

# PECULIARITIES OF HEMOPOIESIS IN THE SPLEEN AND LYMPHATIC GLANDS OF RABBITS

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When investigating the functions of hemopoietic organs, rabbits of various ages are used as experimental animals quite frequently.

The peculiarities at various ages that rabbits have in regard to the cellular components of the peripheral blood and their bone marrow have been detailed by many authors [1,3,5,9,10,11,12,13 and others]. Analogous data on the structure of lymphopoietic organs is available basically for adult animals [6,14,15] but this does not permit a complete analysis of blood formation at various ages in the life cycle of the rabbit. A more thorough investigation of the lymphocyte-forming organs is needed in the rabbit, moreover, as the peripheral blood of its young has a markedly lymphoidal character [5, 14].

## EXPERIMENTAL METHODS

In the present study there was studied the cellular composition of the spleen and the lymphatic nodes of rabbits aged 1-2  $\frac{1}{2}$  months, the chinchilla breed being used. It is at this age that the rabbits usually cease nursing, change their teeth and acquire a complete furry coat [8]. Altogether 20 rabbits, weighing 400 to 900 grams and being maintained on a balanced ration, were examined. The animals were sacrificed by the air embolism method.

The spleen and lymph nodes were fixed in Zenker-formol and imbedded in paraffin or celloidin-paraffin. The sections were cut 4-5  $\mu$  thick, stained with hematoxylin – eosin, Romanovsky – Giemsa and by the Mallory method. Smears were fixed with methyl alcohol and stained with azure II – eosin. All conclusions were made after comparing the cytology of the smears with the character of the structure seen in the section.

## EXPERIMENTAL RESULTS

The lymphopoietic tissues of the spleen in rabbits aged 1-2  $\frac{1}{2}$  months do not have germinal centers which are seen in the adult animals (Fig. 1). However, the general mass of lymphoidal elements and the relatively high cellular content of mitotic figures is testimony of the intense lymphopoiesis proceeding in this organ.

The lymphatic nodes in various regions of the body are characterized by unequal stages of differentiation. Thus, the mesenteric glands, as a rule, possess germinal centers within the follicles and multicellular marrow groups; while the knee, groin and axillary glands may actually exceed the mesenteric in size but are not as developed structurally. In them the lymphatic tissue forms small subcapsular structures bereft of centers of multiplication. Within the loops of the syncytium of the marrow portion a few lymphoidal elements are seen.

This absence of germinal centers within the splenic follicles and the lymphatic nodes of so many regions indicates the specific nature of the developing hemopoiesis. It is known that in man the splenic germinal centers are fully formed by age of two years [4], while the lymphatic nodes reach their full development by

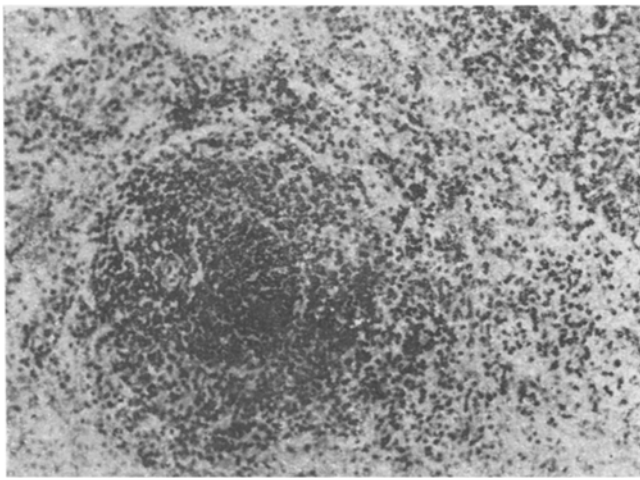


Figure 1. Malpighian body in 1  $\frac{1}{2}$  month old rabbit. Around the eccentric nutrient artery are concentrated mature, intensely staining lymphoidal elements which are surrounded by more juvenile forms. Between the zones of small and large cells is a narrow band of connective tissue. Stain: azure II - eosin. Magnification: ocular 7 $\times$ , objective 20  $\times$ .

