creased protein concentration in the nucleus and cytoplasm of these neurons are evidence in support of the view that the cause of the decrease in the protein content in these structures is not a decrease in the rate of protein synthesis but an increase in the rate of its breakdown. Possibly under the influence of an extraordinary stimulus the body's reserves are mobilized rapidly, and in that case energy is formed not only by the most efficient way, namely oxidative phosphorylation and glycolysis, but also by protein breakdown, and this may possibly have been the cause of the fall in the protein content which was observed.

The results of these experiments thus show that in emotional stress in rabbits changes take place in the activity of structures belonging to both the parasympathetic and sympathetic divisions of the nervous system, accompanied by increased activity of the genetic apparatus of the cell, and manifested as an increase in the intracellular RNA content in both the ganglion nodosum and the stellate ganglion.

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ACTION OF PHOTIC STIMULATION ON SEROTONIN CONTENT IN MITOCHONDRIA OF THE CENTRAL VISUAL SYSTEM OF DOGS IN EARLY POSTNATAL LIFE

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Data in the literature on the effect of changed conditions of sensory stimulation on the developing brain indicate that acquired experience gives rise to significant functional and structural transformations in various systems of the brain. However, existing ideas and hypotheses of the mechanisms of these transformations are ambiguous and contradictory. In particular, the question of at what levels of the sensory systems do these morphological and physiological transformations take place under the influence of unaltered external stimulation remains disputed and unanswered. Another problem which still requires elucidation is that of the nature of the structural and biochemical processes lying at the basis of plastic transformations.

Considering the great importance of serotonin in brain activity, in order to explain its role in perception of photic stimuli, in the investigation described below the distribution of this indolamine was studied in the mitochondria of certain structures of the central visual system of dogs at various stages of postnatal ontogeny under normal conditions and with exposure of the retina to photic stimulation in early postnatal periods.

EXPERIMENTAL METHOD

Dogs aged 12-16, 21, and 45 days (normal) and dogs aged 21 and 45 days after continuous stimulation of the retina for 1 h by flashes (7 Hz), applied on a screen 50 cm away from the eyes, were used. Fractions of mitochondria isolated by the method [11] from the tissues of individual structures of the central visual system were investigated: from the visual cortex

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TABLE 1. Serotonin Content (in μg/g tissue) in Mitochondrial Fractions of Structures of the Central Visual System of Dogs under Normal Conditions and during Continuous Stimulation of Retina by Flashes for 1 h in Early Postnatal Period (M ± m)

Experimental conditions	Age of animals, days	Visual cortex (area 17)	Superior colliculus	Lateral geniculate body
Normal	12—16	0,047±0,08 (100%) $n=5$	0,252±0,023 (100%) $n=5$	0,174±0,024 (100%) $n=5$
	21	0,077±0,014 (164%) $n=7$	0,303±0,018 (160%) $n=6$	0,241±0,023 (140%) $n=6$
	P	>0,1	>0,1	>0,1
	45	0,064±0,012 (136%) $n=8$	0,279±0,03 (110%) $n=6$	0,242±0,03 (140%) $n=7$
	P	>0,5	>0,5	>0,1
Stimulation of retina by flashes	21	0,104±0,017 (135%) $n=6$	0,557±0,03 (184%) $n=6$	0,520±0,029 (216%) $n=6$
	P_1	>0,5	<0,001	<0,001
	45	0,153±0,012 (239%) $n=8$	0,646±0,038 (232%) $n=5$	0,498±0,03 (206%) $n=6$
	P_1	<0,001	<0,001	<0,001

Legend. P) Significance of differences from results obtained in dogs aged 12-16 days. P_1) Significance of differences between experiment and normal, n) number of experiments.

(area 17), superior colliculus, and lateral geniculate body. The serotonin content in these mitochondrial fractions was determined fluorometrically [9, 10]. The experimental results were subjected to statistical analysis [2].

EXPERIMENTAL RESULTS

It will be clear from Table 1 that the serotonin content in mitochondrial fractions from the various structures of the central visual system of dogs differed and varied during development. In newborn dogs it was highest in the superior colliculus, lower in the lateral geniculate body, and lowest of all in the visual cortex. Differences between the serotonin content in mitochondria of the visual cortex and relay formations of the visual system were statistically significant.

Morphological and physiological differentiation of the visual system in dogs during postnatal development was accompanied by an increase in the total serotonin content. A sharp rise in its content was observed in all the structures tested (by 40-60%) by the 21st day after birth, i.e., immediately after the time when the animals acquired vision (12-16 days). At this time intensive differentiation of neurons and the formation of corresponding synapses take place, accompanied by substantial shifts of metabolism.

By the 45th day after birth the serotonin content in the mitochondria of the visual cortex and super colliculus fell a little and came close to its value in newborn dogs. At the same time the serotonin content in mitochondria of the lateral geniculate body remained the same as at the age of 21 days

The results of the morphological study showed that between the ages of 21 and 45 days neurons in structures of the visual system undergo further differentiation, with proliferation of dendrites and the appearance of new synapses. Electrical activity of the brain (in amplitude and character of discharges) closely resembles that in adult dogs [7, 8].

These particular details of the changes in the serotonin content in these three structures of the central visual system indicate that the basic formation of serotoninergic components takes place in these structures before the 21st day after birth. Subsequent differentiation of microstructures of the visual cortex and superior colliculus (21st-45th days) is evidently associated with the appearance of components containing relatively little or no serotonin in the mitochondrial fractions, as a result of which its concentration falls, i.e., there is an apparent "dilution" effect. Meanwhile serotonin does not accumulate in mitochondrial fractions of the neurons of the lateral geniculate bodies, which differentiate earlier than the rest.

The results of this investigation confirm previous observations on age changes in the serotonin content in tissues of the central visual system of dogs [3, 4] and also observa-

tions of other workers [1] showing an increase in the serotonin content in the brain during postnatal development of rats. These results showing an intensive accumulation of serotonin in the visual system during the period of acquisition of sight suggest that serotoninergic structures are closely linked with the performance of the visual function. This hypothesis was tested in experiments in which the dogs' retinas were stimulated by flashes.

It will be clear from Table 1 that photic stimulation in this way led to a significant increase in the serotonin content in mitochondrial fractions from the superior colliculus and lateral geniculate bodies of dogs aged 21 days and in the mitochondria of all three structures in dogs aged 45 days. These experiments thus also revealed a connection between the serotonin content and photic stimulation. The absence of any significant changes in the visual cortex of experimental dogs aged 21 days can evidently be taken to reflect the incompleteness of differentiation of the serotoninergic systems of the visual cortex at this period, or that these systems are late in appearing.

Serotonin in the visual cortex is linked mainly with the synaptic structures of the axons of the raphe nuclei, but in the superior colliculus it may also have other sources [5]. Visual deprivation of rabbits [6] (keeping them in darkness from birth until the age of 2 months) is known to lead to a fall in the intensity of interaction between serotonin and the serotoninergic receptors of the synaptosomes of the visual cortex and superior colliculus. Transferring the deprived animals for 2 weeks into ordinary conditions of illumination restores the ability of the synaptosomes to respond to serotonin (up to 85% of the normal level). On the basis of these and other data, the author cited regards serotonin as a possible neuromediator (modulator) in the central visual system. The results of the present investigation support this view and indicate that the serotonin system is represented in different quantitative parameters in individual structures of the central visual system, and differs in the time of its differentiation in postnatal ontogeny. The most important shifts in serotonin content under the influence of photic stimulation are characteristically found in the lateral geniculate bodies.

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