the edges sewed together by fine catgut that entirely closes in and covers up the irritated peritoneal surfaces.

The end of this fold is then touched with the chemical irritant and stitched forward beside the bladder about opposite and a little above the level of the external inguinal ring. This, of course, will be only a peritoneal attachment and should be rather high, because the peritoneum is held in place here rather loosely.

Thus we practically have two round ligaments on either side, one going from the uterus partly through the first catgut ligature to the attachment behind the external inguinal ring, and the other from the uterus to the ligature and from there to the internal inguinal ring, etc.

The uterine half or quarter inch, or inch, according to the place where we transfix the ligament, is common to both of the newly formed round ligaments.

When there is a tendency to uterine prolapse, I suture the whole side of the fold of the ligament to the peritoneum beside the bladder, or even suture the portions of the round ligaments external to the folds to the parietal peritoneum in front.

When there is decided prolapse, I also stitch the infundibulo-pelvic ligament forward, the fundus uteri itself, and even take folds in the sacro-uterine ligaments.

Fig. 6.—Same as Fig. 5, showing one ligament.

When there is cystocele, I separate the remains of the urachus with a narrow strip of peritoneum, and after loosely twisting the flap thus obtained and drawing up the bladder, attach the flap into the abdominal wound. A complete description of this method was given in my paper on "Prolapse and Procidentia of the Uterus," read before the Third Pan-American Medical Congress in Havana, February, 1901.

Ferguson's method of shortening the round ligaments is, properly speaking, a prolapse operation. In it he has solved the problem of making the round ligament support a prolapsed uterus, and thus has improved on Nature's methods. Whether his results, which are good, will be permanent or not is for the future to decide. Ferguson makes a new channel for the round ligaments through the abdominal parietes higher up and nearer the median line than Nature has made, and draws the ligaments very taut. The movements of the uterus are more limited, but it is held up more firmly.

THE DIFFERENCE.—The young physician is most likely to err through his anxiety to "do something"; the older one because he has got into a rut.—*Med. Standard.*

THE MEANING AND SIGNIFICANCE OF LEUCOCYTOSIS.*

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This subject was first considered by the writer a number of years ago, when cases were noticed that failed to fulfill the requirements of the accepted definition of the term leucocytosis. Certain cases, and indeed the great majority, showed under well-known conditions a decided increase in the number of all the forms of leucocytes in the blood.

For a long time it had been believed that the polymorphonuclear forms were, in such cases, always in excess, and in 1897 Cabot accordingly formulated a definition of the term leucocytosis that has until recently served as the standard of teaching throughout the United States, at least. His definition was as follows: "An increase in the number of leucocytes in the peripheral blood over the number normal in the individual case, this increase never involving a diminution in the polymorphonuclear varieties, but generally a marked absolute and relative gain over the number previously present."

The experience of the writer has gradually led him, not only to question the accuracy of the above definition, but to call attention to certain forms of leucocytosis that have been noted by himself and other observers, but of which little has been written or said up to the present time. Actual cases seem to show that in at least two important respects Cabot's definition of 1897 is in error, viz.:

1. Leucocytosis should not necessarily imply an increase in the total number of leucocytes, even in the presence of an active inflammatory influence. The total number of leucocytes may be normal, or below normal in the individual, and a significant leucocytosis still be present, if there is a relatively high percentage of the polymorphonuclear cells. Such an increase implies that the same processes are at work as are suggested by a numerical increase in the total number of cells, and is of even greater import.

2. Notwithstanding the presence of inflammatory causes in the body, exerting influences that are sufficient to produce an absolute increase in the number of leucocytes, the percentage of polymorphonuclear forms may not only not be increased, but even diminished in the individual case, owing to other and more potent specific influences.

In discussing these forms of leucocytosis the terms relative and absolute will be used because they are now generally understood, and also because they have been employed in a similar sense in previous papers by the writer. By relative leucocytosis will be understood all forms of leucocytosis in which the polymorphonuclear forms are in marked excess of the normal percentage (70 to 75 per cent.). By absolute leucocytosis we will imply an increase in the total number of leucocytes in the individual case, irrespective of the percentages of the various forms.

RELATIVE LEUCOCYTOSIS.

