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EDITORIALS

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LYMPHOCYTIC SYMBIOSIS[1]

In a recent issue of THE JOURNAL [**28** (1960) 458-460] was reprinted a review of the Schwann cell, which had appeared in the editorial pages of the J.A.M.A. Here is reprinted the main part of a similar editorial article on the nature and relationships of the lymphocyte as they are now understood as the result of application of techniques which did not exist when the ideas set forth in most of our textbooks were prevalent. After the introductory sentences reproduced below, the rest of the first paragraph and all of the second one are devoted to malignant neoplastic disease of the lymphoid cell series, which part is omitted here.

Studies on the lymphocyte were discussed in a symposium held in Boston . . . The comprehensive presentations have been published recently [2] and constitute a timely series of monographs on this vital cell . . .

R. Dorothy Sundberg reviewed the origin, structure, and interrelationships of the human lymphocyte in sickness and in health. The reticular connective tissue of lymph nodes and bone marrow has been investigated by modern vital staining techniques, electron microscopy, radioautography, and tritium-labeled thymidine incorporated into deoxyribonucleic acid (DNA). The morbid states associated with abnormal lymphocytes include infectious mononucleosis, thymomas, infectious hepatitis, German measles, and the lymphoblastomas.

According to the latest theory, the lymphocyte originates in the mass of primitive reticular cells, grows, and eventually becomes distinguishable from the histiocyte, the

[1]Reprinted in somewhat abbreviated form, with permission, from the *Journal of the American Medical Association* **174** (1960) 300-301.

[2]The Lymphocyte and Lymphocytic Tissue, edited by J. W. Rebuck, New York, Paul B. Hoeber, Inc., 1960. (An International Academy of Pathology monograph, with 21 contributors. Price, $10.50.)

macrophage, and the mature reticular cell as a compactly nucleated small cell. Conversely, there may be a return of the lymphocyte to large basophilic cells, which resemble hematopoietic reticular calls, and subsequent transformation of these cells to histiocytes, macrophages, epithelioid cells, giant cells, and even fibroblasts in inflammatory tissue. Thus, the cycle is completed, and the ring is closed.

Reutilization of lymphocytes may be related to the desire of the body to save deoxyribonucleic acid, possibly the most vital of the complex chemical substances in the cell. Reticular cells also phagocytize red cells for reutilization of hemoglobin and iron.

The intimacy of normoblasts and the reticular cells (precursors of lymphocytes) is another example of cellular symbiosis. Bessis, according to Sundberg, has produced convincing evidence that the ring of normoblasts which surround the reticular cells of the bone marrow may be predestined. Reticular cells engulf erythrocytes, and once within the reticular cell the erythrocyte loses its characteristic hemoglobin color, leaving only colorless remnants. The cytoplasm of the macrophage that surrounds the phagocytized erythrocyte stains intensely with the Prussian blue-iron stain. Since the normoblast surrounding the reticular cell contains particulate iron, it has been assumed that the iron was derived from the phagocytic reticular cell. The electron microscope, as utilized by Bessis, has revealed that the reticular cell functions as a true mother cell to the normoblasts which receive their iron by a process best described as "nursing." The reticular cell eats its progeny and feeds it as well.

A similar symbiotic phenomenon may be observed between the lymphocyte and the reticular cells. The reticular cell contains a complete series of lymphocytes in various stages of digestion, and it is surrounded by the ring of lymphocytes. The union of the peripheral ring of lymphocytes and the reticular cell is intimate. Linear masses of the nuclei of the lymphocytes penetrate the cytoplasm of the reticular cell and either feed the reticular cell or are fed by it. Possibly both functions are operating. Sundberg has speculated that a third symbiotic process may be responsible for the transfer of gamma globulin and antibodies between the plasma cells, bearers of gamma globulin and antibodies, and reticular cells of the marrow.

Reversion to Virchow and his theory of cellular morphology and disease once more reveals the primacy of lymphoid cells in the pathogenesis of morbid states. The transition of large hematopoietic reticular cells to lymphocytes is evident in lymph node imprints from patients with infectious mononucleosis and chronic lymphatic leukemia. In acute and subacute lymphatic leukemia, the transitional forms progress from narrow-bodied reticular cells to mature lymphocytes. The lymphoblast of acute lymphatic leukemia is structurally similar to the myeloblast of acute myelogenous leukemia. Sundberg has speculated that the immature lymphocyte may also represent a transitional form from lymphocyte to myeloblast. Not yet interpreted is the observation that immature lymphocytes are more numerous in imprints of the human thymus than in imprints of human lymph nodes. These studies, described in brief, constitute a modest portion of the emphasis assigned to the lymphocyte, a cell of great interest to the hematologist, the experimental pathologist, and the clinician.