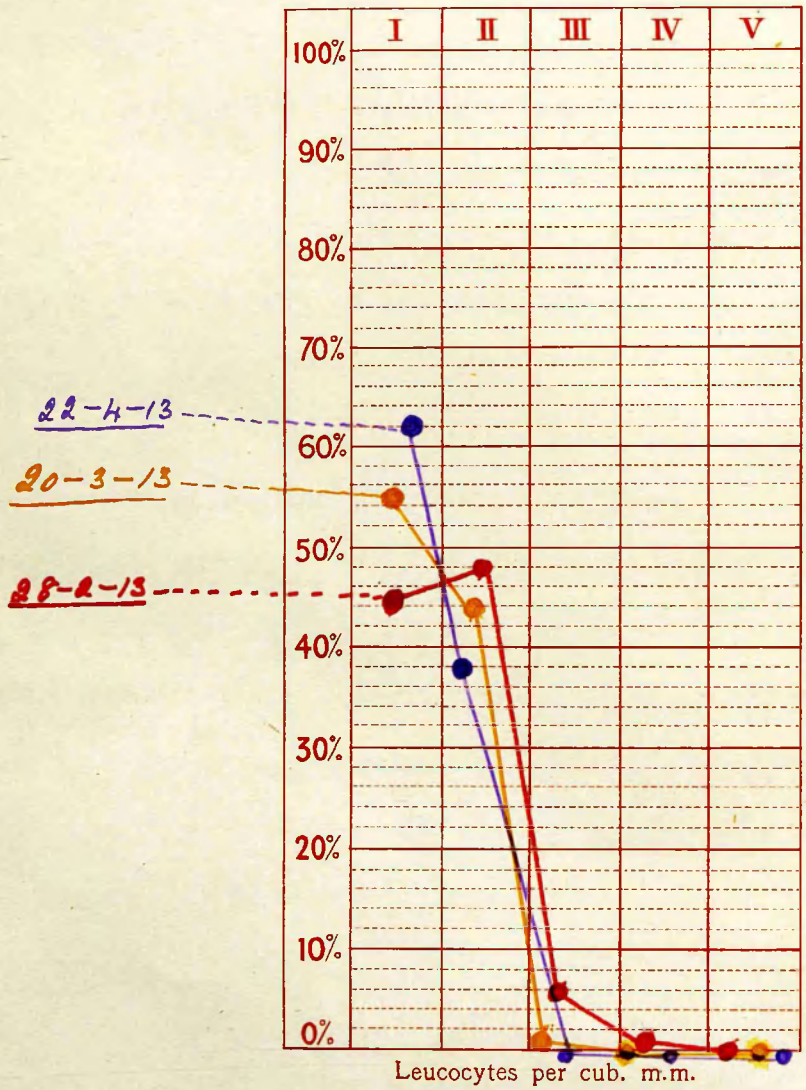
No.15. Rapidly advancing Pulmonary Tuberculosis. This case came under observation on 4-1-13,with the history of having been ill for a month with cough, feverishness and wasting, and these symptoms were said to have followed an attack of pneumonia. She was thin and flushed. Over the left upper lobe of the lungs marked consolidation was present, and over the whole left lower lobe there were signs of consolidation present, though less well marked. The temperature was pyrexial.

5-1-13. Leucocytes = 10,000 per cub. mm.

I.	II.	III.	IV.	V.
37%	47%	13%	3%	0%

Case Mary Edwards No. 15. (Chart II)

Age 14 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

28-2-13 = 11,000.

20-3-13 = 12,000.

22-4-13 = 9,000.

The disease continued to advance, and the temperature was hectic.

25-1-13. Leucocytes = 16,000.

I.	II.	III.	IV.	V.
40%	49%	10%	1%	0%

The temperature now subsided for a week, but rose again, and soon became even more hectic than before. Excavation was beginning in the apex of the left lower lobe, and consolidation had occurred in the apex of the right upper lobe.

28-2-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
45%	48%	6%	1%	0%

The disease continued to progress rapidly, and she died on 28-4-13. By this time she was extremely emaciated and cavities had formed in every lobe of both lungs. The counts made after that on 28-2-13 show a steadily increasing dislocation to the left -

20-3-13. Leucocytes per cub. mm. = 12,000.

I.	II.	III.	IV.	V.
55%	44%	1%	0%	0%

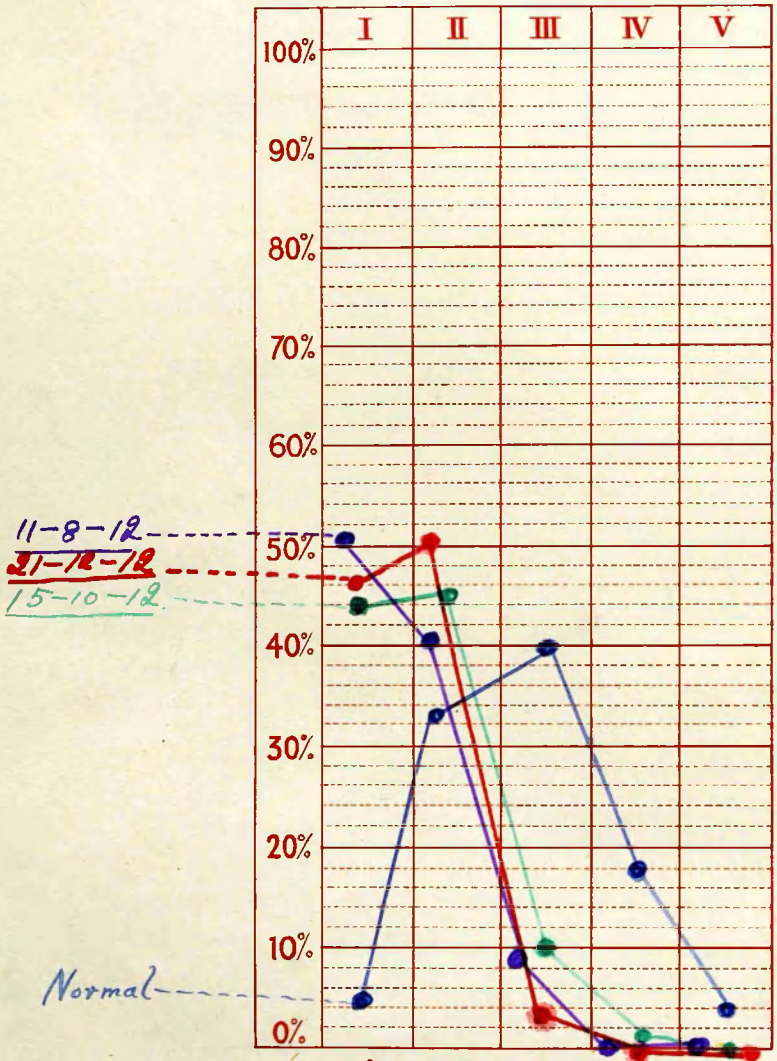
22-4-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
62%	38%	0%	0%	0%

6 days after this last count she died.

Case Isabella Preece No. 16

Age 37 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

11-8-12 = 9,000.

15-10-12 = 8,000

21-12-12 = 11,000.

This case shows the steady and rapid increase in the dislocation to the left coincident with the rapid advance of the disease, until in the last count a dislocation occurs which is remarkable.

Case: Isabella Preece. Aet. 37.

No. 16. Advanced Pulmonary Tuberculosis. This case came under observation on 20-6-12, when there was consolidation in both upper, and the apex of the right lower, lobes, with slight daily elevations of temperature. She became steadily weaker, and thinner, and excavation occurred in both upper lobes.

11-8-12 the blood showed -

Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
50.5%	40.5%	9%	0%	0%

Shortly after this count was made a period of warm sunny weather set in, and patient's bed was wheeled out on to a balcony during the day. The temperature subsided, her cough became less frequent, she took her food better, and appeared to benefit by this treatment.

15-10-12. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
44%	45%	10%	1%	0%

For a short period improvement continued but thereafter no further ground was gained, and she became discontented.

There was a recurrence of the daily elevation of temperature, she coughed more, and the lung condition, which appeared to have quietened down somewhat while she was able to be out in the open, showed signs of progressive advance again. Cavities were now present in all the lobes of the right lung, and the one in the left upper lobe appeared to be extending. She insisted, against advice, in being removed home, and on the day of her departure, 21-12-12, the examination of the blood revealed -

21-12-12. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
46%	50.5%	3.5%	0%	0%

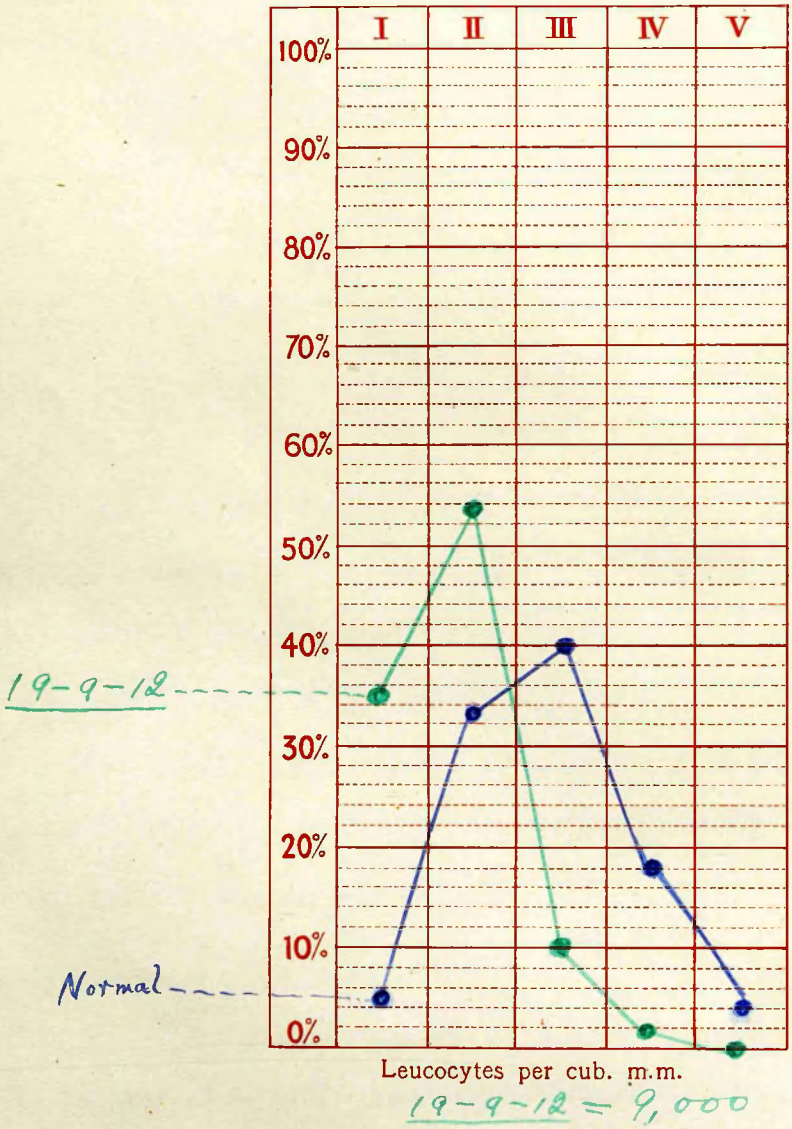
This case is of interest in showing the slight drift of the picture in the second count, towards the right, from the extreme dislocation of the first picture to the left. This improvement coincided with the improvement in the patient's condition; also, the return of the dislocation towards the left, evident in the third count, coincided with the relapse which was in progress at the time.

Case: Louisa Goy. Aet. 35.

No. 17. Advanced Pulmonary Tuberculosis. The whole of the left lung except the base of the lower lobe was solid, and excavation was in progress at the apex of

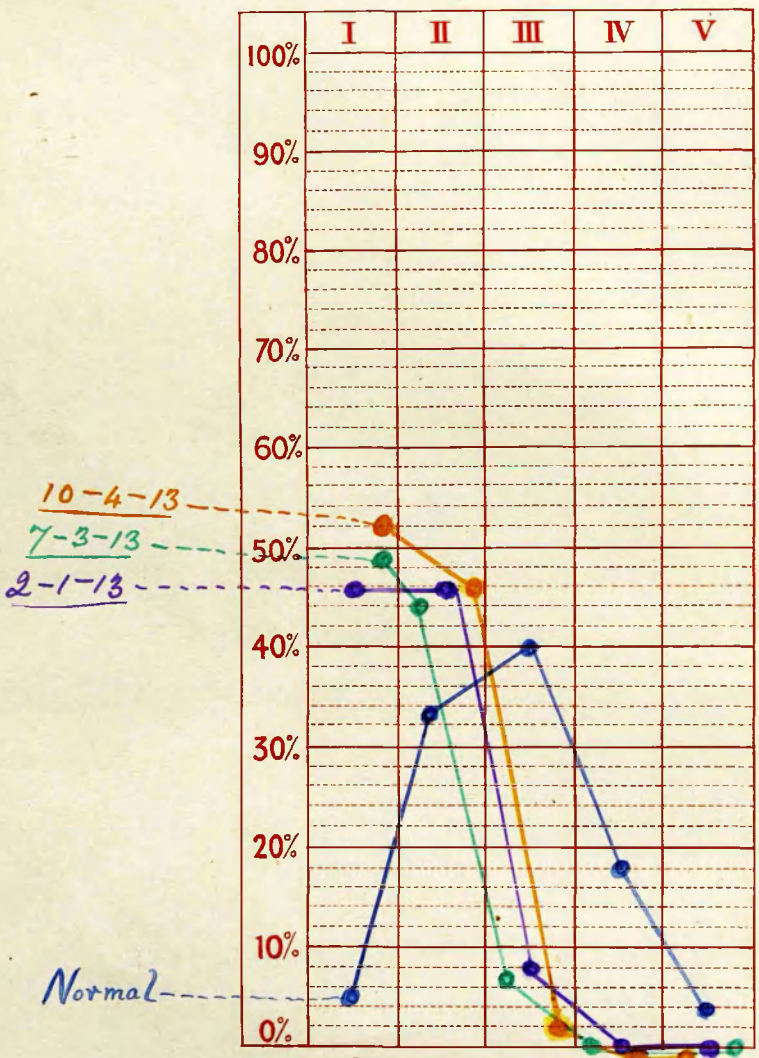
Case Louisa Goz No. 17

Age 35 Disease Pulmonary Tuberculosis.



Case Annie Smith No. 18

Age 60 Disease Pulmonary Tuberculosis: Morbus [illegible]



Leucocytes per cub. m.m.

2-1-13 = 9,000

7-3-13 = 13,000.

10-4-13 = 13,000.

the left upper lobe. Temperature was usually elevated a little at night.

19-9-12. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
35%	53.5%	10%	1.5%	0%

Patient insisted upon being removed home, against advice, the following day.

This was undoubtedly a case in which the prognosis was grave, and though the case was not in its terminal phases, still a very considerable dislocation to the left of the picture has occurred.

Case: Annie Smith, Aet. 60.

No. 18. Pulmonary Tuberculosis: Double Aortic Disease. This patient had been under treatment for 2 years not only for her pulmonary condition but also for attacks of praecordial pain and dyspnoea.

The temperature for some time was within normal limits, but occasionally there were periods of pyrexia, hectic for the most part, and especially as time went on these pyrexial attacks were more frequent.

2-1-13. Leucocytes = 9,000 per cub. mm.

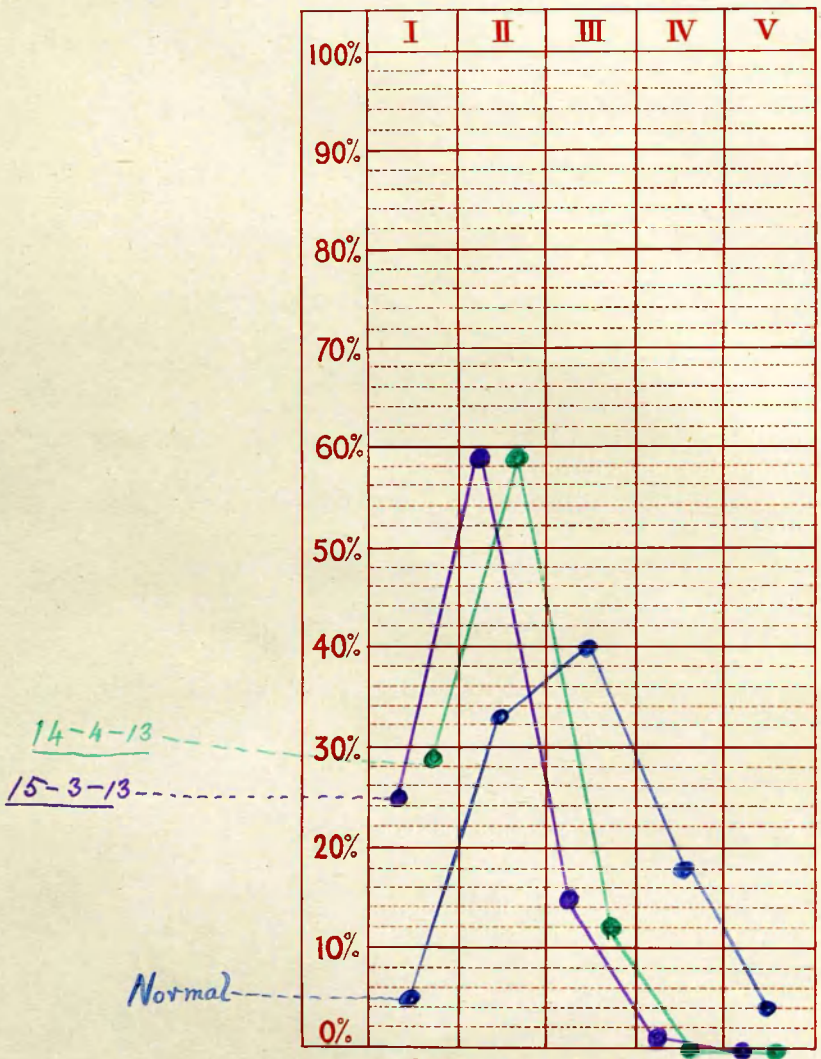
I.	II.	III.	IV.	V.
46%	46%	8%	0%	0%

7-3-13. Leucocytes = 13,000 per cub. mm.

I.	II.	III.	IV.	V.
49%	44%	7%	0%	0%

Case Joseph Ledger No. 19

Age 57 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

15-3-13 = 8,000.

14-4-13 = 9,000.

10-4-13. Leucocytes = 13,000 per cub. mm.

I.	II.	III.	IV.	V.
52%	46%	2%	0%	0%

This case shows the steady, if gradual, increase in the dislocation to the left, coincident with the gradual progress of the disease.

The leucocytosis present at the time of the second count is due to the count having been made during a pyrexial period, when there was a sudden inrush of toxins into the blood from the secondary infection.

Case: Joseph Ledger. Aet. 57.

No. 19. Pulmonary Tuberculosis. Old-standing case, with cavities in both upper lobes, and apex of the right lower. Temperature, normal, when the case first came under observation on 15-3-13.

15-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
25%	59%	15%	1%	0%

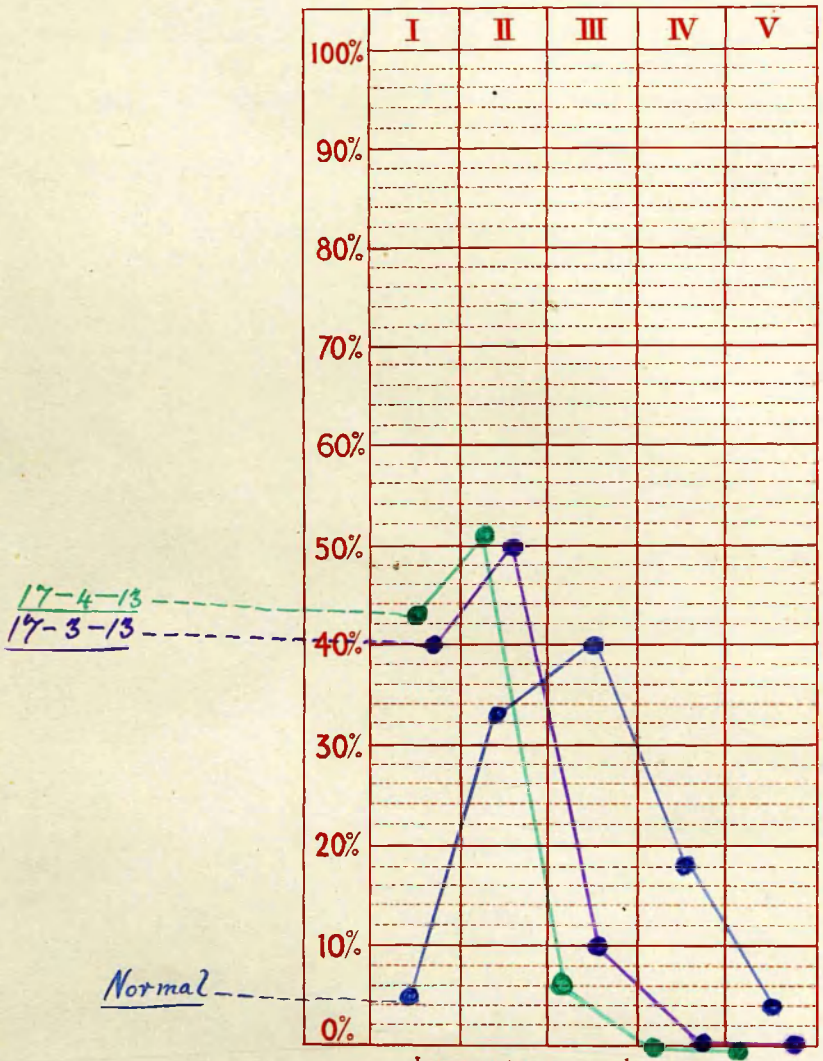
14-4-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
29%	59%	12%	0%	0%

10 days before the second count was made, patient had a slight rise of temperature, and since then there has been a daily pyrexia, hectic in type, and he has not been so well. Numerous moist rales have appeared in the left

Case Constance Broadhead No. 20

Age 14 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

17-3-13 = 8,000.

17-4-13 = 9,000.

lower lobe, and the increasing dislocation of the picture to the left appears to agree with the clinical evidence that the disease is actively progressing.

Case: Constance Broadhead. Aet. 14.

No. 20. Advanced Pulmonary Tuberculosis.

Illness dates back 12 months. On admission 17-3-13, a very large cavity was present in the left upper lobe, and consolidation in the apex of the left lower lobe. Also in the apex of the right upper lobe, an area of consolidation was present, Temperature was pyrexial, and hectic in type.

On admission 17-3-13.

Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
40%	50%	10%	0%	0%

The hectic character of the temperature continued, and signs of excavation appeared in the apices of the right upper and left lower lobes.

17-4-13. Leucocytes per cub. mm. = 9,000.

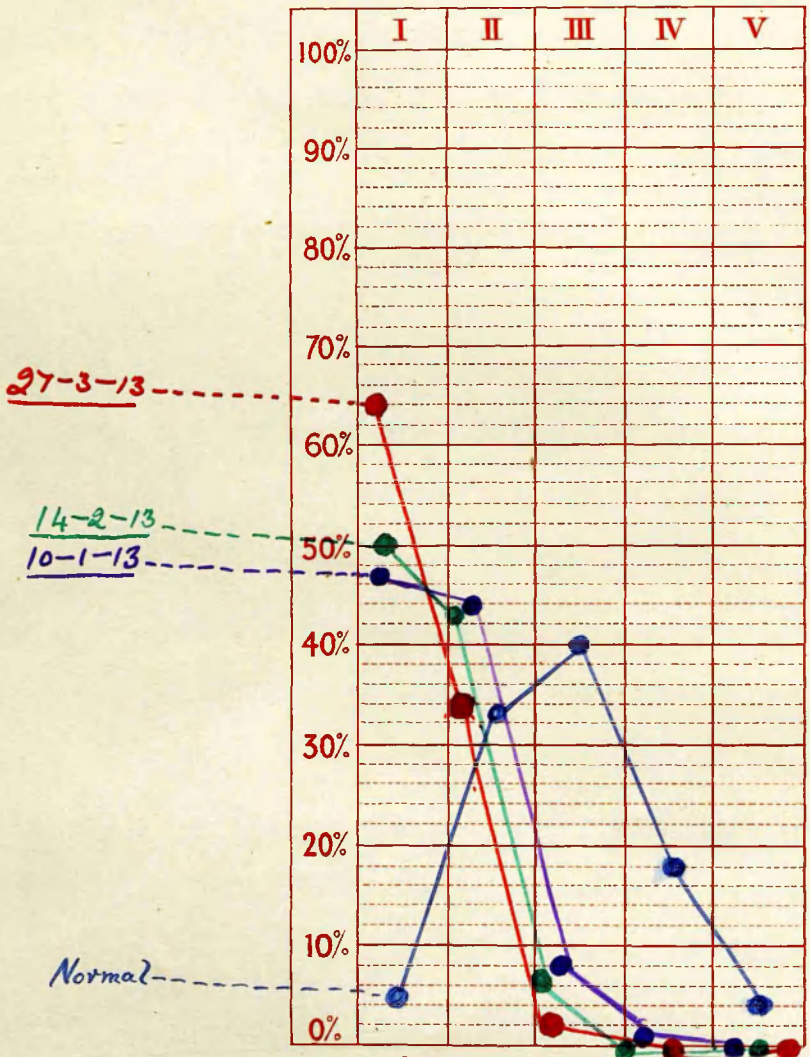
I.	II.	III.	IV.	V.
43%	51%	6%	0%	0%

This case shows the progressively increasing dislocation to the left of the picture of a case which from the clinical point of view is very unfavourable.

The increase is certainly not marked, but is none

Case Walter Styles No. 21.

Age 26 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

10-1-13 = 11,000

14-2-13 = 16,000.

27-3-13 = 13,000.

the less present, and had she remained under the home conditions from which she was brought there is a very strong probability that the dislocation would have been much more marked. Nevertheless, in spite of the favourable circumstances in which she now is as regards open-air, diet, and nursing, the disease is advancing, and her prognosis is very grave.

Case: Walter Styles. Aet. 26.

No. 21. Pulmonary Tuberculosis. This patient had been acutely ill for about 3 months, though he had been ailing for about 2 years before coming under observation on 9-1-13. At that time there were cavities in both upper, and both lower lobes, with very poor breath-sounds elsewhere, and numerous moist râles all over the chest. The temperature was pyrexial, and he was very thin.

10-1-13. Leucocytes = 11,000 per cub. mm.

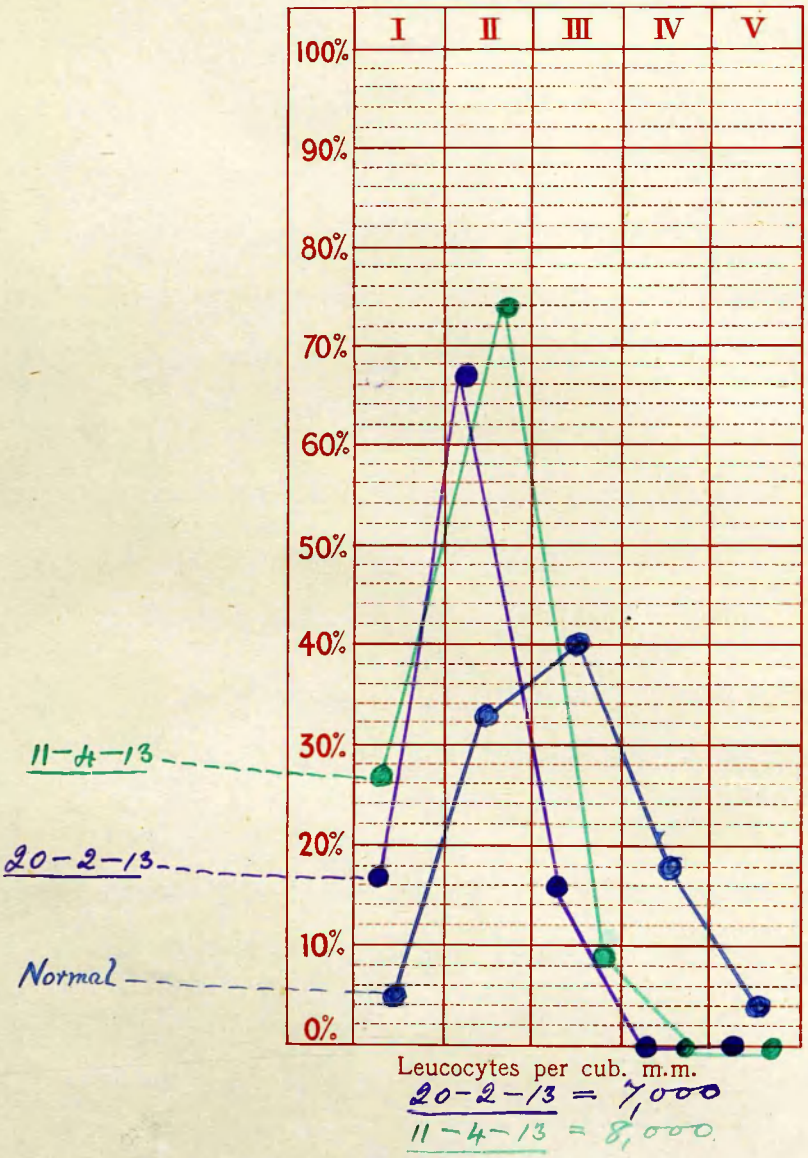
I.	II.	III.	IV.	V.
47%	44%	8%	1%	0%

The disease progressed, the symptoms became more marked, and the physical signs more evident, and more extensive. He was obviously a very advanced case, and his prognosis was very grave. Two further counts were made -

14-2-13. Leucocytes per cub. mm. = 16,000.

Case Thomas Woof No. 22

Age 57 Disease Pulmonary Tuberculosis.



I.	II.	III.	IV.	V.
50%	43.5%	6.5%	0%	0%

27-3-13. Leucocytes per cub.mm. = 13,000.

I.	II.	III.	IV.	V.
64%	34%	2%	0%	0%

The rapidly increasing dislocation to the left coincides with the rapid advance of the disease, and he is now failing rapidly.

Case: Thomas Woof. Aet. 57.

No. 22. Pulmonary Tuberculosis. Old-standing case, showing signs of advancing disease. He came under observation on 20-2-13, when consolidation was present in both upper lobes, with cavities at the extreme apices. Temp. normal.

20-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
17%	67%	16%	0%	0%

The temperature remained normal for some weeks, then his cough became more frequent, signs of consolidation appeared in the apex of the left lower lobe, and the temperature became hectic, though within low reaches.

11-4-13.

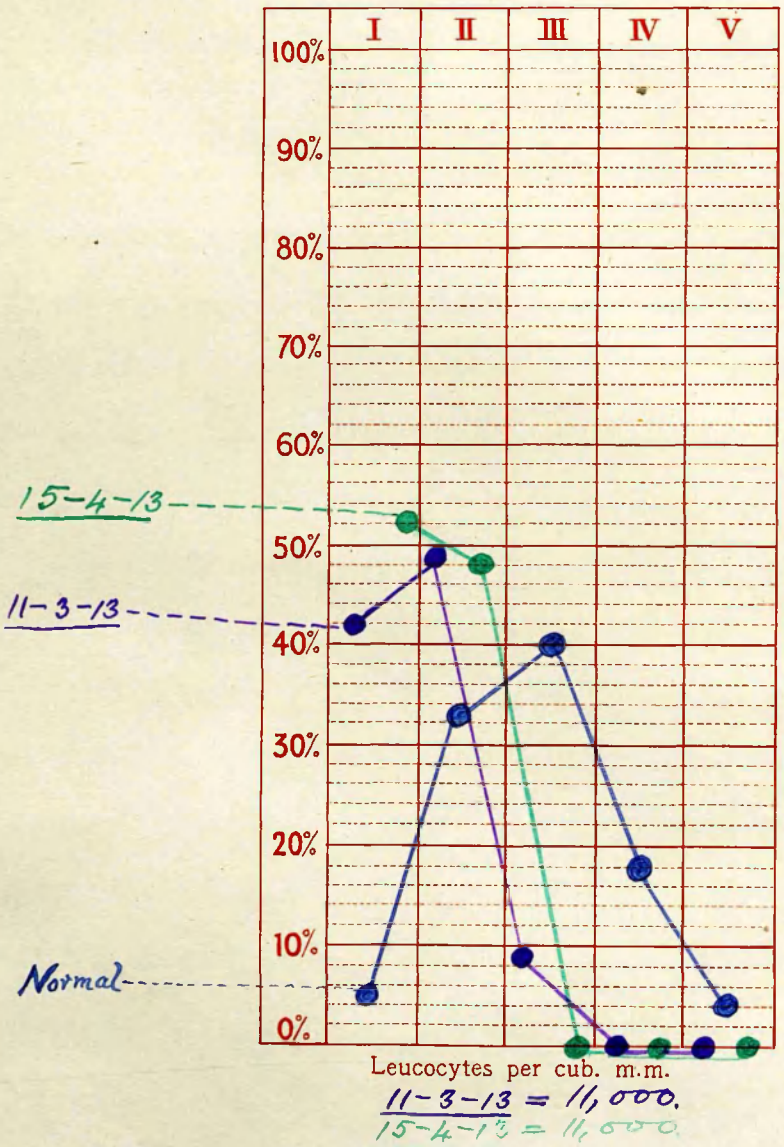
I.	II.	III.	IV.	V.
27%	74%	9%	0%	0%

Leucocytes per cub mm = 8,000

He is now weaker, confined to bed, and clinically, his prognosis is gloomy. The dislocation towards the left

Case Ann Hale No. 23.

Age 38 Disease Pulmonary Tuberculosis.



has, as is seen, markedly increased.

Case: Ann Hale. Aet. 38.

No. 23. Pulmonary Tuberculosis. This patient was under treatment during November and December, 1912, and went home against advice.

She returned on 11-3-13, very emaciated, with swinging temperature, and presenting a picture of advanced pulmonary tuberculosis.

On admission, 11-3-13, every lobe of the right lung was affected, the upper, middle, and upper part of the lower, lobes being excavated, and the remainder in process of solidification. There was a cavity in the left upper lobe also, and her case was obviously hopeless.

11-3-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
42%	49%	9%	0%	0%

15-4-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
52%	48%	0%	0%	0%

The marked dislocation to the left of these pictures, with the striking increased dislocation shown in the second, stamps as hopeless a case in which clinically, the same outlook is all too obvious.

Class II. Stationary Cases.

In this class I have grouped together cases which from the clinical point of view are apparently stationary. That is to say, the disease is apparently arrested, and yet they cannot be said to be cured. In some of the cases, the pictures obtained from examination of their blood are practically normal. In others, there is a departure from normal, a dislocation towards the left being present to a varying extent, never however, extreme. The counts obtained from several examinations on the same cases show a little variation in the drift, but this is so slight, and the cases themselves change so little clinically, that I have classed them as Stationary. In all of these cases the diagnosis has been at one time established by the discovery of tubercle bacilli in the sputum.

I have examined the blood of 16 such cases of pulmonary tuberculosis, and will begin by dealing with 10 of these cases, who have had Sanatorium treatment, accompanied by graduated open-air exercise.

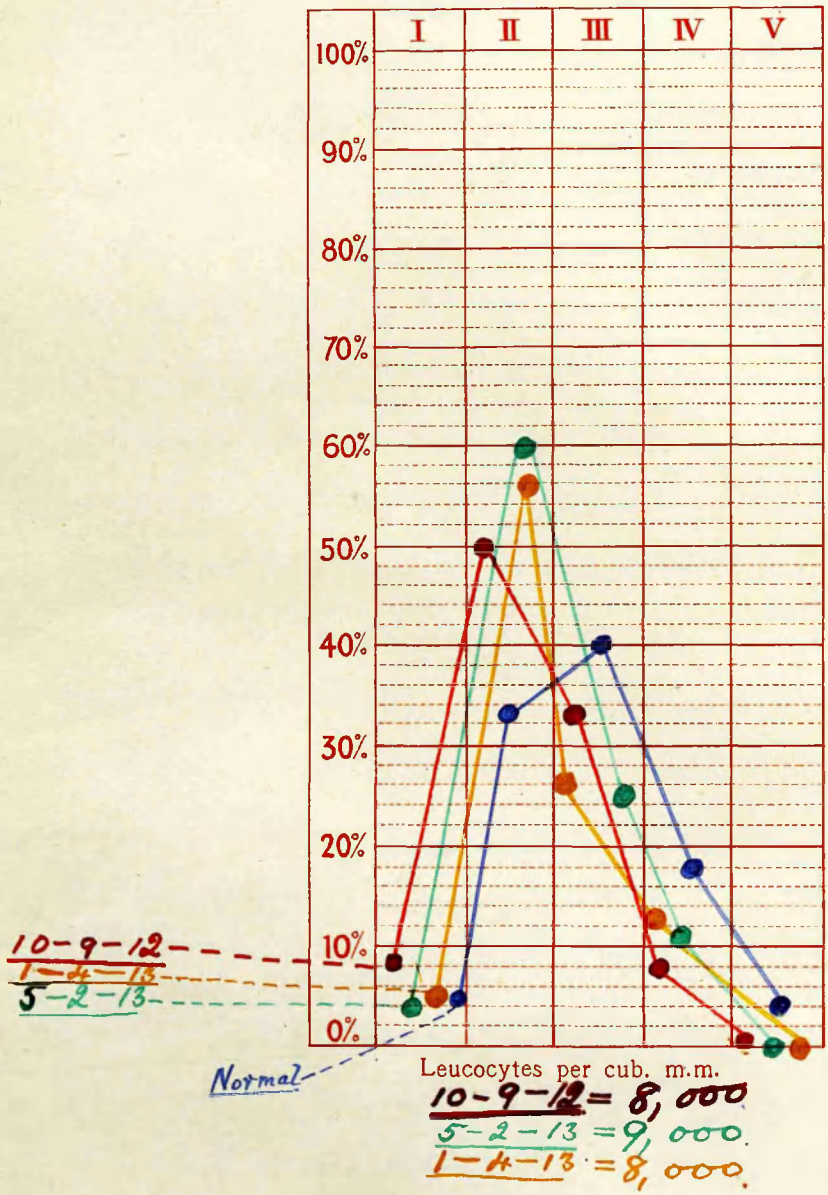
Case: F.Bambery. Aet. 42.

No. 24. Pulmonary Tuberculosis. Lungs: small area of consolidation in the apex of the left upper lobe. No signs of active disease present.

10-9-12. Leucocytes per cub. mm. = 8,000.

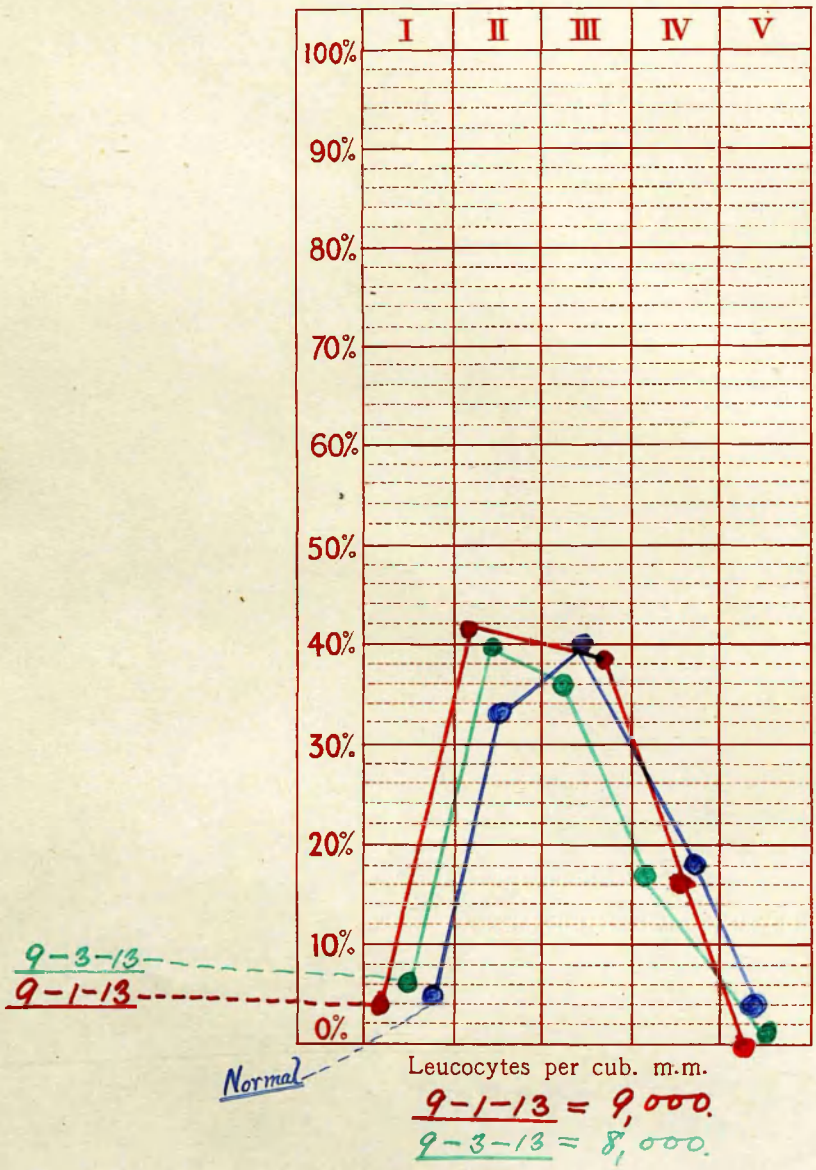
Case F. Bambery No. 24.

Age 42. Disease Pulmonary Tuberculosis.



Case A. Scamadine No. 25.

Age 51 Disease Pulmonary Tuberculosis.



I.	II.	III.	IV.	V.
8.5%	50%	33%	8%	0.5%

5-2-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
4%	60%	25%	11%	0%

1-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
5%	56%	26%	13%	0%

Case: A.Scamadine. Aet. 51.

No. 25. Pulmonary Tuberculosis. Cavity, apparently quiescent, in apex of right upper lobe, and a small area of consolidation in the apex of the left upper lobe. No active signs.

9-1-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
4%	41.5%	38.5%	16%	0%

9-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
6%	40%	36%	17%	1%

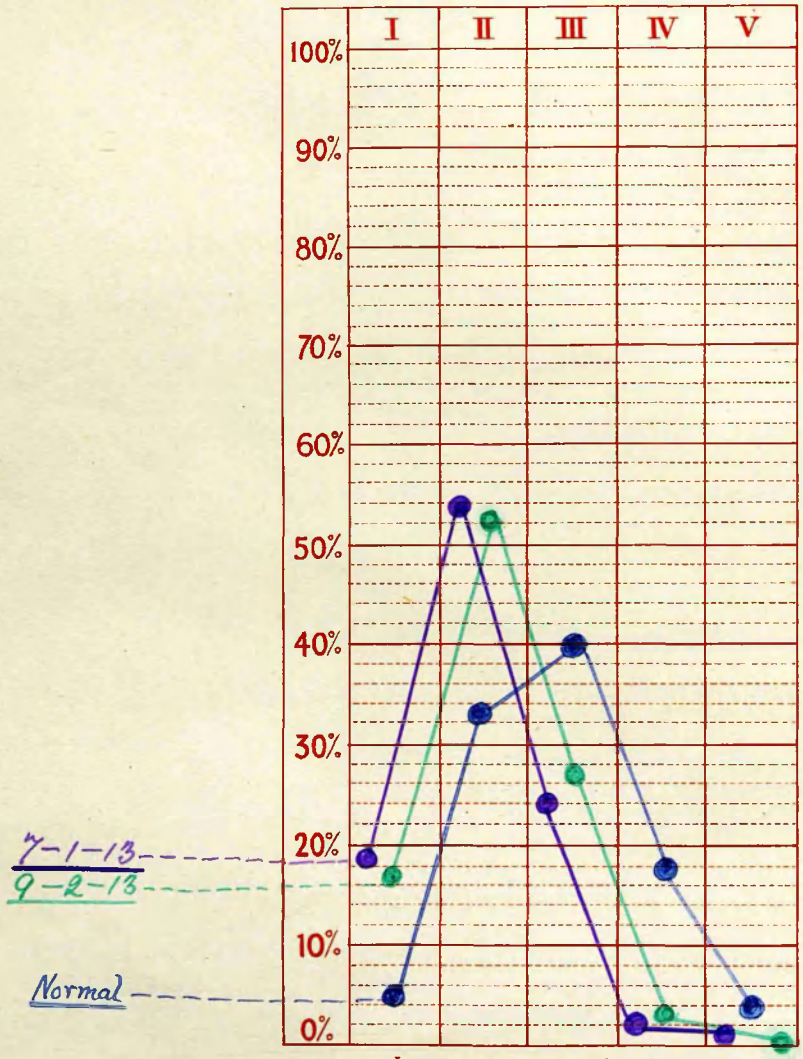
Case: T. Storey. Aet. 31.

No. 26. Pulmonary Tuberculosis. Fairly extensive consolidation in the right upper lobe, with a small apical cavity. No signs of active disease are present.

7-1-13. Leucocytes per cub. mm. = 8,000.

Case J. Storey No. 26.

Age 31 Disease Pulmonary Tuberculosis.



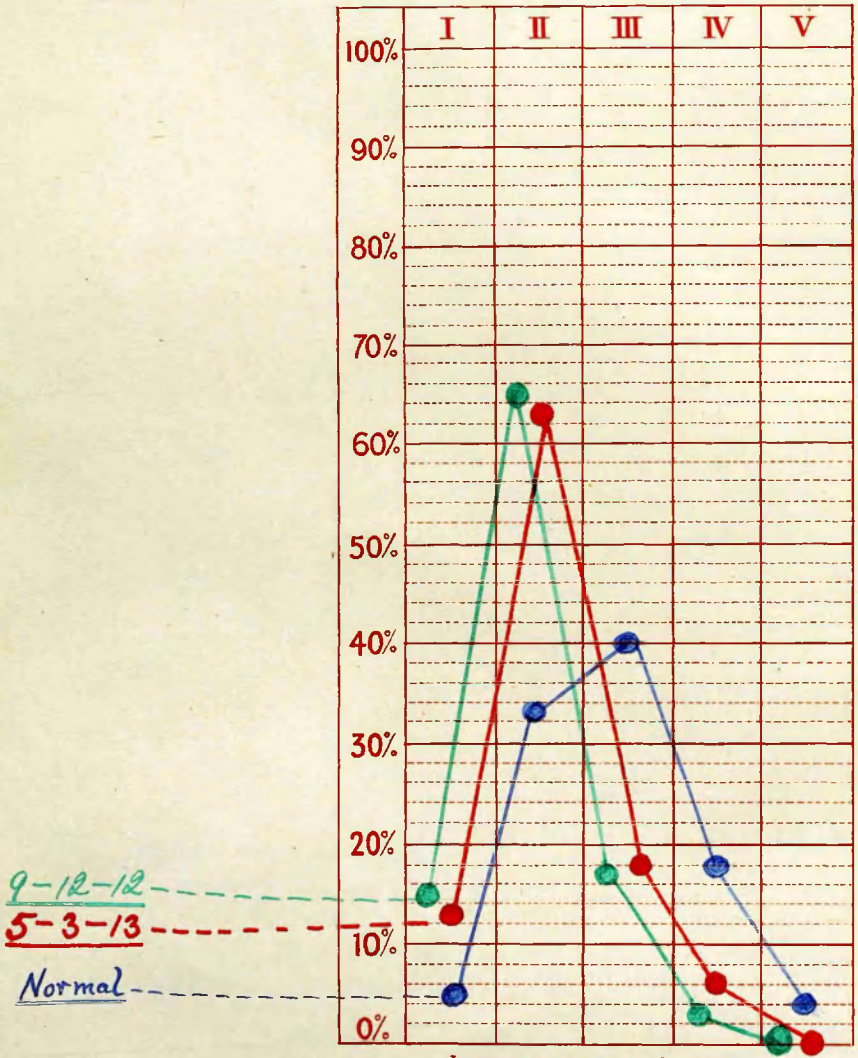
Leucocytes per cub. m.m.

7-1-13 = 8,000.

9-2-13 = 6,000

Case J. Hall No. 27

Age 41 Disease Pulmonary Tuberculosis.



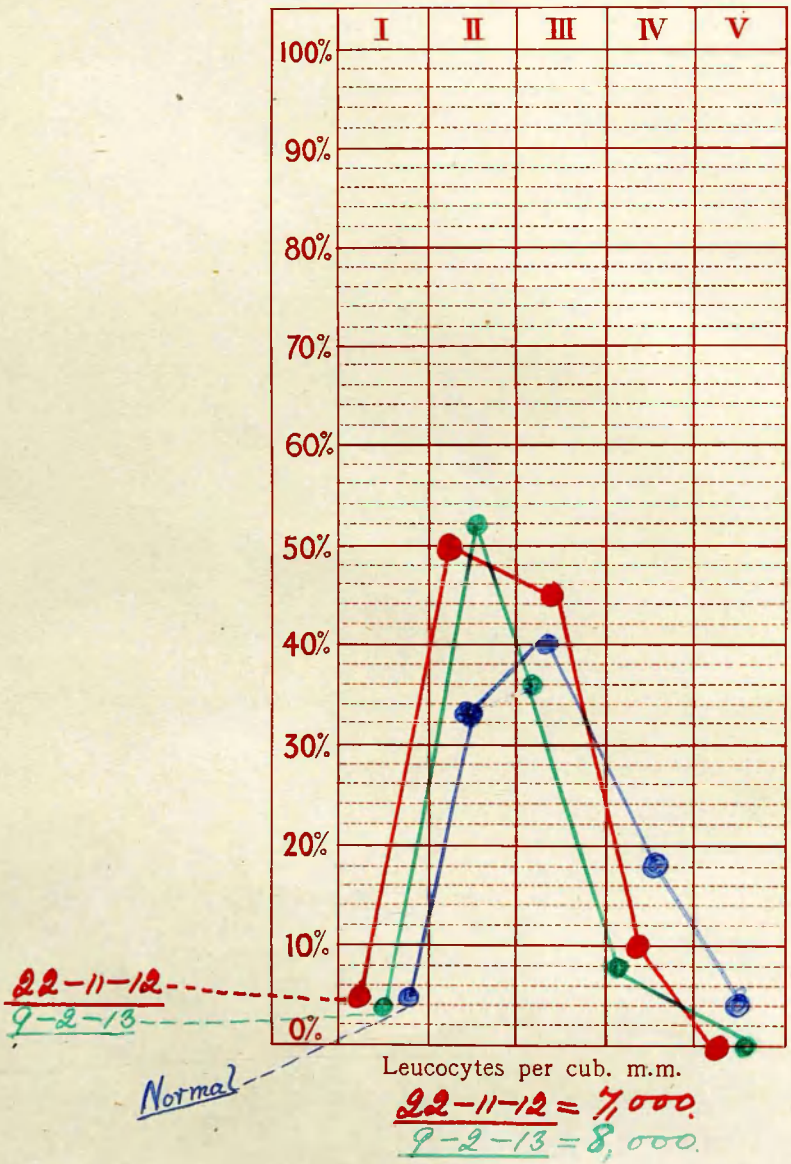
Leucocytes per cub. m.m.