This subject has been briefly referred to by the writer in several papers published during the past two years. Its apparent importance has grown with each new case in which it has been noted, until the conclusion seems warranted that not only do many cases occur in which a decided increase in the polymorphonuclear forms is

* Read at a meeting of the Philadelphia County Medical Society, Nov. 28, 1902.

evident in the absence of an increase in the total number of leucocytes, but that such a decided increase in the polymorphonuclear forms under these circumstances suggests either the presence of pus, or some other active inflammatory condition in addition to a grave loss of power in the natural resisting forces of the body.

Many clinicians have noted cases in which an absolute leucocytosis has been present and gradually fallen as the energy of the body gave way. Some have even gone so far as to make an occasional observation on such an occurrence. In the same chapter as has already been quoted Cabot says: "In some cases in which the absolute number of leucocytes is not increased we see a relative increase in the adult cells, pointing to the fact that influences are at work similar to those which produce an absolute increase."

Many others, before and since the foregoing was written, and among them Thayer at Johns Hopkins Hospital, have cited occasional cases in which the same theory has been demonstrated as true. Nearly every one has regarded these cases, however, as rare exceptions to the ordinary, and the necessity for being on the watch for a relative leucocytosis as a needless precaution. No one except the writer, up to the time of a recent and unfortunately personal discussion of the value of blood examinations in general, seems to have found the routine examination of the relative percentages of the leucocytes in ordinary conditions either of particular interest or worthy of their attention. At that time he endeavored to show that the blood was not thoroughly examined in any case until a differential count of the leucocytes had been made; and several cases were cited to demonstrate the value of the discovery of a relative leucocytosis of marked proportions. Since the publication of these articles it has been a source of pleasure to learn that in many different directions a renewed interest has been excited in the percentage of the various forms of leucocytes, though with considerable skepticism and doubt as to the value of such study. It would seem, therefore, not out of place at this time to again call the attention of clinicians as well as all blood students, to the value of relative leucocytosis as a clinical sign, and to study its actual significance.

No one will deny that in most cases of inflammation the polymorphonuclear leucocytes show an increase in number out of proportion to the other forms, at the same time with and in the presence of an increase of the absolute number of leucocytes. In such cases, as for example, the ordinary instances of intestinal inflammations, tonsillar infections, appendicitis, pleural and abdominal effusion, pneumonia, etc., the process is expected and regular, and the preponderance of the multinuclear forms becomes the more marked with the intensity of the infection and the increased efforts at resistance on the part of the tissues of the body. In such cases we may say, as we have had occasion to remark before, both the absolute and relative leucocytosis to be of any value must be weighed in close connection with the clinical symptoms, and must never be depended on to form a diagnosis or allowed alone to indicate operative or any other vital measures. The writer has, however, yet to see a case in which either an absolute leucocytosis has been present, followed by a fall to or below the normal number of leucocytes, with a persistence of the high percentage of polymorphonuclear forms; or in which there has been from the beginning a complete absence of absolute leucocytosis, and yet a decided increase in the percentage (85 to 100 per cent.) of polymorphonuclear

forms—to repeat, he has yet to see such a case in which there has not been found either a purulent collection, or some grave inflammatory process that threatens the life of the patient.

On the other hand, a considerable number of cases has been previously cited in which the truth of this assertion has been evidenced. The following, including several already mentioned, demonstrate both acute and chronic conditions in which the principle held true.

CASE 1.—A child, aged 8. This case presented a moderate absolute and a very high relative leucocytosis. This condition, as noted at the operation, would indicate that the resistance of the body was at a low ebb, and the absolute leucocytosis, therefore, not high. Forty hours previous to the blood examination she was well. Since then she had grown fretful, with pain in the abdomen. Had passed a few large round worms the day before, and vomited one. Her appearance was decidedly septic. Distinct pain and tenderness on pressure centered around the appendiceal region. Rigidity of the abdomen. Blood examination on Jan. 29, 1902, gave H. 74 per cent., r. b. c. 5,824,000, leucocytes 17,200, polymorphonuclear cells 96 per cent. No other pathologic changes in the blood. The operation showed a gangrenous appendix and a large quantity of foul pus in the abdominal cavity.

