METHODS

Objective Method for Registration of the Sniffing Component of the Search Behavior in Rabbits Subjected to Food Deprivation
A. A. Kromin and Yu. P. Ignatova

A method for registration of the sniffing component of the search behavior in rabbits subjected to food deprivation is suggested. Pulsed activities of the muscles controlling the movements of the wings of the nostrils and the pressure in the nasal cavity are recorded simultaneously. The method allows accurate artifact-free registration of the time and amplitude parameters of the sniffing component of the search behavior. The registration is realized on an MP150 programmed complex, consisting of EMG 100C biopotential amplifiers and Samba 202 intracavitary pressure recorder. The method allows synchronous real-time registration of pulsed activities of the muscles setting in motion the wings of the nostrils and the changes in the intranasal pressure in the course of search behavior of animals under conditions of food deprivation without limiting their locomotor activity.

Key Words: muscles regulating movements of the wings of the nose; pulsed activity; intranasal pressure; search behavior; sniffing respiration

According to the pacemaker theory of motivations [8], the lateral hypothalamus “hunger center”, as the initiative motivatiogenic center, stimulates the limbic structures and the hemispheric cortex and thus forms the search and food-getting behavior of animals.

Alimentary motivation stimulation is specifically reflected by the holographic principle in the structure of pack-wise pulsed activity of neurons in various brain compartments in the form of bimodal distributions of intervals between pulses [2,8].

On the other hand, a special group of search neurons was found in the sensorimotor cortex and the caudate nucleus head [9]; in rabbits subjected to food deprivation these structures were stimulated in response to sniffing at empty holders, and only those from which the rabbit had previously received food before at least once.

Sniffing activity (special sniffing respiration) is one of the characteristic signs of natural and artificial (induced by electrostimulation of the “hunger center” in the lateral hypothalamus) search behavior of animals [1,4,9]. We failed to find reports about food motivation reflection in pulsed activity of muscles regulating the sniffing movements of the wings of the nostrils during search behavior of animals subjected to food deprivation. This fact could be attributed to the absence of an objective method for registration of the sniffing component of the search behavior.

We attempted the development of an objective method for registration of the sniffing component of
the search behavior in rabbits under conditions of food deprivation.

We developed a method for simultaneous registration of pulsed activity of the muscles controlling the movements of the wings of the nostrils and the pressure in the nasal cavity for registration of the sniffing component of the search behavior of rabbits subjected to food deprivation.

Electric activity of the muscles controlling the movements of the wings of the nostrils (m. levator nasolabialis and small muscles of the wings of the nostrils) in rabbits subjected to 24-h food deprivation was recorded via chronically implanted electromyographic electrodes of an original design [5,7].

The electromyographic electrode consisted of two silver hemispheres 0.15 mm in diameter, separated by a distance of 1 mm, and a silver reference plate 2 mm in diameter, fixed to the opposite sides of a textolite sublayer and divided by a layer of dielectric (Fig. 1). The small distance between the electrodes ruled out the artifacts created by respiration, heart work, and locomotor activity of the rabbit, while the silver reference plate stabilized the record of the potentials. The sites of point soldering of half-finished silver articles and MGTF wires on the opposite side of the sublayer were isolated with a thin layer of epoxy glue, after which the silver reference plate was glued to it. An MGTF wire was soldered to the plate. All three wires were enveloped in chlorovinyl cambria, with epoxy glue injected into the lumens. Three holes (0.8 mm) were drilled by the edges of the sublayer in order to suture the electrode to the muscle (Fig. 1).

Bipolar ball silver electrodes were implanted into the muscles regulating the movements of the wings of the nostrils to rabbits under local infiltration anesthesia. The rabbits were scalped and the tissues along the median line of the ridge of the nose were dissected layer-by-layer from the level of the orbital edge to the tip of the nose. The m. levator nasolabialis (contraction of this muscle dilates the nasal passage) was controlled by electric stimulation. A 5-mm incision was made on the m. levator nasolabialis fascia, parallel to the muscle fibers. The myofibrils were pushed apart to form a muscular pouch, to which the electrode was brought. An atraumatic needle was then inserted into the muscle proximally from the muscular pouch apex and brought out through the pouch into the muscle incision. The needle was brought out 2 mm from the site of its insertion through the muscle pouch. Similar manipulations were carried out on the right and on the left. The electrode sublayer held by the ligatures was inserted into the muscle pouch and three individual sutures were tied on the muscle surface. Small muscles of the wings of the nostrils (their contractions narrowed the nasal passage) were separated under electrostimulation control. A bipolar electrode was sutured (heads down) to the muscle surfaces. The MGTF wires were brought out under the skin and soldered to the common radiotechnological plug fixed to the scalped part of the skull [3]. The skin integument after electrode implantation was repaired by solitary sutures.

The MGTF wires from electrode contacts in the response part of plugs, twined together, were connected via a sliding line [6] to the EMG 100C biopotential amplifier input plugs (Fig. 2). The frequency transmission band during registration of pulsed activity of muscles was 1-1000 Hz. After amplification the analog electric signals were transmitted to M150 microprocessor, which digitalized them, the information was then saved in PC memory and could be presented on the monitor.

Fig. 1. Electromyographic electrode, intranasal and intratracheal catheters, intracavitary pressure fiberoptic pickup. a) electromyographic electrode scheme: 1) MGTF wires; 2) chlorovinyl cambria; 3) dielectric (epoxy glue); 4) reference plate; 5) hole in textolite sublayer (6) for electrode fixation in the muscle; 7) ball silver electrodes. I) electrode, top view (silver hemispheres); II) electrode, bottom view (silver plate); b) nasal T-shaped catheter; c) tracheal T-shaped catheter; d) fiberoptic pickup without protective coating (I), coated (II).

Fig. 2. Rabbit during experiment. 1) standard radiotechnological plug connecting the electrode MGTF wires to EMG 100C biopotential amplifier input; 2) implanted intranasal catheter; 3) implanted intratracheal catheter; 4) fiberoptic pickups.