9-12-12 = 7,000.

5-3-13 = 8,000.

Case W. Hobson No. 28

Age 53 Disease Pulmonary Tuberculosis.



I.	II.	III.	IV.	V.
19%	54%	24%	2%	1%

9-2-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
17.5%	52.5%	27%	3%	0%

Case: J. Hall. Aet. 41.

No. 27. Pulmonary Tuberculosis. Cavities in the apices of both upper lobes, with considerable fibroid change, but no signs of active disease.

9-12-12. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
15%	65%	17%	3%	0%

5-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
13%	63%	18%	6%	0%

Case: W.Hobson. Aet. 53.

No. 28. Pulmonary Tuberculosis. Consolidation in both upper lobes, only slightly on the right side, with marked fibroid change. No signs of active disease.

22-11-12. Leucocytes per cub. mm. = 7,000.

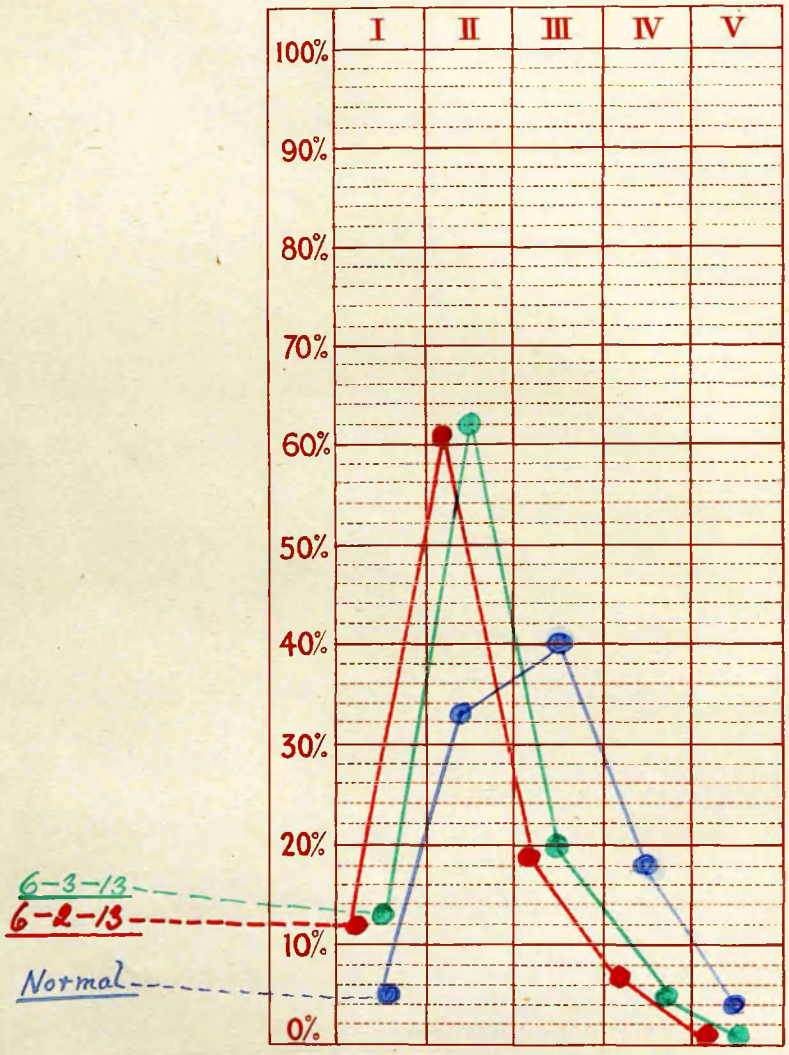
I.	II.	III.	IV.	V.
5%	50%	35%	10%	0%

9-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
4%	52%	36%	8%	0%

Case Fred. Lindley No. 29

Age 40 Disease Pulmonary Tuberculosis.



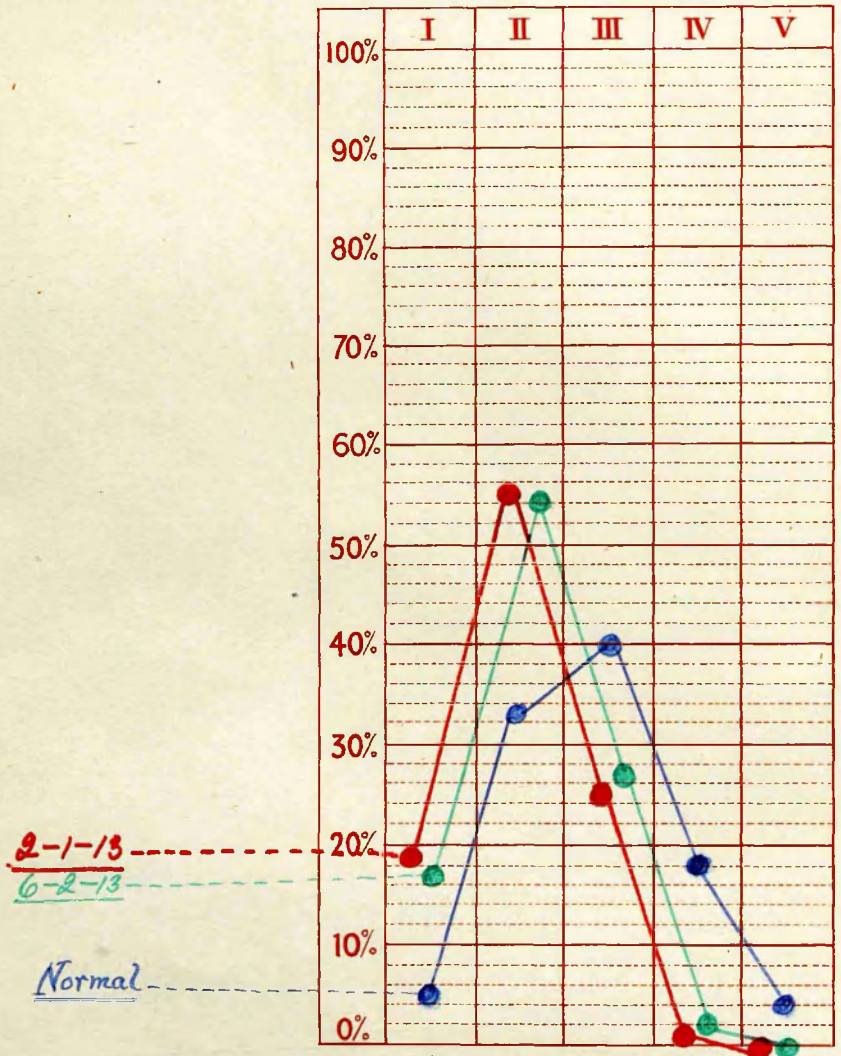
Leucocytes per cub. m.m.

6-2-13 = 6,000

6-3-13 = 6,000.

Case A. Pratt No. 30

Age 50 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

2-1-13 = 8,000.

6-2-13 = 6,000

Case: Fred. Lindley. Aet. 40.

No. 29. Pulmonary Tuberculosis. Area of consolidation at the upper half of the left upper lobe. No active signs present.

6-2-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
12%	61%	19%	7%	1%

6-3-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
13%	62%	20%	5%	0%

Case: A. Pratt. Aet. 50.

No. 30. Pulmonary Tuberculosis. Fairly extensive cavities in both upper lobes are present, also in the apex of the right lower. He did not appear a very promising case at first, but remains fairly well, and the disease does not seem to be advancing in the meantime.

2-1-13. Leucocytes = 8,000.

I.	II.	III.	IV.	V.
19%	55%	25%	1%	0%

6-2-13. Leucocytes = 6,000.

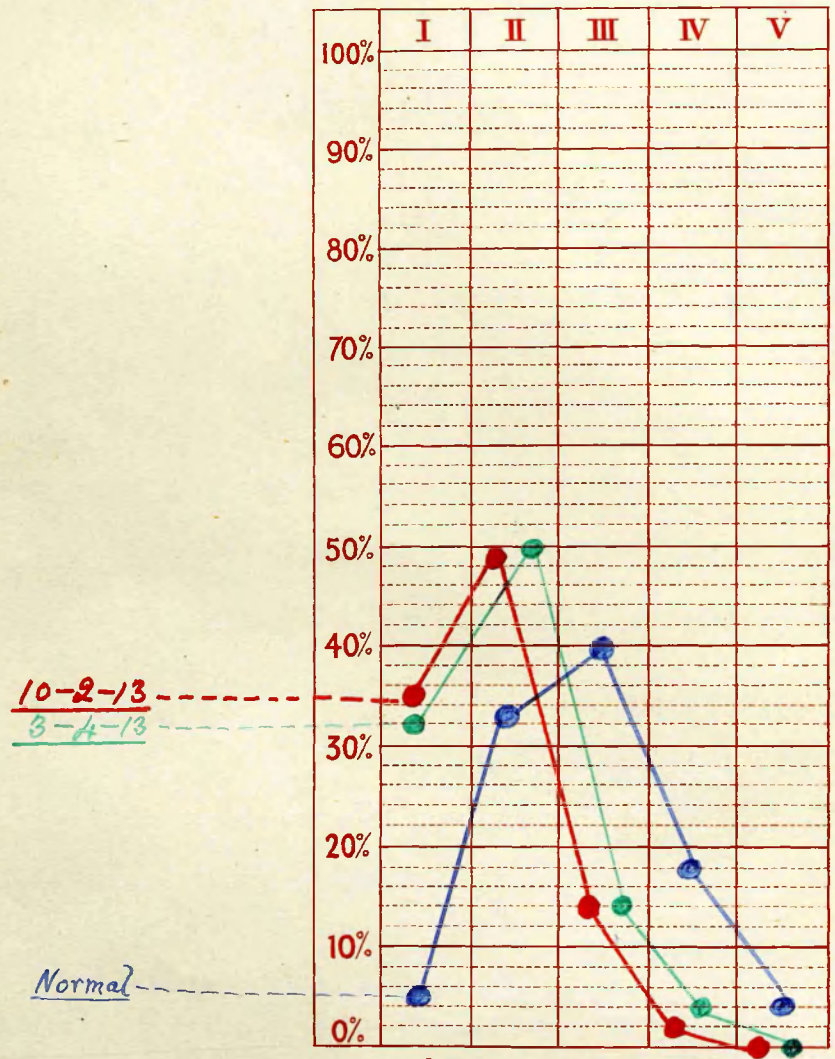
I.	II.	III.	IV.	V.
17%	54%	27%	2%	0%

Case: A. Seaman. aet. 44.

No. 31. Pulmonary Tuberculosis and healed

Case A. Seaman No. 31

Age 44 Disease Pulmonary Tuberculosis.



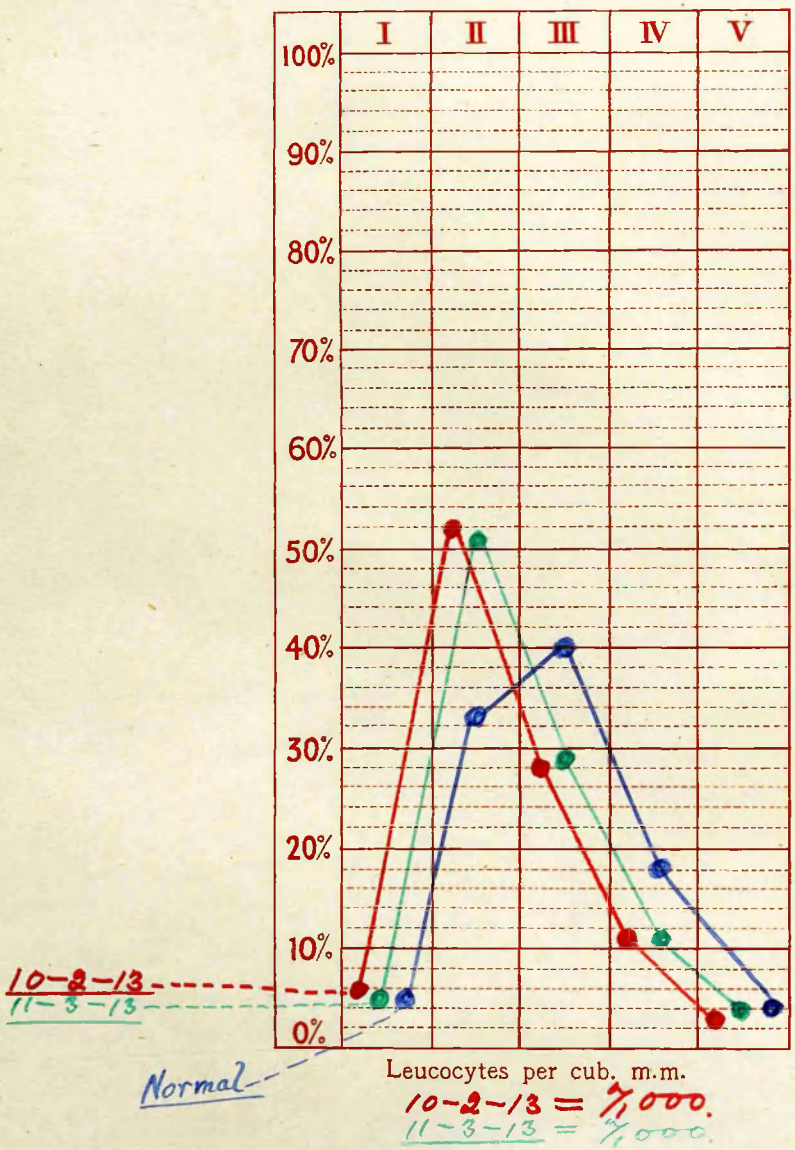
Leucocytes per cub. m.m.

10-2-13 = 9,000.

3-4-13 = 7,000.

Case J. Clover No. 32

Age 30 Disease Pulmonary Tuberculosis.



tuberculous epididymitis. Fairly large cavity in the apex of the left upper lobe, and consolidation in the apex of the right upper lobe.

10-2-13. Leucocytes per cub.mm. = 9,000.

I.	II.	III.	IV.	V.
35%	49%	14%	2%	0%

3-4-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
32%	50%	14%	4%	0%

Case: J. Clover. Aet. 30.

No. 32. Pulmonary Tuberculosis. Consolidation in left upper lobe, in the apex. No signs of advancing disease present.

10-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
6%	52%	28%	11%	3%

11-3[illegible]-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
5%	51%	29%	11%	4%

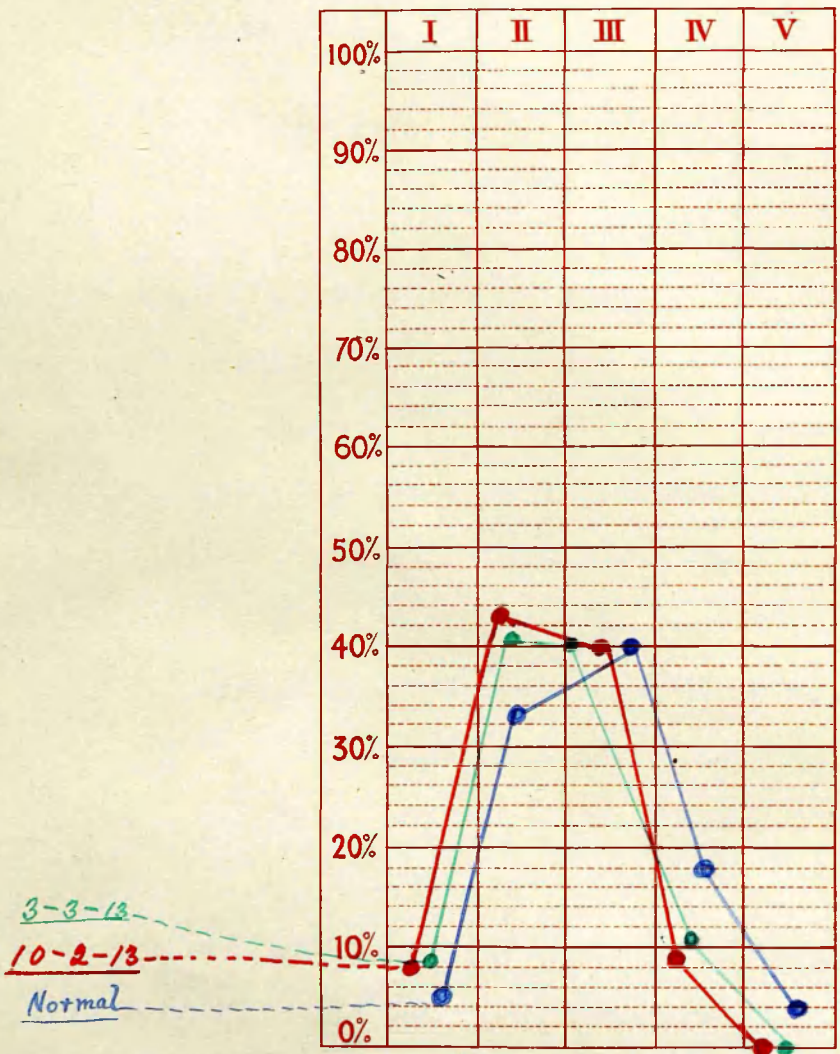
Case: J. Martin. Aet. 43.

No. 33. Pulmonary tuberculosis. Consolidation in apex of right upper lobe. No signs of advancing disease.

10-2-13. Leucocytes per cub. mm. = 8,000.

Case J. Martin No. 33.

Age 43 Disease Pulmonary Tuberculosis.



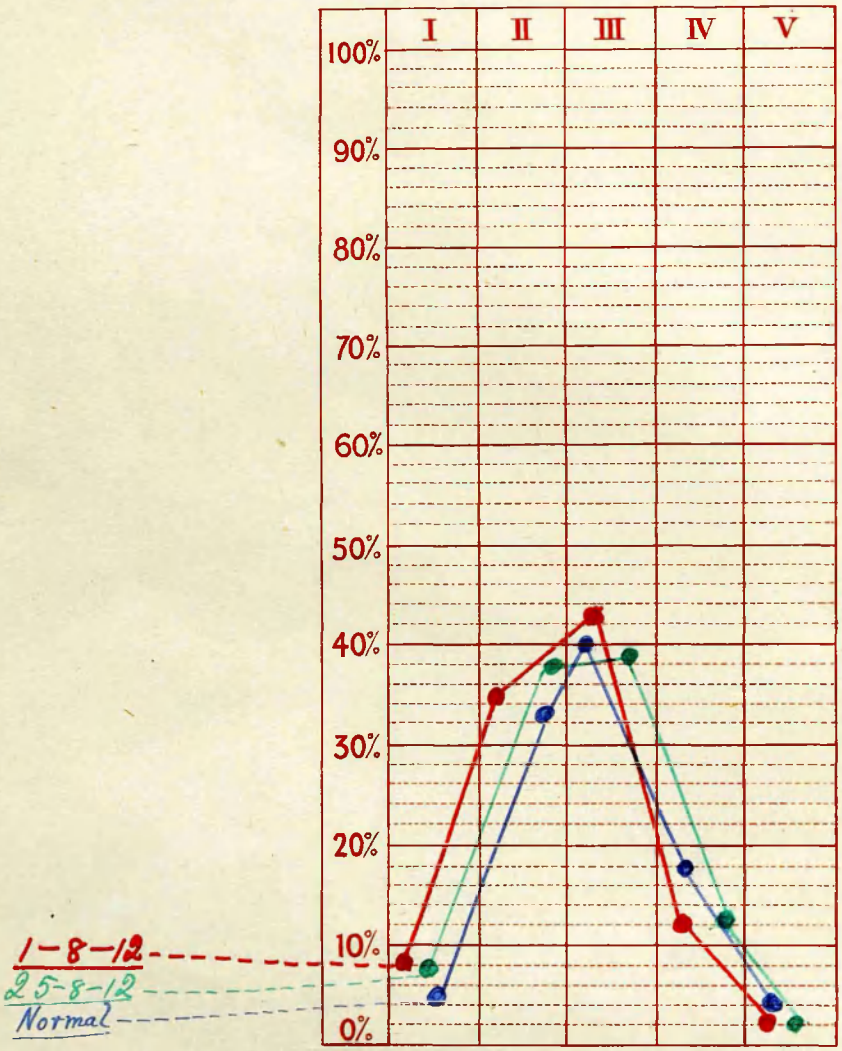
Leucocytes per cub. m.m.

10-2-13 = 8,000.

3-3-13 = 7,000

Case Jessie Wilson No. 35

Age 18 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

1-8-12 = 9,500.

25-8-12 = 9,000.

I.	II.	III.	IV.	V.
8%	43%	40%	9%	0%

3-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
9%	40.5%	40%	10.5%	0%

The following cases have not had Sanatorium treatment, strictly speaking. They have, however, slept in large airy wards, and have been out of doors during the day as much as weather and their own inclinations would allow - for they do not all welcome the open-air part of their treatment - and therefore their conditions of life have approximated closely to sanatorium life. Clinically, no apparent change occurred, while under observation for the periods mentioned.

Case: Jessie Wilson. Aet. 18.

No. 35. Pulmonary Tuberculosis. Consolidation was present at the apex of the right upper lobe, and suspicious signs at the apex of the right lower lobe.

1-8-12. Leucocytes per cub. mm. = 9,500

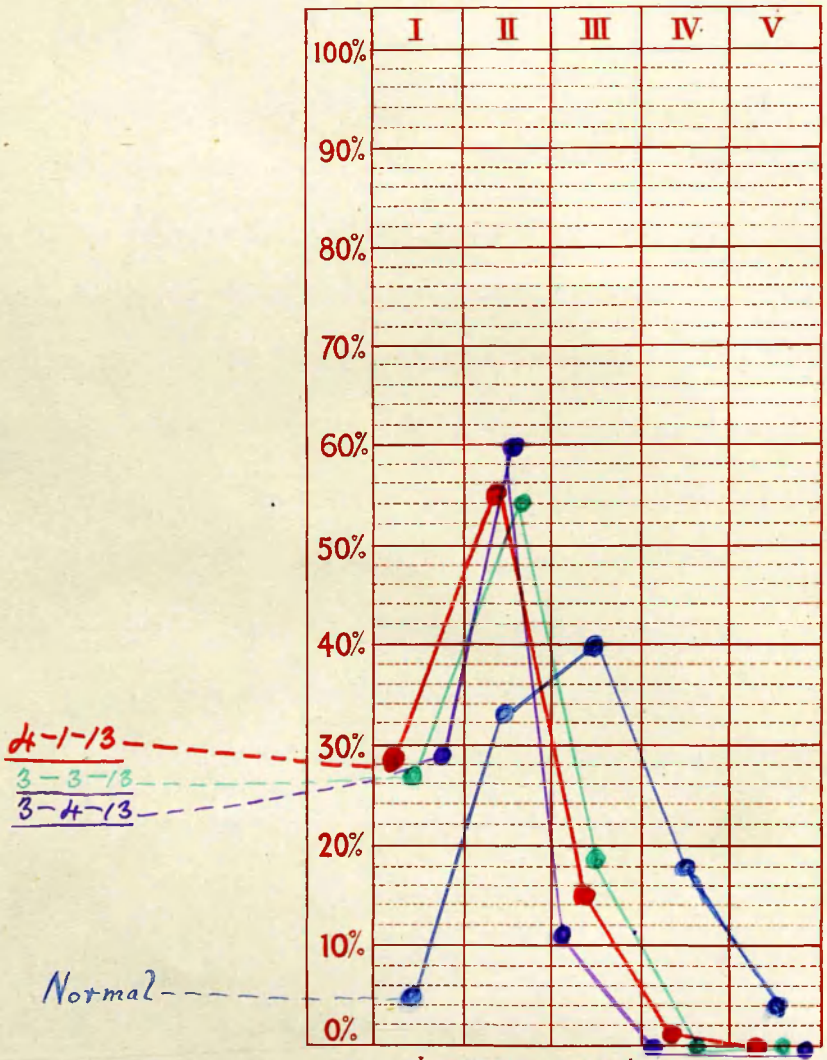
I.	II.	III.	IV.	V.
8.5%	35%	42.5%	12%	2%

25-8-12. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
8%	38%	39.5%	12.5%	2%

Case Samuel Wilkinson No. 36.

Age 64 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

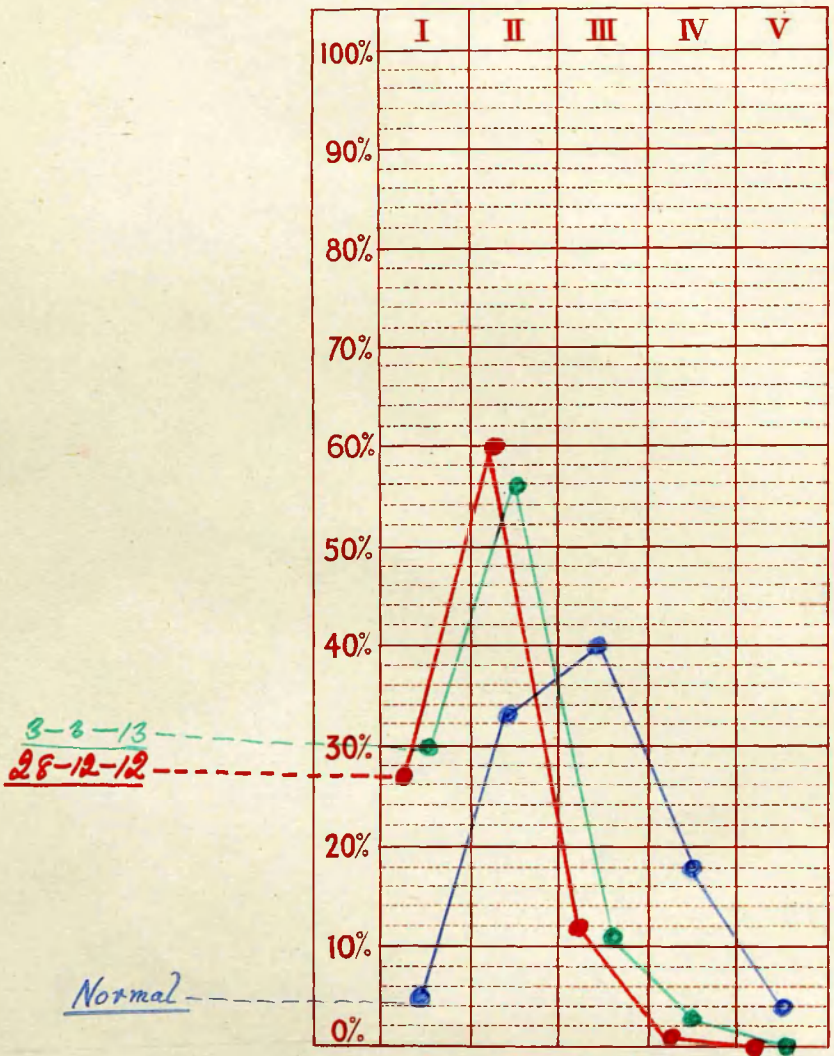
4-1-13 = 8,000

3-3-13 = 9,000

3-4-13 = 8,000.

Case Walter Hartley No. 37

Age 62 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

28-12-12 = 6,000

3-3-13 = 8,000

Case: Samuel Wilkinson. Aet. 64.

No. 36. Pulmonary Tuberculosis. Cavities present in both upper lobes, with fibroid change, of many years' duration. No signs of active disease present.

4-1-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
29%	55%	15%	1%	0%

3-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
27%	54%	19%	0%	0%

3-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
29%	60%	11%	0%	0%

Case: Walter Hartley. Aet. 62.

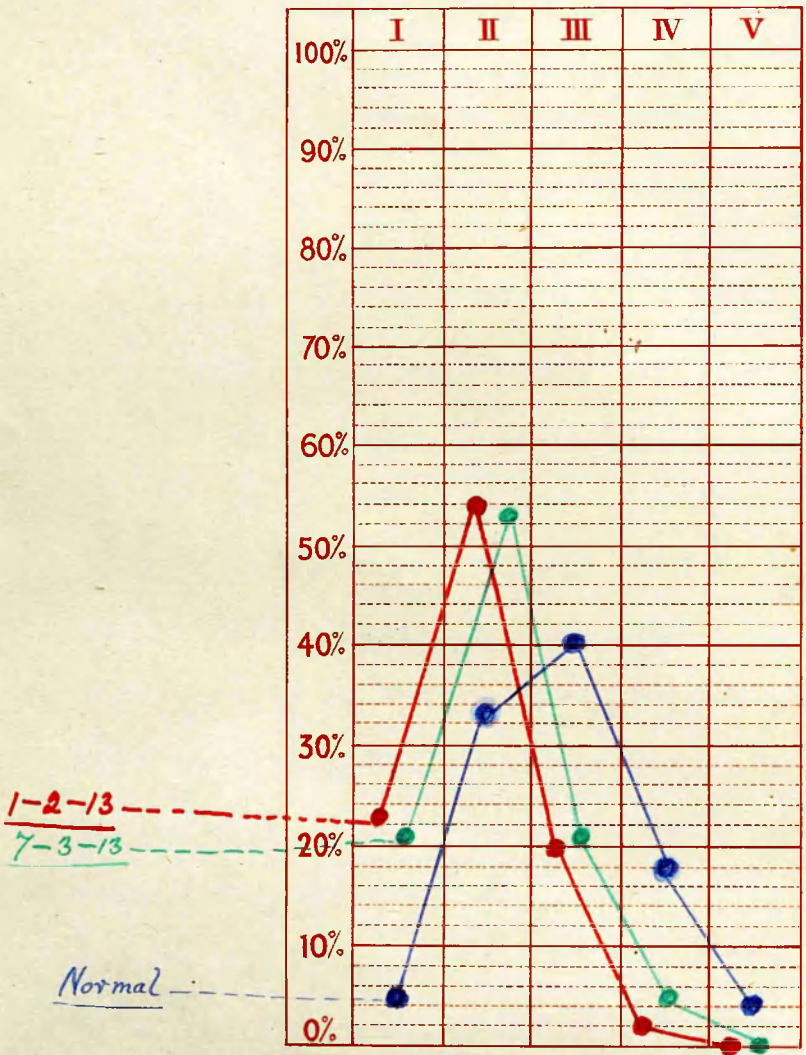
No. 37. Pulmonary Tuberculosis. This was a somewhat feeble man, with cavities in the apices of both upper lobes, and occasionally a little rise of temperature for a day or so. His general condition did not, however, alter much, as the following counts will show, in spite of the fact that there is a somewhat considerable dislocation of the picture to the left.

28-12-12. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
27%	60%	12%	1%	0%

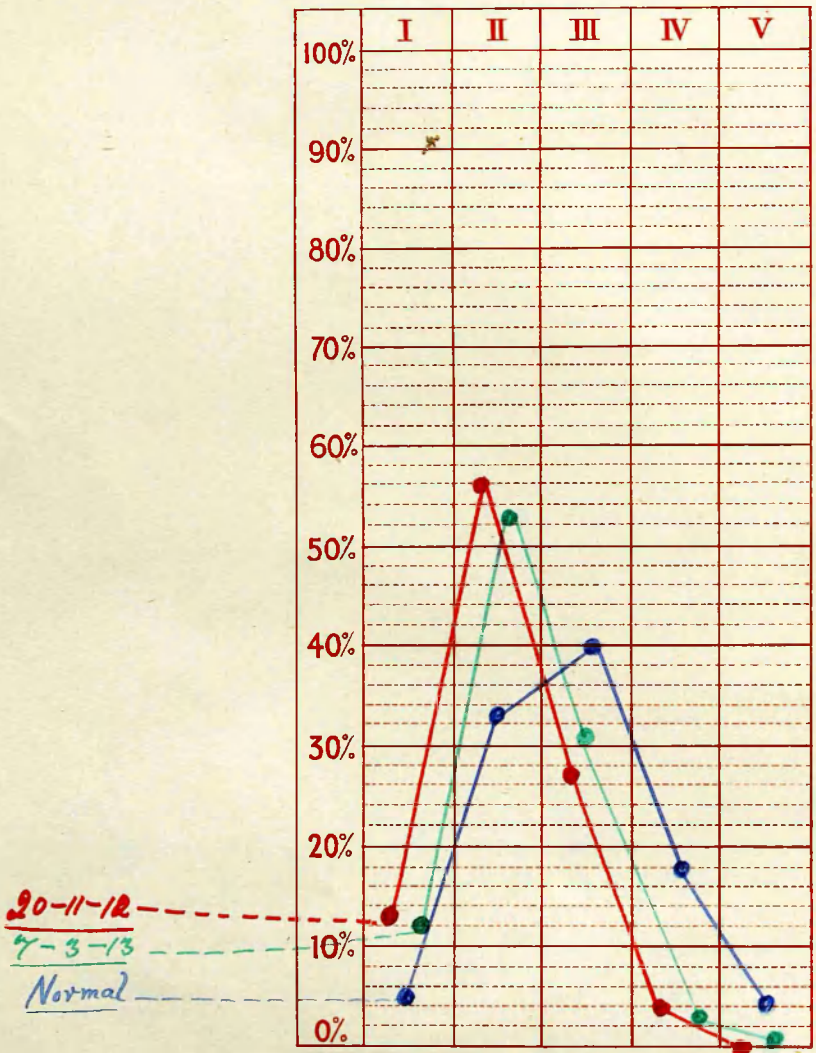
Case Charles Booker No. 38.

Age 32 Disease Pulmonary Tuberculosis.



Case Beatrice Walton No. 39

Age 43 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

20-11-12 = 9,000.

7-3-13 = 8,000.

3-3-13. Leucocytes per cub. mm. 8,000.

I.	II.	III.	IV.	V.
30%	56%	11%	3%	0%

Case: Charles Booker. Aet. 32.

No.38. Pulmonary Tuberculosis. Consolidation in the left upper lobe, with a small apical cavity, the physical signs as to activity being somewhat doubtful.

1-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
23%	54%	20%	2%	0%

7-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
21%	53%	21%	5%	0%

Case: Beatrice Walton. Aet. 43.

No. 39. Pulmonary Tuberculosis. Consolidation with apical excavation present in the left upper lobe. There were occasional traces of blood in the sputum, which was itself scanty.

20-11-12. Leucocytes per cub. mm. = 9,000.

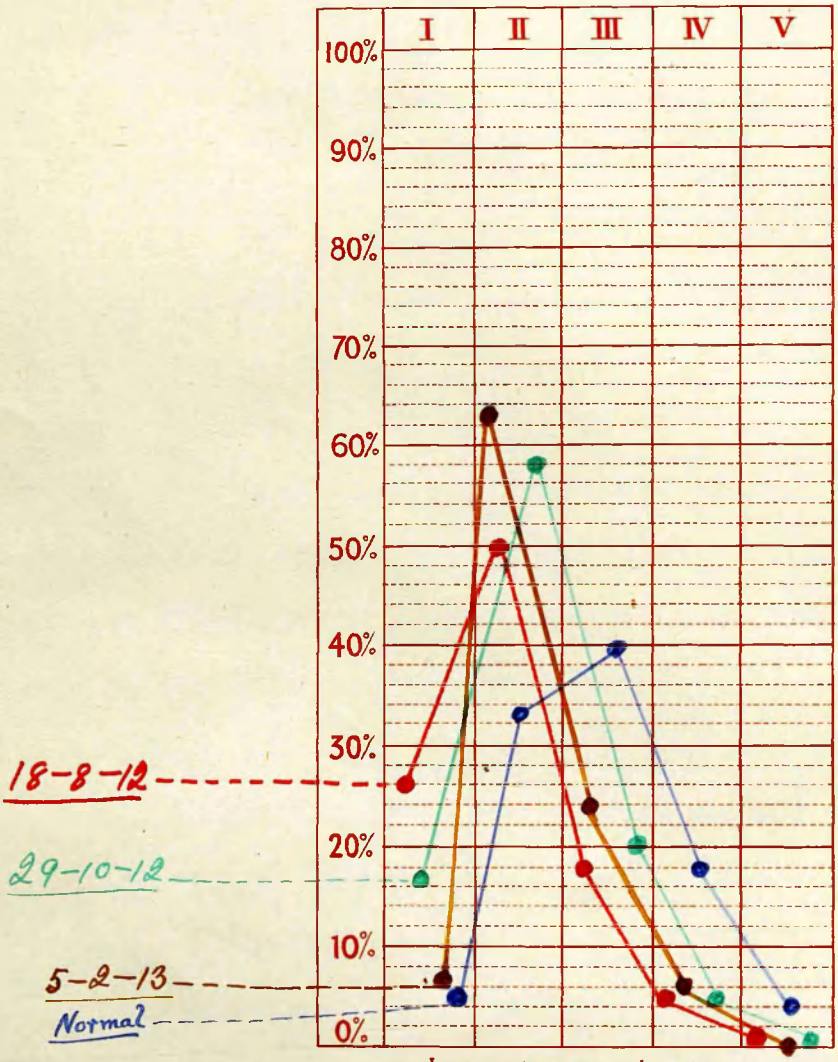
I.	II.	III.	IV.	V.
13%	56%	27%	4%	0%

7-3-13. Leucocytes per cub. mm. 8,000.

I.	II.	III.	IV.	V.
12%	53%	31%	3%	1%

Case Nellie Reid No. 40

Age 18 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

18-8-12 = 9,500.

29-10-12 = 8,000.

5-2-13 = 7,000.

Class III. Favourable or Improving Cases.

These cases are much fewer in number than I should like, but the reason is that the majority of the cases have presented themselves at a stage where recovery was hopeless, or else in a condition where no apparent change occurs over long periods. In this respect I would first point out that several of the cases which I have included under Class II (or Stationary) cases, are really favourable cases. Those included under Class III are those in which definite improvement has occurred.

Case: Nellie Reid. Aet. 18.

No. 40. Pulmonary Tuberculosis. Consolidation was present in both upper lobes, from the apices down to the third ribs, and also in the apex of the left lower lobe. She received open-air treatment, and improved considerably.

18-8-12. Leucocytes per cub. mm. = 9,500.

I.	II.	III.	IV.	V.
26%	50%	18%	5%	1%

29-10-12. Leucocytes per cub. mm. = 8,000.

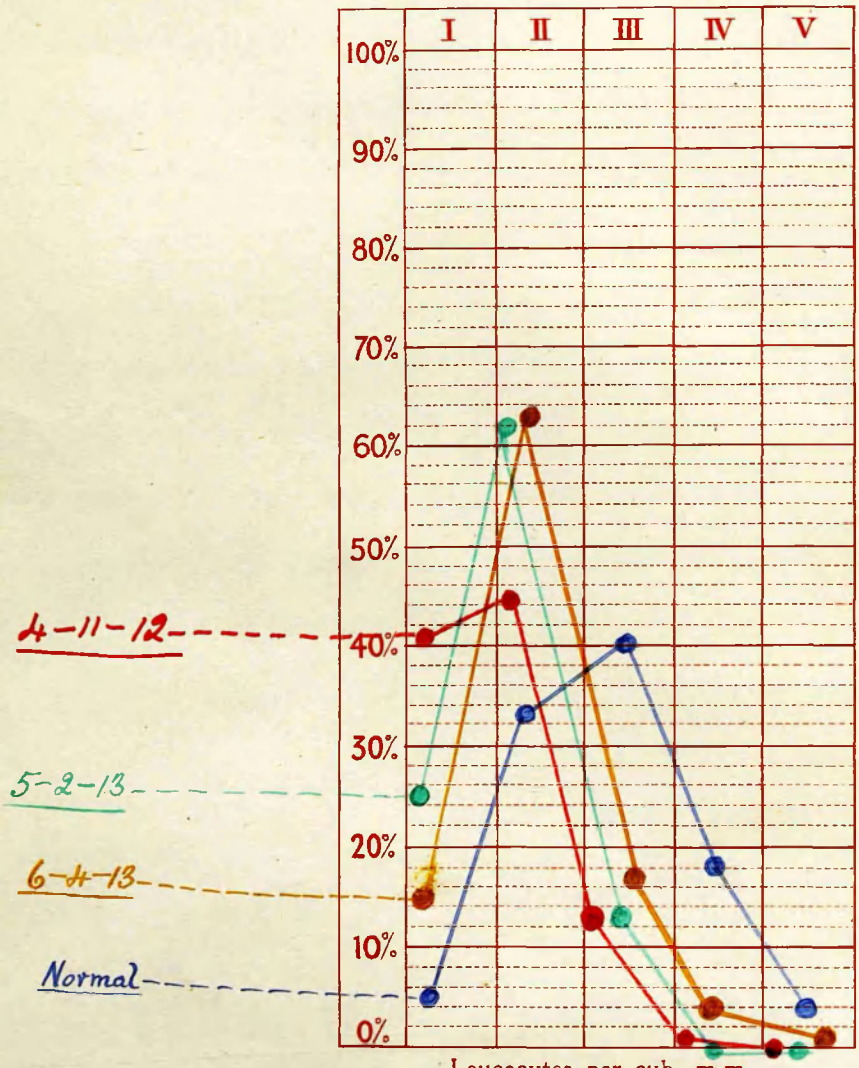
I.	II.	III.	IV.	V.
17%	58%	20%	5%	0%

5-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
7%	63%	24%	6%	0%

Case Thomas Hall No. 41

Age 35 Disease Pulmonary Tuberculosis.



Leucocytes per cub. m.m.

4-11-12 = 8,000

5-2-13 = 8,000

6-4-13 = 7,500.

The very definite change in the picture as the dislocation to the left is reduced by a steady drift to the right, is very striking, and coincides with the improvement in the patient's condition which occurred. The apex of the left lower lobe in which consolidation had begun, is now clear, and she appears to be promising well.

Case: Thomas Hall. Aet. 35.

No. 41. Pulmonary Tuberculosis. This patient had been 4 months under treatment in a ward before the first count was made. Consolidation was present in both upper lobes, and in the apex of the left lower, and moist râles were present over these areae. He was dyspnoeic on slight exertion. He was transferred to the Sanatorium, after improving somewhat, and begun on the lowest grade of the graduated open-air exercise. At the same time his blood was examined, and the readings are as follows -

4-11-12. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
41%	44.5%	13.5%	1%	0%

This patient was the only one of all the patients in the Sanatorium who gave his whole-hearted support to the efforts of those who were seeking to help them. He was

most assiduous in carrying out every part of his treatment, especially the graduated open-air exercise. I must say that at first I did not think he would live many months, but he made astonishing progress, and was soon advanced to higher grades of exercise. By this time he no longer had any dyspnoea on ordinary rational exertion, had a good appetite, and slept well, with only occasional cough. A marked improvement was now evident in his "picture".

5-2-13. Leucocytes = 8,000.

I.	II.	III.	IV.	V.
25%	62%	13%	0%	0%

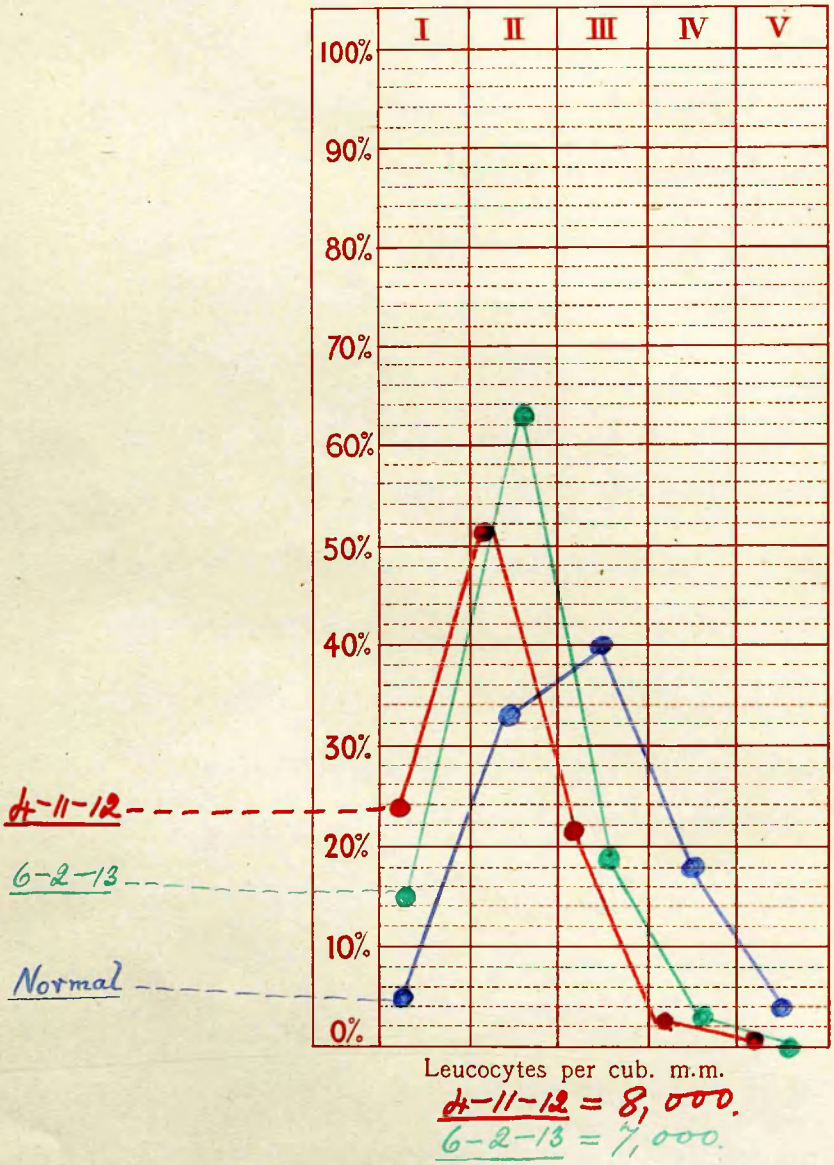
The clinical improvement continued, the lungs by now being quite free of râles, though the signs of consolidation were still present. He was accordingly advanced to the heavy grades of open-air exercise, and now is practically free from cough, is physically hard, and can work in the open, all day, gardening, carrying loads etc., within limits, without dyspnoea.

The physical signs are still present in his chest, however, and, of course, though one may be enthusiastic about the improvement which has taken place, how long that improvement will continue is not quite so certain.

However, as far as the clinical picture and the blood-picture show, the improvement is continuing,

Case John Hulsin No. 42

Age 54 Disease Pulmonary Tuberculosis.



withcut any untoward sign.

6-4-13. Leucocytes per cub. mm. = 7,500.

I.	II.	III.	IV.	V.
15%	63%	17%	4%	1%

Case: John Hukin. Aet. 54.

No. 42. Pulmonary Tuberculosis. Cavities were present in the apices of both upper lobes, and consolidation extending down to the third ribs, and in the apices of both lower lobes also. Under Sanatorium treatment and graduated open-air exercise he improved considerably.

4-11-12. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
24%	51.5%	21.5%	2.5%	0.5%

6-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
15%	63%	19%	3%	0%

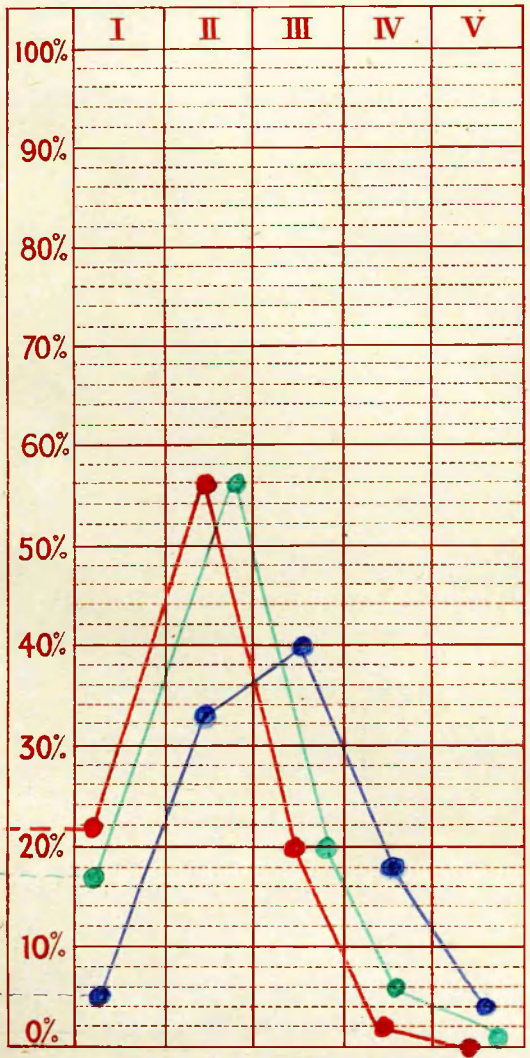
The improvement in the picture coincided with the improvement in the patient's general condition, alhtough no change was observed locally.

Case: Geo. M. Boardman. Aet. 58.

No. 43. Pulmonary Tuberculosis. This patient had a large cavity in the right upper lobe, with consolidation in the apices of the right lower, and left upper lobes. Temp. slightly above normal at times.

