As to *inversion of the entire uncut appendix*, Dr. Dawbarn, whose researches into the literature of the subject have been much more extensive than my own, unhesitatingly ascribes to me priority. He himself has never performed inversion of the entire appendix, nor has he found any mention of the matter in medical literature.

A NEW METHOD OF STUDYING CELL-MOTION.¹

BY CHARLES LESTER LEONARD, A.M., M.D.

SINCE the enunciation by Virchow in 1858 of his theory of cellular pathology the attention of the scientific world has been centred about the study of this unit. Nearly all the unsolved problems of medical science involve in one way or another the consideration of some one of the functions of the cell.

It is my purpose in this paper to call your attention to a new method of studying one of these functions. I have chosen as illustrations some of the well-known facts of physiology already seen and described by competent observers, and have confined the greater part of my study to cell-motion as exemplified in the movements of the red and white blood-corpuscles.

The possibilities of these studies was suggested to my mind by the successful result of an experiment in instantaneous photomicrography made in November, 1892.

The method, which it is the purpose of this paper to illustrate, consists in the making of a consecutive series of instantaneous photomicrographs of the same microscopic field taken at definite intervals, and the comparative study of the series.

The results obtained by this method are the elimination to a greater extent of the personal equation of the observer, the procuring of incontestable proof of phenomena observed, the extension of the observations over any length of time, and the possibility of studying the changes occurring over the entire field at any one moment.

Another feature of this method is that it enables the student to study the condition of a fresh, living, unstained specimen for any length of time in fields taken at definite intervals.

The magnifications given are in diameters measured by the projection of the lines of a stage micrometer. The original magnification was to two thousand diameters. This, however, has been reduced in the pro-

¹ Abstract of paper read before the Academy of the Natural Sciences of Philadelphia, January 15, 1895.

cess of reproduction, and the magnification is at present to one thousand diameters.

I first ask your attention to the study of some of the different conditions observed in blood upon the warm stage; afterward considering the amœhoid motion of the red and white blood-corpuscles and their diapedesis through the vessel-walls.

AMCEOID MOTION OF THE WHITE BLOOD-CORPUSCLE.

SERIES A.—This series illustrates the amœhoid motion of the white corpuscle; the granular nature of the surface of the corpuscle is well marked; its inherent power to overcome obstacles that obstruct its passage and to move them aside is clearly shown in the motion imparted to the surrounding red blood-corpuscles, overcoming, as it does, the cohesion existing between them. Their crescent-like groupings make this easily apparent, one crescent being broken up while another is formed. The various forms of red blood-corpuscle, biconcavo-convex, partially and fully crenated, and those distortions produced by crowding and the cohesion which is being overcome are seen in this field. The original magnification was 2000 diameters, and the interval between the pictures two minutes, the entire change of form occurring in less than six minutes upon a hot stage. The identity of the fields is evident.

SERIES B.—This series shows an interesting part played by a white corpuscle which came under the observation of the author and was easily recorded by his method. It will be seen that the white corpuscle has seized upon a red corpuscle, and a comparison of the three photomicrographs will show that the red blood-corpuscle has been dragged downward. The photomicrographs were taken from a series extending over ten minutes.

AMCEOID MOTION OF THE RED BLOOD-CORPUSCLE.

SERIES C.—This series shows the motion of a red blood-corpuscle; it extends over half an hour and was seen in the blood of a malarial patient during the study of the intra- and extra-corpuscular pigmented and the free amœhoid forms of the malarial plasmodium. The series proves that no other motion took place in the field during the half hour it was under observation. This motion must therefore have been produced by some inherent power in the red blood-corpuscle; and as the photomicrographs show that no twist has occurred, the motion cannot be due to a previous torsion, and may therefore be considered a true amœhoid motion of the red blood-corpuscle. We shall also see in the diapedeses of the red blood-corpuscles from a coagulated capillary artery another instance of amœhoid motion, and a seeming proof that diapedesis is due to this amœhoid motion, and is not a simple filtration due to increased intra-vascular pressure, since we know that the pressure is

SERIES A.

SERIES B.

SERIES C.

SERIES D.

decreased by coagulation, or at least that the excess of pressure ceases to act on coagulated blood in a capillary.

DIAPYCNOSIS OF THE RED BLOOD-CORPUSCLE.

SERIES D.—The diapedesis of the red blood-corpuscle from a stagnated capillary artery is here shown in a number of individual instances. The condition of the blood within the artery is also clearly defined; the red and white corpuscles can be distinctly seen. The wall of the capillary is also easily seen and the parts of corpuscles within and without the capillary can be made out. As mentioned above, the diapedesis from a capillary in this condition would seem to demonstrate the fact that diapedesis is due to amoeboid motion of the cells themselves, rather than to the pressure produced by intra-vascular tension and consequent filtration.

Another series taken by the author also illustrates the participation of the amoeboid factor in the diapedesis of red blood-corpuscles from capillary arteries; there was an entire absence of corpuscular elements from the capillary, with the exception of a few white corpuscles clinging to its inner surface and in the act of passing through the walls, while red blood-corpuscles were seen in the act of passing through the capillary wall, consequently there was absence of intra-vascular tension, as there was stasis and no blood in or flowing through the vessel.

These pictures are not shown as the perfect results of this method, or as the results of research by it; they are simply to illustrate the author's method of studying cell-motion and to prove it capable and worthy of scientific consideration as a method of study and able to uphold the claims made for it.

Its usefulness in producing accurate illustrations, both for publication and for lantern slides, cannot be over-estimated. The student then sees illustrations whose counterpart he can find and recognize under the microscope.

The method is of universal application, lines of research suggest themselves to all microscopists, and wherever the factor of microscopic motion is present this method will be found of great value.

The object of this paper has not been to illustrate the results of research by this method, and has used illustration simply to show, by well-known facts illustrated by it, its capabilities as a method of study and its value as a new method of studying microscopic or cell motion.

326 SOUTH SIXTEENTH STREET, PHILADELPHIA.