

# THE FUNCTIONAL SYMMETRY OF THE CORTICAL PART OF THE AUDITORY ANALYZER

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Investigations by K. S. Abuladze [1] have shown that the auditory analyzer is characterized by strict functional symmetry.

He showed that after removal of the cortex of one hemisphere, conditioned salivation in response to a sound stimulus is abolished in the parotid gland on the ipsilateral side; salivation from the opposite gland is retained and undergoes no particular change.

We carried out experiments in the same area but, in contrast to K. S. Abuladze's experiments, in which

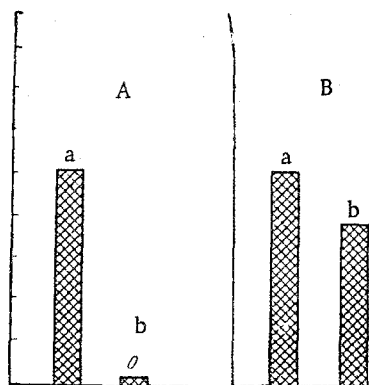


Fig. 1. Experimental results. The dog Sharik. A) Magnitude of the conditioned salivation from the left parotid gland after the isolated stimulation of the left ear with a sound before (a) and after (b) removal of the cortex of the right cerebral hemisphere; B) magnitude of the conditioned salivation from the same parotid gland after the isolated stimulation of the right ear with a sound before (a) and after (b) removal of the cortex of the right hemisphere. Along the ordinate axis – volume of saliva; columns – mean figures for 10 experiments.

ordinary sound stimulation was used as a conditional signal (when the dog hears a signal, supplied to the experi-

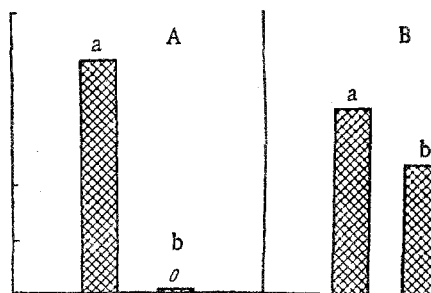


Fig. 2. Experimental results. The dog Kashtanka. A) Magnitude of the conditioned salivation from the right parotid gland in response to the isolated stimulation of the right ear with a sound before (a) and after (b) removal of the cortex of the left cerebral hemisphere; B) Magnitude of the conditioned salivation from the same gland after the isolated stimulation of the left ear with a sound before (a) and after (b) removal of the cortex of the left cerebral hemisphere. Along the ordinate axis – volume of saliva; columns – mean figures for 8 experiments.

mental room, with both ears), we employed isolated stimulation of either ear with a sound. This was done by means of a special apparatus which K. S. Abuladze suggested and which we have described [2].

## METHOD

Experiments were carried out on 4 dogs, in a sound-proof chamber, by the salivary conditioned reflex method. Chronic fistulae of the parotid salivary glands were created in the dogs by Glinskii's method, and conditioned auditory reflexes were established to the isolated stimulation of one ear with a sound (a tone or buzzer). In ad-

dition to the conditioned auditory reflexes, conditioned reflexes were formed in the dogs to a shaker and to visual stimulation (light). All the conditioned stimuli were reinforced by food—a fixed amount of powdered meat and biscuit. The volumes of the conditioned and unconditioned secretion of saliva were recorded in scale divisions by means of a Ganike-Kupalov pneumatic-hydraulic system, separately for the left and right parotid gland.

### RESULTS

In the dogs Al'fa, Sharik, Kashtanka, and Usach, conditioned reflexes were formed to the isolated stimulation of the left and right ear with a sound. After this had been done, the cortex of one cerebral hemisphere was removed by operation. In all the experimental animals, extirpation of the cortex of the left cerebral hemisphere resulted in the complete disappearance of the salivary conditioned reflexes formed in response to the isolated stimulation of the right ear with a sound; conversely, after extirpation of the right cerebral cortex there was disappearance of the conditioned reflexes formed in response to the isolated stimulation of the left ear with a sound (Figs. 1 and 2). Experiments were performed at different times after the operation of the cortex of the cerebral hemisphere—from 10 days to 3 months. The conditioned auditory reflexes which disappeared after removal of the cerebral cortex were not restored in the course of 3-6 months.

In order to explain the results that were obtained, it must be considered that the greater part of the ascending fibers of the auditory nerve, after crossing in the lower portions of the brain, reach the cerebral cortex of the opposite hemisphere; the smaller part of these fibers reach the ipsilateral cortex. It is clear from our experi-

ments that extirpation of the cortex of that hemisphere to which the conditioned excitation mainly passes (during isolated stimulation of the contralateral ear with a sound), causes the disappearance of the conditioned reflex on this side. The conditioned reflexes formed in response to the isolated stimulation of the opposite ear with a sound are preserved, since the conditioned excitation is addressed to the intact hemisphere. These experiments clearly show that the cortical part of the auditory analyzer consists of two symmetrical points, and that the removal of one symmetrical point of the cortex is not followed by a disturbance of the function of the other.

### SUMMARY

Experiments were conducted on 4 dogs by the method of salivary conditioned reflexes. After elaboration of the background of the sound conditioned reflexes the cortex of one of the cerebral hemispheres was removed and the changes in these reflexes were subjected to study. On the basis of experimental data the author concludes that the sound analyzer is characterized by a strict functional symmetry. Removal of one symmetrical point of the cortex does not provoke any functional disturbance in the other.

### LITERATURE CITED

- [1] K. S. Abuladze, *Byull. Eksptl. Biol. i Med.* **41**, 2, 14 (1956).\*
- [2] V. M. Mosidze, *Data on Conditioned and Unconditioned Reflexes Before and After Partial Division of the Corpus Callosum in Dogs*. Candidate's dissertation (Leningrad, 1955)[In Russian].

\*Original Russian pagination. See C.B. translation.