Case Geo. M. Boardman No. 43

Age 58 Disease Pulmonary Tuberculosis



20-2-13

7-3-13

Normal

Leucocytes per cub. m.m.

20-2-13 = 9,000.

7-3-13 = 8,000

20-2-13. Leuc. per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
22%	56%	20%	2%	0%

7-3-13. Leuc. per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
17%	56%	20%	6%	1%

Unfortunately patient went home before a third count was obtained. There is a slight improvement in the second picture, however, and, from the clinical point of view he was distinctly better. At the time of the first count numerous rales were present in the chest, and at the second, these had disappeared, and he looked, and felt, better.

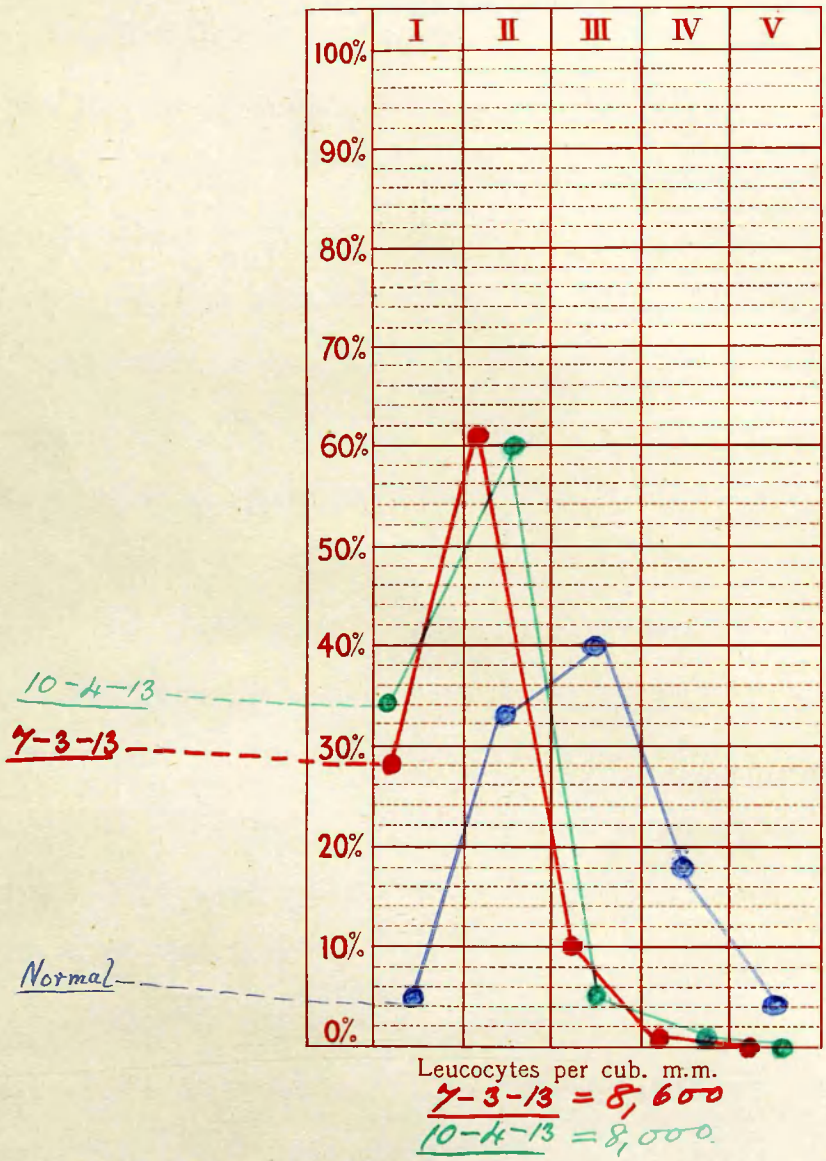
There are still 2 cases of pulmonary tuberculosis which I have not classified.

Case: Florence Mitchell. Aet. 12.

No. 44. Pulmonary Tuberculosis, and Tuberculous Peritonitis. This child has an extensive consolidation in the left lung, both lobes being affected in places. She has also severe tuberculous peritonitis, with some free fluid, so that it is difficult to say how much of her condition is due to the pulmonary, and how much to the abdominal lesion. She is not promising well, however, and the somewhat gloomy prognosis is enhanced by the findings from the blood.

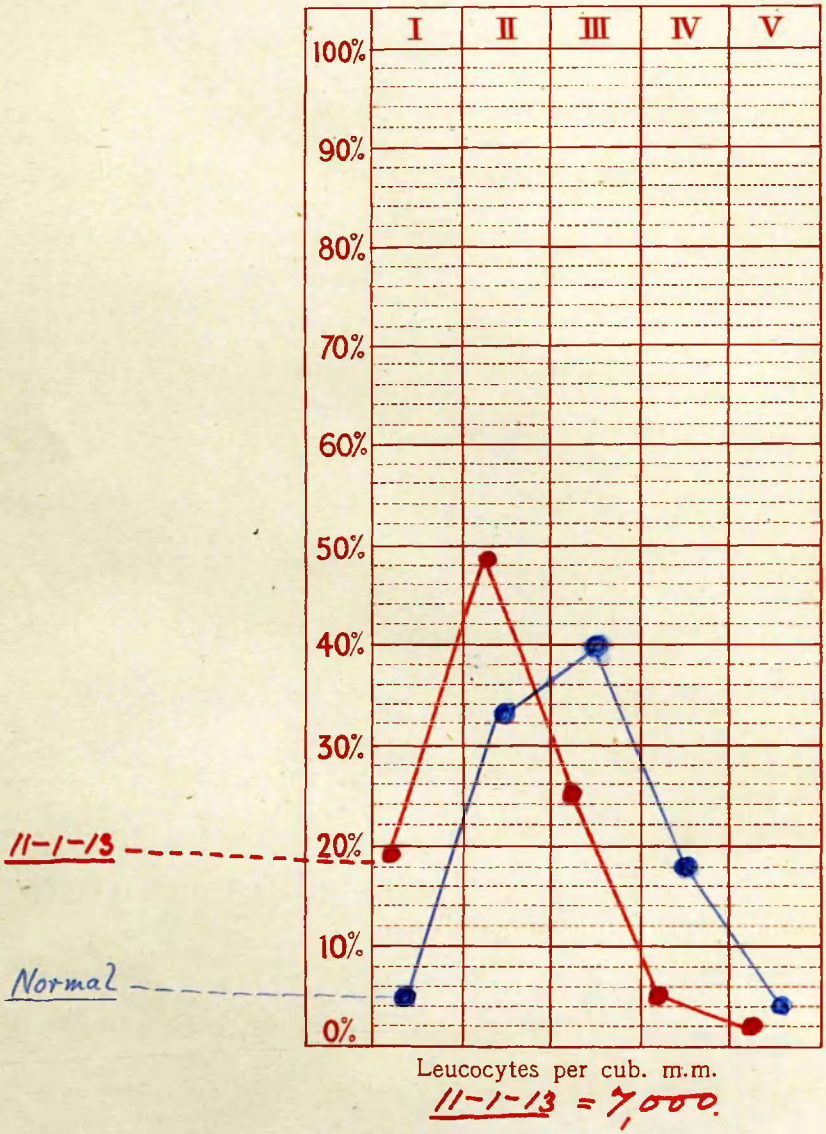
Case Florence Mitchell No. 44

Age 12 Disease Pulmonary Tuberculosis: Tuberculous Peritonitis.



Case Herbert Sharpe No. 45

Age 36 Disease Pulmonary Tuberculosis



7-3-13. Leucocytes per cub. mm. = 8,600.

I.	II.	III.	IV.	V.
28%	61%	10%	1%	0%

10-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
34%	60%	5%	1%	0%

Case: Herbert Sharpe. Aet. 38.

No. 45. Pulmonary Tuberculosis. Consolidation was present in the right upper lobe, with a small apical cavity, and a patch of consolidation was present also at the apex of the left upper lobe.

The difficulty with regard to his classification was due to the fact that he became discontented, and left for home, after being under treatment only 12 days.

His picture was - Leucocytes per cub. mm. = 7,000.

11-1-13

I.	II.	III.	IV.	V.
19.5%	48.5%	25%	5%	2%

There is, therefore, a dislocation of the picture to the left, mild, however, in degree, but definite.

From a consideration of these cases it is evident that in all cases of pulmonary tuberculosis, except those which are practically well, a dislocation of the picture occurs, varying in degree according to the severity of the case. When the disease first secures a hold upon the individual, a dislocation occurs towards the left. If the

disease advances, this dislocation becomes more marked.

If the patient improves, on the other hand, the dislocation becomes gradually reduced by a drift of the picture towards the right.

The dislocation to the left is brought about by an increase in the cells of Classes I and II, at the expense of those of Classes III, IV and V. In a severe case all the cells may disappear from Classes V, IV and III, this disappearance occurring in the order named, that is, the cells of Class V disappear first, then those of Class IV, and finally those of Class III. As the case improves, and the drift of the picture to the right reduces the dislocation, the increase is evident in Class III first, then in Class IV and finally in ClassV.

These changes are perhaps most marked in the cells of Class I, and in this respect I would point out that I have never seen a case of pulmonary tuberculosis show any prospect of recovery, in which the percentage of cells in class I exceeded 50% of the whole neutrophile polymorphonuclear picture.

Also, I have rarely seen any improvement when the number exceeded 45%, and, as a rule, take a very grave view of the prognosis when Class I shows a greater percentage than 40%.

Further points of interest in this series of cases are -

1. The sudden increase in the dislocation to the left which occurs as the result of a pleurisy.

Hence, in estimating the prognosis of a case of pulmonary tuberculosis by this method of blood examination, if a pleurisy is present, or if there is a history of pleurisy just subsided, due allowance must be made for the increased dislocation which will be present, as a result.

2. A haemoptysis, if at all severe, produces a sudden increase in the dislocation to the left. I have been able to observe this within a few hours of the onset of the attack, and this dislocation persists for some time after the subsidence of the haemorrhage.

3. In many of my cases a comparatively high leucocyte count per cub. mm. has been present. This I attribute to the secondary infection present.

4. I consider that the alterations in the picture are independent of the number of leucocytes per cub.mm. In many of the most striking dislocations to the left I admit that the leucocyte count is above the normal, but I have other cases, (some of which will appear later) in which there is a leucopenia, with a striking dislocation to the left.

Syphilis.

I have made observations in a series of 13 cases of this disease, which are made up as follows :-

Secondary Stage: 10 cases.

Tertiary Stage: 1 case.

Parasyphilitic Disease: 1 case.

Syphilitic Psoriasis: 1 case.

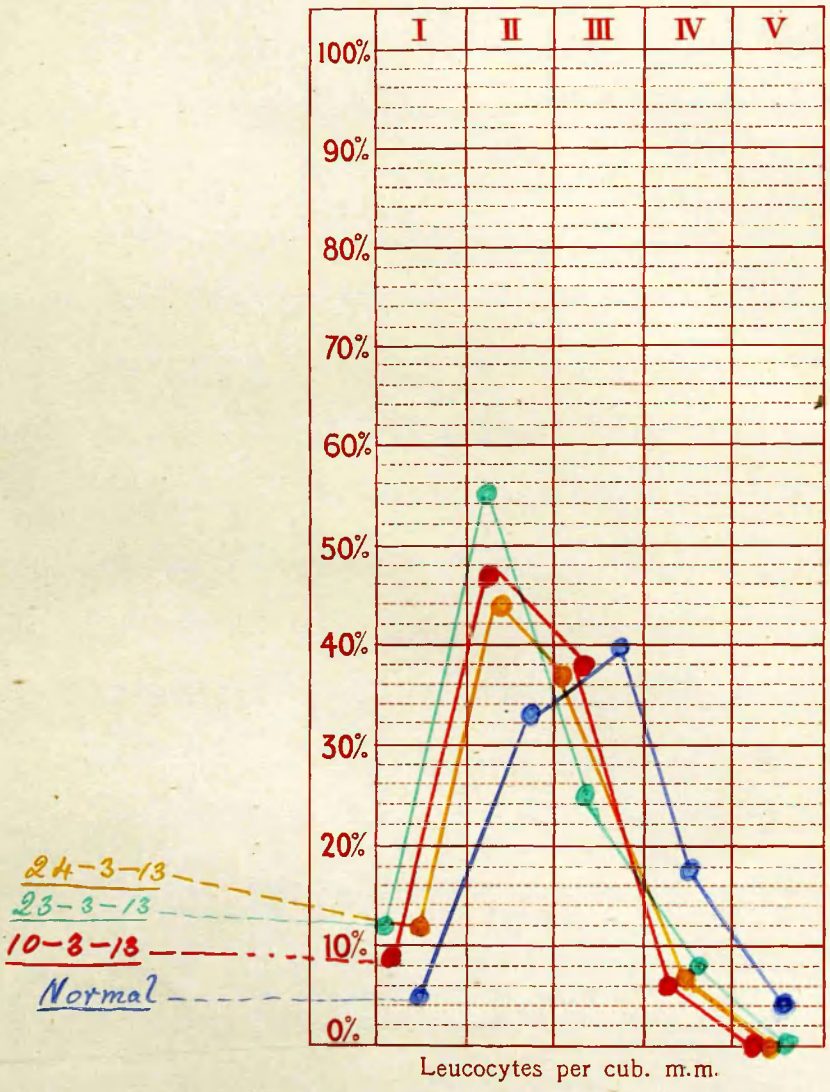
I have found, in Syphilis, that the changes in the blood-picture, while they do occur, are not so marked as in cases of pulmonary tuberculosis. The reason of this I take to be that syphilis can always be arrested before it has advanced as far as these cases of pulmonary tuberculosis which, as has been seen, displayed such striking dislocations of the picture.

I believe that, if syphilis were untreated, and advanced to a similar stage of severity, just as striking pictures would be obtained as in advanced pulmonary tuberculosis.

Another interesting point in this series of cases of syphilis is that in all the cases, treatment was carried out by the intra-venous injection of Salvarsan and the blood-pictures before and after this treatment are shown. In most of the cases the Salvarsan injection was followed, after a short period, by a course of Mercury and Potassium Iodide.

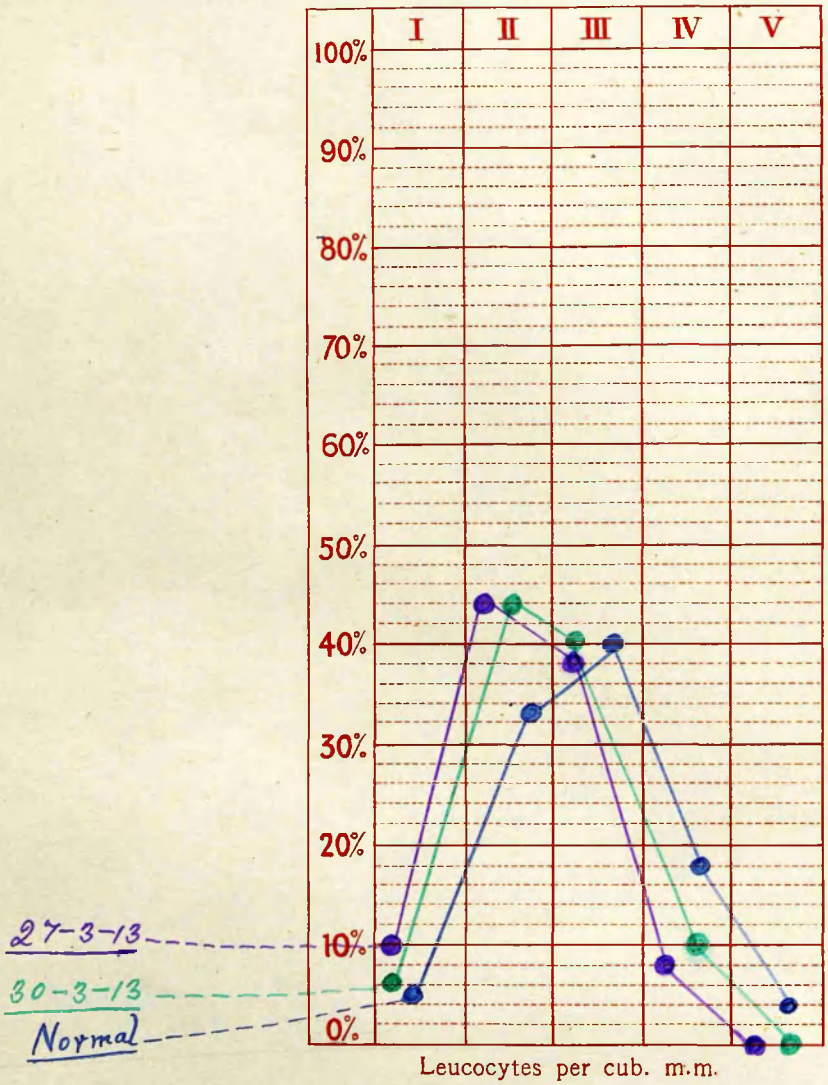
Case Wm. Davies No. 46 (Chart I)

Age 34 Disease Secondary Syphilis.



Case Wm. Davies No. 46 (Chart II)

Age 34 Disease Secondary Syphilis.



Case: Wm. Davies. Aet. 34.

No. 46. Secondary Syphilis. Infection, 4 months previously; history of rash 2 months later; when first seen, the after-glow of the rash was faintly discernible at places, and numerous small ulcers and mucous patches were present on the tonsils, tongue, and buccal mucosa. Temperature normal.

10-3-13. On admission.

I.	II.	III.	IV.	V.
9%	47%	38%	6%	0%

Treatment by Mercury and Potassium Iodide was begun at once, and a second count on

23-3-13 showed

I.	II.	III.	IV.	V.
12%	55%	25%	8%	0%

Immediately after the blood-films had been taken for this count, .6 gramme Salvarsau was given intravenously. The following are the counts made subsequently -

24-3-13.	I.	II.	III.	IV.	V.
	12%	44%	37%	7%	0%
27-3-13.	I.	II.	III.	IV.	V.
	10%	44%	38%	8%	0%
30-3-13.	I.	II.	III.	IV.	V.
	6%	44%	40%	10%	0%

The day after the last count he insisted upon going home,

against advice, and promising to continue treatment.

These observations show a distinct improvement in the "pictures". True, the changes are not marked, but then the original dislocation to the left was not marked, nor was the man very ill.

There is evident, however, a steady drift of the picture to the right, and had I been able to keep the patient under observation a little longer, I am sure that cells would have appeared in Class V.

Clinically, while the last of the injection was being given, he complained of smarting in the ulcers, and before he went out, a week later, all the ulcers had healed. The improvement then, in the successive "pictures", coincided with the clinical improvement of the case.

I shall take the two following cases together.

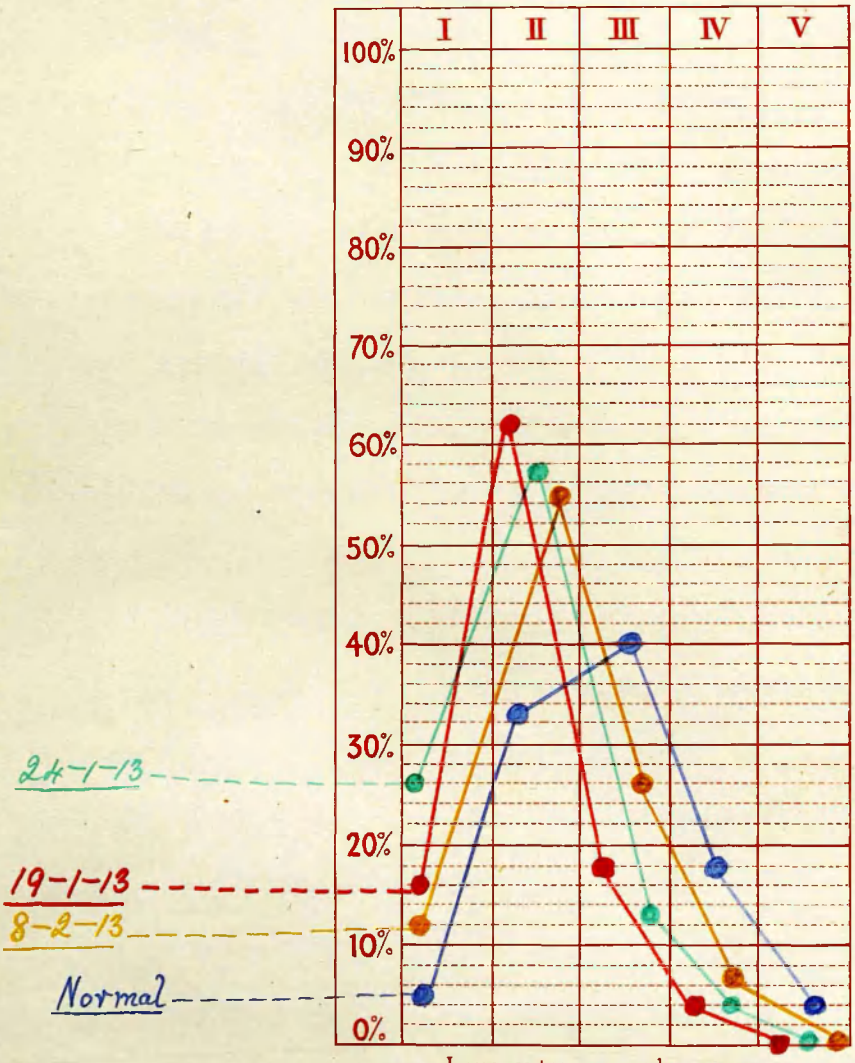
Case: Julia Reece. Aet. 28.

No. 47. Secondary Syphilis. History of infection 2 years previously, and of very insufficient treatment. On admission, the whole vulva was covered with condylomata which spread up into the groins; small superficial sores were present round the vaginal orifice, with slight vaginal discharge. Congestion of the throat and tonsils was present, without ulceration.

19-1-13. Leucocytes per cub. mm. = 8,000.

Case Julia Reece No. 47 (Chart I.)

Age 28 Disease Secondary Syphilis.



Leucocytes per cub. m.m.

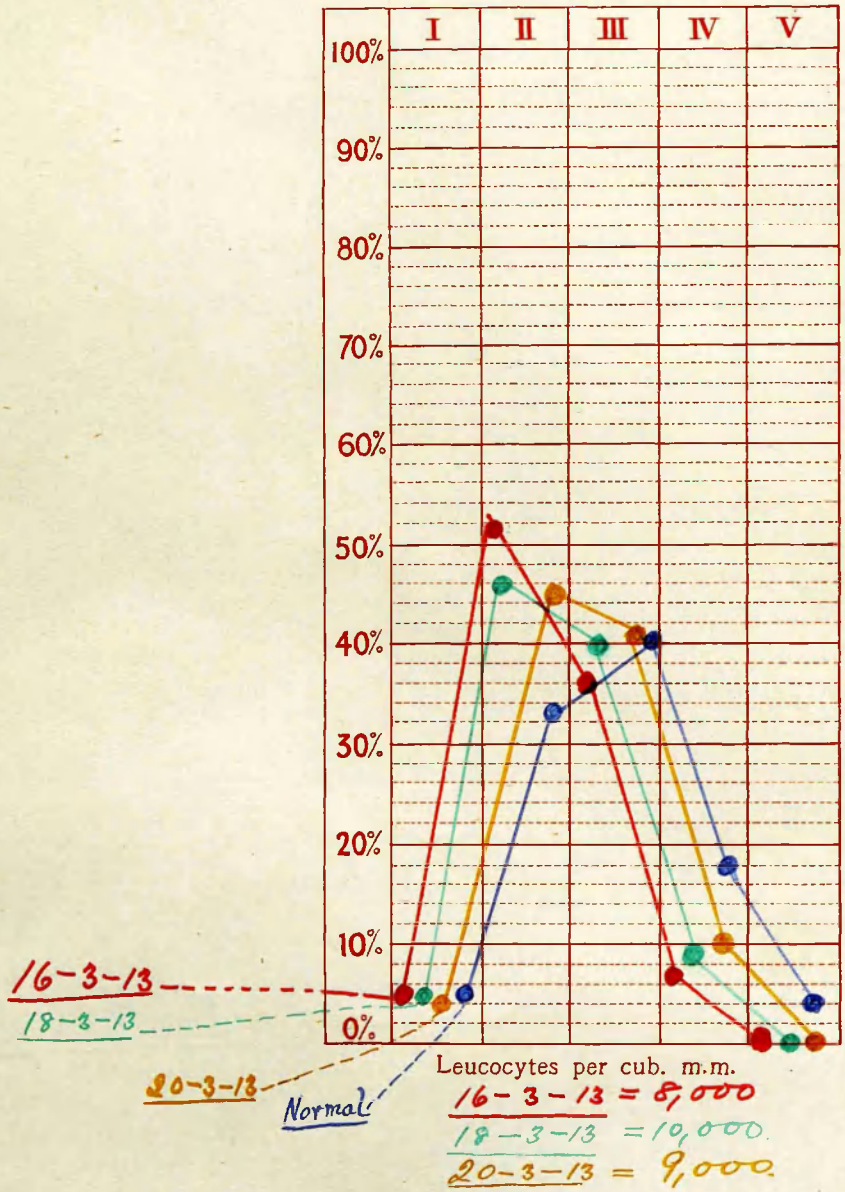
19-1-13 = 8,000.

24-1-13 = 10,000

8-2-13 = 10,000.

Case Julia Reece No. 47 (Chart #)

Age 28 Disease Secondary Syphilis.



I.	II.	III.	IV.	V.
16%	62%	18%	4%	0%

The films for this count were made immediately before the injection, intra-venously, of .3 gramme Salvarsan. The subsequent counts are -

24-1-13. Leucocytes per cub. mm. = 10,000,

I.	II.	III.	IV.	V.
26%	57%	13%	4%	0%

8-2-13. Leucocytes per cub. mm. = 10,000,

I.	II.	III.	IV.	V.
12%	55%	26%	7%	0%

On 16-3-13, a second dose of .3 gramme Salvarsan was given intra-venously, and the picture obtained immediately before the injection was -

16-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
5%	51.5%	36.5%	7%	0%

Subsequently -

18-3-13. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
5%	46%	40%	9%	0%

20-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
4%	45%	41%	10%	0%

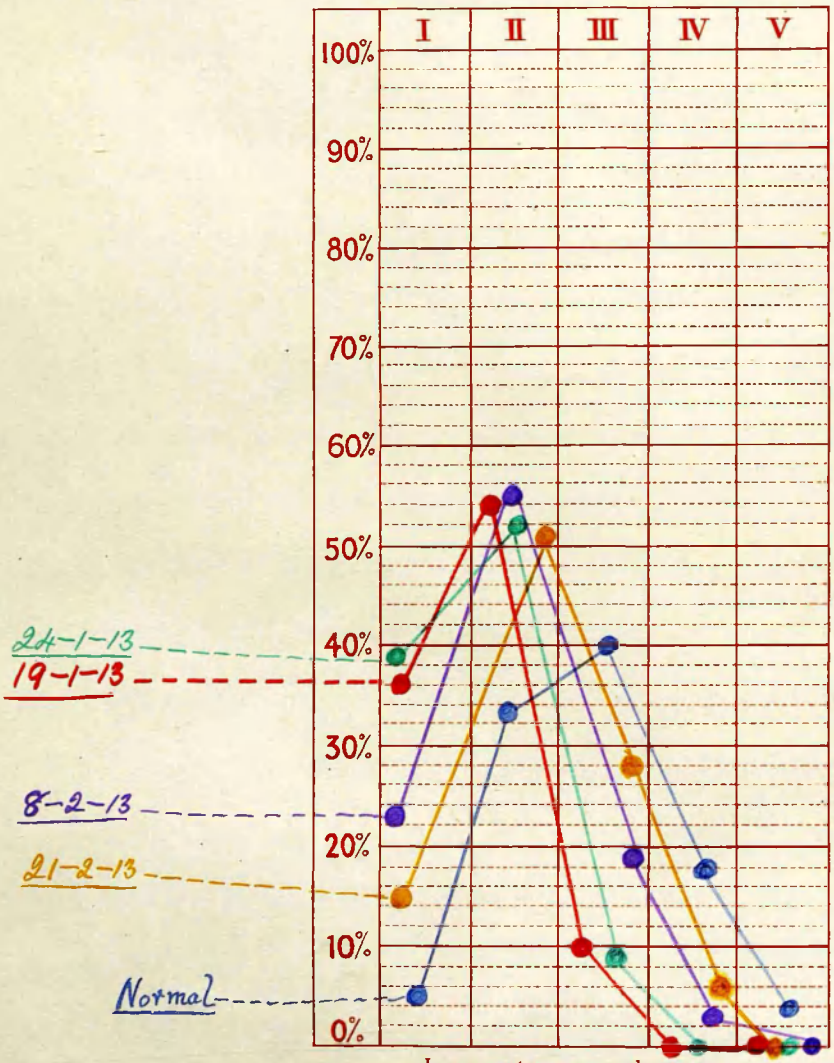
On the afternoon of this day she insisted upon going home, as she felt so well. No sign of condylomata, or sores of any kind whatever, were now present, she had improved in appearance and complexion, and had put on flesh.

It is to be noted that for some time after the first dose of Salvarsan the dislocation of the picture to the left increased. This brings out an interesting point. The solution of Salvarsan for this first dose was made up with normal 0.9% sterile saline solution, prepared from ordinary tap water with physiologically pure sodium chloride. There was a reaction after this dose, evidenced by a slight pyrexia, rigor, nausea, and headache, for a few hours. When the second dose was given, it was dissolved in distilled water, and made up to the required volume with 0.5% sterile saline solution, prepared from distilled water with physiologically pure sodium chloride - as is now recommended by Ehrlich. No reaction occurred, and the pictures showed steady and uninterrupted drifts to the right.

In two other cases in this series I have given the Salvarsan made up as in the first dose of the previous case, simply dissolving the drug in sterile normal saline solution (0.9%) prepared from ordinary tap water, with physiologically pure sodium chloride, and have seen the same reaction occur, with the same temporarily increased

Case Lily Hopplestone No. 348

Age 38 Disease Late Secondary Syphilis



Leucocytes per cub. m.m.

19-1-13 = 8,000.

24-1-13 = 10,600

8-2-13 = 10,000.

21-2-13 = 8,000

dislocatiom of the picture to the left, followed by a drift to the right as the pictures improved.

Case: Lily Hepplestone. Aet. 38.

No.48. Late Secondary Syphilis. This patient had for some time suffered from syphilitic ulceration of the rectum and vagina, a recto-vaginal fistula having occurred. She had had treatment, with the result that the fistula had closed, but a stricture of the rectum had developed. She had gone home for a period, and returned with the stricture tight, and fresh ulceration in the rectum. She also had a rash on the body, eczematous in type, and appeared to be very ill.

She and the preceding case received the Salvarsan on the same days, and the blood counts were made on the same days subsequently.

19-1-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
36%	54%	10%	0%	0%

19-1-13.(same day) .3 gramme Salvarsan given intra-venously, prepared with sterile normal saline made up with tap-water and physiologically pure sodium chloride.

24-1-13. Leucocytes per cub. mm. = 10,600.

I.	II.	III.	IV.	V.
39%	52%	9%	0%	0%

8-2-13. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
23%	55%	19%	3%	0%

She improved remarkably in this period after recovery from the short reaction which occurred after the Salvarsam, which was characterised by rigor, pyrexia, nausea, vomiting and headache. The ulceration in the rectum healed, and graduated bougies were passed daily. She left on 22-2-13 for home, apparently well. The blood-count made on the previous day showed -

21-2-13. Leucocytes = 8,000.

I.	II.	III.	IV.	V.
15%	51%	28%	6%	0%

She had thus improved considerably, both clinically, and from a comparison of her "pictures", as a result of her treatment.

The explanation of the increased dislocation of the picture to the left following the administration of the Salvarsan made up with normal sterile saline (0.9%) prepared from tap-water, with physiologically pure sodium chloride, is not very clear. Certainly, in the other cases, in which the Salvarsan was dissolved in sterile distilled water, and then diluted to the required amount with sterile 0.5% saline solution prepared from distilled water with physiologically pure sodium chloride, no

reaction occurred clinically, and the blood-pictures showed a steady improvement. Whether the explanation of the reaction, is, as some say, hypertonicity of the solution, or according to others, a chemical interaction between impurities in the tap-water, especially the carbonates, and the Salvarsan, is not settled, though it is probable that the cause is the latter of the two.

Whatever be the cause, a comparison of these "reaction" cases with the "non-reaction" cases, cannot fail to impress upon one the delicacy, as it were, of the neutrophile polymorpho-nuclear blood-picture, and how little is necessary to upset its balance, or to alter it when once the balance has been upset.

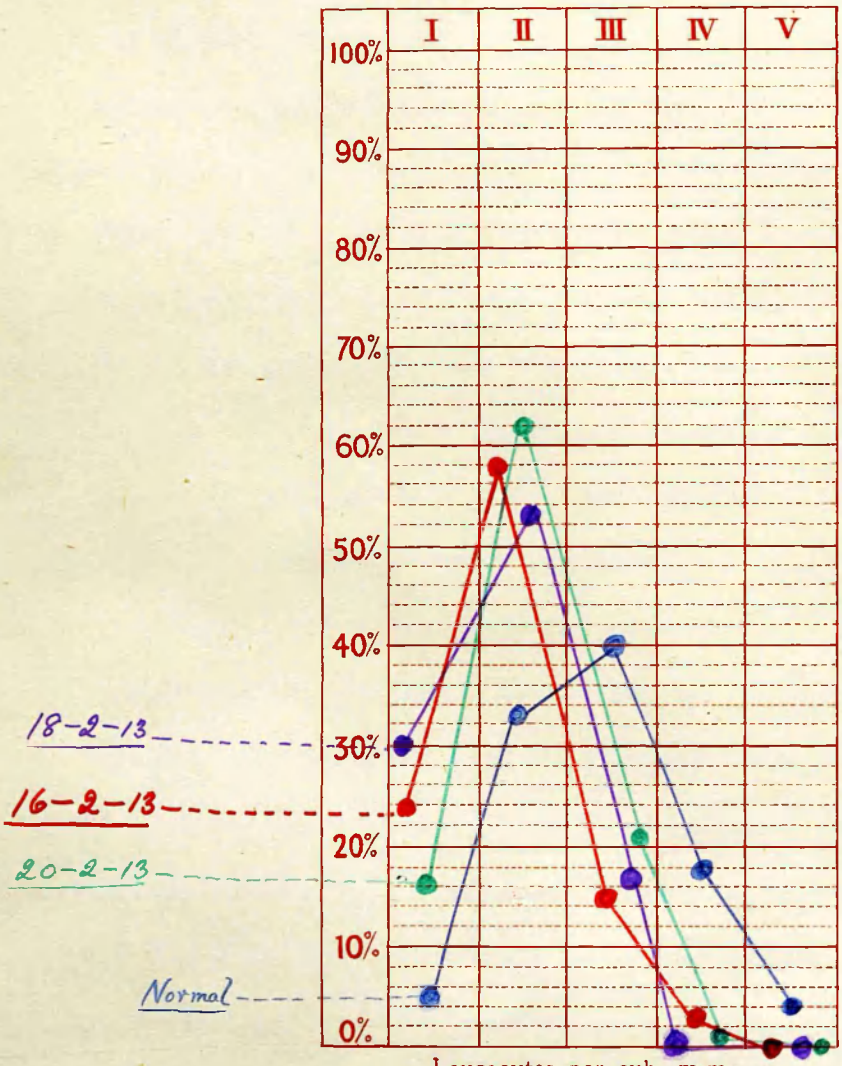
Case: Clara Ibbotson. Aet. 35.

No. 49. Late Secondary Syphilis. This patient had been under treatment for some months for secondary syphilis, and at the time of these observations had numerous small sores on the skin of the trunk, an acne rosacea rash on the face, and a fading secondary rash on the body. On 16-2-13 she received .3 gramme Salvarsan intra-venously, dissolved and diluted with sterile normal saline solution (0.9%) prepared from tap water, with physiologically pure sodium chloride.

The blood was examined immediately before the injection, and the following picture obtained. The succeeding

Case Clara Ibbotson No. 49 (Chart I)

Age 35 Disease Late Secondary Syphilis



Leucocytes per cub. m.m.

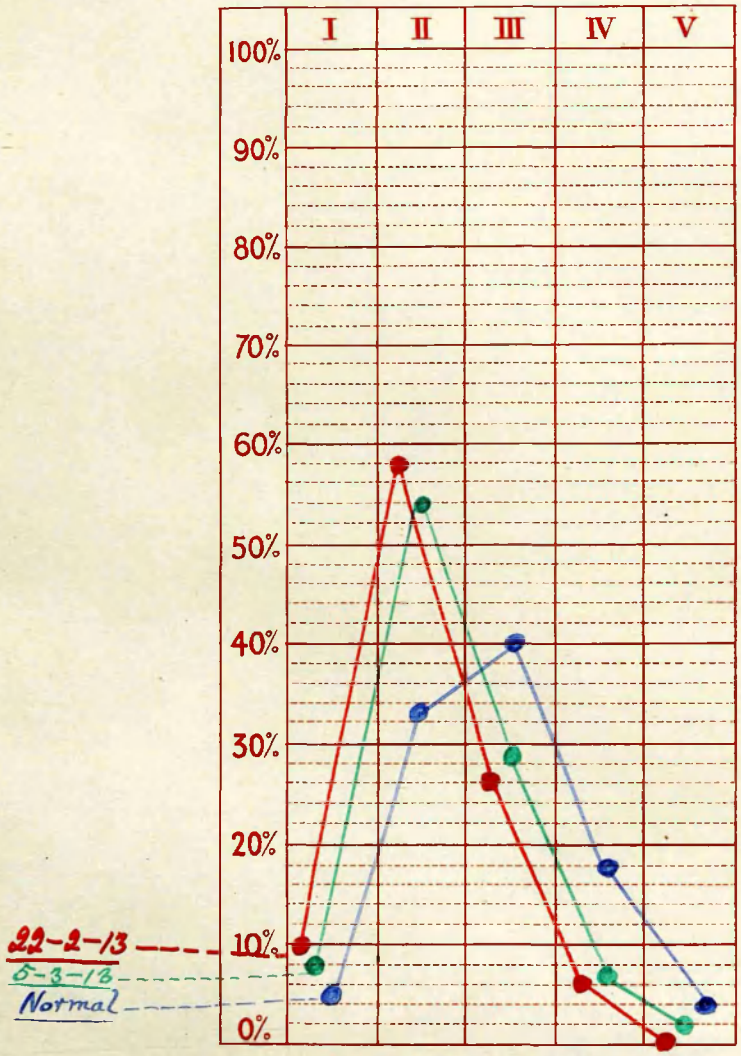
16-2-13 = 8,000.

18-2-13 = 13,000.

20-2-13 = 9,000.

Case Clara Ibbotson No. 49 (Chart II)

Age 35 Disease, Late Secondary Syphilis.



Leucocytes per cub. m.m.

22-2-13 = 8,000

5-3-13 = 4,000

counts are tabulated also.

16-2-13. Before Salvarsan.

Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
24%	58%	15%	3%	0%

.3 gramme Salvarsan intra-venously.

18-2-13. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
30%	53%	17%	0%	0%

20-2-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
16%	62%	21%	1%	0%

22-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
10%	58%	26%	6%	0%

5-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
8%	54%	29%	7%	2%

She went home on 6-3-13, the day following the last count, by which time all the skin conditions had cleared up, she looked and felt better, and had put on flesh.

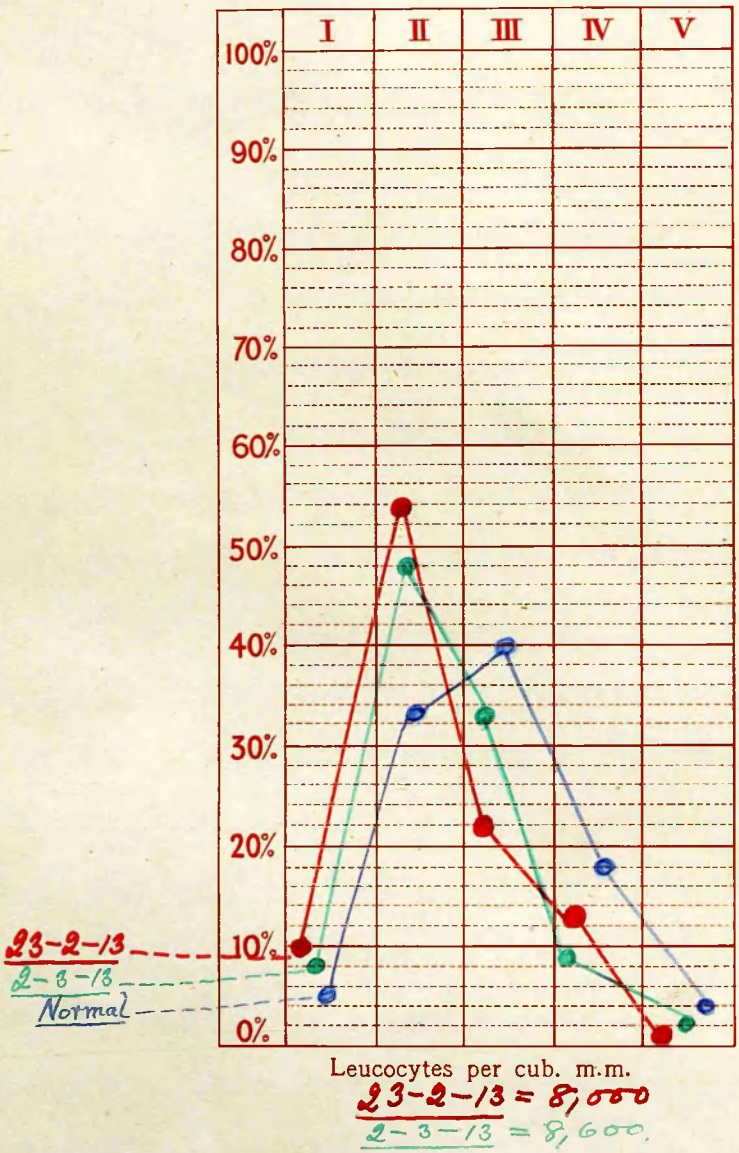
It is to be noted in this case that a slight reaction to the Salvarsan injection occurred, taking the form of a headache, with a rise of temperature, nausea, and a little vomiting. This I attribute to the preparation of the

Salvarsan solution, which I have described, and was accompanied by an increase in the dislocation of the picture to the left. It is seen that before the injection there was some displacement of the picture to the left, due to the syphilis from which she was suffering. During the incidence of the reaction to the Salvarsan, this dislocation increased, but subsided in the course of a few days, being then followed by a steady improvement of the picture as the drift went towards the right. This accurately coincided with the clinical progress of the case, until, on her discharge, when all symptoms had apparently subsided, the picture was practically normal.

Thus again this question crops up. Is this reaction which follows the administration intra-venously of Salvarsan when it is dissolved, and diluted, in sterile normal saline solution (0.9%) prepared from ordinary tap water with physiologically pure sodium chloride, is this reaction due to the injection of a hyper-tonic fluid into the blood, or is it due to an interaction between the Salvarsan and the constituents of the tap water, especially the carbonates? As I have already stated, I believe from the effect on the neutrophile polynuclear picture that it is due to a chemical interaction between the Salvarsan, and the constituents of the tap water, which produces toxic bi-products.

Case Fred. Dewgworth No. 50 (Chart I)

Age 40 Disease Syphilitic Ulcerative Laryngitis



Leucocytes per cub. m.m.

23-2-13 = 8,000

2-3-13 = 8,600.

Associated with the increased dislocation to the left in the count of 18-2-13 (the second count) there is a leucocytosis. The cause of this I am not quite clear upon, unless it is due to a regeneration on the part of the leucocytes to deal with possible toxic bi-products.

Case: Fred. Dungworth. Aet. 40.

No. 50. Syphilitic Ulcerative Laryngitis.

This patient had been under treatment for some months, with Mercury and Potassium Iodide. The improvement, which had at first been rapid, latterly became less and less marked, until scarcely any progress appeared to be made. At this time the parts visible by laryngoscopic examination were congested, and ulceration was present in the epiglottis. The vocal cords were congested and swollen, and patient suffered from husky aphonia, and a frequent, hacking, cough.

On 23-2-13 his blood showed -

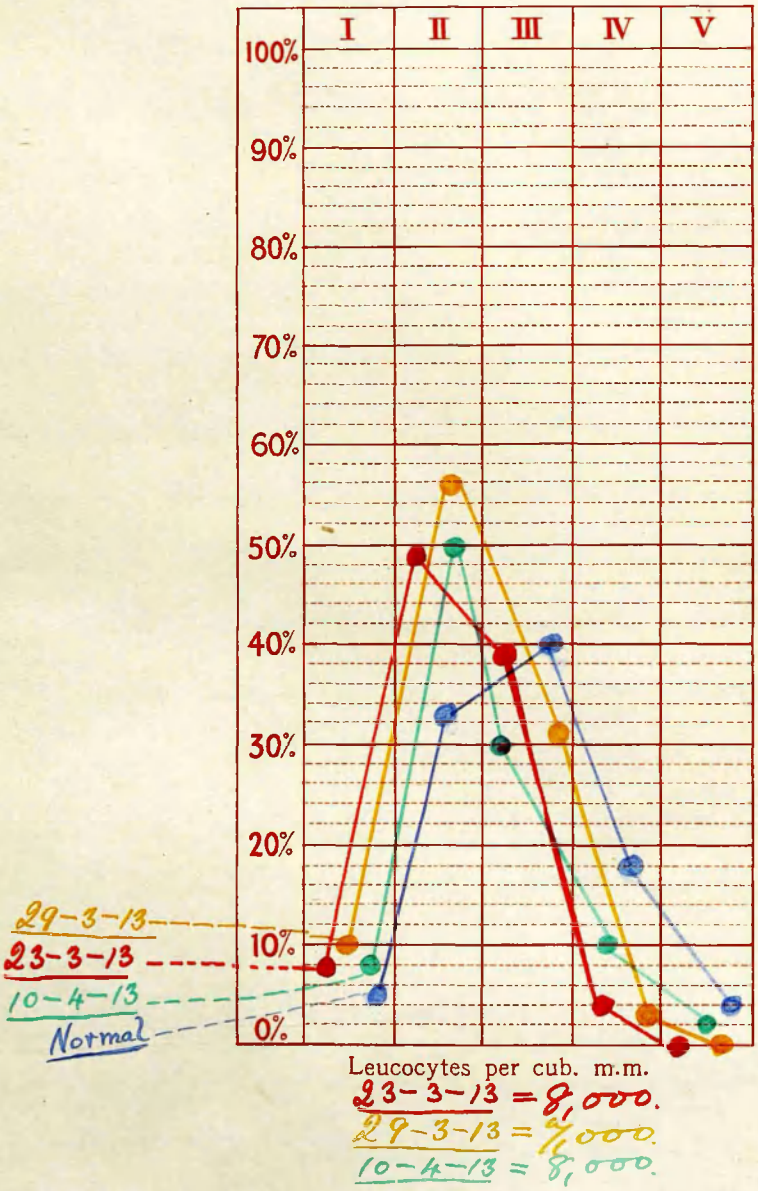
Leucocytes per cub. mm. = 8,000.

I.	II.	III1	IV.	V.
10%	54%	22%	13%	1%

and in the afternoon of the same day he received .3 gramme Salvarsan intra-venously. This dose was dissolved in sterile distilled water, and diluted with sterile 0.5% saline solution prepared fron distilled water, with

Case Fred. Dungworth No. 50 (Chart II)

Age 40 Disease Syphilitic Ulcerative Laryngitis.



physiologically pure sodium chloride, and no reaction of any kind occurred, except that during the injection he complained of smarting in the throat. During the next week he appeared to be somewhat easier, and the congestion of the epiglottis and true cords did not seem to be so marked, when viewed by the laryngoscope.

On 2-3-13, a week after the dose of Salvarsan, his blood showed -

Leucocytes per cub. mm. = 8,600.

I.	II.	III.	IV.	V.
8%	48%	33%	9%	2%

A slight improvement is thus present, coinciding with the improvement in the local and general condition. This clinical improvement, however, did not seem to progress very far, and on 23-3-13 a further blood examination was made, and the following picture obtained -

23-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
8%	49%	39%	4%	0%

and again, 29-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
10%	56%	31%	3%	0%

From a consideration of these two counts it was deemed that the improvement was not being maintained, as a slight but definite and progressively increasing dislocation of

the picture to the left had occurred. His condition clinically did not appear to have become worse, but it certainly had not improved. Accordingly, on the following day, 30-3-13, 0.6 gramme Salvarsan was injected intra-venously, prepared similarly to the first dose.

No reaction followed, and on 10-4-13 the following figures were obtained -

Leucocytes per cub. mm. = 8,000

I.	II.	III.	IV.	V.
8%	50%	30%	10%	2%

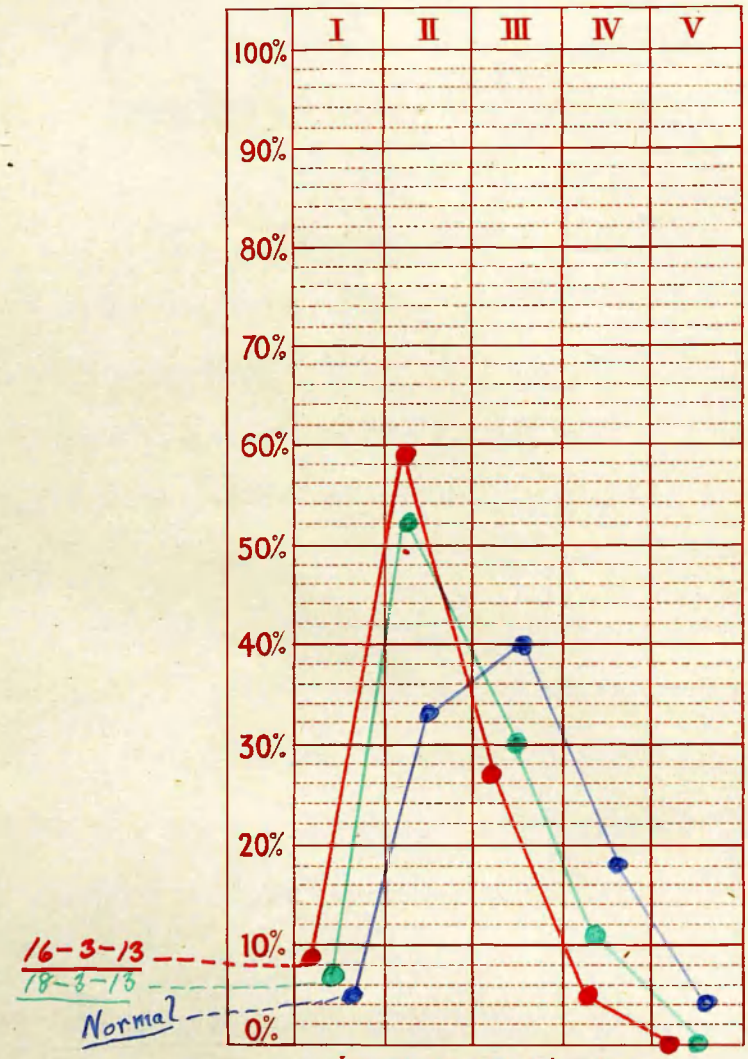
By this time a considerable improvement had occurred in the patient's condition. The cough was easier, he was still hoarse but improving, and no sign of ulceration in the larynx was visible, though the true cords were still swollen.

