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MOTIVATION OF CENTRIFUGAL "TUNING" INFLUENCES ON TASTE RECEPTORS

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UDC 612.87:612.825.57

KEY WORDS: taste reception, centrifugal tuning, motivation.

Peripheral receptor formations of virtually every sensory modality are not impartial witnesses and transformers of the physical parameters of acting stimuli, but they undergo the most active tuning for sensory information perception, due to the presence of wide intersensory interactions, and for that reason a stimulus acting on one sensory system must inevitably influence the sensitivity of other sensory systems and their ability to perceive [8-10]. For instance, a phenomenon manifested as a change in the level of mobilization of the taste papillae of the tongue during stimulation of gastric receptors has been discovered and investigated in detail by a psychophysiological method [6], and it has been called the gastrolingual reflex. Taste-sensitive elements of the tongue have been shown to be in a state of "intermittent" activity, and their number at any given moment is determined both by the general sensory background of the organism and by influences from other clearly defined reflexogenic zones [1, 2, 7]. After introduction of peptone into the stomach or inflation of the stomach [3, 4] the character of the spike flow in the central end of the lingual branch of the glossopharyngeal nerve changes in a regular manner. This has been rightly interpreted by the authors cited as a manifestation of centrifugal action on the sensory apparatus of the tongue, as a neurophysiological equivalent of centrifugal "tuning." In recent years [5] an extensive series of investigations of neuronal activity in different brain regions under the influence of different dominant motivations has been undertaken. The results have shown that the stochastic structure of the pattern of activity of neurons belonging both to afferent and to efferent and association areas of the brain acquire specific features under conditions of hunger and undergo specific changes when the need is satisfied. These data were interpreted by Sudakov as a manifestation of the holographic principle of the working of the brain, which was reflected in the holographic principle of organization of a dominant motivation, enunciated by him [11, 12].

We have studied motivation-determined tuning of taste receptors.

EXPERIMENTAL METHODS

The technique developed at the P. K. Anokhin Institute of Normal Physiology for detection of dominance of interspike intervals was used, and efferent impulsation in the lingual branch of the frog glossopharyngeal nerve was analyzed. The experimental model described in [3, 4] was adopted. Experiments were carried out on 17 male frogs (*Rana temporaria*) immobilized by injection of curare-like drugs (tubocurarine $1 \cdot 10^{-6}$ g/ml, diplacin $1 \cdot 10^{-5}$ g/ml) into the lymph sac. Electrical activity was recorded through bipolar electrodes from the lingual branch of the glossopharyngeal nerve, which was divided distally to the point of

Department of Normal Physiology, N. A. Semashko Moscow Medical Stomatologic Institute. (Presented by Academician of the Academy of Medical Sciences of the USSR K. V. Sudakov.)
Translated from Byulletin' Éksperimental'noi Biologii i Meditsiny, Vol. 105, No. 6, pp. 644-646, June, 1988. Original article submitted April 28, 1987.

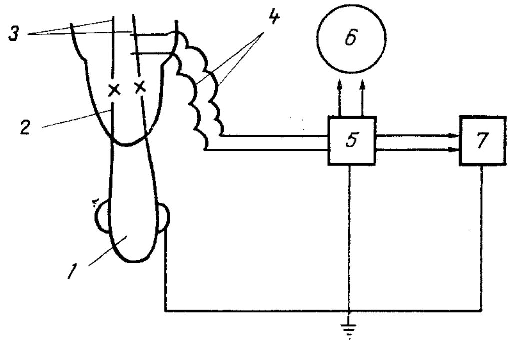

Fig. 1. Scheme of experiment. 1) Tongue, 2) floor of the mouth, 3) proximal end of lingual branch of glossopharyngeal nerve, 4) recording electrodes, 5) amplifier, 6) oscilloscope, 7) computer.

