burners, which are supplied from a common gas-pipe, we find that by moving the Bunsen disc toward the right-hand burner and looking at the right-hand side of the disc we soon reach a point where the periphery of the disc is lighter than the translucent centre, in other words, a point where the light reflected from the opaque periphery of the white disc, which comes from the right-hand burner, is greater in intensity than the light from the left-hand burner which is transmitted through the translucent centre, and by moving the disc toward the left a point will soon be found where the centre of the disc and the periphery appear alike, that is, where the light from each side is equal, and if the apparatus is properly adjusted, this point will be in the middle of the bar. With the instrument in a dark room, if we place a standard red lens at less than its focal distance, say one and a half inches, in front of the left-hand burner and the lens to be tested at the same distance in front of the other, so that their axes are in line with the centre of the openings in the shields, we shall find the disc will have to be moved toward either one or the other ends of the bar to get a point where the light from the two lenses is equal, as the lens to be examined will probably not transmit exactly the same amount of light as the standard lens. If the disc has to be moved toward the standard lens it shows that the new lens is lighter than the standard, and *vice versa*, and an arbitrary limit of from eighteen to twenty-two inches on this bar, measured either way from its centre, can be taken as a range of variation that can be allowed with safety. The standard lens is selected as transmitting a dominant wave-length of about 700000000 mm., and having a medium intensity of color.

Such an instrument is now in use on the Burlington System, and by this means the red lenses can be quickly and easily inspected.

THE MYELOCYTE OF EHRLICH.¹

BY RICHARD C. CABOT, M.D.

DEFINITION AND MORPHOLOGY.

THIS cell seems to have been separately described by several different observers, each of whom gave it a different name. Cornil seems to have been the first to recognize it,² but Ehrlich described it more fully, and, believing that it originated in the marrow, gave it the name of "myelocyte" or marrow cell, by which it is more generally known. Müller dwelt particularly on the vacuoles and karyokinetic figures so often found in it.³ It is usually described as a very large cell, three or four times the diameter of a red cell or even larger, round, and containing a large, faintly-staining, round or oval nucleus, which usually lies eccentrically. The protoplasm is filled with fine, irregularly-shaped granules, which, when stained by Ehrlich's method, are neutrophilic, and take a reddish-violet tinge, the nucleus staining light blue or greenish blue.

My study of these cells, both in leucemia and in other diseases (where they are by no means rare) has convinced me that this definition and description needs modification in several details.

¹ Being a portion of the work done under the terms of the Dalton Scholarship, 1894-5.

² Calling it "cellule medullaire."

³ Hayom called them "Globules blanches hypertrophées." Mosler (Berl. klin. Woch., 1876, p. 701), Eisenlohr (Ebenda, vol. lxxiii, p. 56) and Eberth (Virchow's Arch., 1868, vol. xliii) described them without attributing to them any special significance in the blood.

(a) Size.

The literature of this subject is very vague upon this point. Osler in the new "Pepper's System of Medicine" accepts Ehrlich's description of them as of the same size as the (non-granular) large mononuclear leucocytes. Turning to his description of these latter to find how large they are, we find no statement at all upon the subject. The colored plate gives two pictures of the large mononuclear, which are of different sizes, one being of the same size as the "polynuclear" cell adjacent, while one is considerably larger.⁴ Now this detail of the exact size of the so-called myelocyte would seem to be a matter of no particular importance, but any one who has examined a specimen of leucemic blood stained by Ehrlich's method, will recognize the fact that it is very difficult to make a differential count of the percentage of myelocytes. This difficulty arises from the fact that there are present in leucemia blood cells exactly corresponding in nuclear and staining properties to the myelocyte as above described, but varying in size from that of a red cell (7.5μ) up to 20μ or even 25μ . Now how many of these cells are we to consider and count as myelocytes? Inasmuch as there occur very appreciable percentages of myelocytes in other diseases (*vide infra*), and inasmuch as the large percentage of these same cells in leucemia may be the only fact on which the diagnosis of leucemia is based, it might be of considerable diagnostic and prognostic importance to know just how many of these cells we are to count as myelocytes in a given case.

