The main aim of the present investigation was to attempt to differentiate the reflection of kinesthetic and nociceptive excitation in transcommissural evoked somatosensory cortical responses in experimental animals (cats). According to the literature, besides the lemniscal (contralateral) system, kinesthetic impulses are also transmitted by certain ipsilateral ascending pathways [1, 11, 13, 27-30]. However, we do not know whether these contralateral and ipsilateral kinesthetic projections are found in both hemispheres or whether they are transmitted by the transcommissural pathways of the somatosensory system.

Accordingly, the main aim of the present investigation was to attempt to differentiate the reflection of kinesthetic and nociceptive excitation in transcommissural evoked somatosensory cortical responses in experimental animals (cats). According to the literature, besides the lemniscal (contralateral) system, kinesthetic impulses are also transmitted by certain ipsilateral ascending pathways [1, 11, 13, 27-30]. However, we do not know whether these contralateral and ipsilateral kinesthetic projections are found in both hemispheres or whether they are transmitted by the transcommissural pathways of the somatosensory system.

The same ambiguity exists in our ideas of the structural and functional organization of the spino-thalamic and spino-reticulo-thalamic systems. We know that they conduct nociceptive sensation, but we do not know whether their transcommissural pathways, located rostrally to the midbrain, participate in this conduction.

EXPERIMENTAL METHOD

Experiments were carried out on 15 cats. One group of animals was used for conditioned-reflex investigation, the other for electrophysiological. In the first group of animals conditioned instrumental defensive reflexes were formed, before and after neurosurgical hemisection of the tegmentum at the level of the junction between the mesencephalon and diencephalon, "to the forelimb" contralateral relative to the side of hemisection. The animals were trained to strike presented targets with their forelimb. White targets served as positive, black as negative conditioned stimuli (for full details of the technique, see [3]). In the animals of the second group evoked electrical responses were investigated in the somatosensory areas I and II of both hemispheres in response to electrodermal stimulation of the forelimb before and after hemisection of the tegmentum or division of the decussation of the medial lemniscus in the medulla. The electrophysiological investigations were carried out under pentobarbital anesthesia (35 mg/kg) and, if necessary (after division of the medial lemniscus), with artificial ventilation.
As the morphological control of the hemisection and divisions, serial brain sections from the experimental animals were stained by Nissl's method. Electrical responses of the brain, after amplification of the UBF 1-02 amplifier, were recorded on the SI-18 oscilloscope. A Multistim stimulator (Disa, Denmark) was used as electrical stimulator. Electrodermal stimulation (above threshold) was applied through bipolar pad electrodes securely fixed to the dorsal surface of the wrists.

EXPERIMENTAL RESULTS AND DISCUSSION

The results of these experiments showed that hemisection of the tegmentum in animals is followed by disappearance of the conditioned instrumental defensive reflex to the contralateral forelimb relative to the side of hemisection. However, the conditioned reflex did not disappear irreversibly. Prolonged retraining (for 15-20 days of the experiment; Fig. 1A) was required to restore it. In precisely the same way hemisection of the tegmentum did not prevent primary formation of the conditioned instrumental defensive reflex "to the contralateral forelimb" (Fig. 1B). These experimental results indicate that besides the lemniscal system, which was divided along with all the somatosensory pathways ascending to the contralateral half of the diencephalon, the animals also had ipsilateral pathways for conduction of kinesthetic excitation (running in the ipsilateral half of the brain stem from the forelimb), without the existence of which it would be difficult to explain formation of the reflex under these conditions. An animal must surely monitor the position of its limb in space constantly in order to control it and to perform instrumental movements. Moreover, after synaptic relays, these pathways must certainly reach the contralateral hemisphere, where the motor centers controlling the corresponding forelimb are located. In animals with tegmental hemisection as described above, however, besides preservation of ipsilateral conduction of kinesthetic sensation at the level of the brain stem, conduction of nociceptive and tactile sensation from this same side of the body also is preserved. As our observations show, however, these forms of sensation were weaker than in the contralateral half of the body.