

# AGE CHANGES IN THE BLOOD CELLS IN HYPOXIA IN DOGS

L. S. Gorozhanin

Department of Normal Physiology (Head, Professor S. S. Serebrenikov)

Ivanovskii Medical Institute (Director, Docent Ya. M. Romanov)

(Presented by Active Member AMN SSSR V. V. Parin)

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In man and in animals hypoxia increases the number of erythrocytes and the amount of hemoglobin in the bloodstream [2, 3, 4, 8]. Very varied results have been obtained on the changes in the number of leucocytes [3, 4, 13]. No attention has been paid to age changes in relation to the effect of hypoxia on the vascular system. Nevertheless it would be expected that during development this reaction should show some special features [1, 5, 7, 10, 12].

## METHOD

We carried out 144 experiments (including 57 with hypoxia) on 17 dogs of various ages (see table). Hypoxia was induced by reducing the atmospheric pressure in a pressure chamber to 267 mm mercury, which corresponded to

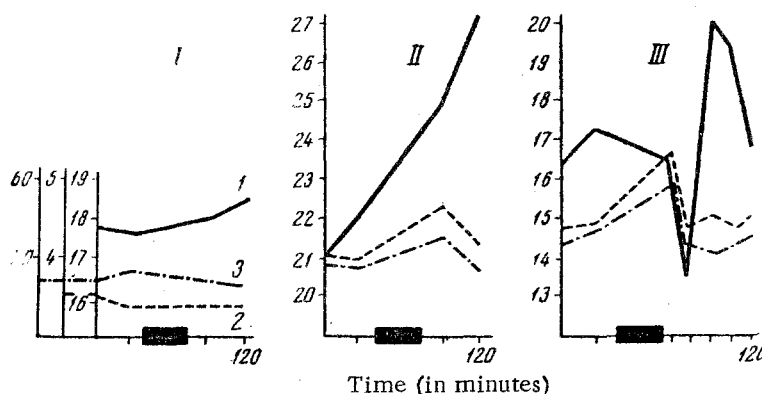


Fig. 1. Changes in the cellular composition of the blood in response to hypoxia, and its relation to the age of the dog (No. 5). I) At age of two months; II) at age of 2 months 18 days; III) at age of 1 year 3 months; 1) number of leucocytes (in thousands) per  $\text{mm}^3$  of blood; 2) number of erythrocytes (in millions) per  $\text{mm}^3$  of blood; 3) amount of hemoglobin (in Sali units); ■) period during which the pressure was reduced to 267 mm mercury.

a height of 8,000 m. The animals remained for approximately 40 minutes at this "height". The rate of "rise" was 15 m/second, and the "descent" took place at 15-20 m/second. Blood was taken from an incision at the tip of the ear at 15-30 minute intervals both before the "ascent" and after the "descent". The number of red cells, amount of hemoglobin, and white cell counts were determined. The intervals between excessive "ascents" were not less than one week.

## RESULTS

In puppies, for the first two months of life, in 24 out of 28 experiments hypoxia caused no change in the red or white cell counts (Fig. 1I). In four experiments there was a reduction in the number of leucocytes (while the red cell count remained unchanged).

It was not until the third month of life that the response to hypoxia developed, when it was shown as an increase in the number of red cells and in the amount of hemoglobin (Fig. 1, II; Fig. 2, II). The increase in the number of erythrocytes was 300,000-1,100,000 per mm<sup>3</sup> (7-17%), of hemoglobin 4-13 units (7-21%). The red cell count returned to normal 15-30 minutes after a "descent".

