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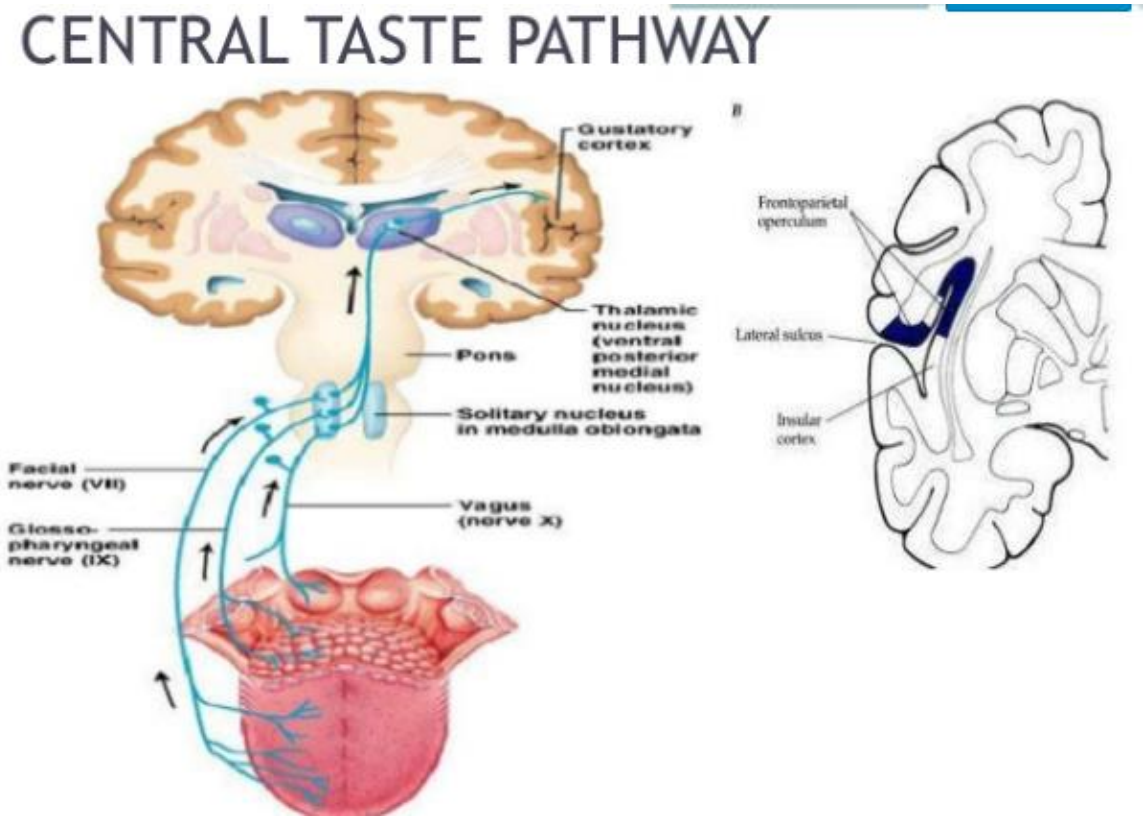
ELUCIDATE THE PATHWAYS INVOLVED IN TASTE:



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1. The **facial nerve** is the seventh cranial nerve, or simply **CN VII**. It emerges from the pons of the brainstem, controls the muscles of facial expression, and functions in the conveyance of taste sensations from the anterior two-thirds of the tongue. The nerves typically travels from the pons through the facial canal in

the temporal bone and exits the skull at the stylomastoid foramen. It arises from the brainstem from an area posterior to the cranial nerve VI (abducens nerve) and anterior to cranial nerve VIII (vestibulocochlear nerve).

The facial nerve also supplies preganglionic parasympathetic fibers to several head and neck ganglia.