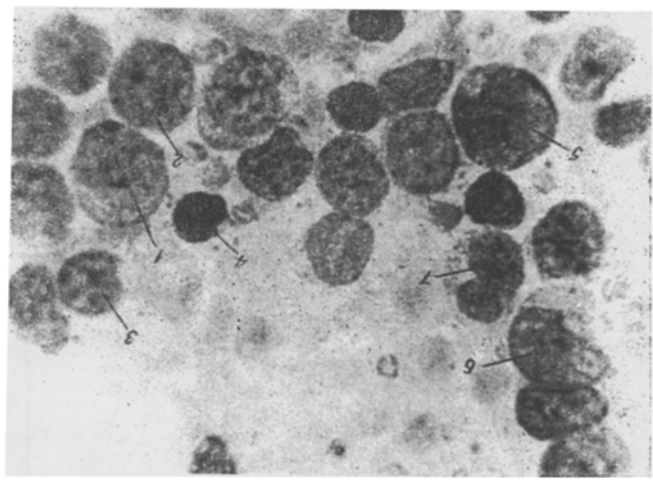


Figure 2. Elements of a splenic smear in a 2 month old rabbit. 1) lymphoblast, 2) prolymphocyte, 3) average lymphocyte, 4) small lymphocyte, 5) proerythroblast, 6) monoblast, 7) monocyte. Stain azure II - eosin. Magnification 7 $\times$ , objective 90 $\times$ .

ages 8-12 years [2]. The most intense absolute and relative lymphopoiesis in the peripheral blood occurs in early childhood up to ages 2-4 years.

The follicular structure described above, void of germinal centers, demonstrates that rabbits at ages 1-2  $\frac{1}{2}$  months preserve some features of lymphopoiesis characteristic of animals in the embryonic stage and the earliest postnatal period. Further evidence of this type of hemopoiesis in the spleen is the low grade intensity of the erythro- and granulopoiesis (Table 1).

The dominant elements in spleen smears and lymphatic glands are cells of the lymphoidal series (Table 1, Figs. 2 and 3). In the spleen they are 91.99% while in the mesenteric glands - 94.5%.

The cells of the erythrocytic and granulocytic series in all stages of differentiation within the spleen are only 4.05%. In the lymphatic glands only mature pseudo eosinophiles and eosinophiles are present and their total number corresponds (0.35%) to the level of these elements in the peripheral blood [5].

The other cells of the splenic smear (3.91%) and lymphatic gland (5.4%) are reticular elements, hemohistioblasts, hemocytoblasts, macrophages and cloudy cells.

Judging by the juvenile and mature forms of the monocytes, in the spleen and lymph glands of rabbits aged 1-2  $\frac{1}{2}$  months monocytopoiesis goes on (Fig. 2).

In the lymphatic glands are seen all transitional phases from the plasmablast to plasmatic cells (Fig. 3).

The ratio between mature and juvenile forms of the lymphoidal series is different in young and adult rabbits. Thus, in rabbits of 2  $\frac{1}{2}$  years, the undifferentiated elements compose 0.7% of the lymphoidal series of the spleen, and the mature compose 65% [14]; in rabbits 1-2  $\frac{1}{2}$  months old. These figures are correspondingly 2.22% and 89.77%. This is confirmed by the data furnished by the partial lymphogram and by maturation indexes. The maturation index of lymphoidal cells of rabbits 1-2  $\frac{1}{2}$  months old is 0.027 (Table 2), but in adult rabbits it is 0.011 [14].

The somewhat larger number of juvenile elements in the lymph glands as compared with the spleen may be partially explained by the great amount of blood in the spleen, the blood containing more mature lymphocytes.

The number per 1000 of cells undergoing mitosis in the spleen smears from the rabbits being studied averaged 4 with the fluctuations being between 2 and 8 while in the lymphatic glands - 6 with fluctuation range being 0 to 10. As a rule, they were juvenile forms of the lymphoidal series - lymphoblasts and prolymphocytes. It seems quite possible that many of the mitotic figures were hemocytoblasts, this possibility having being raised by N. D. Strazhenko and D. N. Yanovsky [7].

In the cells of the lymphatic series in young rabbits, amitoses are exceedingly rare (1 amitosis per 1000 cells in the smear with fluctuation between 0 and 2). In the spleen, normoblasts are seen at times dividing amitotically, while in the lymph glands the same can be said of plasmatic cells.