CASE 2.—A typhoid patient of six weeks' standing. This case illustrates the presence of a marked polymorphonuclear increase in the complete absence of absolute leucocytosis. The patient's general condition improved, and yet the fever chart showed that all was not as it should be; the high percentage of polymorphonuclear cells persisted until the physical signs and the operation demonstrated the presence of pus. In this case the typhoid influence was unfavorable to a leucocytosis, and yet, while it was not overcome sufficiently to allow of the production of an absolute leucocytosis, it was counteracted sufficiently to admit of a polymorphonuclear rise to 96 per cent. The temperature had several times reached normal, and for some days had been bounding up and down in a septic fashion. There had been no chill and no symptom over the body for some time since to account for the temperature. The blood examination, made for Dr. Morris J. Lewis (Jan. 9, 1902), gave H. 95 per cent., R. 4,960,000, L. 7,800; no differential count made. No malarial organisms. No pigmented leucocytes. Jan. 24, 1902, the blood showed H. 70-75 per cent., R. 3,832,000, L. 4,800. Polymorphonuclear cells 92 per cent. No other pathologic change in the blood picture. Condition continued without change and on Jan. 30, 1902, the examination showed H. 78 per cent., R. 4,962,000, L. 9,200, polymorphonuclear cells 92 per cent. On this day a slight bulging was made out in the apex of the vaginal wall. No abdominal tenderness or mass felt then or at any time previous. Operation showed a large ovarian abscess, from the pus of which a pure culture of typhoid bacillus was obtained. The blood examination made the day after operation (Feb. 6, 1902) gave H. 60 per cent., R. 4,320,000 and L. 7,900, the polymorphonuclear cells 72 per cent. This last examination was made by Dr. Longcope at the Pennsylvania Hospital, and, of course, after the pus had been evacuated. The case was reported in full by Dr. Lewis at a later date.¹

Case 3 demonstrated the influence of even a chronic suppurative condition on the percentage of polymorphonuclear cells, and this in the absence of an absolute leucocytosis. The patient was a Swedish girl, with a walnut-sized abscess of the axillary glands. Otherwise well. Blood examination before incision of glands (Feb. 10, 1902) gave H. 94 per cent., R. 5,220,000, L. 7,600, polymorphonuclear cells 94 per cent. No other pathologic blood changes. Blood examination on day following, H. 92 per cent., R. 5,232,000, L. 8,200, polymorphonuclear cells 78 per cent.

CASE 4.—Examined for Dr. F. A. Packard during convalescence from lobar pneumonia of several weeks' standing. Temperature irregular. Pneumonia still unresolved at the base of the lung. Symptoms indicate a pleural effusion, possibly of pus.

1. Amer. Jour. Med. Sc., October, 1902.

Blood examination (Feb. 11, 1902) gave H. 93 per cent., R. 5,264,000, L. 8,400, polymorphonuclear cells 96 per cent. No other pathologic changes. Pleural puncture was made, but no fluid was obtained. From this point on the patient improved steadily and rapidly. This case showed the condition of affairs that one would naturally expect with a mass of leucocytic infiltration in the chest, and throws light only on the novel action of the multinuclear cells in inflammatory processes.

Case 5 resembled in many ways Case 2, in that it occurred in a woman, and also in a typhoid case of weeks' standing. After a protracted course the temperature assumed a septic character, the patient appeared exhausted, an intense cystitis was present, and it appeared possible, if not probable, that a purulent collection was present, either as the result of typhoid infection or secondary to the bladder condition. The physical examination was equally negative with that in Case 2. The blood appeared thin, coagulation was slow; H. 48 per cent., R. 4,160,000, L. 14,200. The polymorphonuclear cells constituted 54 per cent. of the entire number of leucocytes. The Widal test was positive at this time. The case took a sudden turn for the better on the day following the blood examination, and by its subsequent history confirmed the suggestion of the low percentage of polymorphonuclear cells that neither pus nor active inflammatory influences were present in sufficient force to overcome that exerted by the typhoid infection in depressing the number and polymorphonuclear percentage of leucocytes. From that time on the convalescence was steady and complete.

This case was studied not long after the discovery of the purulent collection in Case 2, and with the latter constantly in mind. The presence of 14,000 leucocytes, with a polymorphonuclear percentage of only 54, will be considered subsequently in connection with the second point of our discussion.

