THE CLINICAL SIGNIFICANCE OF LEUCOCYTOSIS IN SURGICAL & MEDICAL PRACTICE.

by

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INTRODUCTION.

In this country clinical examinations of the blood have hitherto been employed almost exclusively by the Physician, and generally in those conditions known as "Diseases of the Blood."

In American and Continental Hospitals haematological examinations have been adopted as a clinical method with a much wider application. We now know that such examinations can give information to the physician in diseases other than diseases of the blood, and further, that they can be of the greatest value to the surgeon. Quite three fourths of my observations upon this subject have been made upon surgical cases, and none of the medical cases I have examined were suffering from any of the so-called "Diseases of the Blood."

It is the blood which sustains the vitality of every organ in the body. Through it the products of constructive and destructive metabolism are carried to their respective destinations, therefore it ought not to be surprising that a careful examination of its several elements should prove of value to the clinician. The necessary technique for such examinations has been improved very considerably during the last ten years, and a very satisfactory degree of accuracy can be claimed for our results at the present time.

We owe a very great deal to men like Ehrlich, Thoma,
Hayem, and many others, not only for their great scientific genius, their emphatic pathological conclusions and their brilliant histological results, but also for that scientific accuracy and untiring perseverance which cannot fail to bear fruit in the younger generation of scientific workers.

A complete examination of the blood occupies so much time, that it is almost impossible for the busy practitioner to carry it out with any degree of regularity. With this feeling in my mind, I have worked at the subject of leucocytosis in order to determine how much information is likely to be obtained by such a partial examination of the blood as simple quantitative estimation of the white blood corpuscles. Every medical practitioner accustomed to the use of the microscope, will have no difficulty in counting leucocytes, and it can be done in so short a time that it ought to be possible to the busiest of us.

Compared to leucocytes the erythrocytes are much less liable to rapid changes in their numerical value. It is true that in diseases such as Pyaemia, Septicaemia, and the like, we get moderately rapid decrease in the red corpuscles of the blood, but even here it takes days and even weeks, to produce a relatively large diminution. With leucocytes it is very different; we
rarely observe leucopenia in any disease; it is generally a leucocytosis. This increase occurs with great rapidity, so much so, that in certain pathological conditions the number of white blood corpuscles may have been multiplied several times within a few hours of the onset of the disease. After effective treatment has been adopted, the return to normal again may be correspondingly rapid. Such a leucocytosis must have some clinical significance, and some definite purpose to serve. Its great constancy in certain diseases precludes the possibility of its being accidental or a mere coincidence. We cannot but regard leucocytosis as an established clinical phenomenon, occurring and disappearing under definite conditions. The charts I submit for observation will show that the leucocyte curve is as positive in its value as that of the temperature or pulse.

Examinations of the temperature, pulse, and urine, are quite as necessary to the surgeon as they are to the physician. They supply valuable information in the great majority of clinical conditions, whether medical or surgical; in certain cases their assistance is much greater than in others. In all clinical work heat, value and pulse rate are watched and charted with the greatest regularity. The clinician knows by experi
ence of their great value in diagnosis: he has learned
to rely on their information, and to regard them as
honored and well tried physical signs. Their careful
record has prevented many mistakes in diagnosis, spared
many needless days of anxiety to the medical man, and
indeed been the means of saving many a patient from an
early grave.
In like manner, I feel sure that regular estimation of
the leucocytes would be of great value to the medical
practitioner. The same frequency of examination is not
necessary, such would involve too much of his time, but
he would be amply repaid for the little additional troub-
le that moderately regular leucocyte counts would in-
cur. It is the surgeon who will in all probability ob-
tain the most information from regular estimations of
the white blood corpuscles.
We have long known of the amoeboid movements of leuco-
cytes, of their phagocytic action, of their special se-
cretory qualities, and the important part they play in
all inflammations. It is therefore a trifle surprising,
that their careful examination has not been adopted by
the surgeon earlier.
Much has already been done to show that regular haemato-
logical examinations are worthy of the utmost attention.
Their assistance in the diagnosis and prognosis of
certain diseases apart from blood diseases proper, has been proved beyond a doubt. I feel confident that the day is not far distant when it will be a regular routine, both in hospital and private practice, to make a careful examination of the leucocytes in a large group of clinical cases. If this were done with the same regularity as we examine the temperature and pulse, many undiagnosed conditions which are revealed in the post-mortem room, would be discovered in life, and successfully dealt with.

No single clinical method - or physical sign - can be regarded as infallible, and I do not for one moment wish to imply that the examination of the leucocytes is an all important one.

I wish it to be considered in conjunction with other physical signs, and if such is done, I think it will prove to be a valuable adjunct to our present clinical methods. A perfect clinical picture is obtained by the careful study of the numerous symptoms and physical signs which a complete clinical examination reveals. For the success of such a picture however, a very accurate sense of proportion is absolutely necessary. A blood examination reveals to the clinician a part of that picture, - in some cases its revelation is greater than in others, and it is only by prolonged
experience, by repeated records, that such can be interpreted aright. I have striven at all times to pursue my investigations with a perfectly open mind. I have never allowed the current opinions as to the condition of a patient to influence my results.

During my observations I have made upwards of 1500 leucocyte counts, practically all of which were furnished by cases in the Birmingham General Hospital. In many of my cases I counted the red corpuscles and estimated the amount of haemoglobin, but I have purposely omitted to record the results of these examinations in order to prove if possible that the examination of the leucocytes alone is a clinical method of the greatest value.

Seeing then that this limited examination of the blood is so simple, involving such a small expenditure of time, and certainly within the capacity of every busy practitioner, I hope that these records may in some measure tend to stimulate young practitioners of my own school to work at this subject and decide for themselves its true clinical value.

All the bacteriological examinations mentioned were carried out in the pathological laboratory of the General Hospital. These bacteriological reports have been introduced into this paper, merely to throw further light upon the particular case of suppuration, meningi-
tis etc. whose blood I was investigating. Pulse rate per minute, respiratory rate per minute, and degree of temperature were taken from the chart by the bedside of each patient. They represent the highest point reached by temperature pulse and respiration at any time during the day upon which the corresponding leucocyte count was taken. They have been placed in the record to show as briefly as possible the general state of the patient and further to bear comparison with the simultaneous position of the leucocyte curve. Operations and post mortems were generally witnessed by me in person, failing which I copied the results from the Operation and Post Mortem books respectively. I saw sections of all the tumours spoken of in the record. Anaesthetics were copied from the anaesthetic book. To the Honorary Staff of the Birmingham General Hospital I am deeply indebted for the ready consent they gave to me in pursing my observations, and for the great interest they manifested in my results. To the Resident Staff I tender my sincere thanks for the many facilities they afforded me, by reporting cases soon after admission, in which I was specially interested.

I should, before proceeding to results, first like to emphasise several points in the technique of leucocyte
counting.

The haemocytometer used was the Thoma-Zeiss. I possessed several white pipettes, which enabled me to get through my daily observations more rapidly. The popular idea that the glass ball in the bulb of the Thoma-Zeiss is a source of error, due to adherence of leucocytes, can I think be overcome by thorough cleanliness. It was my habit to run through my pipettes a quantity of strong nitric acid every few days, and digest them every week in dilute Hydrochloric acid and pepsin. This weekly routine is of course quite unnecessary to a man who is using his pipette less frequently. Having the pipette perfectly dry so that the glass ball moves freely, is an essential condition before any examination can be made.

The best strength of diluting fluid is 3% or 5% of acetic acid, in this, white corpuscles will remain quite well preserved for twenty four or forty eight hours. The addition of Methyl Violet gives little or no advantage, and it stains the pipettes. Stronger solutions of acetic acid disintegrate the white corpuscles, so that it is impossible to keep a full pipette long before making a count. It is further apt to produce clumping or balling of the leucocytes, a condition which entirely disqualifies any result. If the solu-
tion is too dilute, it is apt to prevent the necessary taking of the red corpuscles and renders the counting of leucocytes very difficult.

The needle used for the puncture ought to have a perfect point, a hagedorn, or a large triangle is very good. It is possible to take the blood from a sleeping child by a good needle, without waking it. Gentle rubbing of the lobe of the ear with sterilised wool is quite sufficient precaution to take before the prick is made.

The blood must on no account be expressed from the puncture. This produces a local cyanosis which is sufficient to unduly increase the corpuscular value of the drop expressed.

A dilution of 20 times is the most useful one in counting the white blood corpuscles, as met with in diseases apart from leucocythaemia. Should an air-bubble accidentally enter the pipette, the pipette should be cleaned again, and the whole process repeated. The best way to clean a pipette is to run it through with distilled water, then absolute alcohol and finally methylated ether, which is blown out by an ordinary ball air pump, a stream of air being continued for some time until the glass ball rolls freely in the cavity of the bulb.

The blood should never be allowed to dry in a pipette;
I was in the habit of cleaning my pipette directly the count was made. If such a misfortune should happen nothing can be done but by digesting the dry blood out of the pipette by dilute hydrochloric acid and pepsin. In diluting the blood after the exact amount has entered the pipette, vigorous suction is of advantage at first, because it sweeps the blood up from the barrel of the pipette into its bulb where the mixing alone takes place. When mark 11. is exactly touched by the mixture it is advisable to shake the pipette thoroughly in order to mix the blood so that if a drop or two should fall out in carrying it to the microscope the result is not spoiled. This spilling however can be avoided by holding the pipette horizontal. I always agitated my pipette in several directions for two minutes. The drop for examination was always taken from about the centre of the bulb, by driving out half of the blood, and I always made two counts from the same pipette. These were nearly always of the same numerical value; should they differ I made a third count and took the average of the two most nearly approximated. Newton's rings must always be seen on the cover slip before the count is made. It is very necessary to cleanse the slide and cover slip carefully from time to time with absolute alcohol and ether., Air bubbles over the ruled space quite
spoil a result, so that when this occurs, new drops must be counted.

I have not attempted to describe the general routine of my method, because in other respects it was identical with that given in text books. I feel very confident that provided a careful and rigid technique is adhered to, a very satisfactory measure of accuracy can be obtained by this instrument. If a man persistently uses all precautions against error, rejecting examinations in which he knows there have been mistakes, he will be amply repaid by the universal results he obtains from day to day.

Nearly all my observations upon patients were made between 9 a.m. and 1 p.m. Breakfast was at 6 a.m. dinner at 12. 30 p.m. so that digestion leucocytosis was as far as possible eliminated. I regarded the normal leucocyte count as anything between 5000 and 10,000 per cubic millimetre.

I made my films for staining upon specially prepared glass slides by means of cigarette paper. The end of the cigarette paper is allowed to touch a tiny drop of freshly drawn blood, the paper is held by the other end. This is transferred to the glass slide quickly, the drop spreads out in a thin layer between the paper and the slide. It is then dragged delicately down the
Photograph of film stained with eosin and methylene blue. Note the well defined nucleus of the polymorphonuclear cell, and of the small lymphocyte.
length of the slide, leaving a thin film in its rear. After a little practice, very beautiful films can be obtained by this method. The film should be labelled at once. Most of my films were fixed by heat in the dry steriliser. The heat I liked best was from 105 degrees to 110 degrees centigrade for one hour. The high temperatures of 140 to 150 degrees centigrade recommended by Cabot were not successful in my hands. After fixing with heat, I invariably used Ehrlich's tri-acid stain. At the commencement of my investigations I had great difficulty in obtaining a good tri-acid mixture, and I was compelled to change it several times before my results were satisfactory. There can be no question about the brilliance of this stain, provided you fix with the right degree of heat; you cannot overstain with it. Your mistakes come in the fixing not in the staining. I am not however prepared to call it a perfect stain by any means. Its color effects are indeed lovely, but its definition is not so perfect as the eosine and methylene blue mixture. The nuclei do not stain so deeply with the tri-acid mixture, and their outline is not so distinct as when stained with eosine and methylene blue.

In making my differential counts upon the fatal cases of pneumonia I had very great difficulty in distinguishing the exact outline of nuclei, a matter of very great im-
Film stained with Ehrlich's trisace mixture. Note the imperfect outline of the polymorphonuclear cells.

Note the faintly stained nuclei of the above myelocytes - stained by Ehrlich's mixture.

Note the well marked granules of the above polymorphonuclear cells - stained by Ehrlich's mixture.
importance in differentiating myelocytes from poly nuclear cells. Ehrlich’s mixture is a very brilliant granular stain. It is this feature which largely accounts for the imperfect definition of the nuclei in preparations stained by it. I had difficulty occasionally in deciding whether a cell was a coarsely granular oxyphile (eosinophile) or a finely granular oxyphile (neutrophile), the stain seemed to bring out cells that were transitional between the two. This may be a recommendation for it, but in the light of our present classification of leucocytes it is nevertheless very disconcerting in making differential counts. With my films fixed in formalin vapor, and stained with eosine and methylene blue, I had fairly good results, the definition of individual cells was better than in the Ehrlich films, and I had no such difficulty in distinguishing eosinophiles from so-called neutrophiles. My results, by the eosine and methylene blue method, were more universal than by the Ehrlich method. A good Ehrlich is better however than a good eosine-methylene blue specimen. For the general practitioner, I should recommend the simpler method of fixing the formalin vapor and staining with eosine and methylene blue. To obtain a good Ehrlich film, fixation by heat is almost essential, a method which is not easy in private practice, even
with improvised methods.

My record will give the result of something like 100

differential counts. In doing qualitative estimations

I used a Zeiss microscope with one sixth objective, a

No. 6 compensating eye piece, with the draw tube half

extended. If there was any doubt in my mind concern-

ing a corpuscle I turned on the oil immersion lens,

and examined it more carefully.

Much of the ground I have covered in these investiga-

tions has been worked at by other observers, so that

I wish in no way to claim originality where such is

not deserved. Observations upon the leucocyte record
during wound healing, fractures and strangulated hernia

have as far as I know, not hitherto been made.

My method of following up cases of appendicitis, pneu-

monia and suppuration of all kinds, is to my knowledge

unrecorded elsewhere, and the clinical value of a regu-

lar daily examination in such cases has not I think

been strongly advocated. I am deeply indebted to books

by Cabot, Ehrlich and Lazarus; - to articles by Muir,
Stewart Macdonald, Stengel, Thayer, Sherrington, and

many others for the valuable suggestions I have received
from them, and for the keen interest their works have

invoked in me towards this subject.
APPENDICITIS.
With Suppuration and Leucocytosis.


<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes perc.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 7</td>
<td>98</td>
<td>80</td>
<td>24</td>
<td>8000</td>
</tr>
<tr>
<td>8</td>
<td>99</td>
<td>72</td>
<td>20</td>
<td>10560</td>
</tr>
<tr>
<td>9</td>
<td>98</td>
<td>60</td>
<td>24</td>
<td>13840</td>
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<td>11</td>
<td>98</td>
<td>80</td>
<td>22</td>
<td>13200</td>
</tr>
<tr>
<td>12</td>
<td>98</td>
<td>72</td>
<td>20</td>
<td>15600</td>
</tr>
</tbody>
</table>

14. Operation. One ounce of pus was found, well shut off by adhesions.

Anaesthetic, nitrous oxide and Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes perc.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15</td>
<td>100</td>
<td>64</td>
<td>22</td>
<td>17600</td>
</tr>
<tr>
<td>16</td>
<td>98</td>
<td>72</td>
<td>20</td>
<td>16240</td>
</tr>
<tr>
<td>18</td>
<td>98</td>
<td>72</td>
<td>24</td>
<td>10640</td>
</tr>
<tr>
<td>19</td>
<td>N</td>
<td></td>
<td></td>
<td>14160</td>
</tr>
<tr>
<td>21</td>
<td>N</td>
<td></td>
<td></td>
<td>10240</td>
</tr>
<tr>
<td>22</td>
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<td>9460</td>
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<td>9360</td>
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<td>28</td>
<td>N</td>
<td></td>
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<td>5600</td>
</tr>
<tr>
<td>June 1</td>
<td>N</td>
<td></td>
<td></td>
<td>8880</td>
</tr>
<tr>
<td>5</td>
<td>N</td>
<td></td>
<td></td>
<td>6800</td>
</tr>
</tbody>
</table>

Dressed daily. Wound healed on June 6th.
CMF supplicative appendicitis - Illustrating the rising leukocyte count, irregular pulse and temperature curves.
The rising count in this case from normal, suggests the probability that this case was admitted with a simple non suppurative appendicitis, and that pus was subsequently formed. A rising leucocytosis generally calls for operative treatment. The temperature, pulse and respiration were perfectly normal in this case, despite the fact of suppuration. His local condition according to the notes did not suggest suppuration; such a case proves very forcibly the value of a leucocyte count, because though all the cardinal symptoms and signs of suppuration were absent the leucocyte record pointed strongly to it. His post-operative progress was very satisfactory. He drained well, as the leucocyte counts fully bear out.

2. M.B.  

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
<td>Pulse</td>
<td>Resp.</td>
<td></td>
</tr>
<tr>
<td>May 17</td>
<td>102.</td>
<td>120.</td>
<td>32.  9840</td>
</tr>
<tr>
<td>19.</td>
<td>97.</td>
<td>80.</td>
<td>24.  7920</td>
</tr>
<tr>
<td>21.</td>
<td>N.</td>
<td>70.</td>
<td>24.  12160</td>
</tr>
</tbody>
</table>

Operation performed after last count, about
half a drachm of pus was found in the region of the appendix, well shut off.


<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m</th>
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<tr>
<td>May 22</td>
<td>69</td>
<td>22</td>
<td></td>
<td>12800</td>
</tr>
<tr>
<td>24</td>
<td>66</td>
<td>22</td>
<td></td>
<td>10000</td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td>6800</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td>69 60</td>
</tr>
<tr>
<td>June 7</td>
<td></td>
<td></td>
<td></td>
<td>6560</td>
</tr>
</tbody>
</table>

The wound was packed, dressed on alternate days, little or no discharge. Recovery.

This case was regarded as a catarrhal appendicitis, without suppuration. The leucocytosis is not a high one, indeed it is the lowest I have ever found in suppurative appendicitis. It is however a rising count, and it proves the value of consecutive examinations.

The temperature and pulse on admission were high; this was probably due to the shaking caused by her journey to the Hospital, as it was normal on succeeding days when pus was certainly present.

Her recovery after the operation was uninterrupted, and the leucocytes fell rapidly to normal.
3. M.H.  

Aet. 35.  

Male.

Illness commenced on June 1st, looks very ill

<table>
<thead>
<tr>
<th>Date</th>
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<th>Resp.</th>
<th>Leucocytes per c.m.</th>
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<tbody>
<tr>
<td>June 3</td>
<td>98.6</td>
<td>96</td>
<td>24</td>
<td>17760</td>
</tr>
</tbody>
</table>

Operation same evening, revealed a gangrenous appendix, with a few drachms of pus free in general peritoneal cavity.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>98.8</td>
<td>88</td>
<td>24</td>
<td>10000</td>
</tr>
<tr>
<td>5</td>
<td>97</td>
<td>90</td>
<td>26</td>
<td>7760</td>
</tr>
<tr>
<td>7</td>
<td>98.6</td>
<td>80</td>
<td>20</td>
<td>10000</td>
</tr>
<tr>
<td>10</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dressed daily, was healed on June 13th.

Note the normal temperature before operation. His grave condition suggested a bad prognosis, the leucocytosis is reassuring. His progress after operation was marvellously good, as his leucocyte curve fully bears out.

4. P.G.  

Aet. 5.  

Male.

A very uncertain case; pain, tenderness and distension in region of epigastrum, no lump to be felt, no
vomiting. Thought to be typhoid.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
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<tr>
<td>June 4</td>
<td>101.</td>
<td>108.</td>
<td>40.</td>
<td>17760</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Widal on this day; gave negative reaction.</td>
</tr>
<tr>
<td>5.</td>
<td>101.</td>
<td>118.</td>
<td>40.</td>
<td>19680</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td>Abdomen opened, abscess containing several ounces of pus found behind the coecum.</td>
</tr>
<tr>
<td>7.</td>
<td>102.2</td>
<td>140.</td>
<td>48.</td>
<td>41200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dressed, tube and packing removed, large amount of pus pent up behind it.</td>
</tr>
<tr>
<td>8.</td>
<td>102.5</td>
<td>136.</td>
<td>40.</td>
<td>32320</td>
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<td>99.</td>
<td>108.</td>
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<td>31520</td>
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<td>N.</td>
<td></td>
<td></td>
<td>16650</td>
</tr>
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<td>20.</td>
<td>N.</td>
<td></td>
<td></td>
<td>12960</td>
</tr>
<tr>
<td>21.</td>
<td>N.</td>
<td></td>
<td></td>
<td>14080</td>
</tr>
</tbody>
</table>
Pulse

Temperature

Observation

Suffusion -tuln f-r.

Illustrating a gradual recovery.
Temp.  Pulse.  Resp.  Leucocytes per c. m.
July 2.  N.  8080  "
9.  N.  10880  "
14.  N.  8080  "

Wound discharged until July 8th, on some days more freely than others.

In this case a leucocyte count was of the very greatest value in excluding typhoid. A Widal reaction is also of value, but a patient with appendicitis might have had typhoid a few months or years previously, and give a positive reaction. Then again the Widal test cannot be relied upon until a patient has been ill five days. A leucocyte count would give information whether a patient had suffered from typhoid or not, and within a day or two of the commencement of the attack.

The high leucocytosis on the day following operation was probably due to increased absorption of positively chemiotactic toxin by the freshened walls of the abscess to a less extent perhaps by the loss of blood and the influence of the anaesthetic.

It will be observed that the after progress was very slow in this case. He discharged freely for a considerable time. His leucocyte curve fell very slowly, in striking contrast to so many of my cases. The drainage in this case, owing to the position of the abscess,
could not have been good, and this is a complete explanation of the slowly diminishing leucocytosis. The temperature was normal from June 9th.

Appendicitis with well marked local conditions present.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 30. 10 1.8.</td>
<td>96.</td>
<td>36.</td>
<td>13680</td>
</tr>
<tr>
<td>July 1. 100.4.</td>
<td>92.</td>
<td>36.</td>
<td>15400</td>
</tr>
</tbody>
</table>

Operation after count. Three or four ounces of foetid pus evacuated.

Anaesthetic. Ether.

| July 3. 98. | 80. | 20. | 13600 |
| 4. 96.2. | 88. | 22. | 15120 |
| 5. 100.2. | 116. | 28. | 26240 |

A large amount of pus was found pent up behind the packing on this day.

| 6. 99. | 100. | 28. | 19840 |
| 7. 99. | 100. | 24. | 11120 |
| 9. 99.5. | 108. | 28. | 22120 |
| 11. 99.6. | 104. | 28. | 22120 |

A great deal of discharge and much brawniness around the wound.
Temp. Pulse. Resp. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 13</td>
<td>99.4</td>
<td>108</td>
<td>32</td>
<td>16240</td>
</tr>
<tr>
<td>15</td>
<td>99.8</td>
<td>128</td>
<td>32</td>
<td>22320</td>
</tr>
<tr>
<td>16</td>
<td>Abdomen again opened. A large quantity of pus was evacuated from around the appendix and from the pelvis.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthetic. Gas and Ether.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>98</td>
<td>108</td>
<td>24</td>
<td>17920</td>
</tr>
<tr>
<td>19</td>
<td>101.4</td>
<td>148</td>
<td>32</td>
<td>25280</td>
</tr>
</tbody>
</table>

A large quantity of discharge was evacuated from behind the tube on this date.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>98</td>
<td>100</td>
<td>24</td>
<td>5120</td>
</tr>
</tbody>
</table>

Patient looks much better, quite a different man.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>99</td>
<td>120</td>
<td>24</td>
<td>10240</td>
</tr>
<tr>
<td>26</td>
<td>N</td>
<td>104</td>
<td>24</td>
<td>7520</td>
</tr>
<tr>
<td>31</td>
<td>N</td>
<td></td>
<td></td>
<td>8400</td>
</tr>
</tbody>
</table>

Healed.

The temperature, pulse, and leucocyte count rival each other very closely, in the accurate manner with which they reflect the condition of the patient, on any particular day.

This case clearly points out the value of a leucocyte record in determining the post-operative progress of a case of appendicitis.

His general condition until about July 21st gave rise
Case 5 FD Illustrating an interrupted recovery. Two operations. Poor Management.
to the utmost anxiety. His leucocytosis, though moderately high, was very fitful. It ebbed and flowed, keeping accurate time with the varying amounts of discharge and the degree of its retention. After July 19th it suddenly fell to normal, and from about this time his recovery was assured.

Appendicitis. Thought to be non-suppurative.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 3. 98.</td>
<td>9520 &quot;</td>
</tr>
<tr>
<td>5. 98.6.</td>
<td>12800 &quot;</td>
</tr>
</tbody>
</table>

Not followed further. Operation on July 11th revealed a small abscess in region of appendix.

This case is of little interest, because of my few observations upon it. As I have selected none of my cases, this one, which is one of the least instructive is added.


<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 11. 100.5.</td>
<td>84.</td>
<td>12600 &quot;</td>
<td></td>
</tr>
<tr>
<td>12. 101.2.</td>
<td>84.</td>
<td>12640 &quot;</td>
<td></td>
</tr>
</tbody>
</table>

Differential count on July 12th, was as follows;
Poly-nuclear finely granular oxyphiles 81.9%.
Small Lymphocytes. 8.
Large Lymphocytes. 8.
Transitional cells. 2.1.

Operation revealed several ounces of pus well shut off
Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 13. 100.</td>
<td>17440 &quot;</td>
</tr>
<tr>
<td>14. N.</td>
<td>9680. &quot;</td>
</tr>
<tr>
<td>15. N. Discharges freely.</td>
<td></td>
</tr>
<tr>
<td>16. N.</td>
<td>9820 &quot;</td>
</tr>
<tr>
<td>19. N.</td>
<td>8730 &quot;</td>
</tr>
<tr>
<td>23. N. Healed.</td>
<td>7760 &quot;</td>
</tr>
</tbody>
</table>

This case illustrates the stagnant count of an abscess
well walled off by adhesions, giving rise to very lit-
tle toxine absorption.

His after progress was very satisfactory, and the leu-
cocyte record is typical of a case draining well.

His differential count shows the characteristic in-
crease in the Poly-nuclear finely granular oxyphiles.

Regarded as a non-suppurative case, no resistance or swelling could be palpated.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 1</td>
<td>100</td>
<td>88</td>
<td>28. 21340</td>
</tr>
</tbody>
</table>

Differential count taken on this day was as follows:

- Poly-nuclear purely granular oxyphiles. 94%
- Lymphocytes. 4%
- Transitional cells. 1.6%
- Eosinophiles. 4%

<table>
<thead>
<tr>
<th>2. 99.</th>
<th>80.</th>
<th>24.</th>
<th>13120</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. 101</td>
<td>100.</td>
<td>24.</td>
<td>17600</td>
</tr>
<tr>
<td>6. 102</td>
<td>130.</td>
<td>30.</td>
<td>21040</td>
</tr>
</tbody>
</table>

Operation performed. A large abscess was found behind the colon.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>7. 99.</th>
<th>86.</th>
<th>24.</th>
<th>20560</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. 98.</td>
<td>84.</td>
<td>25.</td>
<td>11840</td>
</tr>
<tr>
<td>9. 98.</td>
<td>72.</td>
<td>22.</td>
<td>12480</td>
</tr>
<tr>
<td>11. 98.</td>
<td>70.</td>
<td>24.</td>
<td>10240</td>
</tr>
<tr>
<td>13. 97.</td>
<td>80.</td>
<td>22.</td>
<td>10240</td>
</tr>
<tr>
<td>16. N.</td>
<td></td>
<td></td>
<td>6800</td>
</tr>
<tr>
<td>21. N.</td>
<td></td>
<td></td>
<td>6560</td>
</tr>
<tr>
<td>25. N.</td>
<td></td>
<td></td>
<td>5600</td>
</tr>
</tbody>
</table>

Recovery.
This case was steadfastly regarded by the surgeon as a non-suppurative one, and on August 6th he decided to operate because the leucocyte record clearly pointed to the reverse. His leucocytosis on admission was to some extent due to the disturbance of his journey to Hospital. It fell on the second day to its correct reading, from which point it gradually increased, and it was this real increase which induced the surgeon to interfere. It proves the value of consecutive counts. Had the blood examination ceased after the second day of admission, it would have given the false impression that the boy was improving; — an opinion that was held by the surgeon in this case, until subsequent counts dispelled it. His temperature and pulse are fully in keeping with his true condition, even though the local symptoms were entirely negative.

The great proportion of Polynuclear finely granular oxyphiles is very characteristic.

His recovery after operation was uninterrupted, as his blood counts fully corroborated.

Tender, swelling felt.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 14. 97.</td>
<td>78.</td>
<td>21.</td>
<td>28720</td>
</tr>
</tbody>
</table>

Differential count gave -
- Poly-nuclear finely granular oxyphiles. 94%
- Small Lymphocytes. 4. 2%
- Large Lymphocytes. 1%
- Eosinophiles. 6%
- Transitional cells. 2%

Operation same evening, revealed a large abscess well shut off containing foetid pus, which gave a pure growth of Bacterium Coli.

Anaesthetic. Gas, Ether, A.C.E mixture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. 98.</td>
<td>76.</td>
<td>29.</td>
<td>19360</td>
</tr>
<tr>
<td>16. 97.</td>
<td>72.</td>
<td>28.</td>
<td>9680</td>
</tr>
<tr>
<td>18. 98.</td>
<td>72.</td>
<td>20.</td>
<td>8080</td>
</tr>
<tr>
<td>21. 97.</td>
<td>60.</td>
<td>13.</td>
<td>9360</td>
</tr>
<tr>
<td>25. 98.</td>
<td>72.</td>
<td>20.</td>
<td>8720</td>
</tr>
</tbody>
</table>

Drained well. Excellent recovery.

His very high count on admission is perhaps to some extent due to his journey. It gives the typical differential count. His temperature and pulse on this day were normal, despite his large abscess.

His after progress was most satisfactory, it drained well, and was practically healed by August 25th.
Case 9, W.B.  Normal Pulse and Temperature.
Rapid rise of leukocytosis after operation.
10. N.P.  
Age 10.  
Female. 
Appendicitis. 

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 26.</td>
<td>101.2</td>
<td>116</td>
<td>26</td>
</tr>
</tbody>
</table>

Operation same evening, several ounces of foul pus were found. 

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.</td>
<td>99.</td>
<td>110</td>
<td>32</td>
<td>12160</td>
</tr>
<tr>
<td>30. N.</td>
<td>88.</td>
<td>24</td>
<td>13680</td>
<td></td>
</tr>
</tbody>
</table>

Sept. 1. N.  
Uninterrupted recovery. Patient discharged September 15th. 

In this case also the leucocyte count closely coincides with the condition prior to operation, and also to her progress afterwards.

11. G.W.  
Age 16.  
Male. 
Appendicitis. 3rd day of illness. Admitted to Medical Wards. 

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 5.</td>
<td>99.6</td>
<td>84</td>
<td>24</td>
</tr>
<tr>
<td>6.</td>
<td>100</td>
<td>84</td>
<td>20</td>
</tr>
</tbody>
</table>

Gave it as my opinion that pus was present. 

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>100</td>
<td>80</td>
<td>24</td>
<td>17760</td>
</tr>
</tbody>
</table>
Temp.     Pulse.  Resp.  Leucocytes per c.m.
Sep. 8. 101.  96.  24.  23120  "
9.      N.    80.  24.  23440  "

Operation upon this day revealed an abscess containing several ounces of foetid pus, with a loose and gangrenous appendix.