I have measured cells corresponding in other respects to the description of myelocytes usually accepted, which had a diameter of 7, 7.75, 8.50, 9, 9.25, 10 and 12μ , and so on up to 23μ , which is the largest white cell I have ever seen in the blood. It seems perfectly arbitrary to specify any one of these figures or say of the myelocyte "Thus small thou mayst be, but no smaller."

Now some of the definitions of myelocytes add to their descriptions of the cell the words, "Such as are found in the marrow." In hopes of finding some traits by which to distinguish the true marrow cell from those resembling it, I have studied the bone marrow of four cases taken at random from autopsies. I will not go into any details as to what was found there, except to state that there was precisely the same range of variation in the diameter of (otherwise) typical myelocytes found in the marrow, that I have alluded to in those found in the blood. Large, small and middle-sized neutrophilic mononuclear cells are present in the marrow in approximately the same proportions, relatively to each other, as in living blood.⁵

It appears therefore that the study of the marrow only confirms what was suspected from the examination of fresh blood, namely, that there is no possibility

⁴ Other writers are equally vague: for example, Klein says, "Very large round or ovoid neutrophilic cells, etc." (Volkmann, Samml. klin. Vorträge, 1893, 8); Thayer, "Large mononuclear elements in which the protoplasm is filled with fine neutrophilic granules" (Boston Medical and Surgical Journal, p. 183, vol. cxxviii, 1893); Rieder gives no exact description of the cell, and his pictures are very diagrammatic; v. Limbeck, "Large Mononuclear cells with pale nucleus, etc."

⁵ The marrow blood was obtained by sawing in halves one of the dorsal vertebrae and squeezing one-half in a vise until blood exuded upon the surface. From this blood cover-slips were prepared in the usual way; the presence of fat in the blood makes the process of staining more difficult, but not impossible. Large portions of each slide were filled with cells injured past recognition by the technique, but there were still many fields full of intact and well-stained cells, fit for study. I add these particulars because something has been said of late of the difficulty of getting good smear-preparations from the marrow.

of distinguishing myelocytes from other cells by size alone, except arbitrarily.

(b) *Shape.*

Since myelocytes are very slightly if at all ameboid, and those cells with which they are most likely to be confounded (the "polynuclear leucocytes") are actively ameboid, it might be supposed that, on account of the putting out of pseudopodia by the latter, some differentiation might be made by shape. The myelocytes would naturally show the round (or rather spherical) shape of all non-ameboid leucocytes, while the polynuclear cells would be more or less irregular in shape.

And, indeed, I have found it true that a larger proportion of the (presumable) myelocytes are spherical than of the "polynuclear cells." But there are also many polynuclear cells which are (so far as the microscope shows) spherical, and this circumstance, together with the fact that the myelocytes are often more or less deformed or misshapen by the technique of spreading the blood, makes it impossible to distinguish sharply between two kinds of cells by their respective shapes.

(c) *Staining Properties, Number and Shape of Nuclei, and Their Relation to the Cell Body.*

As the granular protoplasm of the myelocytes and "polynuclear cells" is by definition identical in appearance ("neutrophilic") there remains nothing by which the myelocytes could conceivably be differentiated except the number, shape, and color of the nuclei, and their relation to the whole cell.

(1) *Number of Nuclei.*—Now the myelocyte is often described as mononuclear, the nucleus being round or oval; but the admission by Osler that Müller's cells with their mitoses (partial or complete) are identical with the myelocytes of Ehrlich shows that he allows the possibility of more than one nucleus in a myelocyte.⁶ In fact the writer has repeatedly found in the blood of leucemia, cells so large that no one would hesitate to call them myelocytes, neutrophilic, and having all the characteristics of typical myelocytes, yet which showed a faint but indubitable division of their large, pale nucleus into two portions. Klein⁷ admits that a myelocyte may have two nuclei and gives a picture of such a cell in his plate.

But if myelocytes can be "polynuclear" and if they are, as every one agrees, neutrophilic, how can they be distinguished from the ordinary "polynuclear neutrophilic" cells of normal blood? Size and shape will not serve us as marks of differentiation; granulation is confessedly identical in both; both may show one or two nuclei. What is left to enable us to tell them apart in case of doubt?

(2) *Staining Properties.*—The staining properties of the nucleus are left, as well as its shape and its relation to the whole cell body; and these characteristics, although by no means satisfactory in every case, yet seem to the writer the best differential marks we have in difficult cases.