The facial and intermediate nerves can be collectively referred to as the **nervus intermediofacialis.**

- Function

Facial expression

The main function of the facial nerve is motor control of all of the muscles of facial expression. It also innervates the posterior belly of the digastric muscle, the stylohyoid muscle, and the stapedius muscle of the middle ear. All of these muscles are striated muscles of branchiomeric origin developing from the 2nd pharyngeal arch.

Facial sensation

In addition, the facial nerve receives taste sensations from the anterior two-thirds of the tongue via the chorda tympani. Taste sensation is sent to the gustatory portion (superior part) of the solitary nucleus. General sensation from the anterior two-thirds of tongue are supplied by afferent fibers of the third division of the fifth cranial nerve (V-3). These sensory (V-3) and taste (VII) fibers travel together as the lingual nerve briefly before the chorda tympani leaves the lingual nerve to enter the tympanic cavity (middle ear) via the petrotympanic fissure. It joins the rest of the facial nerve via the canaliculus for chorda tympani. The facial nerve then forms the geniculate ganglion, which contains the cell bodies of the taste fibers of chorda tympani and other taste and sensory pathways. From the geniculate ganglion, the taste fibers continue as the intermediate nerve which goes to the upper anterior quadrant of the fundus of the internal acoustic meatus along with the motor root of the facial nerve. The intermediate nerve reaches the posterior cranial fossa via the internal acoustic meatus before synapsing in the solitary nucleus.

The facial nerve also supplies a small amount of afferent innervation to the oropharynx below the palatine tonsil. There is also a small amount of cutaneous sensation carried by the nervus intermedius from the skin in and around the auricle (outer ear).

Other

The facial nerve also supplies parasympathetic fibers to the submandibular gland and sublingual glands via chorda tympani. Parasympathetic innervation serves to increase the flow of saliva from these glands. It also supplies parasympathetic innervation to the nasal mucosa and the lacrimal gland via the pterygopalatine ganglion. The parasympathetic fibers that travel in the facial nerve originate in the superior salivatory nucleus.

The facial nerve also functions as the efferent limb of the corneal reflex.

Functional components

The facial nerve carries axons of type GSA, general somatic afferent, to skin of the posterior ear.

The facial nerve also carries axons of type GVE, general visceral efferent, which innervate the sublingual, submandibular, and lacrimal glands, also mucosa of nasal cavity.

Axons of type SVE, special visceral efferent, innervate muscles of facial expression, stapedius, the posterior belly of digastric, and the stylohyoid.

The axons of type SVA, special visceral afferent, provide taste to the anterior two-thirds of tongue via chorda tympani.

2. VAGUS NERVE:

The **vagus nerve**, historically cited as the **pneumogastric nerve**, is the tenth cranial nerve or **CN X**, and interfaces with the parasympathetic control of the heart, lungs, and digestive tract. The vagus nerves are normally referred to in the singular. It is the

longest nerve of the autonomic nervous system in the human body. The ending part of the vagus nerve is known as the nucleus ambiguus.

- **Functions**

The vagus nerve supplies motor parasympathetic fibers to all the organs (except the adrenal glands), from the neck down to the second segment of the transverse colon. The vagus also controls a few skeletal muscles, including:

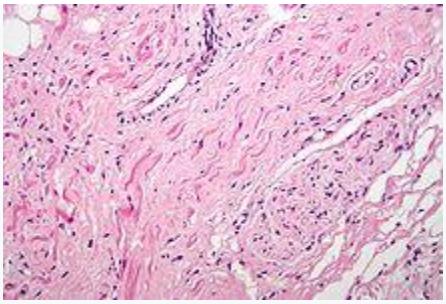
- Cricothyroid muscle
- Levator veli palatini muscle
- Salpingopharyngeus muscle
- Palatoglossus muscle
- Palatopharyngeus muscle
- Superior, middle and inferior pharyngeal constrictors
- Muscles of the larynx (speech).

