

# CHANGES IN THE BIOELECTRIC POTENTIALS OF THE CEREBRAL CORTEX CAUSED BY DETELEN\*

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Detelen (the dicholine ester of succinic acid), given to us by Prof. A. L. Midzhoyany, in whose laboratory it was first synthesized in 1947-1948, is regarded as diacetylcholine and possesses powerful curareform properties [4].

Its pharmacodynamics were demonstrated in investigations carried out in the laboratory of M. Ya. Mikhelson. R. S. Rybolovlev [4] investigated the effects of diacetylcholine on striated muscle and blood pressure. S. N. Vishnyakov, M. Ya. Mikhelson, E. K. Rozhkova and R. S. Rybolovlev [2] carried out a comparative study of diacetylcholine in regard to its curareform properties, its effect on blood pressure, etc. Finally, S. M. Vishnyakov [1] showed that diacetylcholine exhibits a stimulating action on the N-choline receptors of the blood vessels of the reflex zone.

The effect of detelen on the state of the central nervous system, in particular on its higher centers, remains unelucidated.

Studying the effect of detelen on spinal reflexes, R. S. Rybolovlev came to the conclusion that "detelen in curarizing doses exhibits no effect on the central nervous system."

We studied the effect of detelen on the bioelectric activity of various regions of the cerebral cortex of dogs. The purpose of our investigations was to estimate the functioning of the cerebral cortex during the development of the curareform effect by changes in its electrical activity.

## METHODS

The electrical activity of the cortex was recorded, using a 4-stage amplifier and a recording oscillograph. We led off the biopotentials from the occipital, parietal, temporal and frontal regions of the cortex.

In addition to the bioelectric currents, we recorded also the blood pressure, respiration, and body temperature.

Since the animals became absolutely motionless only when breathing ceased, we gave the animals artificial respiration, which was carried out with the help of the appropriate apparatus, which was present in all the experimental rooms and which was attached to the trachea by a rubber tube.

Two series of experiments were carried out. In the first series, consisting of 10 experiments, the effect of detelen in a dose of 0.8-1 mg/kg was investigated.

In agreement with the findings of R. S. Rybolovlev, a sharply expressed curarizing effect was observed following the administration of doses of 5 to 10 mg/kg. Therefore in the second series (12 experiments) we investigated the bioelectric activity of the cerebral cortex after the injection of large doses (5-10 mg/kg) of

\* Russian trade name.

detelen. In all cases a 1% solution of detelen was injected intramuscularly.