The nucleus of typical "polynuclear cells" stains darker and more irregularly than that of the myelocyte in a great majority of cases.⁸

With this stain the nuclei of the myelocytes stain a purplish or greenish blue, always faint, and almost always *even* all over the nucleus.⁹ Its edges are well marked in some cases, hazy in others, but never so violently contrasted with the surrounding protoplasm as is the rule with the polynuclear cells.

The latter, on the other hand, are very irregular in their staining. It is rare to find a nucleus in a polynuclear cell that has not some dark indigo-blue and some much lighter portions. Sometimes the pigment shades gradually from very dark-blue to light. In other cases it is irregularly clumped in spots and patches of indigo on a light-blue ground.

This difference in staining properties is one of the most constant in the respective characters of these two cells. It is not, however, invariable. There occur cells in the blood, which from other characteristics we may guess to be "polynuclear," yet whose nuclei stain precisely in the same pale, even way as those of the myelocytes. In the writer's experience such cells have seemed to be more common in the blood of septic or cachectic conditions. Understaining or overheating may produce similar results, but here the mistake affects all portions of all cells to a greater or less extent, and is easily recognized by any one familiar with color analysis.

In cases where we can rule out our overheating or understaining and where some of the polynuclear cells have nuclei staining exactly like those of myelocytes, we have to fall back on to the last two criteria of which I shall speak, namely:

(3). *Shape and Relation to the Whole Cell.*—In the great majority of cases the nucleus of a polynuclear cell presents a twisted or broken appearance wholly different from anything seen in myelocytes and where the size, shape of the whole cell and color of the nucleus fail us as criteria, this contorted or fragmented look about the nucleus will generally help. It is true that in some cases the nucleus of the polynuclear cell is short, thick, and rod-shaped, or comma-shaped, or even in some cases simply oval, like the myelocyte, but if so, it is here generally deeply stained and centrally placed, for it is also characteristic of the polynuclear cell that the nucleus is rarely if ever in close juxtaposition to the surface of the cell for any considerable part of its length. It may approach the surface of the protoplasm for a short distance, but if so it almost invariably turns away again at once. Whereas the round or oval nucleus of the myelocyte is apt to run along near the surface of the cell for a comparatively large part, or even the whole of its *visible*¹⁰ extent.

Let us sum up what has been said thus far:

(1) Size is no criterion for judging that a given cell is a myelocyte, for there occur cells of all sizes resembling myelocytes in other respects.

(2) Shape is no criterion, as ameboid and non-ameboid cells are alike spherical in most cases when seen in stained specimens.¹¹

(3) Number and shape of nuclei is no final criterion in the following proportion: Biondi powder, ten grains; Aquo destill., 6 cubic centimetres; alcohol, one cubic centimetre.

⁶ The nucleus sometimes shows round transparent areas like vacuoles, often a well-marked network indicating the nuclear structure.

⁷ It may be that the nucleus of the polynuclear cell when it dives down out of sight in the body of the cell may continue the close acquaintance with the cell limiting-wall which it has appeared to sever. But so far as we can see with the microscope, this is not the case.

⁸ Myelocytes are very slightly, if at all, mottled, and "polynuclear" cells are distinctly mottled, but this criterion is not applicable to stained specimens, in which alone can any accurate differential counts be made.

⁶ H. F. Müller (Dad. Arch. für klin. Med., 1891, vol. xlviii) describes myelocytes as occasionally having two nuclei.

⁷ Volkmann's Sammlung klinischer Vorträge, December, 1893.

⁸ It is important for the observer to use always the same make of stain in comparative observations. The writer has used in all cases the "Blondt powder" purchased of H. Grübner, Leipzig, and mixed

tion, for myelocytes may have either one or more nuclei and "polynuclear" cells may have a single oval nucleus.

(4) The staining characteristics of the myelocyte nucleus (pale and even) are generally to be contrasted with those of the cell most resembling it (the so-called "polynuclear" cell), whose nucleus stains dark and unevenly. But this criterion will not always serve.