TABLE 1

General Cytograms of the Spleen and Mesenteric Lymph Glands in Rabbits Aged 1-2½ Months

Elements	Spleen		Lymphatic nodes	
	Arithmetical mean	limits of fluctuation	Arithmetical mean	Limits of fluctuations
Large lymphoidal reticular cells	1.03	0.2—1.6	1.4	0.8—2.0
Small lymphoidal reticular cells	0.46	0.2—0.6	0.4	0.2—1.0
Hemohistioblasts	0.14	0—0.4	0.25	0.2—0.4
Hemocytoblasts	0.31	0.2—0.6	0.4	0.2—0.6
Lymphoblasts	0.91	0.4—1.2	1.35	1.0—1.6
Prolymphocytes	1.31	0.4—2.4	1.95	1.4—2.4
Lymphocytes	5.06 51.83 32.77	1.2—8.2 49.6—55.2 27.6—37.8	2.95 47.7 40.3	90.9 42.8—54.2 29.2—47.4
Broad protoplasm				
Average				
Small				
Plasmablasts	—	—	0.2	0—0.4
Plasmacytes	—	—	0.95	0.4—1.4
Plasmatic cells	0.54	0—0.8	1.3	0.6—2.2
Monocytes	0.74	0.4—1.2	0.3	0—0.6
Macrophages	0.23	0—0.8	0.1	0—0.3
Promyelocytes, variously granulated granulocytes	0.11	0—0.2	—	—
Pseudoeosinophiles	3.31	1.8—4.6	0.25	0—0.4
Eosinophiles	0.23	0—0.6	0.1	0—0.2
Basophiles	0.14	0—0.6	—	—
Proerythroblasts	0.06	0—0.2	—	—
Basophilic erythroblasts	0.2	0—0.6	—	—
Polychromatophilic erythroblasts, Normoblasts	0.4	0.2—0.8	—	—
Cloudy cells	0.2	0—0.8	0.1	0—0.2

TABLE 2

Partial Lymphocytograms of the spleen and Mesenteric Lymph Glands in Rabbits Aged 1-2½ Months

Elements	Spleen		Lymph glands	
	Arithmetical mean	Limits of fluctuation	Arithmetical mean	Limits of fluctuation
Lymphoblasts	1.0	0.8—1.6	1.6	1.4—1.8
Prolymphocytes	1.5	0.6—2.2	2.2	1.4—2.4
Broad protoplasm lymphocytes	5.8	1.4—9.4	3.35	2.2—4.0
Average lymphocytes	55.4	51.8—59.2	50.4	45.4—51.8
Small lymphocytes	36.3	30.8—42.6	42.45	41.2—48.2
Maturation index	0.027		0.039	

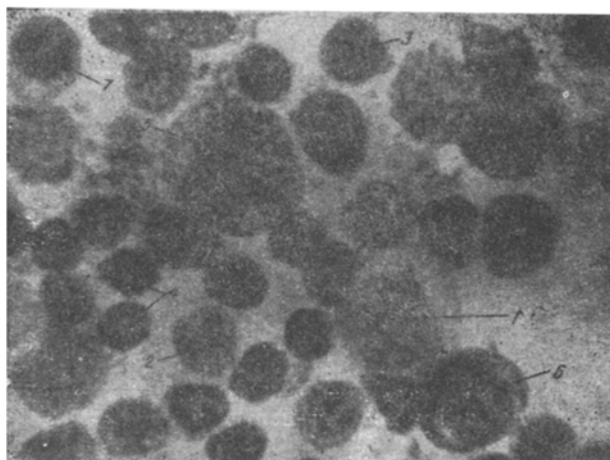


Figure 3. Elements of a mesenteric gland smear from 2 month old rabbit. 1) lymphoblast, 2) broad protoplasm lymphocyte, 3) average lymphocyte, 4) small lymphocyte, 5) plasmablast, 6) plasmacyte, 7) plasmatic cell. Stain azure II - eosin. Magnification ocular 7x, obj. 90x.

#### SUMMARY

The structure and cellular composition of the spleen and lymph glands of young rabbits were studied. The juvenile features of hemopoiesis in animals of ages 1-2  $\frac{1}{2}$  months were noted and the differences between the various lymph glands were stressed. As compared with the adult, many more immature cells were seen.

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