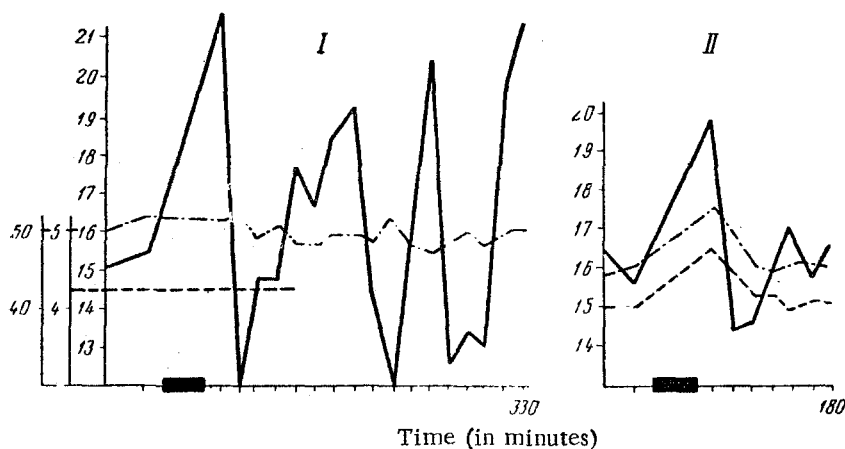


Fig. 2. Changes in the cellular composition of the blood in response to hypoxia, and its relation to the age of the dog (No. 15). I) At age of 1 month 29 days; II) at age of 2 months 15 days. Remaining indications as in Fig. 1.

In puppies, the response in the form of a change in the number of leucocytes may occur simultaneously with the polycythemia reaction (Fig. 1, II), or independently of it (Fig. 2, I). In the latter case, the effect indicates a relative independence of the factors regulating the red and white cells, an effect which was emphasized long ago by G. F. Lang [9]. We had obtained facts supporting this conclusion in our earlier investigations into the age characteristics of the development of the pain response of the vascular system [5, 6, 7].

#### Age of the Dogs Studied, and Dates of Observations

No. of dog	Age of dog	
	At start of experiment	At end of experiment
1	2½ months	6 months
2	2½ months	6 months
3	1½ months	3½ months
4	1 month	3 months
5	10 days	1 year 3 months
6	13 days	1 month
7	13 days	1 month
8	10 days	3 months
9	1 day	
10	1 day	
11	8 months	10 months
12	1½ months	3½ months
12	1½ months	3½ months
13	2 years	
14	10 months	11 months
15	11 days	3 months
16	7 days	3 months
17	1 day	3 months

The leucocytic response to hypoxia is very complex. Typically it consists of an increase in the number of leucocytes, followed by a rapid fall. Next the number continues to vary for a long time (Fig. 2, I, II). The number of leucocytes may exceed the original number by 1550-6750 cells per mm<sup>2</sup> (by up to 42%) or it may fall by 1300-7250 (by 45%). In our opinion, the complexity of the leucocyte response accounts for the contradictory reports about white cell changes induced by hypoxia.

More frequently (in 26 of the experiments with hypoxia), variation in the number of leucocytes was not accompanied by any change in the leucocyte formula. In 20 experiments there was an increase in the percentage of neutrophils.

The reaction of the vascular system to hypoxia, which appeared at the third month, was maintained during the subsequent development period (Fig. 1, III). In this reaction, in the adult dogs the spleen plays an important part as a blood depot [2, 8]. We have shown previously that the development in puppies by the third month of life of the

pain response of the vascular system, which is typical of adult animals, is due to the acquisition at this stage of the ability of the spleen to act as a blood-storage organ [6]. These results agree with the findings of A. P. Polosukhin [11] on the ontogenetic development of splenic contractile power. We must suppose that this factor plays an important part in the development of the vascular reaction to hypoxia.

## SUMMARY

Hypoxia was induced in dogs by exposure for 40 minutes to a reduced atmospheric pressure of 267 mm mercury in a pressure chamber. In puppies less than two months old hypoxia induced no changes in the composition of the blood. During the third month the characteristic adult reaction appeared, and took the form of an increased number of erythrocytes, an increased hemoglobin content, and an alternating increase and decrease in the number of leucocytes.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.

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