

Study of synaptogenesis in tongue epithelium in human foetuses using synaptophysin as immunohistochemical (IHC) marker

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Development of taste in higher organisms always has been a very fascinating yet lesser understood among the five special senses. Many events including the development of taste receptors, neuronal connections and the gustatory cortex determine the overall advent of taste in a human foetus. Each taste bud is innervated by peripheral extensions of primary afferent neurons coming from the sensory ganglia which synapse with the taste receptor cells (TRCs) and convey information to CNS from the tongue epithelium. Hence, the neurons are postsynaptic to sensory cells (TRCs), thereby being functionally similar to CNS neuron dendrites. With an intention of studying the approximate beginning of synaptogenesis in the tongue epithelium, I used a specific marker for synaptophysin, a 38 kDa integral membrane protein found in small, round or flat synaptic vesicles. Synaptophysin being an indicator of vesicle formation is used as an indicator of neurogenesis and terminal neuronal differentiation, for studying neural dysgenesis, medulloblastomas and other neural disorders. In this study, I used sagittal sections of tongue from five human foetuses of ages ranging from 14 to 20 weeks to study the gradual appearance of taste buds using staining with haematoxylin and eosin, and the expression of synaptophysin in the tongue epithelium using immunohistochemistry with anti-synaptophysin antibody. Across the ages, there was an increase in the number of papillae on the dorsum of tongue. In 16-18

weeks, primary papillae were visible which changed to secondary papillae in the later ages of 20 and 22 weeks, indicating maturation of papillae throughout the period 14 to 22 weeks. In 22 week foetus, probable taste buds were identified, which showed organisation into cells with rounded nuclei, the probable basal cells, cells with elongated nuclei, the probable sustentacular cells and elongated cells with a process, the typical neural cells. Expression of synaptophysin was not found in age groups of 14th to 18th weeks. However, there was very faint expression in the epithelium and within the muscle layer in age groups of 20th and 22nd weeks, suggesting the beginning of synaptogenesis and vesicle formation in the age groups of 20 and 22 weeks. Moreover from 16th week onwards, lingual glands were observed in the posterior part of tongue, this being significant as per taste reception. In view of presence of the protein in the muscle layer, we hypothesize that along with its expected presence in the pre-synaptic terminals of the TRCs, it is also produced in the ganglionic cell bodies and is anterogradely transported to be concentrated in axonal endings of sensory neurons, where they probably participate in the regulation/modulation of neurotransmitter release by the TRCs. This work indicates the maturation of taste buds and synaptic vesicles in human foetal tongue epithelium around 20-22 weeks age and this observation will pave the way for future understanding of the development of taste reception in utero.