This paper was nearly ready for publication when a sad and most striking instance of the occurrence of a high polymorphonuclear percentage with a steadily decreasing absolute leucocytic count, marked the almost certain time of perforation of the bowel in a physician well known to the profession and the public, and an intimate and cherished friend of the writer.

CASE 6.—A physician, 39 years of age, with a previous history that was negative except for a slight recurrent bronchitis, and for several undoubted attacks of appendicitis during the past eighteen months.

The writer saw him on Oct. 1, 1902, and, realizing that he was facing a serious illness, on the following day, because of close personal associations, transferred him to the care of Dr. Morris J. Lewis. The history of the past two weeks indicated typhoid fever, or a latent, increasing appendicitis, or both. The blood picture when first seen on Oct. 1, 1902, was H. 73 per cent., R. 4,880,000, L. 10,200. No malarial organisms. No pigmentation of leucocytes. No poikilocytosis. No differential count made. Widal test negative. On the following day the symptoms and physical signs suggested appendix trouble. The leucocytes numbered 10,400 and again 10,600. The polymorphonuclear count, however, showed only 74 per cent., and of small lymphocytes 17 per cent. Both of these blood examinations were made by the writer. On Oct. 2, 1902, Dr. Longcope examined the blood. The clinical symptoms still pointed to appendix involvement, rather than typhoid only. The Widal reaction was not yet perfect, though suggestive. On Oct. 5, 1902, doubtful spots were found; the appendix condition, for the first time, appeared secondary. The blood was again examined by the writer, who found the Widal test for the first time positive. The diazo reaction was strongly positive. The leucocytes numbered 9,800, the polymorphonuclear cells 77 per cent., the small lymphocytes were still 17 per cent. On Oct. 7, 1902, the leucocyte count rose to 14,900, and on the following day to 18,400. There was increasing tenderness in the right iliac fossa, and marked rigidity of the right rectus muscle. The appendix was removed. (A path-

ologic description of the organ will be duly reported by Dr. Lewis. It is sufficient to say that it presented unmistakable evidence of both chronic and acute inflammation.) The Widal test was again positive. On October 9 the leucocytes numbered 14,300; on October 10 14,100; on October 11 the temperature was 104 F., there was a marked chill, and the leucocytes fell to 9,900. The polymorphonuclear count was 86 per cent. No malarial organisms could be found. On October 12 marked signs of weakness; temperature fell to 100 F.; pulse feeble; profuse sweat; extreme abdominal distention and pain; leucocytosis. Polymorphonuclear percentage 91.6 per cent. Small mononuclear forms 4.2 per cent.

October 13.—Blood gave a pure culture of the typhoid bacillus.

October 14.—Wound opened in the lower portion. Marked distention. Profuse sweating. Leucocytes, 10,300.

October 15.—Leucocytes, 7,700.

October 16.—Leucocytes, 9,500. Polymorphonuclear forms 84 per cent. Small mononuclear cells, 10 per cent.

October 18.—Profuse sweating. Both legs slightly tender and swollen. Leucocytes, 7,300.

October 20.—Leucocytes, 8,800. No malarial parasites found.

October 22.—Marked distention and abdominal pain. Leucocytes, 10,000.

October 23.—Much distention, apparently confined to the colon. Leucocytes, 8,300.

October 24.—Marked distention. Leucocytes, 10,000. Polymorphonuclear cells, 86 per cent. Small forms, 8 per cent. During this day and the next severe pain in the left abdomen. Extreme distention. Considerable clear fluid removed from the abdomen. Vomiting. Temperature fell to 97 F. Leucocytes, 14,100.

October 26. Condition much improved. Wound healthy. Serum sweet. Leucocytes, 9,800. Extreme distention. Phlebitis distinct. Leucocytes, 12,250.

October 29.—Pain in left abdomen severe. Leucocytes 8,600.

October 31.—Pain on pressure to left of umbilicus. Appearance of collapse. Gas and fecal matter escaped from wound on examination. Leucocytes 10,100. Polymorphonuclear cells 83.3 per cent. Small mononuclear forms 13.2 per cent. Operation. Large perforation (size of half dollar) in under portion of transverse colon, and surrounded by a gangrenous area. Region around perforation appeared closed off by exudate and adhesions. Death occurred on the following day.²

The last case to which reference will be made is one that came under observation also within the last months, illustrating the same point, though in a different way.

