The retrograde horseradish peroxidase (HRP) transport method was used to study the location and morphology of neuron groups in the ventrobasal complex of the thalamus projecting to the region of vibrissal representation in the somatosensory cortex in rats. Injection of HRP into a circumscribed region of the somatosensory cortex revealed the following pattern of organization of the thalamocortical relay groups of neurons. Labeled neurons were located in the ventro-posterolateral nucleus of the ventrobasal complex and were associated in groups 100-120 μ in diameter. Staining of several groups, even after minimal injections of HRP, and an increase in the number of labeled cells in each group with an increase in the zone of injection of HRP in the cortex suggest the presence of both convergence and divergence of specific thalamocortical pathways. Different shapes of the relay neurons and differences in the degree of HRP accumulation by them may indicate differences in their functional role in thalamocortical integration.

**INTRODUCTION**

The somatosensory cortex, like all cortical projection areas, is organized as a mosaic of structural-functional vertical columns (groups) detectable by both morphological and electrophysiological methods. These vertical groups of neurons also reflect the character of the trajectory of thalamic afferents in the cortex.

In the region of vibrissal representation in the first somatosensory area of the rodent cortex these structural-functional units are the so-called "barrels" [4, 23]. As anterograde degeneration experiments have shown [9], with postnatal injury to the vibrissae [22, 24] or staining of the cortex by the use of acetylcholinesterase [11], the formation of the characteristic structure of the zone of "barrels" is linked with the arrival of specific thalamocortical afferents at the cortex.

The somatosensory cortex receives its main specific input from nuclei of the thalamic ventrobasal complex [1, 5, 9, 12].

To discover the fine organization of thalamic afferent sources experiments were carried out by the retrograde axonal horseradish peroxidase (HRP) transport method after injection of the enzyme into the interior of one barrel.

**EXPERIMENTAL METHOD**

In four albino rats weighing 100-150 g, 0.02-0.05 μl of a 30% aqueous solution of highly active HRP was injected through a microelectrode (diameter of tip 100-150 μ) into a barrel, identified by the potentials evoked by vibrissal stimulation.

After 24 h had elapsed, under general anesthesia the animals were perfused intracardially, first with dextran, then with a mixture of 1.5% glutaraldehyde and 1% paraform in phosphate buffer, pH 7.4. After post-fixation blocks of brain tissue were transferred for 12-24 h into a 30% solution of 0.1 M sucrose in phosphate buffer at 4°C. Sections (20-30 μ) were cut on a freezing microtome. They were processed in a 0.5% solution of diaminobenzidine tetrahydrochloride in Tris buffer with the addition of 0.01% hydrogen peroxide [7]. Some frontal sections were counterstained with cresyl violet. The finished sections were examined in the light microscope in light and dark grounds.

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In each section of the thalamus the number of cells with retrograde labeling was counted and the cells were measured. To prevent overestimation of the number of cells by counting fragments of the same cell in neighboring sections, only cells with clear outlines of the nucleus were counted. Since most cells were oval in shape, the greater and lesser diameters of the cell were measured and the area of the cells determined by the equation for the area of an ellipse.

RESULTS AND DISCUSSION

The size of the zone of microinjection and diffusion of HRP depended on the volume of HRP injected and the duration of the injection. In the center of the injection the region of destruction varied in diameter from 40 to 400 μ (Fig. 1a, b). The region of the cortex with injury and diffusion of HRP was taken as the labeling zone of the thalamocortical terminals. Neurons containing intracellular HRP lying outside this zone could accumulate the enzyme not only by diffusion, but also by axonal and dendritic transport. HRP reaction products in these neurons were contained mainly in granular form, so that they could be taken as proof of retrograde transport [14, 16].

A clearly distinguishable group of neurons showing retrograde labeling with HRP lay in the region of the ventrobasal complex which, according to the classification adopted by many workers, corresponds to the ventroposterolateral nucleus (VPLN) [2, 6, 8].

Information in the literature on which of the subdivisions of the ventrobasal complex is the source of afferents to the region of vibrissal representation in the first somatosensory area of the cortex is contradictory. Some workers [1, 5] consider that the ventroposteromedial nucleus (VPMN) in the ventrobasal complex is the source of fibers running to the region of representation of the snout in the cortex, whereas VPLN is the source for fibers to the region of representation of the whole body; others [2, 15] regard VPLN as the source of afferents to the region of representation of the whole trunk and head.

It can be postulated from our own observations that the zone for the head and, in particular, for the vibrissae has the same representation as that for all the rest of the trunk in VPLN.

HRP-labeled neurons of three types were observed in the thalamic VPLN: The first type consisted of intensely stained cells in which products of the histochemical reaction for HRP filled the whole body of the cell and even the terminal branches of the dendrites (Fig. 2a); cells of the second type accumulated HRP in