10. N. 24960 "
11. N. 15920 "
12. N. 11200 "
14. N. 11520 "
17. N. 9040 "
22. N. 8400 "

Discharged well.

This case was of special interest. It was admitted to the Medical Wards, and regarded as a case of simple catarrhal appendicitis. I commenced my blood count on the day of admission, and on the following day, finding that it was a rising count, I gave it as my opinion that pus was present, and suggested the advisability of a surgical opinion. This suggestion however was not acted upon until September 8th. A rising count such as this is almost an infallible indication of increasing suppuration. His after progress was uneventful; the leucocyte numeral fell steadily in accordance with his rapid recovery. Note the normal temperature and
Case II. J.W. Gradual rise of Leucocyte curve.
Rapid fall after operation.
Note the low Pulse rate and Temperature on morning of Operation.
slow pulse rate on the day of operation.

Appendicitis. Vomiting. Slight tenderness. No swelling can be palpated. 6th day of attack.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 8, 99.4</td>
<td>116</td>
<td>24</td>
<td>16960</td>
</tr>
<tr>
<td>9, 99</td>
<td>100</td>
<td>24</td>
<td>20400</td>
</tr>
</tbody>
</table>

I gave it as my opinion that pus was present.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10, N.</td>
<td>104</td>
<td>24</td>
<td>23920</td>
</tr>
<tr>
<td>11, 99</td>
<td>88</td>
<td>22</td>
<td>21680</td>
</tr>
<tr>
<td>12, N.</td>
<td>84</td>
<td>20</td>
<td>21200</td>
</tr>
<tr>
<td>13, 99.4</td>
<td>88</td>
<td>20</td>
<td>19260</td>
</tr>
<tr>
<td>14, 100</td>
<td>68</td>
<td>22</td>
<td>16800</td>
</tr>
<tr>
<td>15, 100</td>
<td>76</td>
<td>24</td>
<td>18720</td>
</tr>
<tr>
<td>17, 99.6</td>
<td>84</td>
<td>28</td>
<td>23120</td>
</tr>
</tbody>
</table>

Operation performed after count revealed a large abscess (5-6-3) behind the coecum,tracting up to right kidney. The pus contained a pure growth of Bacterium Coli Commune.

Anaesthetic. Gas and Ether.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18, 99.4</td>
<td>84</td>
<td>20</td>
<td>24000</td>
</tr>
<tr>
<td>19, 98.4</td>
<td>72</td>
<td>20</td>
<td>18400</td>
</tr>
</tbody>
</table>
Temp.  Pulse.  Resp.  Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 20.</td>
<td>97.4</td>
<td>72</td>
<td>18</td>
<td>13120</td>
</tr>
<tr>
<td>21.</td>
<td>98.4</td>
<td>72</td>
<td>20</td>
<td>10680</td>
</tr>
<tr>
<td>22.</td>
<td>97.6</td>
<td>78</td>
<td>24</td>
<td>12800</td>
</tr>
<tr>
<td>24.</td>
<td>98.</td>
<td>72</td>
<td>20</td>
<td>12480</td>
</tr>
<tr>
<td>25.</td>
<td>98.</td>
<td>72</td>
<td>20</td>
<td>9840</td>
</tr>
<tr>
<td>27.</td>
<td>98.</td>
<td>72</td>
<td>20</td>
<td>4640</td>
</tr>
</tbody>
</table>

A considerable amount of pus was found pent up behind the drainage tube.

Discharged well.

Another case in which the leucocyte estimation was of the greatest value. Nothing could be discovered by palpation; his temperature and pulse gave little or no assistance. The surgeon, a man of great authority upon this subject, could not satisfy himself that pus was present. It is but another example of the greater relative sensitiveness of the leucocyte record to pulse and temperature in suppurative appendicitis. It presents to us the leucocytosis of a fairly large abscess, well shut off, sending out an almost fixed amount of positively chemotactic toxin from day to day.

The after progress of the case, except for a slight hitch on the fifth day, is very satisfactory. Such deeply situated collections of pus are not wont to drain so rapidly.
Case 12, G.C.

Supranumerary unicorpus.

Rising leucocyte curve until operation. Falling pulse investigation after operation illustrates the leucocyte curve of a case that drains well.
Appendicitis.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 18. 99.2.</td>
<td>96.</td>
<td>24.</td>
<td>13600</td>
</tr>
</tbody>
</table>

Operation same evening, one ounce of pus found with gangrenous appendix.

Anaesthetic. Chloroform.

| 19.100.4. | 68. | 28. | 20880 |
| 20. N. | 68. | 28. | 13440 |
| 21. N. | 80. | 32. | 7120 |
| 22. 99.4. | 84. | 24. | 13360 |

Pent up discharge evacuated.

| 23. 100.4. | 80. | 24. | 7120 |
| 24. 100.2. | 68. | 20. | 11520 |

Pent up discharge in superficial pockets of wound.

| 26. 99. | 15600 |
| 28. N. | 11200 |
| Oct. 1. N. | 12160 |
| 5. N. | 11840 |
| 15. N. | 3120 |

The interest of this case lies in his after progress. He drained well for a few days. His leucocyte count touching normal on the third day, a condition that has occurred in nearly all my cases of gangrenous appendicitis. After this point we meet with a series of rises.
and falls in the leucocyte curve. On two occasions pent up discharge was quite sufficient to explain this; after this, however I could discover no cause for the leucocytosis, and was beginning to suspect another collection of pus. On October 8th the mystery was cleared up in the shape of a plug of iodoform gauze which was fished up from the bottom of the wound. How long this had been present, it was impossible to learn exactly, but it was a fortnight at least.

Appendicitis.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 21</td>
<td>101.8</td>
<td>100.</td>
<td>28.</td>
<td>23120</td>
</tr>
</tbody>
</table>

Differential count on September 21st.

Poly Nuclear finely granular oxyphiles. 88.4%
Small Lymphocytes. 7.2%
Large Lymphocytes. 3.6%
Eosinophiles. 0.8%

Operation same evening revealed a large abscess containing about half a pint of pus, which gave pure growth of Bacterium Coli.
Anaesthetic, Ether.
<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep.22. 99.6.</td>
<td>96.</td>
<td>26.</td>
<td>20560 &quot;</td>
</tr>
<tr>
<td>23. 98.</td>
<td>72.</td>
<td>24.</td>
<td>12800 &quot;</td>
</tr>
<tr>
<td>24. 98.</td>
<td>72.</td>
<td>22.</td>
<td>14800 &quot;</td>
</tr>
<tr>
<td>25. 98.</td>
<td>70.</td>
<td>22.</td>
<td>16960 &quot;</td>
</tr>
<tr>
<td>26. 98.</td>
<td>72.</td>
<td>22.</td>
<td>16800 &quot;</td>
</tr>
<tr>
<td>27. 98.</td>
<td>70.</td>
<td>22.</td>
<td>16800 &quot;</td>
</tr>
<tr>
<td>28. 97.</td>
<td>68.</td>
<td>22.</td>
<td>21040 &quot;</td>
</tr>
</tbody>
</table>

30. As the cavity was draining so badly, the drainage tube was again inserted, having been removed on September 24th.

Oct.1. N. 16240 "
3. 98. 17120 "
5. 98. 7440 "
9. 98. 7440 "

Discharged well.

This case was obviously from the local condition present, one of suppurative appendicitis, there was no difficulty whatever as to the diagnosis. His progress after the operation was somewhat slow, he did not drain well, and it is interesting to observe that his leucytosis was maintained until a few days after the drainage tube was re-inserted. The temperature and pulse remained normal, in contrast to the blood count.

Appendicitis.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 29.</td>
<td>101.2</td>
<td>128.</td>
<td>38.</td>
</tr>
</tbody>
</table>

Differential Count, September 29th.

- Poly **nuclear finely granular oxyphiles** 93.6%.
- Small Lymphocytes. 3.8%.
- Large Lymphocytes. 2.5%
- Transitional cells. .6%

Operation same day revealed a localised abscess, containing about one ounce of foul pus, which on cultivation gave a pure growth of Bacterium Coli.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>101.2</td>
<td>120.</td>
<td>32.</td>
<td>14320</td>
</tr>
<tr>
<td>Oct. 1.</td>
<td>100.6</td>
<td>116.</td>
<td>28.</td>
<td>8080</td>
</tr>
<tr>
<td>3.</td>
<td>99.</td>
<td>76.</td>
<td>24.</td>
<td>10000</td>
</tr>
<tr>
<td>15.</td>
<td>N.</td>
<td>76.</td>
<td>24.</td>
<td>10480</td>
</tr>
<tr>
<td>19.</td>
<td>100.</td>
<td>Healed.</td>
<td></td>
<td>7760</td>
</tr>
</tbody>
</table>

A definite leucocytosis which cleared up directly after operation. The patient made a good recovery.


Appendicitis. Slight pain in right iliac region, no
tenderness. No swelling can be palpated. The general opinion was that there was no suppuration.

Temp.  Pulse.  Resp.  Leucocytes per c.m.
Oct. 18. 99.  101.  28.  24000  

Differential Count:

Poly-Nuclear finely granular oxyphiles 84.8%

Small Lymphocytes.  7.8%

Large Lymphocytes.  4.6%

Transitional Cells.  2.4%

Eosinophiles.  .4%

Operation on same evening revealed an abscess containing one ounce of pus, which on cultivation showed a pure growth of Bacterium Coli.

19.  100.4.  116.  24.  23120  
20.  100.  96.  24.  21140  
21.  101.  108.  36.  11520  
22.  99.2.  96.  24.  20560  

Upon this day a large faecal concretion was passed through the wound.

23.  98.4.  84.  20.  10560  
24.  99.2.  88.  20.  9040  
25.  99.  80.  20.  18050  
27.  99.4.  16800  
29.  100.4.  20560  

Another faecal concretion passed from wound.
<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 30.</td>
<td>100.4.</td>
<td></td>
<td>14240</td>
</tr>
<tr>
<td>Nov. 3.</td>
<td>100.4.</td>
<td></td>
<td>10880</td>
</tr>
<tr>
<td>5.</td>
<td>99.</td>
<td></td>
<td>4640</td>
</tr>
</tbody>
</table>

The leucocyte count in this case pointed to suppuration in spite of the entire absence of local symptoms. The temperature was normal, the pulse rapid. His subsequent career was somewhat chequered. The haemic record pointed to imperfect drainage, and the passage of a faecal concretion, which was probably lying for some time in the bottom of the wound on October 22nd, was quite sufficient to explain his fluctuating count. It rose again on September 26th, and we find that this was due to another concretion which was discharged on October 29th.

His further progress was satisfactory, his temperature did not rise above normal after November 5th, and his wound rapidly healed.

Appendicitis.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 19</td>
<td>101.</td>
<td>96.</td>
<td>20.</td>
<td>13280</td>
</tr>
</tbody>
</table>

**Differential Count.**

- Poly n<sub>uclear</sub> finely granular oxyphiles 82. 6%
- Small Lymphocytes. 14. %
- Large Lymphocytes. 4. %
- Mast Cells. 6%
- Transitional cells. 4%
- Eosinophiles. 4%

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>99.</td>
<td>100.</td>
<td>20.</td>
<td>12160</td>
</tr>
<tr>
<td>21</td>
<td>98.</td>
<td>90.</td>
<td>28.</td>
<td>17440</td>
</tr>
</tbody>
</table>

Operation revealed localised abscess.

Anaesthetic. A.C.E. mixture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.</td>
<td>101.</td>
<td>118.</td>
<td>32.</td>
<td>16600</td>
</tr>
<tr>
<td>24.</td>
<td>98.</td>
<td>108.</td>
<td>28.</td>
<td>16240</td>
</tr>
<tr>
<td>26.</td>
<td>97.</td>
<td>96.</td>
<td>28.</td>
<td>7120</td>
</tr>
<tr>
<td>31.</td>
<td>101.</td>
<td>112.</td>
<td>22.</td>
<td>24000</td>
</tr>
<tr>
<td>Nov. 1</td>
<td>100.6</td>
<td>120.</td>
<td>22.</td>
<td>20000</td>
</tr>
</tbody>
</table>

2. Abdomen again opened, a large abscess was found behind hepatic flexure, which was drained in the loin.

Anaesthetic. Ether.
Temp. | Pulse. | Resp. | Leucocytes per c.m.
Oct.3. 100.2. | 100. | 28. | 20560
4. 99.6. | 120. | 32. | 22800
6. 98. | 100. | 26. | 14640
8. 97.6 | 98. | 22. | 10880
12. 98.4 | 112. | 22. | 8080
21. 98.8 | 100. | 24. | 8400

The wound was practically healed, and the boy was running about the wards.

Dec.5. 99.4. | 100. | 28. | 11840
12. 100.4. | 128. | 32. | 16240

Between the dates of December 4th and 12th, the boy passed through an attack of acute lobar pneumonia, with daily temperature of 104.

This case was one of great interest. His leucocytosis prior to operation suggested suppuration. He appeared to progress very well for a day or two after operation, his temperature, pulse and leucocyte count touching normal on the third day. I did not take his count again for five days, when I found it showing a marked leucocytosis. This of course suggested re-accumulation or bad drainage. He then began to complain of pain higher up in his abdomen. The surgeon decided to explore his belly once more, and discovered a large abscess behind the hepatic flexure. From this point his
Case 17. W. G.
Intermittent Recurring.
leucocyte curve fell steadily, and the boy did well in every way for about a fortnight. A day or two before his intended discharge from Hospital he developed acute lobar pneumonia. He began to ail about December 4th. I took a blood count on December 5th, and found a slight increase of the white corpuscles, this leucocytosis would no doubt increase very considerably, and I am sorry that I was unable to follow it up. On December 12th the leucocytosis was still high after the crisis. The little fellow ultimately to everyone's delight got perfectly well, despite the heavy odds he had to contend with.

Appendicitis.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.19. 102.</td>
<td>110.</td>
<td>20.</td>
<td>16080</td>
</tr>
</tbody>
</table>

Differential Count:-

Poly nuclear finely granular oxyphiles. 95. 2%
Small Lymphocytes. 1. 8%
Large Lymphocytes. 1. 8%
Transitional cells. . 6%
Eosinophiles. . 6%
Mast cells. 

<table>
<thead>
<tr>
<th></th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 20</td>
<td>101.</td>
<td>88.</td>
<td>28.</td>
<td>14000</td>
</tr>
<tr>
<td>21.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operation, - abscess - gangrenous appendix.</td>
</tr>
<tr>
<td>22.</td>
<td>100.</td>
<td>100.</td>
<td>20.</td>
<td>18400</td>
</tr>
<tr>
<td>23.</td>
<td>101.</td>
<td>104.</td>
<td>24.</td>
<td>14960</td>
</tr>
<tr>
<td>24.</td>
<td>100.</td>
<td>120.</td>
<td>28.</td>
<td>19680</td>
</tr>
<tr>
<td>26.</td>
<td>99.</td>
<td>120.</td>
<td>28.</td>
<td>12800</td>
</tr>
<tr>
<td>29.</td>
<td>98.4.</td>
<td>84.</td>
<td>22.</td>
<td>4800</td>
</tr>
<tr>
<td>31.</td>
<td>98.4.</td>
<td>80.</td>
<td>22.</td>
<td>4800</td>
</tr>
</tbody>
</table>

Excellent recovery. Small granulating wound on October 31st.

This case illustrates the characteristic differential count of a suppurative leucocytosis. His after progress was more or less uneventful. There was considerable amount of discharge for a few days after the operation.

Appendicitis. Abscess with fluctuation.

<table>
<thead>
<tr>
<th></th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 19</td>
<td>101.6</td>
<td>88.</td>
<td>24.</td>
<td>16240</td>
</tr>
</tbody>
</table>
Differential Count:

Poly nuclear finely granular oxyphiles. 90.8%
Small Lymphocytes. 3.6%
Large Lymphocytes. 1.6%
Eosinophiles. 2.2%
Transitional cells. 1.6%
Mast cells. .8%

Operation on October 19th. Several ounces of pus evacuated with a gangrenous appendix.

Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.20. 100.6.</td>
<td>96.</td>
<td>32.</td>
<td>16720</td>
</tr>
<tr>
<td>21. N.</td>
<td>68.</td>
<td>24.</td>
<td>16240</td>
</tr>
<tr>
<td>22. 98.</td>
<td>64.</td>
<td>20.</td>
<td>12240</td>
</tr>
<tr>
<td>23. 97.2.</td>
<td>60.</td>
<td>20.</td>
<td>6240</td>
</tr>
<tr>
<td>25. 98.</td>
<td>60.</td>
<td>16.</td>
<td>9360</td>
</tr>
</tbody>
</table>

Illustrates a characteristic leucocytosis. An excellent recovery after operation as is often the case in gangrenous appendicitis. Eosinophiles are unusually numerous in such cases.
Appendicitis.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 4.</td>
<td>29680</td>
<td>&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Differential Count:

Poly nuclear finely granular oxyphiles. 89%
Small Lymphocytes. 4.4%
Large Lymphocytes. 4.2%
Transitional cells. 1.0%
Eosinophiles. 1.0%
Myelocytes. 6.0%
Mast cells. 2.0%

After count operation performed, several ounces of pus were evacuated, which gave a pure growth of Colon Bacillus.

Recovery.

Tender lump in right iliac fossa, is it inflammatory or not? Has been in hospital some days.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.13. 98.</td>
<td>72.</td>
<td>18.</td>
<td>12960</td>
</tr>
</tbody>
</table>
Differential Count:

<table>
<thead>
<tr>
<th>Cell Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly nuclear finely granular oxyphiles</td>
<td>74.8%</td>
</tr>
<tr>
<td>Small Lymphocytes</td>
<td>14.4%</td>
</tr>
<tr>
<td>Large Lymphocytes</td>
<td>6.8%</td>
</tr>
<tr>
<td>Transitional cells</td>
<td>2.4%</td>
</tr>
<tr>
<td>Eosinophiles</td>
<td>1.2%</td>
</tr>
<tr>
<td>Mast cells</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.16</td>
<td>98</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>17</td>
<td>98</td>
<td>66</td>
<td>22</td>
</tr>
</tbody>
</table>

I gave it as my opinion that pus was not present. Operation revealed an inflammatory mass of adhesion, with a little granulation tissue in its middle, which on cultivation gave a copious growth of Bacterium Coli, with a few colonies of Staphylococcus Pyogenes Albus. No actual pus was visible.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>99</td>
<td>88</td>
<td>22</td>
<td>10380</td>
</tr>
<tr>
<td>19</td>
<td>98</td>
<td>80</td>
<td>22</td>
<td>14160</td>
</tr>
<tr>
<td>20</td>
<td>99</td>
<td>70</td>
<td>20</td>
<td>10240</td>
</tr>
<tr>
<td>22</td>
<td>101</td>
<td>88</td>
<td>24</td>
<td>12480</td>
</tr>
<tr>
<td>24</td>
<td>98.2</td>
<td>76</td>
<td>20</td>
<td>7440</td>
</tr>
<tr>
<td>26</td>
<td>98.2</td>
<td></td>
<td></td>
<td>10560</td>
</tr>
<tr>
<td>31</td>
<td>98.4</td>
<td></td>
<td></td>
<td>7440</td>
</tr>
</tbody>
</table>

This case is one in which the leucocyte count is certainly instructive. He gave a slight leucocytosis on
the first day of my observation, which disappeared entirely in a day or two. I had no hesitation in saying that there was no pus present. The differential count made was that of normal blood, a fact of great interest. In the light of facts revealed at the operation I think I might safely feel that the leucocytosis present on October 13th was of an inflammatory nature, due to the smouldering embers of an old pyogenic focus, which was gradually being extinguished. There was no actual pus present at the operation, the only evidence that there had been was a small mass of granulation tissue in the middle of the mass of adhesion. The wound suppurated, and his recuperative power was low.

Pain in abdomen, no tenderness, no swelling.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec.13.</td>
<td>101.8</td>
<td>120.</td>
<td>44.</td>
<td>16240</td>
</tr>
<tr>
<td>14.</td>
<td>101.6</td>
<td>140.</td>
<td>32.</td>
<td>23360</td>
</tr>
<tr>
<td>15.</td>
<td>102.2</td>
<td>152.</td>
<td>36.</td>
<td>21840</td>
</tr>
<tr>
<td>16.</td>
<td>101.4</td>
<td>125.</td>
<td>36.</td>
<td>22500</td>
</tr>
<tr>
<td>17.</td>
<td>101.</td>
<td>125.</td>
<td>36.</td>
<td>23120</td>
</tr>
</tbody>
</table>
The patient at this stage began to have slight tenderness in the right iliac fossa. Surgeon called in, but does not think there is suppuration.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec.18</td>
<td>100</td>
<td>128</td>
<td>28</td>
<td>27040</td>
</tr>
<tr>
<td>19</td>
<td>99</td>
<td>120</td>
<td>28</td>
<td>25000</td>
</tr>
</tbody>
</table>

Differential Count:

Poly nuclear finely granular oxyphiles. 89%
Small Lymphocytes. 6. 2%
Large Lymphocytes. 3. 8%
Transitional cells. 1. %

20. 99. 118. 33120 "

Operation. Large abscess found behind coecum.

Anaesthetic. A.C.E mixture.

21. 99.2. 116. 24680 "
22. N. 115. 23120 "
23. N. 118. 19000 "
Jan.5. N. 112. 28. 12480 "

The case did not appear to drain well, and the drainage tube was re-inserted on January 12th.

14. N. 107. 24. 12480 "

A faecal concretion was passed through the wound on January 18th.

No further counts were made after January 14th, and patient left Hospital on January 27th, against advice,
Case 22. M. H., Suffusion Affected

Pulse and Temperature fell before operation

Leucocyte curve after pus was evacuated.
still discharging.
This case is full of instruction. The local symptoms of suppurative appendicitis were practically absent. She was admitted to a medical ward, and this explains the reluctance shown to secure surgical interference. However, the surgeon, even when called in, did not regard the case as a suppurative one. I had no doubt in my own mind. The temperature, pulse, and increasing leucocyte count clearly pointed to a definite suppuration. The reaction was vigorous, and the leucocytosis well marked. The gradual daily increase of white corpuscles is of the utmost significance, and cannot be disregarded. It is of interest to notice that for two days before the operation, the temperature was almost normal. This is very apt to give the false impression of improvement under such circumstances. The leucocyte curve maintains its steady ascent, according to the condition present. It is not impossible to imagine that many cases of this kind are allowed to remain untouched, until a rupture of the abscess occurs, into the general peritoneal cavity, when operative measures are perhaps useless. A regular leucocyte count would obviate such a danger.
The after progress of this case was not rapid, and although my blood examinations were not made with much
regularity, it can be clearly observed by it alone, that there was some cause which prevented it falling as it ought to have done.

Thinking there was imperfect drainage, the surgeon inserted the drainage tube once more.

On January 18th the true cause of the slow progress became evident. A faecal concretion is quite sufficient to account for a moderate leucocytosis, and impede the healing of such a wound. Under such conditions, when the leucocytes did not fall to their normal quantitative value, a careful search for concretions at the bottom of a sinus would be of value.

Suppurative Appendicitis without Leucocytosis.

Ill eight weeks, large tender mass present in right iliac fossa, which fluctuates. Just admitted.

Temp. Pulse. Resp. Leucocytes per c.m.
June 29. 100. 80. 20. 9360.

Differential Count:–

Poly muclear finely granular oxyphiles. 61. 2%
Small Lymphocytes. 32 %
Large Lymphocytes. 2. 8%
Transitional cells. 8%
Eosinophiles. 2%
Temp.    Pulse.    Resp.    Leucocytes per c.m.

June 30. N.  
July 1. Operation. Several ounces of pus evacuated. It was shut off from the general peritoneal cavity by dense adhesions.

Anaesthetic. Ether.

2. N.  
4. N.  
10. N.  

7440 "  
6400 "  
6960 "  
5600 "

This is the one exception to my otherwise positive record of constant leucocytosis in suppurative appendicitis. It was obviously a suppurative case, and yet my counts on the two days preceding operation were normal ones. Even after operation there was no slight rise in the leucocyte numeral, as is often the case; this may be due to the very mild operation, which consisted in the mere opening of an abscess which was already quite superficial. The patient was anaesthetised by ether which rarely ever seems to increase any existing leucocytosis. The pus was not examined for organisms, much to my regret. I was specially anxious to do this, but being unable to attend the operation, I requested the house surgeon to put me up a specimen in a sterilised capillary tube; this was unfortunately forgotten.

It is to some extent a matter of speculation to attempt
to explain this one anomalous case.

There was a chronic history - he had suffered from pain and tenderness for eight weeks, and his abscess was by no means of recent formation.

The dense fibrous walls were no doubt a very effective barrier to the absorption of septic toxines. There is of course, a remote possibility that this was a tuberculous condition, and had I been able to attend the operation I could have satisfied myself as to whether septic organisms were present or not. His age is not the most suitable for vigorous leucocytic reaction. Children give the highest degrees of leucocytosis.

It is possible also that the man might have some idiosyncracy against the action of the usual positively chemotactic toxin.

The differential count shows no increase whatever in polynuclear cells, indeed a fairly definite increase in the small lymphocytes is to be observed instead.

APPENDICITIS. No suppuration. No leucocytosis.

24. R.A. Aet. 43. Male.

Pain. Tender lump to be felt. Acute attack.

Temp. Pulse. Resp. Leucocytes per c.m.

June 12. 98. 64. 22. 8560 "

13. Appendix excised, adhesions, no pus present.
### Anaesthetic: Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 14</td>
<td>97.5</td>
<td>72</td>
<td>20</td>
<td>8880</td>
</tr>
<tr>
<td>15</td>
<td>98</td>
<td>72</td>
<td>20</td>
<td>9840</td>
</tr>
<tr>
<td>16</td>
<td>N</td>
<td>64</td>
<td>22</td>
<td>9840</td>
</tr>
<tr>
<td>18</td>
<td>N</td>
<td></td>
<td></td>
<td>10240</td>
</tr>
<tr>
<td>19</td>
<td>N</td>
<td></td>
<td></td>
<td>10240</td>
</tr>
<tr>
<td>20</td>
<td>N</td>
<td></td>
<td></td>
<td>7120</td>
</tr>
<tr>
<td>22</td>
<td>N</td>
<td></td>
<td></td>
<td>7160</td>
</tr>
</tbody>
</table>

Healed by first intention.

No leucocytosis. Illustrates the blood count of a case healing by first intention.

---


**Appendicitis. Acute attack.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 16</td>
<td>98</td>
<td>6640</td>
</tr>
</tbody>
</table>


Stitched up.

**Anaesthetic. Chloroform.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>13120</td>
</tr>
<tr>
<td>20</td>
<td>13680</td>
</tr>
<tr>
<td>21</td>
<td>6240</td>
</tr>
</tbody>
</table>
Temp.       Pulse.   Resp.   Leucocytes per c.m.

June 22. N.     7600   "


25. 101.       15 520   "

26. N.         7 200   "

28. N.         10,000  "

This case, beyond its negative value, brings out one or two interesting points.

Chloroform was the anaesthetic used, and we see a moderate leucytosis lasting two or three days. On June 25 the count suddenly rose to 15 520, per c.m. This might be due to two causes. Firstly - and less likely - a dose of liquorice powder on the evening of the 24th, which gave him a rather smart relaxation of the bowels, which generally causes increase in the corpuscular value of the blood. Secondly, a considerable degree of redness was noticed round one or two stitches on this day, with small abscesses. This combination of causes is amply sufficient to account for the sudden degree of leucytosis. My technique was unlikely to be at fault, as I counted the blood more than once that day. The temperature rose on the same evening to 101. The stitches were removed, and the count fell to normal next day.
June 16, 18, 19, 20, 21, 22, 23, 24, 25, 26.

Operation

Stitch removal - Calcaneus.

Case 26: H.T. Intermittent fevers.

Wound healing - small stitchaleness of calcanen.

Appendicitis. Second attack. Ill nine days. Tender swelling in right iliac fossa. Thought to be suppurative.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 1. 98.</td>
<td>72.</td>
<td>24.</td>
<td>8860 &quot;</td>
</tr>
<tr>
<td>4. 98.</td>
<td>10400 &quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Differential Count;-

Poly nuclelar finely granular oxyphiles. 79. 2%
Small Lymphocytes. 14 %
Large Lymphocytes. 4 %
Eosinophiles. 1. 4%
Transitional cells. 1. 4%

Question of operation was considered, but as the patient steadfastly refused, nothing was done.

I expressed the opinion that the tender lump was in all probability impacted faeces.

He was put upon an ice bag, and the lump disappeared in a few days. His differential count is a normal one.
No. 27. J.P. Aet. 40. Male.

Appendicitis. Acute attack.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 26.</td>
<td>100.</td>
<td>76.</td>
<td>22.</td>
</tr>
</tbody>
</table>

Operation. Appendix excised, no pus, stitched up.

Anaesthetic. Ether and Chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.</td>
<td>99.</td>
<td>72.</td>
<td>24.</td>
<td>15280</td>
</tr>
<tr>
<td>29.</td>
<td>99.</td>
<td>70.</td>
<td>22.</td>
<td>9360</td>
</tr>
<tr>
<td>30.</td>
<td>98.</td>
<td>70.</td>
<td>22.</td>
<td>10080</td>
</tr>
<tr>
<td>31.</td>
<td>99.</td>
<td></td>
<td></td>
<td>10560</td>
</tr>
<tr>
<td>Sep. 1.</td>
<td>N.</td>
<td></td>
<td></td>
<td>6560</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td>5920</td>
</tr>
</tbody>
</table>

Healed by first intention.

Note the leucocytosis on the day after operation, chloroform as well as ether being given as an anaesthetic.


Appendicitis. Fifth attack.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 12.</td>
<td>99.8.</td>
<td>72.</td>
<td>22.</td>
<td>9360</td>
</tr>
<tr>
<td>13.</td>
<td>N.</td>
<td>72.</td>
<td>22.</td>
<td>10880</td>
</tr>
<tr>
<td>15.</td>
<td>98.4.</td>
<td>68.</td>
<td>22.</td>
<td>6560</td>
</tr>
</tbody>
</table>

I gave it as my opinion that the case was not a suppu-
rative one.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td></td>
<td>No pus present</td>
<td>Stitched up</td>
<td></td>
</tr>
<tr>
<td>Anaesthetic</td>
<td>Ether</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. N.</td>
<td>72.</td>
<td>26.</td>
<td>10560</td>
<td>&quot;</td>
</tr>
<tr>
<td>19. N.</td>
<td>72.</td>
<td>24.</td>
<td>8720</td>
<td>&quot;</td>
</tr>
<tr>
<td>20. N.</td>
<td>68.</td>
<td>20.</td>
<td>7760</td>
<td>&quot;</td>
</tr>
<tr>
<td>22. 99.</td>
<td>60.</td>
<td>20.</td>
<td>9360</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Healing by first intention.


<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep.12</td>
<td>68.</td>
<td>22.</td>
<td>9520</td>
<td>&quot;</td>
</tr>
<tr>
<td>13. 99</td>
<td>64.</td>
<td>18.</td>
<td>7120</td>
<td>&quot;</td>
</tr>
<tr>
<td>15. 99</td>
<td>64.</td>
<td>20.</td>
<td>9520</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

I gave it as my opinion that there was no pus.

