It can be concluded from these data that binding sites (receptors) on the hepatocyte surface for different gangliosides differ from one another.

The existence of receptors for particular gangliosides has been demonstrated for alveolar macrophages [8]. Gangliosides G_{M2} and G_{D1}, i.e., different gangliosides from those which we showed to have high affinity for hepatocytes, had the highest affinity in the investigation cited. Only further experiments will show whether this means that receptors specific for each type of cell exist on the cell surface for a particular ganglioside (or set of gangliosides).

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MORPHOLOGICAL AND FUNCTIONAL CHARACTERISTICS OF THE THYROID GLAND OF INTACT AND PARTIALLY DESYMPATHIZED RATS IN DIFFERENT AGE GROUPS

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It has now been shown that changes in the pattern of function of the sympathetic nervous system causes readjustment of the morphological and physiological parameters of the endocrine organs. Data on the response of the thyroid gland (TG) to desympathization are few in number and contradictory in nature. Besides a definite reduction of TG functional activity in response to depression of the adrenergic innervation [4, 5], a significant increase in the height of the follicular epithelium and a decrease in the diameter of the follicles are observed [7], evidence of hyperfunction of the gland. Finally, in some investigations no morphological changes whatsoever could be found in the gland as a result of desympathization [2, 10]. In most investigations the question of the role of sympathetic impulses in the regulation of TG activity has been tackled mainly by means of surgical methods of desympathization which, as a rule, lead to mixed denervation of the gland. There have been few investigations of a comprehensive nature into the morphological and functional parameters of TG [2, 15], especially from the age standpoint [5, 7].

The aim of this investigation was to study morphological and functional parameters of TG in rats of different age groups, developing normally and after partial chemical desympathization.

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TABLE 1. Characteristics of Morphometric Parameters for TG of Control and Desympathized Animals of Different Ages

Age of animals, months	Experimental conditions	Bulk density, %			Diameter of follicles, μ	Height of thyrocyte, μ	SIR, μ^{-1}
		colloid	thyroid epithelium	connective tissue			
1	Control	12,17±0,47	70,71±0,66	17,12±0,54	41,55±0,67	11,31±0,15	0,211
	Expt.	18,93±0,51*	61,23±0,63*	19,84±0,51*	45,2±0,66*	8,95±0,17*	0,147
2	Control	17,53±0,49**	64,45±0,62**	18,02±0,5	46,98±0,81**	10,63±0,14**	0,156
	Expt.	22,37±0,54*	52,53±0,64*	25,10±0,56*	49,52±0,93	9,48±0,17*	0,131
3	Control	22,73±0,6**	60,08±0,71**	17,19±0,54	49,44±0,89**	8,62±0,12**	0,124
	Expt.	21,88±0,53	56,03±0,64*	22,09±0,54*	51,11±1,02	9,63±0,11	0,126
6	Control	30,55±0,68**	50,88±1,04**	18,57±0,58	64,41±1,12**	7,95±0,11**	0,082
	Expt.	21,15±0,53*	57,42±0,64*	21,43±0,53*	58,63±1,05*	10.66±0,1	0,107

Legend. **$p < 0.005$ compared with control animals of the same age, †$p < 0.005$ compared with intact animals aged 1 month.

TABLE 2. Functional Parameters of Hormonal Activity of TG and of Thyrotrophic Function of Pituitary in Intact and Desympathized Rats of Different Ages

Age of animals, months	Experimental conditions	T_3, nmoles/liter	T_4, nmoles/liter	TTH, μg/liter	T_4/TTH.10^{-1}, units
1	Control	2,689±0,165	92,362±11,357	4,022±0,283	1,757±0,093
	Expt.	2,258±0,113 ($p<0,05$)*	61,626±4,95 ($p<0,05$)*	4,254±0,097	1,118±0,068 ($p<0,005$)*
3	Control	0,924±0,059 ($p<0,005$)**	92,751±6,593	3,318±0,039 ($p<0,025$)**	2,162±0,131
	Expt.	0,956±0,063	84,606±4,116	4,399±0,138 ($p<0,005$)*	1,491±0,058 ($p<0,005$)*
6	Control	0,618±0,028 ($p<0,005$)**	58,764±2,649 ($p<0,01$)**	2,791±0,309 ($p<0,01$)**	1,661±0,093
	Expt.	0,762±0,052 ($p<0,05$)*	67,768±5,521	4,51±0,522 ($p<0,025$)*	1,179±0,077 ($p<0,005$)*

Legend. *) Significance of differences from control animals of the same age, **) from animals aged 1 month.