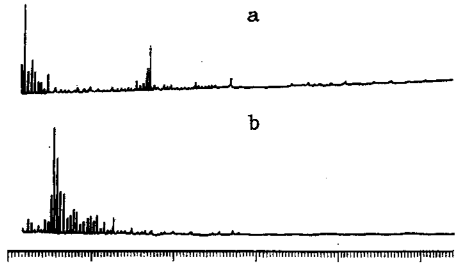

Fig. 2. Histograms of distribution of interspike intervals obtained by superposition method during recording of spike activity from lingual branch of glossopharyngeal nerve (central end) of a frog. a) Food motivation conditions; b) conditions of mechanical distention of stomach by rubber balloon filled with water. Abscissa) time intervals (5 msec); ordinate) number of intervals.

application of the electrodes, and also from the contralateral side. Spike activity was derived by silver electrodes, with an interelectrode distance of 2.5-3 mm. Success of the experiment was determined by carefulness of detection of the chosen nerve, so that recording could be carried out from the smallest number of nerve fibers. Potentials were amplified by the UBP 2-03 amplifier and monitored on the screen of an S 1-18 oscilloscope. Spike discharges were analyzed by ATAK-350 specialized computer on a real time scale (Fig. 1). During analysis interval histograms of measurements of 500 interspike intervals were constructed. Food motivation was formed by depriving the animal of food for 4 days at room temperature, with adequate fluid intake. Activity of the lingual branch of the glossopharyngeal nerve was assessed in the animals in this state, after which changes in the character of spike activity were recorded during stimulation of the stomach by means of a rubber balloon, introduced beforehand, into which 1.5-2.0 ml of water was then injected.

EXPERIMENTAL RESULTS

In 13 (77%) of 17 animals spontaneous activity recorded in the central end of the lingual branch of the glossopharyngeal nerve had a marked burst type of structure. During analysis of interval histograms a bimodal distribution of interspike intervals clearly emerged. The first maximum lay between 10 and 15 msec, the second between 160 and 190 msec (Fig. 2).

During stimulation of the stomach by the rubber balloon, into which water was injected, a change was found in the character of the spike train, as shown by its more regular structure. Analysis of the interval histograms revealed reorganization of the distribution of interspike intervals, with the change toward a monomodal distribution with a maximum between 55 and 60 msec.

Thus under conditions of hunger there is a bimodal distribution of interspike intervals, which changes under the influence of distension of the stomach and becomes monomodal in character. Investigations on frogs essentially confirmed the results of experiments on other models [5] and showed that specific motivational excitation not only has a characteristic pattern of stochastic structure at the center, but it also spreads out to peripheral nerve formations.

We consider that this observation provides a deeper insight into the physiological mechanisms of functional mobility, discovered by Snyakin, and it suggests that the physiological nucleus realizing the above mechanisms is a motivating mechanism, and that the method of coding of the motivating excitation rests on a holographic basis.

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ABOLITION OF THE INHIBITORY EFFECT OF ANTIBODIES TO S-100 PROTEINS ON THE CALCIUM CURRENT OF SNAIL NEURONS BY INTRACELLULAR INJECTION OF EGTA

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UDC 612.822.2.06:612.124.017.1.06:612.822.1.015.348

KEY WORDS: antibrain antibodies, calcium channels, snail neurons, EGTA.

Antibodies to the S-100 fraction of bovine brain proteins depolarize the membrane and inhibit action potential generation in neurons of *Helix pomatia* [5], and under voltage clamp conditions they inhibit the total inward current through voltage-dependent channels [7]. The effect of antibodies to these proteins on voltage-dependent Ca conductance has not been studied. Meanwhile the ability of these proteins to bind Ca^{++} ions [8, 12] suggests that they play a role in the regulation of conductance of Ca channels of the neuronal membrane.

Accordingly, it was decided to study the effect of antibodies to S-100 proteins on the voltage-dependent Ca current (I_{Ca}) of snail neurons and to elucidate the mechanisms of these effects.

EXPERIMENTAL METHODS

Unidentified neurons of *Helix pomatia* were isolated by means of fine needles without preliminary treatment of the preparation with proteolytic enzymes, and placed in a continuously flowing solution of the following composition (in mM): $CaCl_2$ – 10; KCl – 4; $MgCl_2$ – 4, tetraethylammonium bromide – 95; 4-aminopyridine – 5; Tris-HCl – 5 (pH 7.6). If the volume

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(Presented by Academician of the Academy of Medical Sciences of the USSR A. V. Snezhnevskii.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 105, No. 6, pp. 646-649, June, 1988. Original article submitted May 26, 1987.