17. Operation; no pus present; stenosed appendix, from whose interior I obtained a pure growth of Bacterium Coli.

Anaesthetic. Gas and Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. 99</td>
<td>90.</td>
<td>24.</td>
<td>11560</td>
<td>&quot;</td>
</tr>
<tr>
<td>19. 98</td>
<td>76.</td>
<td>18.</td>
<td>11520</td>
<td>&quot;</td>
</tr>
<tr>
<td>20. 97</td>
<td>78.</td>
<td>20.</td>
<td>11600</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
Pulse

Temperature

Catalan appendicitis
Appendectomy with:
Healing by first intention

Case 29: H.B.
Inf.
Temp.      Pulse.  Resp.  Leucocytes per c.m.
Sep. 21. 98.  80.  20.  8560 "
24. 98.    72.  20.  8720 "

Healed by first intention.
There was considerable doubt, clinically, whether
this was a suppurative case or not. The blood count is
quite opposed to an abscess formation. The appendix
was occluded, and from the interior of the swollen
distal end a copious growth of Bacterium Coli was ob-
tained.
The anaesthetic was gas and ether. The slightly plus
blood count during the three days following operation
is of little significance, and was probably due to
blood clot in the wound, or peritoneal cavity.

30. P.C. Aet. 29. Female.
Diagnosis of appendicitis made. Fourth attack.
Pain, tenderness in right iliac fossa.
  12. 98.       10040 "
  13. 97.       9680 "
15. Operation revealed an ovarian tumour with
long pedicle, which had become somewhat twisted, givi-
ing rise to the so-called attacks of appendicitis.
Anaesthetics. Gas and Ether.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 16. N.</td>
<td></td>
<td></td>
<td>16240</td>
</tr>
<tr>
<td>17. 99.4.</td>
<td></td>
<td></td>
<td>7120</td>
</tr>
<tr>
<td>18. N.</td>
<td></td>
<td></td>
<td>7760</td>
</tr>
</tbody>
</table>

Healed by first intention.

There is moderate leucocytosis after the operation, which disappeared the following day.

**CONCLUSIONS.**

1. Leucocyte counts can be of the very greatest value in appendicitis.

2. A leucocytosis lasting more than one day points very strongly to suppuration.

3. A steadily increasing leucocytosis is always of grave significance, pointing to advancing mischief, which ought not to be disregarded.

Even though the temperature and pulse are normal, and there be an entire absence of local symptoms, such an increasing leucocytosis is sufficient to justify operative interference.

4. In suppurative appendicitis, leucocytosis is a much
more constant symptom than a rapid pulse, and a rapid pulse than an elevated temperature.

The degree of leucocytosis cannot be relied upon to furnish correct information as to the amount of pus present, though generally a small abscess gives rise to slight leucocytosis, and a moderately sized abscess to a higher degree of leucocytosis. This leucocytosis is regulated probably more by the amount of toxin given out by the local lesion, and this must vary with the degree of resistance to absorption, as regulated by adhesions, as well as to the virulence of the special organism. Children and young adults give higher degrees of leucocytosis than older patients.

An abscess, well shut off, will give rise to a persistent leucocytosis, which varies in degree from day to day, due to conditions it is very difficult to determine.

Simple catarrhal appendicitis does not give rise to leucocytosis.

If a large abscess is well shut off by adhesions of several weeks' duration, it is possible to find a perfectly normal blood count, as in case 22. It has been definitely proved that a normal quantitative leucocyte count is often found in those serious
forms of suppurative appendicitis, pointing to a grave prognosis. In case 22, no such anxiety ever arose. It is of interest to realise that such a leucocyte estimation can be obtained in such a condition, though I do not think that this exception impairs the value of leucocyte estimation in the diagnosis of acute suppurative appendicitis.

The leucocyte numeral taken on the first day of patient's hospital life is generally unusually high. This is in all probability due to the shaking and disturbance of the journey. A single count therefore is apt to be misleading, unless such circumstances are taken into account.

Consecutive counts of two or three days give much more reliable information than for one day only, so that where a definite leucocytosis is maintained for that period, one may take it that there is a condition of things present that rest in bed does not appear to improve.

The opening of an abscess in this region often increases the leucocytosis for a day or two. This is specially the case where chloroform has been employed as an anaesthetic. After the abscess is evacuated, if the condition is draining properly, the leucocytosis gradually disappears within a few days, and the
count does not rise again.

12. Should the drainage be bad, giving rise to pent up discharge, the leucocyte curve will rise again, and keep on fluctuating according to the amount of retained products.

13. The formation of a fresh abscess is accompanied by increasing leucocytosis.

14. A piece of iodoform gauze in an abscess cavity, or a foecal concretion, gives rise to a maintained leucocytosis.

15. A regular quantitative estimation of the white blood corpuscles can be of the very greatest value in giving information as to the post-operative progress of suppurative appendicitis.

Should the leucocytosis not disappear within a few days, a careful examination of the local conditions present should be made, in order to find out the cause of that delay.

16. In cases in which the appendix has sloughed off into the abscess cavity, the leucocytosis generally disappears in a few days, and does not reappear.

17. Leucocyte counts ought to be of value in the differential diagnosis of appendicitis.

Such affections as Typhoid fever, intestinal colic, biliary and renal colic, unattended by local inflamma-
tory conditions, floating kidney, impacted fæces, abdominal neuralgias, give rise to no leucocytosis.
OTHER FORMS OF LOCALISED PERITONITIS.

F.B.  
Age. 39.  
Male.  
Abscess in region of Pylorus. History of ruptured gastric ulcer about a month ago.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

May 13.  100.5.  100.  24.  15280  

Operation revealed a foetid abscess in epigastric region, containing about two ounces of pus, well shut off by adhesions.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.</td>
<td>98.6</td>
<td>85.</td>
<td>24.</td>
<td>14400</td>
</tr>
<tr>
<td>15.</td>
<td>99.</td>
<td>84.</td>
<td>22.</td>
<td>12000</td>
</tr>
<tr>
<td>16.</td>
<td>98.</td>
<td>88.</td>
<td>20.</td>
<td>15760</td>
</tr>
<tr>
<td>17.</td>
<td>98.4</td>
<td>90.</td>
<td>20.</td>
<td>14960</td>
</tr>
<tr>
<td>18.</td>
<td>99.</td>
<td>112.</td>
<td>24.</td>
<td>13360</td>
</tr>
<tr>
<td>19.</td>
<td>100.</td>
<td>106.</td>
<td>24.</td>
<td>18080</td>
</tr>
<tr>
<td>21.</td>
<td>99.8</td>
<td>100.</td>
<td>24.</td>
<td>12480</td>
</tr>
<tr>
<td>23.</td>
<td>100.6</td>
<td>90.</td>
<td>22.</td>
<td>15280</td>
</tr>
<tr>
<td>28.</td>
<td>97.4</td>
<td>76.</td>
<td>22.</td>
<td>7280</td>
</tr>
<tr>
<td>31.</td>
<td>N</td>
<td>80.</td>
<td>20.</td>
<td>12240</td>
</tr>
</tbody>
</table>

JUNE 5. N  
Wound dressed daily. Discharged freely until May 23.

The discharge varied in quantity from day to day. Wound was healed on June 1st.

The case is interesting because of its after treatment. The abscess did not drain very satisfactorily, owing
to its unfavorable position and the irregularity of its interior. His leucocyte count, after many minor fluctuations, according to the degree of retention of the discharge, touched normal for the first time on May 28th. Three days later it showed a slight rise, and even my last count is not altogether satisfactory.

The wound was healed on June 1st, and he was soon walking about. Nevertheless in view of this terminal return of a slight degree of leucocytosis, it is of interest to record that not long after his discharge he was readmitted to Hospital with all the aggravation of his primary condition.

M.B. Aet. 28. Female.

Had appendicitis several weeks ago. Temperature rising to 102 every night. Does not complain of any pain or discomfort.

Cultivation from blood, sterile.

July 13. 101. 104. 36. 38720 "

Gave it as my opinion that the case was not tubercle, but probably a deeply seated abscess.

16. 102.4. 104. 28. 28560 "

19. Coughed up about a pint of pus.
Temp.  Pulse.  Resp.  Leucocytes per c.m.
July 20.  101.  116.  28.  21680  

Sent to Jaffray Convalescent Hospital.
Died August 4th. Post mortem revealed a large sub-
phrenic abscess perforating diaphragm, and bursting
into the left lung. Adhesions binding down appendix.
This case, though pregnant with interest, is a some-
what tragic one. The case had passed through an attack
of catarrhal appendicitis a few weeks ago, and was said
to have recovered under expectant treatment. Her tem-
perature however did not clear up, and the surgeon, be-
ing unable to find any obvious cause, transferred her
to a medical ward.
She had no pain, no tenderness, and except for the tem-
perature, there was absolutely no clue to her condition.
My cultivations from the blood were all sterile.
The general opinion held was that she was suffering
from early pulmonary tuberculosis; a few râles at the
base of the right lung appeared to confirm that opini-
on.

Then it was that I made my first leucocyte estimation
with the above result. The high leucocytosis present
led me to the opinion that there was some deep-seated
suppuration somewhere. There was no history or evi-
dence of Pneumonia, otherwise I should have thought of
an unresolved condition. Such a leucocytosis dismissed the possibility of its being a pure tuberculosis.

On July 19th the patient suddenly commenced to cough and expectorated nearly a pint of pus. After this one had little difficulty in saying that there was an abscess of the lung present, or some abscess communicating with the lung.

Despite these symptoms and the opinion I ventured to express to the House Physician, she was sent to the Jaffray Hospital to convalesce.

Her sudden death was not a surprise, and the post mortem revelations still less so.

I think in the light of our present knowledge that if an occasional leucocyte count had been made in this case, during and after the attack of acute appendicitis, that the mischief would have been detected earlier, and her life probably saved.

S.S. Aet. 43. Female.

Lumbar abscess, opened on July 13th, thought to be tuberculous. Patient has begun to have severe abdominal pain, with tenderness over the left kidney. Said to have pulmonary Tuberculosis.
<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 30</td>
<td>100.6</td>
<td>144</td>
<td>28</td>
<td>39680</td>
</tr>
<tr>
<td>31</td>
<td>100</td>
<td></td>
<td></td>
<td>40080</td>
</tr>
<tr>
<td>Aug, 1</td>
<td>99.4</td>
<td></td>
<td></td>
<td>37920</td>
</tr>
<tr>
<td>4</td>
<td>N.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>N.</td>
<td></td>
<td></td>
<td>32480</td>
</tr>
</tbody>
</table>

**Differential Count:**

- Poly nuclear finely granular oxyphiles: 91%
- Small Lymphocytes: 6%
- Large Lymphocytes: 2.6%
- Eosinophiles: 2%
- Mast cells: 2%

Patient died about the middle of August.

**Post Mortem** revealed a large ragged stone filling up the pelvis of the kidney, large quantities of pus lying amongst coils of small intestines and communicating directly with the pelvis of left kidney. Many small abscesses bound down by adhesions also, which in some places had ulcerated into the lumen of the gut. There was no trace of Phthisis.

If leucocyte counts been made in this case before the lumbar abscess was opened, it would have probably prevented the error of diagnosis that was made. Exploration of the kidney could not have been made at the time of the operation; and given a high leucocytosis with
such an abscess, this would have been done, because it pointed strongly to a calculus. It was regarded as a tuberculous condition, which, unless infected, gives rise to no leucocytosis.

The patient had a sinus when I saw her first on July 30th, from which there was little or no discharge. The abdominal pain was regarded as due to a tuberculous condition, and Phthisis had also been discovered. I had little doubt in my own mind that whether tubercle was the original disease or not, there was certainly pyogenic mischief present later.

Her temperature record was very misleading. Her pulse rate was not charted regularly. The leucocytosis is a high one, and in the light of a post-mortem revelation, this is not to be wondered at.

I expressed the decided opinion at the time that there must be some considerable focus of pyogenic mischief pent up somewhere.

The differential count is that of an inflammatory leucocytosis.
F.B.  

Ulcer on foot two weeks ago. Inguinal glands enlarged, tender lump in right iliac fossa. Surgeon does not think that suppuration has been established.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

Aug. 18. 101.8.  
19. 100.4. 19360 "

Differential Count:

Poly nuclelar finely granular oxyphiles. 83%
Small Lymphocytes. 13. 2%
Large Lymphocytes. 2. 2%
Eosinophiles. 1. 6%

I had no hesitation in saying that there was suppuration present.

21. 101.8. 28480 "

Operation. No pus was found, much to my surprise.

Anaesthetic. Ether.

22. 102. 112. 36. 28240 "
23. 101. 92. 30. 29680 "

24. Whilst the house surgeon was dressing the case on this day, a large abscess containing several ounces of pus was burst open whilst squeezing the lips of the wound.

25. N. 80. 28. 16240 "
26. N. 60. 20. 13440 "
Temperature curve rises until the 'bus was unwound.
Temp.  Pulse.  Resp.  Leucocytes per C. M

Aug. 28. N.  14960  "
31.  N.  11640  "
Sep. 4.  N.  9360  "

Wound discharged freely from August 24th, until September 2nd. He left Hospital well on September 11.

This case was regarded by the surgeon in charge of it, as a non-suppurative one. After two consecutive counts I had very little hesitation in giving a different opinion.

The incision made into the right iliac region on August 24th missed the abscess which undoubtedly existed.

Ether was the anaesthetic, and unless increasing suppuration had not been present, the leucocytosis would not have been an increasing one for two days. The evacuation of the pus affected the leucocyte numeral at once.

His differential count is characteristic. Despite the ulcer on his right foot two weeks ago, I inclined to regard this case as one of suppurative appendicitis, and not suppurative adenitis.

CONCLUSIONS.

The same conclusions can be drawn from this series of localised suppurative peritonitis as can be drawn from suppurative appendicitis.
GENERAL PERITONITIS (SUPPURATIVE)


General Peritonitis.

Been ill 5 days. Abdomen distended. Looks very ill.

Temp. Pulse. Resp. Leucocytes per c.m.

Aug. 29. 99.6. 120. 36. 29560

Operation. Merely an incision into right flank.

Anaesthetic. Ether.

30. 103. 128. 23. 28830

Post Mortem revealed a general suppurative peritonitis with large amount of pus in pelvis and left loin.

This patient was extremely far spent on admission to Hospital, and I was surprised to find his leucocytosis so well marked. The explanation no doubt was that he had been making a vigorous fight against his toxaemia during the five days of his illness.

It occurred to me that, given a bad case of general peritonitis with considerable leucocytosis, it might be a strong indication to adopt a more perfect method of drainage than was adopted in this case. It is reasonable I think to suppose, that in such a patient, given flushing or sponging, together with free drainage, in both flanks and middle line, to remove as much toxic product as possible, we would give him a much
better chance of coping with the large dose of toxin present. We know, by past experience, that in severe general peritonitis, giving a normal or subnormal leucocyte count, that the prognosis is of the very worst. The dose of toxin is practically a lethal one from the outset, and death is generally but a few hours distant. In such a case we cannot help realising that whatever is done the result is a foregone conclusion. In cases giving a more vigorous reaction, and a well marked leucocytosis, there is I think much more encouragement for making the operative measures as thorough as the patient will possibly stand.

The fact that this patient lived so long after his operation which could not be of much value to him, is in keeping with his vigorous reaction.


Severe General Peritonitis.

Temp. Pulse. Resp. Leucocytes per c.m.
Aug. 31. N. 98. 32. 24000 "

Operation. Abdomen opened in middle line, and right flank. Intestines sponged, glass tube inserted.
2. General Peritonitis. With much accumulation of pus after operation.

A.W. Rising leucocyteosis - normal temperature in two days.
Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th></th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 1</td>
<td>100.4</td>
<td>122</td>
<td>26</td>
<td>27760</td>
</tr>
<tr>
<td>2. N.</td>
<td>128</td>
<td>28</td>
<td>31840</td>
<td></td>
</tr>
<tr>
<td>3. 99.6</td>
<td>128</td>
<td>20</td>
<td>39040</td>
<td></td>
</tr>
<tr>
<td>4. 100</td>
<td>130</td>
<td>28</td>
<td>44800</td>
<td></td>
</tr>
<tr>
<td>5. 101.6</td>
<td>132</td>
<td>32</td>
<td>28400</td>
<td></td>
</tr>
</tbody>
</table>

Died, on September 5th, about two hours after my last count.

Post-Mortem showed general suppurative peritonitis, secondary to appendicitis.

About half a pint of pus was present in the left flank. This case bears out what I have been trying to enunciate in my last case. This boy was very ill also, though not exhibiting the same degree of collapse as the last case.

The treatment was here more vigorous, and the result was, though ultimately fatal, distinctly more encouraging.

In view of his steadily increasing count after the operation, I ventured to suggest to the surgeon that there was increasing mischief somewhere, probably in the left flank, and suggested a further operation, with drainage in this region. The general condition of the boy was good, and fully justified further operative
measures. The P.M. proved I think that my suggestion was by no means a worthless one.

I think that future experience will teach us that even in General Peritonitis just as in local suppurative peritonitis that a regular blood count will be of the greatest value to us in indicating what line of treatment would be wise and judicious.

It is to be observed that the last leucocyte numeral formed just before death, is lower than on the previous day, and I think this points to a lowering of the vital reaction.

I have not in my experience met with any cases of increased leucocytosis due to the moribund state, where leucocytosis has previously existed.

3. X.W.  
Aet. 21.  
Male.

Severe General Peritonitis. Looks very ill.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

Oct. 11. 100.2.  142.  36.  24300 

Differential Count:—

Poly neuclelar finely granular oxyphiles. 96%
Small Lymphocytes. 2.8%
Large Lymphocytes. 6%
Transitional cells. .4%
Eosinophiles. .2%

Operation. Abdomen opened, flushed out and drained.
Cultivations from peritoneum gave pure growth of Bac-
terium Coli.
Anaesthetic. Chloroform and A.C.E. mixture.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 12</td>
<td>100.4</td>
<td>168.</td>
<td>44.</td>
</tr>
</tbody>
</table>

Died on October 13th.
P.M. revealed an acute general peritonitis, due to an ulcerative appendicitis.
The patient looked much better on the day following his operation though his count had not appreciably altered.

4. F.C. Aet. 32. Male.
Sent in as a case of general peritonitis; two days' duration, severe abdominal pain, tenderness, looks very ill. Has diarrhoea.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 15</td>
<td>N.</td>
<td>108.</td>
<td>24.</td>
</tr>
<tr>
<td>16. N.</td>
<td>94.</td>
<td>20.</td>
<td>5600</td>
</tr>
</tbody>
</table>

18. Now regarded as simple diarrhoea with colic.
Discharged in a few days perfectly well.

This case was a satisfactory example of value a leucocyte count can be in diagnosis. The man had the facies and local condition of a general peritonitis. His temperature was normal. The physician, a man of vast experience, was inclined to the view that it was one of commencing peritonitis. My normal count I think entirely dismissed such a possibility, seeing that the patient's constitutional condition was so good. Had it been a case of peritonitis of two days' duration, he would have given a marked leucocytosis.
1. F.M.  Aet. 7.  Male.

Abdomen distended, tender, motionless.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.5.</td>
<td>101.8</td>
<td></td>
<td>26650</td>
</tr>
</tbody>
</table>

**Differential Count:**

- Polynuclear finely granular oxyphiles. 92.8%
- Small Lymphocytes. 2.6%
- Large Lymphocytes. 3.4%
- Eosinophiles. 0.6%
- Transitional Cells. 0.6%

Abdomen opened. Clear fluid with flaky lymph escapes. Mesenteric glands enlarged. No cause of the peritonitis could be found.

<table>
<thead>
<tr>
<th>6.</th>
<th>99.</th>
<th>16400</th>
<th>&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>N.</td>
<td>22800</td>
<td>&quot;</td>
</tr>
<tr>
<td>8.</td>
<td>99.</td>
<td>22580</td>
<td>&quot;</td>
</tr>
<tr>
<td>9.</td>
<td>N.</td>
<td>14000</td>
<td>&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>N.</td>
<td>16720</td>
<td>&quot;</td>
</tr>
<tr>
<td>22.</td>
<td>99.</td>
<td>16080</td>
<td>&quot;</td>
</tr>
<tr>
<td>26.</td>
<td>N.</td>
<td>6560</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

The nature of this case was somewhat obscure. No obvious cause of peritonitis being found at the operation, with enlargement of mesenteric glands, the surgeon was
led to regard it as a tuberculous condition. A pure tuber-
cular peritonitis does not give rise to leucocytosis, and I am inclined to think that if this was original-
ly such a condition, it must have been infected by Bacterium Coli at the time of my observations. The case to all appearance fully recovered.


Had crush over abdomen by railway buffers. Looks ill. Has free fluid in peritoneal cavity.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 27.</td>
<td>101.</td>
<td>120.</td>
<td>24. 16800, &quot;</td>
</tr>
<tr>
<td>30.</td>
<td>99.6.</td>
<td>84.</td>
<td>24. 24640 &quot;</td>
</tr>
<tr>
<td>Oct. 1.</td>
<td>98.6.</td>
<td>82.</td>
<td>24. 23120 &quot;</td>
</tr>
<tr>
<td>3.</td>
<td>98.6.</td>
<td>76.</td>
<td>22. 26400 &quot;</td>
</tr>
<tr>
<td>5.</td>
<td>98.6.</td>
<td>76.</td>
<td>22. 22960 &quot;</td>
</tr>
</tbody>
</table>

8. Abdomen opened. 4½ pints of sterile bile re-
moved. Drainage tube inserted in middle line.

Anaesthetic. Gas, Ether and Chloroform.

9. 98.4. 26800 "
10. 98.4. 16560 "
12. 97. 12160 "
13. 98. 12320 "
Bile (stained) in retroperitoneal cavity
Temp.   Pulse.   Resp.   Leucocytes per c.m.
Oct. 15. 98.   8400   "
23. 98.   13680   "
25. 98.   8720   "

Bile ceased to discharge on October 11th.
There was a slight reaccumulation on October 23rd, which was drawn off by a trocar and canula.
The bile which was drawn off on October 8th was perfectly sterile, as shown by several cultivations on agar.
Nevertheless it was sufficiently irritating to produce a definite leucocytosis and probably a serous peritonitis. No leakages in any of the bile passages could be discovered. Whether bile acts as a mechanical or chemical irritant it is not easy to determine. His leucocyte count did not touch normal until October 15.
A small reaccumulation caused a slight increase of leucocytes on October 23rd. He made an excellent recovery.

CONCLUSIONS ON GENERAL PERITONITIS.

1. Whether serous or suppurative, there is generally a well marked leucocytosis.
I have not amongst my few cases any which illustrate normal or subnormal counts in those very grave forms of general peritonitis. Leucocytosis in a case of Peritonitis excludes the possibility of a pure tuberculous affection.

2. If there is local accumulation of pus, in a general peritonitis, due to bad drainage, the count will increase.

3. Should a definite leucocytosis exist in a case of general peritonitis it is an encouragement to the surgeon to be as vigorous in his attempts to remove the poison already present in the peritoneal cavity, as circumstances will allow.

4. Sterile bile, free in the peritoneal cavity can give rise to a well marked leucocytosis.

5. Estimation of the leucocytes might aid in the differential diagnosis of general peritonitis from such conditions as severe colic, malignant disease, if not very advanced, Phantom tumours, hysteria, all of which do not give rise to leucocytosis.
Chloroform 48°.
Illustrating the fall in hemoclytes curve after exsanguination and severe pain on July 11 - due to access on arm.
OTHER LOCALISED ABScesses.


Acute abscess of neck, following a sore throat,  
No sore throat at present.

Temperature.  Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 26.</td>
<td>104.</td>
<td>21200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 2.</td>
<td>98.6.</td>
<td>10080</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Opened same evening, pus evacuated.

Anaesthetic.  A.C.E. mixture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>101.</td>
</tr>
<tr>
<td>28.</td>
<td>99.</td>
</tr>
<tr>
<td>29.</td>
<td>99.</td>
</tr>
</tbody>
</table>

Small abscess appeared on fore-arm - being fomented.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>98.6.</td>
</tr>
</tbody>
</table>

Opened same evening.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>98.6.</td>
</tr>
</tbody>
</table>

Discharged well.

2. M.B.  Aet. 15.  Female.

Abscess of neck, one week's duration, due to a carious tooth.
Temperature. Leucocytes per c.m.

Aug. 8. 100. 21520 "


Anaesthetic. A.C.E. mixture and Ether.

11. 99.2. 13360 "

13. 98.4. 11200 "

15. 98. 13680 "

18. 99. 8720 "

22. 98.4. 6800 "

Discharged well.


Suppurative Parotitis.

Temperature. Leucocytes per c.m.

Sep. 8. 99.4. 14320 "

Hot fomentations applied.

12. 99.4. 11200 "

Incision made; about one drachm of pus escaped.

17. M. 8400 "

Recovery.

Small abscess of breast, following cracked nipple.

Temperature. Leucocytes per c.m. Sep. 10. 100. 14,000 "

Operation; incision; \( \frac{1}{2} \) to 1 ounce of pus evacuated.

Anaesthetic. Gas, Ether and Chloroform.

11. 99.6. 16560 "
12. N. 13120, "
17. 98. 9680 "

5. E.P. Aet. 20. Female.

Swollen tender breast; probable abscess.

Temperature. Leucocytes per c.m. June 24. N. 12640 "

Operation. No actual abscess cavity found, but acute general inflammation of breast.

26. N. 9840 "
28. N. 6240 "

Recovery.

These five cases are of interest in showing that abscesses in other parts of the body besides the perito-
neum, produce a definite leucocytosis. The blood count was of no value in their diagnosis, because that was obvious.
STRANGULATED HERNIA.

Ingual Hernia. Strangulated for two days. Severe. Patient manifests a good deal of collapse.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 16</td>
<td>100</td>
<td>88</td>
<td>28</td>
<td>28080</td>
</tr>
</tbody>
</table>

Operation same evening. Sac full of brown fluid, no gangrene, bowel put back, drained by a tube.

Anaesthetic. A.C.E mixture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>100.2</td>
<td>88</td>
<td>24</td>
<td>21200</td>
</tr>
<tr>
<td>18.</td>
<td>99.4</td>
<td></td>
<td></td>
<td>19040</td>
</tr>
<tr>
<td>20.</td>
<td>98</td>
<td></td>
<td></td>
<td>14320</td>
</tr>
<tr>
<td>25.</td>
<td>N.</td>
<td></td>
<td></td>
<td>16800</td>
</tr>
<tr>
<td>Sep. 1</td>
<td>N.</td>
<td></td>
<td></td>
<td>6240</td>
</tr>
</tbody>
</table>

Recovery.

This case was moderately acute, and his leucocytosis is very well marked.

It is rather interesting to observe how slowly the leucocytosis disappears after operation. For nine days after the operation the leucocyte count is 16000.
2. T.B.  
Aet. 25.  
Male.

Inflamed irreducible Hernia.

Temperature.  
Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 17.</td>
<td>99.</td>
<td>100.</td>
<td>20.</td>
<td>13520</td>
</tr>
<tr>
<td>Aug. 18.</td>
<td>80.</td>
<td>20.</td>
<td>13520</td>
<td></td>
</tr>
<tr>
<td>Aug. 21.</td>
<td>70.</td>
<td>20.</td>
<td>10000</td>
<td></td>
</tr>
</tbody>
</table>

Got well under an ice bag with rest in bed. This was of course a condition of much milder type, and the degree of leucocytosis is correspondingly low. The same slow resolution is to be observed in this case for after four days of expectant treatment the leucocytes had only diminished to the extent of three thousand. Later it must have fallen lower than this, as he was on low diet.

3. S.J.  
Aet. 40.  
Female.

Strangulated Umbilical Hernia, one day's duration.

Temp.  
Pulse.  
Resp.  
Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 17.</td>
<td>99.</td>
<td>100.</td>
<td>20.</td>
<td>13520</td>
</tr>
<tr>
<td>Aug. 18.</td>
<td>80.</td>
<td>20.</td>
<td>13520</td>
<td></td>
</tr>
<tr>
<td>Aug. 21.</td>
<td>70.</td>
<td>20.</td>
<td>8000</td>
<td></td>
</tr>
</tbody>
</table>

Reduced the same evening, without operation.
A large mass is involved in the stricture. The damage could not have been great.
The leucocytosis is slight, and its recovery to normal rapid.

Inguinal Hernia. Strangulated for two hours.
Very severe. Patient in terrible agony.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct.24.</td>
<td>99.6.</td>
<td>72.</td>
<td>30.</td>
</tr>
</tbody>
</table>

Differential Count;

- Poly nuclear finely granular oxyphiles, 92. 2%
- Small Lymphocytes. 2. 8%
- Large Lymphocytes. 3. 4%
- Mast Cells. 1. %
- Transitional cells. 6%

Operation, strangulation relieved, deeply congested gut, Bassini's operation.

Anaesthetic. A.C.E. mixture.

| 25 | 101.2 | 60 | 30 | 18080 |
| 26 | 99.2 | 92 | 36 | 13440 |
| 27 | 99.2 | 64 | 28 | 13560 |
| 29 | 98.8 | 88 | 30 | 13440 |
Strangulated Injuries Normal 4 F.C.

Illustrating the slow diminution of the leucocytes above
This case of striking interest. He was working comfortably until exactly two hours before my first count was taken, then whilst lifting a heavy weight, he felt his rupture descend by the side of his truss. He could not reduce it, and it commenced to give him severe pain immediately. He was admitted to hospital suffering from intense agony. On finding a leucocytosis of 21000 in two hours after the onset of his strangulation, I was not a little surprised. The severity of the case is no doubt the main factor in explaining this rapid leucocytosis.

The differential count brings out the fact that increase in white cells is due entirely to the addition of Poly nuclear finely granular oxyphiles.

It is obvious in this case also how very slowly the leucocytosis disappears. Sixteen days after the operation it has not touched its lowest point of diminution, for being on low diet, it must have fallen lower than my last count on November 9th records.
5. L.H. Aet. 9 months. Female.

Intussusception. Gut projecting from anus, History of 8 days, apex slightly gangrenous.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 16</td>
<td>100. 168. 36. 17660 &quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. 98.6.</td>
<td>160. 28. 16240 &quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. 98.6.</td>
<td>148. 28. 22800 &quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 98.6.</td>
<td>144. 24. 23440 &quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Died. P.M. revealed an ileo-coecal variety of Intussusception. Very small area of gangrene at apex of entering gut.

This was an increasing leucocytosis. Nothing was done, and the child slowly succumbed.


Symptoms of peritonitis. Been ill 4 days, commenced suddenly two hours after dinner, regarded as a perforated gastric ulcer.

Feb. 25. 99.6. 112. 26. 32160 "

Operation revealed a strangulated loop of small intestine by an abnormal mesenteric band.

This case was diagnosed as a localised peritonitis, due
to a perforated gastric ulcer; the high leucocytosis is not against that view. So that it is an example of the fact that in distinguishing between an acute inflammatory condition of the peritoneum, and an internal strangulation, a leucocyte count is of little value.

CONCLUSIONS.

It is perhaps unwise to draw many definite conclusions from such a small number of cases as I have recorded, but I think one or two facts are fairly well established.

1. A Strangulated Hernia gives rise to a very definite leucocytosis. Of this I am certain, not only from the above examples, but from other examinations I have made which are not recorded here. Such a leucocytosis is probably due entirely to an increase in the Poly-nuclear finely granular oxyphiles.

2. Such a leucocytosis may be very definite within a few hours of the onset of the strangulation in severe cases.

3. It would appear that the amount of damage done to the viscera is the regulating factor in the degree of leucocytosis produced.
4. After relief of the strangulation the leucocytosis disappears very slowly, often taking two or three weeks to reach the normal. This period is shorter in milder forms of strangulation than in severer forms.