EXPERIMENTAL METHOD

Experiments were carried out on 42 male albino rats. Partial desympathization was achieved by subcutaneous injection of a solution of guanethidine (Isobarin, from Pliva, Yugoslavia) in a dose of 15 mg/kg during the first 14 days after birth. The program of administration of the drug led to death in more than 80% of the nerve cells in the sympathetic ganglia [6]. The control series consisted of 46 animals. The experimental animals were divided into the following age groups: 1 month — infantile, 2 and 3 months — immature juvenile, 6 months — reproductive age. To assess the functional activity of TG the rats were given an intramuscular injection of ^{131}I in a dose of 500 kBq/kg body weight and the iodine-accumulating capacity of the gland was investigated with the aid of the DSU-61 system. After radiometry of TG the animals were decapitated and concentrations of tri-iodothyronine (T_3), thyroxine (T_4), and pituitary thyrotrophic hormone (TTH) were determined in the blood serum of each rat by means of standard kits from Byk-Mallinckrodt (West Germany) and "CEA-IRE-Sorin" (France) and also of Soviet test kits. For histological study TG was fixed in Bouin's and Carnoy's fluid and embedded in paraffin wax. Serial sections 4-5 μ thick were stained with hematoxylin and eosin and subjected to stereometric analysis [1]. Small fragments of TG for electron microscopic investigation were fixed in glutaraldehyde and OsO_4 and embedded in a mixture of Epon and M araldite. Ultrathin sections were stained with uranyl acetate and examined in the JEM-7A electron microscope. The results were subjected to statistical analysis.

EXPERIMENTAL RESULTS

The highest functional activity of TG in intact albino rats was recorded at the earliest times of postnatal development. Morphologically, TG in animals aged 1 month consisted of small and medium-sized follicles, mainly circular in shape. The intracellular space was filled with pale pink colloid. The follicular epithelium was high and cylindrical. The results of stereologic analysis indicate that the thyroid epithelium predominated in actions through the gland (Table 1).

At subsequent age periods (2, 3, and 6 months) changes characterized by an increase in the average size of the follicles, flattening of the thyrocytes, and reduction of the stereologic index of resorption (SIR) were observed in TG of the rats. Bulk density of the colloid material was considerably increased. The content of thyroid epithelium was significantly reduced under these circumstances. No significant changes were observed in the connective-tissue components of the gland with age (Table 1). The levels of T_3 and T_4 in the blood serum fell with age, as a result of weakening of pituitary thyrotrophic function (Table 2). Intravital radiometry showed that in rats aged 1 month the rate of accumulation of injected ^{131}I was much greater than in animals aged 2, 3, and 6 months. The percentage of maximal assimilation of ^{131}I was highest in rats aged 6 months. However, when the iodine concentration was calculated per unit weight of TG, the iodine-accumulating capacity of rats aged 1 month was found to be 2.1 times higher than that of animals of the young, reproductive age. Consequently, in postnatal ontogeny gradual reduction of the functional activity of TG is observed, and this is confirmed by the results of quantitative histologic analysis and radioimmunoassay.

