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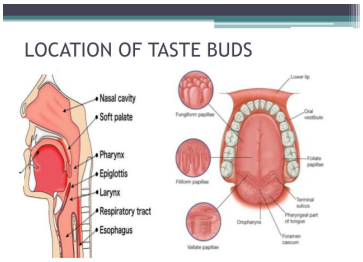


COURSE CODE: PHS 212

ELUCIDATE THE PATHWAY INVOLVED IN TASTE.

Sense organs for taste or gustatory sensation are taste buds.

THE TASTE PATHWAY.

RECEPTORS

Receptors for taste sensation are the type III cells of taste buds. Each taste bud is innervated by about 50 sensory nerve fibers and each nerve fiber supplies at least five taste buds through its terminals.

FIRST ORDER NEURON

First order neurons of taste pathway are in the nuclei of three different cranial nerves, situated in medulla oblongata. Dendrites of the neurons are distributed to the taste buds. After arising from taste buds, the fibers reach the cranial nerve nuclei by running along the following nerves.

1. Chorda tympani fibers of facial nerve, which run from anterior two third of tongue

2. Glossopharyngeal nerve fibers, which run from posterior one third of the tongue

3. Vagal fibers, which run from taste buds in other regions.

Axons from first order neurons in the nuclei of these nerves run together in medulla oblongata and terminate in the nucleus of tractus solitarius.

SECOND ORDER NEURON

Second order neurons are in the nucleus of tractus solitarius. Axons of second order neurons run through medial lemniscus and terminate in posteroventral nucleus of thalamus.

THIRD ORDER NEURON

Third order neurons are in the posteroventral nucleus of thalamus. Axons from third order neurons project into parietal lobe of the cerebral cortex.

TASTE CENTER

Center for taste sensation is in opercular insular cortex, i.e. in the lower part of postcentral gyrus, which receives cutaneous sensations from face. Thus, the taste fibers do not have an independent cortical projection.

PRIMARY TASTE SENSATION

Primary or fundamental taste sensations are divided into five types:

1. Sweet

2. Salt

3) Sour

4) Bitter

5) Umami.

TASTE SENSATIONS AND CHEMICAL CONSTITUTIONS

Substances causing sour or salt tastes are mostly electrolytes. Bitter and sweet tastes are caused by electrolytes or non-electrolytes.

SWEET TASTE

Sweet taste is produced mainly by organic substances like monosaccharides, polysaccharides, glycerol, alcohol, aldehydes, ketones and chloroform. Inorganic substances, which produce sweet taste are lead and beryllium.

SALT TASTE

Salt taste is produced by chlorides of sodium, potassium and ammonium, nitrates of sodium and potassium. Some sulfates, bromides and iodides also produce salt taste.

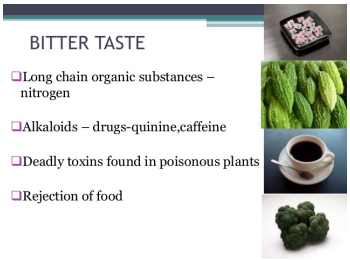
SOUR TASTE

Sour taste is produced because of hydrogen ions in acids and acid salts.

BITTER TASTE

Bitter taste is produced by organic substances like quinine, strychnine, morphine, glucosides, picric acid and bile salts and inorganic substances like salts of calcium, magnesium and

ammonium. Bitterness of the salts is mainly due to cations.



UMAMI

Umami is the recently recognized taste sensation. Umami is a Japanese word, meaning 'delicious'. Receptors of this taste sensation respond to glutamate, particularly monosodium glutamate (MSG), which is a common ingredient in Asian food. However, excess MSG consumption is proved to produce Chinese restaurant syndrome in some people taking Chinese food regularly. Common symptoms are headache, flushing, sweating, perioral numbness, chest pain. In severe conditions, airway swelling and obstruction and cardiac arrhythmia occur.

TASTE RECEPTOR

Generally, taste receptor is a G-protein coupled receptor (GPCR). It is also called G protein gustducin. However, several other receptors are involved in taste sensation. Transduction mechanism is different in each taste receptor cells.

also

SWEET RECEPTOR

Receptor for sweet taste is GPCR. The sweet substances bind to receptor and cause depolarization via cyclic AMP.

SALT RECEPTOR

Receptor for salt taste is called epithelial sodium channel (ENaC). It acts like ENaC receptors in other parts of the body. When sodium enters, this receptor releases glutamate, which causes depolarization.

SOUR RECEPTOR

Sour sensation also has the same ENaC receptor. The proton (hydrogen) enters the receptor and causes depolarization. It is believed that besides ENaC, other receptors such as hyperpolarization-activated cyclic nucleotide-gated cation channel (HCN) also are involved in sour sensation.

BITTER RECEPTOR

Bitter receptor is a GPCR. In bitter receptor, the sour substances activate phospholipase C

through G proteins. It causes production of inositol triphosphate (IP3), which initiates depolarization by releasing calcium ions.

UMAMI RECEPTOR

Umami receptor is called metabotropic glutamate receptor (mGluR4). Glutamate causes depolarization of this receptor. Exact mechanism of depolarization is not clearly understood. Activation of umami taste receptor is intensified by the presence of guanosine mono phosphate (GMP) and inosine monophosphate (IMP).