The improvement in the picture coincided with this visible improvement in a striking manner.

In this case no striking dislocation of the picture was present to begin with, though there was a slight one to the left. It must be remembered, however, that he had been under thorough treatment with mercury and potassium iodide for some months previous to the first count. Also, as the improvement following the use of Salvarsan occurred, it was reflected in the grouping of the picture, thus demonstrating again the delicacy of the

Case Elija Luce No. 51 (Chart T)

Age 20 Disease Secondary Syphilis



Leucocytes per cub. m.m.

16-3-13 = 7000

18-3-13 = 9,000

the neutrophile polymorpho-nuclear leucocytes in responding to stimuli.

I shall now consider 5 other cases of Secondary Syphilis, all of which showed a displacement of the picture to the left, in varying degree, according to the severity of the disease, and all of which showed an improvement, also in varying degree, by the picture drifting to the right, coincident with a corresponding clinical gain.

Case: Eliza Luce. Aet. 20.

No. 51. Secondary Syphilis. This patient had condylomata present, and was otherwise fairly well, except for some vulvar excoriations and discharge.

16-3-13. Leucocytes per cub. mm. = 7,000.

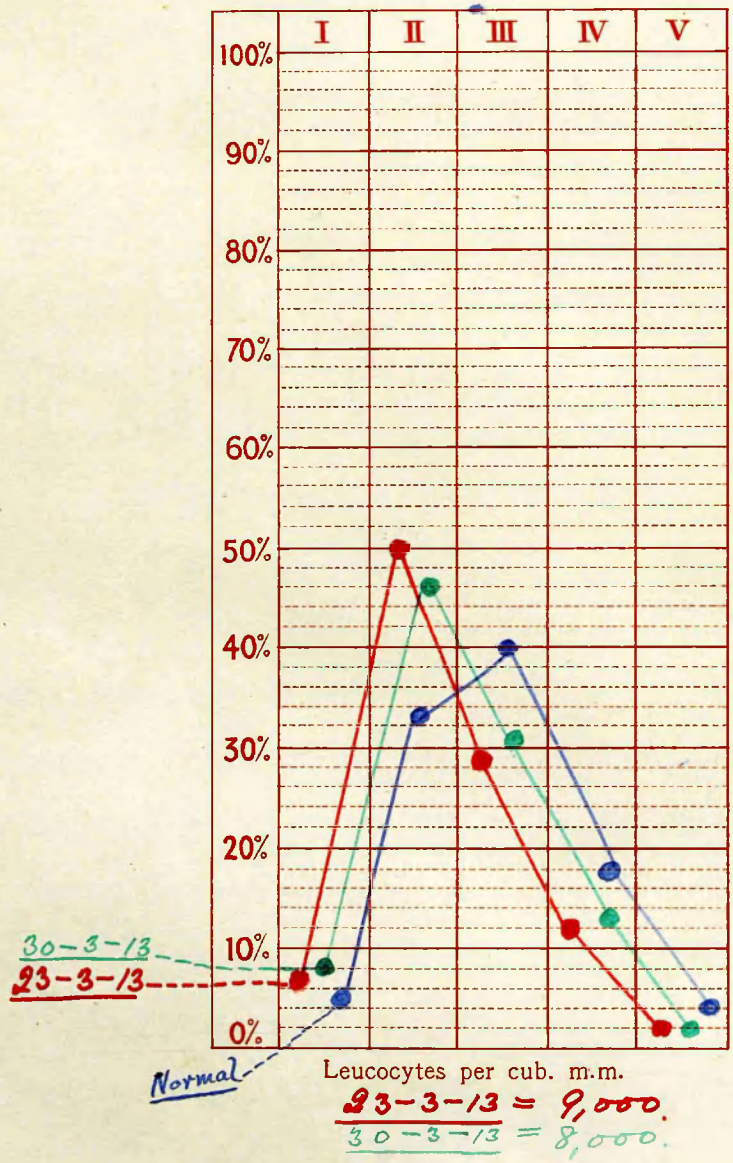
I.	II.	III.	IV.	V.
9%	59%	27%	5%	0%

On the afternoon of the day on which the above count was made, .3 gramme Salvarsan was given intra-venously. (In all the succeeding cases now the solution was prepared by dissolving the Salvarsan in distilled water, and diluting to the required volume with sterile 0.5% saline solution, prepared with distilled water, with physiologically pure sodium chloride, and in none of them did any reaction whatever occur).

Two days later:

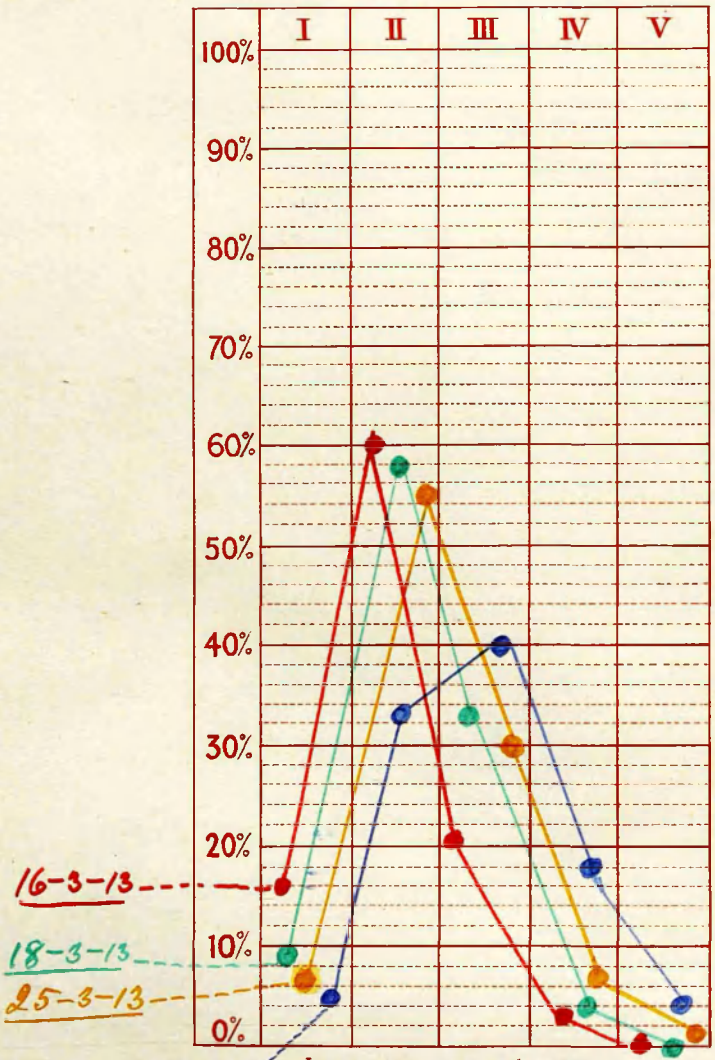
Case Eliza Luce No. 51 (Chart II)

Age 20 Disease Secondary Syphilis.



Case Mary Grayson No. 52

Age 22 Disease Secondary Syphilis.



18-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
7%	52%	30%	11%	0%

23-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
7%	50%	29%	12%	2%

30-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
8%	46%	31%	13%	2%

By this time she was much improved in appearance; the excoriations had healed, and the condylomata were fast disappearing, and almost gone.

Case: Mary Grayson. Aet. 22.

No. 52. Secondary Syphilis. This was a fairly well-marked case of secondary syphilis, with condylomata and some vaginal discharge.

16-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
16%	60%	21%	3%	0%

0.3 gramme Salvarsan was given intra-venously on the above date, after the count had been made. Two days later:

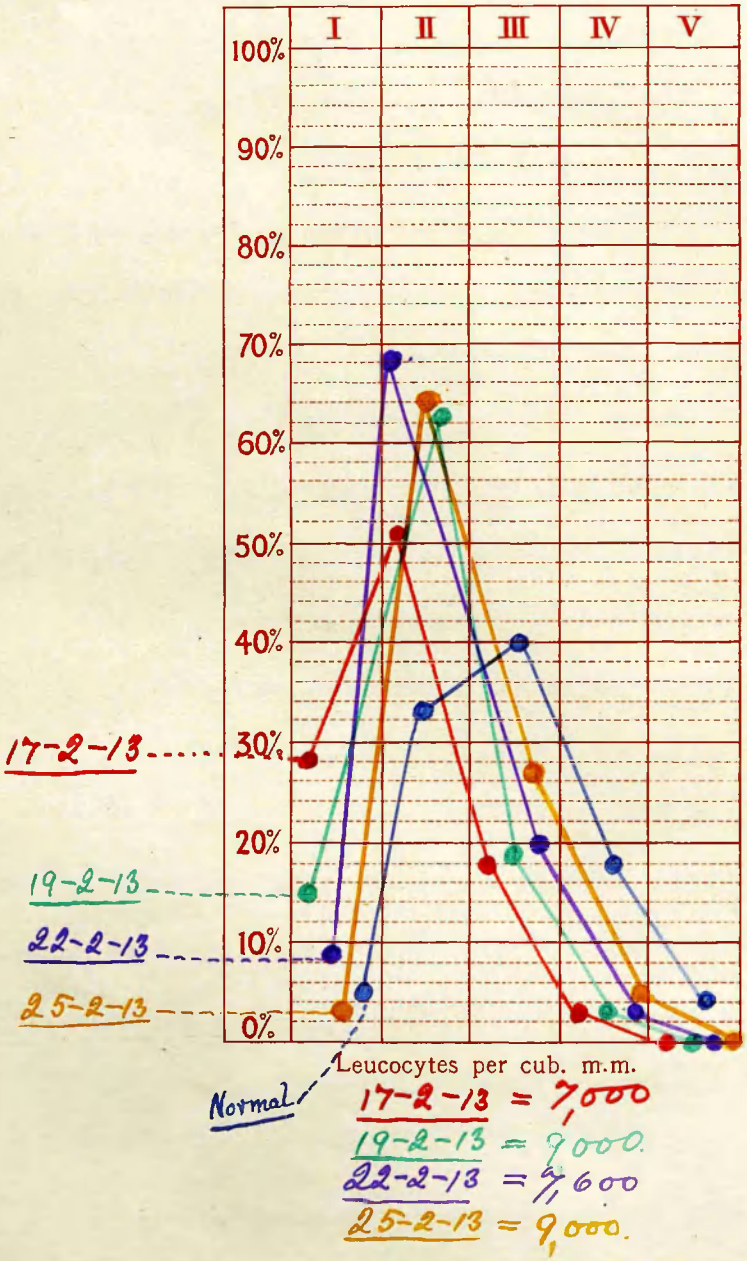
18-3-13. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
9%	58%	33%	4%	0%

25-3-13. Leucocytes per cub. mm. = 9,000.

Case Emma Boothroyd No. 53 (Chart I)

Age 20 Disease Secondary Syphilis.



I.	II.	III.	IV.	V.
7%	55%	30%	7%	1%

By this time the condylomata had almost disappeared, no vaginal discharge was present, and she looked much better.

Case: Emma Boothroyd. Aet. 20.

No. 53. Secondary Syphilis. This case presented the nowadays rather uncommon picture of a typical and well-marked case of rupia. There was a history of previous sore throat, but no rash. The rupia was present all over the body and extremities, and, in places where the crusts had come off, typical ulcers were left behind. Sores were also present on the vulva.

17-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
28%	51%	18%	3%	0%

Immediately after this count was made .3 gramme Salvarsan was given intra-venously, without any subsequent reactions of any kind. Eight days later 25-2-13 only one rupia crust was left, all the other spots being clean, and healthy. On 10-3-13 only scars were present, and she was putting on flesh rapidly, and looked well.

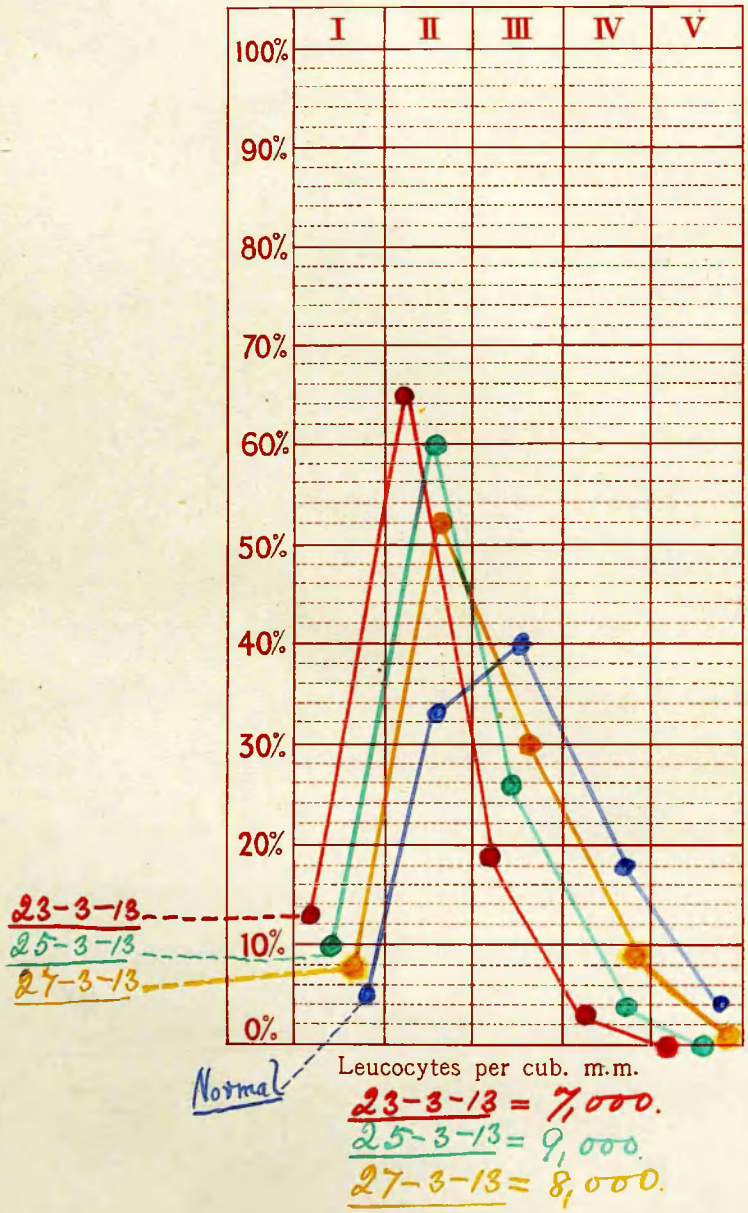
The following shows the details of the counts -

19-2-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
15%	63%	19%	3%	0%

Case Emma Boothroyd No. 53 (Chart II)

Age 20 Disease Secondary Syphilis.



22-2-13. Leucocytes per cub. mm. = 7,600.

I.	II.	III.	IV.	V.
9%	68%	20%	3%	0%

25-2-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
3.5%	64.5%	27%	5%	0%

She continued fairly well, but it was deemed advisable to repeat the dose of Salvrasan (0.3 gramme intravenously) on 23-3-13, in view of the fact that the first dose had not been large, and also that the disease was well-marked. On this day, just before the dose was given, the blood was examined, and the following picture obtained -

23-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
13%	65%	19%	3%	0%

This picture indicated that the effect of the first dose of Salvarsan had passed off, and that the disease was gaining ground again, although to ordinary methods of examination such a conclusion would have been arrived at only by the most careful examination and observation of the case, and perhaps not even then, as the patient looked and felt so much better.

Accordingly, the second dose was given as stated on 23-3-13.

On 25-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
10%	60%	26%	4%	0%

27-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
8%	52%	30%	9%	1%

On this last date she felt so well that she insisted upon going home, promising to continue treatment by mercury at home for a year.

This case is of interest in showing -

1. The comparatively severe dislocation of the picture to the left in a case of syphilis.
2. Also, it shows the improvement under Salvarsan treatment, as evidenced by the drift of the picture to the right, and also clinically.
3. It instances a case where a relapse was detected by the blood-picture before it was definitely diagnosed clinically.
4. It shows the rapid improvement after the relapse when a second dose of Salvarsan had been given.

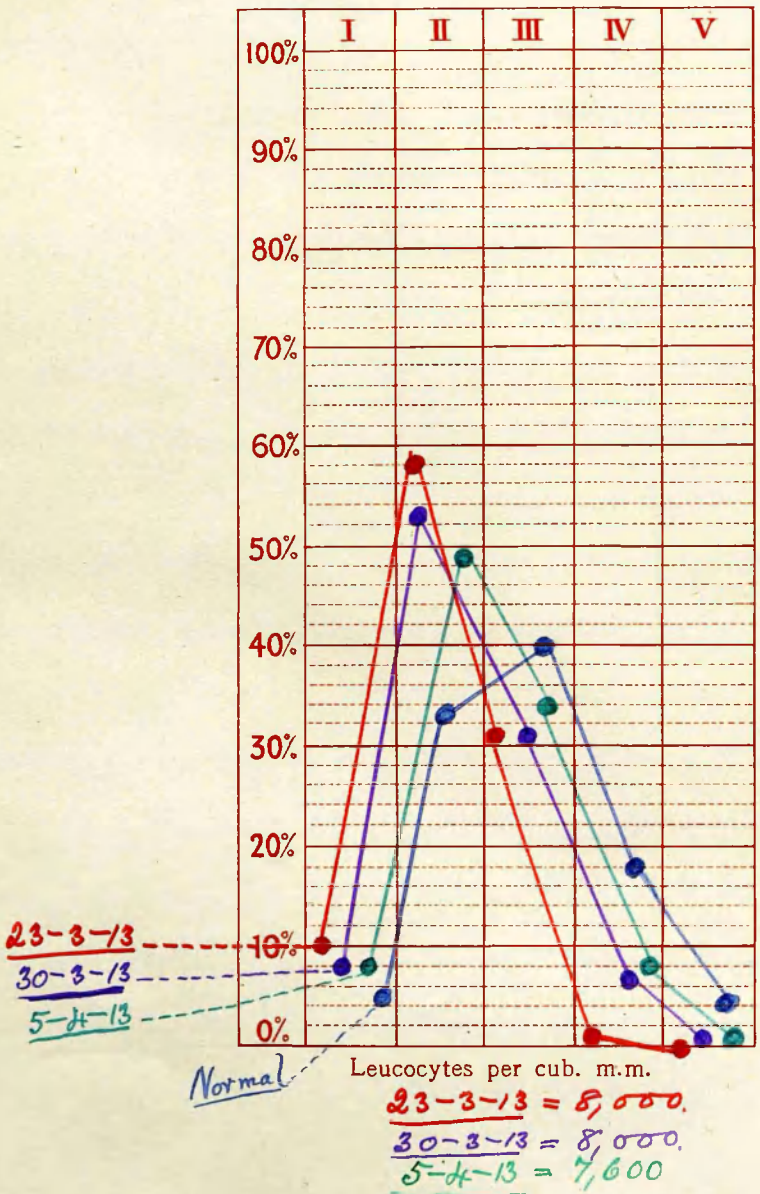
Case: Ellen Moye. Aet. 23.

No. 54. Secondary Syphilis. This case had been well treated by mercury before coming under observation, but a fading rash was still present, with slight injection of the throat.

23-3-13. Leucocutes per cub. mm. = 8,000.

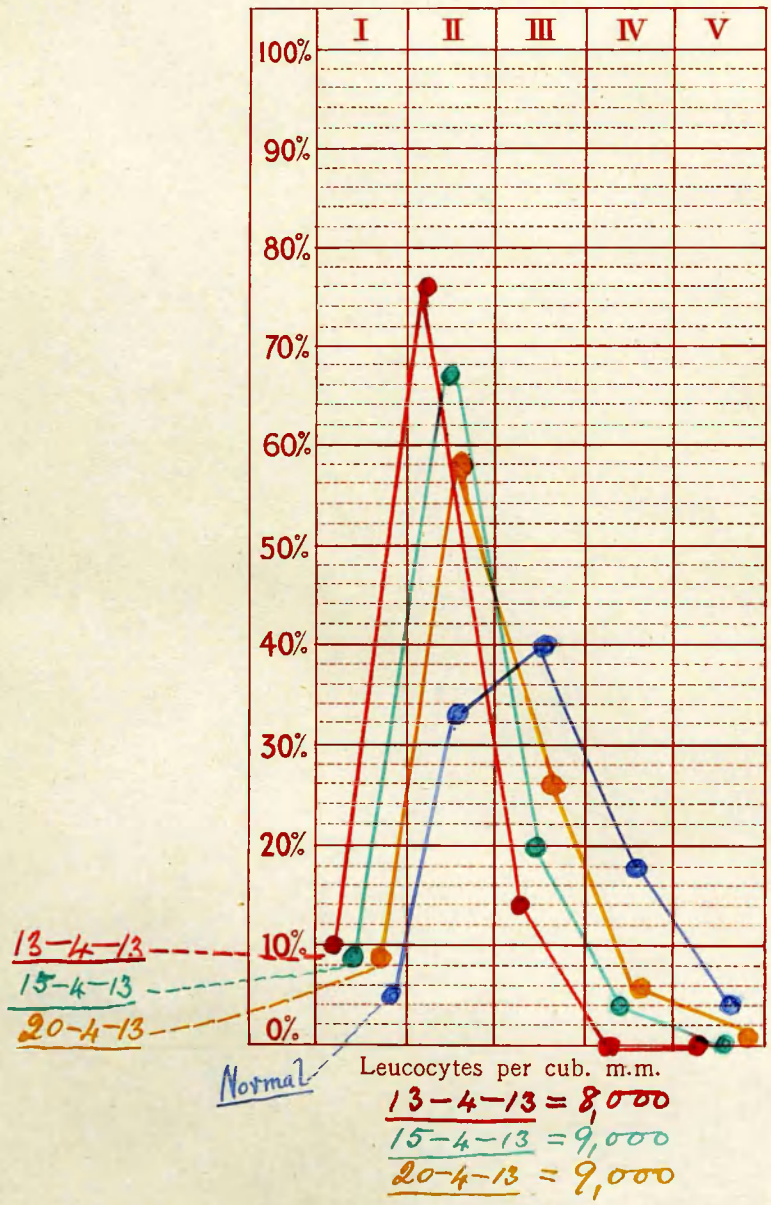
Case Ellen Moye No. 54

Age 23 Disease Secondary Syphilis



Case Eva Fogg No. 55

Age 20 Disease Secondary Syphilis.



I.	II.	III.	IV.	V.
10%	58%	31%	1%	0%

Salvarsan 0.3 gramme given intra-venously immediately this count had been made.

30-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
8%	53%	31%	7%	1%

5-4-13. Leucocytes per cub. mm. = 7600

I.	II.	III.	IV.	V.
8%	49%	34%	8%	1%

The rash had disappeared, and patient appeared much better.

Case: Eva Fogg. Aet. 20.

No. 55. Secondary Syphilis. Condylomata were present, but were mild. She had had treatment previously by mercury.

13-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
10%	76%	14%	0%	0%

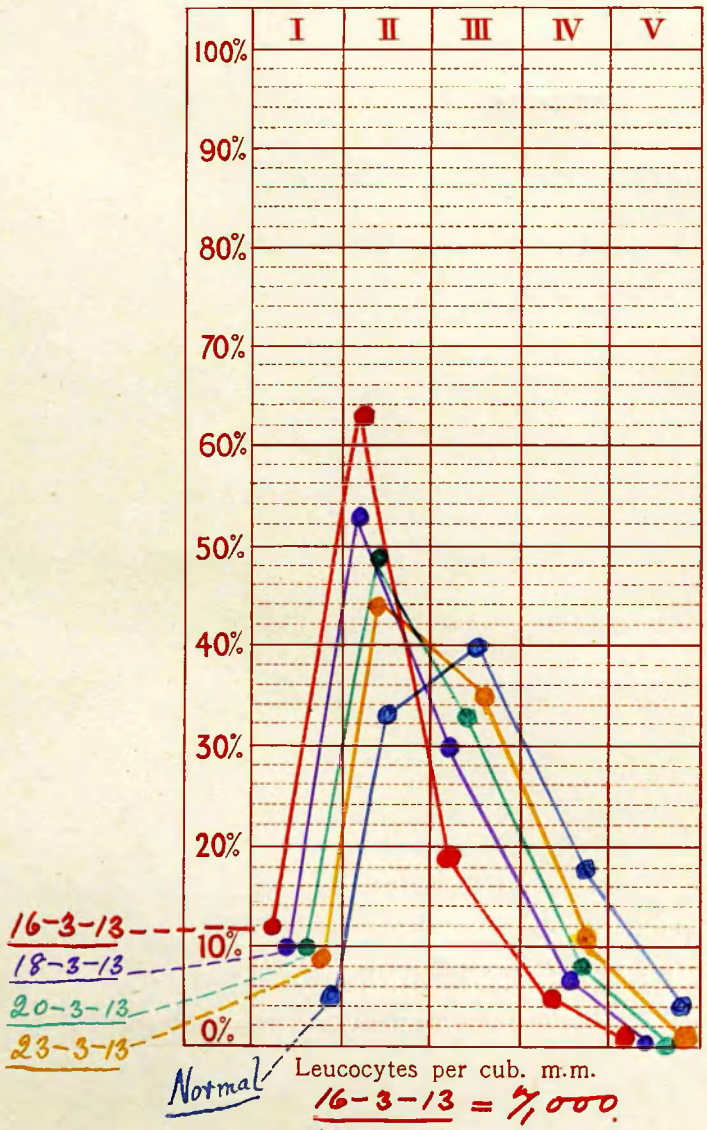
Salvarsan 0.3 gramme given intra-venously, immediately after this count was made.

15-4-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
9%	67%	20%	4%	0%

Case Margaret Gittens No. 56.

Age 60 Disease Syphilitic Ulcer of Leg



Leucocytes per cub. m.m. = 9,000

20-4-13.	I.	II.	III.	IV.	V.
	9%	58%	26%	6%	1%

The improvement in these pictures, though slight, coincided with an improvement in patient's condition. The condylomata were practically non-existent at the time of the last count. She looked and felt better, also.

I shall now consider a case of Tertiary Syphilis.

Case: Margaret Gittens. Aet. 60.

No. 56. Syphilitic ulcer of leg. This was a very foul and chronic ulcer of many years' duration.

16-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
12%	63%	19%	5%	1%

Immediately after this count 0.3 gramme Salvarsan was given intra-venously, and the ulcer improved remarkably.

18-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.,	V.
10%	53%	30%	7%	0%

20-3-13. Leucocytes per cub. mm. = 8,000.

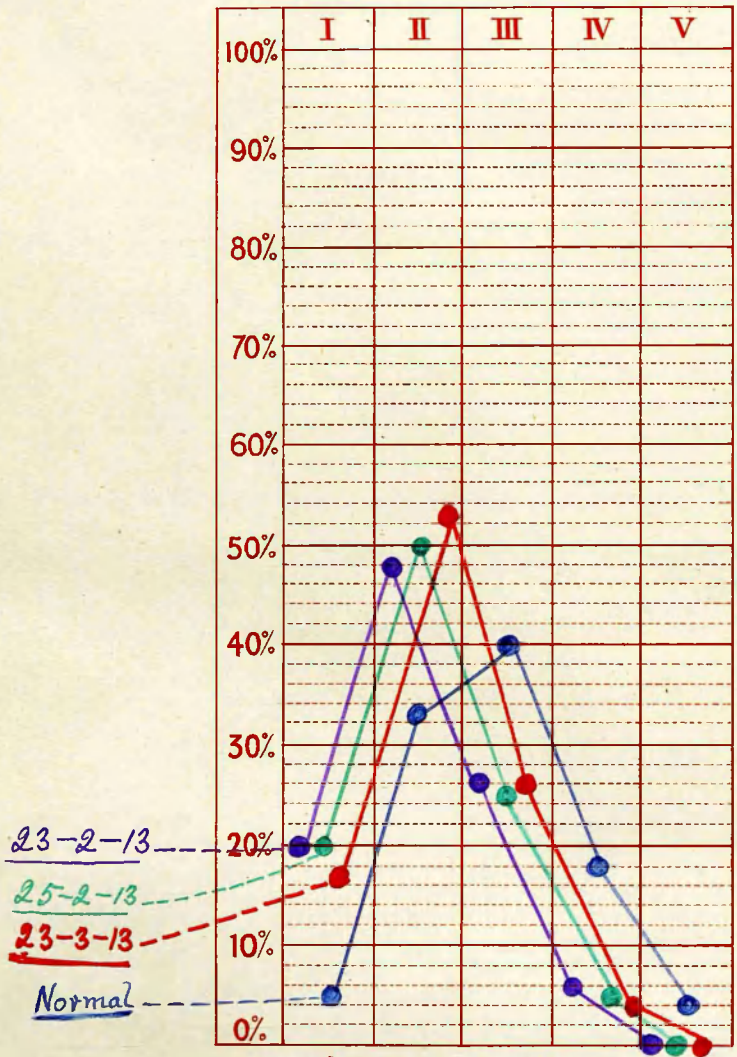
I.	II.	III.	IV.	V.
10%	49%	33%	8%	0%

23-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
9%	44%	35%	11%	1%

Case Thomas West No. 57

Age 42 Disease Locomotor Ataxia.



Leucocytes per cub. m.m.

23-2-13 = 6,000.

25-2-13 = 8,000

23-3-13 = 7,000.

The next case is one of Parasyphilitic Disease, viz. Locomotor Ataxia. In this case a definite history of antecedent syphilis was present. He was a weedy man, with very marked girdle pains, and typical symptoms of the disease.

Case: Thos. West. Aet. 42.

No. 57. Locomotor Ataxia.

23-2-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
20%	48%	26%	6%	0%

Immediately after this count was made a dose of 0.3 gramme Salvarsan was given intra-venously. No reaction occurred, but no improvement in the symptoms of this case followed, though his general health was a little improved.

25-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
20%	50%	25%	5%	0%

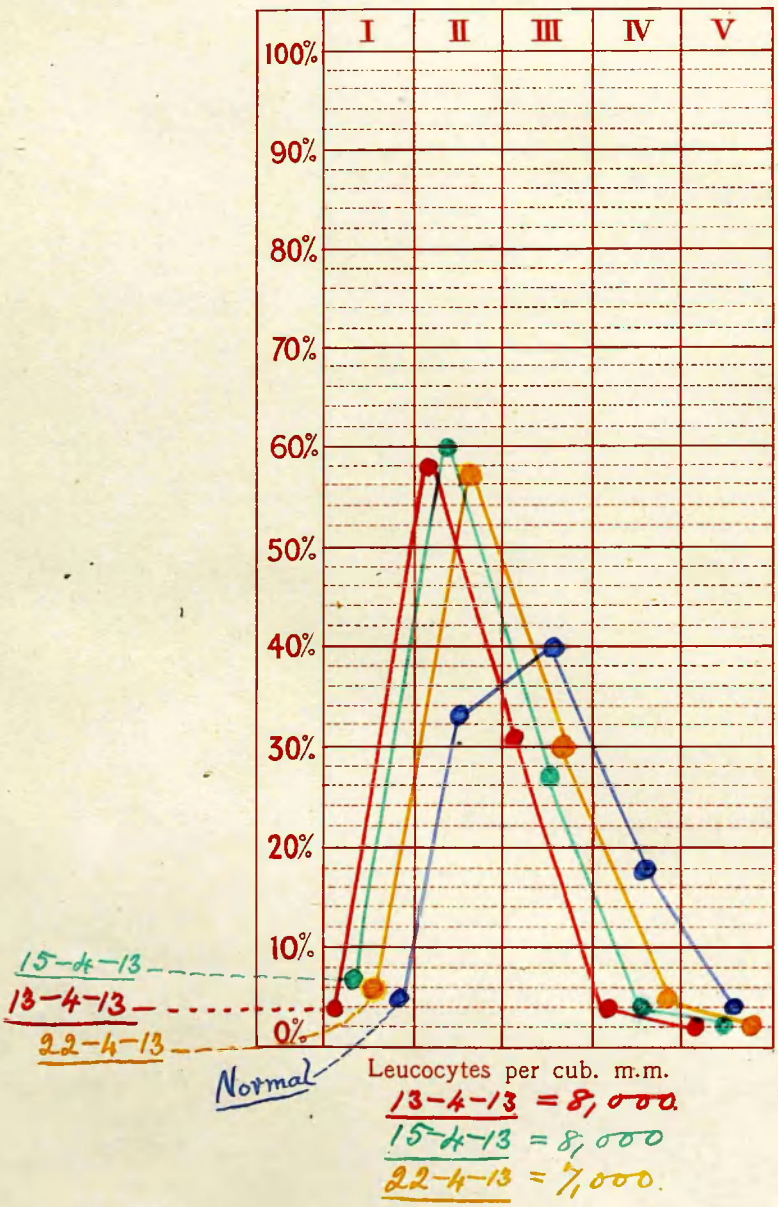
23-3-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
17%	53%	26%	4%	0%

Thus, a full month after his dose of Salvarsan, the only improvement in his case was in his general appearance and nutrition, for he looked a little better. Absolutely no amelioration of his nervous symptoms took place, and this condition of affairs was borne out by the examination

Case Alice Roe No. 58

Age 34 Disease Syphilitic Psoriasis.



Leucocytes per cub. m.m.

13-4-13 = 8,000

15-4-13 = 8,000

22-4-13 = 7,000.

of his blood, where, considering all the 5 classes of the picture, practically no change had occurred.

The last case of my series of Syphilitic cases is one of Syphilitic Psoriasis.

Case: Alice Roe. Aet. 34.

No. 58. Syphilitic Psoriasis.

13-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
4%	58%	32%	4%	2%

Immediately after this count was made, 0.3 gramme Salvarsan was given intra-venously.

The following are the subsequent counts -

15-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
7%	60%	27%	4%	2%

22-4-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
6%	57%	30%	5%	2%

This was a very well-marked case of Psoriasis, with a very definite history of previous syphilis.

The psoriatic patches, which had been very extensive and somewhat moist, had, by the date of the last count, become quite dry, and the scales were diminishing in quantity daily. All her counts do not show a great departure from normal, or a marked difference from each

other, but what difference there is, is progressive in the direction of improvement, though this improvement is not in proportion to the marked clinical improvement evident.

To review, then, briefly, the findings obtained from this series of cases of Syphilis.

1. In cases of active syphilis there is a dislocation of the picture, and this dislocation is always to the left.

No case of syphilis has come under my observation presenting such a marked dislocation as in some of the cases of pulmonary tuberculosis which I have already described. The reason of this is, obviously, that as syphilis is much more amenable to treatment than pulmonary tuberculosis, it is extremely unusual nowadays to find a case so near to death as were some of the cases of pulmonary tuberculosis.

If an examination of the blood could be made in a case actually dying from active syphilis, I am of opinion that a very marked dislocation to the left would be found.

2. According to the severity of the attack the findings are more uniform, and the improvements, or relapses, as the case may be, occur with greater celerity and are more striking, in cases of what may be termed actively

advancing disease than in cases where advance is slow or apparently arrested.

That is to say, where a free blood infection is present, the alterations in the pictures from normal are more striking than in cases where the organisms are apparently walled off from the general circulation.

3. The improvement in the picture coinciding with the improvement in the patient is very striking. Conversely, where no appreciable improvement has occurred in the patient's condition, no appreciable alteration in the picture is evident, as in the case of locomotor ataxia treated by Salvarsan.

4. The remarkable changes in the pictures following the administration of Salvarsan cannot fail to attract notice.

These changes occur quickly, and coincide with the changes in the patient's clinical condition.

Thus, improvement of the picture has been looked for when the patient has improved, and deterioration when the patient has had a relapse, and conversely.

In no case, on comparing the blood picture with the clinical picture, has an erroneous finding been obtained.

In at least one case, (No. 53) a relapse was detected by the blood-picture before it was evident clinically

and therefore the value of the method as an index for treatment, as well as for prognosis, is established.

5. One cannot conclude this review of the cases of Syphilis without again drawing attention to the different effects upon the pictures produced by the intravenous injection of Salvarsan made up into a solution by two different methods. In one, the Salvarsan was dissolved in sterile normal (0.9%) saline solution prepared from ordinary tap water, with physiologically pure sodium chloride, and diluted to the required quantity with sterile normal saline solution.

In three instances this was done, and, each time, a "reaction" occurred. This was represented usually by a rigor, a rise of temperature, headache, nausea and vomiting. In each case, this reaction passed off within 24 hours, and an increase in the dislocation to the left of the pictures occurred for a day or two, before a larger drift to the right occurred, making thus eventually a better picture than the original, and demonstrating the beneficial action of the Salvarsan upon the individual.

In all the other cases the Salvarsan solution was made up as is now recommended by Ehrlich, viz.,

The Salvarsan is dissolved in a little distilled water, and then diluted up to the required volume with

0.5% sterile saline solution itself prepared from distilled water with physiologically pure sodium chloride.

In none of these cases did any "reaction" occur, and in all of them the pictures showed, by a drift to the right an immediate improvement in the patient's condition. (How long this improvement lasts, is beside the point, being a matter of dosage, as has been demonstrated in the case wherein a relapse occurred after the improvement effected by the first dose had passed off, and where a second improvement followed the administration of a second dose. These facts are clearly evidenced by a study of the various counts in the case.)

What is the cause, then, of this clinical reaction accompanied by the temporary deterioration of the blood-picture, following the injection of Salvarsan prepared in the first method? As I have previously stated, two views are held, one that a hyper-tonic solution is produced by the addition of the Salvarsan to the normal saline. Another is that it is due to a chemical interaction between the Salvarsan and the constituents of the tap water, especially the carbonates, producing toxic bi-products.

By following Ehrlich's later method, both these contingencies are met. Thus, which of the two is the real

cause is not quite clear, possibly both play a part. From the study of the effects of other toxins on the blood-picture, and as the "reaction" produces an alteration in a similar direction, viz., to the left, I am inclined to think that the toxic theory has the more weight behind it.

The point on which I should like to lay emphasis at present, is this. During this "reaction" which occurred in several cases, the patients were not so well as before it happened, and after it subsided. This "reaction" was never very severe, nor of long duration, and yet its effects are clearly reflected in the blood-pictures of the cases in question.

Thus, again, the delicacy of the balance of the "picture" is demonstrated, also the delicacy of its response to certain stimuli.

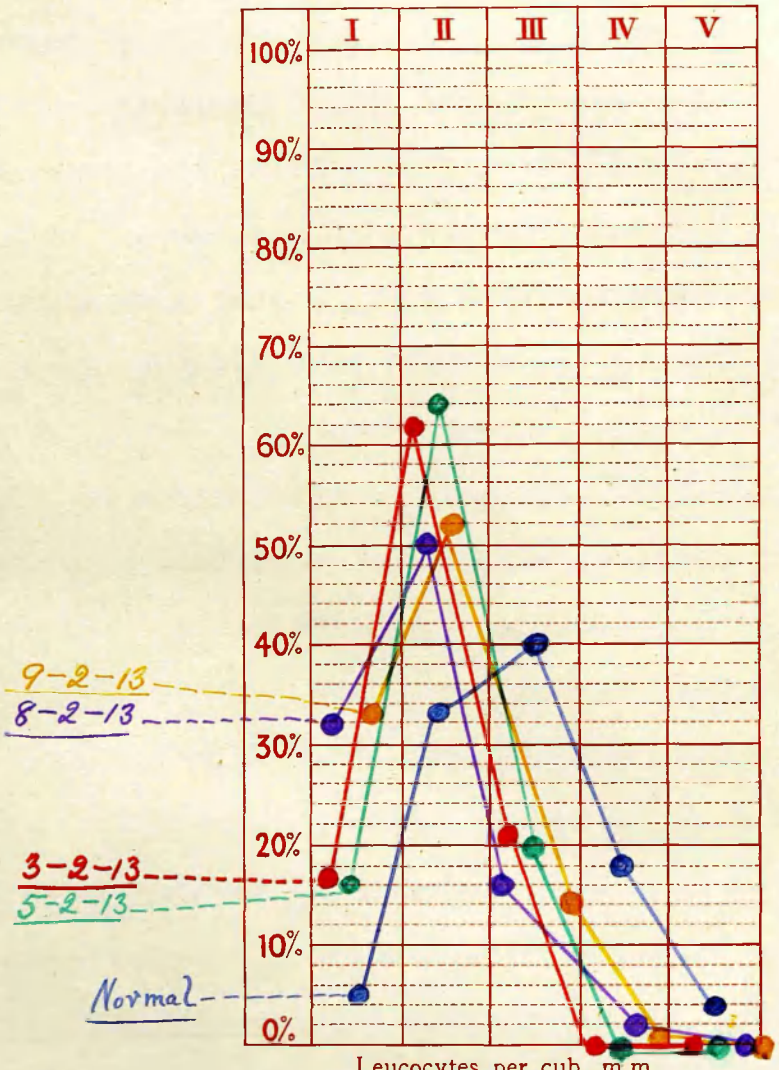
Lobar Pneumonia.

I have made observations in 8 cases of Lobar Pneumonia of which 4 recovered, and 4 succumbed.

The neutrophile blood-picture is markedly altered in this disease, and the improvement, or deterioration, of the pictures in the various cases, coincident with the favourable or unfavourable progress of the patient, is evident from a study of the counts.

Case Thomas Wright No. 59 (Chart I)

Age 32 Disease Lobar Pneumonia.



Leucocytes per cub. m.m.

3-2-13 = 18,000.

5-2-13 = 21,000.

8-2-13 = 17,000.

9-2-13 = 16,000.

Those cases which recovered will be considered first.

Case: Thomas Wright. Aet. 32.

No. 59. Lobar Pneumonia. This patient came under observation on 3-2-13 with a patch of pneumonic consolidation in the left lower lobe, in the axillary line, and with a history of 36 hours illness. He was a strong, healthy-looking man, excited, and with a temperature of 103°F. Nothing abnormal was present in any other system. The temperature remained between 102° and 103° and he was comfortable till 7-2-13, when his left upper lobe solidified completely, the consolidation of the lower lobe extending also till the upper half was solid. He was delirious and required restraint. On 9-2-13 a crisis occurred, and from then onward his recovery was uninterrupted. The various pictures are appended -

3-2-13. Leucocytes per cub. mm. = 18,000.

I.	II.	III.	IV.	V.
17%	62%	21%	0%	0%

5-2-13. Leucocytes per cub. mm. = 21,000.

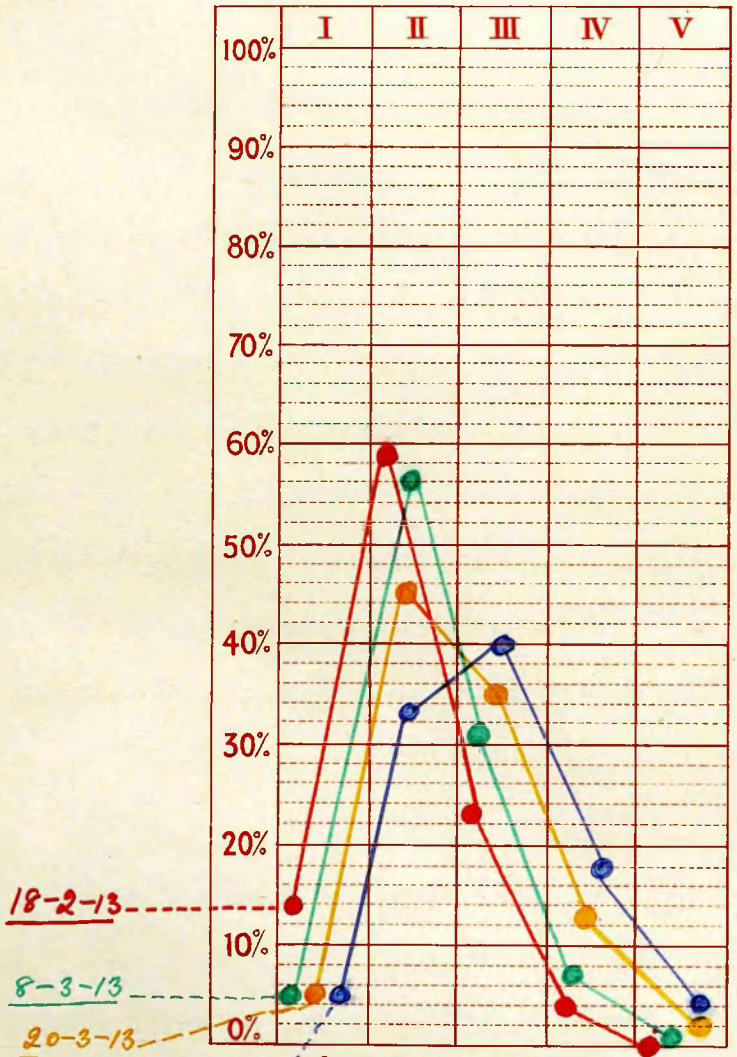
I.	II.	III.	IV.	V.
16%	64%	20%	0%	0%

8-2-13. Leucocytes per cub. mm. = 17,000.

I.	II.	III.	IV.	V.
32%	50%	16%	2%	0%

Case Thomas Wright No. 59 (Chart II)

Age 32 Disease Lobar Pneumonia



18-2-13 = 10,000.

8-3-13 = 8,000

20-3-13 = 9,000.

Crisis. 9-2-13. Leucocytes per cub. mm. = 16,000.

I.	II.	III.	IV.	V.
33%	52%	14%	1%	0%

18-2-13. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
14%	59%	23%	4%	0%

8-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
5%	56%	31%	7%	1%

20-3-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
5%	45%	35%	13%	2%

This case is interesting in showing that a dislocation to the left had occurred, increasing until the crisis, after which a steady and uninterrupted drift to the right took place, until the picture became normal.

The dislocation was never extreme, but at no time did the patient look as though he would die, and therefore the picture may be held to coincide with the clinical facts.

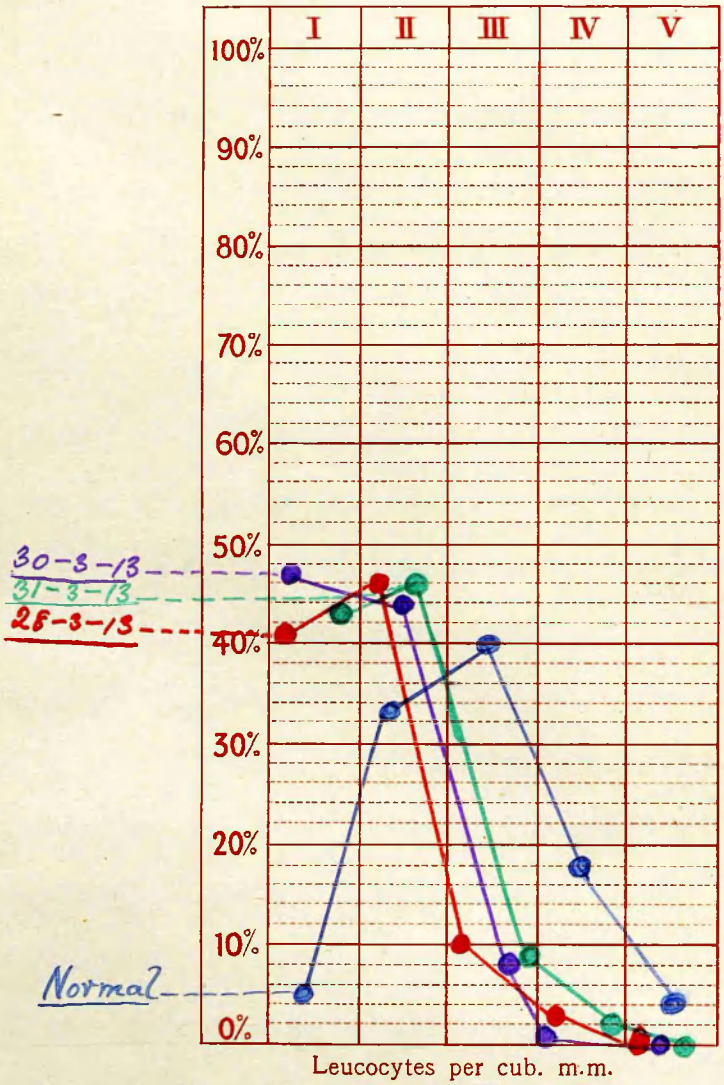
Case: Frederick Lupton. Aet. 3 years.

No. 60. Lobar Pneumonia. Admitted on 28-3-13, with a lobar pneumonia of the left lower lobe, and pneumonic consolidation at the apex of the right upper lobe, of 3 days' duration.

28-3-13. Leucocytes per cub. mm. = 19,000.

Case Frederick Lupton No. 60. (Chart I)

Age 3 years Disease Lobar Pneumonia



Leucocytes per cub. m.m.