CASE 7.—A woman, aged 38, of nervous habit, with a history of longstanding abdominal trouble. During the previous two years she had passed considerable quantities of blood in her urine; a lumbar operation was performed, and a movable kidney sutured in place. Since that time there had been constant and distinct signs of appendicitis until the autumn, when the patient was barely able to keep her feet. She was affected physically, nervously and mentally, and the right side of the abdomen was constantly rigid. With the progression of the case every symptom appeared to point to a collection of pus in the abdomen. The patient was delirious, the temperature that of a septic type, the abdomen rigid, and the history of a longstanding and neglected appendicitis, made the diagnosis of pus probable. The blood was examined just prior to the operation, with a view to confirming, and with no thought of questioning, the presence of pus. The blood picture was: R., 4,010,000; L., 9,400; polymorphonuclear cells, 89 per cent. No poikilocytosis, or other pathologic changes of the red cells. It was agreed before the abdomen was opened that if pus were present under the existing conditions there would probably be present a higher percentage of polymorphonuclear cells, and that the actual percentage (89 per cent.) could be accounted for by a simple inflammatory condition. This was found to be the case, and the operation revealed a long, chronically thickened appendix, containing about one-third of a teaspoonful of serous exudate.

Of course, in the light of cases cited in this paper, conclusions will, and should, be drawn. And yet conclusions should be carefully drawn or not at all. There is no one who will be tempted to say that we know or understand more than a fraction of the significance of relative leucocytosis. And yet, again, it seems certain that there is present in such a series of cases a pointed trend toward a connection between severe inflammatory conditions which appear in a system undermined and threatened with collapse, and a high polymorphonuclear count, especially in the presence of a marked decrease (gradual or sudden) in the absolute leucocyte count.

The most rational explanation of the fall of leucocytes and the persistence of a high polymorphonuclear percentage in cases of this nature appears to the writer to be the following:

In all inflammations and infectious processes the first and prompt tendency is toward phagocytosis, and in the procedure both the total number and the polymorphonuclear percentage of leucocytes increase. It appears that as long as the resistance of the body holds out the total number of leucocytes remains in excess of the normal. When tissue resistance gives way phagocytosis becomes less active, though not entirely done away with, and the total number of leucocytes diminishes. As long as phagocytosis is at all apparent, however, it shows in the increased percentage of polymorphonuclear forms, and at times this is excessive, even when vitality is so low as to be unable to furnish the slightest absolute leucocytosis. In other words, all the forms of leucocytes are diminished owing to the lack of phagocytic energy, which accompanies the loss of vitality in the tissues.

Of the leucocytes that still remain there must be a proportional excess of the adult forms as long as any tissue energy remains, since these forms are most actively concerned in the protective processes of the body, and are most in evidence at such a time. It can not be assumed because there has been an excess of polymorphonuclear forms that when the total number falls the polymorphonuclear forms only remain in excess. This is by no means the case in simple acute effusions, in evident pus collections or in pneumonia; on the contrary, with the decrease in the total number of polymorphonuclear percentage also falls, or, as in Case 3, the polymorphonuclear percentage falls with even a rise in the total number of leucocytes. Case 6 seldom showed an absolute leucocytic count of over 10,000, and only once did it rise to 18,000. For the greater part of the time, however, with a constantly low numerical count (4-10000) the polymorphonuclear percentage averaged over 85 per cent., and at the probable time of perforation registered 91.6 per cent. with a total numerical count of 6,400.

Case 7 showed no absolute leucocytosis, a decided though not extreme polymorphonuclear leucocytosis, in the presence of symptoms all of which indicated a purulent condition. Probably the extreme depression of the patient was the cause of the absence of an absolute leucocytosis. Certainly, I think the appendiceal inflammation accounted for the polymorphonuclear leucocytosis, though in the absence of a numerical total increase, and the fact that this polymorphonuclear percentage remained a moderate one (as has not appeared to be the case in the presence of pus) was of decided interest in the light of the actual findings.