After desympathization of TG in animals of the different age groups, a varied morphological pattern was observed. An increase in the relative density of the stromal component was clearly observed in the organs, possibly due to the appearance of a vascular reaction as the logical sequence to a fall in the level of adrenergic innervation. In experimental rats aged 1 month changes corresponding to hypofunction of the gland were observed in the thyroid parenchyma. The adenomeres of TG were somewhat enlarged, the density of the colloid was increased, whereas SIR and the average height of the thyroid epithelium were reduced (Table 1). Plasmarrhagia, edema, and swelling of the stroma were observed locally in TG, the thyrocytes were hypertrophied, and their cytoplasm showed signs of vacuolation. In some cells cloudy swelling degeneration and necrobiosis were observed. The morphological picture, evidence of reduced activity of the organ, was confirmed also by function tests. The T_3 and T_4 levels in the blood serum of desympathized animals aged 1 month were depressed and the transport (inorganic) phase of iodine metabolism was delayed by comparison with that in control animals of the same age. Since the plasma TTH concentration in animals of this group was not reduced, this suggests that the release of thyroid hormones into the general blood stream is disturbed because of reduced sensitivity of TG to the stimulating action of TTH (Table 2). Similar changes in the thyroid parenchyma of immunodesympathized mice aged 1 month have been observed by other workers also [4]. The morphological changes described above in desympathized rats were somwhat reduced by the age of 3 months. This was evidently on account of a compensatory increase in TTH production by the pituitary, confirming the view that additional mechanisms of regulation of TG by the hypothalamo-hypophyseal system are activated [8, 9, 12, 13].

Analysis of the morphological and functional parameters of TG of the young desympathized animals reveals a hyperthyroid state of the gland. An increase in the total T_4 concentration was recorded by radioimmunoassay of the blood serum. The iodine-accumulating capacity of the gland was considerably increased. Histologically, a decrease in the mean diameter of the follicles and an increase in the height of the follicular epithelium were observed in the gland. The intracellular space was filled with vacuolated colloid, whose bulk density was significantly higher than in control animals of the same age (Table 1).

The age dynamics of the parameters studied may be attributed to partial restoration of the sympathetic innervation of the gland. We know that the density of adrenergic endings in the innervated tissues virtually reaches the control level by the age of 4-5 months [11], and pressor reflexes at the periphery are restored by the same age [3]. The initial sharp increase in the vascular response later gives way to a certain decrease, evidence of restoration of the normal capacity of the vascular bed of the organ due to an increase in tone of the vessel walls. The sympathetic nervous system not only regulates vasomotor responses, but also has a direct stimulating action on thyroid tissue [14]. The sharp decrease in the number of sympathetic neurons in the experimental rats aged 1 month inhibited thyroid function. After partial restoration of the adrenergic innervation of the gland by the age of 6 months, and preservation of the enhanced thyrotrophic function of the pituitary (the latter is evidently due to reduced sensitivity of the thyroid cells to the stimulating action of TTH under conditions of desympathization), TG of the young animals begins to experience functional strain.

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COMPARATIVE EFFECT OF DIFFERENT LIGANDS OF OPIOID RECEPTORS ON CELL DIVISION IN THE ALBINO RAT LINGUAL EPITHELIUM

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Ligands of opiate receptors include regulatory peptides, with a modulating influence on the function of various systems. In previous investigations the writers showed that following direct application and systemic administration of dalargin, a synthetic enkephalin analog, and naloxone, an antagonist of opiate receptors, cell division is stimulated in the corneal epithelium.

The aim of this investigation was to compare the effects of different ligands of opioid receptors on cell division in the lingual epithelium.

EXPERIMENTAL METHOD

Experiments were carried out on male albino rats weighing 150-180 g. β-Endorphin, Leu-enkephalin (from Serva, West Germany), naloxone (from Endo Laboratories, USA), and Dalargin (All-Union Cardiologic Scientific Center, Academy of Medical Sciences of the USSR) were injected intraperitoneally (0.1 ml of a $2 \cdot 10^{-9}$ M solution of the test ligands/100 g body weight). The preparations were injected at 2 p.m. Animals receiving an intraperitoneal injection of the same volume of isotonic saline served as the control. Cell division was studied 24 h after injection of the preparations. An intraperitoneal injection of ^{3}H-thymidine (molar activity 60 Cu/mmole) was given to the animals in a dose of 0.6 μCi/g body weight 1 h before sacrifice. Autoradiographs and histologic sections were prepared, and the index of labeled nuclei (ILN, %), intensity of DNA labeling (IL, average number of grains

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