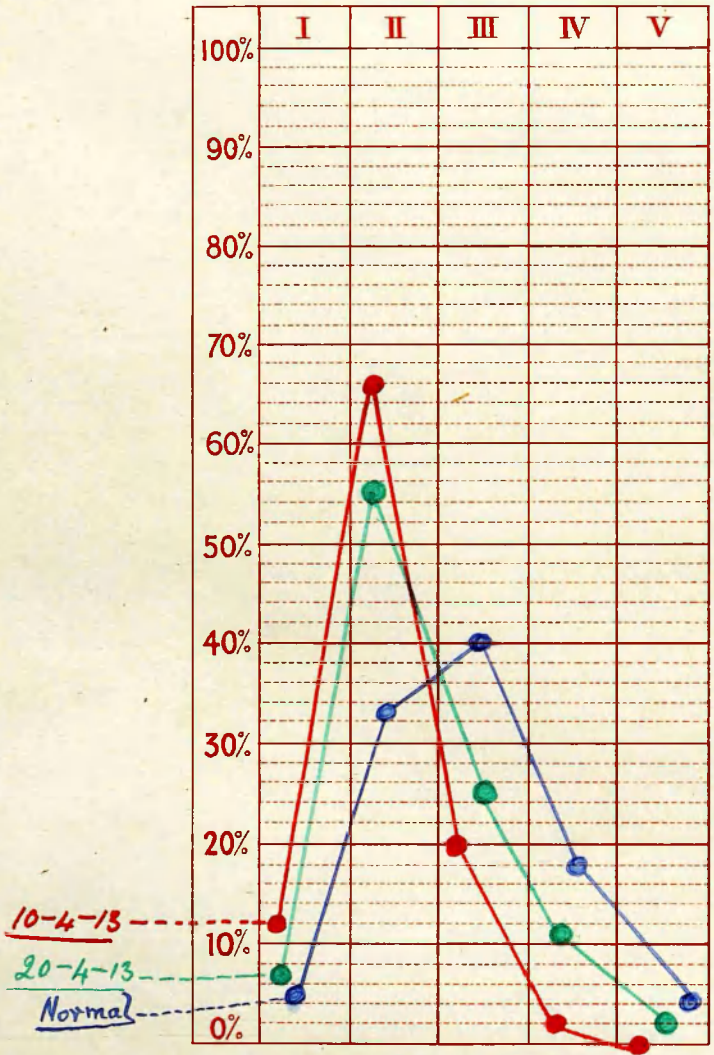
25-3-13 = 19,000.

30-3-13 = 22,000

31-3-13 = 21,000.

Case Frederick Lupton No. 60 (Chart II)

Age 3 years Disease Lobar Pneumonia



Leucocytes per cub. m.m.

10-4-13 = 9,000

20-4-13 = 9,000

I.	II.	III.	IV.	V.
41%	46%	10%	3%	0%

The temperature remained pyrexial, between 101° and 103°, but no complication, or extension, occurred.

30-3-13. Leucocytes per cub. mm. = 22,000.

I.	II.	III.	IV.	V.
47%	44%	8%	1%	0%

31-3-13. Leucocytes per cub. mm. = 21,000.

I.	II.	III.	IV.	V.
43%	46%	9%	2%	0%

On 31-3-13 the count was made in the morning, and in the afternoon, a fall in the temperature, pulse, and respirations, occurred, which proved to be the crisis. Thus, a definite improvement in the picture had occurred in this case before any signs were present of an approaching crisis. Considering the case afterwards, this improvement in the picture may be taken as an indication that the crisis was near.

Recovery was rapid and uninterrupted, and the furthur counts showed.

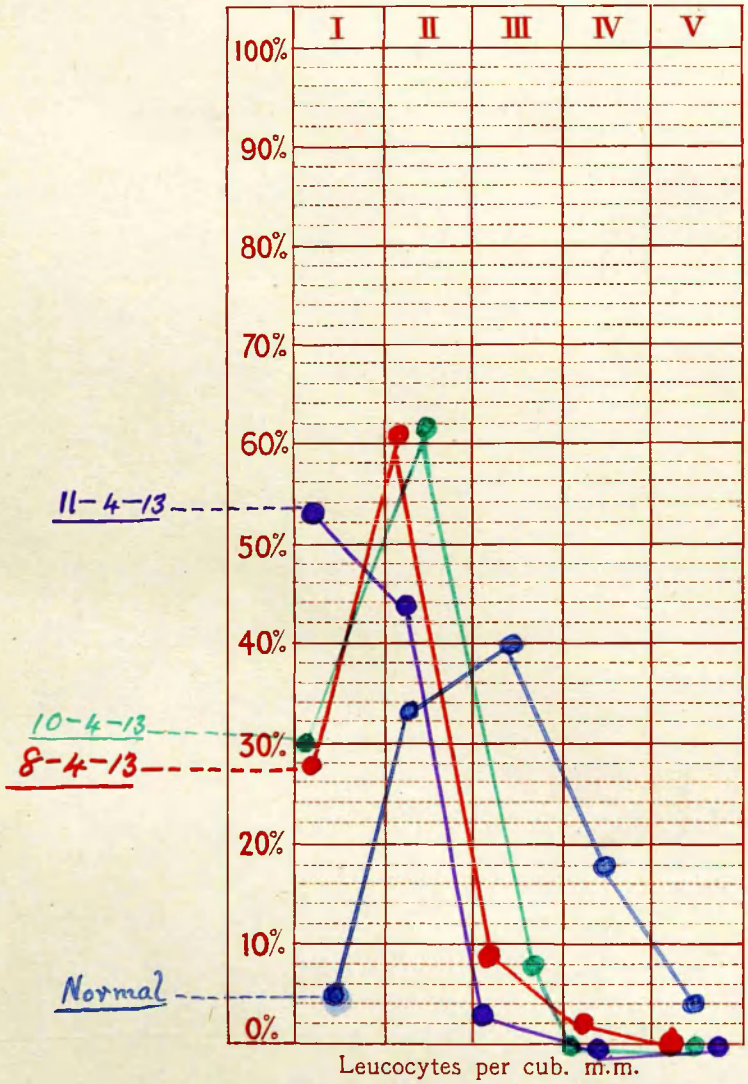
10-4-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
12%	66%	20%	2%	0%

20-4-13. Leucocytes per cub. mm. = 9,000.

Case Joseph Lowther No. 61 (Chart I.)

Age 9 years. Disease Lobar Pneumonia.



Leucocytes per cub. m.m.

8-4-13 = 13,000.

10-4-13 = 14,000.

11-4-13 = 18,000.

I.	II.	III.	IV.	V.
7%	55%	25%	11%	2%

Case: Joseph Lowther. Aet 9.

No. 61. Lobar Pneumonia. This boy came under observation on 7-4-13 with a history of illness of 36 hours' duration. At this time a pneumonic consolidation was present over the limits of the right upper lobe. No other system was affected. The temperature ranged between 102° and 103° and his condition was quite satisfactory. On the morning of 11-4-13 he was not so well, and the right lower lobe was found to be the seat of an extension of the pneumonic consolidation, involving the whole lobe. He improved somewhat during the day, and during the next afternoon the crisis began, and was complete in 12 hours. Thereafter, recovery was rapid and uninterrupted.

The following series of counts shows how accurately the clinical happenings were reflected in the blood-pictures -

8-4-13. Leucocytes per cub. mm. = 13,000.

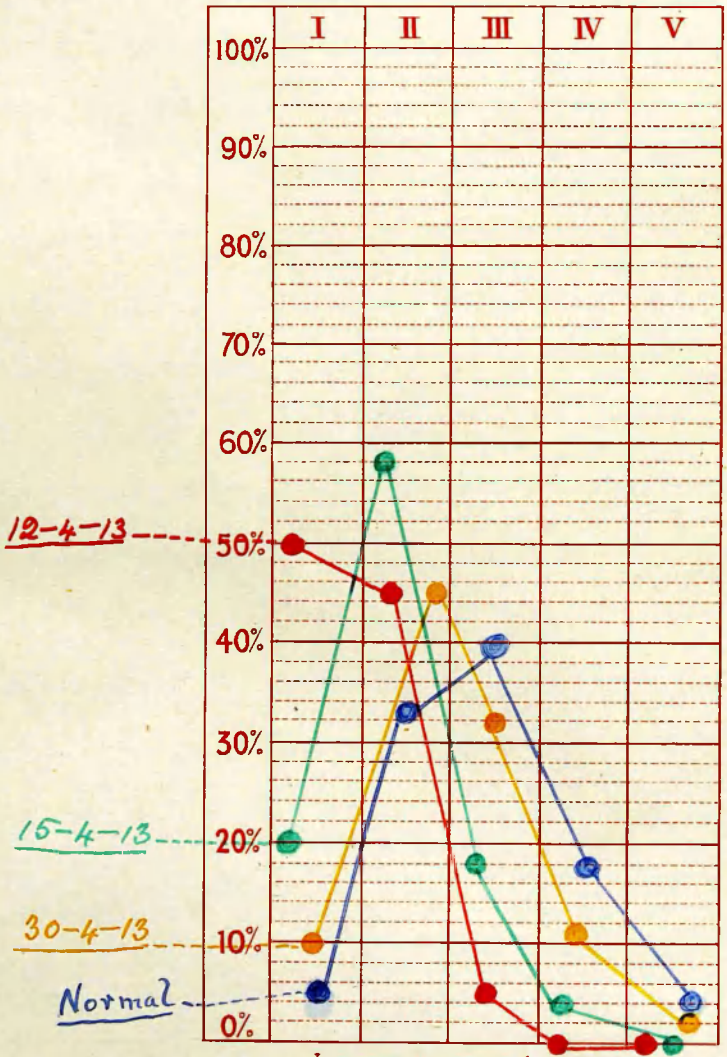
I.	II.	III.	IV.	V.
28%	61%	9%	2%	0%

10-4-13. Leucocytes per cub. mm. = 14,000.

I.	II.	III.	IV.	V.
30%	62%	8%	0%	0%

Case Joseph Lowther No. 61 (Chart #)

Age 9 years Disease Lobar Pneumonia.



Leucocytes per cub. m.m.

12-4-13 = 19,000.

15-4-13 = 11,000.

30-4-13 = 8,000

11-4-13. Leucocytes per cub. mm. = 18,000.

I.	II.	III.	IV.	V.
53%	44%	3%	0%	0%

12-4-13. Leucocytes per cub. mm. = 19,000.

I.	II.	III.	IV.	V.
50%	45%	5%	0%	0%

15-4-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
20%	58%	18%	4%	0%

30-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
10%	45%	32%	11%	2%

The sudden increase in the dislocation of the picture to the left which is present in the picture of 11-4-13 cannot fail to be observed, and when it is remembered that this increase coincided with an extension of the pneumonic consolidation, its full significance can be appreciated. The steady drift to the right of the picture, following the crisis, is marked, and continues until practically normal limits are reached.

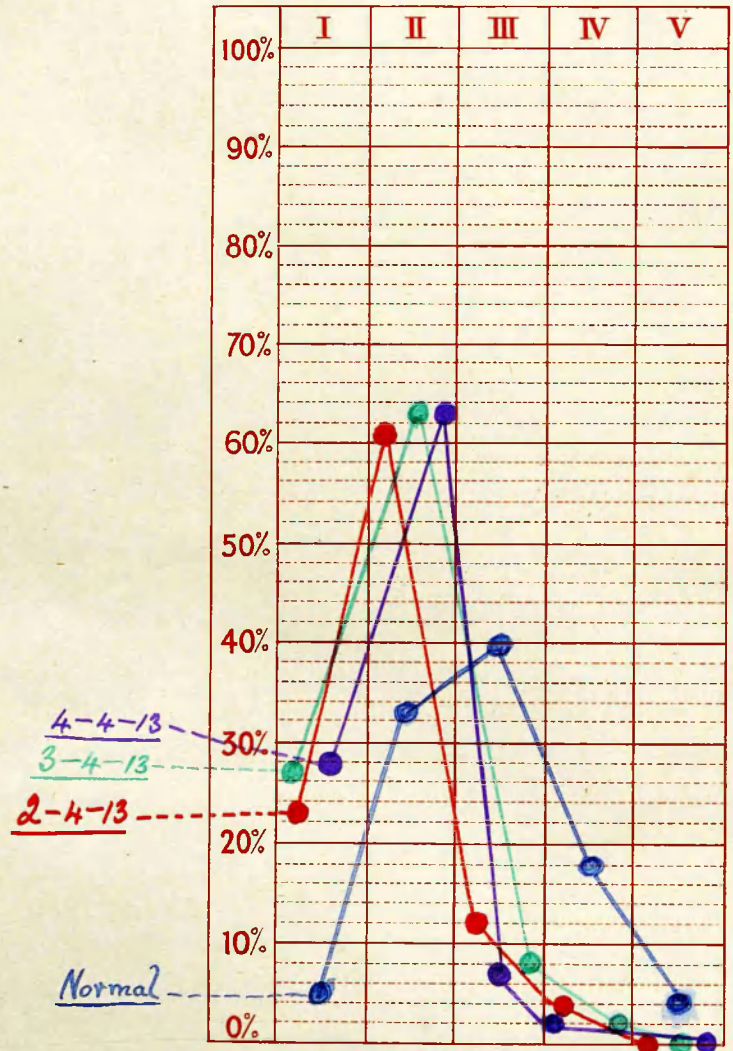
Thus once again these blood-pictures coincide with the clinical happenings

Case: Alfred Parker. Aet. 72.

No. 62. Lobar Pneumonia. This patient came under observation on 1-4-13, with a lobar pneumonia

Case Alfred Parker No. 62 (Chart I)

Age 72 Disease Lobar Pneumonia



Leucocytes per cub. m.m.

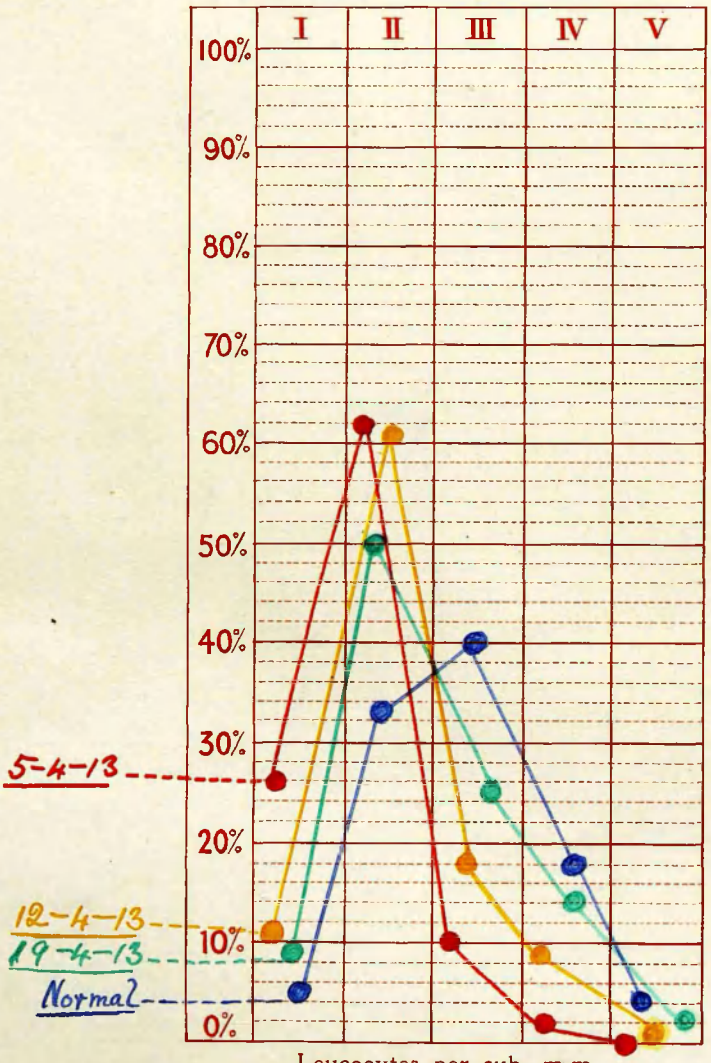
2-4-13 = 14,000

3-4-13 = 14,000

4-4-13 = 16,000.

Case Alfred Parker No. 62 (Chart II)

Age 72 Disease Lobar Pneumonia



Leucocytes per cub. m.m.

5-4-13 = 13,000.

12-4-13 = 9,000.

19-4-13 = 8,000.

of the right upper lobe, of 2 days' duration. He kept wonderfully well during his illness, had his crisis on 4-4-13, during the night, and had an uninterrupted convalescence. The pictures obtained show -

2-4-13. Leucocytes per cub. mm. = 14,000.

I.	II.	III.	IV.	V.
23%	61%	12%	4%	0%

3-4-13. Leucocytes per cub. mm. = 14,000.

I.	II.	III.	IV.	V.
27%	63%	8%	2%	0%

4-4-13. Leucocytes per cub. mm. = 16,000.

I.	II.	III.	IV.	V.
28%	63%	7%	2%	0%

5-4-13. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
26%	62%	10%	2%	0%

12-4-13. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
11%	61%	18%	9%	1%

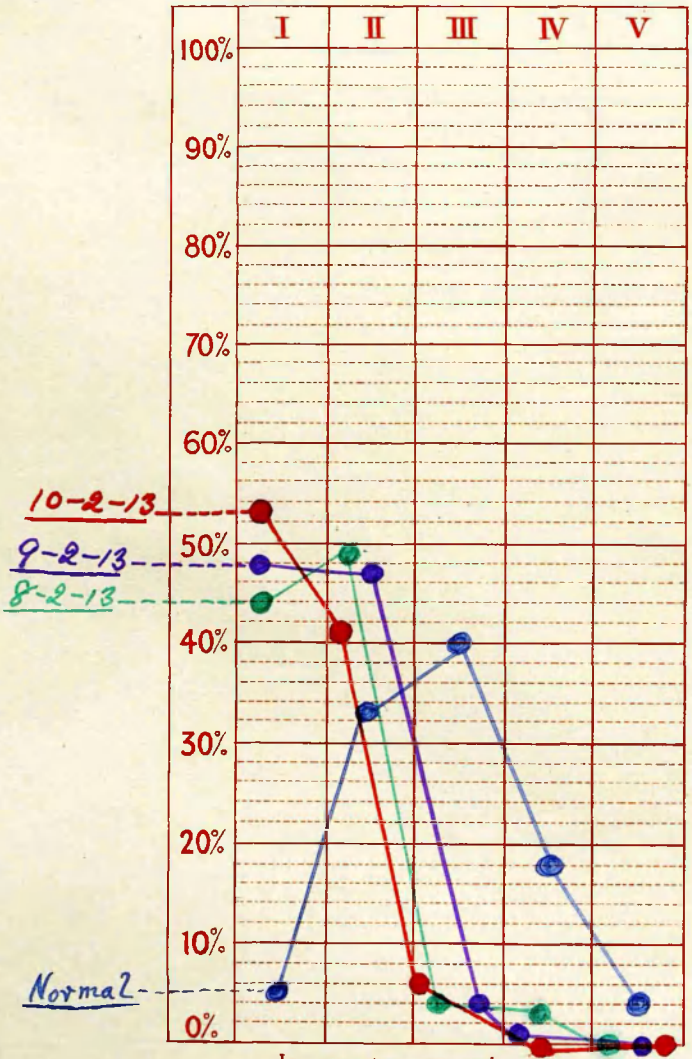
19-4-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
9%	50%	25%	14%	2%

Thus the drift of the pictures to the left before the crisis, and to the right afterwards, is well-marked.

Case J Eyre No. 63

Age 23 Disease Lobar Pneumonia



Leucocytes per cub. m.m.

8-2-13 = 18,000.

9-2-13 = 13,000.

10-2-13 = 12,000.

I shall now deal with those cases of Lobar Pneumonia which terminated fatally.

Case: J. Eyre. Aet. 23.

No. 63. Lobar Pneumonia. This patient came under observation on 8-2-13 with the history of having been ill at home for 4½ days previously.

On admission: The right upper lobe, middle lobe, and upper half of lower lobe, were the seat of one continuous pneumonic consolidation, and there were indications of approaching consolidation in the remainder of the right lung. He was highly fevered. The following day, 9-2-13, the right lung was completely solid, and a patch of consolidation had appeared at the apex of the left upper lobe. He appeared very ill. On the following day 10-2-13, the greater part of the left upper lobe showed signs of solidification, and he died the same afternoon.

The results of the blood-examinations made daily are as follows -

8-2-13. Leucocytes per cub. mm. = 18,000.

I.	II.	III.	IV.	V.
44%	49%	4%	3%	0%

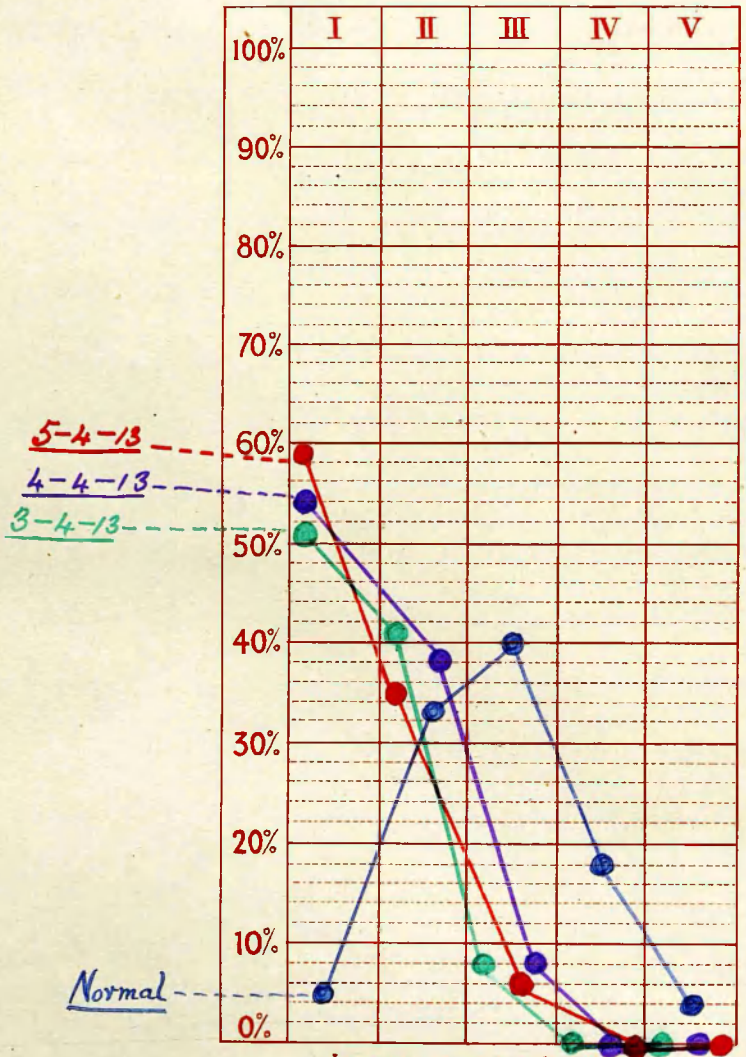
9-2-13. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
48%	47%	4%	1%	0%

10-2-13. Leucocytes per cub. mm. = 12,000.

Case James Turton No. 64.

Age 37 Disease Lobar Pneumonia



Leucocytes per cub. m.m.

3-4-13 = 11,000

4-4-13 = 12,000.

5-4-13 = 9,000.

I.	II.	III.	IV.	V.
53%	41%	6%	0%	0%

Thus there is here a case of virulent spreading pneumonia, terminating fatally on the 7th day. Although under observation only during the last 3 days, from a study of the above pictures one cannot but be struck by the steadily increasing dislocation of the picture to the left, coincidently with the clinical happenings. At the same time the fall in the leucocytosis is worthy of notice.

Case: James Turton. Aet. 37.

No. 64. Lobar Pneumonia. This Patient came under observation on 3 -4 -13 suffering from lobar pneumonia of the right lower lobe, of 5 days' duration. During the 3 days he lived after admission, he became steadily weaker, and the pneumonia spread to the right upper lobe, and to the base of the left lower lobe. He died on 6 -4 -13.

The counts made were,

3 -4 -13: Leucocytes per cub.mm. -- 11,000

1.	11.	111.	1V.	V.
51%	41%	8%	0%	0%

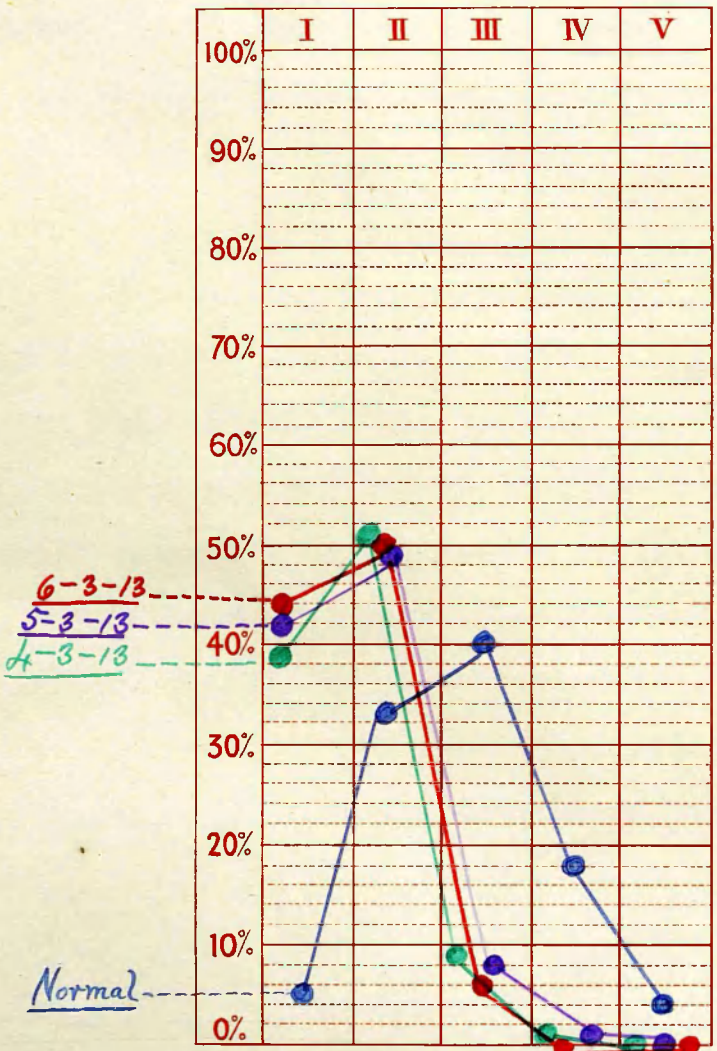
4 -4 -13: Leucocytes per cub.mm. = 12,000.

1.	11.	111.	1V.	V.
54%	38%	8%	0%	0%

5 -4 -13. Leucocytes per cub.mm. = 9,000.

Case Jane Sharp No. 65

Age 68 Disease Lobar Pneumonia.



Leucocytes per cub. m.m.

4-3-13 = 12,000.

5-3-13 = 11,000.

6-3-13 = 9,000.

I.	II.	III.	IV.	V.
59%	35%	6%	0%	0%

Here then, is another spreading pneumonia, terminating fatally, and showing the same steadily increasing dislocation of the picture to the left, as in the previous case. The concurrently falling leucocyte count per cub.mm., at the last, is also to be noticed.

Case: Jane Sharp. Aet. 68.

No. 65. Lobar Pneumonia. Admitted on 3 - 3 -13 with ~~symptoms~~ history of 4 days' illness, with a lobar pneumonia of the left lower lobe. There was also a little collateral bronchitis. On the day following admission the pneumonia spread to the right lower lobe, at its apex, and the following day, the whole lobe was solid. On 6 -3 - 13, she died, and the following pictures show how the blood examinations made daily were in conformity with the clinical happenings.

4 -3 -13: Leucocytes per cub.mm.= 12,000.

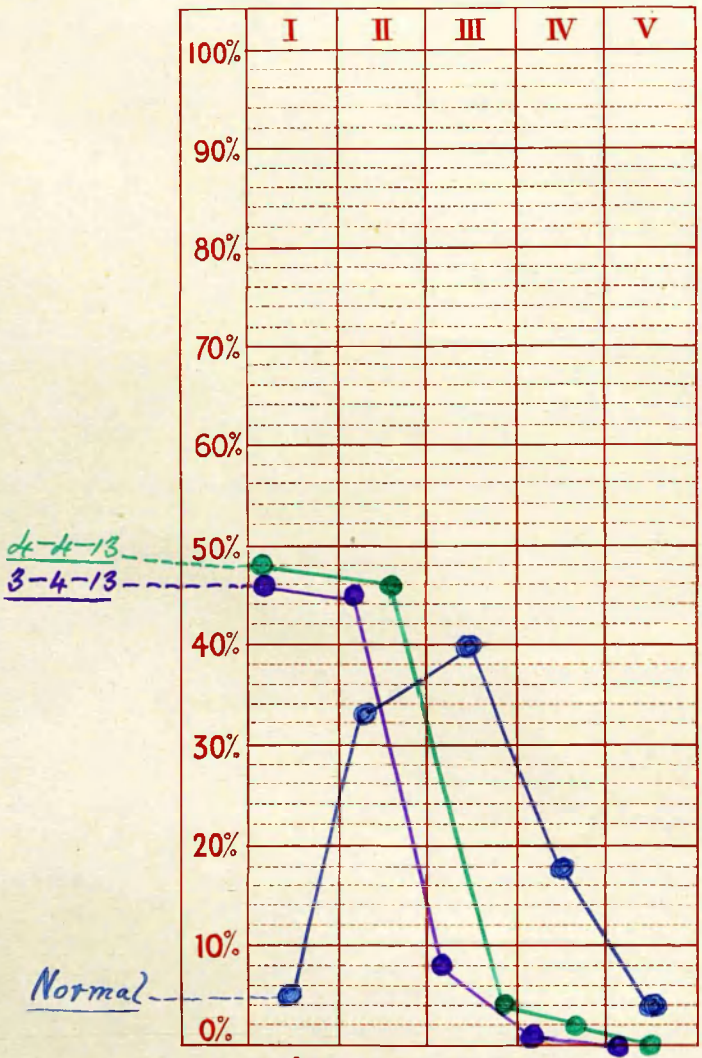
I.	II.	III.	IV.	V.
39%	51%	9%	1%	0%

5 -3 -13: Leucocytes per cub.mm.= 11,000

I.	II.	III.	IV.	V.
42%	49%	8%	1%	0%

Case John Ward No. 66 (Chart I)

Age 66 Disease Lobar Pneumonia.



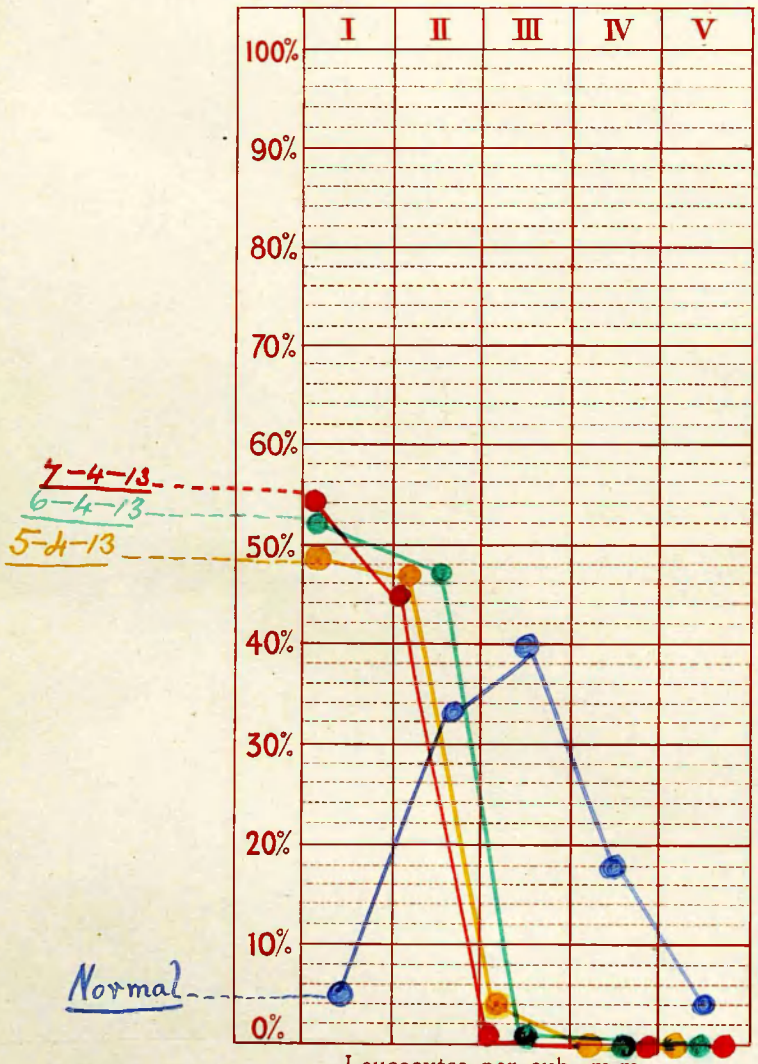
Leucocytes per cub. m.m.

3-4-13 = 14,000.

4-4-13 = 11,000.

Case John Ward No. 66 (Chart II)

Age 66 Disease Lobar Pneumonia



Leucocytes per cub. m.m.

5-4-13 = 12,000.

6-4-13 = 12,000.

6 -3 -13: Leucocytes per cub.mm. = 9,000.

I.	II.	III.	IV.	V.
44%	50%	6%	0%	0%

The steadily increasing dislocation to the left with the falling leucocyte count is to be noted in this case, and these pictures agree with the clinical facts of the case.

Case: John Ward. Aet. 66.

No. 66. Lobar Pneumonia. This case is similar to the last, and on admission a pneumonia of the left lower lobe, of 2 days' duration, was present. He was very ill, and 2 days later his right lower lobe became solid, and he died on 7 -4 -13, 4 days after admission.

The records of his blood examinations, which were made daily, are as follows.

3 - 4 -13: Leucocytes per cub. mm. = 14,000

I.	II.	III.	IV.	V.
46%	45%	8%	1%	0%

4 - 4 -13: Leucocytes per cub. mm. = 11,000

I.	II.	III.	IV.	V.
48%	46%	4%	2%	0%

5 - 4 -13: Leucocytes per cub. mm. = 12,000

49%	47%	4%	0%	0%

6.- 4 -13: Leucocytes per cub. mm. = 12,000

I.	II.	III.	IV.	V.
52%	47%	1%	0%	0%

7 - 4 -13: Leucocytes per cub. mm. = 11,000

I.	II.	III.	IV.	V.
54%	45%	1%	0%	0%

The same phenomenon is observed here as in the last case, the steadily increasing dislocation to the left, associated with the steady failure of the patient.

From a study of these cases it is clear that this method of blood examination is of considerable value in cases of lobar pneumonia. In no case has a finding been obtained from the pictures which was at variance with the clinical happenings. The steady increase in the dislocation to the left of the picture up to the crisis, followed by the drift to the right again after the crisis, is very striking in those cases which recovered. In those cases which succumbed, the manner in which the dislocation to the left increased daily, until it became extreme, cannot fail to impress one. In this respect, also, it is to be noted that in several fatal cases the increasing dislocation to the left was accompanied by a fall in the leucocytes per cub. mm.

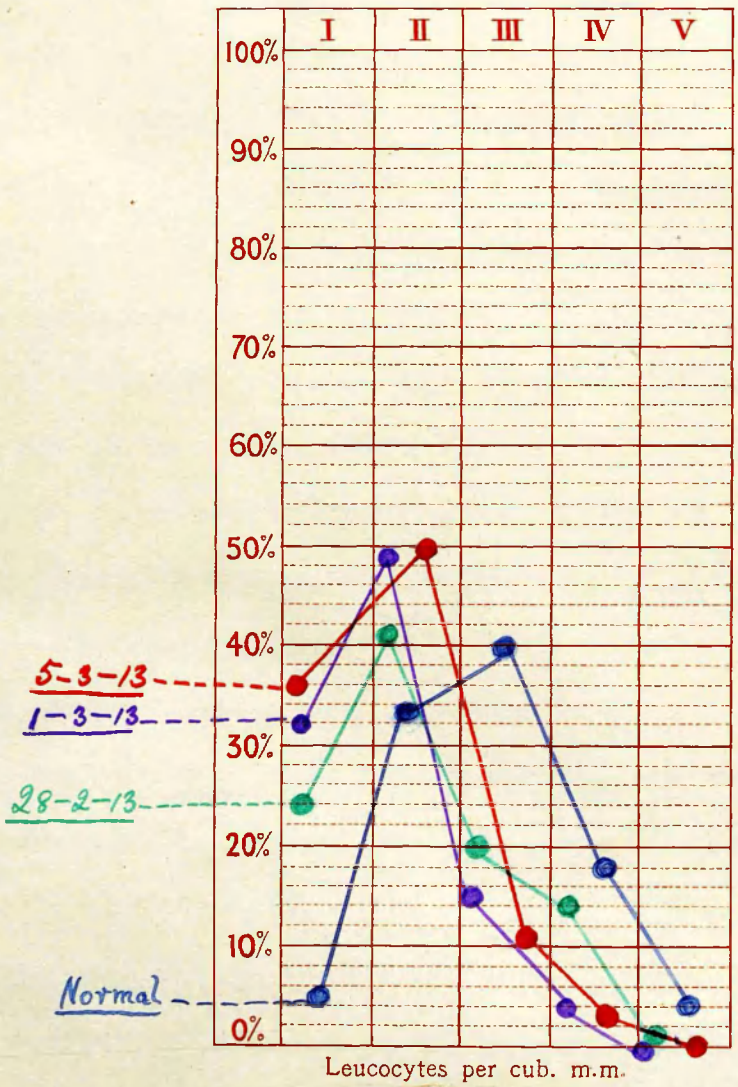
I shall now consider cases of Broncho-Pneumonia.

Case: John Wm. Allen. Aet. 11 days.

No. 67. Broncho - Pneumonia. This patient was born on 23 -2 -13, after a normal labour. On 27 -2 -13 the child became fevered, and numerous fine moist crepitations and rhonchi were audible in the chest.

Case John Wm. Allen No. 67.

Age 11 days Disease Broncho-Pneumonia.



The fever continued, and on 3 -3 -13 patches of consolidation were present in the left upper lobe. The circulation began to fail on 4 -3 -13, and a patch of consolidation appeared at the base of the right lower lobe. Death occurred on 6 -3 -13.

The blood examinations showed.

28 -2 -13:	1.	11.	111.	1V.	V.
	24%	41%	20%	14%	1%
1 -3 -13:	1 .	11.	111.	1V.	V.
	32%	49%	15%	4%	0%
5 -3 -13:	1.	11.	111.	1V.	V.
	36%	50%	11%	3%	0%

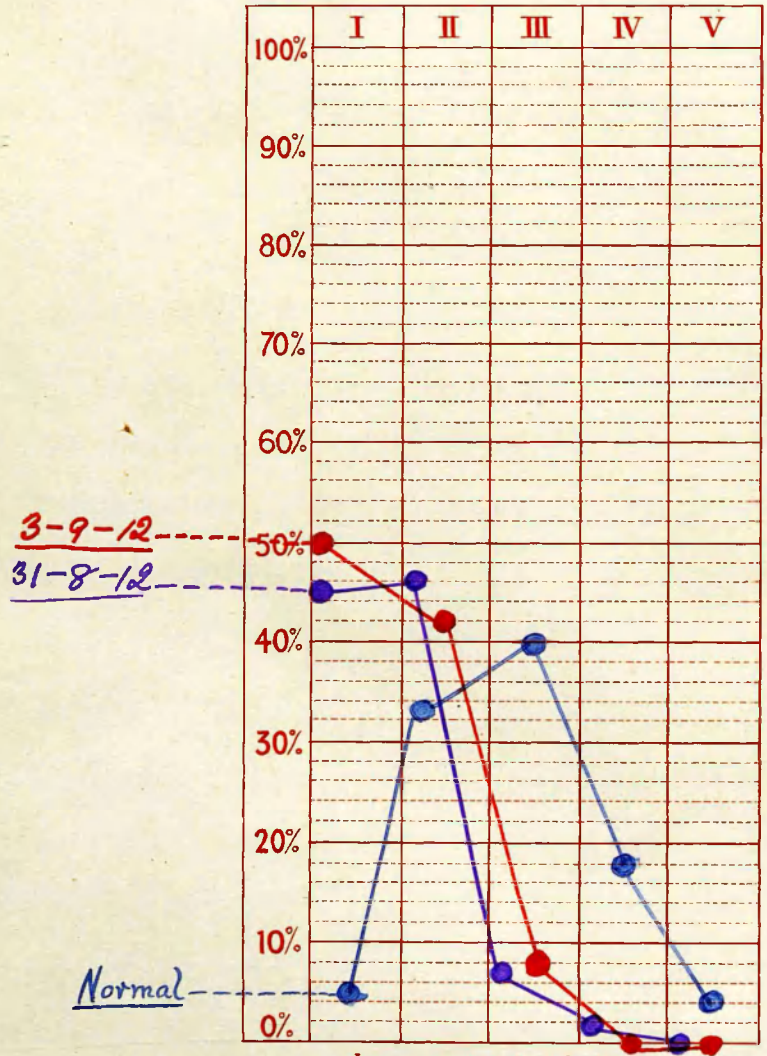
The increasing dislocation to the left of the picture coincidently with the failing condition of the infant, is striking. The dislocation is not so extreme as in some cases, but the important point is the increasing dislocation to the left from day to day. In this case the leucocytes per cub.mm. were not estimated.

Case: Rose Brawn. Aet. 10 months. (On admission)

No. 68. Broncho - Pneumonia and Empyema. This patient was admitted on 16 -8 -12, having been fevered for a week and coughing. The left side of the chest was dull all over, especially in the upper part, and tubular breathing and moist crepitations were present all over. In the right lung rhonchi and moist râles were present all over, and in the centre of the right lower lobe, posteriorly, were two

Case Rose Brawn No. 68 (Chart I)

Age 10 months (On admission) Disease Broncho-Pneumonia and Empyema



Leucocytes per cub. m.m.

31-8-12 = 18,000.

3-9-12 = 14,000

patches of consolidation. The other systems were normal. From the date of admission she became steadily worse: the dulness remained as on admission: the temperature was irregular, but never exceeded 100°. F: she was very ill and very thin. On 31 -8 -12 pus was obtained below the left inferior scapular angle by means of an exploring syringe, and the same evening, under local anaesthesia,(using Eudrenine), a piece of rib was resected, and 10 ounces of yellow pus evacuated. For some days after this, her condition was very critical, but gradually she began to improve. On 30 -10 -12 the sinus from the rib resection had completely healed, and she was gaining weight. Dulness was still present over the left lung, but the air was now entering. Improvement continued, though slowly, and by 5 -2 -13, she was hardly recognisable, when one thought of her condition, on admission, 6 months previously, so plump had she become. There was still at this date a little increased percussion resistance over the left lower lobe,and numerous fine moist râles accompanied breath sounds which were, however, normal. The pictures obtained from the examinations of her blood show.

Before rib resection.

31 -8 -12: Leucocytes per cub. mm. = 18,000

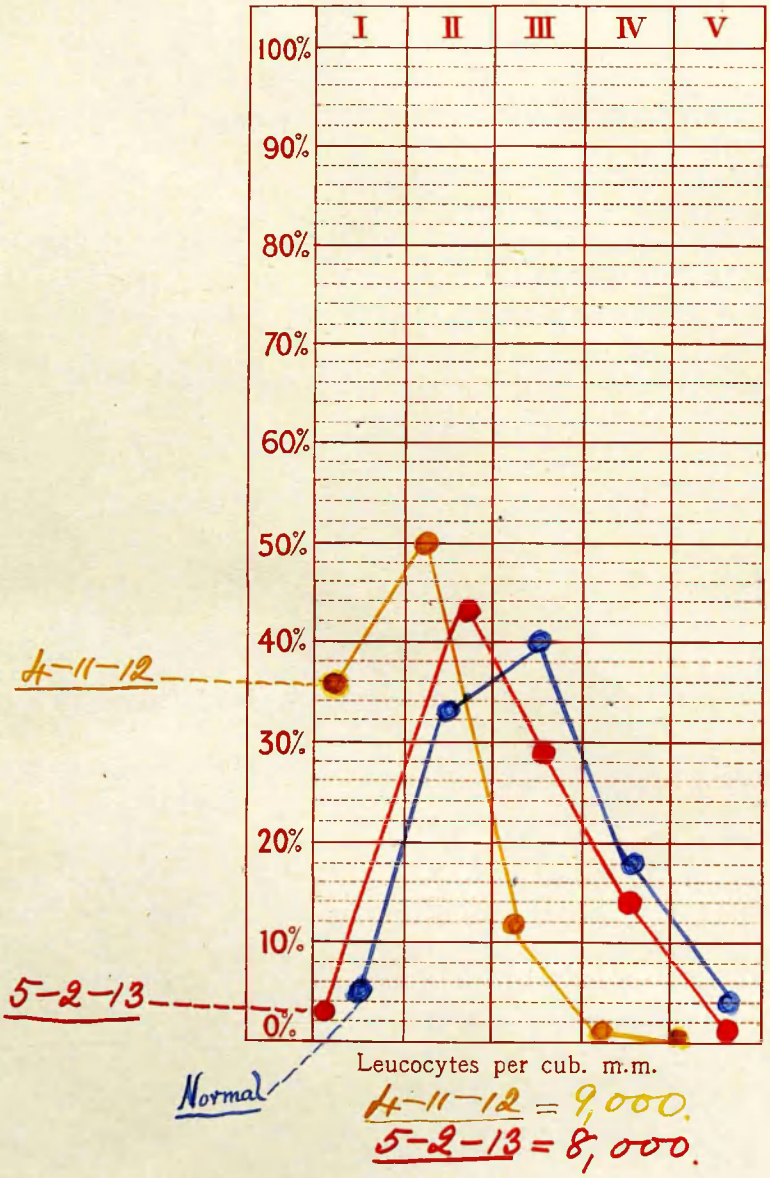
I.	II.	III.	IV.	V.
45%	46%	7%	2%	0%

3 -9 -12: Leucocytes per cub. mm. = 14,000

I.	II.	III.	IV.	V.
50%	42%	8%	0%	0%

Case Rose Brawn No. 68 (Chart ii)

Age 10 months (on admission) Disease Broncho-Pneumonia and Empyema.



4 - 11 -12: Leucocytes per cub. mm. = 9,000

I.	II.	III.	IV.	V.
36%	50%	12%	1·5%	0·5%

5 - 2 - 13: Leucocytes per cub. mm. = 8,000

I.	II.	III.	IV.	V.
3%	43%	39%	14%	1%

This case is an exceedingly interesting one.

I. It illustrates recovery taking place after a dislocation of the picture to the left had occurred to a degree from which recovery is exceedingly rare.

II. The counts were made at long intervals, and improvements in the pictures, as the case improved, were marked. After the rib was resected, patient's condition was critical for a few days, and this condition is reflected in the pictures, as is seen.

III. The improvement in the pictures, by their drift to the right, was slow at first, more rapid later, and this coincided exactly with the child's condition, improvement in which, slow at first, was eventually rapid.

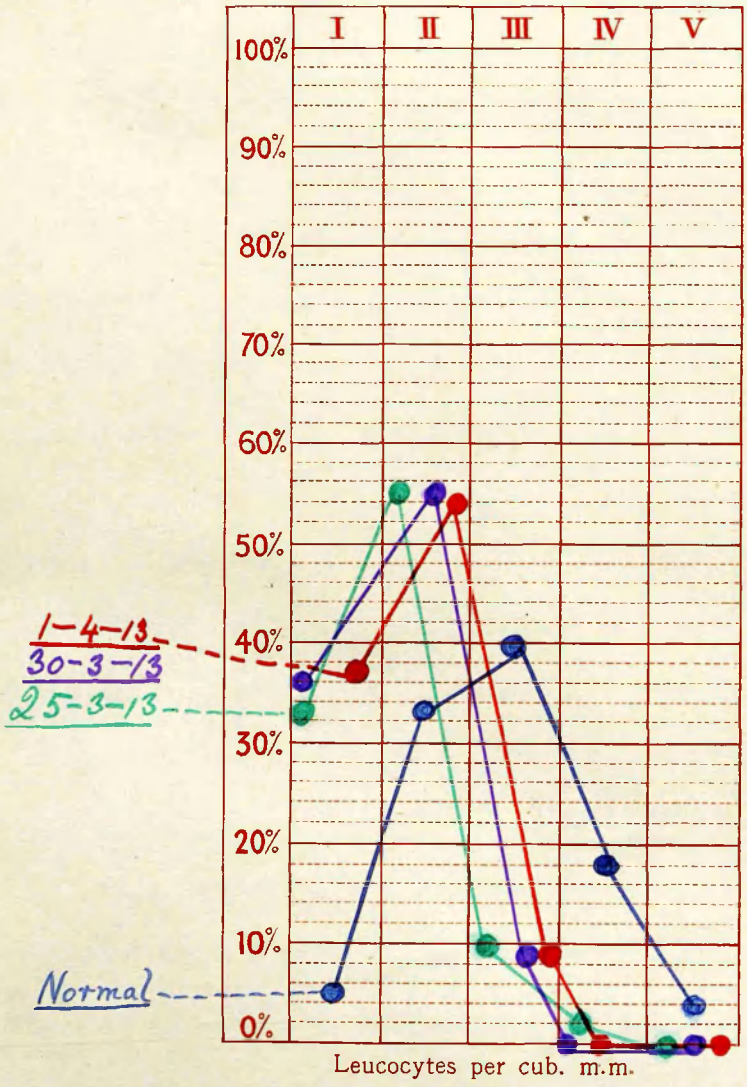
The next case is one of Broncho-Pneumonia following Measles.

Case: Lewis York. Aet. 3 years.