This means that the vagus nerve is responsible for such varied tasks as heart rate, gastrointestinal peristalsis, sweating, and quite a few muscle movements in the mouth, including speech (via the recurrent laryngeal nerve). It also has some afferent fibers that innervate the inner (canal) portion of the outer ear (via the auricular branch, also known as Arnold's or Alderman's nerve) and part of the meninges.

Efferent vagus nerve fibers innervating the pharynx and back of the throat are responsible for the gag reflex. In addition, 5-HT_3 receptor-mediated afferent vagus stimulation in the gut due to gastroenteritis is a cause of vomiting. Stimulation of the vagus nerve in the cervix uteri (as in some medical procedures) can lead to a vasovagal response.

The vagus nerve also plays a role in satiation following food consumption. Knocking out vagal nerve receptors has been shown to cause hyperphagia (greatly increased food intake).

Vagus nerve and the heart



H&E stained fibers of the vagus nerve (bottom right) innervate the sinoatrial node tissue (middle left)

Parasympathetic innervation of the heart is partially controlled by the vagus nerve and is shared by the thoracic ganglia. Vagal and spinal ganglionic nerves mediate the lowering of the heart rate. The right vagus branch innervates the sinoatrial node. In healthy people, parasympathetic tone from these sources are well-matched to sympathetic tone. Hyperstimulation of parasympathetic influence promotes bradyarrhythmias. When hyperstimulated, the left vagal branch predisposes the heart to conduction block at the atrioventricular node.

At this location, neuroscientist Otto Loewi first demonstrated that nerves secrete substances called neurotransmitters, which have effects on receptors in target tissues. In his experiment, Loewi electrically stimulated the vagus nerve of a frog heart, which slowed the heart. Then he took the fluid from the heart and transferred it to a second frog heart without a vagus nerve. The second heart slowed without an electrical stimulation. Loewi described the substance released by the vagus nerve as vagusstoff, which was later found to be acetylcholine. Drugs that inhibit the muscarinic receptors (anticholinergics) such as atropine and scopolamine, are called vagolytic because they inhibit the action of the vagus nerve on the heart, gastrointestinal tract, and other organs. Anticholinergic drugs increase heart rate and are used to treat bradycardia.

Physical and emotional effects

Excessive activation of the vagal nerve during emotional stress, which is a parasympathetic overcompensation for a strong sympathetic nervous system response associated with stress, can also cause vasovagal syncope due to a sudden drop

in cardiac output, causing cerebral hypoperfusion. Vasovagal syncope affects young children and women more than other groups. It can also lead to temporary loss of bladder control under moments of extreme fear.

Research has shown that women having had complete spinal cord injury can experience orgasms through the vagus nerve, which can go from the uterus and cervix to the brain.

Insulin signaling activates the adenosine triphosphate (ATP)-sensitive potassium (KATP) channels in the arcuate nucleus, decreases AgRP release, and through the vagus nerve, leads to decreased glucose production by the liver by decreasing gluconeogenic enzymes: Phosphoenolpyruvate carboxykinase, Glucose 6-phosphatase

3. GLOSSOPHARYNGEAL NERVE

The **glossopharyngeal nerve**, known as the ninth cranial nerve (**CN IX**), is a mixed nerve that carries afferent sensory and efferent motor information. It exits the brainstem out from the sides of the upper medulla, just anterior (closer to the nose) to the vagus nerve. The motor division of the glossopharyngeal nerve is derived from the basal plate of the embryonic medulla oblongata, while the sensory division originates from the cranial neural crest.

- **Functions**

- It receives general somatic sensory fibers (ventral trigeminothalamic tract) from the tonsils, the pharynx, the middle ear and the posterior 1/3 of the tongue.
- It receives special visceral sensory fibers (taste) from the posterior 1/3 of the tongue.
- It receives visceral sensory fibers from the carotid bodies, carotid sinus.[2]
- It supplies parasympathetic fibers to the parotid gland via the otic ganglion.
- It supplies motor fibers to stylopharyngeus muscle, the only motor component of this cranial nerve.
- It contributes to the pharyngeal plexus.