

A morfological study of the vestibular system's neuronal networks in the brainstem

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Applying different neuronal labeling techniques we have studied the morphological background of the neuronal network underlying the eye movements and the brainstem control of vegetative functions of the frog.

Simultaneous labeling of the oculomotor and trochlear nerve with different fluorochroms were performed in in vivo experiments. By the use of confocal laser scanning microscope we detected a large number of close contacts in both nuclei, the majority of them were dendrodendritic appositions. The distance between the adjacent profiles suggested close membrane contacts without intercalating glial or neuronal elements. At the ultra structural level, the dendrodendritic and dendrosomatic contacts did not show any morphological specialization; the long membrane appositions may provide ephaptic interactions between the neighboring profiles. This electrotonic coupling between the oculomotor and trochlear nerve motoneurons may promote the co-activation of the inferior rectus and superior oblique muscles responsible for vertical eye movements.

We have studied whether the primary vestibular afferent fibers establish direct connections with the motoneurons of glossopharyngeal and vagus nerves of the frog. The vestibulocochlear and the glossopharyngeal-vagus nerves were simultaneously labeled with fluorescein dextran amine and tetramethylrhodamine dextran amine. With a confocal laser scanning microscope we could detect close appositions between the vestibular afferent fibers and somatodendritic components of the somato- and visceromotor neurons of the ambiguous nucleus of IX-X nerves. The direct impulse transmission may provide a quick and immediate response of cardiovascular and gastrointestinal system upon body displacement.

Our results can help to understand the structural organization of complex neural systems related to the sense of balance. The results may also assist in developing new therapeutic strategies for the treatment of symptoms of vestibular lesion.

Key words: ambiguous nucleus, oculomotor nerve, trochlear nerve, glossopharyngeal nerve, vagus nerve, neuronal labeling, eye movements.