(5) The shape of the myelocytic nucleus (round or oval) is generally to be contrasted with that of the "polynuclear" cell (twisted, broken), and where this differentiating mark is not present, we have usually

(6) The comparative juxtaposition of the nucleus of the myelocytes to the surface of the cell, to guide us in distinguishing them from the "polynuclear" cells whose nucleus is more centrally placed, or if it approaches the surface, quickly leaves it again.

It merely remains to be said that these last three marks of differentiation (on which the writer is driven to rely in many cases by the absence of any better criteria) are doubtless somewhat arbitrary and minute differences, and further that even these do not serve us in all cases. When all is said, there remain cells where it is impossible to say (with Ehrlich's stain¹²) whether they are myelocytes or polynuclear cells. The writer simply suggests these criteria as the only ways of identifying myelocytes *in case they can be identified at all*. Whether they are sufficient criteria he cannot say, but they seem to be the best there are if Ehrlich's stain is to be relied on.¹³

Klein¹⁴ describes what he calls "small mononuclear neutrophiles" in leucemia, and pictures them as exactly like myelocytes, but smaller.

He gives us no idea how they are to be distinguished from small myelocytes. Thayer¹⁵ states that they are occasionally found in a variety of diseased conditions, and even in health, but thinks they can be distinguished by the staining properties of the nucleus. Such properties however are not brought out so far as I know by Ehrlich's stain or by any stain with which a color analysis is possible.

So far the differentiae between myelocytes and "polynuclear cells" have chiefly occupied us, but in a small number of cases there arises difficulty in distinguishing myelocytes from lymphocytes or large mononuclear cells. I refer to the rare cases observed occasionally where there are present (in specimens not overheated or understained) cells where it is impossible to be certain whether their protoplasm be "granular" or not.

Generally a high power of the microscope makes the question clear. A cell is either clearly granular, or it is free from granules. But there occur cells in regard to which with the highest power of the microscope we cannot decide—unless arbitrarily—whether we are to call them "granular" or not. We may see a few, or a great many very faint granules scattered over the surface of a cell which lies side by side with a number of well and characteristically stained leucocytes. Do these few faint-pinkish granules constitute a neutrophilic granulation? If not, how granular must a cell be in order to be called neutrophilic? Luckily these cells are very rare and do not often puzzle us.

¹² Loc. cit.

¹³ Other stains, such as those used by H. F. Müller (Loc. cit.) bring out some of the characteristics of the myelocytes better but fail in other respects.

¹⁴ Loc. cit.

¹⁵ Oral communication.

In conclusion of this portion of my subject I suggest the following definition which will be used in the remainder of the work.

A myelocyte is a spherical, neutrophilic cell, varying in diameter from 7μ to 20μ or more, and characterized by the presence of one (or rarely two) nuclei which stain faintly and evenly with a purplish or greenish-blue color, are generally round or oval, often vacuolated and are in close relation to the surface of the cell for a comparatively large portion of their extent.

THE MYELOCYTE IN LEUCEMIA.

Osler mentions as remarkable (in his essay on "Diseases of the Blood" in the "American System of Medicine," 1894) that 25 per cent. of the total white corpuscles were found to be myelocytes in one of his leucemic cases. In nine cases which I have studied there has seldom been a count of myelocytes so low as that here reported as remarkably high. I am unable to account for this divergence. I had at first the impression that the author might have deducted from his column of myelocytes all the smaller forms which I have included (*vide infra*) under the heading of small myelocytes, and added them to his "polynuclear" cells; but in that case his count of these latter would have been larger.¹⁶ However this is to be accounted for, it appears to the writer that the percentage of myelocytes in leucemia is generally much higher than one would suppose from Osler's essay.

In 11 cases my results are as follows, 600 cells being counted each time:

CASE I. M. M., twenty-seven, single.

Large myelocytes (over 15μ diameter)	8%
Small myelocytes (under 15μ diameter)	43
"Polynuclear neutrophiles"	44
Lymphocytes	1.5
Large mononuclear	1
Eosinophiles	2.5 100%

CASE II. J. H., forty-one.

Large myelocytes	8%
Small myelocytes	52
"Polynuclear neutrophiles"	26
Lymphocytes	8
Large mononuclear	1
Eosinophiles	5 100%

CASE III. N. A.

Large myelocytes	10%
Small myelocytes	45
"Polynuclear neutrophiles"	32
Lymphocytes	4
Large mononuclear	4
Eosinophiles	5 100%

CASE IV. E. N., thirty-five, single.

