LITERATURE CITED


MORPHOLOGICAL AND PHYSIOLOGICAL STUDY OF AFFERENT PROJECTIONS OF THE POSTEROLATERAL THALAMIC NUCLEUS IN RATS

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It was shown by the method of retrograde axonal transport of horseradish peroxidase that the posterolateral thalamic nucleus (NPL) in rats receives considerable ascending projections from the superior colliculus (SC), the dorsal part of the lateral geniculate body (LGB), and the pretectal region (PT) and smaller projections from n. ventralis posterior (VP) and n. ventralis lateralis (VL) of the thalamus, the ventral part of LGB, the zona incerta, and anterior hypothalamus. The most marked descending projections run into NPL from area 18A of the cortex and the dentate fascia of the hippocampus, whereas inputs from cortical areas 18, 20, 7, 29c, 17, and 36 are less marked. In electrophysiological experiments with peripheral stimulation of visual, auditory, and somatosensory systems, polysensory convergence and interaction between signals from these systems were studied during isolated and simultaneous presentation of heterosensory stimuli. Of 229 neurons tested, 134 (58.5%) responded to at least one of the stimuli mentioned. Among monomodal neurons (53 of 134) there were some cells which responded to visual (77.4%) and somatic (22.6%) stimulation; neurons which responded only to acoustic stimulation were not found in the nucleus. As far as polymodal neurons (81 of 134) responding to two or three sensory stimuli are concerned, the most effective inputs of these units were visual and somatosensory. Interaction between stimuli acting on polymodal neurons was expressed as mutual inhibition or facilitation of responses; opposite effects could be observed on the various components of these responses.

INTRODUCTION

Development of the association systems of the brain began only with mammals, and the degree of their development correlates with the phylogenetic status of the species [1, 4]. Being the most perfect and highest integrative centers of the brain, they have attracted
steadily increasing attention of neurophysiologists. However, most experiments to study mechanisms for integration in association systems have been carried out on carnivores [5, 6] and primates [9, 12]. In mammals with a less highly organized brain (rodents) this problem has so far been studied extremely inadequately, even though the results of such research are essential in order to understand the process of development of the association systems and also to determine the principles governing adaptive evolution of mammals. We know [11] that the parietal association system of rats is poorly differentiated and that at the thalamic level it is represented only by the posterolateral nucleus (PNL). The pulvinar— the most progressively developed thalamic association nucleus in highly organized mammals — is absent in rats. It has also been shown [10] that PNL in rats has extrastriate efferent projections to areas of the parietal cortex. However, the question of organization of the afferent inputs of this nucleus in rats has not been adequately explained [13]. This paper gives the results of morphological and electrophysiological experiments undertaken to study afferent connections of PNL of the rat thalamus and also functional characteristics of PNL neurons during peripheral stimulation of the visual, auditory, and somatosensory systems under conditions of isolated and simultaneous presentation of sensory stimuli.

METHOD

In morphological experiments a 40% solution of horseradish peroxidase (HRP; from Sigma, type VI), made up in phosphate buffer, pH 8.5, was injected iontophoretically (current 2-4 μA, duration 20 min) into PNL of albino rats weighing 200-250 g anesthetized with urethane,