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The human nucleus cuneatus contains discrete territories that share neurochemical features with the relay nuclei for nociceptive information

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Traditionally, the spinal dorsal column and the gracile (GN) and cuneate (CN) nuclei are believed to be involved in somatic tactile and proprioceptive perceptions. However, more recent clinical and experimental studies show that this system is also involved in the neurotransmission of visceral nociceptive stimuli (Willis et al., Proc. Natl. Acad. Sci. USA 96, 7675, 1999; Pale?ek J., Physiol. Res. 53, S125, 2004). Early studies in our laboratory (Del Fiacco et al., Brain Res. 264, 142, 1983; Neuroscience, 12, 591, 1984) showed that, at variance with that of laboratory animals, the human CN contains discrete subregions that are strongly immunoreactive to substance P, a neuropeptide classically involved in pain transmission. Here we provide further information on the chemical neuroanatomy of the human dorsal column nuclei and show that the substance P-immunoreactive subregions of the CN retain the neurochemical features of the protopathic relay nuclei.

Tissue distribution of a number of neuropeptides, trophic factors and neuroplasticity-associated proteins was analyzed by immunohistochemistry in postmortem specimens of medulla oblongata from subjects aged 21 gestation weeks to 78 years, with no signs of neuropathology.

Immunoreactivity to neuropeptides calcitonin gene-related peptide, leucine- and methionine-enkephalin, somatostatin, galanin, and peptide histidine-isoleucine, to trophins of the Neurotrophin and glial-derived neurotrophic factor families and related receptors, and to the neuroplasticity-associated proteins growth-associated protein-43 and polysialylated-neural cell adhesion molecule labels neuronal elements in restricted areas of the cuneate nucleus, located along its dorsal edge or embedded in the white matter of the cuneate fasciculus. Multiple immunolabelling shows that, with respect to one another, the examined substances are distributed in these regions as in the superficial layers of the spinal dorsal horn and trigeminal subnucleus caudalis. By contrast, the immunoreactivity in the GN is usually sparse and not gathered in definite subregions.

The results show that, at variance with that of laboratory mammals, including primates, the human CN contains clear-cut subregions with neurochemical features reminiscent of those present in the relay nuclei for protopathic and pain perception. Moreover, the peculiar localization of the examined substances suggests that the superficial layers of those regions may constitute a “gelatinous subnucleus”. The origin as well as the functional involvement of such innervation remains to be elucidated.

Keywords: dorsal column nuclei, human, chemical neuroanatomy, nociception