This is in very striking contrast to the rapid disappearance of a leucocytosis after an abscess is opened.

The cause of this rapid increase of white blood corpuscles in strangulated Hernia, must be a matter of some speculation. Probably it is due to absorption of toxin, which is quickly produced in the damaged gut. It is a recognised fact that the Bacterium Coli commune, existing in great numbers, can become rapidly pathogenic, once the gut in which they lie is seriously damaged. And it is not difficult to understand that in a condition like strangulated hernia, a very perfect factory for the production of toxin is established. The gut is damaged, and the Colon bacillus becomes pathogenic. Given such a toxaemia, plus a damaged tissue, the meaning of such a rapid leucocytosis becomes evident.

The slow disappearance again of such a leucocytosis is no doubt due to the very slow recovery
of the damaged gut. The toxic products do not cease forming, directly the strangulation is relieved, and perhaps as long as the gut remains damaged, the colon bacillus retains its pathogenic properties.

This disappearance of the existing leucocytosis is perhaps the best clinical guide we can have that a case is doing well, after the relief of the strangulation; and will give information as to the exact time when the gut has fully recovered.

Repeated records of cases can alone bring out the fullest and most reliable information concerning the subject of leucocytosis in strangulated hernia.
WOUND HEALING
(By First Intention)

Varicocaele. Leucocytes perc. m

May 23. Before operation. 11360"
Operation on the 23rd, stitched up.
Anaesthetic. Ether.
23. After operation, two hours. 16560"
24. N. 10640"
25. N. 10240"
28. N. 10000"

For some reason I could not determine, this patient showed slight leucocytosis before the operation.

W.2. A.E. Adult. Female.
Ventral Hernia.

May 19. N. 3520"
Operation of radical cure on May 21st.
Anaesthetic. Gas, Ether and Chloroform.
22. N. 11360"
23. N. 10880"
25. N. 7200"
<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 29.</td>
<td>N.</td>
<td>10000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Healed by first intention.</td>
</tr>
</tbody>
</table>

Fatty tumour of groin, thought to be femoral hernia.
30. N. 4960 "
June 1. Operation; large flap dissected up,
Anaesthetic. Ether.
2. N. 9440 "
4. N. 6620 "
7. N. 10000 "
Healed by first intention.

Inguinal hernia.
May 30. N. 7600 "
June 1. Radical cure performed.
Anaesthetic. Gas and ether.
2. N. 11520 "
4. N. 7760 "
7. N. 8720 "

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Fractured Patella</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 26 N.</td>
<td></td>
<td></td>
<td>9360</td>
</tr>
<tr>
<td>27.</td>
<td>Knee opened, patella wired.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthetic: Ether.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. N.</td>
<td></td>
<td></td>
<td>6960</td>
</tr>
<tr>
<td>30. N.</td>
<td></td>
<td></td>
<td>7920</td>
</tr>
<tr>
<td>July 6. N.</td>
<td></td>
<td></td>
<td>6280</td>
</tr>
</tbody>
</table>

Healed by first intention.

---


Genu Valgum.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 8. 98.</td>
<td>10080</td>
</tr>
<tr>
<td>Anaesthetic: A.C.E. mixture.</td>
<td></td>
</tr>
<tr>
<td>11. 98.</td>
<td>24320</td>
</tr>
<tr>
<td>13. 98.</td>
<td>9620</td>
</tr>
<tr>
<td>15. 98.</td>
<td>9040</td>
</tr>
</tbody>
</table>

Put in plaster and sent out.

Note the leucocytosis in this case on the day following operation. The anaesthetic was A.C.E. mixture. It is very much the same degree of leucocytosis as is seen soon after nearly all my cases of fractured femur.
W.7.  R.B.  Aet. 60.  Female.
Large mixed tumour of the sub-maxillary gland, of many years' duration, grown rapidly recently.

Temperature.  Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 24.</td>
<td>N. 10000</td>
</tr>
</tbody>
</table>

Removed August 29th.

Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.</td>
<td>12640</td>
</tr>
<tr>
<td>31.</td>
<td>12160</td>
</tr>
<tr>
<td>Sep. 1.</td>
<td>N. 11200</td>
</tr>
<tr>
<td>4.</td>
<td>8080</td>
</tr>
<tr>
<td>13.</td>
<td>6560</td>
</tr>
</tbody>
</table>

Healed by first intention.

W.8.  A.B.  Aet. 42.  Female.

Encephaloid Cancer of breast. 2 years.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 8.</td>
<td>5920</td>
</tr>
</tbody>
</table>

Breast amputated.

Anaesthetic. Ether. Good deal of shock.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>8080</td>
</tr>
<tr>
<td>12.</td>
<td>5280</td>
</tr>
<tr>
<td>13.</td>
<td>9360</td>
</tr>
<tr>
<td>15.</td>
<td>5600</td>
</tr>
</tbody>
</table>
W.9. E.C.  Aet. 34.  Female.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Floating Kidney.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 21st. N.</td>
<td></td>
<td>9290</td>
</tr>
</tbody>
</table>

Operation: Nephrocrraphy.

Anaesthetic: Gas, ether and chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>100.5</td>
<td>14960</td>
</tr>
<tr>
<td>24</td>
<td>99</td>
<td>14640</td>
</tr>
<tr>
<td>28</td>
<td>99</td>
<td>5920</td>
</tr>
<tr>
<td>31</td>
<td>98.6</td>
<td>7920</td>
</tr>
</tbody>
</table>

June 3. N.

8. N.

Healed by first intention.

W.10. L.C.  Aet. 45.  Female.

Goitre.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 31. N.</td>
<td>9360</td>
</tr>
<tr>
<td>Sep. 1. N.</td>
<td>12480</td>
</tr>
<tr>
<td>2. N.</td>
<td>8720</td>
</tr>
<tr>
<td>3. N.</td>
<td>4640.</td>
</tr>
</tbody>
</table>

Healed by first intention.
To the above ten cases of healing by primary union might be added those six records I made in non-suppurative appendicitis, all of which were stitched up at the operation and healed by first intention. (except case 25)

In eleven out of the sixteen cases a mild degree of leucocytosis is produced by the operation. This leucocytosis varies in degree and it appears to have no relation whatever to the degree of severity of the operation. The highest, that of 24000 being due to McEwen's operation for knock knee, the next being two of 16000 due to operation for varicocele and excision of the appendix, whereas one case of amputation of the breast gave rise to no leucocytosis at all.

In the five cases where the operation produced no leucocytosis, the anaesthetic either wholly or chiefly used was Ether. Chloroform seems to have a much greater tendency to increase the white corpuscles than ether. I noticed very much the same result in my cases of suppurative appendicitis. The leucocytosis on the day following operation was often greater than the count made just before the operation, when chloroform was the anaesthetic used.

Loss of blood probably is an important factor in the production of leucocytosis after aseptic wounds. Young patients are, furthermore, apt to give a leucocytosis
than old patients.

In practically all those cases which showed a leucocytosis, we notice that it has disappeared about the second or third day after operation. The leucocytosis reaches its maximum in my records on the day following operation.

I have very little doubt that a very well marked leucocytosis will exist on the evening of the operation, as I have noticed this in several cases which I have examined though not recorded.

In the great majority of cases the leucocytes reach a maximal normal (10000 per c.m.) on the second day, and failing this, on the third day. Case 7 is the only one that did not touch normal until the fourth day.
HEALING BY GRANULATION.

1. F.G. Ast. 27. Female.

Fibro-Adenoma.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 20. N.</td>
<td>6240</td>
</tr>
</tbody>
</table>

21. Excised, stuffed.

Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>N.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.</td>
<td>11360</td>
</tr>
<tr>
<td>23.</td>
<td>5600</td>
</tr>
<tr>
<td>25.</td>
<td>4960</td>
</tr>
<tr>
<td>28.</td>
<td>6160</td>
</tr>
</tbody>
</table>

Healed by Granulation.

2. L.R. Ast. 16. Female.

Housemaid's Knee.

June 20. N. 6560

21. Opened, stuffed, no suppuration.

Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. 4360</td>
</tr>
<tr>
<td>23. 8060</td>
</tr>
<tr>
<td>25. 6800</td>
</tr>
</tbody>
</table>

Healed by Granulation.
3. J.B.  Aet. 38.  Female.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 22</td>
<td>N.</td>
<td>4960</td>
</tr>
<tr>
<td>23.</td>
<td>Breast excised. Large surface left to granulate.</td>
<td></td>
</tr>
<tr>
<td>Anaesthetic: Ether.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>99.</td>
<td>14000</td>
</tr>
<tr>
<td>26.</td>
<td>98.</td>
<td>11840</td>
</tr>
<tr>
<td>28.</td>
<td>N.</td>
<td>3600</td>
</tr>
<tr>
<td>Sep. 2</td>
<td>99.</td>
<td>7760</td>
</tr>
</tbody>
</table>

4. F.R.  Aet. 47.  Female.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 4</td>
<td>99.8</td>
<td>14640</td>
</tr>
<tr>
<td>5.</td>
<td>Breast amputated, raw surface left to granulate.</td>
<td></td>
</tr>
<tr>
<td>Anaesthetic: Gas. Ether.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>99.4</td>
<td>11200</td>
</tr>
<tr>
<td>7.</td>
<td>N.</td>
<td>12800</td>
</tr>
<tr>
<td>9.</td>
<td>N.</td>
<td>10220</td>
</tr>
<tr>
<td>11.</td>
<td>N.</td>
<td>10000</td>
</tr>
<tr>
<td>17.</td>
<td>N.</td>
<td>6800</td>
</tr>
</tbody>
</table>

The leucocytosis on September 4th is no doubt due to
the septic condition of the ragged fungating sore.

5. B.C. Aet. 70. Male.

Rodent Ulcer of Face.

Temp. Pulse. Resp. Leucocytes per c.m.

June 12. N. 10400 "

15. Operation 10 a.m. Large part of cheek removed bone scraped and cauterised, wound packed to granulate.

Anaesthetic. Chloroform one hour.

4 p.m. 100. 90. 20. 13120 "
16. 99. 90. 20. 18400 "
18. N. 13440 "
20. N. 14000 "
22. N. 10400 "
25. N. 8720 "
28. N. 10240 "
July 3. N. 8400 "

These five cases of healing by granulation give very much the same leucocyte records as we have already observed in healing by primary union.

The fall to normal is perhaps a trifle less rapid, though...
in other respects they are practically identical. The larger the granulating surface, the longer is the mild leucocytosis maintained.
SUPPURATING WOUNDS.

   Sarcoma of Scapula. (spindle celled.)
   Temp.   Pulse.  Resp.  Leucocytes per c.m.
   Aug.4.  98.6.   62.  24.   4960 "
   5.    98.   62.  24.   6560 "

8. Operation. Scapulo-humeral amputation (Berger)
   Anaesthetic. Ether.
   9.    102.  120.  30.   24960 "
   10.   104.  124.  24.   16640 "
   11.   98.   120.  32.   13360 "
   13.   100.  100.  20.   9020 "

14. Suppuration set in on this date.
   15.  98.6.   96.  28.   14800 "
   17.  99.2.   92.  24.   12400 "

21. N.    5200 "
25. N.    8000 "

Gradually ceased discharging and healed.

This case involved a very serious operation with considerable haemorrhage, which accounts for his high post-operative leucocytosis. This leucocytosis gradually disappeared and five days after the operation his count was practically a normal one.
It was on August 14th that suppuration was detected for the first time, although his wound had been dressed more than once. It will be observed that on the following day a new leucocytosis had appeared, due to no doubt to the retention of septic material between the flaps. As the drainage was made more perfect, his leucocyte count began to fall, and on August 21st, although a large quantity of pus was pouring out of this wound, his blood count is a normal one.

Such a case convinces me, as did also my records on the post-operative course of suppurative appendicitis, that so long as pus is not pent up there is no general leucocytosis, as determined by examining the blood. There must of course be a very well marked local leucocytosis, to produce such large quantities of suppuration. It is probable therefore that the general leucocytosis is due to a positively chemiotactic toxin, which is absorbed into the general circulation from a local focus of pent up pyogenic matter. Such a leucocytosis will disappear when free drainage is established, because such a toxin ceases to be absorbed.
2. E.B.  Ast. 16.  Female.

Goitre. Excised three weeks ago.

Wound nearly all healed: at one point under the healed cicatrix, there is a tender swelling.

Temperature.  Leucocytes per c.m.

Aug. 18.  99.  14480

Incised. Several drachms of pus escaped.

20.  97.8.  10000
21.  98.8.  8080
23.  98.  9680

This case proves that even a small collection of pus in a wound is sufficient to cause a definite leucocytosis.

3. F.F.  Adult.  Female.

Fibro-Adenoma of Breast.

Aug. 9.  N.  7920

13. Tumour excised and stuffed with gauze.

Anaesthetic. Gas Ether and Chloroform.

14.  99.  12800
15.  N.  12480
16.  N.  5280
18.  N.  5280
21.  N.  4960
This case suppurated, but being dressed daily there was never any pent up discharge.


Abscess of axilla, ulceration of breast due to malignant disease.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 30.</td>
<td>101</td>
</tr>
<tr>
<td>101</td>
<td>15920</td>
</tr>
<tr>
<td>31.</td>
<td>101</td>
</tr>
<tr>
<td>101</td>
<td>15120</td>
</tr>
</tbody>
</table>

Axillary abscess opened.

Aug. 7. N. 11520

It has not fallen to normal. This is due either to the ulceration of the breast or to her advanced carcinoma. It is evident however that the axillary abscess accounted for the greater part of her leucocytosis on July 30th and 31st.


Anaesthetic. Gas, Ether and Chloroform.

| 11. 100. | 100. | 26. | 22880 |
| 12. 99.2.| 88.  | 24. | 10780 |
| 13. 100.| 100. | 24. | 13680 |

Suppuration noticed first on this day, and until August 18th was very profuse.

15. N. 88. 20. 13840
Temperature.

Leucocytes per c.m.

| Aug. 16. N. | 10400 |
| 18. N.     | 5280  |
| 22. N.     | 9280  |

Still slight discharge. No more counts taken.

There was a well marked leucocytosis after the operation, which rapidly diminished. Suppuration was anticipated in this case, and on the fourth day after operation we get evidence of it in the temperature pulse and leucocyte count. When drainage became free the leucocytosis disappeared.

My cases of suppurating wounds are too few in number to enable me to make many definite statements with regard to the leucocytes. In pursuing my observations upon wound healing, I often thought I was peculiarly unfortunate in finding so many of the wounds heal by primary union. Not one of my cases of appendectomy suppurated, and none of the cases of exploratory laparotomy— which I made observations upon but have not recorded— went wrong.

Yet these four cases above recorded, together with my experience in the after treatment of suppurating appendicitis, lead me to the opinion that if a wound suppurates, and there is imperfect drainage leading to pent
up discharge, there will be a rise in the leucocyte curve about four days after the operation. As soon as free drainage is established, such a leucocytosis will rapidly disappear, even though the suppuration be considerable. This disappearance of leucocytosis during free drainage does not detract from the value of regular leucocyte counts in wound healing: for it is not the free suppuration that the surgeon dreads so much, as the pent up suppuration. This is specially emphasised in wounds involving the great serous membranes of the body.

It may be annoying to the careful surgeon to find his technique imperfect when operating on wounds that involve no internal cavity, but it is not fraught with the same danger and prolific with the same anxiety as imperfect technique when such cavities are involved.

It is in our laparotomies, our trephinings, and arthrectomies that a regular leucocyte record would probably prove of the greatest value in wound healing; though in large wounds, such as amputation of the breast, it might be of value also. We can all remember cases of suppuration in wounds in which the temperature, pulse and local symptoms signally failed to give the slightest evidence of it. Early recognition of such a suppuration is of the greatest value, and it is as a worthy adjunct to the evidences already in use that
I would recommend the simple enumeration of white corpuscles. My records are too scanty to fully establish its value, and I think it is a work that surgeons would do well to investigate in the near future.

Cf. adjoining charts illustrating the leucocyte curve in healing by first intention, by granulation, and by suppuration.
1. E.H. Aet. 64. Female.

Scirrhus of Breast.

Temperature. Leucocytes per c.m.

Aug. 8. 12480 "

Anaesthetic, notrous oxide, ether and chloroform.

14. 23880 "
15. 12800 "

Died same evening.

Post Mortem examination revealed a healthy wound, early pneumonia with acute pleurisy.

The leucocytosis on August 14th was due to her operation. The fall in white corpuscles on August 15th is only to be explained by the onset of the pneumonia, which must have been too severe for the old lady's reactionary power, and given rise to a fall of her leucocyte curve.


Large Goitre.

Sep. 19. 7760 "

20. Goitre excised, great deal of haemorrhage.
Anaesthetic, chloroform.

Temperature.  Leucocytes per c.m.

Sep. 21.  12320 "

Death same evening.

Post Mortem revealed an infected wound with septic pneumonia.

This case gives little or no post operative leucocytosis and the probable explanation is that the severe form of pneumonia was sufficient to paralyse his reactionary qualities, and prevent not only the usual post operative leucocytosis, but also the leucocytosis expected in septic pneumonia. The low count then probably is to be interpreted as pointing to a grave prognosis.
1. W.H.  
   Aet. 9.  
   Male.  
   Fracture of Femur, upper third, very little bruising.  
   Temperature.  
   Leucocytes per c.m.  
   Sep. 4.  few hours after accident.  22800 "  
   6.  13360 "  
   8.  8720 "  

2. J.A.  
   Aet. 14.  
   Male.  
   Fractured Femur, no contusion.  
   Twelve hours' duration.  
   Sep. 5.  6720 "  
   6.  7120 "  
   8.  5920 "  

3. A.B.  
   Aet. 80.  
   Male.  
   Fracture of neck of Femur, done on September 10.  
   Sep. 11.  12160 "  
   12.  11840 "  
   13.  14000 "  
   15.  9040 "
Temperature. Leucocytes per c.m.

Sep. 17. 11520, "

Left for workhouse infirmary.

This man had bronchitis, and this accounts to some extent for his irregular leucocytosis.


Fracture of lower end of Femur.

Duration, eight hours.

Oct. 11. 97. 31520 "

Differential Count;

Poly- nuclear finely granular oxyphiles. 89. 6%
Small lymphocytes. 5. 2%
Large Lymphocytes. 3. 6%
Mast Cells. . 8%
Eosinophiles. . 4%
Transitional Cells. . 4%

Oct. 12. 97. 10400 "
13. 98. 6240 "
15. 98. 8400 "


Fracture of Femur, done several hours, no contusion.
<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
<th>Differential Count:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 24</td>
<td></td>
<td>14400</td>
<td>Poly nuclear finely granular oxyphiles. 89.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Small Lymphocytes. 5.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large Lymphocytes. 3.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mast Cells. 0.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Eosinophiles. 0.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Transitional Cells. 0.4%</td>
<td></td>
</tr>
<tr>
<td>Oct. 12</td>
<td></td>
<td>10400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>97.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. 98.</td>
<td></td>
<td>6240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. 98.</td>
<td></td>
<td>8400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. J.H.  
Aet. 8.  
Male.

Fracture of Femur, done several hours, no contusion.

14400  

Differential Count:  
Poly nuclear finely granular oxyphiles. 87%  
Small Lymphocytes. 8%  
Large Lymphocytes. 5%  
Transitional Cells. 1%  
25. 7120  
27. 8420
Fractured Femur, done several hours, little bruising.

Temperature.  Leucocytes per c.mm

Oct. 24.  16240  "
Differential Count;-
Poly nuclear finely granular oxyphiles.  90.8%
Small Lymphocytes.  8%
Large Lymphocytes.  1%
Transitional Cells.  2%

Oct. 25.  10240  "
27.  6800  "

Fractured Femur, done two hours.

Nov. 9.  16560  "
Differential Count;-
Poly nuclear finely granular oxyphiles.  82%
Small Lymphocytes.  10%
Large Lymphocytes.  3.6%
Transitional cells.  1.6%
Myelocytes.  1.2%
Mast Cells.  8%
Eosinophiles.  8%
Temperature.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 10.</td>
<td>6240</td>
</tr>
<tr>
<td>12.</td>
<td>4640</td>
</tr>
</tbody>
</table>

8. E.T.  
Aet. 15.  
Male.  
Fractured Femur, lower half, done few hours ago.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 17.</td>
<td>8720</td>
</tr>
<tr>
<td>18.</td>
<td>10560</td>
</tr>
</tbody>
</table>

Differential Count:
Poly nuclear finely granular oxyphiles.. 82. 4%
Small Lymphocytes.  
Large Lymphocytes.  
Myelocytes.  
Transitional Cells.  
19.  

9. A.T.  
Aet. 55.  
Female.  
Fractured pelvis, five days ago.
Cystitis, blood in urine.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 1.</td>
<td>100.8.</td>
</tr>
<tr>
<td>4.</td>
<td>100.</td>
</tr>
<tr>
<td>8.</td>
<td>N.</td>
</tr>
</tbody>
</table>

The high leucocyte count in this case is largely ac-
Average Leucocyte Chart of Severe Cases of Simple Fracture of the Femur.
There are quantitative estimations of leucocytes in eight cases of simple fracture, qualitative estimations in five. All were cases of fracture of the femur. In six out of the eight there was a definite leucocytosis within a few hours of the accident. In case 3 there was a fairly well marked bronchitis present, so that his count cannot clearly be interpreted. The differential counts bring out the fact that it is the so-called poly morphonuclear neutrophiles that are increased.

In two cases myelocytes were present.

The count in fractures is very much that of a wound showing primary union, only the tissue involved is bone instead of soft part, and any effect of anaesthetic is absent. It will be observed that in five out of the six cases showing leucocytosis, that the count had fallen to normal on the day following the fracture, so that the leucocytosis is a very temporary one.

In seven out of the eight cases of simple fracture, the patient is practically a child. Corresponding observations upon adults would be of interest.

The cause of the usual leucocytosis after fracture is probably loss of blood, associated with injury to tissue, both of which call upon the leucocytes to deal with the damage done. Local stimulation of bone marrow as a cause, is probably of less importance.
ERYSIPelas.

1. E.R.  
   Aet. 47. Female.
   Case of amputation of breast, the post-operative leucocytosis had disappeared, the last two counts being as follows:-

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 11.</td>
<td>N.</td>
<td>10000</td>
<td>&quot;</td>
</tr>
<tr>
<td>17.</td>
<td>N.</td>
<td>6800</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

   Skin graft placed on granulating surface on September 24th. The following day a very wide spread erysipelas appeared over chest and abdomen.

   | Sep. 26. | 103.4. | 108. | 24. | 9200 | " |
   | 28. | 103.4. | 88. | 28. | 7120 | " |
   | Oct. 3. | 103. | 104. | 28. | 15760 | " |
   | 6. | 99.6. | | | 8080 | " |
   | 8. | N. | | | 4640 | " |

   This was a very severe case, involving the whole chest and abdomen. There is an entire absence of leucocytosis for several days after the commencement of her disease. A normal count is recorded on the fourth day. The next count taken was on the ninth day, which shows a leucocytosis of 15000 which had disappeared three days afterwards. At the date of her leucocytosis her rash had ceased to spread.
2. K.B.  Adult.  Female.

Erysipelas of Buttock, duration two days.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

Sep. 7. 103.  118.  46.  7440  "
10. 103.2.  128.  28.  9360  "

This case, though giving no grave anxiety, presented a very extensive rash. The leucocyte count, five days after the rash appeared, was a normal one.


Erysipelas face, neck, been very ill several days.

Differential Count:-

<table>
<thead>
<tr>
<th>Type of Cell</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly nuclear cells</td>
<td>75%</td>
</tr>
<tr>
<td>Small Lymphocytes</td>
<td>18%</td>
</tr>
<tr>
<td>Large Lymphocytes</td>
<td>7%</td>
</tr>
</tbody>
</table>

12. 101.  13280  "
13. 106.  19040  "

Differential Count:-

<table>
<thead>
<tr>
<th>Type of Cell</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly nuclear finely granular oxyphiles.</td>
<td>80%</td>
</tr>
<tr>
<td>Small Lymphocytes</td>
<td>15%</td>
</tr>
<tr>
<td>Large Lymphocytes</td>
<td>3.6%</td>
</tr>
<tr>
<td>Transitional cells</td>
<td>.8%</td>
</tr>
<tr>
<td>Mast Cells</td>
<td>.2%</td>
</tr>
<tr>
<td>Eosinophiles</td>
<td>.4%</td>
</tr>
</tbody>
</table>
Patient died the same evening.

This case was one of great severity. He had been ill for several days previous to admission, yet both his quantitative and qualitative leucocyte counts were normal. On October 12th a mild leucocytosis was present. On the 13th it had become considerably increased, and he died the following morning. The leucocytosis was on the 13th entirely of a poly-morpho-nuclear variety.

4. C.W.  
Act. 36. Male.
Erysipelas of face and neck, has existed several days.

Temperature. Leucocytes per c.m.
Oct. 31. 10240 "
Nov. 1. 12160 "
7. 11200 "

Rash disappeared.

Differential Count of November 1st.
Poly nuclear cells. 88%
Small Lymphocytes. 7. 4%
Large Lymphocytes. 3. 4%
Transitional Cells. . 6%
Eosinophiles. . 6%

This case also was very acute and severe. At no time does he appear to have manifested much reaction. On
November 1st, when his disease was at its height, he showed a very mild polyuclear leucocytosis.

**CONCLUSIONS.**

From four cases it is impossible to draw many definite conclusions about the leucocyte counts in Erysipelas. Nevertheless, seeing that my cases were all extensive ones, three of them giving considerable anxiety as to the life of the patient, it was not a trifle surprising to realise the results I obtained.

The records upon Erysipelas are not numerous, but those obtained by Von Limbeck, Reider, Reinert, Halla and others differ very markedly from my own. I should say there is absolutely no parallel between the temperature and the leucocyte count. There was in my cases no relation between the leucocytosis and the spread of the rash.

In the first few days of all my cases there was no leucocytosis present; towards the termination of the disease, a mild leucocytosis appeared, which was of short duration.

The leucocytosis is due to an increase in the polymorphonuclear cells.
MENINGITIS.

Meningitis. Diplococcus of Still, obtained by lumbar puncture, and identified by Dr. Stuart Macdonald.

Temp. Pulse. Resp. Leucocytes per c.m.
June 2. 100.8. 125. 32. 17760 "

Differential Count;-
Poly-nuclear finely granular oxyphiles. 64. 2%
Small Lymphocytes. 29%
Large Lymphocytes 4. 4%
Transitional cells. 1. 6%
Eosinophiles. 8%

6. 96.4. 104. 30. 17680 "
10. 99. 102. 32. 18400 "
19. 99. 120. 32. 21840 "

Died soon after last count.
P.M. revealed a typical retro-basal meningitis. A definite leucocytosis in which the small lymphocytes are distinctly increased, the poly-nuclear cells to a less extent.
2. C.T.  

Set. 24.  

Male.

Diplococcus of Still, found and cultivated from cerebro spinal fluid, obtained by lumbar puncture.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 14.</td>
<td>100.</td>
<td>72.</td>
<td>34.</td>
<td>14440</td>
</tr>
<tr>
<td>15.</td>
<td>100.</td>
<td>86.</td>
<td>26.</td>
<td>24640</td>
</tr>
<tr>
<td>16.</td>
<td>100.8.</td>
<td>94.</td>
<td>28.</td>
<td>35120</td>
</tr>
<tr>
<td>18.</td>
<td>99.5.</td>
<td>92.</td>
<td>24.</td>
<td>29560</td>
</tr>
<tr>
<td>19.</td>
<td>99.</td>
<td>100.</td>
<td>30.</td>
<td>17760</td>
</tr>
<tr>
<td>20. N.</td>
<td>100.</td>
<td>30.</td>
<td>20400</td>
<td></td>
</tr>
</tbody>
</table>

Differential Count:-

Poly nuclear finely granular oxyphiles. 94. 2%

Small Lymphocytes. 2%

Large Lymphocytes. 1%

Transitional cells. 2. 2%

Myelocytes. 4%

Eosinophiles. 2%

23. N. 110. 36. 20720

25. 98.2. 110. 28. 18400

27. N. 112. 30. 16560

29. 101. 128. 30. 38760

Post Mortem - a retrobasal meningitis, practically confined to the Cisterna Magna.

There was acute suppuration in the sphenoidal and ethmoidal air cells, which was probably only of a day
or two's duration. There was no extension of suppuration to the cranial cavity.

In this case also, in which Dr. Macdonald identified the organism of stil, there is a very definite leuco-
cytosis. It varies somewhat from day to day, due to causes one cannot easily determine. The increase in white cells was entirely of the poly-morpho-nuclear character.

The last leucocyte count is specially high, and this was probably due to the terminal injection of the sphenoidal and ethmoidal air cells, which from the character of the bone surrounding was of a very recent origin.

3. R.A. Aet. 6 months. Male.

Twitching, vomiting, slight retraction, bad condition, sent in as meningitis, regarded by Physician as a functional condition allied to Tetany.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 19. 97.</td>
<td>48.</td>
<td>11520</td>
<td>&quot;</td>
</tr>
<tr>
<td>21. 96.</td>
<td>32.</td>
<td>12160</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Differential Count:-

Poly-nuclear finely granular oxyphiles. 83. 2%
Small Lymphocytes. 10. 8%
Large Lymphocytes. 4%
Eosiniphiles. 1. 6%
Mast Cells. . 4%

Whilst counting 500 white corpuscles, two nucleated reds were found.

Temp.  Pulse.  Resp.  Leucocytes per c.m.
Aug. 24.  By lumbar puncture I obtained cerebro-spinal fluid, which showed a diplococcus by films which on cultivation and staining was identical with the diplococcus of still.

31. 97.  30.  15280

Sep. 3. Died.
P.M. revealed a typical retro basal meningitis.

In this case, the leucocytosis, though moderate, was very strongly in favor of meningitis rather than a functional trouble. It was an increasing one, and the poly-morpho nul cular is the cell increased in number. Two nucleated red corpuscles were seen during the count of 500 white corpuscles.
4. A.B.  
Aet. 3.  
Female.

Meningitis coming on after pneumonia. A diplococcus was found, but unfortunately for some reason or other it was not definitely decided whether it was a pneumococcus, or the diplococcus of Still, or the diplococcus of Weichselbaum.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 20</td>
<td>100.</td>
<td>105.</td>
<td>24.</td>
<td>16560</td>
</tr>
<tr>
<td>27.</td>
<td>102.1</td>
<td>140.</td>
<td>24.</td>
<td>17760</td>
</tr>
<tr>
<td>30.</td>
<td>100.</td>
<td>128.</td>
<td>28.</td>
<td>10880</td>
</tr>
<tr>
<td>Aug. 1</td>
<td>99.6.</td>
<td>136.</td>
<td>28.</td>
<td>15920</td>
</tr>
</tbody>
</table>

Differential Count;

- Poly nuclear finely granular oxyphiles. 78. 2%
- Small Lymphocytes. 10. 8%
- Large Lymphocytes. 9. 2%
- Transitional Cells. 1. 2%
- Eosinophiles. 6%

1 nucliated red found whilst counting 500.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>97.</td>
<td>108.</td>
<td>28.</td>
<td>11200</td>
</tr>
<tr>
<td>7.</td>
<td>98.4.</td>
<td>96.</td>
<td>28.</td>
<td>7840</td>
</tr>
<tr>
<td>11.</td>
<td>96.2.</td>
<td>100.</td>
<td>36.</td>
<td>9680</td>
</tr>
<tr>
<td>16.</td>
<td>98.4.</td>
<td>100.</td>
<td>28.</td>
<td>9040</td>
</tr>
<tr>
<td>31. N.</td>
<td>84.</td>
<td>24.</td>
<td>4960</td>
<td></td>
</tr>
</tbody>
</table>

This child was a mere skeleton to commence with, with all the signs of severe meningitis, but it slowly put on
Pulse:

Temperature:

Leucocytes:
Case A & B, Meningitis (Pneumococcis?) Recovery.
flesh, and eventually became perfectly well, bodily and mentally.
This condition supervened upon an attack of pneumonia, and would have been of much greater interest had the bacteriology been more exact. There were definite diplococci in the cerebro-spinal fluid obtained by lumbar puncture, which in shape resembled pneumo-cocci. But as some accident happened to the exploring syringe at the time of withdrawal of the fluid, reliable cultures could not be made.
The differential count made was practically that of a healthy child, one nucleated red being found whilst counting 500 white cells. The leucocytosis is a moderate one that gradually disappears as the child improved.

