its normal inhibitory effect on the respiratory center. That is why, despite the normal composition of the blood gases, the patient needs additional stretching of the muscles and additional artificial ventilation of the muscles, which causes hypocapnia. The latter, in turn, makes it necessary to increase the hyperventilation still more. However, the primary reason why hyperventilation is necessary in patients with paralysis of the respiratory muscles is insufficiency of the inhibitory Hering–Breuer reflex.

**LITERATURE CITED**


**CHANGES IN BLOOD CHOLESTEROL AND TRIGLYCERIDE LEVELS DURING SELF-STIMULATION AND AVOIDANCE REACTIONS**

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Change in the blood cholesterol and triglyceride levels during self-stimulation and avoidance reactions were studied in rabbits of both sexes. Self-stimulation was accompanied by a significant fall in the blood cholesterol and triglyceride levels. During the avoidance reaction the character of changes in the cholesterol level varied. In avoidance reactions of the *aggression* type the blood cholesterol was raised, whereas in reactions of the *fear* type it was lowered. The maximal deviation of the blood cholesterol from its initial level in all types of reactions was observed 15-30 min after stimulation.

KEY WORDS: electrical stimulation of the hypothalamus; self-stimulation and avoidance reactions; lipids.

In an earlier chronic experimental investigation [8] it was shown that compulsive stimulation of the emotogenic zones of the hypothalamus through implanted electrodes, giving rise to qualitatively different emotional behavioral responses, both negative and positive, is accompanied by opposite changes in the blood cholesterol level.

In the investigation described below, in order to obtain more objective conclusions regarding the appearance of a positive emotional state in the animal, the self-stimulation method was used; according to most investigators, this method is associated either with the appearance of an emotional state of positive sign only, or with predominance of positive components in the emotional state [2-5, 15]. The avoidance reaction was used as the criterion of a negative emotional state. The character of changes in the blood cholesterol and, in some cases, the triglyceride levels were investigated in these states.

**EXPERIMENTAL METHOD**

Experiments were carried out on 20 adult rabbits of both sexes weighing 3-3.5 kg. Bipolar nichrome electrodes 0.1 mm in diameter were implanted into the brain structures by a random method [14] in accordance with coordinates of a stereotaxic atlas [16]. To obtain a self-stimulation reaction the electrodes were inserted into the region of the lateral hypothalamus and medial forebrain bundle, and to obtain negative emotional and
TABLE 1. Effect of Self-Stimulation Reaction on Changes in Blood Cholesterol and Triglyceride Levels in Rabbits (M ± m)

<table>
<thead>
<tr>
<th>Indices of lipid metabolism</th>
<th>Initial level</th>
<th>Time of taking blood after end of self-stimulation, min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Cholesterol, mg%</td>
<td>45.4 ± 3.1</td>
<td>33.9 ± 3.04</td>
</tr>
<tr>
<td>n</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>P</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Triglycerides, mg%</td>
<td>46.3 ± 2.3</td>
<td>29.3 ± 2.5</td>
</tr>
<tr>
<td>n</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>P</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

Legend. Here and in Table 2, limits of variations shown in parentheses.

behavioral avoidance reactions they were inserted into the ventro- and dorsomedial nuclei of the hypothalamus. A sinusoidal current with a strength of between 10 and 100 μA and a frequency of between 20 and 60 Hz was applied to the electrodes.

To teach self-stimulation skills a stimulator with time relay [1], giving constant duration of stimulation (1 sec), was used. To press the lever the rabbit used its teeth or mouth.

The avoidance reaction was elicited by the use of the same apparatus. Self-stimulation and avoidance sessions lasted 30 min. All the animals took part in the experiments for 1 to 2 months.

Blood from the marginal vein of the ear was taken in some cases before and 3 min after the end of stimulation, and in other cases 3, 15, 30, and 60 min after stimulation. The blood cholesterol concentration was determined by the method in [11] and the triglycerides as in [12, 13].

To verify the location of the electrode tips morphologically the brain was fixed in 10% formalin solution. Sections were stained by Nissl’s method.

EXPERIMENTAL RESULTS AND DISCUSSION

Three types of reactions were observed during self-stimulation in the rabbits. In some cases there was only a self-stimulation reaction, in others a self-stimulation reaction accompanied by a food response and, finally, relatively weak self-stimulation with a predominant food response.

The avoidance reaction appearing in the rabbits after compulsory contact with the lever as a rule was mixed in character, as other workers also have found [4]. Nevertheless, two types of negative emotional and behavioral reactions could be distinguished: "fear" and "aggression." Whereas during a "fear" reaction the rabbits usually tried to hide in the corner or to squeeze against the floor, in the "agression" reaction the animals behaved actively: They stamped on the floor with their hind limbs, uttered threatening sounds and, when the provoking object was shown to them they pounced on it, and even after the end of electrical stimulation, for a long time they remained in a state of excitation — they stamped with their paws and continued to make threatening noises. In most cases, however, the predominant reaction of the animals was one of "fear."

The morphological control showed that the electrode tips were located in the lateral hypothalamic region (at the level of the tuber cinereum) in its dorsal, ventral, or lateral parts, and also in the lateral preoptic region (dorsal part). An avoidance reaction of "agression" type was observed when the electrode tips were located in the ventromedial nucleus of the hypothalamus and on the boundary between the ventro- and dorsomedial nuclei of the hypothalamus. An avoidance reaction of "fear" type was observed in some rabbits in which the electrode tips were located in the same structures, but also in the posterior hypothalamic nucleus, on the boundary between the ventro- and dorsomedial nuclei and the posterior hypothalamic nucleus, on the boundary between the dorsomedial and perifornical hypothalamic nuclei, and also in the dorsal part of the medial preoptic region between the paraventricular nucleus and the fornix.

Investigation of the blood-lipid levels showed that during self-stimulation there was a tendency in most rabbits for the cholesterol level to fall regardless of the type of responses which predominated. In some cases deviations of the cholesterol concentration from its initial level were not observed. On average, in 33 experiments on five rabbits the cholesterol level before stimulation was 38.6 ± 2.1 mg%, compared with 29.7 ± 2.18 mg% 3 min after the end of self-stimulation (P < 0.01).