At just what point to call the condition a significant polymorphonuclear increase presents a serious question. It seems safe to say that the cases already studied indicate 80 to 85 per cent. of polymorphonuclear cells as a suspiciously high percentage, and in the absence of an absolute leucocytosis a very serious one. Over 90 per cent. would appear to be still more indicative of active and grave inflammatory processes, and usually suggestive of purulent or other leucocytic exudates or effusions. Pneumonic consolidations give this picture, as may also acute and chronic pus collections, and nearly all septic intoxications. If in any of these conditions the absolute leucocytosis disappears, and the polymorphonuclear percentage continues high, we have a warning of overtaxed powers of resistance. As all powers finally give way even the polymorphonuclear percentage must fall, as it is the last sign of a worn-out energy. It is not safe to form iron-bound rules for new principles; but if any new principle seems to be well grounded on fact it is the one that urges scrupulous attention to a patient whose leucocytes show a high polymorphonuclear count in the absence of an absolute leucocytosis.

ABSOLUTE LEUCOCYTOSIS.

Far less need be said at the present time in regard to the occurrence of an increase in the total number of leucocytes in the blood under inflammatory and similar conditions. There is still in existence, as there always will be, a small body of men who persist in striking at the phantom of a leucocytosis that will diagnose a case or decide difficult operative questions. Needless to say they will wear themselves out in the effort and with no injury to the ghost that never assumed material form. The great mass of clinicians (and this term includes distinguished clinicians as well as a large class of so-called country doctors that are not a whit behind the city men

2. These notes are inserted owing to the courtesy of Dr. Morris J. Lewis, who will report the full clinical history elsewhere.

in energy and up-to-date methods of medical diagnosis) is learning to look on the occurrence of an absolute leucocytosis as only a clinical symptom, though sometimes a very significant one. It may occur in slight degree in absolutely healthy persons; it may also point to a fatal condition. In every instance the particular individual and the particular leucocytosis must be considered together in order to obtain any value from the study and in order to avoid error.

In many cases nothing new will be learned from the examination of the leucocytes; in many others invaluable information will be derived. Moreover, it can not be denied that in certain conditions even a pus collection may be so nearly walled off from the general circulation as to have no serious effect on the processes required for a seemingly healthy existence. Such an instance is seen in occasional large abscesses of the liver, especially the tropical form, which are known to have existed beyond shadow of doubt within active persons for years before evacuation. Sometimes these fail to cause an absolute leucocytosis, even though the resisting powers of the patient are good; and the explanation of its absence must lie in the fact that a membrane of such density is formed as to protect the circulation from the influence of the purulent process, and must in like manner prevent the very process necessary to the production of a leucocytosis. Just as fever, pain and swelling may all be absent in the presence of a pus collection surrounded by a dense fibrous membrane, so the absolute leucocytosis seems occasionally to fail, and for the same reasons. The writer has as yet, however, never seen a case of so-called walled-off abscess in any portion of the body that failed to present a relative leucocytosis of the polymorphonuclear cells.

It seems hardly necessary to state that the leucocytes vary normally from 5,000 to 10,000 in a single individual, and that digestion and exercise are two of the most common causes of such variation. Any text-book on the blood will advise the reader that a leucocytosis, to be significant, must be of decided proportions, and certainly an increase over the number normal in a given person. Most text-books, however, fail to state that the presence of a leucocytosis is one clinical sign, and that there is no clinical sign known to-day whose value is not to be estimated as part only of a complex picture. The fact is also usually overlooked that one examination of the leucocytes is not only unsatisfactory, but often misleading; and that frequent and even constant examinations must be made in order to obtain the full and certain value of any study of the blood. No number of leucocytes can be fixed at which we can say that pus or any other inflammatory or infectious condition is present. In one subject 20,000, in another 50,000, and in another double that number, of leucocytes will be found suggesting identical conditions, and yet each of these figures is suggestive of a certain order of process that will be still more strongly indicated by the complete clinical picture. There has never been a more untrue accusation than that the students of leucocytosis are endeavoring to decide on operative measures and make diagnoses that will rest solely on the blood picture. Such accusations are always made by men who have heard and believed the enthusiastic beginner, or who hear half a statement and lose the gist of the argument because they have not had time or interest to listen carefully or well. Such men make serious mistakes, as the result of a misuse of a valuable clinical sign, and lay the blame for a result for which they themselves are

solely responsible at the door of an innocent and valuable measure.