No. 69. Broncho- pneumonia following measles. This patient had had Measles 14 days before admission on 25 -3-13. On admission: no rash was present, and no pyrexia. Slight rhinorrhoea was present. Dulness, tubular breathing, and moist râles were present over the left lower lobe . The general

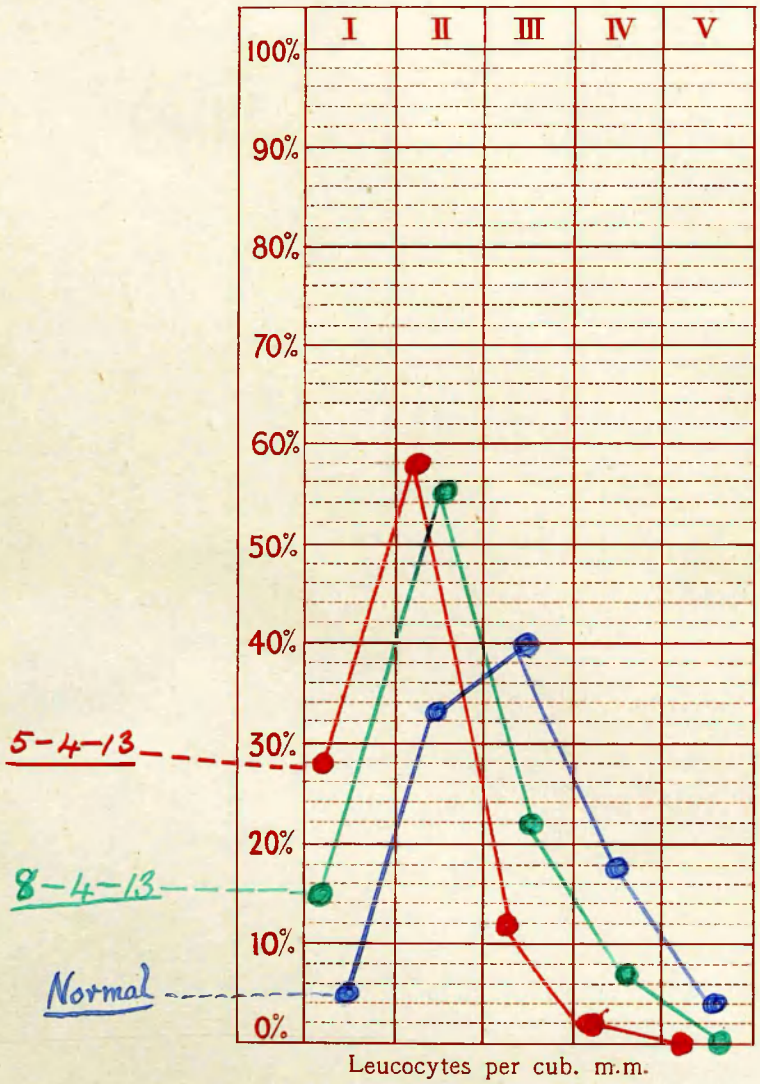
Case Lewis York No. 69 (Chart T)

Age 3 years Disease Broncho-Pneumonia following Measles



Case Lewis York No. 69 (Chart II)

Age 3 years Disease Broncho-Pneumonia following Measles.



condition was fair; on 1 -4 -13 patches of consolidation were present over both lower lobes. On 8 -4 -13 he was removed to the country by his parents, the lungs being clear except for a few crepitations over the left lower lobe.

Blood pictures:

25 -3 -13

I.	II.	III.	IV.	V.
33%	55%	10%	2%	0%

30 -3 -13

I.	II.	III.	IV.	V.
36%	55%	9%	0%	0%

1 -4 -13

I.	II.	III.	IV.	V.
37%	54%	9%	0%	0%

5 -4 -13

I.	II.	III.	IV.	V.
28%	58%	12%	2%	0%

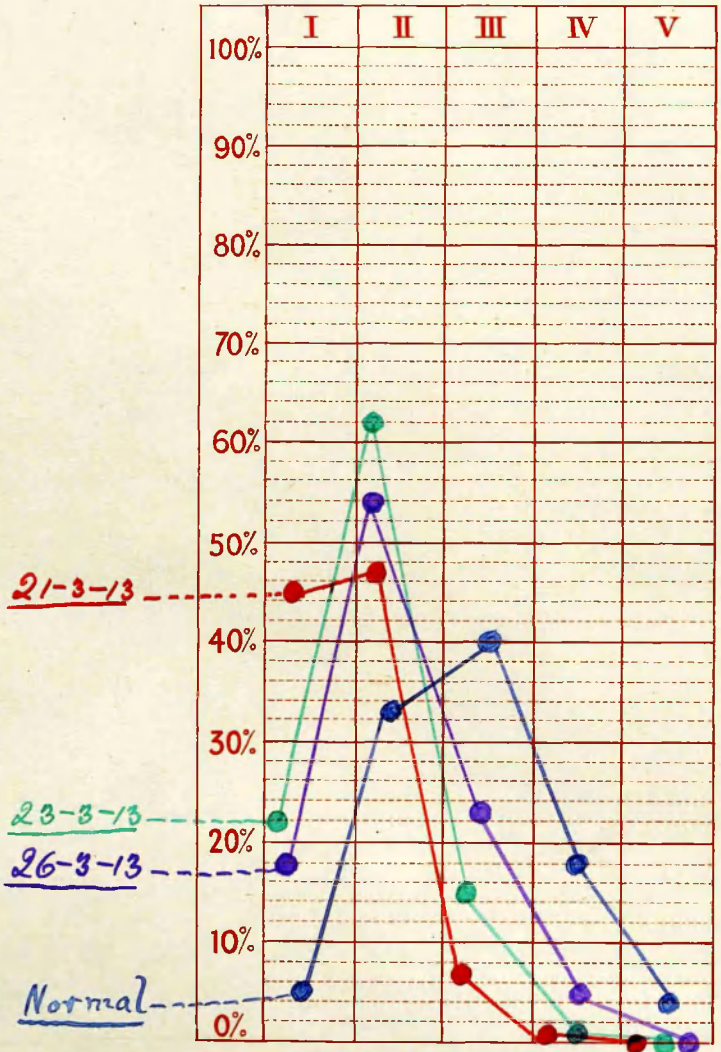
8 -4 -13

I.	II.	III.	IV.	V.
15%	56%	22%	7%	0%

In this case a marked dislocation of the picture to the left is present, and is evidently dependent upon the pulmonary condition, and not upon the antecedent measles, as the pictures coincide with the lung conditions from day to day. Thus, the pictures obtained from these cases of Broncho-pneumonia, like those of Lobar pneumonia, show marked fluctuations according

Case George Edwin Woolhouse No. 70 (Chart 1)

Age 7 years. Disease Measles.



Leucocytes per cub. m.m.

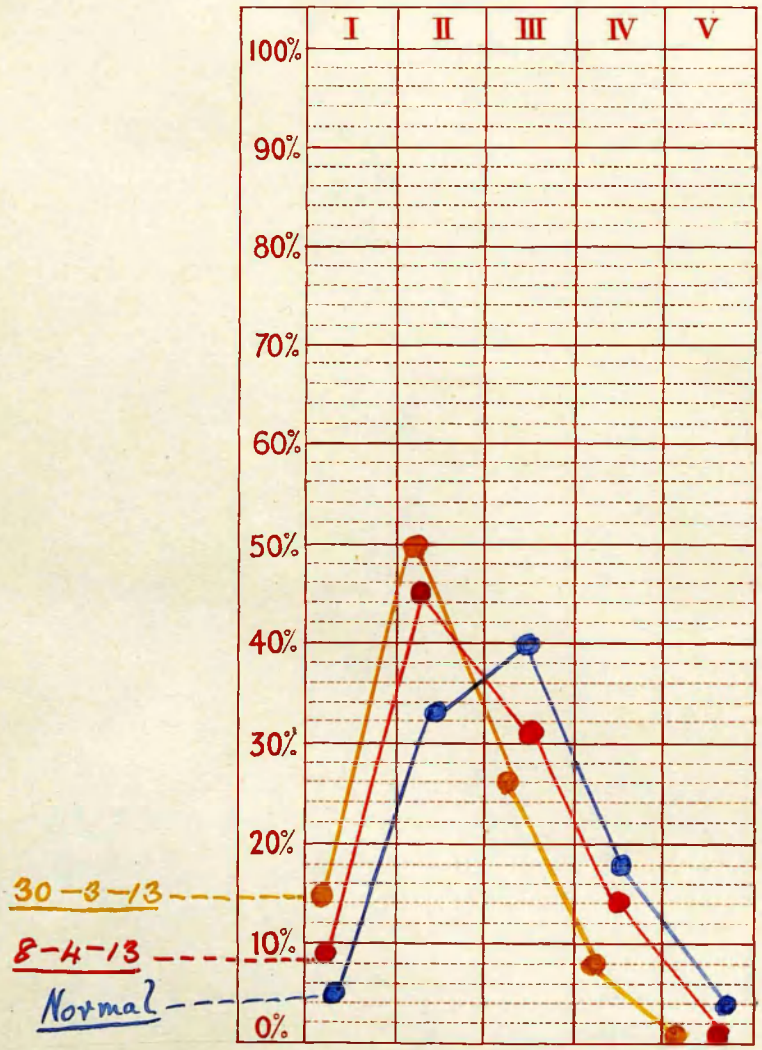
21-3-13 = 7,000

23-3-13 = 6,000

26-3-13 = 6,000

Case George Edwin Woolhouse No. 70 (chart II)

Age 7 years Disease Measles.



Leucocytes per cub. m.m.

30-3-13 = 6000

8-4-13 = 7,000.

to the condition and progress of the case, and are of considerable value in estimating prognosis, and in aiding Diagnosis.

I shall now consider 2 cases of Measles and 1 case of Scarlet Fever.

Case: George Edwin Woolhouse. Aet. 7.

No. 70. Measles. This case was admitted on 20 -3 -13, without a history, but with a well-marked measles rash on the trunk, and a few catarrhal sounds in the left lung. The eyes were suffused. No definite Koplik's spots were present. Temperature pyrexial. By 26 -3 -13, all signs of rash had gone, and the temperature was normal. By 8 -4 -13 he was quite well again.

Blood examinations:

21 -3 -13: Leucocytes per cub. mm. = 7,000

I.	II.	III.	IV.	V.
45%	47%	7%	1%	0%

23 -3 -13: Leucocytes per cub. mm. = 6,000

I.	II.	III.	IV.	V.
22%	62%	15%	1%	0%

26 - 3-13: Leucocytes per cub. mm. = 6,000

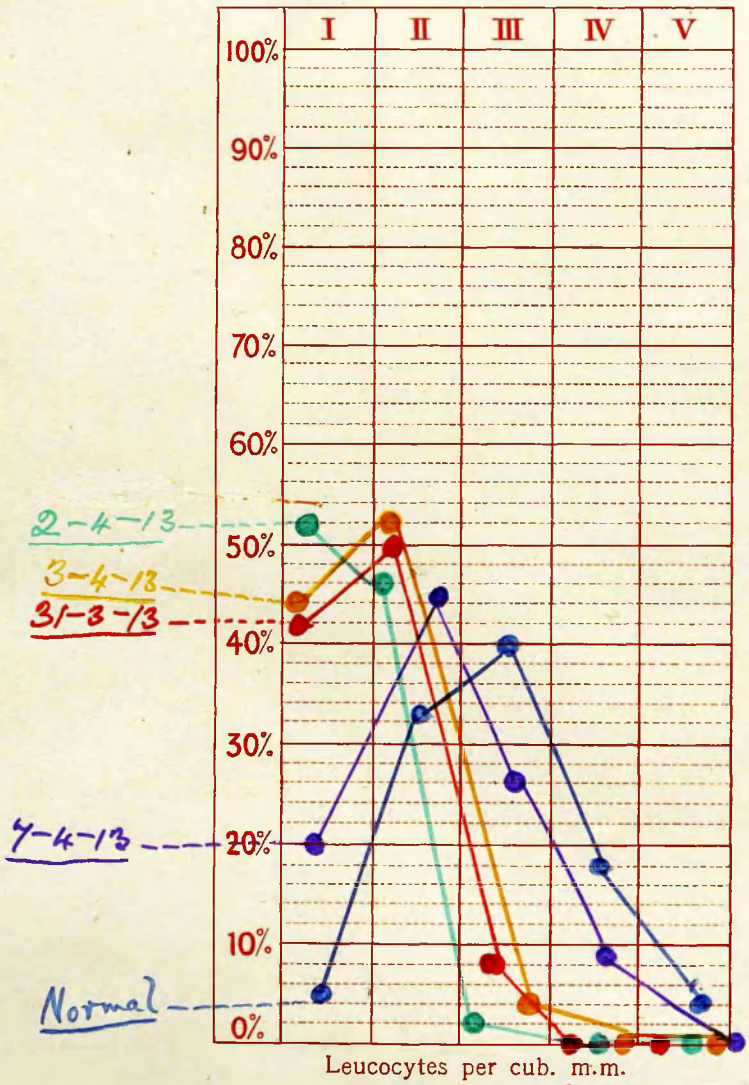
I.	II.	III.	IV.	V.
18%	54%	23%	5%	0%

30 -3 -13: Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
15%	50%	26%	8%	1%

Case Edward Geo. Marsden No. 71

Age 6 years Disease Measles.



Leucocytes per cub. m.m.

31-3-13 = 6,000

2-4-13 = 5,000.

3-4-13 = 6,000

7-4-13 = 6,000.

8-4-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
9%	45%	31%	14%	1%

Case: Edward Geo. Marsden. Aet. 6 years.

No. 71. Measles. This case was admitted on 31-3-13 with a history of 3 days' illness. The rash appeared on the day previous to admission. On admission: the whole body was covered with a well-marked measles rash: eyes suffused: rhinorrhoea present: mucosa of mouth congested: no Kopliks' spots visible now. Temperature 101°. Lungs: Slight bronchitis present. By 3-4-13 the temperature was normal, and the rash fading. On 7-4-13 the rash had gone completely, and he appeared well though coughing slightly. His parents then removed him home strongly against advice. The pictures were :-

31-3-13: Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
42%	50%	8%	0%	0%

2-4-13. Leucocytes per cub. mm. = 5,000.

I.	II.	III.	IV.	V.
52%	46%	2%	0%	0%

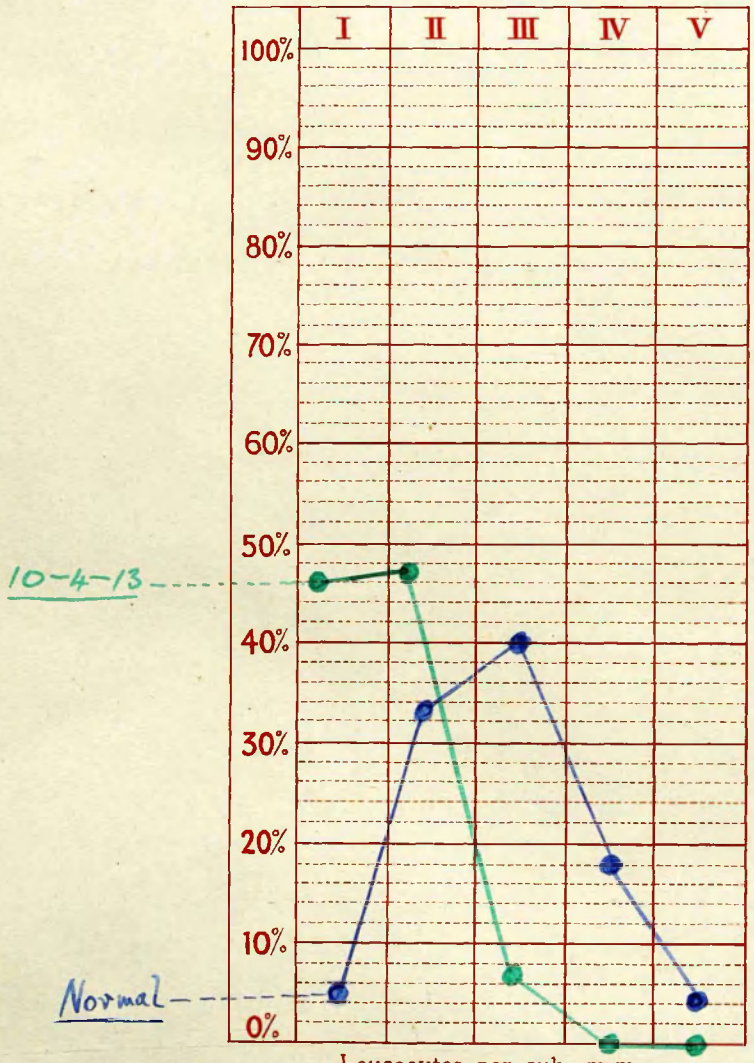
3-4-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
44%	52%	4%	0%	0%

7-4-13. Leucocytes per cub. mm. = 6,000.

Case Wm. Giles No. 72

Age 34 Disease Scarlet Fever



Leucocytes per cub. m.m.

10-4-13 = 7,000

I	II	III	IV	V
20%	45%	26%	9%	0%

In these 2 cases of measles a very marked dislocation of the picture to the left has occurred, thus showing that measles alters the neutrophilic blood picture, and in no uncertain manner, either. Also, it is to be observed that in these cases the number of leucocytes per cub. mm. has always been near the lower limit of normal, and sometimes even a leucopenia is present. Thus, the condition of the blood picture is shown to be independent of the total number of leucocytes per cub. mm.

The next case is one of Scarlet Fever.

Case: Wm.Giles. Aet 34.

No. 72. Scarlet Fever. This case was admitted on 10 -4 -13 with a history of sore throat, and feverishness, of 2 days' duration.

On admission: A well-marked and typical scarlatinal rash was present, and the tonsillitis and other symptoms were characteristic. Temperature 103 · 6°F.

Examination of the blood showed:

10-4-13: Leucocytes per cub. mm. = 7,000.

1.	11.	111.	1V.	V.
46%	47%	7%	0%	0%

Patient was transferred the same day to an isolation hospital, so that further counts could not be obtained.

It is clearly evident, however, from the very pronounced

alteration present, that Scarlet fever dislocates the picture to the left, and, as is evident from the above picture, this dislocation is marked. The low leucocyte count per cub. mm. is also to be noted.

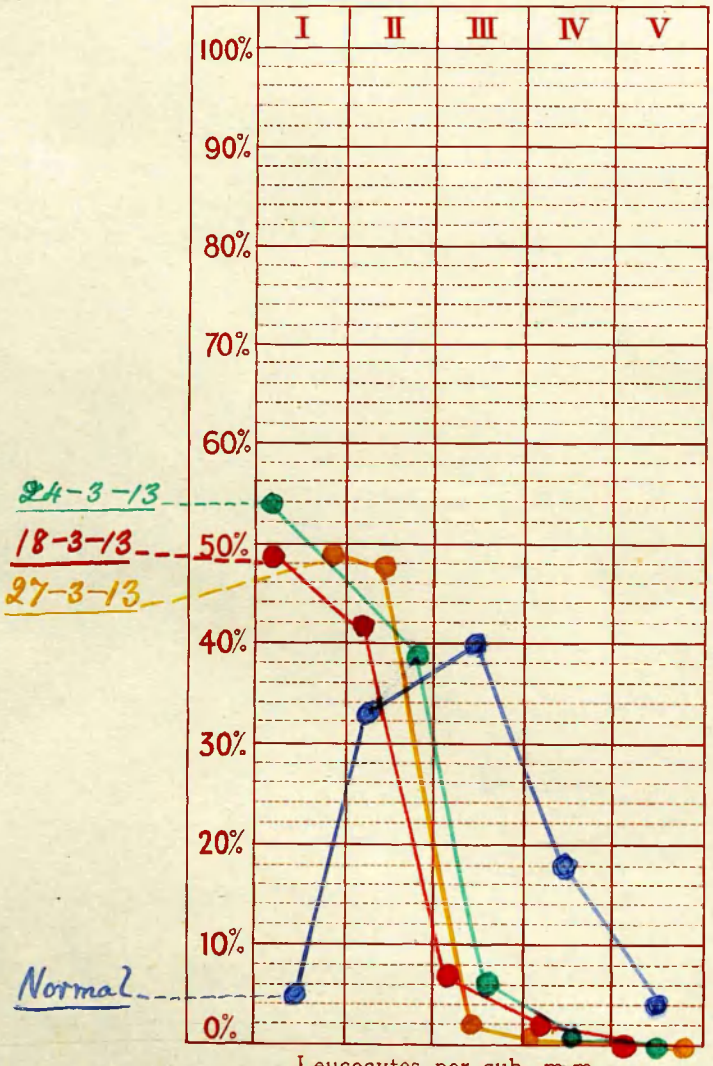
Enteric Fever. I have examined the blood in 2 cases of this disease . In one the patient recovered; in the other, he died.

Case: Ruth McCann: Aet. 44.

No. 73: Enteric Fever: Recovery. This was a very interesting case. She was admitted to hospital, suffering apparently from acute nephritis of several weeks' duration. The temperature was slightly pyrexial for a few days after admission, but never exceeded 100°F and, for a few days, slight oscillations occurred before it finally became normal. There was some bronchial catarrh present, and at the time little importance was attached to this few days' slight pyrexia. Its real importance became evident when viewed in the light of subsequent events. Under treatment, the nephritis improved considerably: by the end of a week the blood had disappeared from the urine, and the albumen had diminished. Patient's general condition had likewise improved, and there was nothing in her case to suggest that anything but an acute nephritis had been the disease. The improvement in the patient's condition continued, but on 12 -3 -13, 15 days after the patient's temperature had first reached normal after admission, it rose suddenly to 102° and remained pyrexial. No cause for this

Case Ruth McCann No. 73 (Chart I)

Age 44 Disease Enteric Fever: Recovery.



Leucocytes per cub. m.m.

18-3-13 = 5,000

24-3-13 = 4,500

27-3-13 = 5,000

could be discovered, and a Widal reaction was performed, and proved to be strongly positive.

Careful enquiry now elicited the fact that from the house in which patient had lain during her illness prior to admission to hospital, a case of enteric fever had recently been removed. This case, then, was evidently admitted during the last few days of an attack of enteric fever, and after 15 days, a relapse had occurred. The acute nephritis therefore, was an enteric nephritis. This relapse, which began on 12-3-13, had subsided completely by 5-4-13, and patient began to improve. Another relapse supervened on 13-4-13, and lasted till 27-4-13, after which improvement was rapid, and on 10-5-13 she was putting on flesh rapidly, felt very well, and was apparently on the way to complete recovery.

The pictures of the various blood examinations made in this case are depicted below -

18-3-13. Leucocytes per cub. mm. = 5,000.

I.	II.	III.	IV.	V.
49%	42%	7%	2%	0%

24-3-13. Leucocytes per cub. mm. = 4,500.

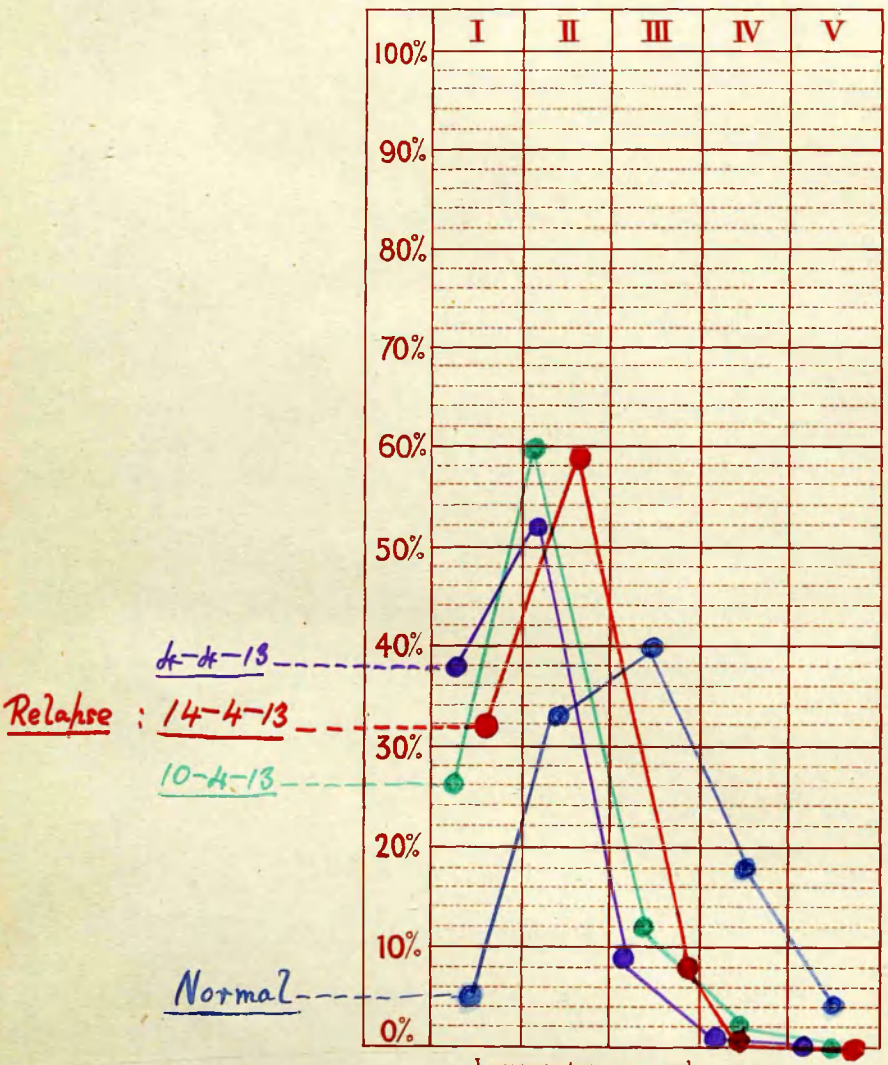
I.	II.	III.	IV.	V.
54%	39%	6%	1%	0%

Recovering: 27-3-13. Leucocytes per cub. mm. = 5,000.

I.	II.	III.	IV.	V.
49%	48%	2%	1%	0%

Case Ruth McCann No. 73 (Chart II)

Age 44 Disease Enteric Fever: Recovery.



Leucocytes per cub. m.m.

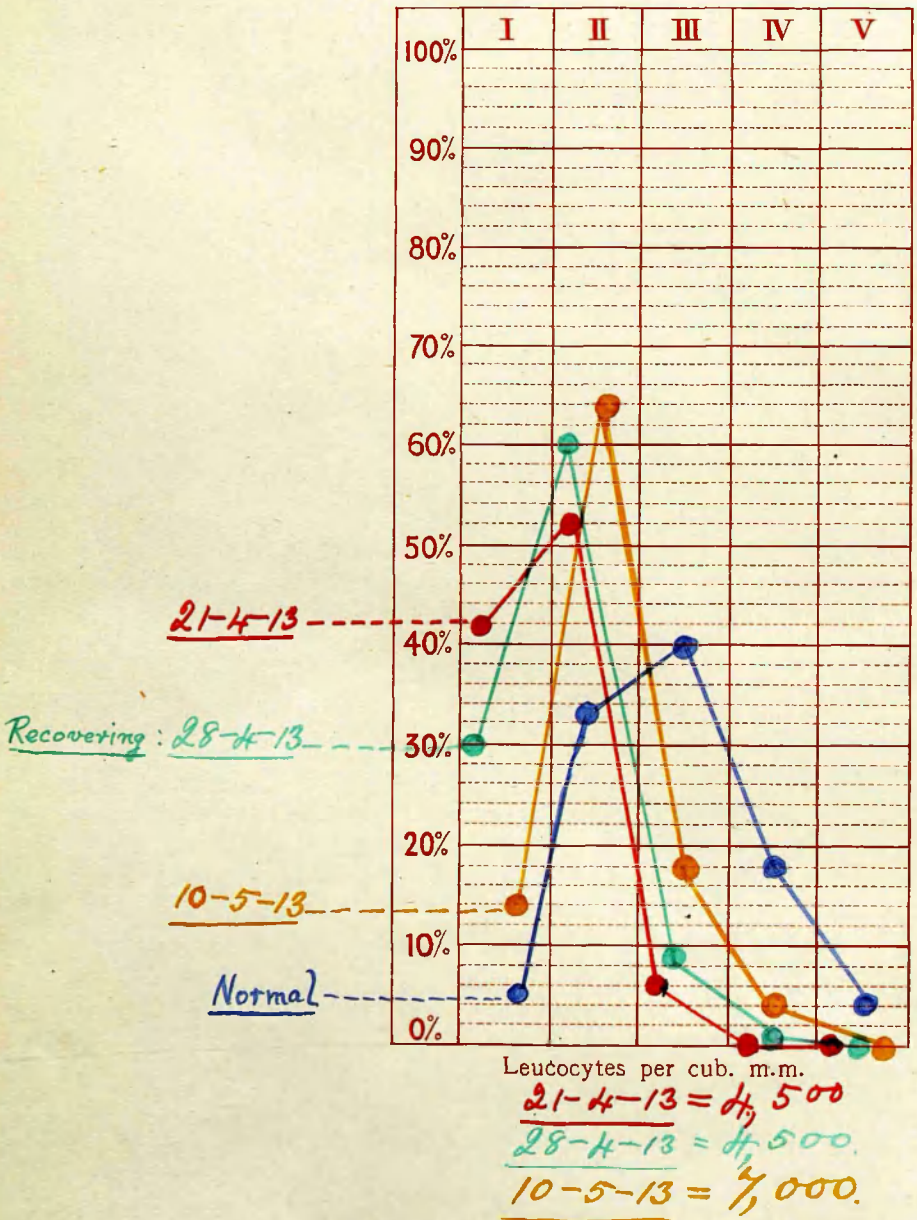
4-4-13 = 5,000

10-4-13 = 6,000

14-4-13 = 5,000

Case Ruth McCann No. 73 (Chart III)

Age 44 Disease Enteric Fever.



4-4-13. Leucocytes per cub. mm. = 5,000.

I.	II.	III.	IV.	V.
38%	52%	9%	1%	0%

10-4-13. Leucocytes per cub. mm. = 6,000.

I.	II.	III.	IV.	V.
26%	60%	12%	2%	0%

Relapse: 14-4-13. Leucocytes per cub.mm. = 5,000.

I.	II.	III.	IV.	V.
32%	59%	8%	1%	0%

21-4-13. Leucocytes per cub. mm. = 4,500.

I.	II.	III.	IV.	V.
42%	52%	6%	0%	0%

Recovering: 28-4-13. Leucocytes per cub.mm. = 4,500.

I.	II.	III.	IV.	V.
30%	60%	9%	1%	0%

10-5-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
14%	64%	18%	4%	0%

In this case, then, it is seen that in Enteric Fever a very marked dislocation of the picture to the left occurs, varying in extent according to the severity of the attack. Also, as the case becomes worse, so is the picture displaced more and more to the left, and as improvement sets in, the drift of the picture is to the right. In the count made on 27-3-13 a definite

improvement was observed, and this occurred at a time, too, when clinically there was no sign that the attack was subsiding.

The subsequent deterioration of the picture as it was again displaced to the left on 14-4-13, coincided with the relapse then commencing.

Similarly, its drift to the right on 28-4-13 coincided with the subsidence of this attack.

The final count made on 10-5-13 yields the most favourable picture in the whole case, and, though one cannot be certain that no further relapse will take place, still, this greatly improved picture, coupled with the simultaneous great improvement in the patient's general condition, certainly is a strong justification for presuming that the disease has run its course.

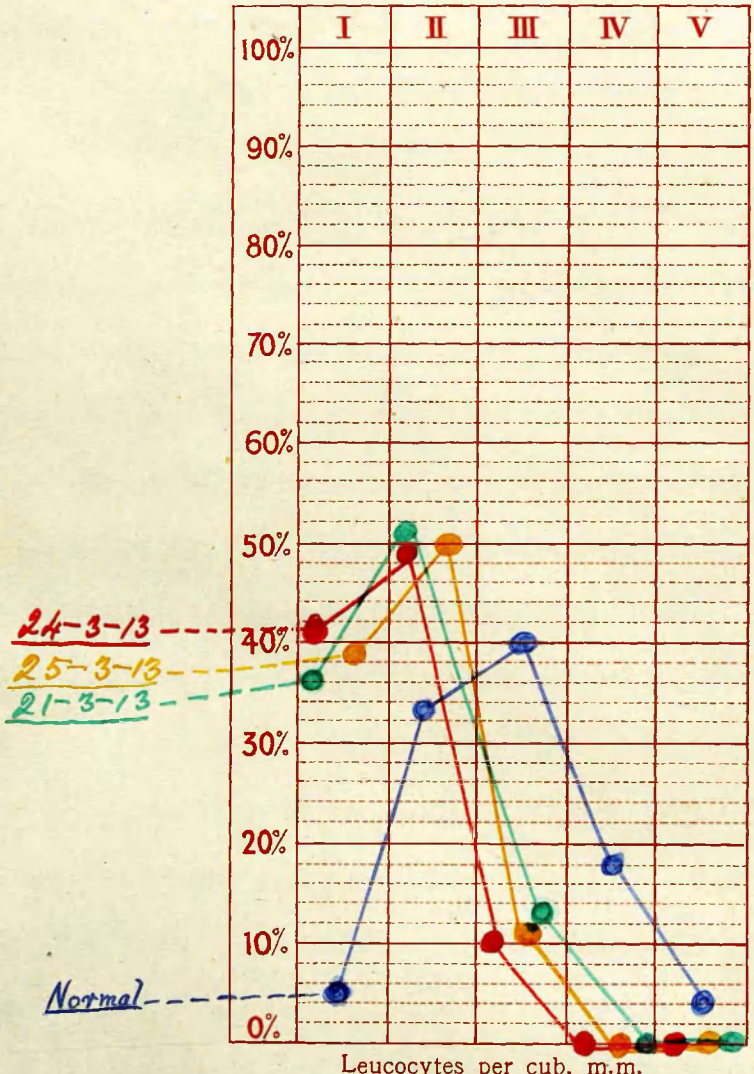
A most important and striking point in this case is the persistent low leucocyte count per cub. mm. which has obtained throughout the disease.

Case: Rowley Grayson. Aet. 40.

No. 74. Enteric Fever: Death. This case was admitted on 19-3-13, having lain at home for some weeks. He was very ill on admission, and on 23-3-13 had a haemorrhage from the bowels to the amount of nearly a pint. On 25-3-13 he had a further haemorrhage of 2 pints, and again on 28-3-13, of 15 ounces.

Case Rowley Grayson No. 74 (Chart 1)

Age 40 Disease Enteric Fever: Death.



Leucocytes per cub. m.m.

24-3-13 = 4,000.

25-3-13 = 4,000.

21-3-13 = 4,000

On 30-3-13 he had another profuse haemorrhage from the bowels, losing nearly 2 pints, and died on 31-3-13.

The temperature during this period was pyrexial, varying between normal and 101°, until the last 24 hours, when it became subnormal.

The following are the pictures of the blood examinations made during his residence.

21-3-13. Leucocytes per cub. mm. = 4,000.

I.	II.	III.	IV.	V.
36%	51%	13%	0%	0%

On the day before that on which the next count was made, patient had a haemorrhage from the bowel, and the increase in the dislocation of the picture to the left, which follows a haemorrhage, (as I have already shown when discussing pulmonary tuberculosis) is shown here -

24-3-13. Leucocytes per cub. mm. = 4,000.

I.	II.	III.	IV.	V.
41%	49%	10%	0%	0%

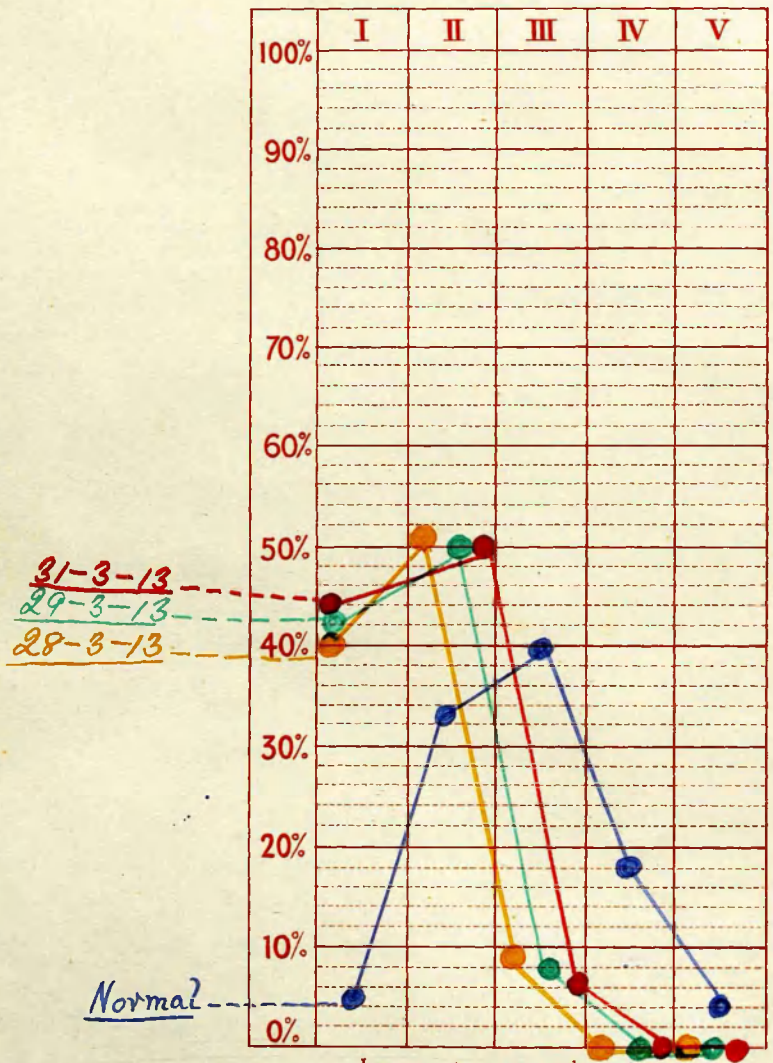
25-3-13. Leucocytes per cub. mm. = 4,000.

I.	II.	III.	IV.	V.
39%	50%	11%	0%	0%

A few hours after this count was made, a further large haemorrhage occurred, and the slight improvement manifest in the last count was completely negatived by the resulting increase in the dislocation again.

Case Rowley Grayson No. 74 (Chart II)

Age 40 Disease Enteric Fever; Death.



Leucocytes per cub. m.m.

28-3-13 = 4,500

29-3-13 = 4,000.

31-3-13 = 4,500

28-3-13. Leucocytes per cub. mm. = 4,500.

I.	II.	III.	IV.	V.
40%	51%	9%	0%	0%

Some 5 hours after the last examination was made, a further haemorrhage occurred, and on 29-3-13 the picture was -

29-3-13. Leucocytes per cub. mm. = 4,000.

I.	II.	III.	IV.	V.
42%	50%	8%	0%	0%

On 30-3-13 another and profuse haemorrhage from the bowel occurred, and the examination of the blood made on 31-3-13, and, as it happened, 4 hours before death, showed the following picture.

31-3-13. Leucocytes = 4,500.

I.	II.	III.	IV.	V.
44%	50%	6%	0%	0%

Thus, in this case several points are brought out:

1. The dislocation of the picture present, to the left, which increases as the disease advances.
2. The increase in this dislocation following a haemorrhage.
3. The leucopenia present in all the counts.

Puerperal Septicaemia.

I have examined the blood in a series of 3 cases of this disease, and have found the changes in the blood picture well-marked. One of the cases recovered, after

a very severe illness, the other two died.

Case: Florence Godby. Aet. 21.

No. 75. Puerperal Septicaemia: Recovery.

On 30-10-12 this patient was delivered of her third child. The labour was in every way normal, except that a slight tear in the perinaeum occurred, was unobserved, at the time, and was sutured, 12 hours later. This was probably the cause of the subsequent septicaemia, as it was ascertained that no vaginal examination had been made, as the arrival of the attendant midwife found the child's head presenting at the vulvar orifice.

In the early hours of 2-11-12 patient had a severe rigor, the temperature shot up to 103°F., pulse and respirations also were accelerated, she was flushed, complained of headache, and, in short, presented a picture of puerperal septicaemia. The temperature reached normal next day, in the evening, but the following day, 4-11-12, rose to 104.2° at 6 p.m., and remained pyrexial until 2 a.m. on 7-11-12, falling to normal jerkily. During this attack she was slightly cyanosed.

At 6 p.m. on 7-11-12 there was another exacerbation of the disease, the temperature rising to 104.6° at 10 p.m. With cold sponging a remission occurred to 103°, but at 2 p.m. on 8-11-12 a temperature of 106.8° was recorded, and patient was deeply cyanosed and lethargic, with running

almost imperceptible, radial pulse. She looked as though death were imminent. However, by vigorous treatment she was tided over this critical time, but the temperature remained pyrexial, and rose to 106.2° at 6 p.m. on 10-11-12, before falling to normal at 2 a.m. on 11-11-12. Another severe relapse occurred on 12-11-12, when a temperature of 106° was recorded, and again, on 15-11-12, a slight relapse occurred. She began to improve now, but on 18-11-12, and again on 20-11-12, further relapses occurred, and she was very ill again. She recovered from these, however, and convalescence appeared to be well in progress, when, on 10-12-12, another relapse occurred, this time mild in nature. She had recovered from this in 3 days time, and from then until she was discharged, well, on 28-12-12, convalescence was uninterrupted, and she was well, and putting on flesh rapidly, at the time of her discharge.

In the parametrium thrombosed veins were palpable, and it is probable that the cause of the sudden bursts of temperature, accompanied by all the signs and symptoms of profound toxaemia, lay in these veins, a septic thrombosis being present, and every now and again a fresh dose of organisms and their toxins being set free into the blood-stream.

The treatment carried out included saline infusions,

intra-venously, subcutaneously, and per rectum. A rubber drainage-tube was fixed in the uterus, and intra-uterine douches given daily. Very beneficial effects resulted from the use of Adrenalin Chloride solution, in the intra-venous salines, and also intramuscularly. Brandy and Digitalis also proved of assistance, and the temperature was controlled by cold sponging.

This case, then, is of interest in showing the blood-pictures of a case which was as near to Death's door as one could well imagine, and recovered.

Little comment is necessary upon these pictures. Suffice it to say that a marked dislocation was present to the left, and that this dislocation became more marked, or less marked, according as the case became clinically worse, or improved, and that with unvarying accuracy.

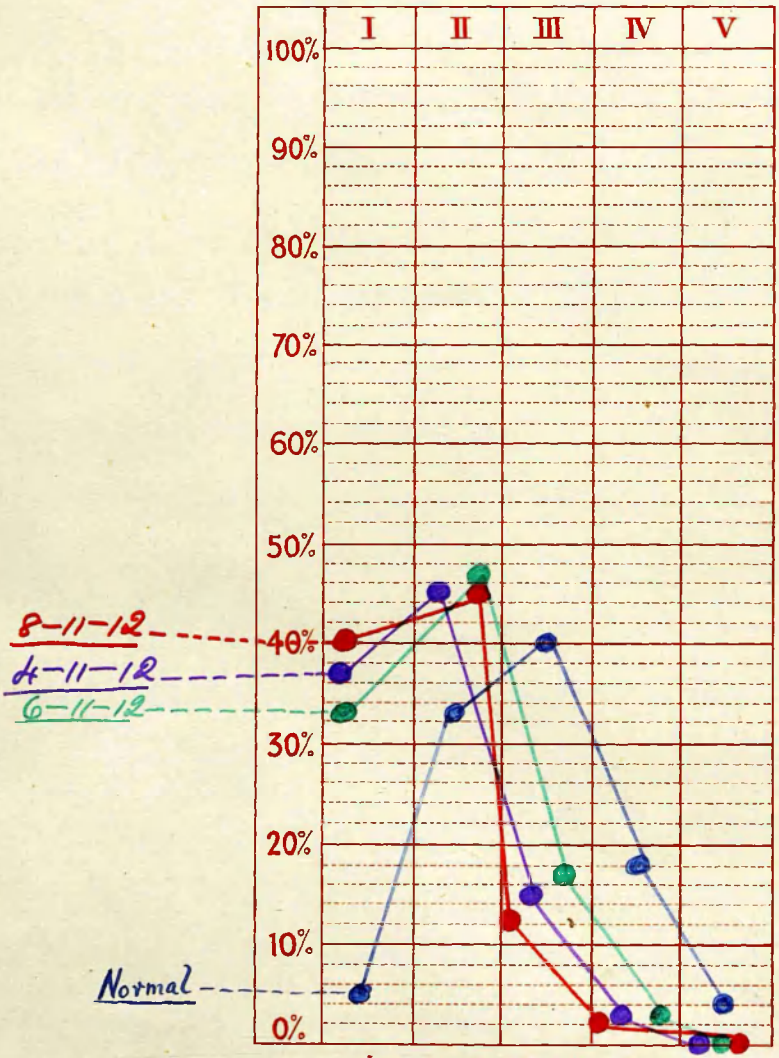
The last count of all, when the patient was restored to health, shows a practically normal picture, and the difference between this picture and those made at the height of a relapse, is very striking.

Two points more :

1. There never was a marked leucocytosis, which is what one would expect from such a profound toxaemia.
2. These counts were all made within a period of 8 weeks, so that here is further proof that the blood-pictures may show a considerable variation within short spaces of time,

Case Florence Godby No: 75 (Chart I.)

Age 21 Disease Puerperal Septicaemia: Recovery.



Leucocytes per cub. m.m.

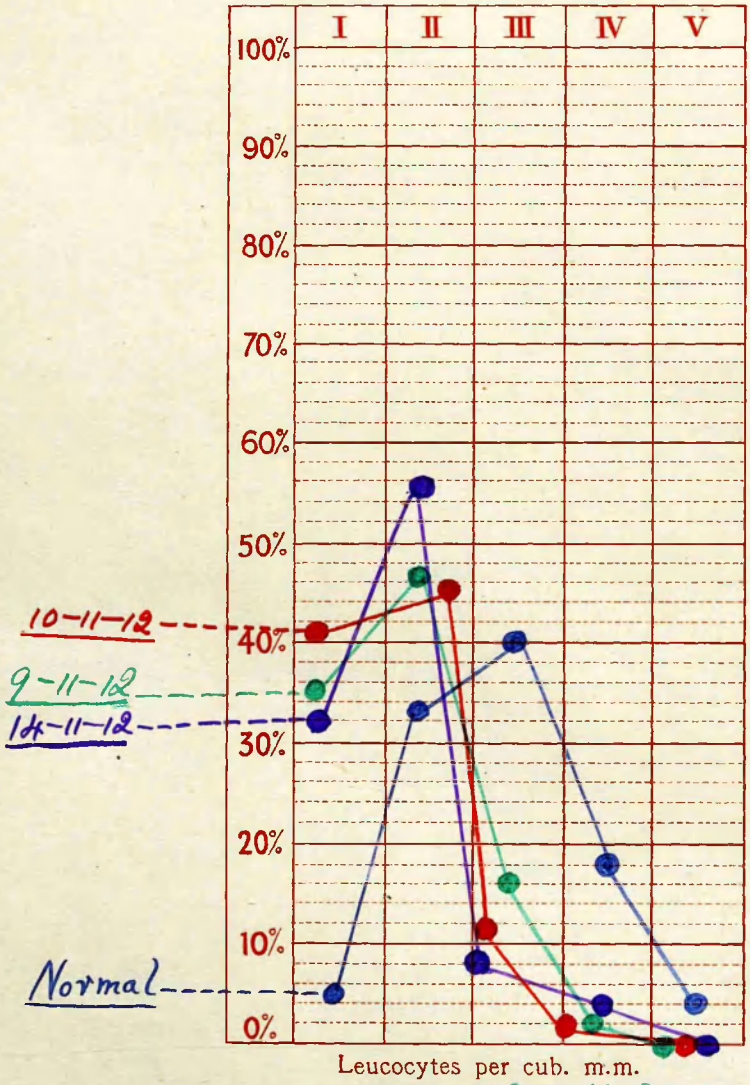
4-11-12 = 10,000

6-11-12 = 9,000.

8-11-12 = 12,000.

Case Florence Godby No. 75 (Chart II)

Age 21 Disease Puerperal Septicaemia. Recovery.



Leucocytes per cub. m.m.

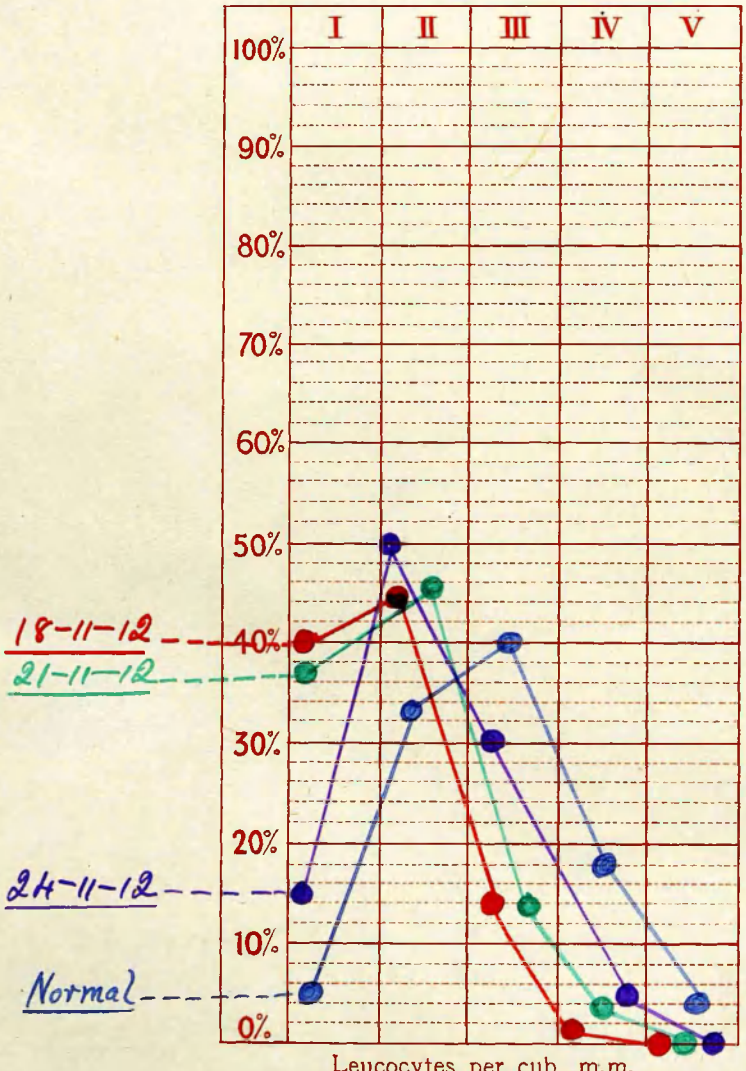
9-11-12 = 11,500

10-11-12 = 12,000

14-11-12 = 9,000.

