

NAME: UWAOGU KELECHI OYINDAMOLA

DEPARTMENT: NURSING

MATRIC NUMBER: 18/MHS02/192

COURSECODE: PHS212

COURSE TITLE: PHYSIOLOGY

Question:

Elucidate the pathway involved in Taste

The neural taste pathway will undergo scrutiny from the perspective of starting within the tongue and moving away from it towards the brain. The three nerves associated with taste are the facial nerve (cranial nerve VII), which provides fibers to the anterior two-thirds of the tongue, the glossopharyngeal nerve (cranial nerve IX), which provides fibers to the posterior third of the tongue, and the vagus nerve (cranial nerve X), which provides fibers to the epiglottis region. Taste fibers categorize as special visceral afferent (SVA).

The branch of the facial nerve that innervates the anterior two-thirds of the tongue is the chorda tympani nerve. Another branch of the facial nerve, called the greater petrosal nerve, supplies innervation to taste buds of the soft palate. The cell bodies of the facial nerve associated with taste occur within the geniculate ganglion. Its central processes enter the brainstem at the pontomedullary junction and travel caudally to the medulla oblongata, where they synapse at the nucleus solitarius.

The cell bodies of the glossopharyngeal nerve associated with taste are in the inferior ganglion of the glossopharyngeal nerve (petrosal ganglion). The central processes of the glossopharyngeal nerve travel through the jugular foramen, enter the brainstem at the level of the rostral medulla, and eventually synapse at the nucleus solitarius.

The cell bodies of the vagus nerve associated with taste exist in the nodose ganglion. Its central processes travel through the jugular foramen, to the medulla, and also synapse at the nucleus solitarius.

At this point, fibers from all three of these nerves have synapsed at the nucleus solitarius. Specifically, the synapse occurs in the rostral part of the nucleus solitarius known as the gustatory region of the nucleus. The caudal area of the nucleus solitarius receives cardio-respiratory information, and it is known as the visceral region.

Next, the second-order fibers ascend ipsilaterally to the parvicellular division of the ventral posteromedial nucleus (VPMpc) of the thalamus, where the next synapse occurs.

The third order fibers travel ipsilaterally through the posterior limb of the internal capsule to terminate in the frontal operculum, anterior insular cortex, and in the rostral part of the

Brodmann area 3B. The overall function of these third-order fibers is to provide discriminatory taste sensations.

Additionally, there are secondary fibers that travel from the gustatory cortex to the posterolateral portion of the orbitofrontal cortex (OFC). This area is where the integration of taste and smell takes place, as well as the phenomenon of food reward. The description of food reward is the enjoyment of a particular food at the time in which an individual is eating it.

The glossopharyngeal nerve innervates a third of the tongue including the circumvallate papillae. The facial nerve innervates the other two thirds of the tongue and the cheek via the chorda tympani.

The pterygopalatine ganglia are ganglia (one on each side) of the soft palate. The greater petrosal, lesser palatine and zygomatic nerves all synapse here. The greater petrosal carries soft palate taste signals to the facial nerve. The lesser palatine sends signals to the nasal cavity; which is why spicy foods cause nasal drip. The zygomatic sends signals to the lacrimal nerve that activate the lacrimal gland; which is the reason that spicy foods can cause tears. Both the lesser palatine and the zygomatic are maxillary nerves (from the trigeminal nerve).

The special visceral afferents of the vagus nerve carry taste from the epiglottal region of the tongue.

The lingual nerve (trigeminal, not shown in diagram) is deeply interconnected with chorda tympani in that it provides all other sensory info from the $\frac{2}{3}$ of the tongue. This info is processed separately (nearby) in rostral lateral subdivision of nucleus of the solitary tract (NST).

NST receives input from the amygdala (regulates oculomotor nuclei output), bed nuclei of stria terminalis, hypothalamus, and prefrontal cortex. NST is the topographical map that processes gustatory and sensory (temp, texture, etc.) info.

Reticular formation (includes Raphe nuclei responsible for serotonin production) is signaled to release serotonin during and after a meal to suppress appetite. Similarly, salivary nuclei are signaled to decrease saliva secretion.

Hypoglossal and thalamic connections aid in oral-related movements.

Hypothalamus connections hormonally regulate hunger and the digestive system.

Substantia innominata connects the thalamus, temporal lobe, and insula.

Edinger-Westphal nucleus reacts to taste stimuli by dilating and constricting the pupils.

Spinal ganglions are involved in movement.

The frontal operculum is speculated to be the memory and association hub for taste.

The insula cortex aids in swallowing and gastric motility.