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Observations on the Contraction of Fibrin in Blood.

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The hanging-drop method was employed exclusively, with aseptic precautions. The blood preparation was sealed with sterile vaseline. The optical equipment consisted of a Zeiss apochromat microscope; objective 3 mm. 1.4 N.A. oil immersion gave the best results, though the 2 mm. 1.3 N.A. is satisfactory. The light source was a Zeiss filament lamp. The blood was taken from the human subject, dogs, rabbits, and guinea pigs; the results noted in the different animal species are practically the same; those reported here are based on approximately 100 different preparations. Each observation lasted between one and 6 hours. The observations were made at room temperature; the coagulation time varied in the different bloods; those clotting with moderate rapidity were most suitable for study.

Observation of the edges of the blood-drop sooner or later shows in some area a distortion of the oval or round red corpuscles by fibrin threads which have anchored themselves to the periphery of the corpuscle. These fibrin filaments generally stretch at right angles to the periphery of the drop and appear attached to the serum edge of the drop (often to a blood-shadow) and to the main body of the blood-drop itself. Commonly 2 fibrin filaments are cemented to opposite sides of a corpuscle and the corpuscle then assumes a spindleshape due to contractin of the fibrin filaments. The fibrin threads may appear short at first, 5μ and less, and may seem to end in the clear serum. Gradually more of the fibrin filament becomes visible, at times showing a length of 40μ; the section adjacent to the red cell thickens somewhat in diameter, becoming occasionally slightly fuzzy in outline and this same portion may show a faint diagonal striation. This diagonal striation may be that of a right screw thread or a left, or it may change from one to the other during observation. These fibrin threads shorten in length and the attached red corpuscle becomes slenderer and more spindle-shaped. Suddenly one of the anchoring fibers snaps at the peripheral end and the red corpuscle darts across a section of the field as a pear-shaped body. The severed fiber may roll up into a glistening, refractile nodule which adheres to the round side of the red corpuscle while the other fibrin thread now shows more or less active motion; it sways, rotates on its short

axis, twists, forms large open loops, straightens out, etc. (Fig. 1.)

Instead of forming a nodule, the torn fibrin filament at times shortens and thickens moderately, sways stiffly, rotates, shows diagonal striations either right or left or changing from one to the other and then abruptly a series of equidistant, refractile beads appear one after the other in the thickened thread, beginning at the periphery. This process may occur in steps or be completed abruptly, but finally a chain of refractile beads writhes, twists and rotates actively. (Fig. 1.) The tip bead describes circles, ovals and apparently figures-of-eight when in the optical axis; it moves in all planes approaching the point of fixation in loops and then straightening out. Occasionally the terminal bead is twisted off and then it rolls and quivers free in the serum, indistinguishable from so-called blood-dust. Or the entire chain of beads breaks away and now rolls, trembles and sways away in the serum.

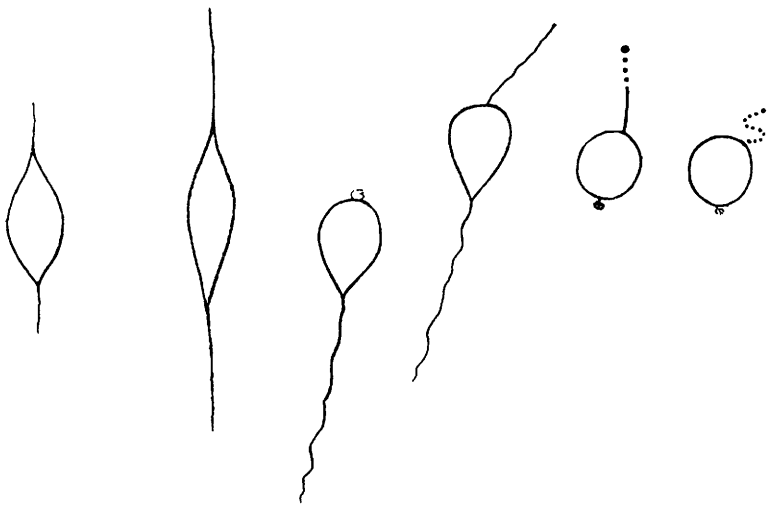

FIG. 1.

Some of the changes observed in fibrin-threads anchoring a red corpuscle in normal clotting blood. Sketches are a composite of two cells.

The refractile nodule formed on a red corpuscle by the contraction of a fibrin thread slowly disappears; whether it is dissolved on the surface of the red corpuscle or by the serum, is impossible to state; on the blood-shadows the refractile globules may persist for hours.

It was noted several times that a severed contracted fibrin filament moved across the surface of a red corpuscle and then moved back, or that a microcyte adherent to a red cell at the point of attachment of an actively vibrating fibrin flagellum, was slowly moved continuously

in one direction and then slowly in a directly opposite direction. The explanation for this will be given in a subsequent paper.

Polarized light with compensator (Red, first order) gave no definite evidence that the refractile nodules and beads were anisotropic.

More than 2 fibrin filaments may anchor a red corpuscle; many times a red corpuscle more or less crenated may be seen with 3 and even 4 actively vibrating, rotating and even lashing fibrin flagella. The action of these flagella or even of a single one imparts a tremulous quiver to the red corpuscle which undoubtedly heretofore has been interpreted as Brownian movement.

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Formation of Macrocytes and Microcytes from Normal Red Blood Corpuscles.

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The technique employed and the optical equipment were the same as those noted in my preceding communication on the contraction of fibrin.[1] The blood was obtained from man, dog, rabbit and guinea pig.

The red corpuscles of all the species examined are round or slightly oval, show a della, and vary somewhat in size. In the human subject the diameter measurements varied between 7.8-9μ; in dog between 7-7.8μ; in rabbit 6-7.8μ; in guinea pigs 6-7.8μ.

The formation of macrocytes occurred as follows in all species: Immediately after the hanging blood-drop is made, laking of red corpuscles begins in the periphery. If 2 corpuscles are touching each other, the area of contact slowly becomes greater until the 2 reds form an oval mass with an encircling median groove. In the middle of this groove a whitish line is seen which represents the opposed or fused surfaces of the 2 corpuscles. When this common septum disappears the 2 corpuscles form a round or slightly oval macrocyte measuring 10μ+ in diameter. As long as the septum exists the macrocyte shows a slight indentation in its outline. (See Fig. 1.) The hemoglobin content is usually the same as that of a normal red corpuscle, which shows that the thickness of the macrocyte is not appreciably greater than that of a normal erythrocyte.

[1] Auer, John, PROC. SOC. EXP. BIOL. AND MED., 1930, xxvii, 618.