Case Florence Godby No. 75 (Chart III)

Age 21 Disease Puerperal Septicaemia Recovery.



Leucocytes per cub. m.m.

18-11-12 = 10,000

21-11-12 = 9,600

24-11-12 = 7,000.

in certain diseases.

4-11-12. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
37%	45%	15%	3%	0%

6-11-12. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
33%	47%	17%	3%	0%

Relapse: 8-11-12. Leucocytes per cub.mm. = 12,000.

I.	II.	III.	IV.	V.
40.5%	45%	12.5%	2%	0%

Improving: 9-11-12. Leucocytes per cub.mm. = 11,500.

I.	II.	III.	IV.	V.
35.5%	46.5%	16%	2%	0%

Relapse: 10-11-12. Leucocytes per cub.mm. = 12,000.

I.	II.	III.	IV.	V.
41%	45.5%	11.5%	2%	0%

Improving: 14-11-12. Leucocytes per cub.mm. = 9,000.

I.	II.	III.	IV.	V.
32%	55.5%	8.5%	4%	0%

Relapse: 18-11-12. Leucocytes per cub.mm. = 10,000.

I.	II.	III.	IV.	V.
40%	44.5%	14%	1.5%	0%

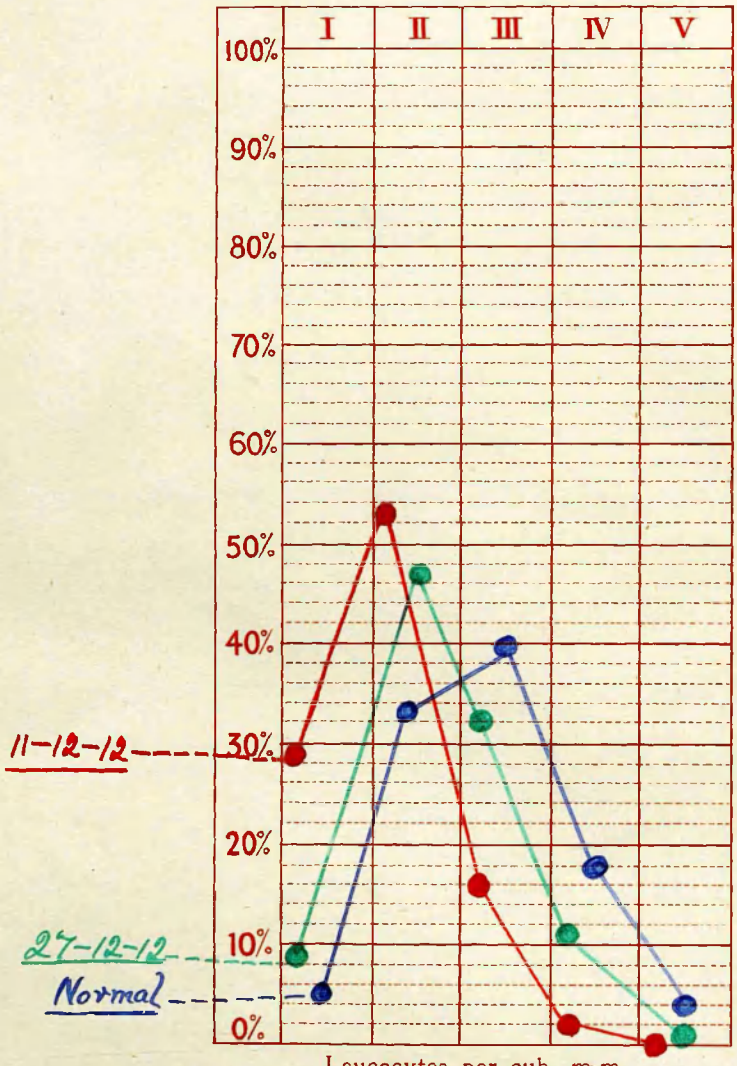
Improving: 21-11-12. Leucocytes per cub.mm. = 9,600.

I.	II.	III.	IV.	V.
37%	45.5%	13.5%	4%	0%

Case Florence Godby No. 75. (Chart IV)

Age 21. Disease Puerperal Septicaemia

Recovery.



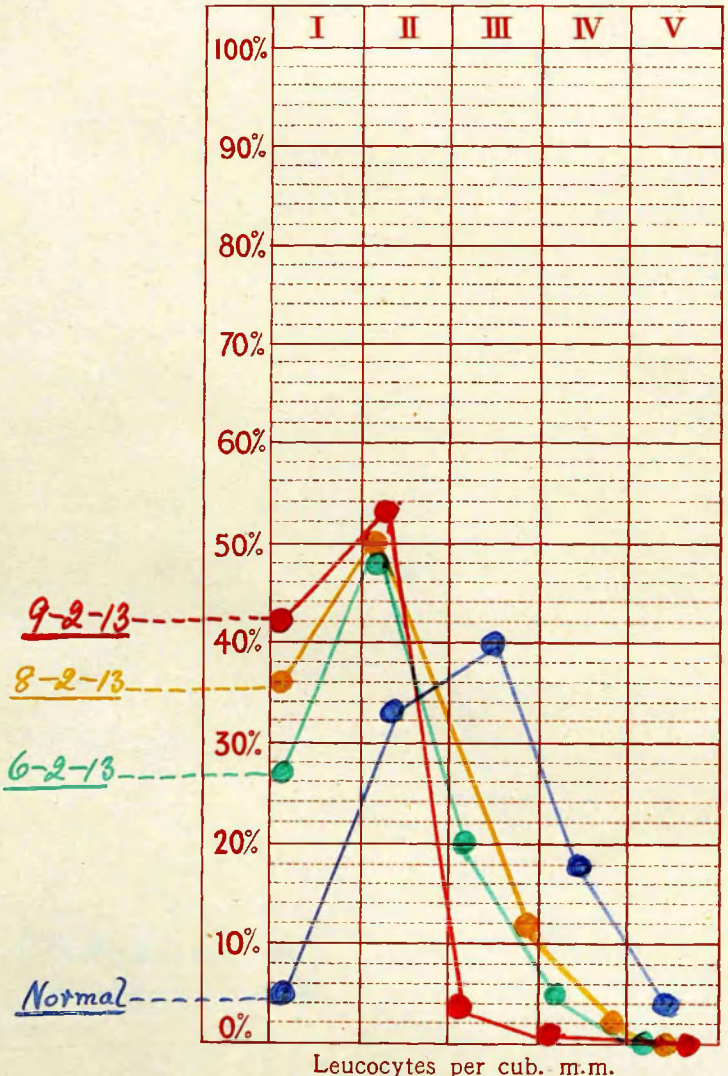
Leucocytes per cub. m.m.

11-12-12 = 11,000

27-12-12 = 8,000.

Case Mary Ann Bell No. 76.

Age 34 Disease Puerperal Septicaemia: Death.



Leucocytes per cub. m.m.

6-2-13 = 11,000.

8-2-13 = 8,000.

9-2-13 = 8,000.

Improving: 24-11-12. Leucocytes per cub.mm. = 7,000.

I.	II.	III.	IV.	V.
15%	50%	30%	5%	0%

Relapse: 11-12-12. Leucocytes per cub.mm. = 11,000.

I.	II.	III.	IV.	V.
29%	53%	16%	2%	0%

Well: 27-12-12. Leucocytes per cub.mm. = 8,000.

I.	II.	III.	IV.	V.
9%	47%	32%	11%	1%

I shall now consider 2 cases of Puerperal Septicaemia, in both of which death occurred.

Case: Mary Ann Bell. Aet. 34.

No. 76. Puerperal Septicaemia: Death.

This patient had been delivered a week previous to the first count made, and had been ill at home for 5 days before coming under observation in hospital. On admission, on 6-2-13, she was fevered and slightly jaundiced. The temperature remained pyrexial, and swinging, in character, she became lethargic and cyanosed, and, in spite of all treatment, died on 10-2-13.

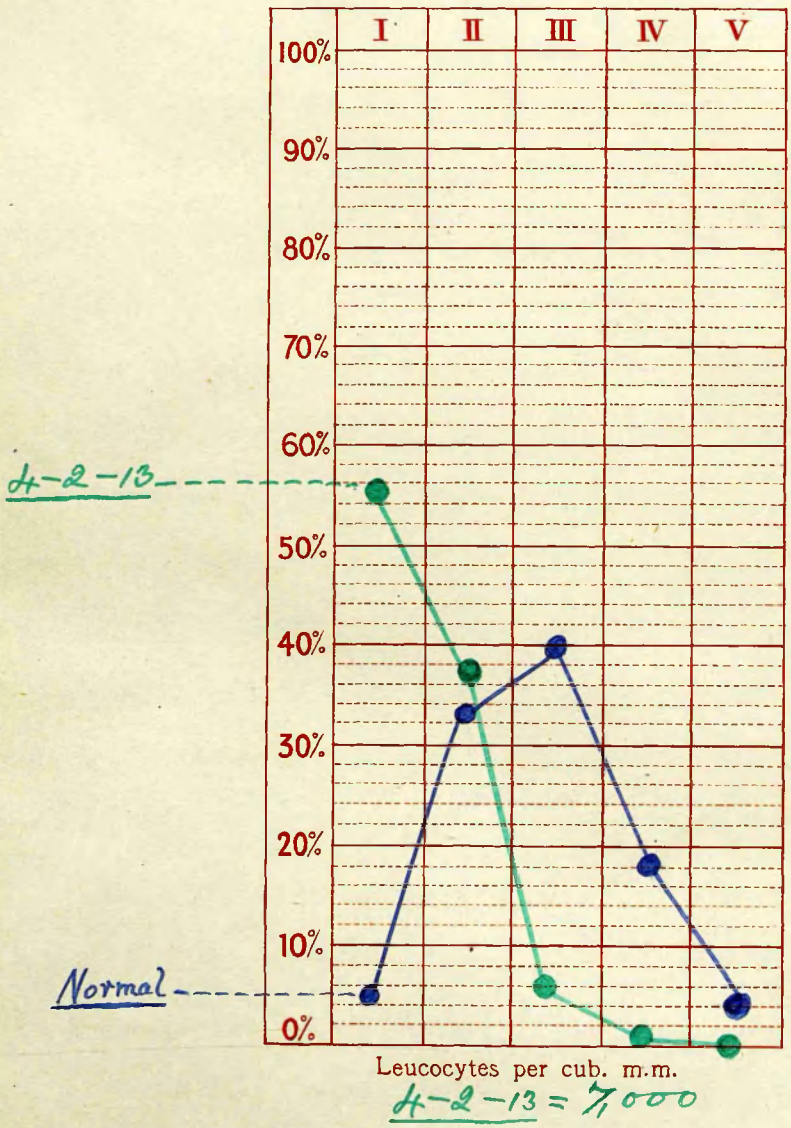
The counts made were as follows :-

6-2-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
27%	48%	20%	5%	0%

Case Alice Smith No. 77

Age 35 Disease Puerperal Septicaemia: Death.



8-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	Iv.	V.
36%	50%	12%	2%	0%

9-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
42%	53%	4%	1%	0%

Death occurred next day.

These pictures, then, show a steadily and rapidly increasing dislocation to the left in a case which steadily progressed to a fatal termination.

The diminishing leucocyte count per cub. mm. coincident with this increasing dislocation is noteworthy.

The next case is that of a woman who was admitted practically moribund, suffering from Puerperal Septicaemia of 7 days' duration. She was almost pulseless, was deeply cyanosed, and fevered.

She died 12 hours after admission, and the one blood-picture made from her case shows a dislocation to the left of the picture which is extreme, and from such a dislocation I have never seen a recovery.

Case: Alice Smith. Aet. 35.

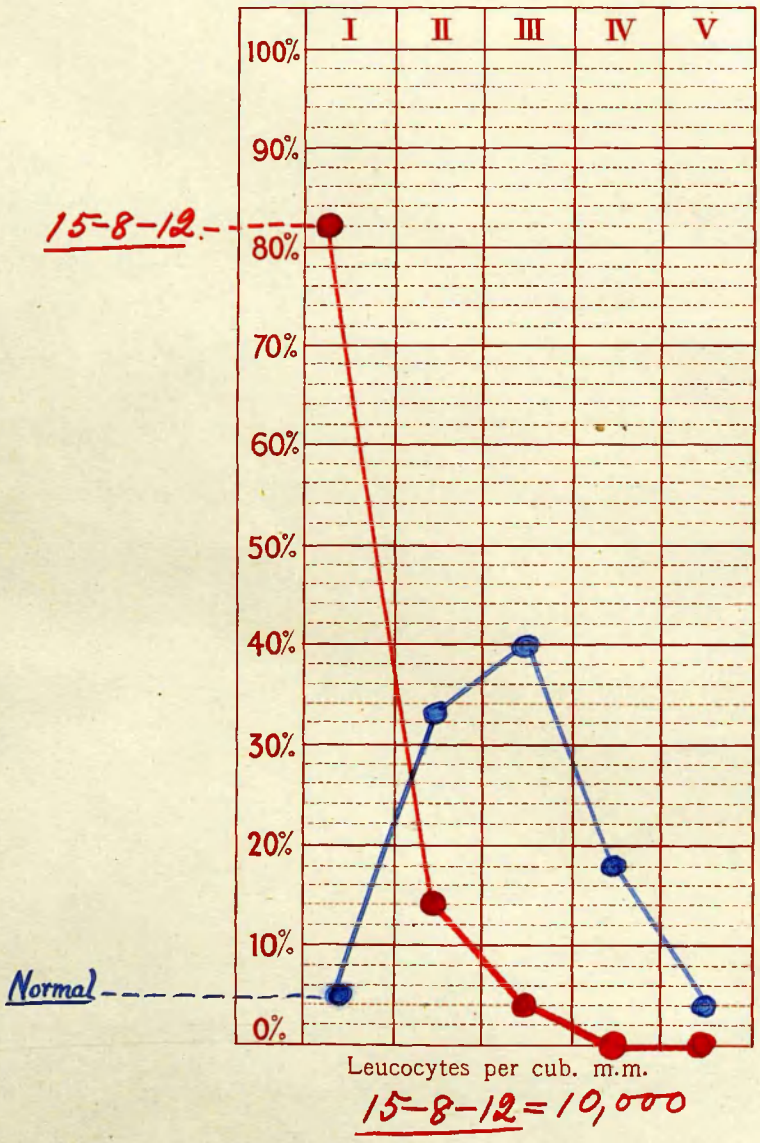
No. 77. Puerperal Septicaemia: Death.

4-2-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
55.5%	37.5%	6%	1%	0%

Case Mary Alice Lofts No. 78

Age 6 years Disease Septic General Peritonitis.



Again is to be noted the low leucocyte count per cub. mm., with a very marked dislocation to the left of the picture.

Septic General Peritonitis.

I shall next discuss 2 cases of Septic General Peritonitis, both of which terminated fatally.

Case: Mary Alice Lofts. Aet. 6 years.

No. 78. Septic General Peritonitis: Death. This was a case in which there was a history of appendicitis of 5 days' duration. On admission, 15-8-12, she was extremely ill, with signs of septic general peritonitis. It was deemed that she ought to have the chance of operation, but, on opening the abdomen, it was found to be full of pus, the cause being perforation of the appendix. She died 5 hours after operation.

Immediately before operation an examination of the blood revealed the following picture, which shows the most pronounced dislocation I have ever seen, and that with a comparatively low leucocyte count per cub. mm.

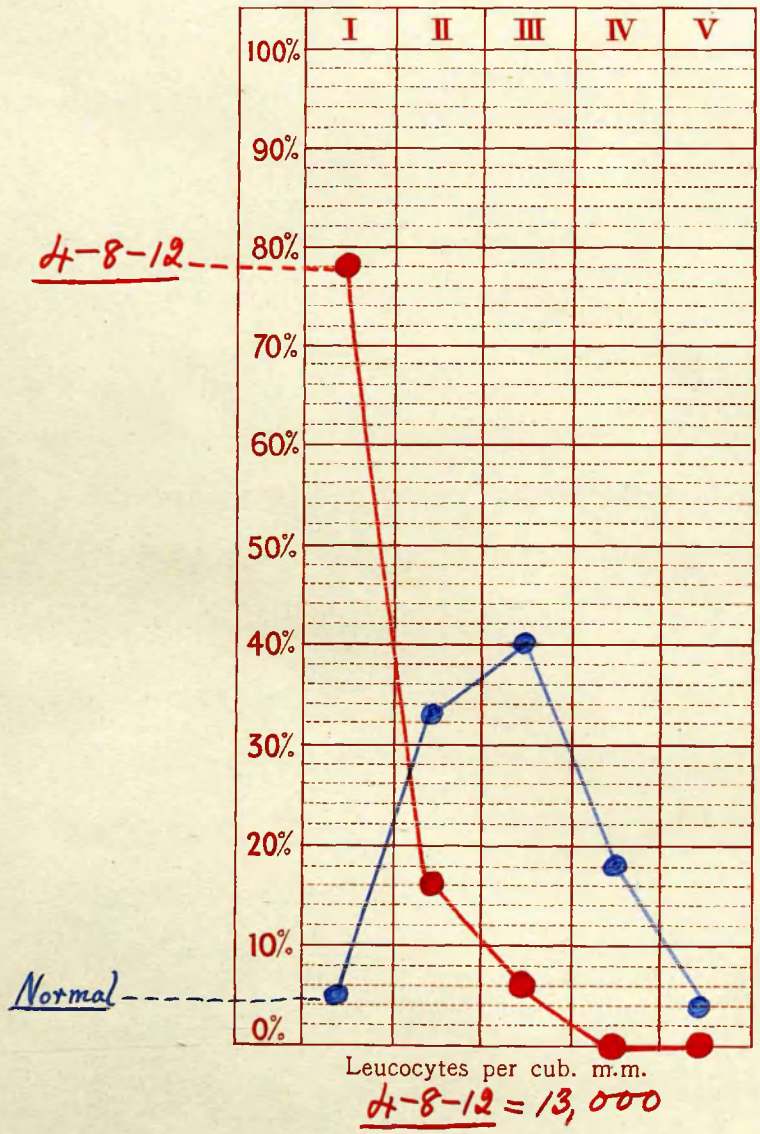
15-8-12. Leucocytes per cub. mm. = 10,000.

I.	II.	III.	IV.	V.
82%	14%	4%	0%	0%

The next case is very similar to the preceding, and shows a dislocation to the left almost as pronounced.

Case Wm. Elliott No. 79.

Age 11 years Disease Septic General Peritonitis.



Case: Wm. Elliott. Aet. 11 years.

No. 79. Septic General Peritonitis. This patient was admitted on 4-8-12, with a history suggestive of appendix trouble of 2 months' duration; also, of sudden onset of pain, with all the other symptoms characteristic of a perforation of an abdominal viscus.

On admission: he was extremely ill, and signs of septic general peritonitis were present. Immediate laparotomy was performed, and the abdomen found to be full of purulent fluid from a perforation in the appendix, round which were signs of previous abscess formation. He died 16 hours after operation.

The examination of the blood made on admission, just before operation, showed the following picture -

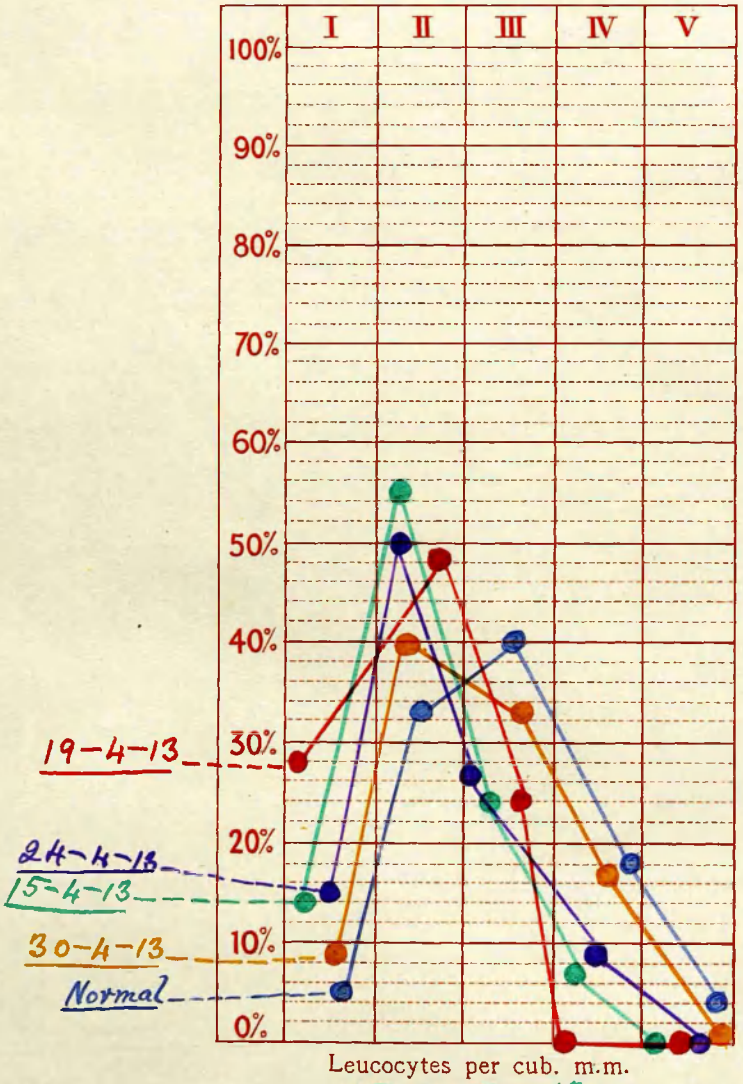
4-8-12. Leucocytes per cub. mm. = 13,000.

I.	II.	III.	IV.	V.
78%	16%	6%	0%	0%

These last two cases show dislocations of the picture to the left, which are extraordinary in their severity, and are the most striking I have ever seen. It is worthy of note that they both occurred in children, and that in neither case was the total leucocyte count per cub. mm. at all high.

Case John Flynn. No. 80.

Age 55 Disease Erysipelas of Leg.



Leucocytes per cub. m.m.

15-4-13 = 13,000

19-4-13 = 14,000

24-4-13 = 12,000.

30-4-13 = 9,000.

Erysipelas.

Two cases, both recovering.

Case: John Flynn. Aet. 55.

No. 80. Erysipelas of Leg. This patient was admitted on 15-4-13 with an erysipelas of the left leg and thigh, arising from a septic cellulitis of the foot, where there was a small wound.

Under treatment he made a good recovery, and the following are the pictures obtained from the blood examinations which were made, and the improvement, or deterioration, of the pictures, coincided with the improvement, or deterioration, clinically, of the case.

On admission: 15-4-13. Leucocytes per cub.mm. = 13,000.

I.	II.	III.	IV.	V.
14%	55%	24%	7%	0%

Erysipelas spreading. 19-4-13. Leucocytes per cub.mm. = 14,000.

I.	II.	III.	IV.	V.
28%	48%	24%	0%	0%

Erysipelas subsiding. 24-4-13. Leucocytes per cub.mm. = 12,000.

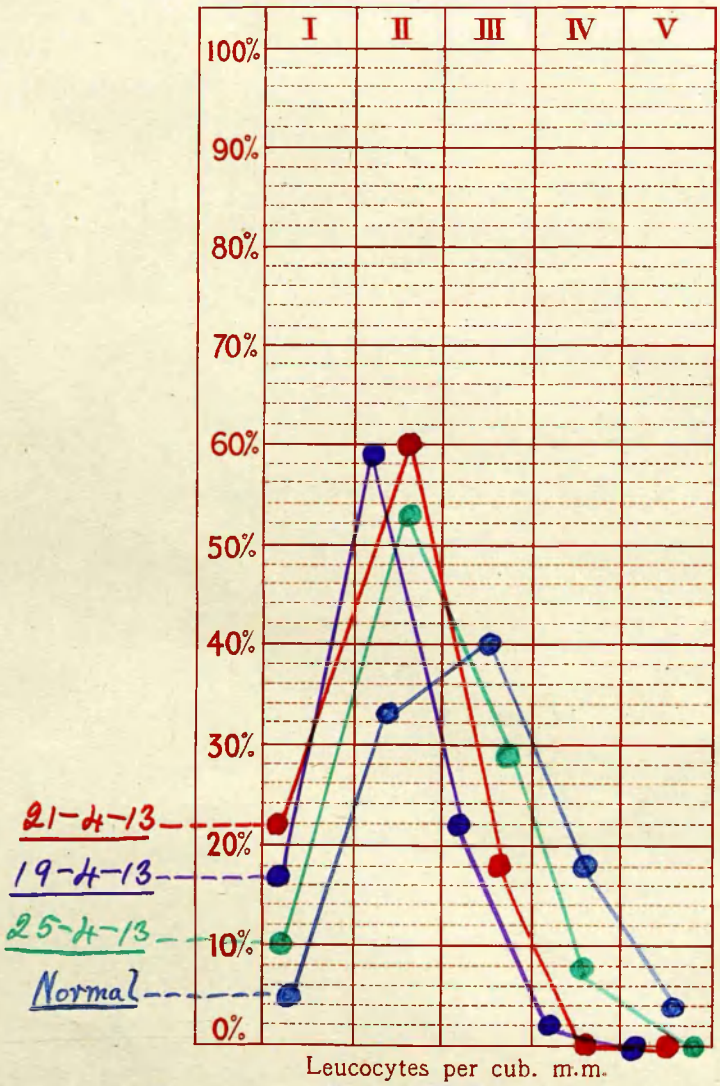
I.	II.	III.	IV.	V.
15%	50%	26%	9%	0%

Well. 30-4-13. Leucocytes per cub.mm. = 9,000.

I.	II.	III.	IV.	V.
9%	40%	33%	17%	1%

Case Sarah Atkinson No. 81

Age 78 Disease Erysipelas of Face.



Case: Sarah Atkinson. Aet. 78.

No. 81. Erysipelas of Face. This patient came under observation on 18-4-13, with a facial erysipelas which subsided inside a week. The dislocations of the pictures were definitely to the left, though not extremely so, and as the patient recovered, the picture became normal again.

19-4-13.	I.	II.	III.	IV.	V.
	17%	59%	22%	2%	0%

Erysipelas spreading. 21-4-13.

	I.	II.	III.	IV.	V.
	22%	60%	18%	0%	0%

Almost well. 25-4-13.

	I.	II.	III.	IV.	V.
	10%	53%	29%	8%	0%

Thus from these two cases it is evident that in Erysipelas the same changes in the blood picture occurs as in the diseases already discussed.

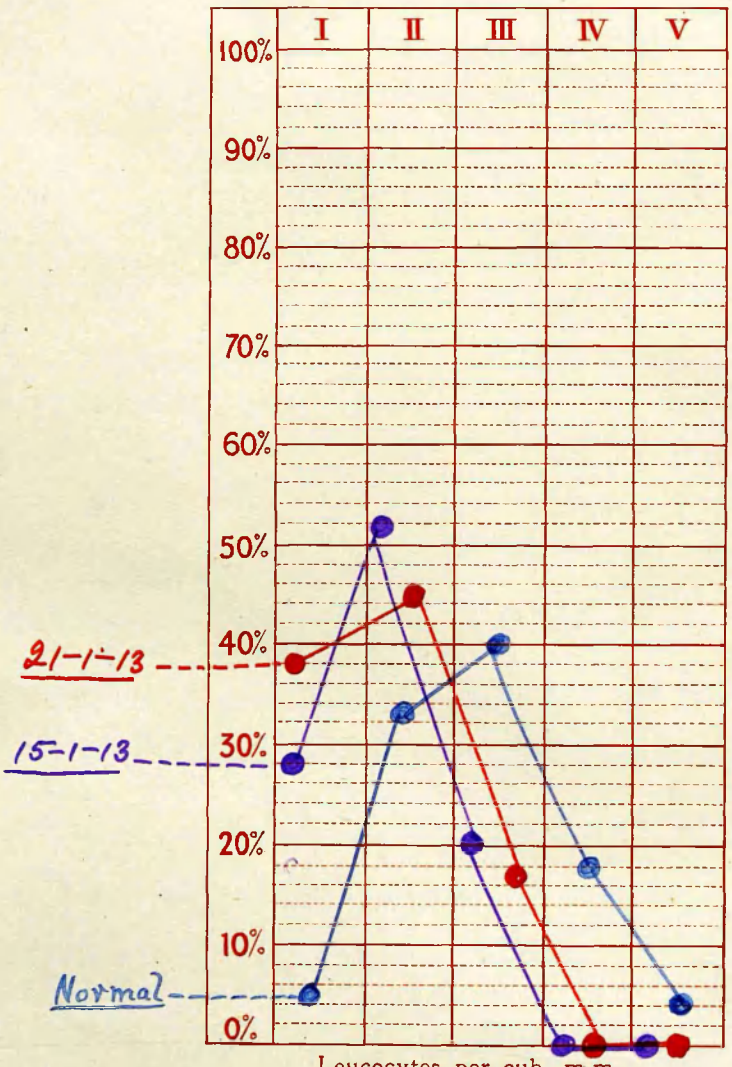
Mastoiditis with Septic Meningitis.

Case: W. Staniforth. Aet. 34.

No. 82. Mastoiditis: Septic Meningitis: Death. This patient was admitted on 15-1-13 with signs of acute mastoiditis: on the following day mastoidectomy was performed, and the same day signs of meningitis became evident. This was confirmed 2 days later by lumbar

Case W. Stamforth No. 82

Age 34 Disease Mastoiditis: Septic Meningitis



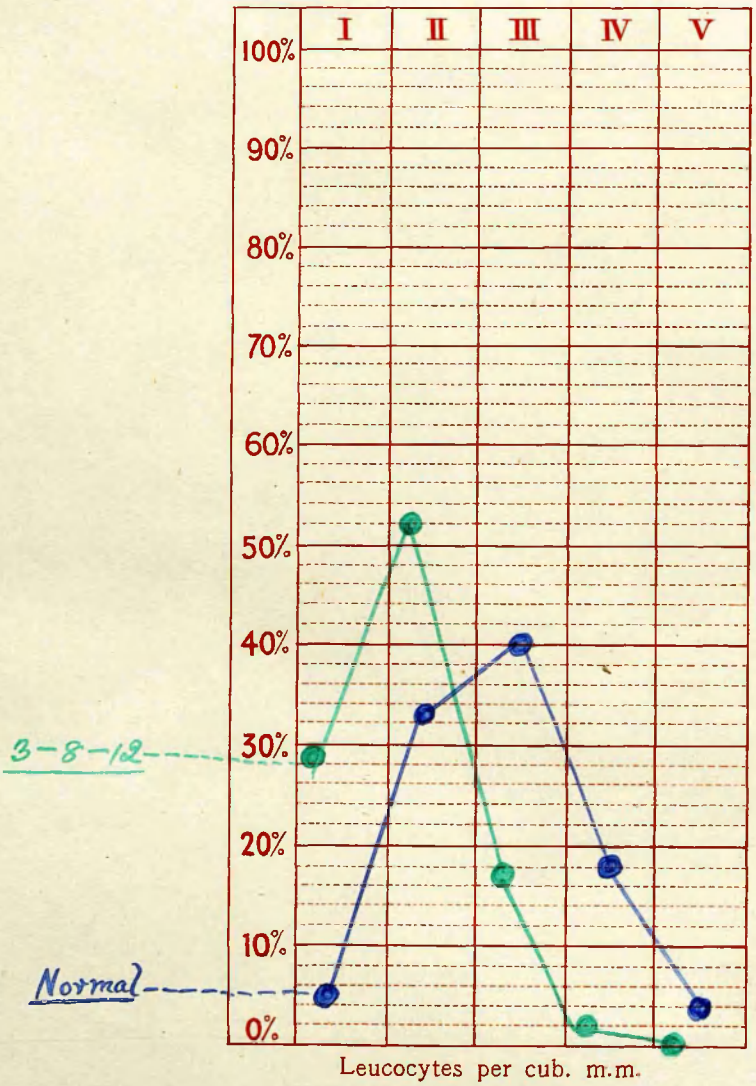
Leucocytes per cub. m.m.

15-1-13 = 20,000

21-1-13 = 19,000.

Case J. Ellis No. 83.

Age 49 Disease Bronchitis with Emphysema.



puncture. He became steadily worse, and died on 21-1-13.

The following 2 blood-pictures show the increased dislocation produced by the presence of the meningitis.

15-1-13. Leucocytes per cub. mm. = 20,000.

I.	II.	III.	IV.	V.
28%	52%	20%	0%	0%

21-1-13. Leucocytes per cub. mm. = 19,000.

I.	II.	III.	IV.	V.
38%	45%	17%	0%	0%

Bronchitis with Emphysema.

This was a case of a long-standing bronchitis with emphysema, which had reached a terminal stage. Hypostasis was commencing in the lungs, and the sputum was very purulent. Only one count was made, and it showed a dislocation of the picture to the left, in moderate degree, and probably due to the septic condition of the bronchial tubes.

Case: J. Ellis. Aet. 49.

No. 83. Bronchitis with Emphysema.

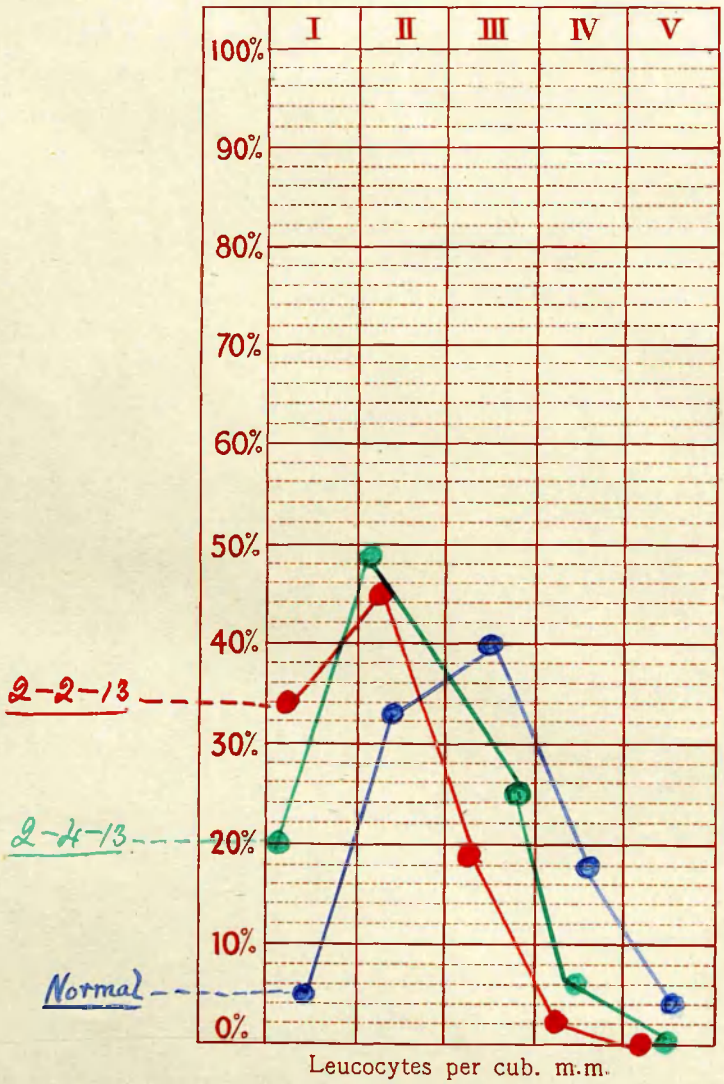
3-8-12.	I.	II.	III.	IV.	V.
	29%	52%	17%	2%	0%

Malignant Disease.

I shall now take up a series of 14 cases of Malignant Disease to which I have applied this method of blood examination.

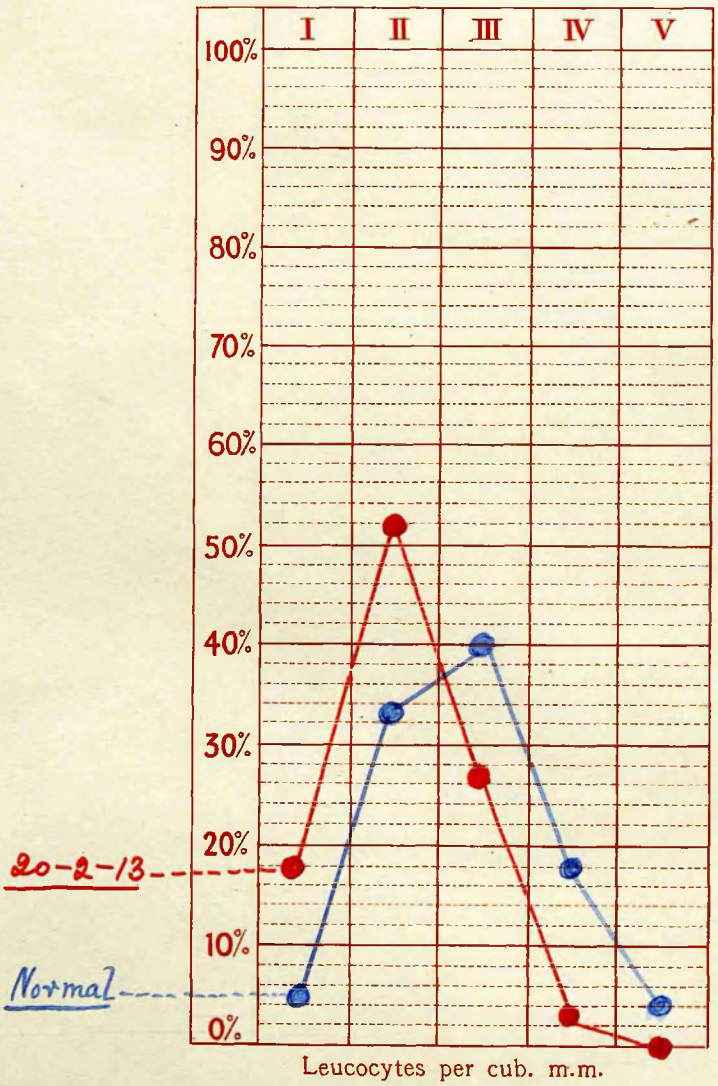
Case Thomas Fairweather No. 84.

Age 66. Disease Epithelioma of Lip.



Case Robert Brumhill No. 85

Age 48 Disease Carcinoma of the Stomach



Case: Thomas Fairweather. Aet. 66.

No. 84. Epithelioma of Lip. This patient was admitted with a very foul ulcer on the lower lip, which had perforated into the mouth at the lower part. It was very septic, and profuse discharge was present. The ulcer was excised radically, and he imrpoved remarkably in condition.

2-2-13.	I.	II.	III.	IV.	V.
	34%	45%	19%	2%	0%
2-4-13.	I.	II.	III.	IV.	V.
	20%	49%	25%	6%	0%

This improvement I take to be due to the removal of the focus of septic absorption.

Case: Robert Brumhill. Aet. 48.

No. 85. Carcinoma of the Stomach. This patient had a large inoperable carcinoma of the stomach, with marked anaemia and wasting.

20-2-13.	I.	II.	III.	IV.	V.
	18%	52%	27%	3%	0%

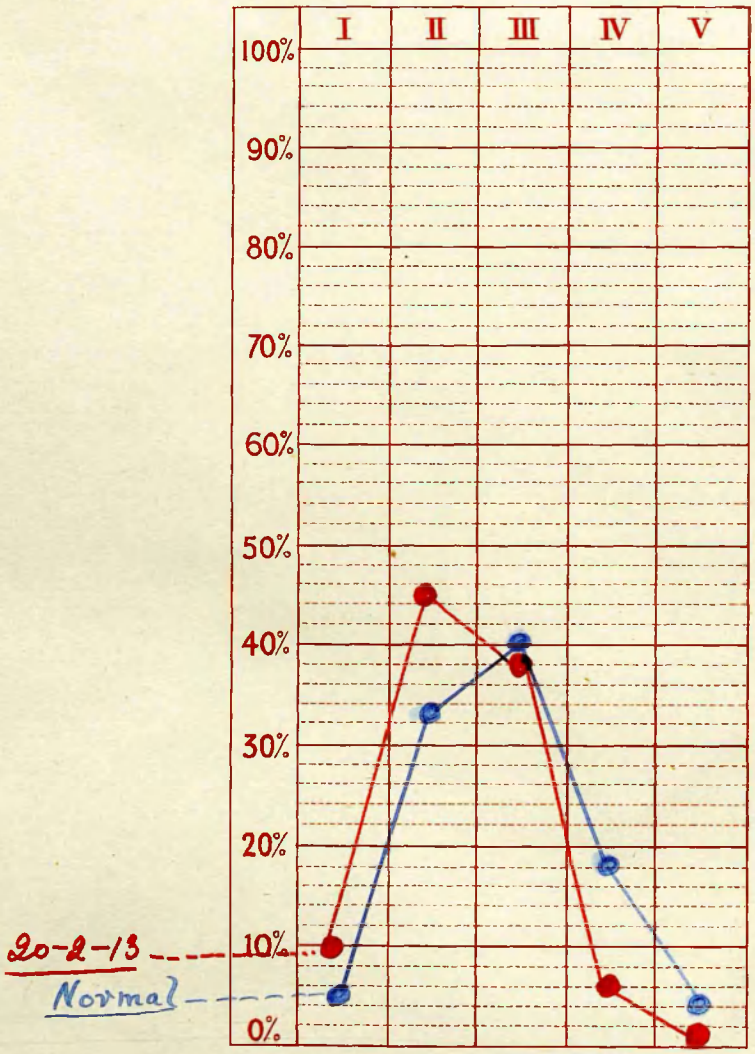
A month later, he died.

Case: Michael Carl. Aet. 57.

No. 86. Epithelioma of Floor of Mouth etc. This was a case of very extensive epitheliomatous ulceration of the floor of the mouth and left cheek, so that the jaws were almost fixed, impeding mastication. There was

Case Michael Carl No. 86

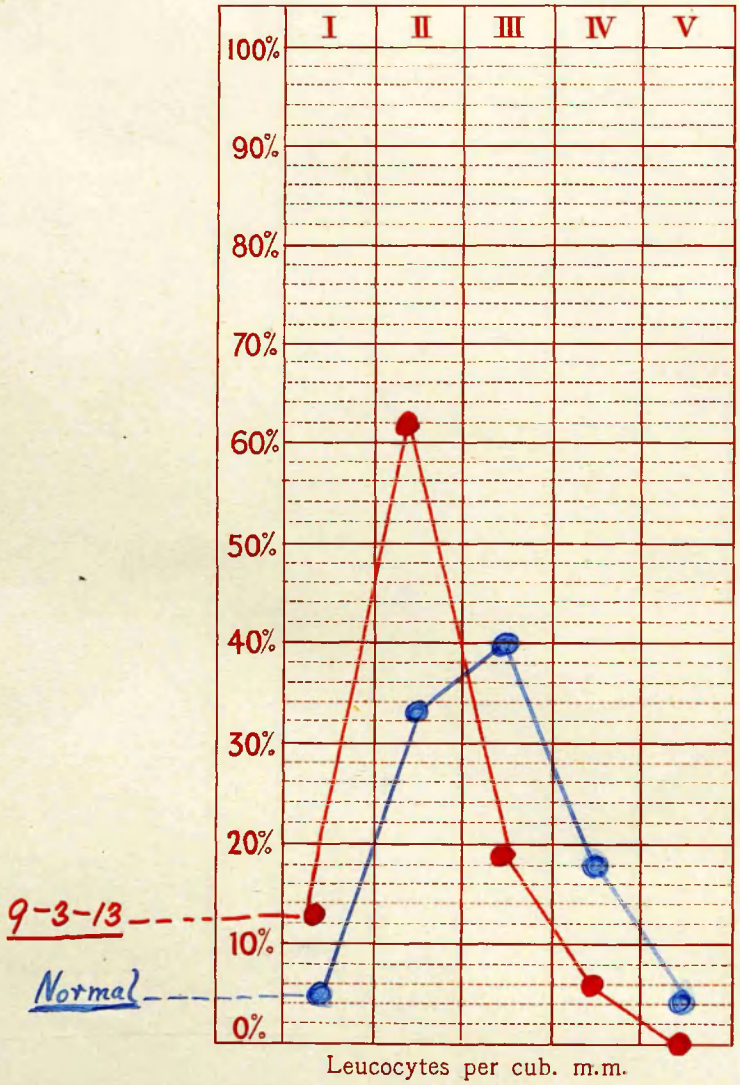
Age 57 Disease Epithelioma of floor of mouth &c.



Leucocytes per cub. m.m.

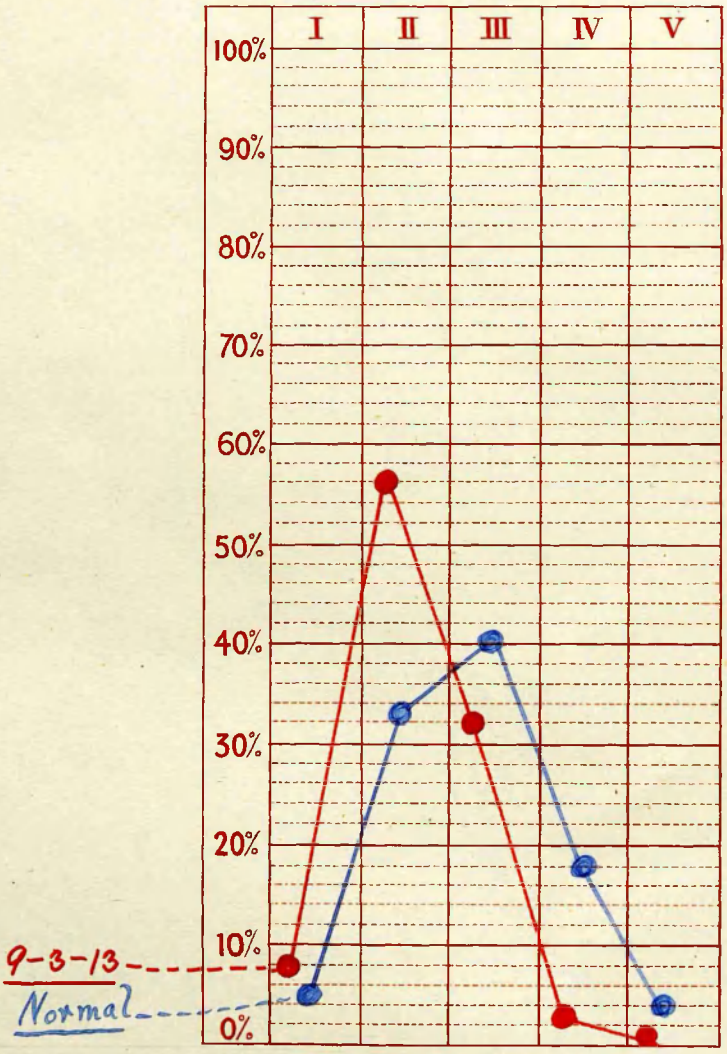
Case Martin Layden No. 87

Age 56 Disease Epithelioma of Floor of Mouth.



Case Frederick Purser No. 88

Age 70. Disease Epithelioma of Lip.



Leucocytes per cub. m.m.

some sepsis present, and he was in some danger of death from mechanical causes, as he had frequent attacks of oedema of the lips and face.

In spite of all these facts, the blood-picture of 20-2-13, made 30 days before death, shows little departure from normal.

20-2-13.	I.	II.	III.	IV.	V.
	10%	45%	38%	6%	1%

Case: Martin Layden. Aet. 56.

No. 87. Epithelioma of Floor of Mouth. This case was inoperable, and the mouth was septic.

9-3-13.	I.	II.	III.	IV.	V.
	13%	62%	19%	6%	0%

Case: Frederick Purser. Aet. 70.

No. 88. Epithelioma of Lip. This was another inoperable case, a large epitheliomatous ulcer being present on the lower lip, and extending on to one cheek.

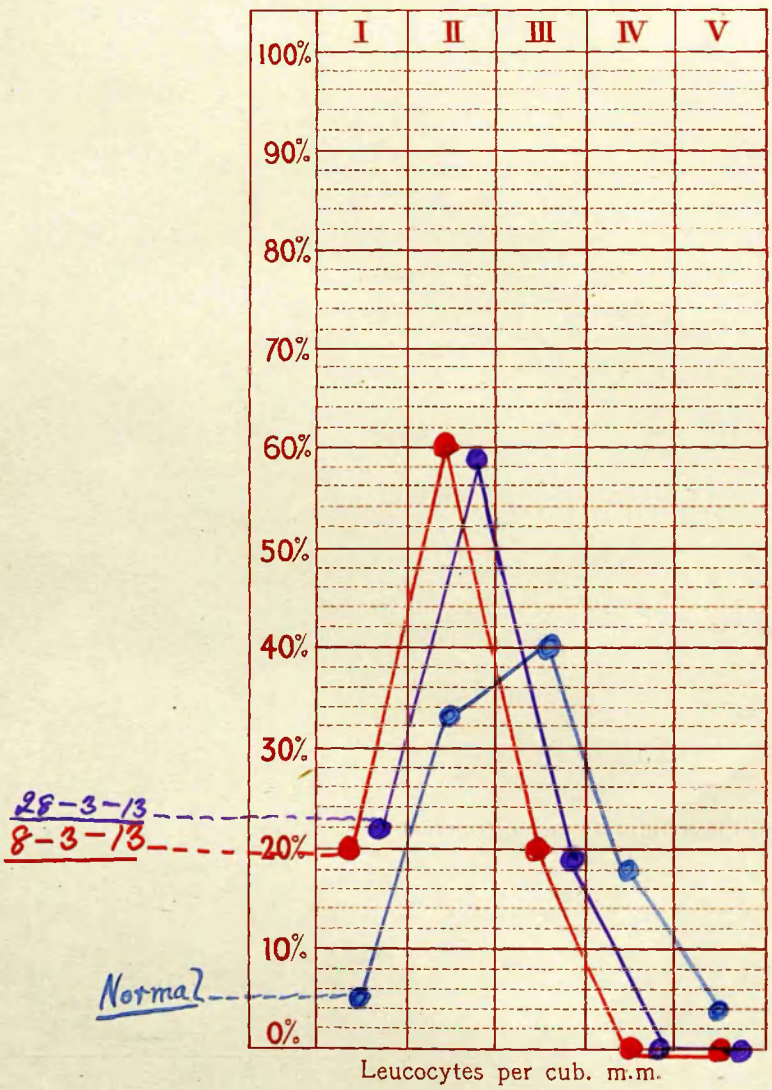
It was fairly clean, and was made quite clean by dressings. An examination of the blood was then made, and the following picture obtained -

9-3-13.	I.	II.	III.	IV.	V.
	8%	56%	32%	3%	1%

This shows only a very slight departure from any average normal count.

