INFLUENCE OF A DOMINANT FOCUS, FORMED IN THE BLINK REFLEX CENTER, ON A LOCAL DEFENSIVE REFLEX IN THE RABBIT

G. Ya. Roshchina

The dominant is a general principle of the operation of neural centers which underlies the restructuring of intercenter relationships. The question of the influence of a dominant focus formed in some segment of the central nervous system (CNS) on the operation of other centers is linked to the problem of conjugate inhibition in the presence of a dominant, has been little investigated, and is one of the most urgent questions for the understanding of the mechanisms of the operation of the integral brain.

A. A. Ukhtomskii, originator of the study of the dominant, repeatedly wrote, in a number of his works, of the overflow character of conjugate inhibition [14]. In later works he then speaks of the inhibition of reflexes which are functionally incompatible with the dominant [13].

The development of the concepts of conjugate inhibition and the investigation of this phenomenon is the achievement of R. A. Pavlygina. She has demonstrated on the basis of experimental material that "the formation in one segment or another of the CNS of a dominant focus leads to a mosaic change in the functional state of other segments: to the conjugate inhibition of some centers, and, apparently, to the induction excitation of others" [7].

The purpose of the present study was the investigation of the influence of a dominant focus, formed in the blink center of the CNS of the rabbit (under the rubric of center we subsume A. A. Ukhtomskii's "constellation of centers" [14]) on the establishment of a local motor defensive reflex.

It was necessary, before embarking on the investigation of the interaction of the centers of the reflexes under study to elucidate, under conditions of the formation of a dominant focus in one of them, the kind of influence exerted by the center of the blink reflex on the center of the defensive reflex in the initial state of these centers, and during the formation in the blink center of a focus of excitation which does not have dominant properties. We investigated the influence of the center of the blink reflex on the center of the defensive reflex in three series of experiments: first, in the initial state of the centers; second, during the formation in the blink center of a focus of excitation; and third, during the formation in the blink center of a dominant focus.
METHODS

The experiments were carried out on five unanesthetized, non-immobilized rabbits in 24 chronic experiments. During the experiment the animal was placed in a special chamber which was fixed non-rigidly to the trunk.

In order to stimulate the eye with a stream of air, a rod was affixed to the nasal bones of the skull, and a coupling with a copper tube (diameter 2 mm), one end of which was brought close to the eye at a distance of 1 cm, and the other connected to a plastic tube leading from the air pump, was fitted on it during the course of the experiment. The intermittent blast of air was effected by means of a solenoid, the core of which constricted the plastic tube. The travel time of the core was 0.05 sec, and the volume of air delivered was 8 ml. An isolated blink of a specific amplitude of the corresponding eye was recorded stably under these conditions in response to a solitary stimulation of the eye [3]. With change in the stimulation parameters a clear correspondence of the amplitude of the blink movement to the altered parameter was observed.

Electrocutaneous stimulation (ECS) (10-20 V, 0.2 sec, 1 imp/sec) of the forelimb in the region of the carpus was carried out by means of an ESU-I [electronic level indicator-1] stimulator via silver cup electrodes filled with paste.

In order to record the blink movements, silver wire electrodes were implanted in the lids of both eyes (the time constant of the amplifier was 0.03; 15-30 Hz high-pass filter). The mechanogram of both forelimbs was recorded by piezoelements attached to the wrists. The recording of the movements was accomplished by means of an ink-writing electroencephalograph (Nihon Kohden, Japan). The investigation of the influence of the center of the blink reflex on the center of the defensive reflex was done in the following manner: Stimulation of the cornea of the eye by the stream of air was carried out, and the ECS was applied to the limb after one of certain time intervals (from 0 to 1 sec, with a step of 0.1, 2, 3, or 4 sec) employed in random order over the course of the experiment. The next pair of stimulations was presented after 2-5 min. Ten to thirty such trials were employed in an experiment. The manifestation of a conditioned reflex, i.e., the movement of the limb in response to the stimulation of the eye by the stream of air, was observed only once in our experiments.

A focus of excitation in the blink center was formed by the presentation of 10 stimulations to the eye. Following the 10th stimulation, stimulation was applied to the limb after one of the above-cited intervals. Ten to twenty such trials with intervals of 5-10 min were employed in an experiment.

A dominant focus was formed by serial stimulation of the eye (four to six series of 10-15 stimulations; the inter-stimulation interval was 1-5 sec; the interval between the series was 10 sec to 2 min). When the dominant focus was formed in the blink center, it was tested by electrocutaneous stimulation of the limb, and by acoustic stimuli (a tone of 250 Hz, 80 dB, 5-10 sec; and the rustling of paper.

RESULTS

The Influence of the Center of the Blink Reflex on the Center of the Defensive Reflex in the Initial State of the Centers, and during the Formation in the Blink Center of a Focus of Excitation Which Does Not Have the Properties of a Dominant Focus. A threshold value of the current was chosen for each animal such that the movement of the limb elicited by this current was very weak. Analysis of the amplitude of the defensive reflex in response to threshold stimulation of the limb, presented following one of the investigated time intervals after solitary or serial stimulation of the eye, showed that the blink reflex does not influence the defensive reflex. For all intervals investigated between the stimulation of the eye and the ECS, the parameters of the motor reaction remain unchanged, as do those with the isolated effect of the current (Fig. 1).

Data were obtained in the investigation of the influence of the blink center on the motor center which indicate the reciprocal influence of the centers investigated. Figure 2 illustrates these data. In the first case, a blink appears in response to the stimulation of the eye, while a movement of the limb appears in response to the ECS, and then, now without stimulation, another blink, succeeded by the movement of both limbs (Fig. 2a). In the second example, a blink and a movement of the limb are observed respectively in response to stimulation of the eye and of the limb, and then a blink and a movement again