Large myelocytes	6%
Small myelocytes	26
"Polynuclear neutrophiles"	55
Lymphocytes	5
Large mononuclear	4
Eosinophiles	4 100%

CASE V. M. S., twenty-three, married.

Large myelocytes	4%
Small myelocytes	29
"Polynuclear neutrophiles"	61
Lymphocytes	3
Large mononuclear	0
Eosinophiles	3 100%

CASE VI. H. F., fifteen.

Large myelocytes	4%
Small myelocytes	46
"Polynuclear neutrophiles"	46
Lymphocytes	2
Large mononuclear	.5
Eosinophiles	1.5 100%

¹⁶ See the full report of a similar case in Thayer's article in the Boston Medical and Surgical Journal, 1893, vol. cxxviii, p. 183.

CASE VII. A. S., forty-seven, widow.

Large myelocytes	4.4%
Small myelocytes	20
" Polynuclear neutrophiles "	50.6
Lymphocytes	18.9
Large mononuclear	0
Eosinophiles	6.1 100%

CASE VIII. M. S.

Large myelocytes	4%
Small myelocytes	22
" Polynuclear neutrophiles "	37
Lymphocytes	23
Large mononuclear	6
Eosinophiles	8 100%

CASE IX. C.

Large myelocytes	22.7%
Small myelocytes	25.3
" Polynuclear neutrophiles "	46
Lymphocytes	1.5
Large mononuclear	.5
Eosinophiles	4 100%

CASE X. S. R.

Large myelocytes	14.6%
Small myelocytes	24
" Polynuclear neutrophiles "	49.6
Lymphocytes	3.6
Large mononuclear	2.2
Eosinophiles	6 100%

CASE XI. N. One thousand cells counted.

Myelocytes	30.3%
" Polynuclear neutrophiles "	62.3
Lymphocytes	3.8
Large mononuclear	1.8
Eosinophiles	1.8 100%

The labor of making these counts was very great on account of the design of measuring a large number of myelocytes to ascertain whether they were "large" (over 15μ) or "small" (under 15μ). The measuring was done in the following manner: a stage micrometer ruled to a hundredth of a millimetre was put under the oil immersion lens γ₂, with a No. 3 ocular (Zeiss) and a tube 160 mm. long, of the ordinary length of the tube in a Zeiss or Leitz stand. Using a camera lucida and keeping the drawing perpendicularly under the mirror, the divisions of the micrometer were traced on paper as they appeared under this magnifying power. Approximate accuracy was secured by repeating the process until several successive drawings so made, exactly corresponded with each other in the distance between the divisions as traced with the camera.

Fig. 1.

Fig. 1 is a copy of the tracing so obtained. The next step was to carefully divide each of these sections into 10 smaller sections as shown in Fig. 2.

Fig. 2.

This done, we have a ruler, each division of which corresponds to 1μ as seen under the magnifying power above mentioned. To measure any cell, we have only to draw it carefully with the camera and with the same magnifying power, and measure the drawing with our "μ ruler."

THE MYELOCYTE IN DISEASES OTHER THAN LEUCEMIA.

Klein^{1a} gives the following list of diseases in which the myelocyte in small numbers has been found: Uremia, diabetes, syphilis, carbonic-acid poisoning, puerperal mania, sarcoma, osteomalacia, Basedow's disease, also in menstruation. J. J. Thomas has found them in myxedema. Capps has found them in general paralysis.

The present writer has found small percentage of typical large myelocytes (over 15μ in diameter) in the following affections:

	Cases.
Pernicious anemia (out of a total of 20 examined),	17
Sarcoma	3
Cancer	5
Burns (large surface)	2
Osteomyelitis	2
Malaria, with anemia	1
Cystitis and chronic starvation	1
Septicemia	3
Bone tuberculosis	1
Rickets	1
Hodgkin's disease	2
Addison's disease	1

He has also found small myelocytes in healthy infants, under ten days, three cases.

In all these cases some of the myelocytes were drawn with camera lucida and carefully measured.