5. J.C.  
Aet. 8.  
Male.

Otitis media.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 12. 103</td>
<td>68.</td>
<td>22.</td>
<td>18400</td>
</tr>
<tr>
<td>14. 101.6</td>
<td>72.</td>
<td>24.</td>
<td>14240</td>
</tr>
<tr>
<td>17. 101.</td>
<td>104.</td>
<td>22.</td>
<td>14000</td>
</tr>
</tbody>
</table>

Differential Count;
Poly nuclear finely granular oxyphiles. 74. 8%
Small Lymphocytes. 14.8%
Large Lymphocytes. 7.4%
Transitional cells. 1.4%
Myelocytes. 1%
Mast Cells. 0.4%
Eosinophiles. 0.2%

Temp. Pulse. Resp. Leucocytes per c.m.

Sep. 18. Operation. No pus in mastoid antrum, small abscess below the scalp.
Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>98</td>
<td>84</td>
<td>18</td>
<td>14960</td>
</tr>
<tr>
<td>22</td>
<td>98.4</td>
<td>70</td>
<td>18</td>
<td>8080</td>
</tr>
<tr>
<td>27</td>
<td>98</td>
<td>72</td>
<td>18</td>
<td>9360</td>
</tr>
</tbody>
</table>

Oct 1. 104 (Rigor) 92. 26. 11520
4. 101.4. 80. 20. 17120
9. 100. 112. 28. 11200

Sent to Moseley Convalescent Home.
Returned on October 18, much worse.

18. 104. 76. 24. 13200
19. 103.8. 104. 28. 17760
20. Skull trephined, nothing found.
Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>103.6</td>
<td>120</td>
<td>23</td>
<td>7440</td>
</tr>
<tr>
<td>29</td>
<td>103</td>
<td>120</td>
<td>23</td>
<td>12960</td>
</tr>
</tbody>
</table>

Nov. 2. 103. 128. 30. 8560
This boy for weeks was a perfect puzzle. He was admitted for Otitis Media, was operated upon on September 18; beyond a small abscess under the scalp, no pus was found. It is probable that this small abscess accounted for his mild initial leucocytosis, as it disappeared a few days after the operation. On October 1st he had a rigor; then followed a few days in which he exhibited a mild but irregular degree of leucocytosis.

He was sent to a convalescent home on October 9th. I felt that there must be some cause to account for the leucocytosis, and I was surprised to find him discharged. He returned however on October 18th much worse, with a high temperature and mild leucocytosis.

His skull was trephined, but nothing could be found. The boy at times spoke of a slight headache, but apart from this, he had no symptoms whatever. He was seen by several surgeons and one or two physicians. At last (this being about the end of October) Dr. Lewis discovered that the boy had Koenig's sign, and suggested the advisability of having a lumbar puncture made.

This was done, and revealed several important facts. Firstly it showed that there was very marked intra spinal pressure, as when the needle entered the spinal canal, the piston of the exploring syringe was shot back by the pressure from within, and when the syringe
was detached from the needle insitu, the cerebro-spinal fluid was ejected as a spurt from the needle.

Secondly the cerebro-spinal fluid was turbid, and thirdly on cultivation it showed a rich growth of staphylococcus pyogenes aureus.

I was unable to follow the case after November 2nd, but it was drained in the lumbar region, so as to allow slow leakage from an incision in this region.

The boy died on November 13th.

Post Mortem revealed a suppurative meningitis. It is very difficult indeed to interpret the leucocyte count in this case. The low degree and marked fitfulness of the leucocytosis points to some low infective condition, that ebbs and flows in its severity. In the light of his lumbar puncture, one is compelled to think that he had suffered from a meningitis probably caused by his otitis media, and which was of a very sub-acute nature. The patient, beyond complaining of slight headache, showed practically nothing to suggest such a pathological condition; his rigor, irregular temperature and leucocytosis pointed to some obscure condition, but there were no characteristic symptoms of meningitis till November 1st. After his spinal drainage, his symptoms became more aggravated, and he gradually sank.
Staphylococcus pyogenes aureus, and streptococcus pyogenes were found by the pathologist in his cerebro-spinal fluid after death.

CONCLUSIONS.

1. Meningitis due to the diplococcus of Still generally produces a well marked leucocytosis, which has a tendency to fluctuate in degree from day to day.

2. In one of my cases there was lymphocytosis present.
   In the other two it was the poly nuclear cell that showed the increase.

3. In case 4, which was in all probability a pneumococcic meningitis, there was a mild leucocytosis in the early stage of the disease which disappeared early in the convalescence. The increase of white cells in this case was due to the poly nuclear cells.

4. Myelocytes were found in one of my cases of Still's meningitis, and also in case 5, due to Staphylococci and streptococci.

5. The leucocytosis was very mild and fitful, normal counts being recorded on several days during the disease.
6. Estimation of leucocytes might be of value in distinguishing meningitis from such diseases as hysteria, tetany, typhoid, diabetic coma, coma due to alcohol or cerebral tumour, to lead poisoning, all of which give no leucocytosis. Obviously it could not aid one in a differential diagnosis from localised suppurations of the brain.
PYAEMIA.


Acute necrosis of Tibia, abscess over radius. Been ill for a week or ten days.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

May 31.  103.  29680  "

Differential Count;-

Poly \textit{nuclear} finely granular oxyphiles.  88. 2%

Small Lymphocytes.  4. 8%

Large Lymphocytes.  7%

Junel.  103.  29360  "

Abscess of arm opened, several ounces of pus evacuated.

Anaesthetic. Gas and Ether.

2.  103.  26640  "

Abscesses over chest and arm opened, necrosis of sternum and localised empyema.

Anaesthetic. A.C.E. mixture.

3.  103.8.  33680  "

4.  102.8.  132.  54.  28400  "

5.  102.  150.  58.  24160  "

Worse, abscess of neck formed.

6.  103.5.  168.  52.  23200  "

7.  103.5.  160.  58.  22480  "
Temp.  Pulse.  Resp.  Leucocytes per c.m.

June 8.  103.  168.  64.  16960 "
9.  103.  176.  68.  12820 "

Delirious.
10.  101.  174.  72.  21200 "
11.  103.  180.  62.  24320 "
12.  100.8.  158.  60.  22480 "
13.  102.  172.  60.  23280 "
15.  101.4.  148.  54.  24160 "
16.  101.6.  148.  52.  16960 "
18.  100.8.  182.  52.  16960 "
19.  99.4.  146.  48.  17760 "
21.  102.  148.  58.  21040 "
23.  20240 "
26.  101.  150.  46.  14800 "

27.  Old abscess of leg opened, bone scraped, sternal abscess healed.

Anaesthetic.  A.C.E. mixture.
28.  102.  158.  42.  13840 "
30.  102.2.  142.  32.  12800 "

July 2.  99.6.  138.  40.  12800 "

3.  New abscess in arm appeared; opened.

Anaesthetic.  A.C.E. mixture.
4.  97.  25440 "
5.  100.4.  18240 "
Temp. | Pulse. | Resp. | Leucocytes per c.m.
--- | --- | --- | ---
July 7. | 100.8. | 17120 | "
10. | 101. | Worse, very restless. 37120 | "
12. | 101.2. | 21040 | "
14. | Sent to Jaffray Hospital, still very ill. | Died August 10th. P.M. refused.

This is a typical case of pyaemia, and manifests a very well marked leucocytosis from the beginning to the end. The record is necessarily a long and tedious one, at times running for days at a steady rate of leucocytic increase at others exhibiting a series of rises and falls which it is not easy to interpret aright. Probably the leucocyte curve rises more or less parallel to the amount of or virulence of toxic products generated locally, or already circulating in the blood.

The leucocytosis was entirely due to an increase in the poly nuclear cells.

The blood was not examined for organisms.

2. B.S. | Aet. 17. | Male.
Pyaemia, following middle ear disease, with mastoid abscess.

July 7. | 103. | 92. | 24. | 14000 | "

Operation on July 8th; mastoid abscess opened.
Antrum trephined, lateral sinus opened, no thrombosis.

**Anaesthetic: Chloroform.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 9</td>
<td>103.6</td>
<td>100</td>
<td>28</td>
<td>10000</td>
</tr>
<tr>
<td>10</td>
<td>103.2</td>
<td>100</td>
<td>32</td>
<td>10000</td>
</tr>
<tr>
<td>12</td>
<td>105</td>
<td>140</td>
<td>32</td>
<td>13120</td>
</tr>
<tr>
<td>13</td>
<td>101.5</td>
<td>108</td>
<td>28</td>
<td>14000</td>
</tr>
<tr>
<td>14</td>
<td>100</td>
<td>96</td>
<td>24</td>
<td>13360</td>
</tr>
</tbody>
</table>

Had two rigors; tenderness down jugular vein, no discomfort.

<table>
<thead>
<tr>
<th>Date</th>
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<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>105.2</td>
<td>108</td>
<td>28</td>
<td>21360</td>
</tr>
<tr>
<td>16</td>
<td>Operation: jugular vein opened in neck, contained yellow pus, vein drained by rubber tube.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Anaesthetic: Chloroform.**

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>102.5</td>
<td>23840</td>
</tr>
<tr>
<td>19</td>
<td>100.8</td>
<td>14960</td>
</tr>
<tr>
<td>23</td>
<td>104.2</td>
<td>12400</td>
</tr>
<tr>
<td>26</td>
<td>105.</td>
<td>14960</td>
</tr>
</tbody>
</table>

Differential Count:

- Poly nuclear finely granular oxyphiles. 86. 2%
- Small Lymphocytes. 5. 2%
- Large Lymphocytes. 6. 2%
- eosinophiles. 1. 6%
Transitional Cells. . . . 6%
Myelocytes. . . . 2%

Temp.  Pulse.  Resp.  Leucocytes per c.m.

July 28.  103.8.  21820  "
30.  103.8.  22640  "

Culture from blood on this date showed copious growth of staphylococcus pyogenes aureus.

Aug. 1.  104.4.  20800  "
3.  102.  19680  "
7.  99.  26280  "

Cough, pain in chest and difficulty in breathing developed about July 26th, pointing to lung abscess.

Died August 7th. Post Mortem refused.

Another typical case of Pyaemia following middle ear disease. He was admitted with a large mastoid abscess which accounted no doubt for the mild leucocytosis present. I was astonished to find such a low degree of leucocytosis from so large an abscess. The patient was however severely ill, and seemed to have been much exhausted by his middle ear mischief before his pyaemia set in. His count fell somewhat after his first operation, but soon rose again until it reached 21000 when the second operation was done. After this point we have the same type of count as is seen in the first case, a
Case 2. B.S. Well marked case of Pyaemia.
series of ebbs and flows, though a definite leucocytosis exists all the time.

I obtained rich growths of staphylococci in all the tubes inoculated.

The polymorphonuclear cells are alone increased in quantity. One myelocyte was seen in the 500 white cells counted.

Infective Periostitis of Tibia, abscess containing half a pint of pus.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 21. 102.</td>
<td>40.</td>
<td>60.</td>
<td>35760</td>
</tr>
<tr>
<td>Abscess opened, pus evacuated, no anaesthetic used.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. 102.4.</td>
<td>140.</td>
<td>60.</td>
<td>19680</td>
</tr>
<tr>
<td>26. 101.</td>
<td>144.</td>
<td>60.</td>
<td>23120</td>
</tr>
<tr>
<td>28. 102.</td>
<td>148.</td>
<td>50.</td>
<td>31200</td>
</tr>
<tr>
<td>29. 104.</td>
<td>150.</td>
<td>54.</td>
<td>21600</td>
</tr>
<tr>
<td>31. 103.6.</td>
<td>146.</td>
<td>48.</td>
<td>15840</td>
</tr>
<tr>
<td>Sep. 3. 104.</td>
<td>148.</td>
<td>44.</td>
<td>13120</td>
</tr>
</tbody>
</table>

Died September 5th.

Post Mortem examination revealed infective periostitis of Tibia, abscesses over radius, occiput and trochanter. Abscesses in both lungs. Purulent pericarditis, and double purulent pneumonia.

On August 25th I took cultivations from his blood, and in all my tubes I obtained a rich growth of Staphylococcus pyogenes aureus. I took a careful cultivation from his occipital abscess a few minutes after death, and again obtained a pure growth of staphylococcus pyogenes aureus. The large fall in his leucocytosis on August 23rd was due to the evacuation of such a large abscess. It soon began to rise again steadily until
it reached a maximum on August 28th. About this date he developed symptoms of pericarditis. We then noticed that his leucocyte curve began to fall, and this was probably due to the gradual and overwhelming dose of toxin generated by the severe pericarditis and pleurisy.

4. F.A.  
Aet. 36.  
Male.

<table>
<thead>
<tr>
<th>Mastoid disease.</th>
<th>Pyaemia.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temp.</strong></td>
<td><strong>Pulse.</strong></td>
</tr>
<tr>
<td>Sep. 12. 103.6.</td>
<td>152.</td>
</tr>
<tr>
<td>13. 102.6.</td>
<td>170.</td>
</tr>
</tbody>
</table>

Died September 14th.

Post Mortem revealed pus in mastoid antrum, septic thrombosis of jugular vein, double purulent pleurisy, small abscesses in lungs and liver.

This case illustrates how low the leucocyte count may be in a case of severe pyaemia. This patient must have been suffering from general blood poisoning for some time before admission. It looks as if he had been so far spent by his otitis media, that when this grave complication of pyaemia set in, that his reactionary powers had become so exhausted that the leucocytosis had begun to wane, as we noticed in the terminal stage of case 3.
5. E.L. Aet. 22. Female.

Streptococcic Pyaemia.

Patient had a labor on July 8th; developed a large mammary abscess, opened and healed up. Temperature never fell after her abscess appeared. Admitted to hospital with a fluctuating temperature. Examination of pelvic and other organs gave no information. Widal reaction was negative.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 13</td>
<td>102.2</td>
<td>126.</td>
<td>26</td>
<td>3520</td>
</tr>
<tr>
<td>15</td>
<td>102.</td>
<td>112.</td>
<td>28</td>
<td>7760</td>
</tr>
<tr>
<td>18</td>
<td>103.</td>
<td>116.</td>
<td>28</td>
<td>7760</td>
</tr>
<tr>
<td>24</td>
<td>104.</td>
<td>120.</td>
<td>30</td>
<td>8740</td>
</tr>
</tbody>
</table>

Abscess forming over sacrum.

25. 103. 120. 24. 7440

Abscess opened. I took cultivations from the pus, and obtained pure growths of streptococcus pyogenes.

26. I took cultivations from her blood, and in all my tubes obtained a beautiful pure growth of streptococcus pyogenes.

28. 103.4. 128. 24. 8080

30 c.c. of anti-streptococcic serum injected during the day.

29. 104.6. 128. 28. 9520
<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 1</td>
<td>104.</td>
<td>156.</td>
<td>27.</td>
<td>8940</td>
</tr>
<tr>
<td>3.</td>
<td>103.6</td>
<td>132.</td>
<td>36.</td>
<td>13120</td>
</tr>
</tbody>
</table>

Cultivation from knee joint gave pure growth of streptococci.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>101.</td>
<td>132.</td>
<td>28.</td>
<td>12800</td>
</tr>
<tr>
<td>7.</td>
<td>101.4</td>
<td>140.</td>
<td>36.</td>
<td>12840</td>
</tr>
<tr>
<td>10.</td>
<td>101.8</td>
<td>136.</td>
<td>32.</td>
<td>20880</td>
</tr>
</tbody>
</table>

Differential Count:–

- Poly nüclear finely granular oxyphiles. 90. 4%
- Small Lymphocytes. 4%
- Large Lymphocytes. 3. 8%
- Transitional cells. 1%
- Eosinophiles. 8%

12. Cultivation from blood - sterile.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>102.2</td>
<td>136.</td>
<td>22.</td>
<td>19360</td>
</tr>
<tr>
<td>Date</td>
<td>Temp</td>
<td>Pulse</td>
<td>Resp</td>
<td>Leucocytes per c.m</td>
</tr>
<tr>
<td>--------</td>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Oct.15</td>
<td>102.</td>
<td>132.</td>
<td>32.</td>
<td>24000</td>
</tr>
<tr>
<td>17.</td>
<td>102.2</td>
<td>132.</td>
<td>32.</td>
<td>21840</td>
</tr>
<tr>
<td>20.</td>
<td>103.8</td>
<td>158.</td>
<td>36.</td>
<td>16240</td>
</tr>
<tr>
<td>25.</td>
<td>102.6</td>
<td>138.</td>
<td>28.</td>
<td>28720</td>
</tr>
<tr>
<td>28.</td>
<td>103.</td>
<td>138.</td>
<td>28.</td>
<td>29560</td>
</tr>
</tbody>
</table>

Differential Count:
- Poly neutrophilic finely granular oxyphiles: 88%
- Small Lymphocytes: 7.2%
- Large Lymphocytes: 3.4%
- Transitional Cells: 0.8%
- Mast cells: 0.2%
- Eosinophiles: 0.4%

Abscess of buttock developed on this day.

30. Abscess of buttock opened, pus gave pure growth of streptococci.

31. 100.2. 136. 28. 53680

Differential Count:
- Poly neutrophilic finely granular oxyphiles: 90.6%
- Small Lymphocytes: 7.7%
- Large Lymphocytes: 1.4%
- Transitional cells: 0.6%
- Eosinophile cells: 0.4%

Nov.4. Knee again opened, this time freely. Pus in it gave a pure growth of streptococci.
Pulse.

Temperature

Blood culture.

Leucocyte curve.
Large sub-deltoid abscess which had been present several days was also opened, about one pint of pus being evacuated. This pus also gave a pure growth of strepto-cocci.

Anaesthetic. Chloroform and A.C.E. mixture.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov.7. 100.</td>
<td>128.</td>
<td>28.</td>
<td>27620</td>
</tr>
<tr>
<td>11. 99.</td>
<td>120.</td>
<td>24.</td>
<td>26560</td>
</tr>
</tbody>
</table>

Died December 3rd.

Post Mortem examination revealed sub deltoid abscess, empyema, pus in knee joint, no visceral abscesses, generative organs healthy. General anaemia in all the organs, slight pneumonia.

For quite a considerable time after admission this case remained a mystery. Many suggestions as to diagnosis were given, but none with any degree of certainty. My leucocyte counts threw no light whatever upon the case, indeed I regarded them as distinctly weakening the possibility that our patient was suffering from pyaemia. The fallacy of this I learned later.

A Widal gave a negative result.

It will be evident that during the month of September there was no leucocytosis present whatever, even though an abscess developed over her sacrum.

It was by finding strepto-cocci in the pus of this ab-
scess that I was led to take cultivations from the patient's blood. The nature of the case then became clear. We had to deal with a low form of strepto-coc-cic pyaemia. Anti-strepto-coccic serum was then injected hypodermically.

Whether it was due to these injections or to pure coincidence I do not know, but a day or two after the third injection, the patient showed a definite leucocytosis for the first time. This leucocytosis was maintained and increased until the end of my observations, and it can be observed as in the other case of pyaemia that the same fluctuation, the same ebb and flow is present in the leucocyte curve. The highest count recorded is that of October 31st, and this was due to a large sub-deltoid and axillary abscess which had existed some time before it was opened on November 4th.

The next highest count, that of October 28th, was due to a gluteal abscess, which was opened on the following day.

This patient presented a clinical picture of the most intrinsic interest. At the outset of her hospital career she lay on her bed complaining of nothing but weakness. She was emaciated, feverish and fretful. Her pulse was rapid, her tongue dry and raw, and her skin dry, rough and covered by fine scales.
She was alert and suspicious of all who came near her. Every method of examination was exhausted except the one which proved of so much value. I am surprised now that we did not examine her blood for bacteria earlier in her disease. My low leucocyte count was largely responsible for the delay. I took it for granted that a person who had battled so long as this case, with some foe of undoubted severity, would have given a definite leucocytosis, had it been of a pyaemic nature. We only obtained an exact history from her medical attendant several weeks after her admission to hospital.

It is a matter of intense interest to realise the complete absence of leucocytosis in the early weeks of her disease. It might be that she had become too exhausted by her mammary abscess to offer much reaction to the invasion of a strepto-coccus, or it might be that she had become gradually used to an increasing dose of strepto-cocci toxin without manifesting any degree of leucocytic response.

Any one who was not familiar with the case would probably ascribe it to the very small dose of toxin produced, or to its extremely low virulence, yet the appearance of the patient pointed to a severe toxaemia. Is it possible that the preliminary normal leucocyte counts are allied in any way to that preliminary leucopenic con-
dition met with by Jacob and Goldsneider in their experiments on infective processes in animals? Soon after her third dose of anti-strepto-coccic serum, and about ten days after her first abscess appeared, a definite leucocytosis began. Whether the anti-strepto-coccic serum so improved her reactionary qualities or whether there was an increased production of toxin to account for this leucocytosis I do not know.

A very interesting fact is revealed by the differential count made on October 29th, for although the quantitative count is a normal one, it will be seen that the polymorphonuclear cells are relatively much increased in number. It would be a work of great interest to make careful differential counts of these normal quantitative estimations of leucocytes in Pyaemia, to ascertain whether my experience in this case is usual or not. If it is usual, it might be a point of considerable value from the diagnostic point of view.

Throughout, this case was purely of a strepto-coccic nature, and this fact, associated with its slow chronic course, renders it of peculiar interest.
SEPTICAEMIA.

1. E.K. Aet. 2. Female.

Patient just passed through an attack of Pneumonia.

Temp. Pulse. Resp. Leucocytes per c.m.

July 17. Cultivation from blood gave pure growths of pneumococci, (Dr. Macdonald.)

20. Blood cultivations again showed a pure growth of pneumococci. (Dr. Macdonald.)

28. 100. 136. 60. 21680 "
30. 101. 160. 72. 31840 "

Differential Count as follows;-

Poly nuclear finely granular oxyphiles. 50.8%
Small Lymphocytes. 43.2%
Large Lymphocytes. 4%
Myelocytes. 1.2%
Transitional cells. .4%
Eosinophiles. .2%

4 nucleated red corpuscles seen whilst counting 500 cells. Blood cultivation on this day gave a rich growth of pneumococci.

Aug. 1. 100. 152. 60. 28080 "
3. 99. 152. 88. 31200 "

4. I obtained a rich growth of pneumococci from the blood, with two colonies of staphylococci pyogenes albus (probably accidental.)
<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug.7.</td>
<td>100.</td>
<td>136.</td>
<td>60.</td>
</tr>
<tr>
<td>10.</td>
<td>99.8.</td>
<td>137.</td>
<td>64.</td>
</tr>
<tr>
<td>16.</td>
<td>100.</td>
<td>138.</td>
<td>80.</td>
</tr>
<tr>
<td>28.</td>
<td>101.</td>
<td>132.</td>
<td>50.</td>
</tr>
<tr>
<td>31.</td>
<td>101.</td>
<td>148.</td>
<td>60.</td>
</tr>
</tbody>
</table>

Post Mortem examination revealed a localised empyema in left pleura, unresolved pneumonia at right base, hydropericardium, profound anaemia.

I venture to think that such an usual condition as this, is not unworthy of mention, because of its chronic course and comparative rarity. Pneumococci were obtained from the blood in large numbers on four different occasions, twice by Dr. Macdonald and twice by myself. The child was extremely anaemic. The anti-pneumococccic serum appeared to hasten her end rather than delay it. Her temperature became higher, her exhaustion more marked, and her leucocytosis became less, than at any time during my observations. The leucocyte curve illustrates the same irregularity that we have observed in pyaemia. The differential count is a remarkable one, in that the variety of white corpuscle increased is the small lymphocyte. Lymphocytosis has been recorded in one case of pneumonia by Cabet, and it is not a little interesting to find
such a distinct lymphocytosis in this well marked case of pneumococcic septicaemia.

Six myelocytes and four nucleated red corpuscles were observed whilst counting 500 white corpuscles.

CONCLUSIONS.

1. In Pyaemia and Septicaemia there is generally a well marked leucocytosis.

2. The leucocytosis ebbs and flows according to a variety of conditions that our present knowledge cannot interpret with certainty.

3. The increase of white corpuscles is generally due to a poly nuclear leucocytosis, though in my case of pneumococcic septicaemia it was chiefly a lymphocytosis.

4. There may be an entire absence of leucocytosis, as in the early stage of my case of streptococcic pyaemia.

5. The leucocytosis generally falls to a lower level within the last few days of life.

6. Myelocytes were present in two out of my six cases.

7. Organisms were cultivated from the blood in four out of my six cases, in the other two no cultivations were ever made.
OTITIS MEDIA and its Complications.

1. F.C. Aet. 10. Male.
Mastoid abscess.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 21</td>
<td>105</td>
<td>140.</td>
<td>40.</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>104</td>
<td>152.</td>
<td>36.</td>
<td>13840</td>
</tr>
</tbody>
</table>

Operation same evening, mastoid antrum trephined, and pus evacuated.

Anaesthetic, chloroform.

23. 18880

24. 102.4. 130. 30. 19360

Lateral sinus opened, septic thrombosis revealed. Anaesthetic, chloroform.

Violent twitching observed on this day.

25. 105 (Rigor) 130. 30. 35120

27. 103. 136. 50. 29200

29. 103. 30480

30. 19360

Died on May 30th, soon after last count was taken.

Post Mortem examination revealed extra dural abscess that had burst, causing well marked general meningitis with considerable accumulation of pus at the base of the brain and between the hemispheres.
Cerebral mischief was not suspected until May 24th. In spite of the operation on May 22nd, at which the antrum was opened and pus evacuated, the leucocyte curve keeps steadily advancing. It might be thought that the anaesthetic, which on both occasions was chloroform, is sufficient to account for this rise after each operation, but this cannot be the only cause, inasmuch as the leucocytosis is maintained and increased from day to day. It is I think quite a legitimate conclusion to draw that given a rising leucocyte curve after free drainage of the antrum in Otitis media, that there must be some complication, such as extra dural abscess, meningitis, or suppurative thrombosis.

The last count, taken a few hours before death, is lower than the preceding one, and I regard it as another example of the decreasing vitality of approaching death.

Discharge from ear; boy cries out with pain, tenderness in neck; no rigors.
Had high temperature for some time.
Temp.  Pulse.  Resp.  Leucocytes per c.m.
July 31.  104.4.  148.  40.  27280
Differential Count:

Poly nuclear finely granular oxyphiles. 90.6%
Small Lymphocytes. 6.2%
Large Lymphocytes. 3%
Eosinophiles. 2%

Aug. 1. Purpuric rash. Antrum opened, no pus found.
Died same evening.

Post Mortem revealed suppuration in antrum, bone around necrosed, lateral sinus full of broken down pus.

This case was no doubt one of acute pyaemia, following otitis media. The leucocytosis is well marked, and entirely made up of poly nuclear finely granular oxyphiles.

Otitis Media. Mastoid Abscess.

Temp. Pulse. Resp. Leucocytes per c.m.
Aug. 2. 100.8. 94. 22. 21040 "
3. Operation; abscess evacuated; antrum trephined, pus found and drained; anaesthetic. chloroform.
4. 98. 100. 24. 9520 "
6. 98. 11520 "
8. 98. 10080 "
Temp.    Pulse.    Resp.    Leucocytes per c.m.
Aug.10.  98.     8400    "

This gives us the leucocyte curve in a favorable case. On the day of admission there is a definite leucocytosis, which disappears entirely as soon as free drainage is established. The fall to normal is somewhat fitful, as might be expected in cases that are packed.

Otitis Media.
Nov. 1. 100.2.     88.    28.    23440    "

Differential Count:

Poly nucelar finely granular oxyphiles. 91. 2%
Small Lymphocytes.                       4. 4%
Large Lymphocytes.                       2. 8%
Transitional Cells.                      1. 6%

The quantitative and qualitative counts are quite characteristic.
Antrum opened, pus evacuated on November 1st, died November 2nd. P.M. revealed a cerebellar abscess.

Negative Case.

E.W.    Adult.    Female.

Surgeon thought it was either a case of extradural or cerebral abscess, secondary to old otitis
Temperature.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytosis per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 1</td>
<td>98.</td>
<td>5760</td>
</tr>
<tr>
<td>2</td>
<td>98.</td>
<td>6560</td>
</tr>
</tbody>
</table>

Operation. Antrum could not be found, no pus discovered. Skull trephined, no intra cranial abscess could be found.

I was satisfied in my own mind that this was a negative case. The operation, though a very thorough one, revealed nothing.

CONCLUSIONS.

Suppurative otitis media gives rise to well marked leucocytosis.

All my cases were complicated with antral mischief, and most of them with cerebral infection.

It is quite likely that leucocyte counts might be of value in excluding complications in suppurative otitis media. If after perforating the tympanum, establishing free drainage, and regular syringing there still exists a leucocytosis, complications might be suspected. Then if after the antrum is trephined, and drained, a rising leucocytosis is still observed, it is strong evidence in favor of cerebral mischief of some kind, as is seen in Case 1.
Illustrating the line of onset curve of a complicated case - Cerebral Disease

Otitis Media

Operation

The line of onset curve in this case with no cerebral complication

Otitis Media
The degree of leucocytosis is of little value in estimating the extent of suppurative present, nor can it in any way be an indication as to whether cerebral complications are present or not, unless the otitis media or antral mischief has been dealt with by operation. It is probable that very grave cases with virulent infections will give normal or sub-normal counts, as is seen in pneumonia, diptheria or peritonitis, and this possibility must not be forgotten.

In favorable cases, such as case 3, we obtain a rapid disappearance of the leucocytosis after free drainage is established.
**ACUTE LYMPHADENITIS.**

1. **A.L.**  
   *Aet. 13.*  
   Male.  
   Had sore on foot; glands in groin and iliac fossa enlarged; not very tender; obviously not suppurative.  
   
<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 2. N.</td>
<td>8080</td>
<td>&quot;</td>
<td></td>
</tr>
</tbody>
</table>

   Recovered within a few days, with rest in bed.  
   No leucocytosis, no suppuration.