Perhaps one of the most pertinent suggestions given by an increase in the total number of leucocytes is obtained when constant examinations show either a persistently high count, accompanied by symptoms and physical signs that point to a localized process, or a gradually but steadily increasing count (total) under similar conditions. A gradually falling leucocytosis usually indicates a bettering of the general physical condition. We have already laid sufficient stress on the study of the polymorphonuclear percentage to fear that this last assertion will be misinterpreted. Occasionally every physical sign and symptom will abate and improve, and the total number of leucocytes fall to or below normal, though the actual condition is one of grave seriousness. In such cases the relative leucocytosis may be relied on to warn of impending danger; at this point all clinical symptoms and signs fail. Procedures must, in the light of our present knowledge, be undertaken that may not seem clearly warranted, and with the full knowledge that the interior of the body presents riddles that can not always be deliberately solved. Any and every leucocytosis should be looked on with grave suspicion, but with the full knowledge that it is only one clinical sign, and that clinical signs are only signs after all. The prevailing wind may cause them to point in the wrong direction. When this is fully realized the so-called dangers of blood study will have been lost sight of, and certain reluctant semi-students will fall into the line of those who use to full advantage every form of leucocytosis that may be found present, after a number of thorough examinations of the blood has been made. They will then no longer insist either that the breath sounds are always absent over a pleural effusion, or that a leucocytosis, when properly studied, is misleading. The experience of men who are to be trusted has too often proven both of these beliefs to be without foundation.

The final and all-important question is: "Of what clinical value is a leucocytosis to the practitioner?" The experience of the writer at the bedside and in the laboratory leads him to answer as follows. As long as the clinician considers first the physical signs, then the temperature chart and history of the case, and lastly the report of the laboratory examinations of all obtainable excretions and secretions, and finally all three in their proper relation to one another, just so long will he find the presence of a leucocytosis, whether absolute, relative, or both, of inestimable aid. Its presence or absence should never, let it be once again repeated, alone decide in favor of one diagnosis or form of treatment or another; or persuade the surgeon to operate unless other indications of convincing nature are present. But in their presence such evidence as a marked absolute or polymorphonuclear leucocytosis must assuredly bear great weight; and when followed day by day—as it should be in a serious case—a leucocytosis may point to the correct solution of a grave problem. Who knows but that what we have learned from the behavior of the leucocytes in cases such as have been presented may save to us precious lives such as that so recently lost to the medical profession and the world at large. Experience and desire were at a loss to ascertain either the state of affairs within the abdomen or the proper course to pursue; another hint in such a case is beyond price. In a sudden rise, or a steady gradual increase from hour to hour, or from day to day, we have a sign board that

means danger, and points to a careful study of physical signs. A leucocytosis never can indicate pus, or any other inflammatory condition, and should never be allowed to influence treatment in the absence of other equally convincing evidence.

In certain conditions a leucocytosis indicates the retention of considerable resisting power on the part of the patient, as in pneumonia; and in like manner in the presence of pus, the physician would fear to see the number of leucocytes fall while the purulent collection remained in the body. It is a different matter when the total number of leucocytes is low, and the polymorphonuclear percentage is very high. It may then be inferred that a grave condition is present, and it is fair to assume that the polymorphonuclear increase is the indicator of all that is left of resisting power on the part of the body. Let this loss of tissue energy decrease still further and if the principle hold true even the polymorphonuclear increase must fall with the complete collapse of phagocytic action. We have still much to learn from the study of actual cases, but we have progressed far enough to lay hold of certain indications that will be valuable when other signs have failed. It is warrantable to state that no case has as yet been observed in which normal processes have been accompanied by such a blood picture.

ABSOLUTE LEUCOCYTOSIS IN THE ABSENCE OF POLYMORPHONUCLEAR INCREASE.