The largest percentage of typical myelocytes seen in any case was in one of the cases of pernicious anemia, which went out of the hospital afterwards much improved and with nearly 4,000,000 red corpuscles, but subsequently died. When seen by the writer he had but 1,073,000 red corpuscles. A differential count of 500 leucocytes showed

Typical myelocytes (over 15μ diameter.)	4.6%
Large mononuclear and transitional	3
Eosinophiles	69 ⁴
" Polynuclear neutrophiles "	23 100%
Lymphocytes	23

This man showed also a variation in the diameter of the red reaching from 2.5μ to 19.6μ (the normal red corpuscles varying between 6μ and 9μ). The next highest count of typical myelocytes was in a case of sarcomatosis, a man in whom sarcomatous nodules were distributed all over the internal organs and in the skin. A differential count of 700 white cells showed in his case

Typical myelocytes (over 15μ)	2%
Small myelocytes (under 15μ)	5
Small lymphocytes	19
Polynuclear neutrophiles	70
Large mononuclear and transitional	3
Eosinophiles	1 100%

The autopsy showed no special lesions in the spleen, glands, or bone marrow, except those due to the sarcomatous nodules.

It is true that under arsenical treatment the number of myelocytes in leucemia may be very greatly reduced as Osler has pointed out ("Practice of Medicine," p. 703), but here it would not be likely to lead to a mistaken diagnosis. Greater difficulty would arise were we to come across a case of leucemia in an early stage. Among all the cases on record so far as I can ascertain, none is mentioned in which the number of myelocytes in the blood has been watched while developing into the condition typical of splenomyelogenous leucemia. Cases have not as yet come under observation in this particular until "full fledged," so to speak. Although presumably there are stages in which the blood would be indistinguishable from that present in some of the various non-leucemic conditions noted above.

^{1a} Loc. cit.

The presence of myelocytes in the two cases of pseudo-leucemia mentioned above is interesting, particularly as one of them showed a considerable leucocytosis. The count in this case was as follows: red corpuscles, 5,500,000; white corpuscles, 64,000; ratio 1 to 96. Hemoglobin, 75 per cent. Differential count of 500 cells showed:

"Polynuclear neutrophiles"	92.6%
Lymphocytes	3.6
Large mononuclear	1.6
Small myelocytes	2
Large myelocytes	.2 100%

Now in none of these cases is there any reason to think of leucemia. In many the absolute proof of the autopsy is against it, yet the fact that pernicious anemia shows these cells in a large majority of all cases (as will be demonstrated in a later article) seems to point to their dependence on an abnormal condition of the blood-making organs and also to that close relationship between leucemia and pernicious anemia, which is suggested by the rare but well-certified cases of a transition from the one condition to the other.

In most of the other non-leucemic cases in which I have found myelocytes, a considerable degree of anemia and cachexia has been present. In one case, however, which I have put down as "cystic and chronic starvation," the presence of from two to five per cent. of myelocytes, with a moderate leucocytosis, but without any anemia, puzzled me very much. The patient entirely recovered, the myelocytes and the leucocytosis disappeared and there has been no return of any of the symptoms. It is now eight months since the illness.

The writer has no theory to explain the presence of these myelocytes in various diseases, and merely wishes to point out that they are by no means peculiar to leucemia, and that it is only a large percentage that is indicative of that disease.

In the other pseudo-leucemic case the blood showed: red corpuscles, 4,210,000; white corpuscles, 3,300. Differential count (500 cells) showed one per cent. of myelocytes.

These cases would seem to support the French theory that pseudo-leucemia are really early cases of leucemia, which if they live long enough will change to true leucemia. But the fact that myelocytes are frequently present in so many other conditions leads one rather to suppose that their presence in these pseudo-leucemic cases is due to the exhaustion common both to them and the other conditions next to be mentioned.

MALIGNANT DISEASE.

Cancer.

