EFFERENT REACTIONS IN THE SUBLINGUAL NERVE

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Problems of the efferent regulation of various physiological systems including the sensory system is attracting increasing attention from electrophysiologists [9].

As far back as the 1930's Soviet scientists had established that a centrifugal regulatory influence was exerted upon receptor apparatuses [1, 3-6]. Since 1940 this problem has been intensively studied by P. E.Snyakin and his co-workers [7, 8]; they have introduced the idea of a functional mobility of receptor apparatus in which efferent regulation plays the part of "setting" the activity of the receptors to correspond to altered conditions of the external or internal environment. This hypothesis has been confirmed by electrophysiological investigations carried out, in particular, on the taste receptor apparatus [2]. It has been shown that the electrical activity of chemoreceptors of the frog tongue is under regulation by reflex influence originating in the gastric interoceptors. Also stimulation of the central end of the lingual nerve by an induction coil produces inhibition of afferent activity from taste receptors, which undoubtedly demonstrates the participation in the effect observed of centrifugal influences in the lingual nerve.

Also it is known that in taste reception not only are specific chemoreceptors of the tongue involved but there is also a motor component, particularly the muscle elements of the tongue, whose activity must be directly related to the work of the taste receptors. With this in mind we have set out to study electrophysiologically the possible occurrence of efferent reactions produced by the motor component of the taste apparatus.

EXPERIMENTAL METHOD

The experiments were carried out on frogs (Rana ridibunda, and R. temporaria), in which the spinal cord was destroyed; the brain including the medulla oblongata remained intact. To record efferent responses we used the sublingual nerve, which in many cases was dissected away from the tongue; an electrical record was made from its central end. The index of activity of the taste receptors of the tongue was provided by afferent impulses in the lingual nerve produced by adequate stimulation of the tongue. The potentials were picked up by a pair of silver electrodes separated by a distance of 3-4 mm. Taste stimuli were provided by a 5% solution of sodium chloride in tap water which was used to irrigate the dorsal surface of the tongue. The records were made on a "Al'var" type myograph.

EXPERIMENTAL RESULTS

At first it was important to determine whether electrical activity in the tongue could be detected under conditions when no sensory stimuli were applied to it. As a rule no electrical activity occurs under these conditions, but in [illegible] influence could be detected. The potentials were of the order of 15 μV, and [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

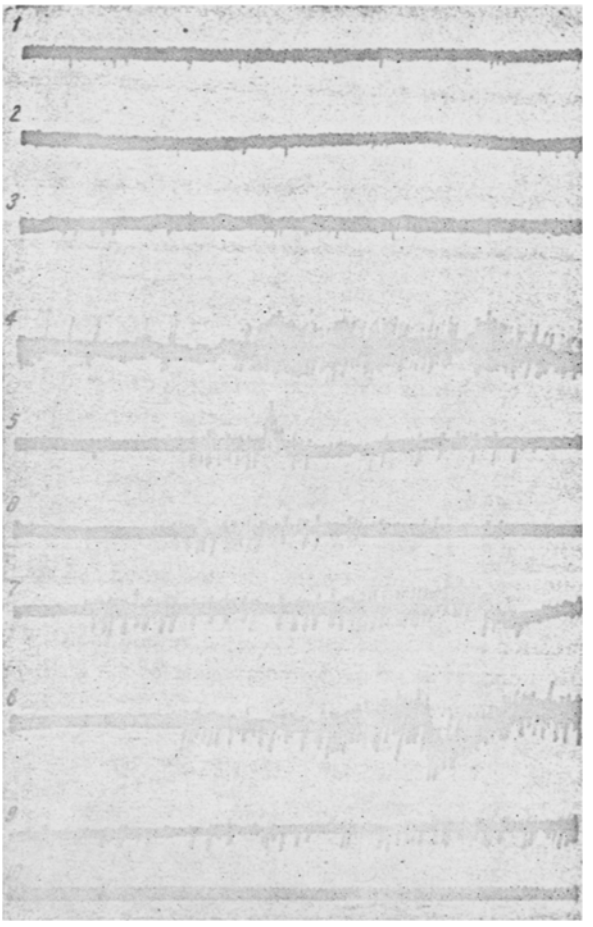

Fig. 1. Impulses in the central ends of the sublingual nerve of the frog. 1, 2, 3) Before stimulation of the taste receptors (5-min intervals between recordings); 4) electrical activity of the lingual nerve during changeover from water to salt solution for tongue irrigation; 5) increase of impulses in the sublingual nerve 2 min after the action of salt solution on the taste receptors; 6, 7, 8, 9) records of the electrical activity of the sublingual nerve 1½-2 min after stimulation of the lingual taste receptors (water plus NaCl solution); 10) time marker (50 cycles per sec). In records 5, 7, 8 displacement of the zero line is an art effect due to displacement of the electrodes.

Very often these impulses could be observed during prolonged gustatory stimulation, for example by application of salt solution to the lingual taste receptors. In such a case the chemoreceptors showed electrophysiological adaptation, but the central end of the sublingual nerve (separated from the tongue) showed considerable electrical activity. The same effect can be seen in Fig. 2. The electrical activity takes the form of volleys, which vary both in duration and in the number of impulses per volley.

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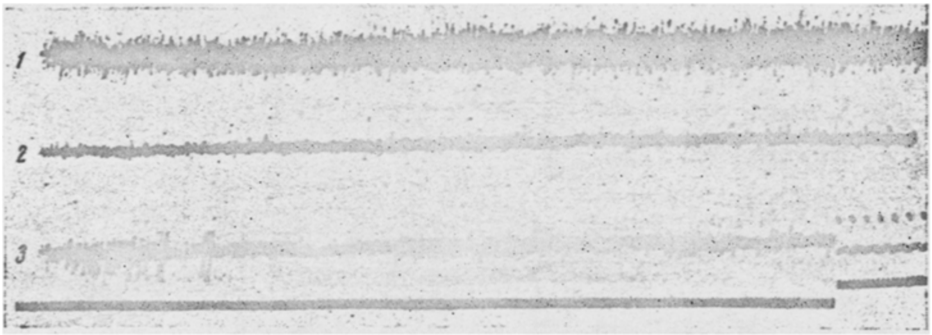

Fig. 2. Electrical impulses in the central end of the sublingual nerve. 1) Impulses in the lingual nerve during stimulation of the taste receptors with salt solution; 2) response of the lingual nerve to a 7-min continuous irrigation of the tongue with saline; 3) impulses in the central end of the sublingual nerve after adaptation of the taste receptors to saline. Calibration shown at the side – 100 μV. Lower record – time marker (50 cycles/sec).

Taste stimuli were applied to the frog tongue. Electrical impulses were recorded from the central end of the cut sublingual nerve. A change from water to saline as taste stimuli or the prolonged application of salt solution to taste receptors caused a marked increase in the frequency of impulses in the central cut end of the sublingual nerve. The impulses disappeared after the connection between the sublingual nerve and the CNS had been broken, indicating their efferent nature. In all probability control of the motor component of the taste organ is effected through these impulses, because sublingual nerve fibers innervate muscle fibers in the tongue.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. Some or all of this periodical literature may well be available in English translation. A complete list of the cover-to-cover English translations appears at the back of this issue.