2. **W.S.**  
   *Aet. 22.*  
   Male.  
   Sore on foot, enlarged gland; in left groin and iliac fossa, very tender.  
   
   | Oct. 8. 102. | 14640 | "     |                     |
   | 9. 101.4.    | 15600 | "     |                     |

   **Differential Count:**  
   Poly n\_uclear finely granular oxyphiles. 86. 8%  
   Small Lymphocytes. 6. %  
   Large Lymphocytes. 2. 8%  
   Eosinophiles. 4. 4%  
   13. 101. 82. 30. 13680 "  
   15. 98.4. 82. 20. 12160 "  

This case of greater interest, and my record is of much more value. On the second day of my observations I gave it as my opinion that suppuration had been established, and I am still of the same opinion. The surgeon was in great doubt as to whether he ought to cut down on the mass or not, but eventually decided not to, largely because of the patient's aversion to being operated upon. He was put upon frequent fomentations, and his subsequent progress is of great interest. The leucocyte curve upon October 9th, on which day a differential count brought out the marked increase in poly nuclear finely granular oxyphiles, and the unusual increase in Eosinophiles. From this day the leucocyte numeral fell slowly and steadily from day to day, so much so that it took ten days to fall from 15000 to 11000. The temperature behaved very much like the blood curve. I feel as satisfied now as I did at the time of my second count, that this was a suppurative lymphadenitis, and I regard it an as example of a small quantity of pus hemmed in, destroyed, and finally absorbed by local reactionary measures. It cannot accurately
be defined at what stage the process of inflammation may stop short of suppuration and recover itself. It is not a generally accepted idea that even quantities of pyogenic pus can be absorbed and destroyed by nature under expectant measures. The surgeon is apt to imagine that if suppuration is once established, it must come to a head somewhere and evacuate itself. My work upon gynecological cases points to a greater frequency of nature's cures than hitherto I thought possible. Of course I do not advocate for one moment the use of expectant measures in suppurative conditions. The risk of leaving them to nature is considerably greater than proper surgical measures for their removal. Indeed my blood record seems to strengthen the position of the surgeon, for I feel sure, had an incision been made in this man's tender lump, pus would probably have been evacuated, and his blood count and local condition would have recovered more rapidly.

The blood count did not reach normal until seventeen days after the maximum count.

3. F.B.  
   Aet. 13.  
   Male.  
   Sore on foot two weeks ago; glands in right groin and right iliac fossa.
Reported amongst other forms of localised supplicative Peritonitis.

Temp. Pulse. Resp. Leucocytes per c.m.

Aug. 18. 101.8. 19840 "
   19. 100.4. 19360 "

Differential Count:-

Poly nuclease finely granular oxyphiles. 83%
Small Lymphocytes. 13. 2%
Large Lymphocytes. 3. 2%
Eosinophiles. 6%

21. 101.8. 28480 "

Operation performed; incision made in the
direction of the tender lump, but no pus was
found.

22. 102. 112. 36. 28240 "
23. 101. 92. 30. 29680 "

24. Whilst being dressed this day, a large abscess
was accidentally opened.

25. N. 84. 28. 16240 "
26. N. 80. 20. 14960 "
28. N. 14960 "
31. N. 11840 "

Sep. 4. N. 9360 "

Healed and discharged September 11th.
I have introduced this case here merely to compare it with the foregoing. It was regarded as a suppurative lymphadenitis, although it is quite possible that it was a case of suppurative appendicitis. The count is a high one, and a rising one. At the operation the pus was missed, the leucocytosis is still maintained until the abscess was accidentally opened. Then the decrease in the leucocyte numeral commences. It is of interest to compare the effect of treatment upon the leucocyte curve of this case, with the preceding one. In case 2, from expectant treatment, we observe a fall from 15000 to 11000 in ten days, whereas in case 3, from evacuation methods, we notice a fall from 29000 to 11000 in seven days. Many better examples could be obtained from my suppurative records to illustrate the advantage of free drainage in expectant methods in abscess formations.
SURGICAL GANCRENE.

A.B. Aet. 20. Female.

Moist gangrene of foot and ankle.

Temperature. Leucocytes per c.m.
Aug. 29. 100. 21600 "

Died.

Post Mortem revealed chronic salpingitis with thrombosis, and phlebitis of right iliac vein.

W.F. Aet. 52. Male.

Moist gangrene of penis, perineum and scrotum.
Oct. 12. 101. 22480 "

Differential Count:
Poly nucleer finely granular oxyphiles. 92% 
Small Lymphocytes. 4% 
Large Lymphocytes. 4% 
16. 99. 22160 "

Death on October 20th; temperature rose to 105 just before death.

H.H. Aet. 45. Male.

Dry gangrene of all the toes and part of foot.
Sep. 13. 10120 "
The two cases of moist gangrene show a definite leucocytosis, which appears to be a poly nuclear variety. This is due no doubt to the accompanying sepsis. In the case of dry gangrene there is no appreciable increase.
INFLAMMATION OF BONE.

H.P.  

<table>
<thead>
<tr>
<th>Age</th>
<th>Male.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

Epiphysitis of the lower end of the Femur.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 27.</td>
<td>103.</td>
<td>14640</td>
</tr>
<tr>
<td>29</td>
<td>102.4.</td>
<td>24640</td>
</tr>
<tr>
<td>31</td>
<td>100.4.</td>
<td>16800</td>
</tr>
<tr>
<td>Nov. 2</td>
<td>101.</td>
<td>11200</td>
</tr>
<tr>
<td>5</td>
<td>100.8.</td>
<td>26800</td>
</tr>
</tbody>
</table>

Differential Count:–

- Poly
  - Nuclear finely granular oxyphiles. 89%
- Small Lymphocytes. 8.4%
- Large Lymphocytes. 2.6%

One nucleated red found in counting 500 white corpuscles.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>100.</td>
<td>27600</td>
</tr>
</tbody>
</table>

This case is one of moderate severity, there is a very definite degree of leucocytosis. No abscess was present. The bone however was extensively inflamed. There is considerable ebb and flow in the leucocyte curve, as might be expected in a bone inflammation. It is a poly

nuclear leucocytosis. The boy's condition was about at its worst when I left off examining his blood. He eventually got perfectly well.
GONORRHOEAL ARTHRITIS.

M.T.  
Aet. 22.  Female.

Knee red and swollen; left after rheumatism, vaginal discharge.

Gonococci found in pus of joint.

Temperature.  Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 17.</td>
<td>100.4.</td>
<td>11520</td>
</tr>
<tr>
<td>11.</td>
<td>101.4.</td>
<td>14320</td>
</tr>
</tbody>
</table>

Operation; knee flushed out and drained.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>101.</td>
<td>12800</td>
</tr>
<tr>
<td>25.</td>
<td>100.4.</td>
<td>9360</td>
</tr>
<tr>
<td>Oct. 3.</td>
<td>99.2.</td>
<td>5600</td>
</tr>
<tr>
<td>11.</td>
<td>99.4.</td>
<td>8080</td>
</tr>
</tbody>
</table>

No other organism except the gonococcus was found in the joint of this case, so that one may reasonably assume that it was this gonococcal inflammation that gave rise to the leucocytosis.

Cellulitis of Head.

W.H.  
Aet. 32.  Male.

Cellulitis of head and neck; very ill.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep.30.</td>
<td>103.</td>
<td>110.</td>
</tr>
<tr>
<td>24.</td>
<td>17120</td>
<td></td>
</tr>
<tr>
<td>Oct. 4.</td>
<td>98.6.</td>
<td>17600</td>
</tr>
<tr>
<td>10.</td>
<td>97.</td>
<td>17440</td>
</tr>
</tbody>
</table>
The leucocytosis is a very steady one. The temperature, elevated on the first day, was normal ever after.

Scald on Body.

W.J.  Aet. 5.  Male.

Scald on body on the morning of October 16th.

Temperature.  Leucocytes per c.m.

Oct. 18.  20240  "

Differential Count:

Poly nuclelar finely granular oxyphiles.  91.6%

Small Lymphocytes.  4.6%

Large Lymphocytes.  1%

Transitional Cells.  2%

Myelocytes.  . 4%

Eosinophiles.  . 4%

20.  11520

24.  7120  "

M.H.  Aet. 11.  Female.

Burn of body, second degree, done six hours ago.

Sept. 27.  10000  "
SARCOMA.

1. E.B.  Aet. 20.  Female.
   Sarcoma of ovary; round celled; (microscopic exam.) Inoperable.
   Temperature.  Leucocytes per c.m.
   June 11.  11680  "
   26.  8240  "
   Though an advanced case with secondary deposits in lymphatic glands, and peritoneum, there is no definite leucocytosis present.

2. L.P.  Aet 1½.  Female.
   Tender enlarged liver, intense jaundice.
   Is it an abscess, or is it sarcoma?
   Nov. 9.  14640  "
   Differential count as follows;-
   Poly nuclear finely granular oxyphiles.  61%
   Small Lymphocytes.  34.  4%
   Large Lymphocytes.  3%
   Transitional cells.  1%
   Eosinophiles.  . 6%
   Ten nucleated red corpuscles found whilst counting 500 leucocytes.
   10.  13280  "
Post Mortem revealed a large round celled Sarcoma of the liver.
This case was admitted on November 9th. For several days her temperature was somewhat elevated. The question of hepatic or sub-phrenic abscess was considered. The leucocytosis present was much lower than one would expect to find in a child with suppuration. The differential count however is quite sufficient to exclude suppuration. The cell increased is the small lymphocyte. Ten normo blasts were observed among the differential count of 500 white cells. This is largely accounted for by the age of the patient.

Malignant angioma of hand, ulcerating.

Temperature. Leucocytes per c.m.  
Aug. 8. 11520

The septic ulceration was quite sufficient to account for such a mild degree of leucocytosis.
Round celled sarcoma of right lung, and bronchial glands. Right lung absolutely dull to percussion. Bronchial breathing, cough for weeks, losing flesh no hemoptosis.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 20.</td>
<td>101.2</td>
<td>108.</td>
<td>32.</td>
</tr>
<tr>
<td>21.</td>
<td>99.4</td>
<td>108.</td>
<td>32.</td>
</tr>
<tr>
<td>22.</td>
<td>100.</td>
<td>104.</td>
<td>32.</td>
</tr>
<tr>
<td>23.</td>
<td>100.</td>
<td>104.</td>
<td>32.</td>
</tr>
<tr>
<td>29.</td>
<td>101.</td>
<td>104.</td>
<td>32.</td>
</tr>
<tr>
<td>Sep. 1.</td>
<td>100.4</td>
<td>104.</td>
<td>34.</td>
</tr>
<tr>
<td>18. N.</td>
<td>128.</td>
<td>36.</td>
<td>19760</td>
</tr>
</tbody>
</table>

Died.

Post Mortem revealed a large round celled sarcoma of bronchial glands and right lung.

The first count, which is the highest, was taken on the day of admission. The subsequent record gives a remarkably steady rate of leucocytosis. The diagnosis just made was bronchiectasis, but it would be well nigh impossible to obtain such a leucocyte record in bronchiectasis. It would fluctuate according to the degree of retention of the purulent secretion. The next diagnosis made was fibroid phthisis, but here again my leucocyte numeral would not fit in. In phthisis, unless cavita-
tion exists, the blood count is normal, and if a cavity be present, the leucocytosis is always a fluctuating one. Empyema was excluded by introducing an exploring needle into the chest, with a negative result. New growth was then suspected, and the steady position of the leucocyte curve which is a striking feature in this case, was not opposed to that view. The patient died, and a large sarcoma was revealed in the root of his right lung.


Lymphosarcoma of mediastinal axillary and cervical glands, verified by microscopic section.

Temperature. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2</td>
<td></td>
<td>15720</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>14760</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>21840</td>
</tr>
</tbody>
</table>

Differential Count:

- Poly nuclear finely granular oxyphiles. 90%
- Small Lymphocytes. 5.5%
- Large Lymphocytes. 3.5%
- Eosinophiles. 1%

This case gives a very definite leucocytosis, as one would expect. The case was a very rapid one, and involved several sets of glands. It will be observed that the lymphocytes are considerably decreased in num-
ber, and that the leucocytosis is entirely a poly nuclear one.


Large osteo-sarcoma of sacrum, filling up the lower half of the abdomen.

Temperature.  Leucocytes per c.m.

Oct. 4.  8720  "

On October 12th patient developed symptoms of peritonitis.

25.  21840  "

Differential Count:-

Poly nuclear finely granular oxyphiles.  94%
Small Lymphocytes.  3. 8%
Large Lymphocytes.  1. 4%
Eosinophiles.  . 4%
Mast Cells.  . 4%

Died October 29th.

Post Mortem revealed General Peritonitis and large osteo-sarcoma of sacrum.

Though this was a very extensive sarcoma, giving rise to emaciation and cachexia, no leucocytosis is present. When general peritonitis was established a very definite poly nuclear leucocytosis is obvious.
Large spindle cell sarcoma of Scapula.
Temperature.  Leucocytes per c.m.
Aug. 4.  4960  
5.  6560  

The counts are perfectly normal ones. My films of this case did not stain sufficiently well to make a reliable count.

Mixed cell sarcoma of Femur.
Oct. 30.  10240  
31.  9360  

Differential Count;
Poly nuclear finely granular oxyphiles.  69. 6%
Small Lymphocytes.  22. 8%
Large Lymphocytes.  6. 8%
Eosinophiles.  8%

Sarcoma of Femur, mixed cell, of several months' duration.
Mar. 22.  7600  

In my two cases of sarcoma of the femur, no leucocytosis was present, but it is of interest to find that in the first case there was a mild lymphocytosis present.

CONCLUSIONS.
Out of my nine cases of Sarcoma, three gave a definite leucocytosis, two out of the three were cases of visceral sarcoma, and the third an advanced lymphosarcoma. My four cases of ostea sarcoma showed no leucocytosis whatever, one of which was very advanced, and of a very malignant type. A mild lymphocytosis existed in one of the cases.
The case of sarcoma of the ovary with secondary deposits gave normal quantitative counts. The slight increase of white corpuscles seen in my case of malignant angiomma was in all probability entirely accounted for by the septic condition of the ulceration.
These results are obviously very different to those obtained by Hayem, Alexander, Limbeck and others. In the majority of their cases a very well marked leucocytosis was found, and they regarded this as sufficiently constant to be of considerable assistance in diagnosis. I regret that my experience is so much different to theirs, because from the diagnostic point of view my
results are very unsatisfactory. A leucocytosis in three out of nine cases is much too inconstant to speak with any decision about the matter. Some of my cases, which gave normal leucocyte counts, were certainly not rapidly growing, nor advanced, but several of them again were very advanced and very rapid in growth.

Visceral cases, and granular sarcoma seem to me to give rise to increase of leucocytes more constantly than osteosarcoma. There is not however anything like the same constancy of leucocyte proliferation as we have seen in suppuration.

Two of my cases gave a lymphocytosis rather than a polymorphonuclear leucocytosis.

In specially selected cases, given a leucocytosis it might be of value in pointing to a sarcoma, but I cannot help feeling that the absence of leucocytosis does not in the least exclude sarcoma.

I shall work at this subject with considerable interest in future, in order to multiply my records and convince myself of the true relation of leucocytosis to this disease.
CARCINOMA.

Epithelioma.

1. J.G. Aet. 64. Male.
   Epithelioma of Leg, verified by microscope.
   Temperature. Leucocytes per c.m.
   June 22. 8240 "

   Epithelioma of Tongue, tongue excised two years ago, recurred with glandular infection.
   June 22. 12640 "

   Large Epithelioma of Hand, - microscopic.
   July 23. 9520 "

   Epithelioma of Leg, two years' duration, no glands
   May 25. 5240 "

CONCLUSION.

There was glandular involvement in one out of my four cases, and this case showed a mild degree of leucocyto-
sis. In the others there was no leucocytosis present.

CARCINOMA OF STOMACH.


Cancer of Stomach, extensive ulceration, revealed at the Post Mortem examination.

July 27.  7920  "


Sent in to Hospital as a case of suppurative appendicitis, a large tender mass to be felt opposite the umbilicus, vomiting.

Sep. 29.  6960  "

30.  6140  "

Operation revealed a large fixed growth of the Pylorus, glandular infection.

The absence of leucocytosis excluded a suppurative appendicitis.

CARCIMONA OF LARGE INTESTINE.

8. B.D.  Aet. 60.  Male.
Cancer of Rectum, advanced, ulceration, secondary growths.

Temperature. Leucocytes per c.m.

June 21. 19520

Cancer of Rectum, advanced cachexia, ulcerating.
June 23. 12960

10. C.W. Aet. 50. Female.
Cancer of Rectum, one year's duration.
Aug, 3. 6720

Differential Count;
Poly muclear finely granular oxyphiles. 76%
Small Lymphocytes. 19%
Large Lymphocytes. 4%
Eosinophiles. 1%

11. E.A. Aet. 50. Female.
Cancer of Rectum, five months' duration.
Aug. 3. 10240

Differential Count;
Poly nuclear finely granular oxyphiles. 82%
Small Lymphocytes. 12%
Large Lymphocytes. 2%
Eosinophiles. 1%

12. C.F. Male.
Advanced carcinoma of sigmoid flexure.
Aug, 31. 7120 "
Sep. 4. 8080 "

13. J.B. Aet. 64. Male.
Very advanced carcinoma of rectum, ulcerating.
Aug. 31. 10880 "
Sep. 3. 14640 "

Cancer of Rectum, nine months' duration.
Sep. 18. 7780 "

Cancer of Rectum, growth fixed, glandular infection.
Temperature. Leucocytes per c.m.

Oct. 4. 5920 "

Malignant disease of abdomen, with secondary growths.

Sep. 10. 9040 "

CARCINOMA OF UTERUS.

17. S.P. Aet. 40.
Cancer of Cervix, ulcerating, fixed, inoperable.

Aug. 17. 11840 "
18. 10480 "

CARCINOMA OF THE OVARY.

18. M.P.
Cancer of the ovary, inoperable, as revealed by laparotomy.

June 14. 10720 "

19. A,M. Aet. 50.
Temperature. Leucocytes per c.m.

Oct. 15. 12800 "

Differential Count:

Poly nuclear finely granular oxyphiles. 83%
Small Lymphocytes. 11%
Large Lymphocytes. 4%
Transitional Cells. 2%

CARCINOMA OF LIVER.

Cancer of liver, excision of breast for Scirrhus, three years ago, secondary growths in peritoneum.

Sep. 3. 14880 "
5. 10880 "

Inoperable cancer of Gall Bladder, as shown by laparotomy.

May 31. 7920 "

CARCINOMA OF BREAST.

22. A.B. Aet. 42. Female.
<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 17</td>
<td></td>
<td>8720</td>
</tr>
<tr>
<td>Aug. 7</td>
<td></td>
<td>12480</td>
</tr>
<tr>
<td>Aug. 20</td>
<td></td>
<td>8080</td>
</tr>
<tr>
<td>Aug. 22</td>
<td></td>
<td>4960</td>
</tr>
<tr>
<td>Sep. 6</td>
<td></td>
<td>6960</td>
</tr>
</tbody>
</table>
27. E.R. Aet. 47. Female.
Encephaloid cancer of breast, microscopic, ulcerating.

Temperature. Leucocytes per c.m.
Sep. 4. 14640 "

28. A.B. Aet. 42. Female.
Encephaloid cancer of breast (microscopic)
History of two years.
Oct. 8. 5920 "

Differential Count:
Poly nuclear finely granular oxyphiles. 80%
Small Lymphocytes. 9%
Large Lymphocytes. 9%
Eosinophiles. 1%
Mast Cells. 1%

29. E.H. Aet. 32. Female.
Scirrhus.
Oct. 13. 6800 "

RODENT ULCER.
CONCLUSIONS.

In twenty nine cases of carcinoma, only nine showed any degree of leucocytosis. My highest count was 19000, obtained in a case of cancer of the rectum, my next highest were three cases of carcinoma of rectum, breast and liver, giving 14,000. The remaining five were between 11000 and 13000.

Out of eight cases of rectal carcinoma, three showed a definite leucocytosis. They were all advanced cases in which ulceration was present, and I am not at all sure whether ulceration in this locality where bacterium coli are so plentiful, is not sufficient in itself to account for the leucocytosis present.

In ragged ulceration with sepsis it is very difficult to know how much of the leucocytosis is due to pyogenic matter, and how much to the carcinoma. The differential count shows that the increase is in Poly nuclear cells a fact which is not against this septic explanation of leucocytosis in the alimentary canal.
Carcinoma in solid viscera and glands like the mamma present no such complication, and any leucocytosis present must be ascribed to the growth. It is rather a significant fact that seven out of the nine cases showing leucocytosis were associated either primarily or secondarily with the alimentary canal. The eighth was seen in an ulcerating encephaloid of the breast, the ninth in a one year old scirrhus. Case 5, in which there was extensive ulceration of the stomach, gave no leucocytosis. Ulcers of the stomach, even malignant ones, are not so prone to become septic as intestinal ulcers owing to the antiseptic qualities of the gastric juice. After reading the literature on the subject of leucocytosis in carcinoma, I fear that I cannot accept all the conclusions that have been laid down concerning this subject. My observations have entirely failed to prove that the presence or absence of leucocytosis is of much value in the diagnosis of carcinoma. And whenever such uncertainty exists, it is quite impossible to rely on the leucocyte count for assistance in the diagnosis of such a disease. Leucocytosis may occur, especially in advanced carcinoma, associated with ulcerations, but even in advanced stages it may be entirely absent. Leucocytosis is less rarely seen in cancer than in sarcoma.
If practitioners waited until a general leucocytosis was present before diagnosing carcinoma, it is surely obvious that the operative treatment for such cases would be less than useless.
PHTHISIS.


Phthisis with cavitation, verified by Post Mortem.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 31</td>
<td>100.4</td>
<td>100</td>
<td>48</td>
<td>12320</td>
</tr>
<tr>
<td>Aug.  7</td>
<td>102.4</td>
<td>100</td>
<td>38</td>
<td>13440</td>
</tr>
</tbody>
</table>

Phthisis without cavitation gives no leucocytosis.

Phthisis with cavitation produces a leucocytosis.


Phthisis with bronchitis.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 11</td>
<td>104</td>
<td>132</td>
<td>48</td>
<td>13440</td>
</tr>
<tr>
<td>12.</td>
<td>101</td>
<td>132</td>
<td>50</td>
<td>12560</td>
</tr>
<tr>
<td>15. N.</td>
<td>132</td>
<td>36</td>
<td>6800</td>
<td></td>
</tr>
</tbody>
</table>

This case was of interest. He had been acutely ill for two days, brought on by a severe chill. He had suffered from a cough for several weeks. The question arising in the physician's mind was - is this pneumonia? - or is it bronchitis in a phthisical patient? Consolidated lung giving bronchial breathing was an important feature in this case.

The leucocyte count is very low for such an apparently acute attack of pneumonia, if pneumonia it was, and the leucocytosis present on the first two days, points I think...
to bronchitis rather than to pneumonia. On a stimulating expectorant mixture the bronchitis cleared up in a few days, and a well marked phthisis was evident.

3. J.C. Aet. 25. Male.
Phthisis with cavitation.

Temperature. Leucocytes per c.m.
Oct. 24. 12320 "

A mild leucocytosis, due no doubt to the septic processes going on within the cavity.

4. C.P. Aet. 28. Female.
Phthisis and tubercular kidney.

Sep. 18. N. 5600 "
In spite of the great frequency of septic processes associated with tubercle in these organs the count is a normal one.

5. J.A. Aet. 21. Female.
Phthisis. Cavitation.
Aug. 21. 100.6. 11040 "
23. 100. 13280 "
Temperature.  Leucocytes per c.m.

Aug. 25.  99.6.  9680  "
Sep. 1.   99.4.  10560  "
10.      99.    12480  "

Irregular leucocytosis due to large cavity in tubercular lung.

TUBERCULOUS NEPHRITIS.

6.  J.B.  Adult.  Female.
    Tuberculous Kidney.
    June 20.  9720  "

TUBERCULAR PERITONITIS (dry stage.)

7.  M.S.  Aet. 20.  Female.
    June 23.  8400  "

8.  S.B.  Aet. 25.  Female.
    Tubercular Peritonitis, verified by laparotomy.
    June 24.  5760  "

Both cases give perfectly normal quantitative counts.

TUBERCULOUS ADENITIS.

    Tubercular glands of neck, non suppurative.
    June 30.  7920  "

    Large axillary glands, soft.
Temperature. Leucocytes per c.m.

Oct. 10. 5280

Operation, found to be caseous and suppurating.

10a. A.B. Aet. 20. Female.
Extensive tuberculous glands of neck.

Oct. 24. 7440
Nov. 1. 6860

No leucocytosis exists in any of the cases.

TUBERCULAR ABSCESS.

Large lumbar abscess, verified by operation.

Nov. 3. 9680

Operation - about half a pint of pus evacuated.

Large tuberculous abscess, from spinal disease.

Aug. 23. 100. P100. R18. 8720

Abscess opened, about a pint of pus was evacuated. Cultivations on agar showed no growth to naked eye after 5 days.

This abscess was free from the common pyogenic organ-
tity of tuberculous pus should fail to produce the slight
est degree of leucocytosis.


Large cold abscess in lumbar region.

Aug. 28. N.  8760  "

29. Operation - about half a pint of pus was
    evacuated.

    Anaesthetic. Gas and Ether.

Aug. 30. 100.4.  12640  "

Sep. 3.  103.  19040  "

6.  103.  11200  "

11.  103.  12640  "

24.  102.8.  13360  "

Much discharge; patient looks hectic. This was a very
large abscess, yet the leucocyte count is a normal one.
There can be no doubt that this was infected at the
operation; there was a definite leucocytosis on the
day following operation, which was more or less main-
tained as long as my observations lasted. The tempera-
ture and general progress of the patient bore this out
to the full. It is probable that a daily estimation of
the leucocytes would be an important guide as to wheth-
er tuberculous abscesses, which had been opened, scraped
and closed up again, did become infected by septic or-
ganisms or not. Such might be done, and prevent a disturbance of the dressing.


Large lumbar abscess, thought to be tubercular.

Temperature. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 11</td>
<td>101.</td>
<td>34720</td>
</tr>
<tr>
<td>12.</td>
<td>100.2.</td>
<td>25700</td>
</tr>
<tr>
<td>15.</td>
<td>97.6.</td>
<td>36800</td>
</tr>
</tbody>
</table>

I took cultivations from the pus as it escaped, and obtained a copious growth of staphylococcus pyogenes aureus.

Anaesthetic. Ether.

<table>
<thead>
<tr>
<th>Date</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 17</td>
<td>22580</td>
</tr>
<tr>
<td>19.</td>
<td>22800</td>
</tr>
<tr>
<td>25.</td>
<td>16490</td>
</tr>
</tbody>
</table>

Left Hospital still discharging.

This case was thought to be one of Tuberculous abscess. I took a leucocyte count, and found a very great increase. It informed me that this abscess was not purely a tuberculous condition, and that septic organisms must be present. This fact I proved by making cultures from the pus.
Another interesting feature is brought out by the behaviour after operation. I informed the surgeon previous to the operation that it must be an abscess of mixed infection. He treated it as pure tuberculous lesion — opening, scraping, and closing it up. The result was of course, that it suppurated freely. A leucocyte count in such abscesses might be of value in ascertaining whether we are dealing with a pure bacillary nature or of mixed infection.

No cause for this abscess could be detected, and it is just possible that it was not even a primarily tuberculous one.

HIP JOINT DISEASE.

Tubercle of hip joint, two years' standing, no abscesses at any time.
July 30.  9520  
No sepsis, no leucocytosis.

Tubercle of hip joint, 2½ years, sinuses.
July 30.  100.  16240  
Aug. 3.  Amputation at the hip joint.
Anaesthetic. A.C.E. mixture and ether.

Aug. 6. 24240  "

Died.

Post Mortem revealed suppuration high up between the flaps, well marked amyloid disease. This case had old sinuses present, which were no doubt septic, and so accounted for the leucocytosis.

The high leucocyte count three days after the operation is probably due to the suppuration between the flaps.


Hip joint disease, with suppuration and sinuses.

Aug. 22. 30880  "

Sepsis present, with definite leucocytosis.


Hip joint disease, 4 years' standing, sinuses with much discharge, well marked waxy disease.

July 30. N. 20240  "


Aug. 23. N. 15920  "

Sep. 5. N. 15920  "
Temperature. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Oct. 4</th>
<th>N.</th>
<th>6200</th>
</tr>
</thead>
</table>

Patient left, looking well.

This case was an old one with undoubted waxy degeneration in liver and kidneys. He was emaciated and hectic. His leucocytosis is accounted for by the copious septic discharge. The wound suppurated after the operation. For at least a month subsequent to the operation there was a moderate degree of leucocytosis. On October 4th, the wounds having all healed, we find that his count is a normal one. He became fatter and stronger very rapidly. This case proves pretty conclusively that getting rid of the sepsis gets rid of the leucocytosis, even though waxy disease be still present.

Caries of Spine.


Caries of spine, large lumbar abscess in region of kidney.

Cultivation from interior of abscess, gave a rich growth of streptococci.

<table>
<thead>
<tr>
<th>Sep. 21</th>
<th>98.6</th>
<th>112.</th>
<th>22.</th>
<th>13440</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22.</td>
<td>99.</td>
<td></td>
<td>12800</td>
</tr>
</tbody>
</table>

This case was undoubtedly one of mixed infection.
HYDATID CYSTS.

1. L.W. Aet. 25. Female.

Hydatid of Liver.

Temp. Pulse. Resp. Leucocytes per c. m.

July 14. N. 96. 23. 9520 "

15. Operation. Hydatid of liver, 3 or 4 pints of clear bile stained fluid was evacuated.

Anaesthetic

16. 100. 120. 32. 15600 "
19. 99.5. 120. 30. 25600 "
21. 99.6. 104. 28. 20240 "
26. N. 96. 24. 19200 "
31. 98. 92. 24. 11520 "

Up to this date patient appeared to be doing well, On August 1st pus was noticed on the dressing. Patient began to vomit and gradually sank. There was much distress towards the end.

Aug. 7. 97. 112. 20. 44000 "

Died August 8th; Post Mortem refused.

Before operation there was no leucocytosis. After the operation a very definite leucocytosis is set up, which reaches a maximum on July 19th. From this day it steadily fell until it reached 11000 on the last day in July. On August 1st pus was seen in the discharge for the first time. On August 7th the leucocytes have in-
creased enormously. It was very unfortunate that a post mortem was refused. The post operative leucocytosis is no doubt due to an intense local reaction produced by stripping away the hydatid membrane and possibly to a local peritonitis set up around the drainage tube. The high leucocytosis on August 7th is either due to the septic processes within the Hydatid cavity or to a peritonitis from some perforation or another.


Hydatid of Liver.

<table>
<thead>
<tr>
<th></th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 23.</td>
<td>102.6.</td>
<td>100.</td>
<td>28.</td>
<td>4320 &quot;</td>
</tr>
<tr>
<td>29.</td>
<td>101.4.</td>
<td>88.</td>
<td>24.</td>
<td>3480 &quot;</td>
</tr>
<tr>
<td>Sep. 6.</td>
<td>101.8.</td>
<td>108.</td>
<td>20.</td>
<td>8720 &quot;</td>
</tr>
<tr>
<td>7.</td>
<td>102.4.</td>
<td>106.</td>
<td>20.</td>
<td>1040 &quot;</td>
</tr>
<tr>
<td>10.</td>
<td>100.8.</td>
<td>88.</td>
<td>28.</td>
<td>1520 &quot;</td>
</tr>
</tbody>
</table>

This was thought to be a possible abscess of the liver. It was kept under observation for some time before operation. The temperature is very irregular, the leucocytes are few in number. Operation was performed, and a hydatid was found undergoing natural cure.

Hydatid of Lung, verified by operation.

Oct. 11.  7120.

No leucocytosis.


Suppurating Hydatid of Liver.

July 6.  101.8.  112.  36.  15280  "
7.  17440  "
8.  Operation; several pints of bile stained pus was evacuated.

