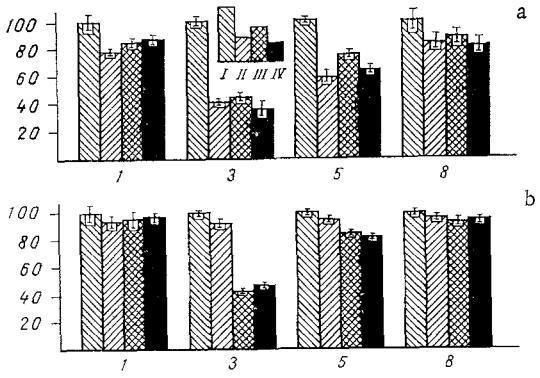

Fig. 1. Transketolase activity in liver (a) and brain (b) tissues of albino mice at different times of investigation after injection of HT (II), HTCP (III), and HTCPB (IV) in % of control (I). Abscissa, time (in days); ordinate, transketolase activity (in % of control).

reason for their higher toxicity than that of HT.

The suggested compounds can thus be used successfully as preparations specifically inhibiting the functioning of the pentose cycle in nerve tissue at the transketolase level.

LITERATURE CITED

1. A. I. Voskoboev, Yu. M. Ostrovskii, and I. P. Chernikevich, Bioorg. Khim., 1, 1488 (1975).
2. M. D. Mashkovskii, Therapeutic Substances [in Russian], Moscow (1972).
3. Yu. M. Ostrovskii, Antivitamins in Experimental and Clinical Practice [in Russian], Minsk (1973).
4. F. H. Bruns, E. Dunwald, and E. Notlmann, Biochem. Z., 330, 495 (1958).
5. A. G. Datta and E. Racker, J. Biol. Chem., 236, 617 (1961).
6. L. R. Johnson and C. J. Gubler, Biochim. Biophys. Acta, 156, 85 (1968).
7. J. T. Litchfield and F. J. Wilcoxon, J. Pharmacol. Exp. Ther., 96, 99 (1949).
8. A. Muralt, Ann. N.Y. Acad. Sci., 98, 499 (1962).
9. G. Rindi, L. Giuseppe, and U. Ventura, J. Nutr., 81, 147 (1963).

RNA CONTENT IN STRUCTURES OF THE AUTONOMIC NERVOUS SYSTEM OF RABBITS IN ACUTE EMOTIONAL STRESS

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KEY WORDS: stress, ganglion nodosum; stellate ganglion; RNA.

Changes in protein metabolism in the extramural ganglia of the autonomic nervous system were demonstrated previously in rabbits in acute experimental stress. Since RNA plays a primary role in protein biosynthesis, it appeared important to study whether the RNA content changes in neurons of the parasympathetic ganglion nodosum and sympathetic stellate ganglion of rabbits with acute emotional stress.

EXPERIMENTAL METHOD

Emotional stress was induced in immobilized rabbits by simultaneous aperiodic stimulation of negative emotiogenic centers of the hypothalamus (ventromedial nuclei) and electrodermal stimulation in accordance with a specially developed stochastic scheme. The ventromedial hypothalamic nuclei were stimulated by bipolar nichrome electrodes, and electrodermal stimulation was carried out through steel needles inserted under the skin of one of the ani-

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TABLE 1. RNA Content in Ganglia of Autonomic Nervous System in Acute Experimental Emotional Stress (M ± m)

Test structure	Experimental conditions	Number of animals	Number of neurons	Total RNA	Number of neurons	After extraction at 3°C
Ganglion nodosum	Animal house control	5	143	177±9	65	255±11
	Stress	5	114	231±10*	91	176±11
Stellate ganglion	Animal house control	5	117	171±7		
	Stress	5	109	211±9*		

*Difference significant compared with control ($P < 0.05$).

