MORPHOLOGY AND PATHOMORPHOLOGY

THE ULTRASTRUCTURE OF HUMAN RED CELLS

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By the use of a special method of mounting a red cell film between two films of sapon lac, Gol'din [1] showed the existence of three types of red cell stroma. In addition to red cells with a homogeneous structure, he found a stroma made up of superimposed reticular layers, and also a stroma with a large defect of the membrane, which in this author's opinion indicated the position of the nucleus.

We have observed forms similar to those described by Gol'din, by the use of a method of preparation of films suggested by Reagan and his co-workers [2] with slight modifications.

EXPERIMENTAL METHOD AND RESULTS

To two drops of blood, taken from the finger, was added 2 drops of physiological saline with heparin (10 mg heparin in 10 cm^3 of physiological saline). The mixture was kept for 1 hour in the refrigerator and for 10 minutes at room temperature and agitated from time to time. Drops of the mixture were placed on a grid and immediately aspirated into a finely drawn-out pipette.

The preparations were rinsed with 6-7 drops of distilled water and, after drying, were dusted with nichrome at an angle of 15°.

Red cells from cancer patients and healthy persons were investigated.

In these investigations we found no differences in the electron-microscopic picture of the red cells.

The total magnification (electron-optic and photographic) of the photographs illustrated here is approximately 8000 x.

In addition to red cells with a comparatively homogeneous structure, from time to time forms were found with defects of the membrane. These defects were present to varying degrees — small, isolated holes, multiple holes — giving the stroma the appearance of net or lace and, finally, large defects in the membrane. It is thus difficult to agree with L. S. Gol'din that the large membrane defects indicate the position of the nucleus.

Among these forms of red cells others could be found which were identical with those described by L. S. Gol'din. For example, the red cell in Fig. 1, b resembles that describe by Gol'din as "Type I", and that in Fig. 1, d as "Type II". It does not seem possible to us, however, to divide them into separate types, for they are combined with homogeneous forms and also with intermediate forms (see Fig. 1).

This evidently reflects gradual changes in the osmotic resistance of the red cells in the course of maturation and senescence.

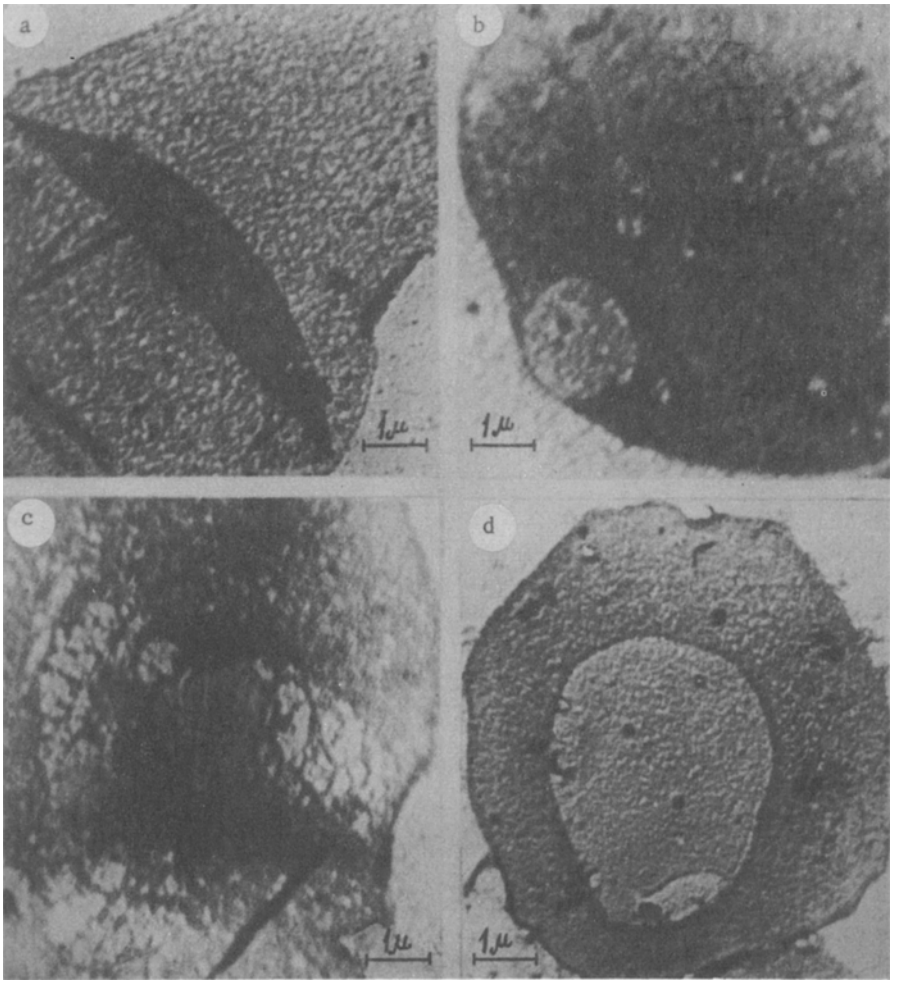

Fig. 1. Different forms of disturbance of the stroma of red cells by osmotic hemolysis. a) Diffuse rarefaction of the membrane; b) membrane in the form of lace; c) a single opening in the membrane; d) a large defect in the membrane.

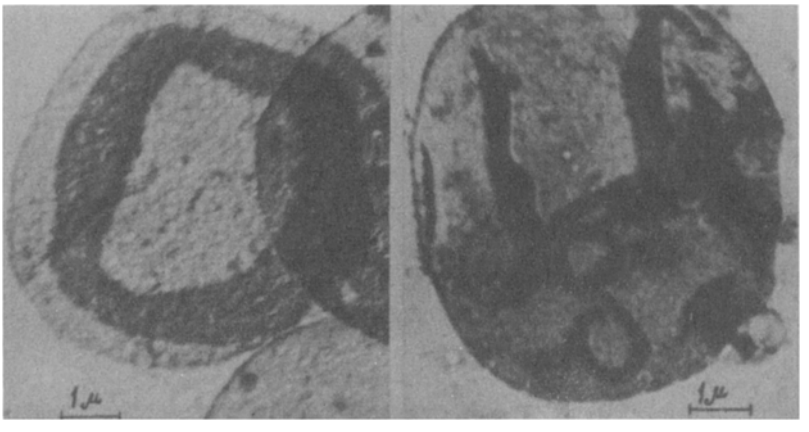

Fig. 2. Structures formed by fragments broken off the membrane and by remnants of hemoglobin.

In spite of the fact that the preparations were rinsed with distilled water, the stroma of many cells showed a greater or lesser amount of hemoglobin, in the form of clumps or granules. Together with the folds in the membrane, they formed now and then quite distinctive patterns (Fig. 2).

It is possible that the structures described by Gol'din as resembling Cabot's rings are similar in origin.

SUMMARY

Forms with defects of various degrees were discovered in an electronic-microscopic study of the erythrocytic stroma obtained by osmotic hemolysis. These forms can not be split into individual groups (as it was done by Gol'din), since they are transitionally linked with each other.

LITERATURE CITED

[1] L. S. Gol'din, Doklady Akad. Nauk SSSR 117, 4, 701-703 (1957).*

[2] R. L. Reagan, E. D. Palmer and E. C. Dalaha, Texas rep. biol. a. med. 12, 1, 178-181 (1954).

* See English translation.