RECEPTOR BINDING OF CORTICOSTERONE IN MONOAMINERGIC STRUCTURES OF THE BRAIN OF RATS AFTER NEONATAL BLOCKADE OF THE HYPOPHYSEOADRENAL SYSTEM

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The monoaminergic structures of the brain play a substantial role in the realization of stressor effects. The signals arriving from the environment pass along them to a hypothalamus, effecting the stressor activation of the adrenocorticotropic function of the hypophysis [1, 2]. Data exist indicating that the catecholamines may potentiate the effect of corticoliberin, by interacting with α-adrenoreceptors in the anterior and intermediate lobes of the hypophysis [6, 7, 8]. A feedback loop between the hypophyseoadrenal system and the monoaminergic structures also exists, since the corticosteroids alter not only the content but the metabolism of norepinephrine and dopamine in the hypothalamus and in a number of other brain structures [4, 12]. We have not encountered data in the literature regarding the influence of these hormones on the corticosteroid receptors in the monoaminergic structures.

MATERIALS AND METHODS

The study was carried out on Wistar rats that were administered hydrocortisone in a dose of 0.1 mg per animal on the first 5 days of life. The reception of corticosterone in the monoaminergic structures was investigated in the animals at the age of 1 and 2 months. For this purpose the animals were adrenalectomized 2 days before the experiment; on the day of the experiment the brain was extracted after decapitation, washed free of blood in cooled physiological solution, and the following structures were removed: the hypophysis, the hippocampus, the hypothalamus, and the macula coerulea, containing primarily noradrenergic neurons and terminals. The structures extracted were homogenized in a cooled 50 mM tris-HCl buffer at pH 7.4, containing 10 mM of Na₂MoO₄, 5 mM CaCl₂, and 2 mM of dithiothreitol (7 μliters per 1 mg of raw tissue weight). The homogenate was centrifuged 30 min at 5000g. The supernatant in a volume of 100 μliters was placed in paired test tubes; 4·10⁻⁸ M labeled corticosterone (Amersham, relative activity 80–100 Ci/m mole) in 100 μliters tris-HCl buffer was added to one test tube; and the same amount of labeled hormone with 500 times the content of unlabeled corticosterone was added to the other. The samples were incubated for 3 h in an ice bath. In order to extract the unbound hormone, 500 μliters of a dextran-charcoal mixture (0.5% dextran and 5% charcoal in a tris-HCl buffer) were added to each sample. All of the samples were agitated, held at 0°C for 10 min, and centrifuged. The radioactivity of the supernatant was determined on a Mark-3 scintillation counter (USA) with a photopeak efficiency of about 50%. The degree of receptor binding was estimated on the basis of the difference between the radioactivity of the samples which contained and did not contain an excess of unlabeled ligand. The receptor-bound hormone was calculated per 1 mg of protein. The corticosterone content was determined radioimmunologically using an antiserum obtained by immunizing rabbits with a protein-steroid complex synthesized in Leningrad University.*

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RESULTS AND DISCUSSION

When the number of corticosteroid receptors in various structures of the rat brain was studied, it was established that the binding of corticosterone in dopaminergic (striatum, substantia nigra) and noradrenergic (macula coerulea) structures does not differ from that in the target tissues for the corticosteroid hormones (the hypothalamus and the hypophysis) (Fig. 1).