Anaesthetic, ether and chloroform.

9.  27040  "

Post Mortem confirmed the diagnosis.

This case was suggestive of suppurating hydatid cyst. The temperature, pulse, leucocyte count and local conditions all pointed to it. It is of very great importance to the surgeon to know whether he is dealing with a pure hydatid or a septic hydatid. If the latter, his endeavor to shut off the general peritoneum would be more assiduous, as the danger of peritonitis is so much greater. Estimation of the leucocytes in such cases would probably be of value in determining whether suppuration exists or not.
MISCELLANEOUS SURGICAL CONDITIONS.

E.C.    Aet. 23.    Female.
Lump and tenderness on sigmoid, thought to be inflammatory.

Temperature.  Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Count</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>May 11.</td>
<td>3040</td>
<td>&quot;</td>
</tr>
<tr>
<td>14.</td>
<td>5600</td>
<td>&quot;</td>
</tr>
<tr>
<td>18.</td>
<td>7440</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Got well in a few days after first count. There is an entire absence of leucocytosis.

Urine laden with pus, pain and swelling on one kidney, tubercle bacilli not been found in urine.

June 3.  28400  "

The leucocytosis points to a well marked pyogenic infection, either due to a calculus or a mixed infection with tubercle.

Patient left hospital against advice.
J.M. Aet. 49. Male.

Large gumma of fore-arm.

Temperature. Leucocytes per c.m.

June 20. 7120 "

Disappeared under Potassium Iodide.

E.M. Aet. 29. Female.

Syphilitic Arthritis.

Sep. 27. 8400 "

W.S. Aet. 50. Male.

Knottiness, swelling of right arm, following a rat bite.

July 30. 100.2. 92. 18560 "

27. 101. 96. 32640 "

Aug. 11. 99. 98. 36240 "

This case was one of peculiar interest. It followed a rat bite, there was knottiness spreading apparently in the lymphatics of the arm, axilla and neck. Slightly tender. On section composed of a fibrous stroma in which numerous large embryonic looking cells were placed. No organism of any kind was discovered. It resembled in some respects Chronic Glanders. My blood counts I think entirely exclude Syphilis or Tubercle. The man was discharged from hospital, and within a few months got perfectly well.
Chronic Mastitis. Leucocytes per c.m.
May 18. 8490. "
No leucocytosis.

F.F. Female.
Adenoma of Breast.
Aug. 9. 7920 "
No leucocytosis.

A.F. Aet. 25. Female.
Fibroma of abdominal wall.
Sep. 9. 4060 "
Uncomplicated.


Been in hospital several days. Rusty sputum, stools like a typhoid, no physical signs of pneumonia.

Daily temperature about 104. Pulse 140 per m.
Resp. 36 per m.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 1. 104.</td>
<td>148.</td>
<td>36.</td>
<td>27440</td>
</tr>
</tbody>
</table>

Physical signs of pneumonia present for the first time. Widal Reaction negative on this day.

4. 103. 148. 64. 39260

5. Crisis at 8 a.m.

At 4 p.m.

99. 130. 34. 26080

7. 97.5. 96. 24. 14640

9. N. 72. 18. 17920

13. N. 72. 18. 6400

Patient discharged June 17th.

The physician was in considerable doubt whether this was a case of pneumonia or typhoid. Physical signs were entirely absent till June 1st. Had a leucocyte count been taken in the earlier days of his illness a very definite leucocytosis must have been revealed, and
Breathing: Pulse: Temperature: Leucocytes
Breathing: Pulses: Temperature: Leucocytes in uncooled
Pneumonia T.D. Case 2.
have led to a confident diagnosis. It is obvious that Widal's reaction can give no information in the first few days of such an illness, and even after the fifth day of illness, it is quite impossible for the general practitioner to apply such a test. It is however within the easy reach of all to estimate the number of leucocytes per cubic millimetre. If this were done many of those obscure cases of early pneumonia giving no physical signs - such as central pneumonia, and which so closely simulate enteric fever, would become clear. The leucocytosis is definite. It is maintained for some days after the crisis due most likely to a somewhat slow resolution.

2. T.D.  
Aet. 20.  
Male.

Pneumonia; been ill eight days.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 1st. 102.</td>
<td>148.</td>
<td>62.</td>
<td>39680</td>
</tr>
<tr>
<td>2. 103.</td>
<td>128.</td>
<td>60.</td>
<td>44480</td>
</tr>
<tr>
<td>3. Crisis on this day.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. 99.</td>
<td>104.</td>
<td>30.</td>
<td>25760</td>
</tr>
<tr>
<td>8. N.</td>
<td>80.</td>
<td>20.</td>
<td>6800</td>
</tr>
<tr>
<td>16. N.</td>
<td>80.</td>
<td>20.</td>
<td>9840</td>
</tr>
</tbody>
</table>

A very well marked leucocytosis with an uninterrupted recovery.
Pulse

Temperature

Leucocytes

Uncomplicated case of Pneumonia

Pneumonia.

2nd and 3rd day.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 8.</td>
<td>104.4</td>
<td>130.</td>
<td>32.</td>
<td>24960</td>
</tr>
<tr>
<td>9.</td>
<td>104.2</td>
<td>136.</td>
<td>32.</td>
<td>21200</td>
</tr>
<tr>
<td>11.</td>
<td>103.</td>
<td>142.</td>
<td>42.</td>
<td>24840</td>
</tr>
<tr>
<td>13.</td>
<td>102.6</td>
<td>144.</td>
<td>42.</td>
<td>28080</td>
</tr>
</tbody>
</table>

Crisis at midnight on this day.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.</td>
<td>98.</td>
<td>96.</td>
<td>26.</td>
<td>9520</td>
</tr>
<tr>
<td>18.</td>
<td>97.</td>
<td>80.</td>
<td>24.</td>
<td>9280</td>
</tr>
</tbody>
</table>

Uninterrupted recovery.

No less than 36 hours after his crisis the leucocyte count had fallen to normal.


Pneumonia, mild case, been ill several days.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 12.</td>
<td>103.6</td>
<td>133.</td>
<td>40.</td>
<td>17280</td>
</tr>
<tr>
<td>14.</td>
<td>103.6</td>
<td>150.</td>
<td>36.</td>
<td>9040</td>
</tr>
</tbody>
</table>

Crisis in the evening of this day.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>98.</td>
<td>72.</td>
<td>30.</td>
<td>7200</td>
</tr>
</tbody>
</table>

In this case, which was a very mild one, the leucocytes fell before the crisis.

Lobar Pneumonia, right lung almost entirely solid.

Temp. Pulse. Resp. Leucocytes per c.m.

Oct. 26. 104.4. 96. 24. 3600 

Differential Count.
Poly nuclear finely granular oxyphiles. 80%
Small Lymphocytes. 3%
Large Lymphocytes. 3%
Transitional Cells. . 8%
Eosinophiles. . 8%

28. 104. 108. 36. 3760 

Differential Count.:
Poly nuclear finely granular oxyphiles. 85%
Small Lymphocytes. 10%
Large Lymphocytes. 5%

29. 103.8. 120. 36. 9360 

Differential Count.:
Poly nuclear finely granular oxyphiles. 93.4%
Small Lymphocytes. 3. 8%
Large Lymphocytes. 2. 8%

30. 102.8. 112. 38. 16800 

Differential Count.;-
Poly nuclear finely granular oxyphiles. 92%
Small Lymphocytes. 5%
Large Lymphocytes. 2%
Transitional Cells.
Below.

26 28 30 31 1 2 3

November.

Breathing Per Min.

Pulse per Min.

Chills.

Temperature.

Leucocytes.

Fairly severe case of Pneumonia, with a very mild Leucocyte Reaction in Blood.
Eosinophiles.  . 4%

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 31</td>
<td>102</td>
<td>96</td>
<td>30</td>
</tr>
</tbody>
</table>

Differential Count:

Poly nuclear finely granular oxyphiles. 90%
Small Lymphocytes. 5%
Large Lymphocytes. 3%
Transitional Cells. 1.5%
Eosinophiles.  . 5%

Nov. 1 | 102 | 96 | 30 | 10560 |

Differential Count:

Finely granular poly nuclear oxyphiles. 90%
Small Lymphocytes. 4%
Large Lymphocytes. 3%
Transitional Cells. 2%
Eosinophiles. 1%

Crisis on evening of the 31st.

2. N. 72 30 9680
6. N. 72 24 4860

Uninterrupted recovery.

This is without doubt an exceptional case. The attack was a severe one, yet not severe enough to ever give anxiety as to prognosis. I followed the case with no little excitement. It was impossible to regard it as the count of a mild case; and to give a satisfactory
interpretation of my results is no easy matter. This patient was a strong robust man, and the question arises - is it possible that a physical constitution can be so strong, so sthenic that it can afford to treat even a large dose of pneumonic toxin with contempt?

Or is it likely that this is an example of a prolonged preliminary leucopenia prior to the ensuing leucocytosis, as is seen in the experimental infections in animals?

The simplest explanation of course would be that it was in reality a mild case, but its clinical appearance was entirely opposed to that view. It might be that some human mechanisms are possessed of distinct idiosyncracies in reference to this vital function of leucocytic reaction to bacterial infection. Children certainly react more readily than adults; and it is not unlikely that some adult natures retain that peculiar sensitive function of reaction, more readily than others. It is rather a remarkable fact that even while there is no leucocytosis on October 28th and 29th, the ratio of poly nuclear finely granular oxyphiles is increased, and this increase steadily becoming more marked from day to day, reaches its maximum on October 30th, the same day as the maximum quantitative count. Eosinophiles were absent from the films taken on October 28 and 29, and reappeared towards the crisis.

Pneumonia, third day, mild attack.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c. m</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 29</td>
<td>103</td>
<td>120</td>
<td>30</td>
<td>20,000</td>
</tr>
<tr>
<td>30</td>
<td>102.8</td>
<td>120</td>
<td>30</td>
<td>17120</td>
</tr>
<tr>
<td>31</td>
<td>98</td>
<td>80</td>
<td>25</td>
<td>8400</td>
</tr>
<tr>
<td>June 2</td>
<td>N.</td>
<td>72</td>
<td>22</td>
<td>6160</td>
</tr>
</tbody>
</table>

Uninterrupted recovery.
The leucocytosis in this case, as in case four which was also a mild one, falls somewhat before the crisis.


Pneumonia, only complained of being ill two or three days, much distress.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c. m</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 22</td>
<td>104.8</td>
<td>132</td>
<td>30</td>
<td>26240</td>
</tr>
<tr>
<td>23</td>
<td>98</td>
<td>100</td>
<td>26</td>
<td>12480</td>
</tr>
<tr>
<td>24</td>
<td>97</td>
<td>84</td>
<td>20</td>
<td>10400</td>
</tr>
<tr>
<td>29</td>
<td>N.</td>
<td>76</td>
<td>08</td>
<td>8240</td>
</tr>
</tbody>
</table>

This boy must have been ill longer than he admitted.
The leucocytosis fell directly after the crisis.
PNEUMONIA WITH COMPLICATIONS.


Double Pneumonia, fourth day of illness.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 17.</td>
<td>102.</td>
<td>120.</td>
<td>60.</td>
</tr>
<tr>
<td>18.</td>
<td>101.</td>
<td>124.</td>
<td>64.</td>
</tr>
<tr>
<td>19.</td>
<td>101.8.</td>
<td>132.</td>
<td>54.</td>
</tr>
<tr>
<td>21.</td>
<td>100.</td>
<td>120.</td>
<td>44.</td>
</tr>
<tr>
<td>22.</td>
<td>98.4.</td>
<td>96.</td>
<td>32.</td>
</tr>
<tr>
<td>23.</td>
<td>98.</td>
<td>96</td>
<td>32</td>
</tr>
<tr>
<td>24.</td>
<td>98</td>
<td>96</td>
<td>30</td>
</tr>
<tr>
<td>29.</td>
<td>98.</td>
<td>98</td>
<td>22</td>
</tr>
<tr>
<td>June 1.</td>
<td>N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>N.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>N.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Still dulness and crepitations at bases of both lungs.

18. | 32160 |

Child makes no complaint.

22. | 44480 |

Differential Count:

Poly nuclear finely granular oxyphiles. 83. 6%
Small Lymphocytes. 11. 6%
Large Lymphocytes. 2. 6%
Transitional Cells. 1%
Myelocytes. 3%
Eosinophile Cells. 6%
Pneumonia Case 673. Complicated with slow resolution, no pus found by exploring needle.
<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse.</th>
<th>Resp.</th>
<th>Leucocytes perc.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 27.</td>
<td>97.8.</td>
<td>92.</td>
<td>19520 &quot;</td>
</tr>
<tr>
<td>30.</td>
<td>99.</td>
<td></td>
<td>16720 &quot;</td>
</tr>
<tr>
<td>July 4.</td>
<td>100.</td>
<td>108.</td>
<td>33120 &quot;</td>
</tr>
</tbody>
</table>

The temperature fluctuates, child is not progressing, looks ill, perspires freely at night, dulness at right base. Exploring needle introduced; nothing could be found.

9. | 99. | 88. | 22. | 20080 " |
13. | 98. |       | 16640 " |
20. | N. |       | 16080 " |
27. | N. |       | 11680 " |
31. | N. |       | 12000 " |

At this stage the boy was allowed to get up, though still pale.

This case is an excellent example of a slowly resolving pneumonia, lasting nearly three months. It was a double pneumonia, and his reaction is very vigorous. It furnishes the highest degree of leucocytosis which I obtained during my observations. On the day of his crisis his leucocytosis was 73,000, and from this maximum it fell steadily for three weeks until it reached 18000. Then we get an exacerbation which is more or less maintained for several weeks, and then falls very slowly until well nigh normal, at which point the boy was sent to
a convalescent home.

Such a leucocyte record is not found without a reason, and it is all the more striking because of the approximately normal condition of the temperature, pulse and respirations. The boy never complained, but it was not difficult to see that he did not improve as he ought to have done. The question of Empyema arose on several occasions, a needle was introduced more than once, but nothing was revealed; so that one is driven to look upon this as a case of slow resolution, and not as some suppurative condition.

It is thus a significant fact that after all the cardinal symptoms of pneumonia have disappeared, after the temperature, pulse and respiration have become normal, that the leucocyte record should remain a high one. Such a fact would suggest that a careful estimation of the leucocytes is one of the best guides as to whether a case of convalescing pneumonia is progressing favorably or not. When the leucocyte curve has fallen, to normal, and remains so for some days, the case may be regarded as sufficiently recovered to be out of danger.

Pneumonia for several days before admission.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 14</td>
<td>101.4</td>
<td>133</td>
<td>36</td>
<td>21040</td>
</tr>
<tr>
<td>June 16</td>
<td>100.0</td>
<td>110</td>
<td>28</td>
<td>19360</td>
</tr>
<tr>
<td>June 19</td>
<td>99.4</td>
<td>120</td>
<td>32</td>
<td>22480</td>
</tr>
<tr>
<td>July 27</td>
<td>98.4</td>
<td>96</td>
<td>30</td>
<td>19200</td>
</tr>
</tbody>
</table>

Aug. 27. Boy up, looks very pale; there are still coarse crepitations over one base.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 31</td>
<td>99.</td>
<td>88</td>
<td>28</td>
<td>21200</td>
</tr>
<tr>
<td>Sep 3</td>
<td>98</td>
<td>96</td>
<td>22</td>
<td>10240</td>
</tr>
</tbody>
</table>

Discharged on September 15th.

This boy had his crisis about July 19th, and six weeks after this he still had a leucocytosis of 21200. The coarse crepitations were present in one lung until the end of August. Pleural cavity was not explored for pus, but I think there can be little doubt that it was a case of slow resolution following an ordinary pneumonic attack.


Pneumonia.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 13</td>
<td>102.8</td>
<td>116</td>
<td>56</td>
<td>33360</td>
</tr>
<tr>
<td>Aug 14</td>
<td>101.2</td>
<td>100</td>
<td>60</td>
<td>23440</td>
</tr>
</tbody>
</table>
Aug. 15. 101.4. 100. 60. 26800 "
16. 100.8. 100. 50. 29040 "
17. 100. 88. 46. 30380 "
19. 98.4. 80. 30. 29280 "
23. 101. 120. 44. 27920 "
26. 102.4. 130. 38. 23560 "
29. 102.4. 104. 40. 16560 "

Exploring needle put in, no pus found.

Sep. 5. 101.4. 120. 40. 21200 "
9. 100.4. 100. 36. 19360 "
13. 100. 100. 36. 21200 "
18. 100.4. 130. 48. 18080 "
19. Again needled, this time pus was obtained, and several ounces of the pus were evacuated the same evening.

20. N. 112. 32. 16560 "
22. N. 120. 40. 13600 "
24. N. 126. 42. 15920 "
26. N. 8080 "

Sent to Jaffray Convalescent home with slight discharge.

This case is very instructive. Crepitations and cavernous breathing were present until August 29th. It is more than likely, I think, that pus was present when the first exploration was made; both his leucocyte count
August
18 14 15 16 17 19 23 24 29 5 9 13 18 19 20 22 24 26 31
September
Pulse
90 100 110 120 130
Temperature
98 99 100 101 102 103
Culture
Recovery
Pneumonia - Empyema closed
Empyema - Empyema opened
Hemoptysis present
Case 10 A.F. Pneumonia - Complicated by Empyema.
and his temperature seem to bear this out. The leucocytes did not fall after his crisis to any extent, so that it is impossible at which point the empyema began to form. It is probable that there was retarded resolution, which was gradually followed by the empyema. The leucocytosis slowly disappeared after the empyema was opened. Such a case as this suggests the advisability of not hesitating to introduce the exploring needle whenever the leucocyte curve points to some complication. If this was done many of the unfortunate deaths following an attack of pneumonia would be prevented.

It is also an example of the value that regular leucocyte estimation can be in pneumonia. The knowledge that a definite leucocytosis still exists at some time after the crisis would induce the medical attendant to examine his patient carefully for retarded resolution or suppuration, before allowing him to get up or be discharged. A student does not require to work in the post mortem room long before he meets with cases of undiagnosed empyema following pneumonia. An examination of the leucocytes from time to time during convalescence would prevent the pathologist from revealing a large number of these unfortunate conditions. What is the little extra trouble of leucocyte estimation, compared to the genuine satisfaction of knowing how one's patient really is pro-
I do not of course forget the value of such clinical aids as the temperature and the pulse, but we know how occasionally they mislead us, and I am convinced that the leucocyte numeral is more sensitive than either.


Pneumonia, cyanosed, ill, as if on the point of death. Duration of illness four days.

<table>
<thead>
<tr>
<th></th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 10</td>
<td>104.6</td>
<td>132.</td>
<td>30.</td>
<td>20880</td>
</tr>
<tr>
<td>11.</td>
<td>103.8</td>
<td>112.</td>
<td>48.</td>
<td>20720</td>
</tr>
<tr>
<td>12.</td>
<td>104.4</td>
<td>128.</td>
<td>52.</td>
<td>21200</td>
</tr>
<tr>
<td>13.</td>
<td>103.6</td>
<td>112.</td>
<td>40.</td>
<td>21200</td>
</tr>
<tr>
<td>14.</td>
<td>102.6</td>
<td>108.</td>
<td>36.</td>
<td>25600</td>
</tr>
<tr>
<td>15.</td>
<td>101.</td>
<td>100.</td>
<td>40.</td>
<td>23760</td>
</tr>
</tbody>
</table>

Differential Count: -

Poly nuclear finely granular oxyphiles. 89. 4%

Small Lymphocytes. 4. 4%

Large Lymphocytes. 4. 2%

Eosinophiles. 1%

Transitional Cells. .8%

Myelocytes. .2%

16. 99. 88. 20. 27840
17. 99.6. 82. 20. 21800
<table>
<thead>
<tr>
<th>Oct</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>98.6</td>
<td>84</td>
<td>20</td>
<td>21680</td>
</tr>
<tr>
<td>20</td>
<td>98.6</td>
<td>85</td>
<td>22</td>
<td>13640</td>
</tr>
<tr>
<td>22</td>
<td>98.6</td>
<td>60</td>
<td>22</td>
<td>11040</td>
</tr>
<tr>
<td>31</td>
<td>99.6</td>
<td>90</td>
<td>13</td>
<td>5920</td>
</tr>
</tbody>
</table>

The crisis occurred on October 15th. Eosinophiles are present in the films taken on this day. The maximal count is seen on the day following the crisis, from which it slowly fell to normal. No evidence of suppuration was present, and the somewhat slow recovery of the leucocyte curve is due to retarded resolution. Except for this, it is practically an uncomplicated case.
W.W. Aet. 54. Male.

Alcoholic pneumonia, second day.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 31</td>
<td>103.8</td>
<td>108.</td>
<td>44.</td>
<td>21340</td>
</tr>
</tbody>
</table>

Differential Count:

- Poly nuclear finely granular oxyphiles: 89.2%
- Small Lymphocytes: 5%
- Large Lymphocytes: 3.8%
- Myeyleocytes: 0.8%
- Eosinophiles: 0.8%
- Transitional Cells: 0.4%

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 1</td>
<td>102.8</td>
<td>92.</td>
<td>42.</td>
<td>14320</td>
</tr>
<tr>
<td>2</td>
<td>101.8</td>
<td>120.</td>
<td>42.</td>
<td>6960</td>
</tr>
</tbody>
</table>

Differential Count:

- Poly nuclear finely granular oxyphiles: 87%
- Small Lymphocytes: 4.4%
- Large Lymphocytes: 2.6%
- Myeyleocytes: 6%

Died on August 3rd.

Post Mortem examination revealed acute pleurisy with early pneumonia on the right side. Acute pericarditis. The patient, a strong massive man, gave a considerable leucocytosis on the day of admission. On the following
July 31st

Respiratory Curve

Pulse Curve

Temperature

Leucocytes

Death

Total case of Pneumonia Case 12. Died on 6th day of disease. Note the fall in temperature and leucocyte curves.
day the leucocytosis had diminished by seven thousand, and on the following day again, had entirely disappeared. The patient was acutely ill, and could not possibly have had a true crisis. He died on the morning of August 3. Such a falling leucocyte curve, in the early days of a severe pneumonia, can only have one true explanation,—namely,—that the vital reactionary power of the patient is being rapidly paralysed by the overwhelming dose of pneumonic or other toxin. The differential counts in this case were of great interest. The film taken on July 31st was stained by eosine and methylene blue, and I experienced no difficulty whatever in seeing that the leucocytosis was almost entirely a poly-nuclear one of the finely granular variety. There were four myelocytes present, amongst the 500 leucocytes counted. The film taken on August 2nd was very different. It was stained by Ehrlich's so called tri-acid mixture. The granules as usual took up the stain with great brilliance, so much so that I had great difficulty at times in making up my mind whether the more faintly stained nucleus was single or multiple. The myelocytes which have been credited to each differential count, were undoubted ones, but it is quite possible, despite the fact that a 1500 magnification power was used, that a much higher myelocytosis existed. In all the differential counts
I made in these cases of fatal pneumonia, except the one taken on July 31st, the films were stained with Ehrlich's mixture, and in all I had the same difficulty. The nuclei of the poly nuclear cells appeared to be larger than normal, more faintly stained, and tending to adhere together in one part of the body of the cell. The idea suggested was a kind of transitional cell between the poly nuclear finely granular oxyphile, and the uninnuclear finely granular myelocyte.

As far as I know there are no existing records of differential counts in these fatal cases of pneumonia, which show no leucocytosis. I shall endeavor to pursue my investigations on this matter to greater length, and in doing so, I feel sure that the eosine and methylene blue stain will give more definite results.


Pneumonia, eighth day of disease, strong robust woman, very ill.

Temp.  Pulse.  Resp.  Leucocytes per c.m.
Aug. 10.  104.  120.  40.  9200 "

Patient died three hours after count was taken. Post Mortem examination revealed a Septic Pneumonia. Such a leucocyte count on the fifth day of a severe
pneumonia, must be regarded with the greatest apprehension.

Differential Count:— as follows; 250 cells counted

Poly nuclear finely granular oxyphiles.  91.4%
Small Lymphocytes.  4.0%
Large Lymphocytes.  2.2%
Myelocytes.  1.2%
Transitional Cells.  0.4%

There is a very well marked relative increase in the poly
nuclear cells. Three myelocytes were found while count-
ing 250 leucocytes. I had much the same difficulty in my
differential count as in the Ehrlich film of case 12.

Pneumonia, alcoholic, third day.

Temp.  Pulse.  Resp.  Leucocytes per c.m.
May 24. 104.  140.  36.  3840  

Died in the night.
The patient was a strong healthy man. A very well marked
leucopenia exists.

Autopsy;— A well marked pneumonia was revealed.

15. A.H.  Aet. 32.  Female.
Patient delirious, rapid breathing, râles in chest,
with consolidation, duration several days.
Temp.  Pulse.  Resp.  Leucocytes per c.m.

June 18.  10,000  

Died on the following morning.

Post Mortem examination revealed pneumonia in both lungs with patches of old tubercle.

There is an entire absence of leucocytosis in this fatal case.

---


Pneumonia, very ill, duration several days.

Nov. 3.  104.  128.  24.  5600  

Differential Count:

- Poly nuclear finely granular oxyphiles.  86.2%
- Small Lymphocytes.  6.2%
- Large Lymphocytes.  3.4%
- Myelocytes.  3.4%
- Eosinophiles.  8%

Patient died the same evening.

Post Mortem examination revealed Apical Pneumonia in stage of grey hepatisation.

Though my stained films of this case were very good, I had the same difficulty in recognising the correct outline of the nuclei, as in case 12.
CONCLUSIONS.

1. Pneumonia gives rise to a very definite leucocytosis of a poly nuclear variety.

2. The leucocytosis probably begins to appear on the first day of illness.

3. If the patient is vigorous, and the dose of toxin not overwhelming, the leucocytosis increases steadily day by day, reaching its maximum about the day of the crisis.

4. If the pneumonia is mild, the leucocyte curve may anticipate the crises, and fall to normal a day or two before the crisis.

5. If the attack is a severe one, with marked leucocytosis the leucocytosis is maintained for several days after the crisis, and falls to normal gradually.

6. A mild attack of pneumonia gives rise to a mild degree of leucocytosis. A severe attack, with vigorous reaction, gives rise to a high degree of leucocytosis; a severe attack with poor reaction gives little or no leucocytosis.

In one case, No. 5, there was no leucocytosis until the 6th day of disease, although the case was a severe one, in a strong robust man;--such an exceptional case is as well kept in mind when the question of prognosis is being considered.

7. Five of my sixteen cases proved fatal. In four of these
I was only able to make one observation, because of the patient's death, but they all gave either normal or sub-normal leucocyte counts. In the fifth I was able to make three daily observations. The first day gave a leucocytosis of 21000, the second to 14,000, the third to 6000. He died the following day.

So that a falling count in a severe case of pneumonia as well as a normal or sub-normal count, taken some days after the commencement of the attack, must be regarded as a very grave indication.

Of course it must not be assumed that every case of pneumonia giving a definite leucocytosis will recover - many of the highest degrees of leucocytosis are found in fatal cases, simply because there is severity of disease associated with vigorous reaction, and the battle ends in the favor of the former. The point is that in those cases of severe pneumonia, giving normal, sub-normal, or even falling leucocyte counts before the crisis, the prognosis is bad. It is nevertheless rather remarkable that none of my cases showing well marked leucocytosis proved fatal.

The differential counts in three of my cases of fatal pneumonia, prove that although the quantitative count is a normal one, there is a well marked increase in the poly-nuclear cells. Myelocytes were present in all
my cases. I think it quite possible that I have underestimated the exact degree of myelocytosis, and I submit my results in this matter with a certain degree of reservation.

8. In retarded resolution the leucocytosis is maintained for an indefinite time after the crisis - it may be for weeks or even months. Such a condition of things might call for a searching examination to exclude suppuration. The temperature in a case of pure resolution, does not appear to be so much elevated as in suppurative complications, but the exploring needle should be used freely if there is any doubt. The leucocytosis in retarded resolution is definite, irregular in degree, and tends to disappear gradually.

9. Suppuration following pneumonia is similarly indicated by a rising leucocytosis after the count has fallen to normal, or it resembles that of retarded resolution in being a continuation, on a lower scale, of the primary pneumonic leucocytosis. Suppuration is probably associated with more elevation of temperature than retarded resolution. An exploring needle is however our best means of distinction.

10. It is quite easy to realise that under certain circumstances an examination of the leucocytes might be of
considerable value in the differential diagnosis of Pneumonia. Such conditions as typhoid, malaria, influenza are very liable to be confused with it before physical signs appear in its early stages, and all of these give rise to no leucocytosis. Measles and pure tuberculosis again can be excluded by the presence of leucocytosis.

11. Of course leucocyte estimation must only be employed in conjunction with the other clinical methods of diagnosis already at our disposal. In central pneumonia, especially where there is an entire absence of physical signs, we find it of great value.
EMPYEMA.

1. A.H.  
Aet. 12.  
Male.  

Emphyema.  

Temp.  
Pulse.  
Resp.  
Leucocytes per c.m.  

June 29. 98.  
120.  
26.  
14080  

July 2. 98.  
21200  


Anaesthetic, Chloroform.  

4. 100.  
25120  

6. 98.8.  
12480  

10. 97.8.  
12160  

16. 98.  
13360  

Still discharging.  

A definite leucocytosis, which is increasing. The leucocytosis, though falling considerably after the evacuation of the pus, is still quite evident two weeks after the operation. This is after all not surprising: the pleural cavity does not drain freely after an empyema is opened, then there is probably some special susceptibility to general leucocytosis, when the lung is the seat of the inflammatory trouble. We see it in a retarded resolution in pneumonia, and in none of my empyemas has the leucocytosis disappeared after evacuation. A well marked local leucocytosis will exist for some
time after an abscess is opened, and when the lung is involved in that abscess, it is possible that this local leucocytosis is sufficient to account for a general leucocytosis.

The bad drainage however is without doubt an important factor in that persistent leucocytosis.


<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 12.</td>
<td>103.</td>
<td>136.</td>
<td>48.</td>
<td>15280</td>
</tr>
</tbody>
</table>

Operation same evening, large amount of pus was evacuated. Ethyl Chloride used as a local anaesthetic.

| | | | | |
|---|---|---|---|
| 13. | 102. | 120. | 52. | 9360 |
| 14. | 99. | | | 16640 |
| 16. | 99.6. | | | 11360 |
| 19. | 99.4. | | | 17120 |
| 26. | 100.6. | | | 17280 |
| Aug. 3. | 100. | | | 17920 |

Still discharging freely.

A moderate leucocytosis, which fell on the day of operation to normal. It is rather interesting to observe that the anaesthetic was a local one in this case, and may ac-
count for the temporary fall in the leucocyte curve.
It however rose again, and three weeks after the opera-
tion there was a very definite leuocytosis present.
He left hospital still discharging, and not very long
afterwards I heard of him being admitted again for the
same trouble.


Empyema.
Had pneumonia, temperature is not as settled as
it might be, question of complication is raised.

Temperature.  Leucocytes per c.m.

July 11.  12580  "
Advised exploratory puncture, pus found. Small
empyema opened same evening.
28.  14640  "
Still discharges.
Sent to Jaffray Hospital - died.

Post Mortem revealed old empyema, abscess of lung,
acute miliary tuberculosis.
The leucocytosis was mild in this case, but sufficient
to justify exploratory puncture, which proved of value.
5. M.P.  
Aet. 45.  
Female.

Empyema, came into hospital practically moribund. 