CASE I. Extensive abdominal cancer; great cachexia. Six hundred cells showed:

"Polynuclear neutrophiles"	89.4%
Lymphocytes	5
Large mononuclear	5
Eosinophiles	.1
Myelocytes (3 in 600 cells)	.5 100%

CASE II. Cancer of uterus; marked cachexia and leucocytosis. One thousand cells showed:

"Polynuclear neutrophiles"	82.3%
Lymphocytes	11.7
Large mononuclear	5.6
Myelocytes (4 in 1,000 cells)	.4 100%

CASE III. Cancer of uterus; died two days later. Red corpuscles, 7,000,000; white, 62,000. Consider-

able stasis helps to explain the count. Differential count of 500 cells showed:

"Polynuclear neutrophiles"	93%
Lymphocytes	4
Large mononuclear	2
Eosinophiles	0
Myelocytes (5 out of 500)	1 100%

CASE IV. Cancer of liver, jaundice and cachexia; died soon after. Differential count of 500 cells showed:

"Polynuclear neutrophiles"	92%
Lymphocytes	3.4
Large mononuclear	2.6
Small myelocytes	1.2
Large myelocytes (4 in 500)	.8 100%

CASE V. Cancer of abdomen; cachetic. Differential count of 1,000 cells showed:

"Polynuclear neutrophiles"	82%
Lymphocytes	8.5
Large mononuclear	8.1
Eosinophiles	1
Myelocytes (4 in 1,000)	.4 100%

CASE VI. Cancer of stomach, liver, etc., with perforated stomach; cachexia. Leucocytosis, 105,000. Fifteen hundred cells showed:

"Polynuclear neutrophiles"	90.7%
Lymphocytes	2.4
Large mononuclear	2.4
Eosinophiles	.2
Myelocytes (68 in 1,500)	4.3 100%

Sarcoma.

CASE I. Sarcoma of abdominal wall. Differential count of 800 cells showed:

"Polynuclear neutrophiles"	84%
Lymphocytes	10.5
Large mononuclear	5
Eosinophiles	.2
Myelocytes	.3 100%

CASE III. This is the sarcomatous case above mentioned with 7 per cent. of myelocytes.

BURNS.

CASE I. A severe extensive burn in process of healing; 1,000 cells showed:

"Polynuclear neutrophiles"	76.1%
Lymphocytes	17
Large mononuclear	4.1
Eosinophiles	.8
Myelocytes (20 in 1,000 cells)	2 100%

CASE II. Similar to Case I. Eight hundred white cells counted showed:

"Polynuclear neutrophiles"	74%
Lymphocytes	18.1
Large mononuclear	7
Eosinophiles	.3
Myelocytes (5 in 800 cells)	.6 100%

OSTEOMYELITIS.

CASE I. Five hundred white cells counted:

"Polynuclear neutrophiles"	63.8%
Lymphocytes	27.4
Large mononuclear	5.2
Eosinophiles	2.4
Myelocytes (6 in 500 cells)	1.2 100%

CASE II. Five hundred white cells counted; boy eight years, necrosed tibia:

"Polynuclear neutrophiles"	50%
Lymphocytes	35
Large mononuclear	10
Eosinophiles	3.4
Myelocytes (1 in 500 cells)	.2 100%

MALARIA.

CASE I. During chill 200 white cells counted:

"Polynuclear neutrophiles"	78%
Lymphocytes	12
Large mononuclear	7.5
Eosinophiles	.5
Myelocytes (4 in 200 cells)	2 100%

CYSTITIS AND CHRONIC STARVATION.

The case alluded to above was never anemic, and never very sick. Made a rapid recovery, which has persisted now eight months. There was at the first count a leucocytosis of 15,100; part due to cyanosis, as she had just been having a chill. The red cells were 7,300,000. Hemoglobin, 87 per cent. Differential counts were as follows:

	May 2	May 6	May 7	May 8	May 13
	800	1,000	400	400	1,000
"Polynuclear neutrophiles"	82.7%	82.2%	83.6%	80.2%	68.5%
Lymphocytes	8.6	12.5	9.4	11.3	25.2
Large mononuclear	8.2	1.5	2	6	.6
Myelocytes	.5	3.5	4	2.5	.5
Eosinophiles	.0	.3	1	0	

SEPTICEMIA.

CASE I. Deep abscess of neck; chills. One thousand white cells showed:

"Polynuclear neutrophiles"	82.7%
Lymphocytes	10
Large mononuclear	7.7
Eosinophiles	0
Myelocytes (3 in 1,000 cells)	.3

CASE II. Empyema; vomiting pus. Age 1 year, marked leucocytosis: Five hundred white cells showed:

"Polynuclear neutrophiles"	44%
Lymphocytes	26
Large mononuclear	23
Eosinophiles	4
Myelocytes (15 in 500 cells)	3

CASE III. Sub-diaphragmatic abscess; chills. One thousand white cells showed:

"Polynuclear neutrophiles"	73.4%
Lymphocytes	19.6
Large mononuclear	6
Eosinophiles	.6
Myelocytes (40 in 1,000 cells)	.4 100%

BONE TUBERCULOSIS.