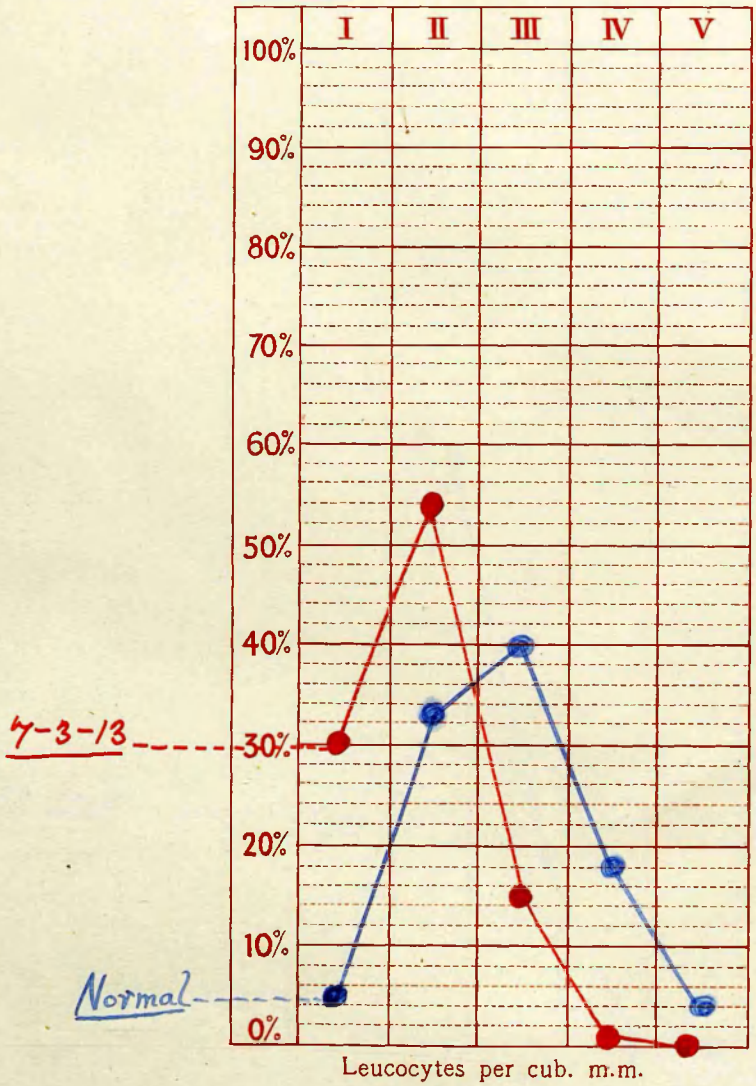
Case James Jackson No. 89

Age 62 Disease Carcinoma of the Stomach.



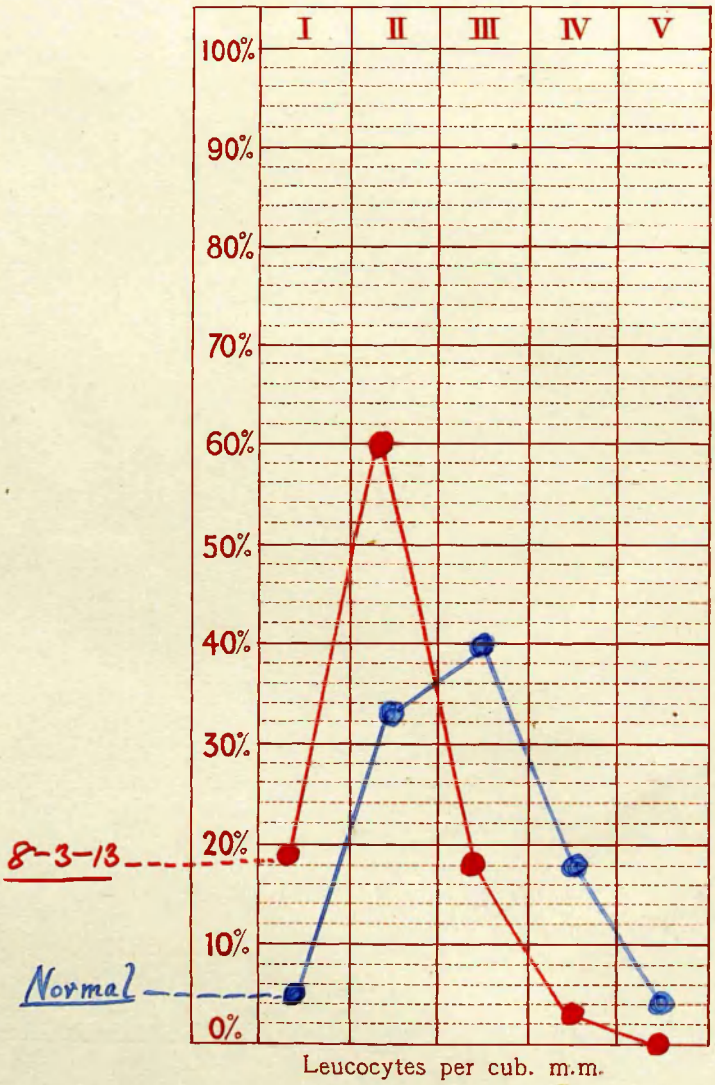
Case Eliza Mellors No. 90

Age 65 Disease Carcinoma of the Caecum.



Case George Bradley No. 91.

Age 57 Disease Carcinoma of the Liver



Case: James Jackson. Aet. 62.

No. 89. Carcinoma of the Stomach. This was an inoperable case of carcinoma of the stomach with persistent vomiting.

The blood-pictures showed.

	I.	II.	III.	IV.	V.
8-3-13.	20%	60%	20%	0%	0%
28-3-13.	22%	59%	19%	0%	0%

Case: Eliza Mellors. Aet. 65.

No. 90. Carcinoma of the Caecum. This patient's blood-picture showed a definite dislocation to the left, but she died suddenly, before a further count had been made. She was the subject of double aortic disease, and presumably this was the cause of her death.

	I.	II.	III.	IV.	V.
7-3-13.	30%	54%	15%	1%	0%

Case: George Bradley. Aet. 57.

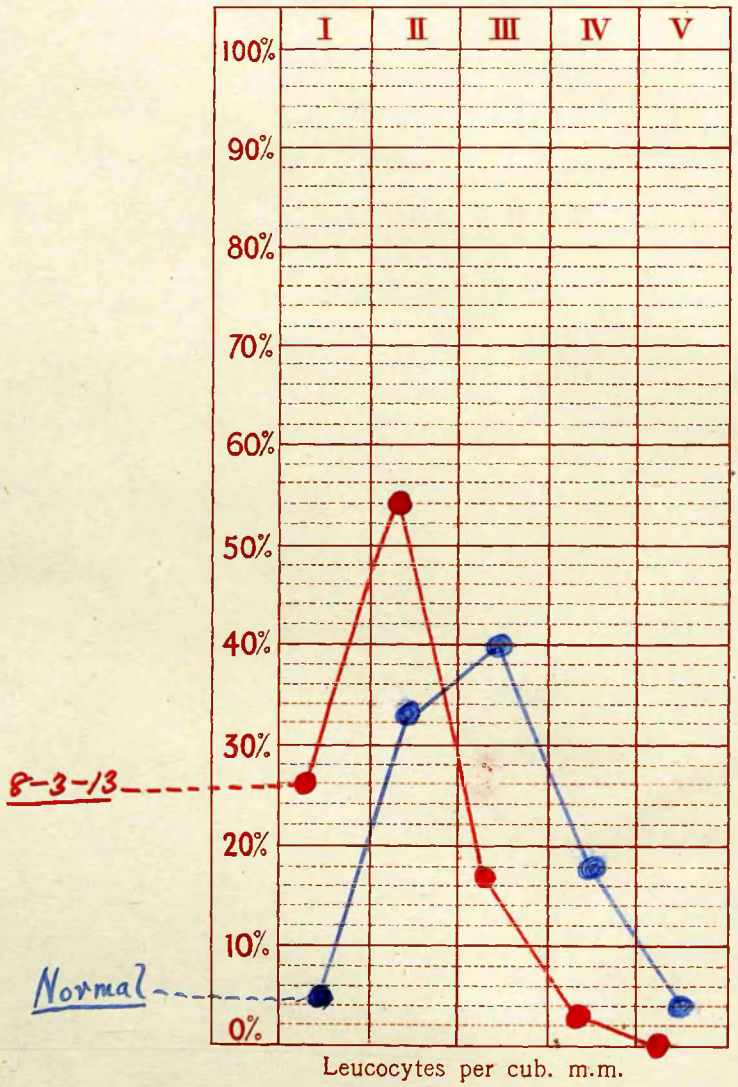
No. 91. Carcinoma of the Liver. This was an advanced case of carcinoma of the liver, with jaundice and marked wasting.

A mild dislocation to the left was evident in one picture compiled from his blood-examination.

	I.	II.	III.	IV.	V.
8-3-13.	19%	60%	18%	3%	0%

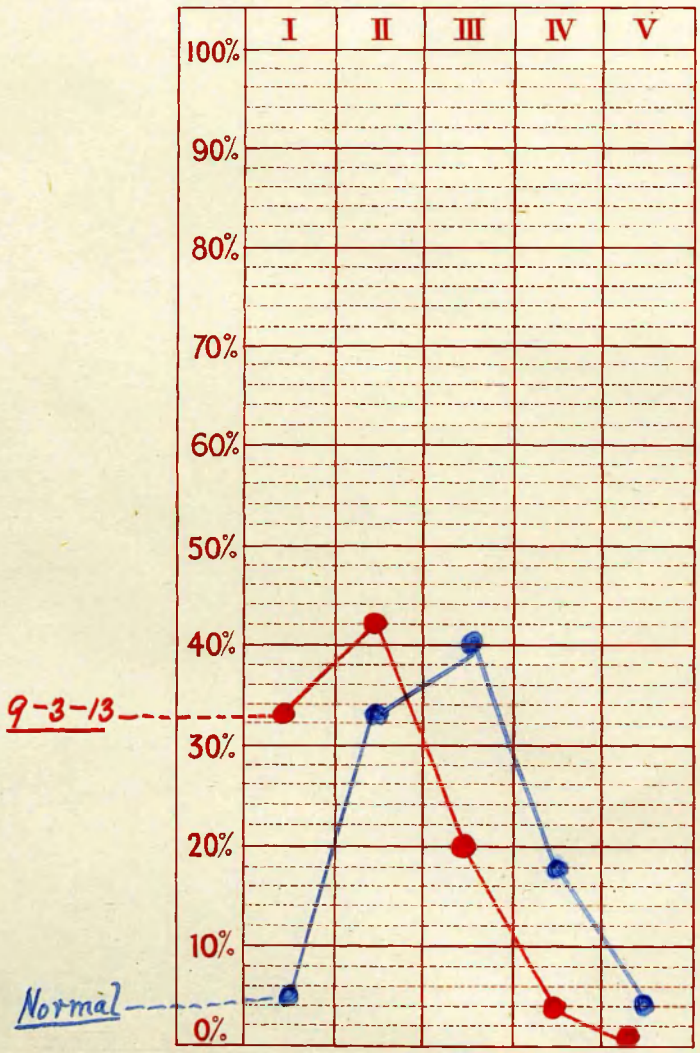
Case Wm. Shields No. 92.

Age 42. Disease Epithelioma of Lip.



Case Eliza Warburton No. 93

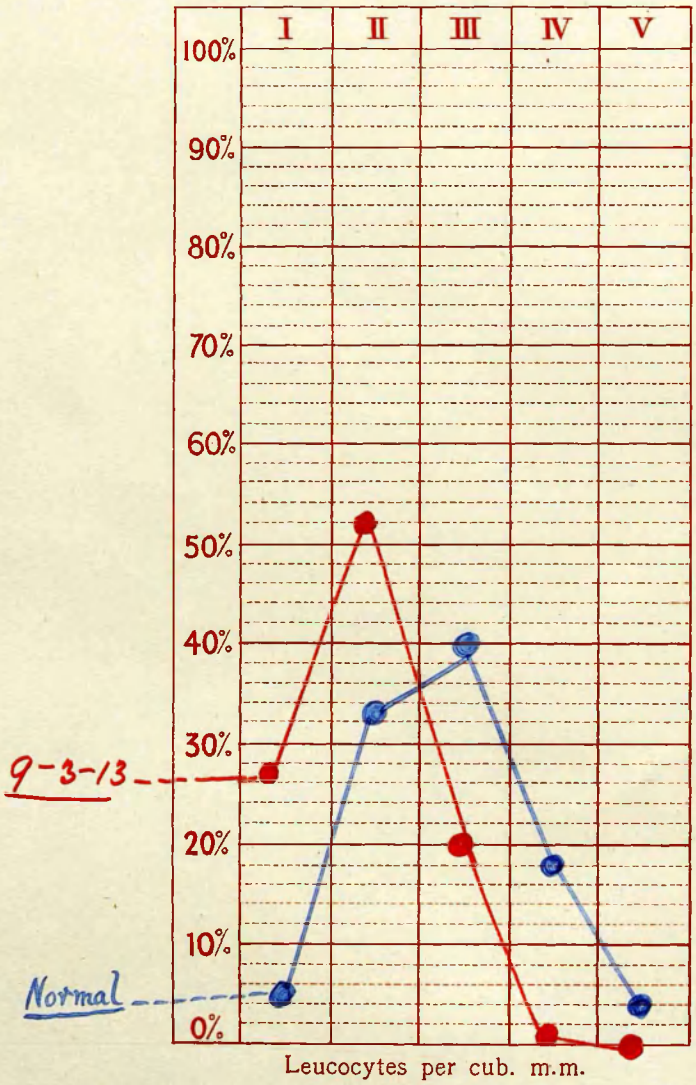
Age 63 Disease Carcinoma of the Liver.



Leucocytes per cub. m.m.

Case Sarah A. Whittle No. 94

Age 36. Disease Carcinoma cervicis uteri.



Case: Wm. Shields. Aet. 42.

No. 92. Very extensive and spreading epitheliomatous ulcer of the lower lip. He died three weeks after the following count was made -

8-3-13. Leucocytes per cub. mm. = 11,000.

I.	II.	III.	IV.	V.
26%	54%	17%	3%	0%

Case: Eliza Warburton. Aet. 63.

No. 93. Carcinoma hepatis. This was an advanced case, with jaundice and emaciation. She came under observation on 9-3-13, in a very feeble condition.

The blood showed -

9-3-13.	I.	II.	III.	IV.	V.
	33%	42%	20%	4%	1%

She died the following day.

Case: Sarah A. Whittle. Aet. 36.

No. 94. Carcinoma cervicis uteri. This also was an advanced case, with marked constitutional signs. She went home 3 weeks after the following count was made.

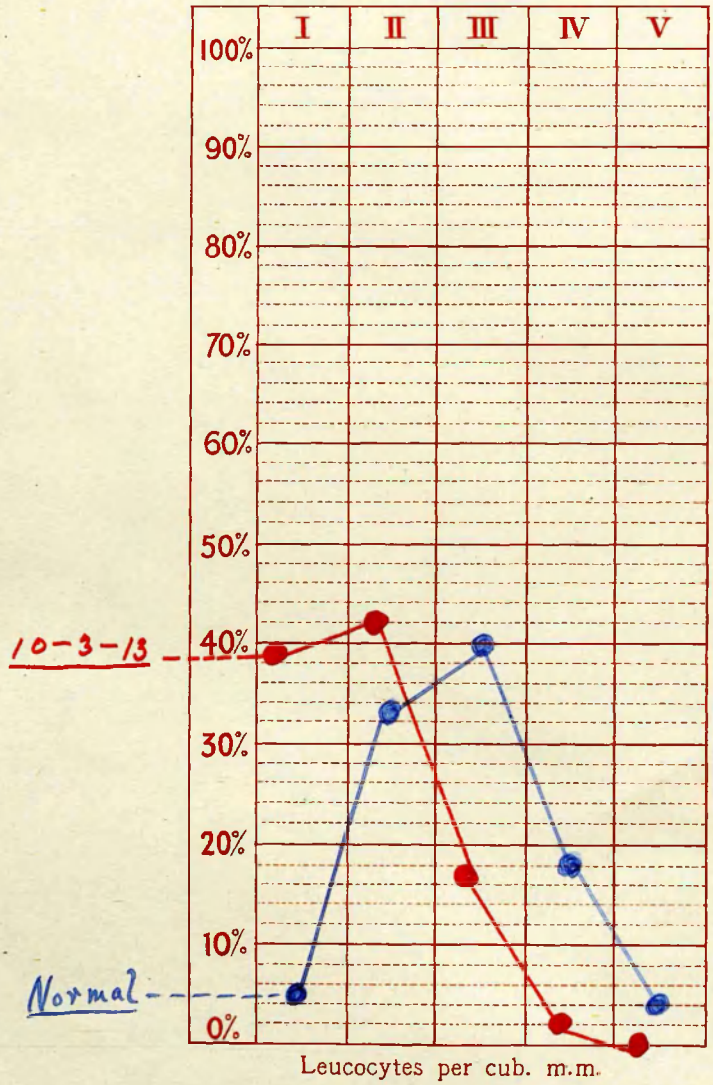
9-3-13.	I.	II.	III.	IV.	V.
	27%	52%	20%	1%	0%

Case: Christina Tyas. Aet. 46.

No. 95. Epithelioma Vulvae. This was a very extensive and quite inoperable case. 10 days after

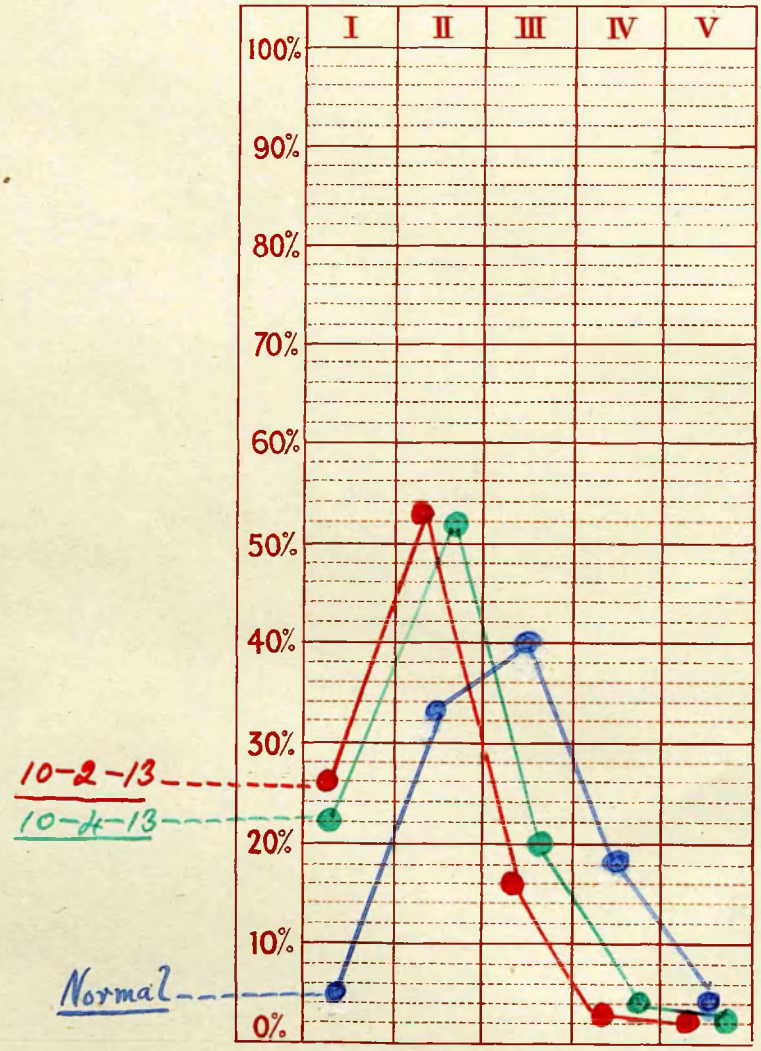
Case Christina Tyas No. 95.

Age 46. Disease Epithelioma Vulvae.



Case Rose Grimley No. 96

Age 58 Disease Carcinoma cervicis uteri.



Leucocytes per cub. m.m.

the following count was made, she died.

10-3-13.	I.	II.	III.	IV.	V.
	39%	42%	17%	2%	0%

A considerable dislocation is thus present.

Case: Rose Grimley. Aet. 58.

No. 96. Carcinoma cervicis uteri. This was a case of 2 years' duration, operation having been persistently refused in the early stages. The whole parametrium was involved when these observations were made, and very profuse foul discharge was present.

10-2-13.	I.	II.	III.	IV.	V.
	26%	53%	16%	3%	2%
10-4-13.	I.	II.	III.	IV.	V.
	22%	52%	20%	4%	2%

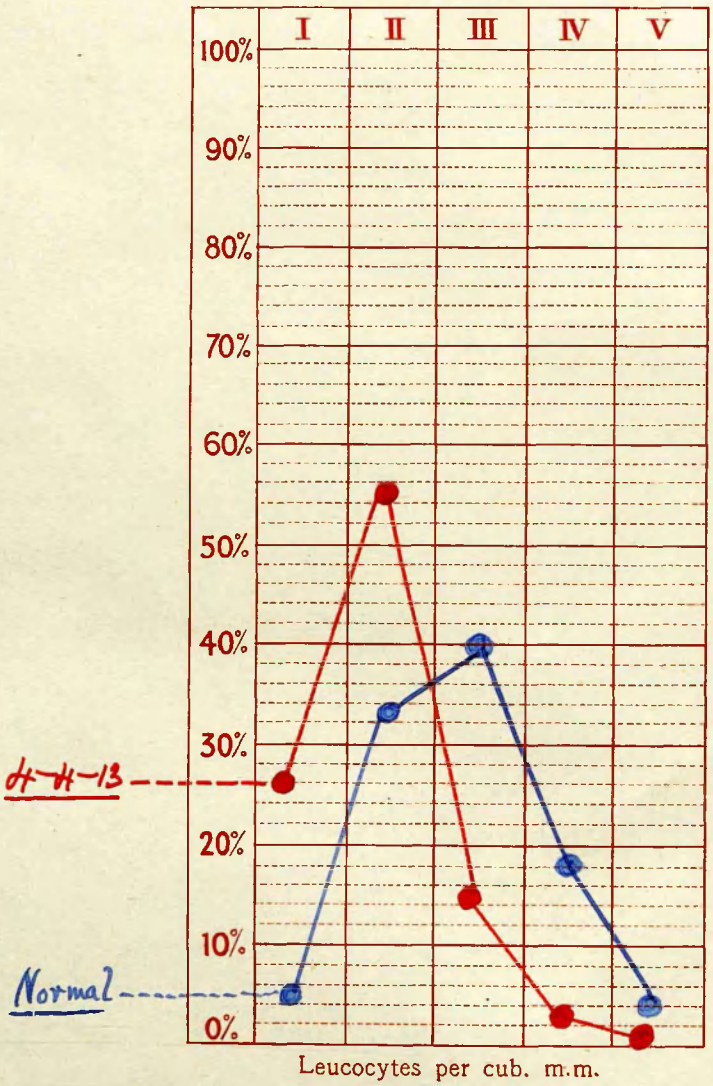
This slight but definite improvement in the pictures of a case which, clinically, was steadily approaching a fatal termination, is probably due to the fact that at the time the second count was made, the septic discharges had abated somewhat, owing to the removal of some fungating fragments.

Case: Martin Tully. Aet. 62.

No. 97. Carcinoma of the Liver. This was a case, far advanced, and of long standing. The blood-picture below shows a fairly mild dislocation to the left.

Case Martin Tully No. 97

Age 62 Disease Carcinoma of the Liver



4-4-13.	I.	II.	III.	IV.	V.
	26%	55%	15%	3%	1%

20 days later he died.

In malignant disease, also, then, a dislocation of the picture is very frequently found, as has been seen.

This dislocation is not so marked as in some diseases already dealt with, nor is it so extreme at the time of death. This latter phenomenon may, of course, be due to the fact that the cause of death in malignant disease is sometimes a mechanical one, from pressure or ulceration.

Nevertheless, from my experience so far, I do not attach so much importance to this method of blood-examination in malignant disease as in some other diseases, as in (malignant disease) there are various factors working together, an important one, so far as the alterations in the blood-picture are concerned, being, in my opinion, Septic Infections.

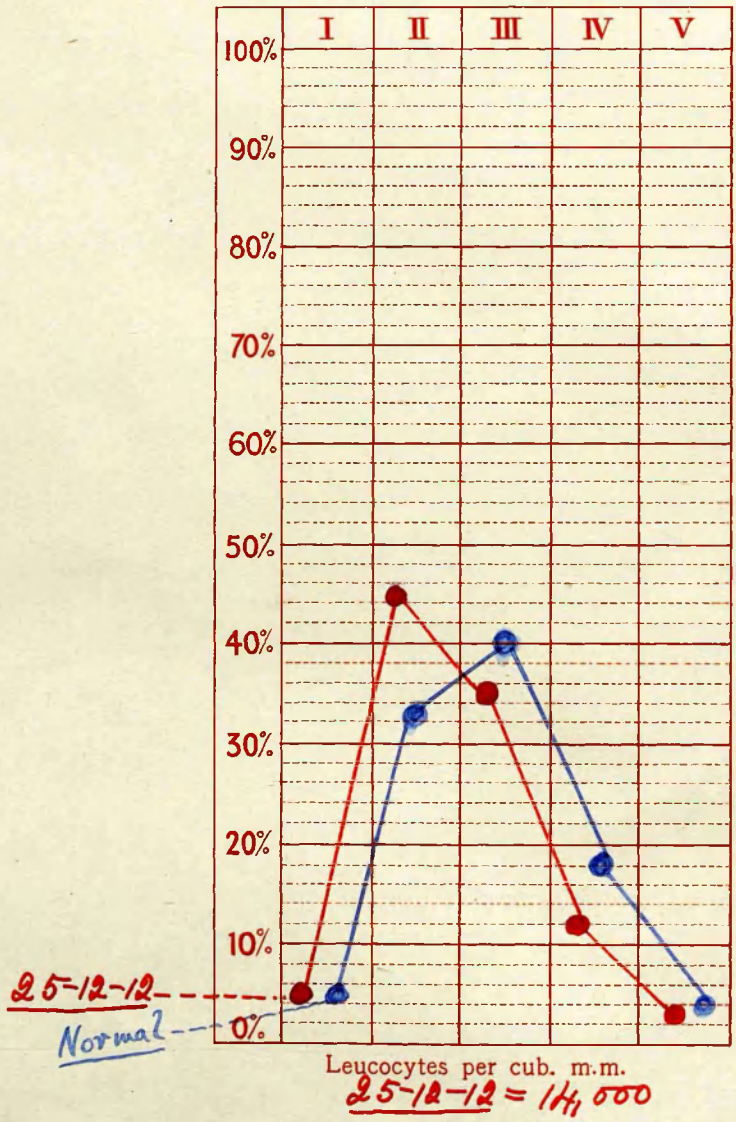
I shall now discuss 2 cases of Gall-Stones, in one of which there was an acute suppurative cholecystitis present.

Case: J. Blakeley. Aet. 44.

No. 98. Gall-Stones with acute suppurative cholecystitis. This was a case which came under observation with symptoms of an acute abdominal condition.

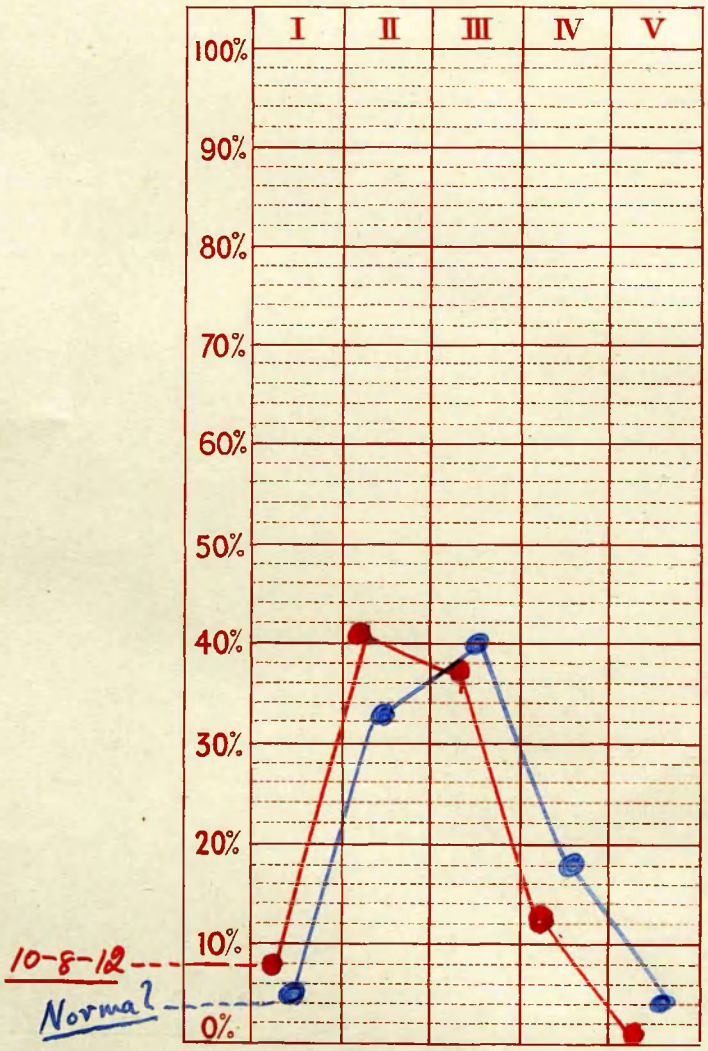
Case J. Blakeley No. 98

Age 44 Disease Gall-Stones with Acute Suppurative Cholecystitis.



Case George Worley No. 99.

Age 40 Disease Gall-Stones.



Leucocytes per cub. m.m.

10-8-12 = 9,000.

At the operation of cholecystectomy which was performed, a hypertrophied and inflamed gall-bladder was discovered, filled with stones, and glairy pus. The operation was entirely successful, and patient made an uninterrupted recovery.

An examination of the blood made just before operation revealed a normal picture, which was taken as a good prognostic sign, and the result bore out this contention.

25-12-12. Leucocytes per cub. mm. = 14,000.

I.	II.	III.	IV.	V.
5%	44.5%	35%	12%	3.5%

Case: George Worley. Aet. 40.

No. 99. Gall-Stones. The examination of this blood was made just before operation, and a good prognosis was framed from the normal picture which resulted.

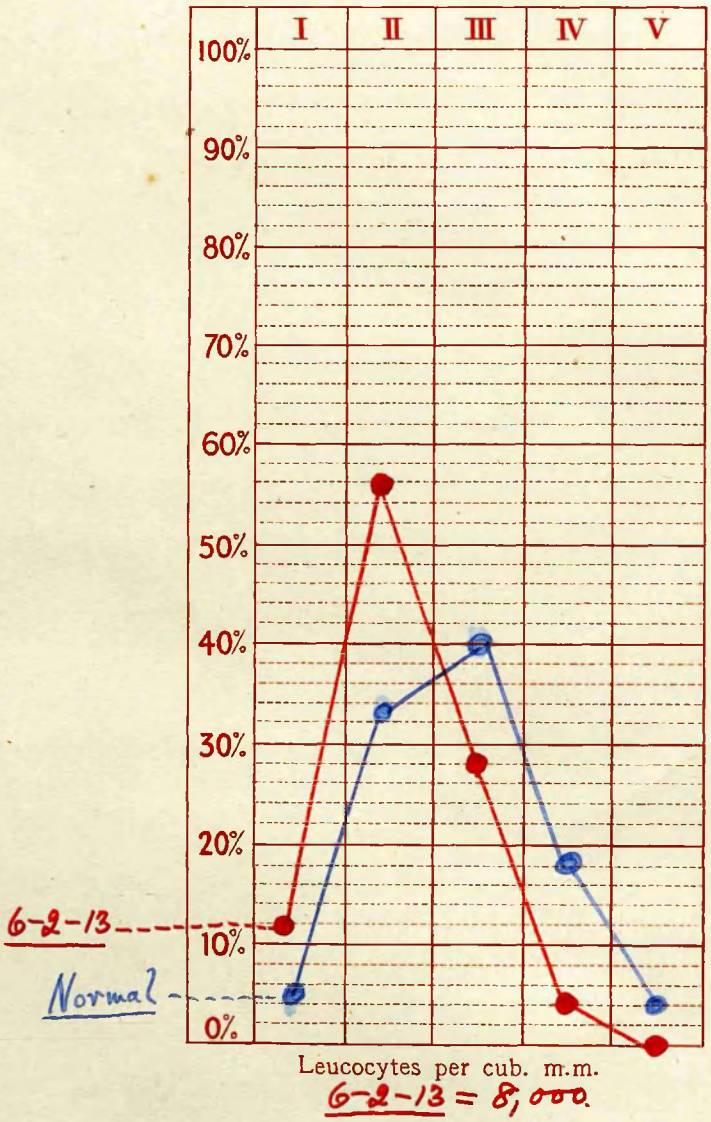
At the operation it was found that the gall-bladder was in an unhealthy condition: removal was impracticable from adhesions and from its smallness, and a drainage operation was performed. Uneventful recovery bore out the favourable prognosis made from the normal blood-picture.

10-8-12. Leucocytes per cub. mm. = 9,000.

I.	II.	III.	IV.	V.
8%	41%	37.5%	12.5%	1%

Case James MacMillan No. 100.

Age 8 years. Disease Cerebral Abscess.



Cerebral Abscess.

Case: James MacMillan. Aet. 8.

No. 100. Cerebral Abscess. This was a case in which absolutely no localising signs or symptoms were present, and tuberculous meningitis was suspected.

A blood-examination showed the following picture - 6-2-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
12%	56%	28%	4%	0%

There is here a slight dislocation of the picture to the left.

A week after this examination was made, patient suddenly became collapsed, and died.

At the post-mortem examination a cerebral abscess of old standing, about the size of a pigeon's egg, was discovered, and rupture had occurred into the lateral ventricle.

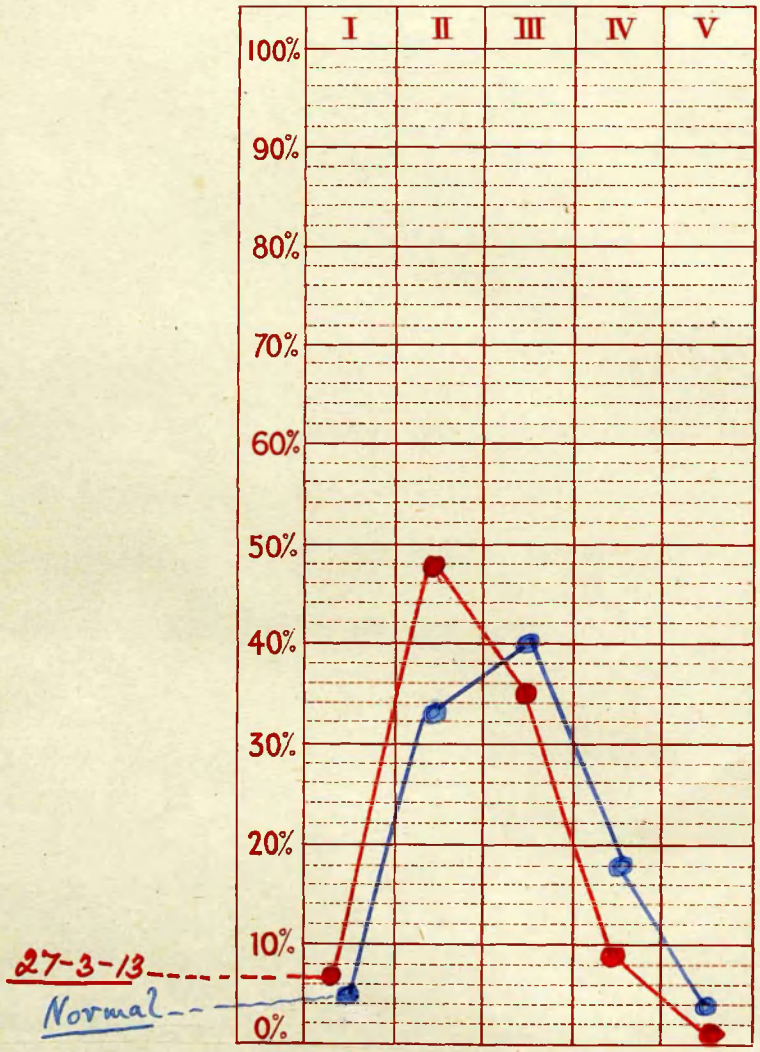
Thus there is here a case in which only a slight departure from normal had occurred in the picture, due to the encapsulation of the abscess, which was thick-walled, and of old standing, no toxic absorption occurring.

The next three cases instance diseases in which this method of blood-examination is of no value.

These are all cases in which the patients were clinically, very ill, and yet the blood-pictures were all

Case Margaret Adams No. 101

Age 49 Disease Pernicious Anaemia



Leucocytes per cub. m.m.

27-3-13 = 4,500.

within normal limits.

Case: Margaret Adams. Aet. 49.

No. 101. Pernicious Anaemia. This patient presented the typical appearance of pernicious anaemia. The ordinary blood-count was: 27-3-13.

Reds	= 1,500,000.
Whites	= 4,500.
Haemoglobin	= 40%.
Colour Index	= 1.2

Poikilocytosis and polychromasia were marked, and normoblasts and megaloblasts were fairly numerous.

The blood-picture showed -

27-3-13. Leucocytes per cub. mm. = 4,500.

I.	II.	III.	IV.	V.
7%	48%	35%	9%	1%

This is practically a normal picture.

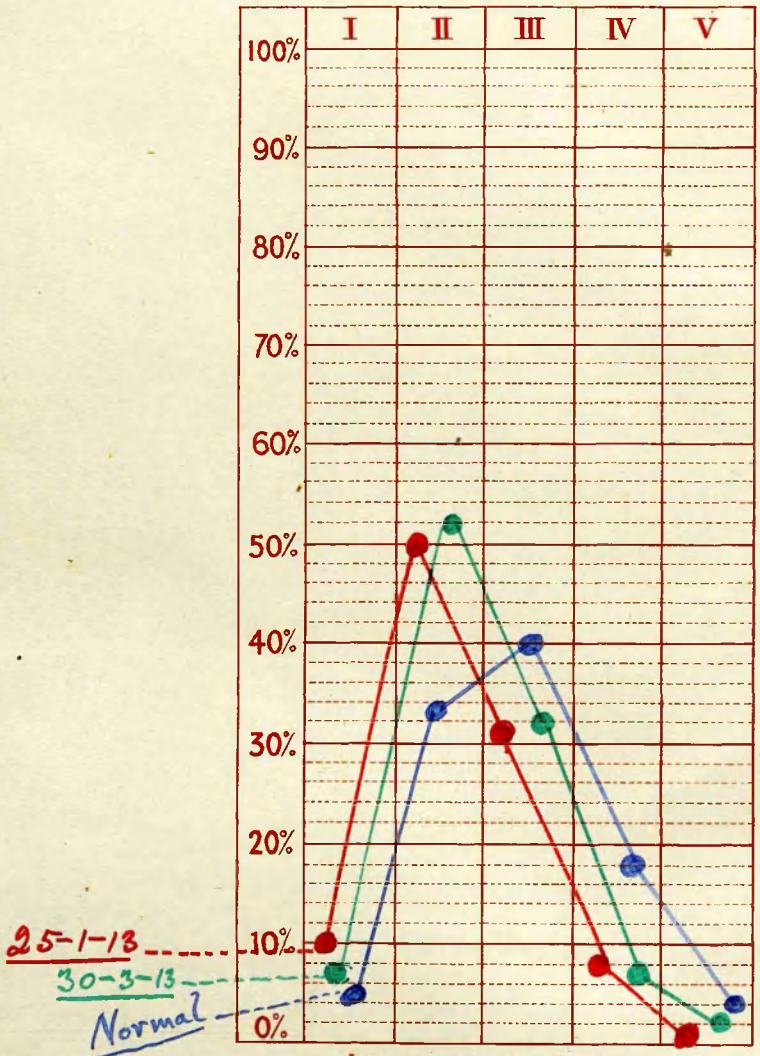
Case: Edith Mary Bagshawe. Aet. 27.

No. 102. Secondary Anaemia. This was a case of anaemia in which the patient had been living under very unfavourable circumstances, and in addition had a mild degree of pyorrhoea alveolaris. Poikilocytosis and slight polychromasia were present, and also a scanty normoblasts.

The ordinary blood-count was: 25-1-13.

Case Edith Mary Bagshawe No. 102.

Age 27 Disease Secondary Anaemia.



Leucocytes per cub. m.m.

25-1-13 = 7,000

30-3-13 = 8,000

Reds	=	3,000,000.
Whites	=	7,000.
Haemoglobin	=	34%
Colour Index	=	.5

The offending teeth were removed, and she was put on Iron and Arsenic, with the result that in 2 months she had improved almost beyond recognition.

The first blood-pictures shows practically no departure from normal. There is certainly an improvement in the second, but the departure from normal in the first is so slight that no practical importance can be attached to the difference.

25-1-13. Leucocytes per cub. mm. = 7,000.

I.	II.	III.	IV.	V.
10%	50%	31%	8%	1%

30-3-13. Leucocytes per cub. mm. = 8,000.

I.	II.	III.	IV.	V.
7%	52%	32%	7%	2%

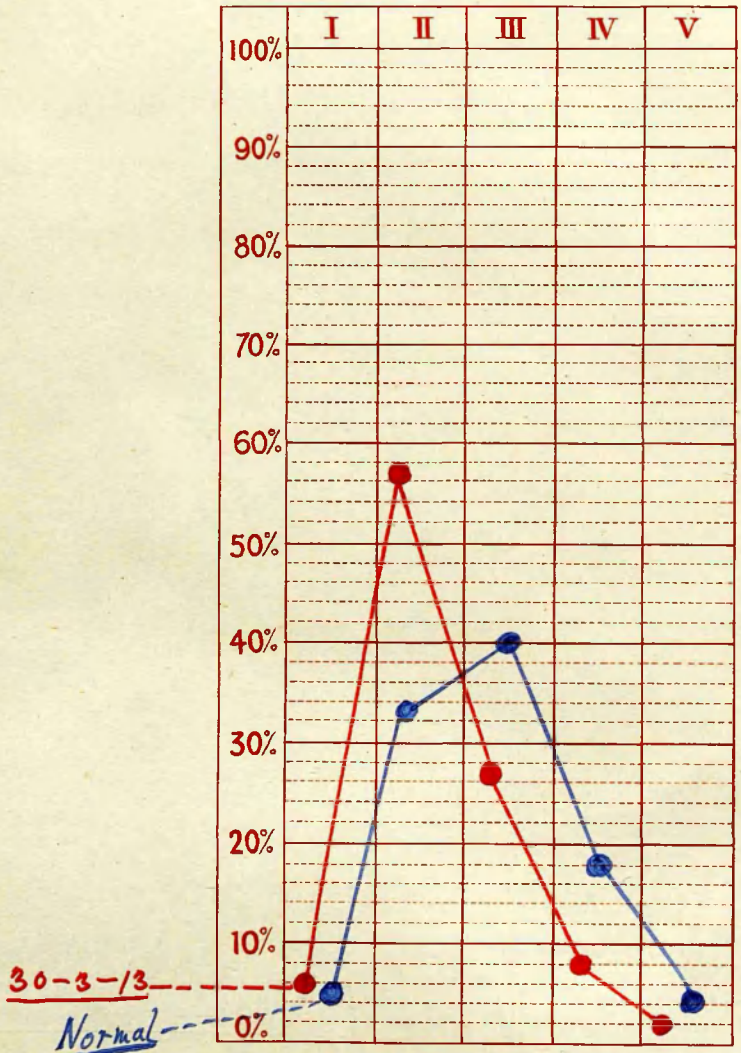
Myxoedema.

Case: Catherine Gray. Aet. 60.

No. 103. Myxoedema. This was a case of many years' duration. She had had several courses of treatment with Thyroid Extract previously, but for a considerable period latterly had ceased to have any

Case Catherine Gray No. 103

Age 60 Disease Myxoedema.



treatment, and had relapsed.

The signs of the disease were typical. The blood-picture was -

30-3-13.	I.	II.	III.	IV.	V.
	6%	57%	27%	8%	2%

A few days after this count was made, she began to have marked delusions, and died on 14-4-13, 2 weeks after the examination was carried out.

Thus there is here a case of disease of years' duration, in which life was prolonged only a fortnight after the observation on the blood was made, and yet a normal blood-picture is present.

This, coupled with the two preceding cases, shows that this method of blood-examination is of no value whatever in certain, though few, diseases, which have come under my observation.

GENERAL SUMMARY AND CONCLUSIONS.

Having now considered the foregoing 103 cases, which involve 306 individual blood-examinations, I shall briefly state my conclusions as to the value of this method of investigation in clinical work.

In health the number of neutrophile polymorpho-nuclear leucocytes in the blood with nuclei varying from one upwards remains remarkably constant within certain narrow limits.

The most constant cells of all are those with one nucleus, and hence it is to the cells of this class that the observer's attention is particularly directed.

There is no doubt whatever that in infective diseases of all kinds there is a very definite change in the neutrophile blood-picture, varying in degree with the intensity of the infection.

The change consists in an increase in the number of cells with one and two nuclei, and a diminution in those with higher numbers.

In very severe cases almost all the cells may be mono-nuclear, only a few having two nuclei, and none having more.

Amongst young people, and particularly in children, these changes are especially well-marked.

The changes are independent of the total number of leucocytes per cubic millimetre, as the cases show all variations from leucopenia to leucocytosis, and yet the same change in the nuclear character of the cells is manifest in all.

These changes take place at times with extreme rapidity, observations made at intervals of 24 hours showing definite differences.

These variations follow closely the advance of the infection, and in those cases where the infection is overcome, the blood conditions return to normal coincidently.

Not only do these changes follow the progress of the disease as observed clinically, but I maintain that careful and frequent examination will foreshadow the clinical happenings before they are otherwise evident, in many cases.

Thus, the results of this method of blood-examination are not only very interesting pathological phenomena, but also are facts on which the greatest reliance can be placed in forming an opinion as to the ultimate prognosis.

While discussing the various cases, I mentioned that in certain diseases it can be said, that, when the percentage of cells with single nuclei reaches above a certain figure, the result is inevitably fatal. It is possible

that a similar statement might be made of all infective diseases, provided a sufficient number of examinations was recorded.

Moreover, since we can observe closely the reaction of these leucocytes to the infection, information of the greatest value in deciding upon treatment is obtained.

I am unable to make a definite statement as to the causes of the cell changes. Arneth expresses the view, in the papers previously quoted, that the cells with the higher number of nuclei are the more mature cells, which form the first line of defence against infection, and are consequently the first to be destroyed where the infection is gaining the upper hand. These cells are replaced by those of one and two nuclei which are younger and less resistant. This view is upheld by Hamilton Black, (British Medical Journal, January 18th, 1913), in an article in which he demonstrates the more active phagocytosis of the cells with the higher number of nuclei towards the tubercle bacillus. In support of another view that these cells are degenerate forms, I can find no evidence.

Though we are still in ignorance of the true cause underlying the blood-changes, this, fortunately, does not detract from the clinical value of the investigation.

While it is only in the definitely infective

diseases that striking changes are found, in other cases the changes, though slight, may be of great importance. In this latter group it is particularly important to compare repeated examinations in the same case, as even very slight changes, if tending in the same direction, are worthy of note.

It is highly important in this, as in all other methods of clinical investigation, that the pathologist be not divorced from the clinician, as various intercurrent complications of a temporary nature, such as pleurisy, or haemoptysis, in pulmonary tuberculosis, or moderate haemorrhage in enteric fever, cause marked and sudden alterations in the existing proportions of the various cells, which disappear with the subsidence of the complications.

With those who decry this method on the ground that the information to be gained therefrom does not repay the time and labour spent upon it, I absolutely disagree, as in many of the cases discussed, valuable information was obtained as to progress which would not have been obtained from any other method of examination of the blood.

By the technique I have previously described, a complete examination of the blood can be made in about half-an-hour, after a little practice. Consequently, the

method cannot be considered tedious. Moreover, no elaborate apparatus is required for its performance, and the technique is so simple that it can easily be carried out, even by the busy general practitioner.

Finally, although there still remain many affections in which the results are less definite, and there is much to be done before a conclusion can be come to as to its value in these cases, the value of this method has been proved with regard to the infective diseases, and I feel convinced that this is a most important addition to our methods of clinical examination, and one which will become as much a routine as is the enumeration of the total leucocytes.

Balfour McKean.

Union Hospital,
Fir Vale,
Sheffield.

15th May 1913.

(Over)

Addendum:

Since the summary of the literature of this subject was written, a short article has appeared in the British Medical Journal of 3rd May, 1913, by J. B. H. Holroyd, in which he gives the results of his experience of Arneth's method in 30 cases of pulmonary tuberculosis. His results are similar to those detailed in this paper, and no new facts are brought to light.

B.M.