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Yusuke Shimada

Division of Oral Diagnosis & Radiology, Tohoku University Graduate School of Dentistry
4-1, Seiryo-machi, Aoba-ku, Sendai 980-8575, Japan

The beta-2 subunit of the mammalian brain voltage-gated sodium channel (SCN2B) was examined in the rat trigeminal ganglion (TG) and trigeminal sensory nuclei. In the TG, 42.6% of sensory neurons were immunoreactive for SCN2B. These neurons had various cell body sizes. In facial and oral mucosae, corpuscular nerve endings contained SCN2B-immunoreactivity. SCN2B-immunoreactive (IR) nerve fibers formed nerve plexuses beneath taste buds in the tongue and incisive papilla. However, SCN2B-IR free nerve endings were rare in cutaneous and mucosal epithelia. Tooth pulps, muscle spindles and major salivary glands were also innervated by SCN2B-IR nerve fibers. A double immunofluorescence method revealed that about 40% of SCN2B-IR neurons exhibited calcitonin gene-related peptide (CGRP)-immunoreactivity. However, distributions of SCN2B- and CGRP-IR nerve fibers were mostly different in facial, oral and cranial structures. By retrograde tracing method, 60.4% and 85.3% of TG neurons innervating the facial skin and tooth pulp, respectively, showed SCN2B-immunoreactivity. CGRP-immunoreactivity was co-localized by about 40% of SCN2B-IR cutaneous and tooth pulp TG neurons. In trigeminal sensory nuclei of the brainstem, SCN2B-IR neuronal cell bodies were common in deep laminae of the subnucleus caudalis, and the subnuclei interpolaris and oralis. In the mesencephalic trigeminal tract nucleus, primary sensory neurons also exhibited SCN2B-immunoreactivity. In other regions of trigeminal sensory nuclei, SCN2B-IR cells were very infrequent. SCN2B-IR neuropil was detected in deep laminae of the subnucleus caudalis as well as in the subnuclei interpolaris, oralis and principalis. These findings suggest that SCN2B is expressed by various types of sensory neurons in the TG. There appears to be SCN2B-containing pathway in the TG and trigeminal sensory nuclei.