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The Relative Proportion of Different Types of Cells in Blood and Lymphoid Organs of Normal Rats.

C. H. HU AND K. Y. CH'IN. (Introduced by S. H. Liu.)

From the Department of Pathology, Peiping Union Medical College.

Lymphoid cells, especially the small ones, fixed and stained by the ordinary methods, do not show sufficient morphological differences to be classified according to their relative maturity as is possible with the granular leucocytes. Difference of opinion thus exists over the developmental potency of the small blood lymphoid cells, and the exact stage of development of the small tissue lymphoid cells is not definitely determined. No further progress in our knowledge of these cells is likely to be made by the old methods of fixation and staining for study.

Stained with neutral red and janus green supravitally, however, the lymphoid cells present some very important morphological features which may be used as a basis for their finer differentiation. These features are: (1) the degree of opacity of the cytoplasm, (2) the number and size of mitochondria, and (3) the number of neutral red bodies.

We have been able to divide the lymphoid cells, irrespective of their sizes, into 3 types, namely: lymphoblasts, intermediate forms, and lymphocytes. The lymphoblasts have opaque cytoplasm, abundant, coarse mitochondria but no, or very few, neutral red bodies. The lymphocytes have clear cytoplasm, fine, scanty mitochondria, but numerous neutral red bodies. The intermediate forms, as their name implies, are morphologically intermediate between the lymphoblasts and lymphocytes, and are therefore presumably older than the lymphoblasts but younger than the lymphocytes.

This classification is used in the present supravital study of the lymphoid cells of the blood, spleen and lymph nodes of a large number of normal rats. The relative proportion of cells is fairly constant in all the animals studied. In Tables I and II the average values of the counts on the blood of 20, and those on the lymphoid organs of 7 animals are presented.

It is seen that both the blood and the lymphoid organs of normal rats contain lymphoblasts of all sizes. The peripheral blood, however, contains a higher percentage of mature lymphocytes, while in the lymphoid organs the intermediate forms predominate.

The presence in the rat blood of the lymphoid cells of all ages

TABLE I.

Average percentage values of the differential counts on the lymph nodes and spleen of 7 normal rats. 500 cells counted in each preparation.

Type of Cell	Organ		
	Inguinal lymph node	Mesenteric lymph node	Spleen
Small lymphoblasts	0.6	1.3	2.0
Small intermediate forms	75.7	64.7	60.0
Small lymphocytes	0.9	1.9	1.9
Small degenerated cells	21.2	29.3	28.9
Medium-sized lymphoblasts	0.3	0.4	1.3
Medium-sized intermediate forms, lymphocytes and degenerated cells*	0.3	1.0	2.7
Large lymphoblasts	0.2	0.4	0.8
Large intermediate forms, lymphocytes and degenerated cells*	0.2	0.3	0.9
Plasma cells	0	0.4	0.3
Monocytes	+	0	0
Clasmatocytes	0.1	0.1	0.6
Neutrophilic leucocytes	0.1	0.1	0.4
Eosinophilic leucocytes	+	+	0.3

+ = present, but less than 0.1%.

* Owing to their scarcity these cells are placed in one group under their respective sizes.

TABLE II.

Average percentage of 6 differential counts of the white blood cells of 20 normal white rats.

Small lymphoblasts	0.85	Degenerated cells, all sizes	0.15
Small intermediate forms	34.88	Monocytes	2.33
Small lymphocytes	23.11	Plasma cells	0.02
Medium-sized lymphoblasts	0.90	Clasmatocytes	0.02
Medium-sized intermediate forms	2.34	Myelocytes	0.07
Medium-sized lymphocytes	1.90	Poly. neutrophiles	26.58
Large lymphoblasts	1.33	Poly. eosinophiles	1.70
Large intermediate forms	2.65		
Large lymphocytes	1.17		

has led one of us (C. H. H.) to examine the blood of a few normal rabbits and normal human beings. It was found that a similar classification of their lymphoid cells is also possible and that lymphoblasts of all sizes are likewise present. The finding of both lymphoblasts and lymphocytes in the blood probably explains the controversy regarding the developmental potency of the small blood lymphoid cells. It seems quite possible that the presence of the lymphoblasts has led some to the conclusion that all "lymphocytes" are primitive cells and that of the mature lymphocytes has led others to the opposite conclusion that all "lymphocytes" are end cells.