Aug. 28. 35 ounces of pus drawn from pleura by the aspirator.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 29</td>
<td>100.4</td>
<td>158</td>
<td>56</td>
<td>50000</td>
</tr>
<tr>
<td>30</td>
<td>102.2</td>
<td>160</td>
<td>64</td>
<td>26640</td>
</tr>
<tr>
<td>31</td>
<td>101</td>
<td>150</td>
<td>56</td>
<td>33120</td>
</tr>
<tr>
<td>Sep. 1</td>
<td>100.6</td>
<td>148</td>
<td>56</td>
<td>34800</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>144</td>
<td>56</td>
<td>34000</td>
</tr>
<tr>
<td>3</td>
<td>100.6</td>
<td>128</td>
<td>48</td>
<td>16800</td>
</tr>
<tr>
<td>4</td>
<td>100.6</td>
<td>140</td>
<td>56</td>
<td>18360</td>
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<td>8</td>
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<td>17</td>
<td>100</td>
<td>130</td>
<td>32</td>
<td>6240</td>
</tr>
<tr>
<td>27</td>
<td>101.2</td>
<td>76</td>
<td>40</td>
<td>11840</td>
</tr>
<tr>
<td>Oct. 9</td>
<td>N.</td>
<td>108</td>
<td>36</td>
<td>10240</td>
</tr>
</tbody>
</table>

Still slight discharge, though walking about the ward.

The empyema followed an attack of pneumonia.

The leucocytosis is very considerable. On the evening of August 29th, the pleural cavity was freely opened and drained.

The patient ultimately recovered.
6. A.C. Aet. 32. Female.

Empyema.

Temperature. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 23.</td>
<td>101.</td>
<td>130.</td>
<td>70.</td>
<td>42800</td>
</tr>
<tr>
<td>26.</td>
<td>29680</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Differential Count:
Poly nuclear finely granular oxyphiles. 96. 4%
Small Lymphocytes. 2.
Large Lymphocytes. 1. 6%
27. 30360 ' 
29. 16720 ' 
Nov. 1. 26160 ' 
7. 13120 ' 
13. 12800 ' 

The pleural cavity was drained on November 4.

7. K.F. Aet. 20. Female.

Empyema following pneumonia.

Temp. Pulse. Resp. Leucocytes per c.m.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 25.</td>
<td>101.</td>
<td>130.</td>
<td>70.</td>
<td>42800</td>
</tr>
<tr>
<td>28.</td>
<td>100.</td>
<td>100.</td>
<td>60.</td>
<td>34160</td>
</tr>
</tbody>
</table>

Operation same evening, 42 ounces of pus was evacuated from the pleura.
Illustration of a rapid increase in temperature as being recorded after some initial decrease.
Temp. Pulse. Resp. Leucocytes per c.m.

May 31. 99.4. 125. 50. 10520 "
June 2. 99.4. 112. 44. 11680 "

6. N. 108. 36. 12480 "
11. N. 100. 34. 11680 "
18. 98. 100. 32. 11520 "

Sent to the Jaffray Hospital discharging slightly.

A very high degree of leucocytosis is seen in this case which had fallen almost to normal three days after operation. This case appeared to drain very satisfactorily, there was nevertheless a very faint excess of leucocytes three weeks after the operation. The temperature recovers its normal standard in advance of the leucocyte curve, the pulse and the respirations.


Had broncho-pneumonia, temperature normal, though child was still pale, and far from its normal state of health. Physician asked me to examine its blood, as he intended discharging it that day.

Temp. Pulse. Resp. Leucocytes per c.m.

Aug. 31. 98.4. 108. 27. 15600 "
I advised careful examination of the chest, with exploratory puncture. This was done, pus was discovered, not evacuated.

Temp. Pulse. Resp. Leucocytes per c.m. Sep. 3. 98. 104. 44. 14080

No more counts taken.

This case is a direct example of the value of a leucocyte record. Had an occasional count been made, of this child's leucocytes after her attack of pneumonia, it would probably have led to a more careful examination of the chest and then to exploratory puncture earlier than it did. When I discovered this leucocytosis present, I could only say that there must be a complication, and suggested retarded resolution or empyema.

CONCLUSIONS.

1. Suppurative pleurisy produces a very definite leucosytosis. This forms a very striking contrast to the leucocyte record in aorous pleurisy. As in other inflammatory conditions, the leucocytosis is due to an increase in the poly nuclear finely granular oxyphiles.

2. After evacuation of the pus, the leucocytosis does not disappear with the same rapidity as we have
noticed after the drainage of other abscess formations. This is largely due to the very great difficulty we have in effectually draining the pleural cavity.

All my cases of empyema left hospital still discharging pus from the operation wound, so that I was unable to follow any of them until a complete cure had been effected.

3. Gross accumulations of pus occurring after an empyema has been opened would in all probability be detected by regular leucocyte estimations. As in suppurative appendicitis imperfect drainage would be accompanied by an elevation of the leucocyte curve.
### PLEURISY. Serous.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W.H.</td>
<td>38</td>
<td>Male</td>
<td>100.8</td>
<td>108</td>
<td>32</td>
<td>5260</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>101</td>
<td>108</td>
<td>32</td>
<td>10240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100.8</td>
<td>84</td>
<td>24</td>
<td>8030</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>92</td>
<td>24</td>
<td>6080</td>
</tr>
</tbody>
</table>

Recovery.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.F.</td>
<td>13</td>
<td>Male</td>
<td>103</td>
<td>120</td>
<td>36</td>
<td>6800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>103</td>
<td>120</td>
<td>26</td>
<td>5720</td>
</tr>
</tbody>
</table>

Recovery.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.N.</td>
<td>11</td>
<td>Female</td>
<td>Oct. 4</td>
<td></td>
<td></td>
<td></td>
<td>4960</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c. m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.F.</td>
<td>48</td>
<td>Male</td>
<td>Oct. 6</td>
<td>99.6</td>
<td>96</td>
<td>20</td>
<td>5440</td>
</tr>
</tbody>
</table>

In none of my cases of serous pleurisy did I obtain in-
crease of the leucocytes. This forms a very striking contrast to serous peritonitis. It is also of interest to compare these results with cases of Empyema, in which a very well marked leucocytosis is to be found. Such a comparison suggests to one's mind the possibility that examination of the blood would be of value in the differential diagnosis of such conditions. It is of course quite impossible to say what proportion of these cases of serous pleurisy are tuberculous. A careful investigation of these cases of serous pleurisy from the bacteriological point of view might prove of great value.

GANGRENE OF LUNG.


Had pneumonia. Gangrene of Lung.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2</td>
<td>18240</td>
</tr>
</tbody>
</table>

Post Mortem revealed gangrene of lung. There is a distinct leucocytosis. It would have been interesting to have followed the leucocytosis of his pneumonia to ascertain what relation it had to that of his gangrenous lung.

Consolidation of lung, irregular temperature, foul sputum, had malaria recently.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 19</td>
<td>101.</td>
<td>144.</td>
<td>64.</td>
<td>15600</td>
</tr>
</tbody>
</table>

Operation. Lung explored for abscess, no abscess found. Tube inserted into lung.

Anaesthetic. Chloroform.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.</td>
<td>99.6.</td>
<td>144.</td>
<td>52.</td>
<td>17440</td>
</tr>
<tr>
<td>21.</td>
<td>100.2.</td>
<td>132.</td>
<td>48.</td>
<td>18080</td>
</tr>
</tbody>
</table>

Differential Count;

- Poly nuclear finely granular oxyphiles. 68.6%
- Small Lymphocytes. 25.2%
- Large Lymphocytes. 4.4%
- Transitional Cells. 1%
- Eosinophiles. 8%

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 1</td>
<td>101.</td>
<td>128.</td>
<td>40.</td>
<td>15600</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td>20080</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td>15920</td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td>18400</td>
</tr>
</tbody>
</table>

Oct. 11th.

Died October 11th.
Post Mortem revealed a small shrivelled gangrenous right lung, pleural cavity on that side occupied chiefly by air; walls inflamed.

At the operation several organisms were obtained from the foul bloody fluid drawn out from the chest by the exploring needle. They were as follows;-

Micrococcus Tetragenous.

Diploccocus.

Streptococcus Pyogenes.

This case was one of great obscurity. He was suffering from some toxic condition, with dulness at the base of his right lung. The diagnosis made was pulmonary abscess, which was not confirmed, by the operation. When the pleura was opened there was a very foul odour came out of the wound. There was no fluid in his pleural cavity. An incision was made into lung, and a tube was inserted.

He progressed very well for some time, discharging foetid grumous looking fluid, through his tube, with occasional pieces of lung tissue.

After discharging a large piece of lung tissue on October 8th, he became suddenly worse, and rapidly sank.
PERICARDITIS.

J.C.  Ast. 9.  Female.

Acute Pericarditis.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 8</td>
<td>102.4</td>
<td>160.</td>
<td>60.</td>
<td>16800</td>
</tr>
<tr>
<td>10.</td>
<td>99.3</td>
<td>144.</td>
<td>52.</td>
<td>16240</td>
</tr>
<tr>
<td>13.</td>
<td>101.2</td>
<td>140.</td>
<td>36.</td>
<td>18240</td>
</tr>
<tr>
<td>19.</td>
<td>98.</td>
<td>112.</td>
<td>32.</td>
<td>15280</td>
</tr>
<tr>
<td>24.</td>
<td>97.6</td>
<td>76.</td>
<td>32.</td>
<td>24000</td>
</tr>
</tbody>
</table>

Differential Count:-

Poly nuclear finely granular oxyphiles.  84. 2%
Small Lymphocytes.  14. 4%
Large Lymphocytes.  6%
Mast Cell.  8%

Oct. 2.  98.  96.  32.  16240
9. 101.  112. 36.  9040
23. 99.  96.  32.  7740
31. 98.6. 76.  24.  7440

Discharged to the Jaffray Hospital, much improved.

There is a very definite increase of the poly nuclear finely granular oxyphiles, with almost entire absence of large lymphocytes. When the leucocytosis was most
marked the child's condition was at its worst, indeed during the last weeks in September its life was despaired of: surviving this however it gradually got better. The leucocyte curve steadily fell from its highest point. The temperature and pulse are very irregular all through.

**ULCERATIVE ENDOCARDITIS.**


- Enlarged spleen, fluctuating temperature, looks ill.
- Several cultivations from the blood were perfectly sterile.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 10</td>
<td>102.</td>
<td>132.</td>
<td>44.</td>
<td>4640 &quot;</td>
</tr>
<tr>
<td>17.</td>
<td>101.</td>
<td>144.</td>
<td>28.</td>
<td>2800 &quot;</td>
</tr>
<tr>
<td>21.</td>
<td>102.</td>
<td>144.</td>
<td>40.</td>
<td>4680 &quot;</td>
</tr>
<tr>
<td>29.</td>
<td>101.</td>
<td></td>
<td></td>
<td>3440 &quot;</td>
</tr>
<tr>
<td>Oct. 17</td>
<td>101.5</td>
<td></td>
<td></td>
<td>3680 &quot;</td>
</tr>
</tbody>
</table>

Cultivation from the blood a few days before death, showed numerous colonies of staphylococcus pyogenes aureus. Patient died, and showed well marked ulcerative endocarditis.

This case was for a considerable time one of great difficulty. Cultivations of the blood, until a few days before...
death, were perfectly sterile. A heart lesion existed that varied very little in character. The red corpuscles were between two and three million per cubic millimetre all the time he was in hospital, and the haemoglobin varied between 30 and 35%. The boy appeared to be suffering from a toxaemia of moderate severity, though chronic in type.

There is a leucopenia present during the whole of his hospital career, despite the fact of his existing ulcerative endocarditis.

2. B.R.  

Act. 36.  

Male.

Had an old heart lesion, strong healthy man.

Temperatures  
Pulse  
Resp  
Leucocytes per c.m.

July 2.  

Varicose vein of leg excised.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>103</td>
<td>130</td>
<td>36</td>
<td>11,520</td>
</tr>
<tr>
<td>9.</td>
<td>102.5</td>
<td>140</td>
<td>40</td>
<td>8,720</td>
</tr>
<tr>
<td>10.</td>
<td>105</td>
<td>144</td>
<td>44</td>
<td>10,560</td>
</tr>
</tbody>
</table>

Death,

Post Mortem revealed ulcerative endocarditis on mitral and aortic valves. Slight local suppuration under scar of leg. Infarcts in both kidneys.
In contrast to the preceding case, this is of short duration, being more acute in character. It is a very severe form of ulcerative endocarditis, coming on after wound infection. There was a definite history of rheumatic fever, and cardiac murmurs. Organisms gaining access into the blood, and coming contact with damaged valves, have set up this malignant condition. In spite of the evident severity of his attack, the leucocytes are scarcely if at all increased. The most reasonable explanation of this absence of leucocytic reaction is — that the dose of toxic infection was overwhelming, and the low leucocyte count is to be regarded as pointing to a grave prognosis. The suppuration in the wound was more than sufficient to produce a definite leucocytosis had the reactionary powers been sufficiently vigorous. No blood cultures were taken, — it was regarded as a case of Delirium Tremens, and its true nature was only revealed by the autopsy.
ENTERIC FEVER.

Uncomplicated.

   First week. Widal - positive.
   Temp. Pulse. Resp. Leucocytes per c.m
   Sep. 6. 102.2. 130. 20. 4640  

   Second week. Widal - positive.
   Sep. 6. 102.4. 120. 30. 3680  

3. M.H. Aet. 32. Female.
   Doubtful case - enteric or pneumonia.
   Sep. 7. 102.4. 152. 68. 3120  
   I thought it was either enteric or pneumonia with a bad prognosis.
   First week gave a negative Widal.

9. 4320  
10. 4960  
12. Had a miscarriage. Now gives a positive Widal.
13. 4960  
   Recovery.
This patient never had any symptoms or physical signs of a pneumonia beyond her rapid breathing. I think her leucocyte record, together with her subsequent progress, quite excludes the possibility of a pneumonia. It is very interesting to observe that even though the patient had a miscarriage, and lost a certain amount of blood, there should be no leucocytosis.

4. A.K.  
Aet. 20.  
Female.

Enteric, eight days, Widal - positive.

Temp.  Pulse.  Resp.  Leucocytes per c.m.

Sep. 8.  102.6.  120.  32.  2480

Symptoms of perforation set in on September 11th, and patient died on September 12th.

Post Mortem revealed a very malignant type of Typhoid, ulceration is present with general peritonitis.

This case illustrates a very well marked leucopenia, which often exists in Typhoid fever. According to Thayer, there is a leucotyosis preceding actual perforation, due to a local form of peritonitis. This condition might exist in cases of gradual perforation, but in a case of this kind, with malignant ulceration, where more than one ulcer leaked at the same time, I should think it very unlikely that any time could be given for a preliminary leucocytosis. Still it is a question that will be of interest to investigate.
5. H.C.  
   Aet. 10.  Male.
   Enteric. Positive Widal.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 8.</td>
<td>104.2</td>
<td>112.</td>
<td>32.</td>
</tr>
</tbody>
</table>

6. G.K.  
   Aet. 15.  Male.
   Sep. 8.  102.  100.  32.  7920

7. C.M.  
   Aet. 35.  Male.
   Enteric, eight days, Widal, positive.
   Sep. 11. 102.  104.  22.  5280
   Died.
   Post Mortem revealed very malignant form of typhoid.
   Ulceration.

8. E.W.  
   Aet. 23.  Male.
   Sep. 12. 102.4.  100.  28.  4960

9. F.W.  
   Aet. 40.  Male.
   Enteric, Widal positive, second week.
   Sep. 14. 100.  128.  24.  7760
Enteric, second week.

Oct. 1. 102.8. 102. 24. 4640  

Enteric.
Sep. 26. 102.6. 105. 30. 4320  

Relapsing enteric, patient had typhoid, temperature been normal 10 days, slight discharge from ear. Physician thinks it is middle ear disease.

19. 6240  
Gave it as my opinion that it was a relapse - rash appeared later.

Second case of relapsing typhoid.
Patient had typhoid, temperature been normal several days, beginning to rise with abdominal tenderness.

Is it a relapse, or is it abdominal suppuration?
Sep. 21. 103.8. 120. 28. 4000  

I gave it as my opinion that it was a relapse, and a typical rash appearing later confirmed this.

Enteric with Complications.


Enteric, Widal positive.  Pneumonia?

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 1</td>
<td>103.</td>
<td>120.</td>
<td>32.</td>
<td>4480</td>
</tr>
<tr>
<td>6.</td>
<td>101.</td>
<td>100.</td>
<td>36.</td>
<td>5280</td>
</tr>
</tbody>
</table>

My count is quite against the idea of the case being complicated by pneumonia, and the physician in charge now admits that no physical signs of it ever existed.


15. 100.  128.  36.  16240  "

Differential Count;

Poly nuclear finely granular oxyphiles.  92%
Small Lymphocytes.  4.  4%
Large Lymphocytes.  2%
Mast cell.  1.  2%
Transitional cell.  4%

Abscess opened. One ounce of pus evacuated, which on cultivation gave a pure growth of staphylococcus pyogenes aureus.
<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 17.</td>
<td>101.8</td>
<td>120.</td>
<td>28.</td>
<td>16560 &quot;</td>
</tr>
<tr>
<td>19. N.</td>
<td>120.</td>
<td>37.</td>
<td></td>
<td>8400 &quot;</td>
</tr>
</tbody>
</table>

This case presents one or two points of great interest. The house physician had given it as an opinion that this was a complicated case. I examined the blood from that standpoint, and expressed a very strong opinion against the probability of there being pneumonia present. The physician and also the house physician admitted that pneumonia was only vaguely suspected, and that no definite symptoms had ever existed. There is later however a very definite complication in the form of an acute abscess due to staphylococci infection. This, as the record shows produced a very well marked poly nuclear leucocytosis.


Enteric with well marked acute bronchitis.

Oct. 20. 104. 112. 22. 12880 "

Such a leucocyte numeral as this is very unusual in typhoid fever, unless there is a very definite complication

Enteric, Widal positive, child much emaciated. Perforation 3½ hours before my first count in the early morning of October 6th.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 6.</td>
<td>101.6</td>
<td>144.</td>
<td>36.</td>
<td>7120</td>
</tr>
</tbody>
</table>

**Differential Count:**
- Poly nuclear finely granular oxyphiles. 79%
- Small Lymphocytes. 16%
- Large Lymphocytes. 4.6%
- Eosinophiles. 4%

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 7.</td>
<td>98.</td>
<td>172.</td>
<td>36.</td>
<td>19760</td>
</tr>
<tr>
<td>Oct. 8.</td>
<td>96.</td>
<td>144.</td>
<td>36.</td>
<td>18880</td>
</tr>
</tbody>
</table>

**Differential Count:**
- Poly nuclear finely granular oxyphiles. 89.8%
- Small Lymphocytes 7.2%
- Large Lymphocytes. 1.6%
- Transitional cells. 8%
- Eosinophiles. 6%

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 9.</td>
<td>96.</td>
<td>28.</td>
<td>18720</td>
<td></td>
</tr>
<tr>
<td>Oct. 10.</td>
<td>96.</td>
<td>104.</td>
<td>25600</td>
<td></td>
</tr>
<tr>
<td>Oct. 12.</td>
<td>96.</td>
<td>120.</td>
<td>31440</td>
<td></td>
</tr>
<tr>
<td>Oct. 14.</td>
<td>97.</td>
<td>112.</td>
<td>20880</td>
<td></td>
</tr>
<tr>
<td>Oct. 16.</td>
<td>96.</td>
<td>116.</td>
<td>27440</td>
<td></td>
</tr>
<tr>
<td>Oct. 19.</td>
<td>98.</td>
<td>120.</td>
<td>31200</td>
<td></td>
</tr>
</tbody>
</table>
Note the leucopenia after intubation - High Temp - Rapid Pulse.
Temp. | Pulse | Resp. | Leucocytes per c.m.
--- | --- | --- | ---
Oct. 22. 96.6. | 128. | 30. | 21260 "
25. 99.2. | 128. | 20. | 15760 "
27. 98. | 104. | 20. | 19680 "
31. 97.4. | 96. | 20. | 15280 "
Nov. 6. 98. | 104. | 28. | 18080 "

Recovered slowly and got perfectly well.

It will be observed that my first count taken 3½ hours after perforation is a normal one, both quantitatively and qualitatively. On the following day a very well marked leucocytosis is present, which is entirely a poly nuclear one. The peritonitis was general, though subacute in character. The child was very emaciated, and dragged on from day to day. An ice bag was kept over the abdomen for about a fortnight. Operation seemed out of the question as the patient was extremely weak. It is of interest to realise that in spite of the extreme weakness of the child, a very well marked leucocytosis was present, and this was well maintained to the end of my observations.
CONCLUSIONS.

1. Uncomplicated enteric fever produces either a normal, or as is more usual, a subnormal leucocyte count. This fact cannot but produce the greatest wonder and speculation as to its true explanation. We cannot explain why typhoid bacillus, the influenza bacillus, the tubercle bacillus, and the plasmodium malariae should entirely fail to produce an increase in the number of circulating white blood corpuscles, while most of the other less virulent organisms so readily give rise to such an increase. The fact nevertheless remains, and though uninterpretable by us we cannot help realising that this entire absence of leucocytosis in uncomplicated typhoid fever might be used as an important aid in the differential diagnosis from such diseases as pneumonia, scarlet fever, appendicitis and other abdominal inflammations. It can be of further value in cases of relapsing typhoid before the rash appears, when the rising temperature might be explained in another way as illustrated in cases 12 and 13.

In eight out of me twelve cases of uncomplicated typhoid the leucocyte count was less than 5000 per cubic millimetre.
2. Enteric with complications will give a leucocytosis in accordance with the particular complication, so that in estimating the leucocytes for a diagnostic purpose, the presence of a complication must always be carefully considered.
BILIARY COLIC.

1. E.S.  
   Aet. 50.  Female.
   Gall stone colic, third attack.
   Temp.  Pulse.  Resp.  Leucocytes per c.m.
   Sep. 7.  
   3280  "
   No leucocytosis, little or no inflammatory condition set up.

2. B.P.  
   Aet. 38.  Male.
   Gall stone colic, tender over gall and bladder.
   Oct. 7.  101.6.  112.  26.  14000  "
   13.  98.6.  66.  20.  7840  "
   This case on October 6th gives a moderate degree of leuco-
cytosis, which was probably due to slight cholecysti-
tis, or cholangitis.

3. M.B.  
   Aet. 56.  Female.
   Gall stone colic, tenderness over gall and bladder.
   Oct. 24.  14160  "
   25.  6240  "
   Patient passed a gall stone about the size of a hazel nut
   on October 26th, temperature fell, pain ceased.
   There is here again a moderate leucocytosis which is pro-
   bably due to slight cholecystitis or cholangitis.
Cases 2 and 3 were almost identical - pain, tenderness, jaundice, slight temperature. The first count in each shows the same degree of leucocytosis, the second a normal count.

It seems to me that in such conditions as gall stone colic, it would be a matter of the utmost comfort to have some reliable guide, apart from those we are accustomed to use at present, to inform us whether the inflammation set up by the passing stone is a serious one or not.

How often is it not the case that surgical interference is not invited until a very free sepsis is established in the gall bladder or bile ducts. Under such conditions operative measures are both dangerous and difficult, whereas they are so easy and free from risk, when taken sufficiently early. I am inclined to think that a careful leucocyte record of such attacks, would largely obviate that unfortunate delay in adopting surgical measures in septic cases, as well as add materially to the mental comfort of the medical attendant in simple ones. In the first class of case, the leucocytosis would be maintained and probably increased, whereas in the latter it would disappear in a few days.
LYMPHADENOMA.

1. A.B.  
   Adult.  
   Male.  
   Glands in neck, axilla, ear.  
   Temperature.  
   Leucocytes per c.m.  
   May 31.  
   9360

2. J.R.  
   Adult.  
   Male.  
   Extensive neck, axilla, groin.  
   May 31.  
   29040
   June 21.  
   43360
   Advanced case, which proved fatal.

There is a very considerable degree of leucocytosis present in this case.

3. J.G.  
   Act. 8.  
   Male.  
   Neck, axilla, groin.  
   Aug. 20.  
   12440
   22.  
   17120
   Sep. 7.  
   10400. Better.

This child was a very typical case.

PURPURA. G.C.  
   Male.  
   Sept. 11.  
   16560
ACUTE CENTRAL MYELITIS. A.W. Aet. 44. Female.

Temperature. Leucocytes per c.m. Two bedsores. P.M. - extensive central myelitis.

Oct. 18. 8400 "


July 4. 6800 "

CHRONIC LEAD POISONING. Adult. Male.

June 29. 7280 "

DOUBLE GRANULAR NEPHRITIS. A.C. Aet. 40. Male.

Sep. 10. N. 92. 20. 13440 "

Died.

Post Mortem revealed double granular nephritis, several small abscesses in the interior of the liver.

GASTRIC ULCER. F.W. Aet. 19. Female.

Perforated, symptoms sub-acute.

June 27. 12320 "

July 13. 8080 "

She got well on expectant treatment.

CHRONIC GASTRITIS. A.H. Adult. Female.

July 14. 4960 "

IT
ABDOMINAL ANEURISM. J.W.          Aet. 41.  Male.
          Temperature.          Leucocytes per c.m.
          Oct. 8.           5280  "

Death.
Large abdominal aneurism, with ulceration of the stomach, as a result of pressure.

RENAL COLIC. E.H.          Aet. 54.  Female.
          No suppuration present, stone passed same day.
          Oct. 15.  N.  3280  "

THROMBOSIS OF LEG. A.B.      Aet. 33.  Male.
          Sep. 7.  N.  7920  "
MY work in the gynaecological ward was far from being as fruitful as I had hoped it might be. This was not because I met exceptions to the general results of my blood work, but simply because I had the misfortune to meet with cases that were very indefinite, and in which expectant methods were employed. There are however several interesting facts brought out in my few observations, and I believe that there is no branch of surgical work in which leucocyte records might prove of greater value, than in gynaecology. Suppurations are often obscure, deeply seated, and present the utmost difficulty to diagnosis, and under such circumstances the gynaecologist would heartily welcome the assistance, that any clinical method could give him.

1. M.S. Adult.

Obscure pelvic suppuration.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 23.</td>
<td>21840</td>
</tr>
<tr>
<td>24.</td>
<td>15920</td>
</tr>
</tbody>
</table>

Operation revealed masses of granulation tissue in the cellular tissues of the pelvis, no actual abscess was found. The wound suppurated freely.

This case was regarded by the gynaecologist as one of
suppurative cellulitis, arranged in minute foci.

Diagnosed as a suppurative salpingitis.

Temperature.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 10</td>
<td>99.4</td>
<td>8080</td>
</tr>
</tbody>
</table>

Operation revealed an unruptured tubal gestation.

Diagnosed as a suppurative salpingitis.

<table>
<thead>
<tr>
<th>Date</th>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 17</td>
<td>99.</td>
<td>5040</td>
</tr>
</tbody>
</table>

18. Operation revealed a fibrous mass in the broad ligament, no suppuration or granulation tissue.

19. 8400 "
20. 8400 "

These two cases were both diagnosed as suppurative salpingitis, and in both there is an entire absence of leucocytosis. Suppurative salpingitis or pus tube almost invariably gives rise to a very definite leucocytosis, very much of the same character as we get in suppurative appendicitis. It was not my fortune to obtain the opportunity of meeting with a single case, so that I can record no positive cases. Extra uterine gestation where a considerable quantity of blood has been lost, gives rise also to a well marked leucocytosis, but in this
case there is diminution of the red corpuscles at the same time. It is always however important to bear this point in mind in making a differential diagnosis.


Cellulitis, regarded by the gynaecologist as a suppurative one.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Leucocytes per c.m.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 21. 98.4.</td>
<td>12160 &quot;</td>
</tr>
<tr>
<td>22. 99.6.</td>
<td>13120 &quot;</td>
</tr>
<tr>
<td>25. 99.</td>
<td>10560 &quot;</td>
</tr>
<tr>
<td>Oct. 2. 99.4.</td>
<td>10080 &quot;</td>
</tr>
<tr>
<td>9. 98.4.</td>
<td>6800 &quot;</td>
</tr>
</tbody>
</table>

The patient got perfectly well under expectant treatment.

The leucocytosis is a mild one, and it will be seen that it falls slowly under treatment.

It suggests to one's mind that in such cases a leucocyte record would be of interest in watching the effect of treatment. If the curve fell to normal under the expectant method, operative treatment need not be adopted. Should the leucocytosis increase, it must be taken as an indication that further treatment is necessary.
5. J.G. Aet. 42.

Local peritonitis.

Temp. Pulse. Resp. Leucocytes per cm

Sep. 27. 105. 146. 28. 12800 "

Differential Count:

Poly nuclear finely granular oxyphiles. 93. 6%
Small Lymphocytes. 2. 6%
Large Lymphocytes. 3. 8%

28. 101. 10560 "

Oct. 2. 99.2. 10560 "

5. 99.8. 108. 31. 8880 "

9. 100.8. 8720 "

This case had been ill some time, and was one of considerable obscurity. The initial leucocytosis diminished under expectant treatment, and patient got perfectly well.


Oct. 2. 99.6. 104. 24. 22800 "

Differential Count:

Poly nuclear finely granular oxyphiles. 92. 6%
Small Lymphocytes. 4. 4%
Large Lymphocytes. 2. 2%
Transitional Cells. .6%
Eosinophiles. .2%
Temperature.          Leucocytes per c.m.
Oct. 3.   102.      14640 "
5.   101.6.    16080 "
9.   101.      14960 "
22.  99.       12640 "
23. Incisions made into the vagina, no pus found.

Anaesthetic, A.C.E. Ether.
24.      14240 "
25.      18080 "
26.      12640 "
27. Plug removed from vagina.

Anaesthetic, A.C.E. Ether.
28.      15600 "
30.      11520 "
Nov. 3.   11520 "
9.       12480 "

The surgeon regarded this case as one of local suppurative peritonitis with pus shut off in the meshes of the pelvic cellular tissue. The irregular leucocytosis points to some suppurative condition. The operation revealed nothing beyond granulative tissue, and did not appear to benefit her. A faecal fistula, opening into the vagina formed, and she was ill for many weeks after the end of my observations, and indeed at the present time she is at the Jaffray Hospital. Her differential count is characteristic of an inflammatory
leucocytosis.

7. J.L.  

Had miscarriage ten days ago.

Temperature.  

Leucocytes per c.m.  

Temperature 103 and 104, abdominal pain and tenderness, rigors.

Practitioner diagnosed suppurative salpingitis or peritonitis. Severe diarrhoea. Sthenic.

103. 100. 22. 11200 "

I saw this case in consultation with the practitioner. I examined the blood, and considering the fact that she had suffered all day from an attack of diarrhoea, induced by calomel, I regarded the count as pointing more to a sapraemia from retained products than a salpingitis or a peritonitis. I advised soft curetting and flushing out the uterus. This was done and her temperature was normal next day, and she made a good recovery.

8. M.T.  

Female.

Incomplete abortion, two weeks ago, looks very ill, rigors, feverish, rapid pulse.

Sept. 11. 105. 7740 "

Uterus curetted & flushed out, temperature fell and
patient recovered at once. Another case of retained products. The symptoms were still more indicative of severe sapraemia though it is impossible to draw a distinction by mere clinical examination between this and pyaemia. Finding organisms in the blood would of course conclusively point to the latter.

It is thus very interesting to realise that though the symptoms were purely of a sapraemic nature, and very severe in character, that there is no leucocytosis.