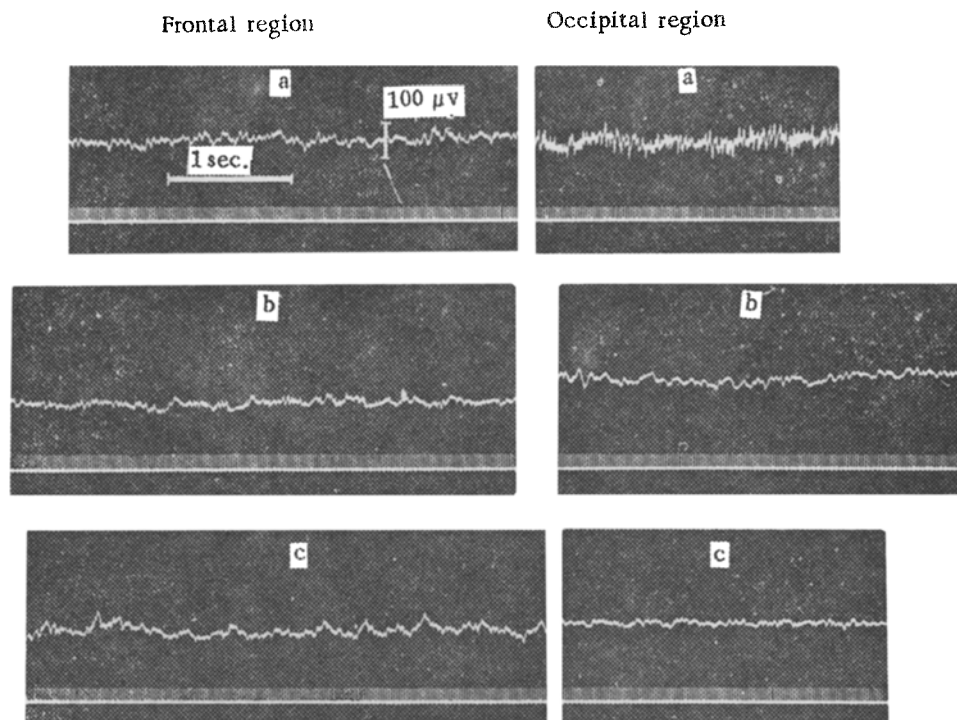


Fig. 1. Changes in the bioelectric activity of the cerebral cortex after injection of detelen. a) before injection of detelen; b) about 15 minutes after injection of 0.8 mg/kg of detelen; c) about 40 minutes after injection of detelen (dog still completely motionless).

Changes in the electroencephalogram (EEG) appeared within 2-3 minutes after intramuscular injection of detelen in large doses, and about 10-15 minutes after the injection of small doses of the preparation.

Analysis of the EEG provides evidence that in the animals curarized with detelen a depression of the dominant rhythm of biopotentials is observed in all regions of the cerebral cortex which were tested, and as would be expected the degree of depression of the dominant rhythm varies according to the dose of detelen, i.e., the extent and duration of the curarizing effect.

As can be seen from Fig. 1 (Experiment No. 4), detelen brings about a decrease in amplitude of the oscillations of cerebral cortex potential, and as would be expected the depression is more distinct in the occipital region of the cortex. About 40 minutes after administration of detelen (c), the bioelectrical activity of all regions recovered completely, but in the occipital region rapid oscillations of low amplitude were observed. If before the administration of detelen the amplitude of the dominant rhythm of the occipital region was 40-50  $\mu$ v, then about 50 minutes after injection it was 10-15  $\mu$ v.

Depression of the biopotentials sets in about 10-15 minutes after administration of the detelen; before this there are no important changes in the EEG.

The second series of experiments showed that detelen in doses of 5-10 mg/kg produces stronger and earlier alteration of the bioelectric activity of the brain. As a rule in about 3-5 minutes there is observed a sharp alteration in rhythm, and in about 10 minutes depression of the bioelectric activity of all areas sets in. In Fig. 2 (Experiment No. 3) there are presented electroencephalograms in various stages of immobilization of the dogs.