Cold abscess of rib, marked leucocytosis. Five hundred white cells showed:

"Polynuclear neutrophiles"	78.2%
Lymphocytes	12
Large mononuclear	7
Eosinophiles	2
Myelocytes (4 in 400 cells)	.8

RICKETS.

Baby 21 months. Five hundred white cells showed:

"Polynuclear neutrophiles"	46
Lymphocytes	26.8
Large mononuclear	25
Eosinophiles	2
Myelocytes (1 in 500 cells)	.2 100%

ADDISON'S DISEASE.

One thousand white cells showed:

"Polynuclear neutrophiles"	53.4%
Lymphocytes	34
Large mononuclear	7.5
Eosinophiles	4.3
Myelocytes (8 in 1,000 cells)	.8

CONCLUSION.

- (1) The definition of myelocyte must be enlarged so as to include cells of all sizes from 7.5μ upwards.
- (2) The percentage of myelocytes in leucemia is much larger than that generally given in text-books; 25 per cent. is a small number.
- (3) Small percentages of myelocytes are the rule in pernicious anemia, common in malignant diseases of cachectic type and not uncommon in a variety of other conditions.

DR. JOHN RIDLON has been appointed Orthopedic Surgeon to Michael Reese Hospital, Chicago.

SCHOOL DESKS.¹

BY E. H. BRADFORD, M.D., BOSTON.

SOME years ago a committee was appointed in Boston to look into the question of school desks, and it did most admirable work. Of this Society, Dr. Henry Williams and Dr. David Lincoln served on this committee. A few years ago Dr. C. L. Scudder made a very careful examination of the actual condition of the school seats in our public schools and showed by means of photographs of different school-rooms, that the children were seated not at all according to their height, but according to the seats that were in the possession of the school-teacher: without any rational method of seating.

The School Committee, however, found itself powerless to remedy the matter, and was able only to make suggestions as to the need of improvement. Dr. E. M. Hartwell has called to my attention the fact that the first impulse toward improvement in school desks and seats started from this country and largely from Massachusetts. At the Vienna Exhibition, Boston's school desks and school seats received a diploma and a great deal of attention. This stimulated several of the German investigators, and since then improvements have been made and several commissions have been appointed to investigate the subject.

It might be advisable to adopt the report of some of these commissions as a standard. We are met, however, with a practical difficulty in the fact that American ingenuity has invented a number of adjustable desks and chairs for the use of schools. In certain localities, certain manufacturers would be able to influence school committees; the best desk would not be introduced, but the one the local school committee would be persuaded was the best. There is, therefore, need for some scientific statement of the principles that should govern the construction of school desks and school chairs. Such a matter should be looked up more thoroughly even than has been done in Germany and the results published. Coming from a body of experts, acting at the instigation of a scientific body — such as the Improvement Society — the report would command attention.

It is therefore proposed to memorialize the School Committee of Boston to the following effect:

TO THE SCHOOL COMMITTEE OF BOSTON:—

All of your memorialists are citizens of Boston and members of the medical profession. Viewed from the medical standpoint school life in Boston being a sedentary pursuit followed during the fateful period of growth is necessarily unnatural and artificial at best. Failing the best hygienic and sanitary conditions attainable, in a crowded and still growing city, the school population may easily constitute a serious menace to the public health. The fact that city children are inevitably handicapped somewhat in the struggle for existence by their environment — in which the school constitutes a large and potent factor — emphasizes the need of unremitting care and activity to prevent enfeebling and deteriorating influences from overweighting them altogether. We gratefully recognize that the School Committee has evinced an interest in the physical welfare of the children under its charge by providing in some measure for their physical training; by co-operating with the Boston Board of Health in the inauguration of a system of daily medical inspection of the schools, in order to limit the spread of infectious diseases; and by measures to improve the character and distribution of school furniture.

¹ Read before the Boston Society for Medical Improvement, November 4, 1896.