Case 6, as already noted, furnishes at least one instance of the occurrence of a moderate leucocytosis (absolute) in the absence of an increase in the number of multinuclear cells. (See footnote at end of article.) Just what significance to ascribe to this is not easily determined. There were present a typhoid infection that would tend to diminish the absolute number of leucocytes (which it failed to completely do), and the polymorphonuclear percentage, and also a cystitis that would have the opposite influence. The result seems to have been a compromise. Probably the typhoid infection was by far the most potent influence, and certainly it was the one that at that time dominated the system. The cystitis was also, no doubt, of typhoid origin; and yet the pus formation must have been so local in its influence, and so completely drained through the ready outlet through the urethra, that the suppuration had little or no influence on the general economy in comparison with the typhoid poison. Occasional cases of typhoid fever, and, in fact, certain normal persons, present an average leucocytic count of several thousand above the customary figure (5,000 to 10,000), and 14,000 in this case may not have been a leucocytosis. It appears more likely, however, that it did represent the slight influence of the local suppuration on the blood and tissues, held in check by the typhoid infection. Other and similar cases have been noted in which the absolute leucocytosis was even of a less degree and therefore even more questionable.

CONCLUSIONS.

The following conclusions seem warranted:

1. The term leucocytosis must include every increase in the absolute number of the leucocytes of the blood examined, as well as every increase in the percentage count of the various leucocytic forms.
2. A leucocytosis, of whatever nature, must always be regarded as a clinical sign of importance, but never of such weight as to influence against equally convincing physical signs.
3. A high percentage of the polymorphonuclear forms in the absence of an absolute leucocytosis indicates the

presence either of pus or of some grave inflammatory process, together with a low vitality of the patient.

4. Specific factors may rarely exert such an unusual influence as to interfere with the customary reaction of the polymorphonuclear cells. At least one instance has been noted in which the total number of leucocytes was increased at the same time with a marked reduction in the number of the polymorphonuclear forms. This condition is, probably, seldom encountered.*

5. Single counts of the leucocytes, or single estimations of the leucocytic percentages are often misleading; while a persistent series of observations will seldom fail to aid in the diagnosis and treatment of the condition.

6. A gradual, but steady, rise in the total count of leucocytes above the customary number usually indicates the presence of an active and augmenting inflammatory influence. When this increase reaches large proportions it may be looked on as an indication of the presence of an active leucocytic process (seroses or purulent effusion, localized pus collection, pneumonic exudate, etc.), provided the clinical picture also bears out the suggestion.

IS THE CONSUMPTIVE CHEST FLAT?

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Some years ago, in the course of a study of the diseasabilities of the human as compared with the animal chest, I was led to take some measurements of the diameters of the human chest at various ages and in certain diseases. The results of these were somewhat unexpected, and led to further researches, of which a preliminary report was read before the Philadelphia meeting of the Association in 1897, and published in *THE JOURNAL of the American Medical Association*, Sept. 11 of that year.

Since that time I have been gradually accumulating further data, though unfortunately delayed by a period of impaired health, and as these are now sufficient in number to give a reasonable probability of correctness to deductions drawn from them, I have ventured to again report progress through the columns of *THE JOURNAL*. A short résumé of the position taken in my former paper will be necessary to clearness.

My views may be briefly summed up in the statement that the tuberculous chest instead of being flat is really round; that the antero-posterior (sagittal) diameter, instead of being diminished relatively to the transverse, is, on the contrary, increased, so that the term "flat-chested," as applied to the consumptive, is really a misnomer.

So far as I have been able to discover, no text-book—with the exception of the last edition of Cabot, which mentions my findings—or other authority on physical diagnosis supports this view; on the contrary, most of them directly controvert it. Manual after manual of physical diagnosis repeats, parrot fashion, the time-honored statement that the typical tuberculous chest is flat, in support of which is shown one ancient drawing of what I am strongly tempted to regard as a purely ideal

* Since the preparation of this paper the writer has had the privilege of studying a case of appendiceal abscess, yielding a pure culture of the colon bacillus, in which later an abscess formed posterior to the bladder, and still later another posterior to or within the liver, the pus from both of which also gave a pure culture of the same organism. The total count of the leucocytes varied from 20,000 to 46,000, and at no time was the polymorphonuclear percentage above 80, usually ranging from 70 to 75 per cent. The influence of the colon bacillus on leucocytosis will be discussed in a later full report of this case.