Frontal region

Occipital region

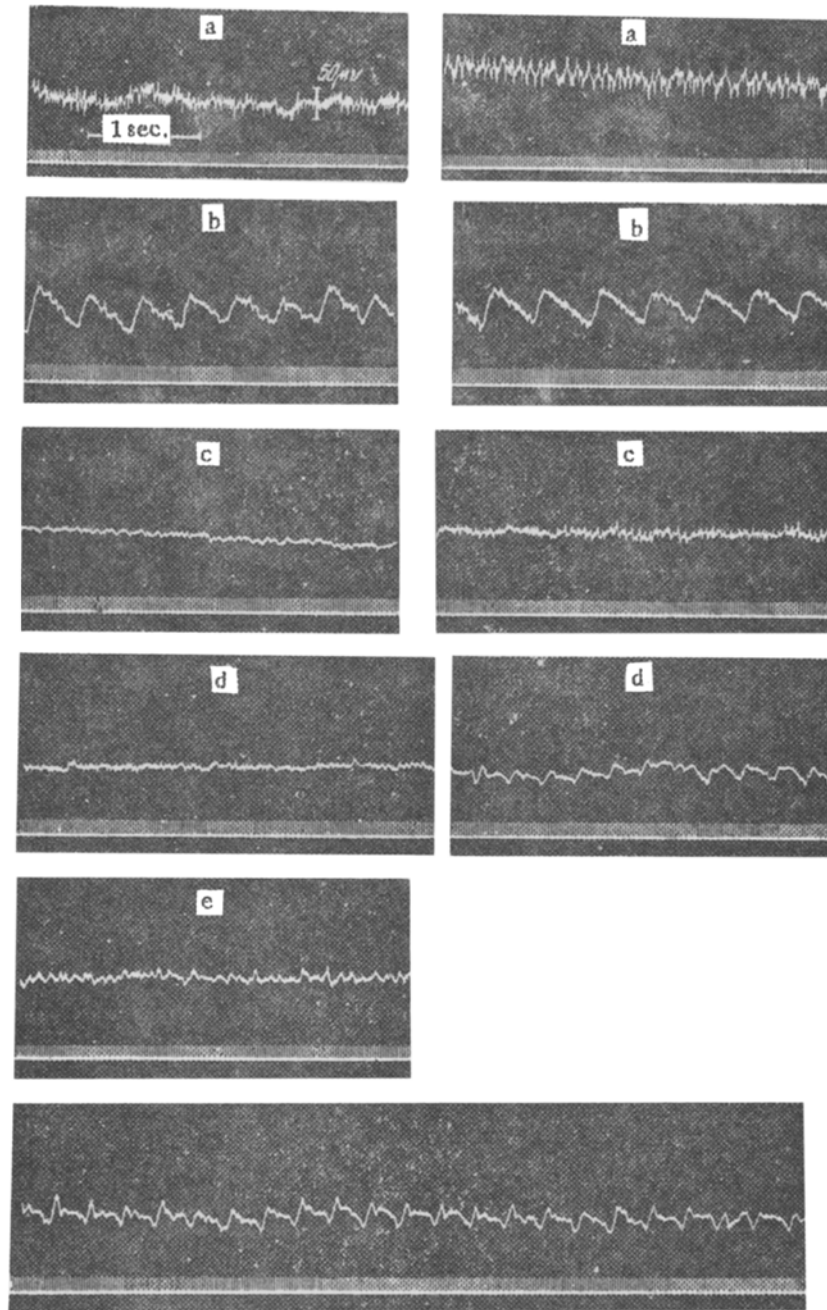


Fig. 2. Change in bioelectric potentials of the cerebral cortex after administration of 5 mg/kg of detelen. a) before injection; b) about 3 minutes after injection; c) about 1 hour after injection; d) about 1  $\frac{1}{2}$  hours after injection; e) about 2 hours after injection.

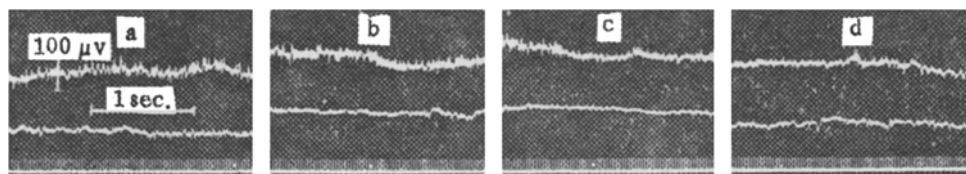


Fig. 3. Effect of detelen on the bioelectrical activity of the parietal region of the cerebral cortex. a) before injection; b) about 30 minutes after injection; c) about 2 hours after injection.

Comparison of the EEG recorded about 3 minutes after administration of the detelen (b), with the original (a) could lead to the conclusion that in that time detelen caused the appearance of slow regular waves, with the superposition of high frequency oscillations of low amplitude. These changes were recorded from all regions of the cortex, including the occipital. About an hour (c) and about 1  $\frac{1}{2}$  hours (d) after administration of the detelen there was observed a sharp depression of the dominant rhythm. Two hours after the administration of detelen the bioelectric activity of all regions tended to be restored (e), but in the EEG of the occipital region slow waves predominated.

As shown above, detelen causes a depression of the bioelectric activity of all regions of the cerebral cortex.

It is evident from the encephalogram of Experiment No. 8 (Fig. 3) that detelen produces a sharp depression of the biopotentials of the parietal region. It should be noted that the depression is always prolonged, as the EEG record about 2 hours after administration of detelen (c) shows the same changes as after 30 minutes (b).

Aside from this, we have established that as the curarizing effects of detelen wear off (muscle twitches appear in the dogs), the bioelectrical activity of the cortical regions studied is almost completely restored.

Blood pressure records showed that detelen, as a rule, did not produce substantial alterations in the hemodynamics.

The body temperature of the immobilized animals fell.

In the first series of experiments the body temperature of the dogs went down by 0.5-1°, and in the second series the temperature went down by 1-15°.

#### SUMMARY

The effect of detelen on the bioelectric activity of various areas of the cerebral cortex was studied. The effect of detelen depends on the dose. Small doses resulting in a marked curareform effect affect the electric activity of the brain only slightly, while large doses cause significant inhibition of the activity of the cerebral hemispheres.

#### LITERATURE CITED

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