

# CHOLINESTERASE AND PSEUDOCHOLINESTERASE ACTIVITY IN BLOOD OF RATS DURING ONTOGENESIS

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During ontogenesis in rats activity of the cholinesterase (ACE) and pseudocholinesterase (PCE) of the blood at first reaches a maximum by 12-18 and 2-3 days (respectively); the level then falls. Three waves of increase are observed in these levels, although they do not always coincide in time for ACE and PCE.

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Laboratory investigations have shown that puppies, rabbits, and rats in early life before assumption of the standing posture are characterized by a high level of metabolism and of activity of their cardiovascular and respiratory systems. This situation is made possible by the earlier operation of stimulating nervous mechanisms, the higher content of catecholamines, and the higher acetylcholinesterase activity of the blood than in adult animals [1-5, 8-10].

Because of the almost complete absence of data concerning the humoral regulation of homeostasis in rats, the present investigation was carried out with the object of investigating changes in activity of acetylcholinesterase and pseudocholinesterase in the blood in ontogenesis in connection with the nonmediator role of acetylcholine [7].

## EXPERIMENTAL METHOD

Experiments were carried out on rats from the end of the intrauterine period until the age of 15 months. Mixed blood (20  $\mu$ liters) was taken from the heart of rat fetuses and young rats under one month old and from the tail of rats older than one month by amputation.

The blood was hemolyzed in 0.4 ml distilled water in a test tube. To determine acetylcholinesterase (ACE) and pseudocholinesterase (PCE) activity, A. A. Pokrovskii's colorimetric micromethod was used [12]. Altogether 242 rats of different ages were used. Each blood sample was analyzed two or three times.

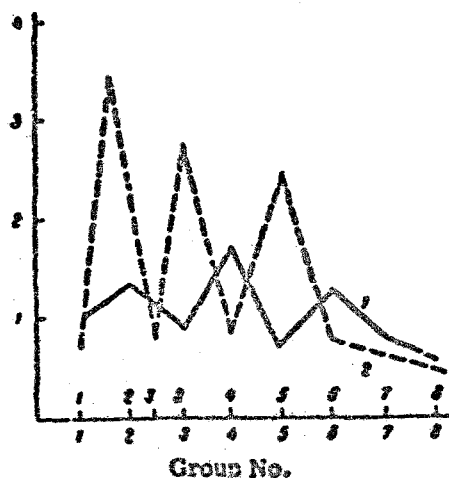


Fig. 1. Acetylcholinesterase (1) and pseudocholinesterase (2) activity in rats of different ages. Ordinate: activity of cholinesterase in  $\mu$  moles acetylcholine hydrolyzed by 1 ml blood per min. Abscissa: nos. of age groups: top row of numbers for PCE, bottom row for ACE.

## EXPERIMENTAL RESULTS

The rats were subdivided into eight groups.

As Table 1 shows, changes in ACE and PCE activity were fluctuating in character: periods of increase alternated with periods of decrease, although these periods did not coincide exactly for the two enzymes. Because of this, group 3 was divided into two subgroups on the basis of results of PCE determination.

Analysis of the results in Table 1 shows that the ACE and PCE activity was high on most days of the early age group (until 25-30 days), falling during ontogenesis.

Comparison of the ACE activity for age groups 2, 4, and 7 shows a significant difference between groups 2 and 4

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TABLE 1. Acetylcholinesterase (I) and Pseudocholinesterase (II) activity of Rat Blood During Ontogenesis ( $\mu$  moles/ml blood/min)

I				II			
Group	Age	number of animals	$M \pm m$	Group	Age	number of animals	$M \pm m$
1	Fetuses	10	$0.97 \pm 0.012$	1	Newborn animals	19	$0.76 \pm 0.016$
2	5 days	35	$1.35 \pm 0.014$	2	2-3 days	10	$3.35 \pm 0.183$
3	7-10 "	15	$0.87 \pm 0.015$	3	5-7 days	10	$0.82 \pm 0.033$
4	12-18 "	29	$1.73 \pm 0.024$	4	8-13 "	18	$2.72 \pm 0.353$
5	20-22 days	8	$0.72 \pm 0.001$	5	14-17 "	13	$0.86 \pm 0.022$
6	25-30 days	15	$1.29 \pm 0.011$	6	18-22 days	15	$2.44 \pm 0.112$
7	2-7 months	15	$0.82 \pm 0.020$	7	25-30 days	13	$0.81 \pm 0.022$
8	15 months	5	$0.60 \pm 0.001$	8	2-7 months	15	$0.60 \pm 0.026$
					15 months	5	$0.52 \pm 0.009$

( $P < 0.01$ ), between groups 2 and 7, and also between groups 4 and 7 ( $P < 0.001$  and  $P < 0.01$  respectively). It may be assumed that the higher ACE activity, by reducing the concentration of endogenous acetylcholine, is responsible for predominance of sympatho-adrenergic influences at an early age. The results obtained by E. A. Eskin and co-workers [19], indicating a higher content of catecholamine in the adrenals of rats under 14 days of age than in adult animals, suggest that their content in the blood is also higher. The predominant adrenergic background of regulation at early age periods is responsible for the high oxygen consumption and the high level of activity of the respiratory and cardiovascular systems [18].

The importance of pseudocholinesterase is not yet completely clear. It will be noted that the decrease in PCE activity in subgroup 3a and its increase in subgroup 3b preceded the corresponding changes in ACE, while in groups 4, 5, and 6 the changes in ACE and PCE were opposite in character (Fig. 1). In connection with the views put forward by some authors [6] concerning the protective role of PCE relative to acetylcholinesterase, this character of the changes as described above may be important for maintaining acetylcholine hydrolysis at an adequate level of intensity. Our results reflecting complex changes in the ACE and PCE of the blood of rats during ontogenesis must stimulate further investigation of their role in certain aspects of metabolism in connection with the nonmediator function of acetylcholine [7].

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