DATA RELATING TO THE MECHANISM OF ACTION OF THYROXIN

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The effect of L-thyroxin on the state of the sympathetic ganglia was studied in acute experiments on cats. By applying L-thyroxin to the body of a ganglion with acetylcholine or adrenalin in different orders it was shown that the hormone may act directly on the efferent part of the sympathetic reflex.

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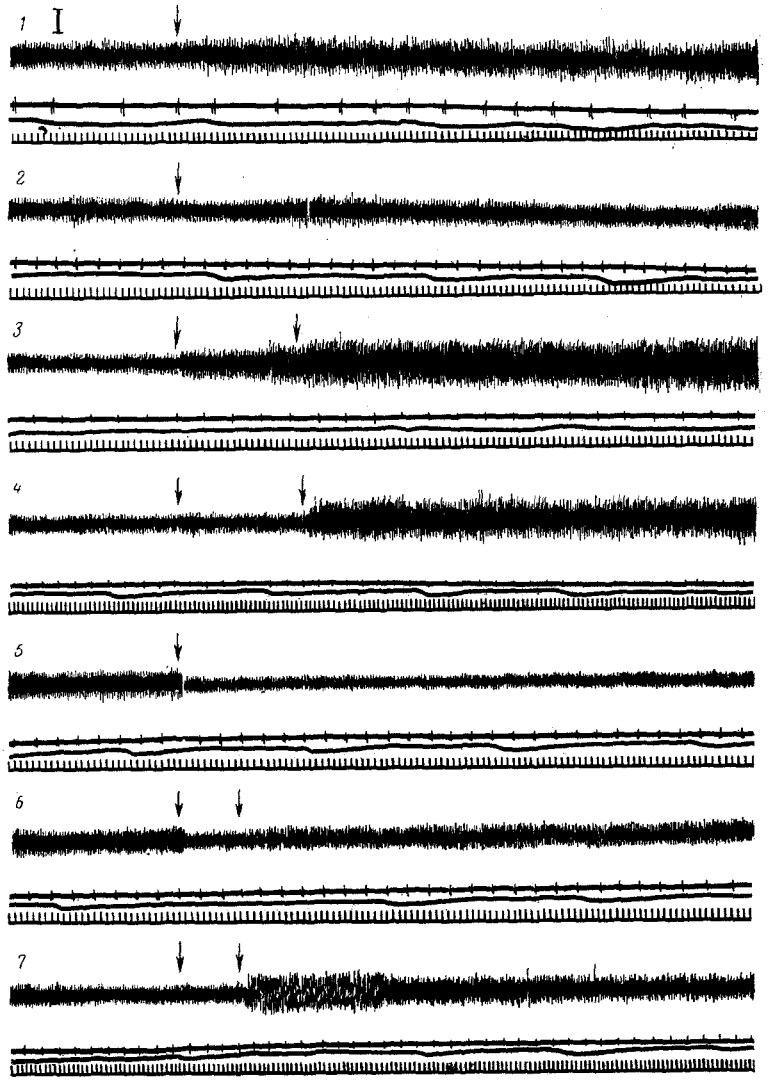

Fig. 1. Potentials of postganglionic fibers of inferior mesenteric sympathetic ganglion. 1) Dynamics of activity after injection of 20 μg acetylcholine (beginning of injection indicated by arrow); 2) activity after injection of 30 μg L-thyroxin; 3) injection of 30 μg thyroxin against a background of acetylcholine (20 μg); 4) injection of 20 μg acetylcholine after preliminary injection of thyroxin (30 μg); 5) injection of 1 μg adrenalin; 6) injection of 30 μg thyroxin after injection of 1 μg adrenalin; 7) injection of 1 μg adrenalin after injection of 30 μg thyroxin. Scale of amplitude 20 μV. Time marker 0.1 sec. Experiments on spinal animals.

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Existing views of possible ways and mechanisms of the action of thyroid hormones in the intact organism have not taken into account their influences on peripheral effectors [1-8].

An attempt was made to investigate the direct action of thyroid hormones on sympathetic ganglia.

EXPERIMENTAL METHOD

The test objects were the inferior mesenteric and superior cervical sympathetic ganglia of spinal cats. Electrical activity of the postganglionic nerve fibers of the ganglia, deprived of their central connections, was recorded by the usual electrophysiological method.

EXPERIMENTAL RESULTS

Injection of L-thyroxin into the blood stream in doses of between 30 and 500 μg in an acute experiment usually had no effect on electrical activity in the pre- and postganglionic nerve fibers. Large doses of the hormone, on the other hand, abolished all activity in both groups of fibers. Perfusion of the sympathetic ganglion with these doses of L-thyroxin likewise caused no changes in bioelectrical activity (see Fig. 1).

Different results were obtained in an acute experiment when the hormone was given (30 μg) after preliminary injection of acetylcholine (5-10 μg) or adrenalin (0.5-1 μg) into the blood stream, and also in cases when acetylcholine or adrenalin was injected after thyroxin. The oscillogram (see Fig. 1, 1) shows changes in the electrical activity of the postganglionic nerve fibers after injection of 10 μg acetylcholine. Injection of 30 μg thyroxin in a pure form had no effect on electrical activity of the postganglionic fibers (see Fig. 1, 2). Injection of thyroxin against the background of the preliminary injection of acetylcholine considerably increased both the frequency and the amplitude of impulse activity in the postganglionic fibers, already increased by the action of the acetylcholine (see Fig. 1, 3). Injection of acetylcholine after thyroxin caused a marked and prolonged increase of activity (see Fig. 1, 4). The amplitude of the impulses exceeded 40 μV, and it became difficult to estimate the frequency of the impulses. Injection of thyroxin after preliminary injection of adrenalin diminished the inhibitory effect of adrenalin (see Fig. 1, 6), while conversely, the injection of adrenalin after thyroxin caused a very slight increase in electrical activity of the postganglionic fibers.

The results of these investigations in which thyroxin was applied intraarterially to the body of the ganglion in various combinations with acetylcholine and adrenalin thus show that in certain conditions the hormone may act directly on the neurons of the sympathetic ganglia.

LITERATURE CITED

1. S. G. Genes, Uspekhi Sovrem. Biol., 44, No. 2, 186 (1957).
2. G. N. Kassil' and T. G. Plotitsyna, Byul. Éksp. Biol., 8, No. 1, 50 (1939).
3. G. N. Kassil' and T. G. Plotitsyna, Fiziol. Zh. SSSR, No. 6, 681 (1946).
4. A. M. Marits, Fiziol. Zh. SSSR, No. 10, 1235 (1961).
5. Yu. Rosner, Fiziol. Zh. SSSR, No. 5, 473 (1958).
6. G. Benetato, K. Oprishiu, E. Rozenfeld, et al., Probl. Éndokrinol., No. 2, 43 (1959).
7. B. Issekutz and B. Issekutz, Arch. Exp. Path. Pharmak., Bd.177, S.442 (1935).
8. S. Werner (Editor), The Thyroid Gland, Physiology and Clinical Aspects [Russian translation], Leningrad (1963).