ACTIVITY OF GLUTAMATE – OXALOACETATE AND GLUTAMATE – PYRUVATE TRANSAMINASES IN VARIOUS PARTS OF THE BRAIN OF GROWING DOGS

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In previous investigations the author showed the distinctive character of the distribution of glutamate-oxaloacetate (GOT) and glutamate–pyruvate (GPT) transaminases in the brain structures of dog fetuses (47th-48th day of pregnancy) and of newborn puppies (1 day old).

Despite the fact that in newborn animals the activity of the enzyme was lower than in the fetuses, the GOT and GPT indices remained higher in the spinal cord than in the various parts of the brain [2].

It was decided to investigate the activity of these transaminases in the same division of the brain and spinal cord in the growth period of dogs, and the present investigation was carried out for that purpose.

EXPERIMENTAL METHOD

The activity of the enzyme was studied in the spinal cord, thalamus, hippocampus, the head of the caudate nucleus, and the cerebral cortex using the method described in the previous paper. Experiments were carried out on 10 puppies aged 3-4 weeks, 9 dogs aged 2 months, and 8 adult dogs. The results of the determination are given in conventional units per gram dry weight of tissue.

EXPERIMENTAL RESULTS

The results given in the table show the difference between the activity of the enzymes in the parts of the brain examined during growth of the animals. In the portions of the brain, for instance, the GOT activity at the age of 3-4 weeks was appreciably higher only in the hippocampus and the head of the caudate nucleus, while in the cerebral cortex and thalamus it remained at the same level as in the fetuses.

In the period when the orienting reaction was well developed, with signs of generalization [1], in the puppies aged 2 months, the GOT activity showed a sharp increase in all portions of the brain examined.

In the adult animals the enzyme activity was highest in the head of the caudate nucleus and the cerebral cortex – the phylogenetically youngest brain formations.

The lowered GPT activity in the portions of the brain during the first days of life increased in the course of growth, and in the adult dogs it was close to the values found in the brain structures of the fetuses.

So far as the transaminase activity in the spinal cord is concerned, the GOT level fell particularly sharply during growth of the dogs until the moment of manifestation of the orienting reaction [3] in puppies aged 3-4 weeks. In the adult dogs the GOT activity in the spinal cord was almost 50% below that in the cerebral cortex. The high GPT level in the spinal cord of the fetuses fell until birth, then rose until the age of 2 months, to reach the level of enzyme activity in the fetuses, fell sharply after the adult state had been reached, and came close to the characteristic values found in the newborn puppies.

Hence, in different periods of growth, similar values of activity of these enzymes were found in the portions of the brain studied (a slightly lower level of GPT activity was found only in the cerebral cortex of puppies aged 3-4 weeks). This is evidently due to the unity of cortico-subcortical interaction, which has repeatedly been confirmed in neurophysiological investigations.

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Table 1. Transaminase Activity (in conventional units per gram dry weight of tissue), M ± m

Test object	GOT	GPT	Ratio GOT/GPT
Puppies aged 3-4 weeks (10 animals)			
Cerebral cortex	56 613±5 145	5 655±571	10
Head of caudate nucleus	64 438±3 412	8 418±1 140	7,6
Thalamus	69 550±4 104	8 362±862	8,3
Hippocampus	70 351±3 435	9 172±1 095	7,6
Spinal cord	57 243±2 898	23 935±1 949	2,4
Puppies aged 2 months (9 animals)			
Cerebral cortex	115 680±3 800	11 090±1 166	10,4
Head of caudate nucleus	110 561±4 960	9 840±1 156	11,2
Thalamus	103 933±5 000	11 730±1 049	9
Hippocampus	108 952±5 477	10 898±1 517	10
Spinal cord	67 985±4 197	26 924±2 000	2,1
Adult dogs (8 animals)			
Cerebral cortex	127 089±9 654	12 691±2 149	10
Head of caudate nucleus	133 050±10 880	13 333±1 766	10
Thalamus	116 960±7 616	12 906±2 329	9
Hippocampus	112 204±8 017	11 042±1 703	10
Spinal cord	55 760±5 843	15 941±2 349	3,5

As regards the ratio between the GOT and GPT activities, in the cortex this was constant in the animals of all three age groups (10, 10.4, and 10); in the head of the caudate nucleus by the age of two months this coefficient had reached values somewhat higher than that found in adult dogs (7.6, 11.2, and 10), while in the hippocampus and thalamus of the puppies aged two months, the GOT/GPT ratio was the same as that found in adult dogs (7.6, 10, and 10 and 8.3, 9, and 9, respectively for these parts of the brain). In the period of growth of the dogs, the lowest ratio was found in the spinal cord, increasing slightly in the adult dogs (2.4, 2.1, and 3.5).

Hence, the known difference in the velocity of the reactions catalyzed by GOT and GPT [3-5] was confirmed by these investigations. In the spinal cord, however, this difference was less marked than in the portions of the brain.

It may be concluded from the results obtained that the activity of the enzymes reflects to some degree the functional maturation of phylogenetically different portions of the central nervous system.

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