mal's hind limbs. Square pulses of current with a frequency of 50 Hz, pulse duration 1 msec, and voltage 5-10 V, applied for a duration of 1-2 min, were used. The parameters of the electric current were selected individually, with a view to causing an increase of 20-30 mm Hg in the blood pressure without any marked motor response from the animal. In the course of implementation of the whole stress program (3 h) the arterial blood pressure, heart rate, and respiration rate of the rabbits were continuously recorded with the aid of strain gauges and piezoelectric transducers connected to a Siemens-Elema Mingograph. Depending on the character of changes in these autonomic parameters the experimental animals were divided into two groups: resistant and predisposed to stress. The group of resistant animals was characterized by very small fluctuations of arterial pressure, whereas in the predisposed group the pressure fell progressively and the animals ultimately died. Only predisposed animals were chosen for cytochemical investigation. Animals kept in the animal house under normal conditions were used as the control. The parasympathetic ganglion nodosum and the sympathetic stellate ganglion were taken from the experimental rabbits for study. The ganglia were fixed in Carnoy's fluid and embedded in paraffin wax. Single neurons were isolated from sections 40μ thick by means of a De Fonbrune micromanipulator under control of the MBI-3 microscope. To determine the RNA content in single neurons the micromethod described by Edström [4] and modified by Maksimovskii [2] was used. The RNA content in a single cell was calculated by the method in [6]. An attempt was made to fractionate the RNA by selective precipitation from the cells with phenol [5]. For this purpose the isolated cells were placed in a solution containing equal volumes of 0.14 M NaCl and water-saturated phenol. Extraction continued for 1 h at 3°C. The cells were then transferred into cold absolute alcohol for 15 min. The RNA left in the cells was determined by the method in [4]. All the numerical results were subjected to statistical analysis by the methods in [3].

EXPERIMENTAL RESULTS

The experiments showed that a significant increase in the RNA content by 30 and 23% relative to the control took place in neurons of the parasympathetic ganglion nodosum and sympathetic stellate ganglion of rabbits predisposed to stress (Table 1). Many biochemical investigations have now shown that there are three types of RNA in the cells of animal tissues: ribosomal RNA (high-polymer, containing the greater part of the total cell RNA), transfer RNA (low-polymer, acting as molecular adaptor of amino acids, transferring particular amino acids to their appropriate sites on the protein-synthesizing template), and messenger RNA (high-polymer, playing the role of template in protein synthesis). In the present investigation, transfer RNA and some of the ribosomal RNA could be isolated from neurons of the ganglion nodosum by extraction of the RNA at 3°C; in this case the residual RNA (nuclear and some cytoplasmic) in neurons of the experimental animals was 13% greater (Table 1, difference not significant).

The results of previous investigations [1] are evidence that under conditions of emotional stress activity of structures of both parasympathetic and sympathetic divisions of the nervous system is modified in rabbits predisposed to stress. In a ganglion of the sympathetic nervous system (stellate) increased functional activity was accompanied by predominance of anabolic processes, as shown by an increase in the concentration of water-soluble proteins which are particularly important for the performance of cell functions, including mediator synthesis. Changes in the RNA content in cells of the stellate ganglion, in the same direction as changes in the protein content, also point to increased activity of these ganglia. A decrease in the protein content in both nucleus and cytoplasm was found in the parasympathetic ganglion nodosum. The increase in RNA content in cells of the ganglion nodosum discovered in the present experiments, just as in previous experiments [1], and the in-

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.

LITERATURE CITED

1. A. V. Gorbunova and V. V. Portugalov, Arkh. Anat., No. 7, 28 (1980).
2. L. F. Maksimovskii, Tsitologiya, No. 4, 522 (1969).
3. N. A. Plokhinskii, Biometric [in Russian], Moscow (1970).
4. J. E. Edström, Methods Cell. Physiol., 1, 417 (1964).
5. E. Egyhazi, Biochim. Biophys. Acta, 114, 516 (1966).
6. D. Slagel and J. E. Edström, J. Cell. Biol., 34, 395 (1967).

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

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KEY WORDS: ontogeny; photic stimulation; serotonin; brain.

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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