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Notes on the Nucleus Tractus Solitarius

The nucleus tractus solitarius (NTS) has long been considered as the first central relay for gustatory and visceral afferent informations only. However, data obtained during the past ten years, with neuroanatomical, biochemical and electrophysiological techniques, clearly demonstrate that the NTS is a structure with a high degree of complexity, which plays, at the medullary level, a key role in several integrative processes.

The NTS, located in the dorsomedial medulla, is a structure of small size containing a limited number of neurones scattered in a more or less dense fibrillar plexus. The distribution and the organisation of both the cells and the fibrillar network are not homogeneous within the nucleus and the NTS has been divided cytoarchitecturally into various sub-nuclei, which are partly correlated with the areas of projection of peripheral afferent endings. At the ultrastructural level, the NTS shows several complex synaptic arrangements in form of glomeruli. These arrangements provide morphological substrates for complex mechanisms of intercellular communication within the NTS.

The NTS is not only the site of vagal and glossopharyngeal afferent projections, it receives also endings from facial and trigeminal nerves as well as from some renal afferents. Gustatory and somatic afferents from the oropharyngeal region project with a crude somatotopy within the rostral part of the NTS and visceral afferents from cardiovascular, digestive, respiratory and renal systems terminate viscero-topically within its caudal part.

Moreover the NTS is extensively connected with several central structures. It projects directly to multiple brain regions by means of short connections to bulbo-ponto-mesencephalic structures (parabrachial nucleus, motor nuclei of several cranial nerves, ventrolateral reticular formation, raphe nuclei ...) and long connections to the spinal cord and diencephalic and telencephalic structures, in particular the hypothalamus and some limbic structures.

The NTS is also the recipient of several central afferent inputs. It is worth to note that most of the structures that receive a direct projection from the NTS project back to the nucleus. Direct projections from the cerebral cortex to the NTS have also been identified.

These extensive connections indicate that the NTS is a key structure for autonomic and neuroendocrine functions as well as for integration of somatic and autonomic responses in certain behaviours.

The NTS contains a great diversity of neuroactive substances. Indeed, most of the substances identified within the central nervous system have also been detected in the NTS and may act, at this level, as classical transmitters and/or neuromodulators.