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PATHWAY FOR TASTE

RECEPTORS

Receptors for taste sensation are the type III cells of taste buds. Each taste bud is innervated by about 50 sensory nerve fibres and each nerve fibre 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 fibres reach the cranial nerve nuclei by running along the following nerves:

1. Chorda tympani fibres of facial nerve, which run from anterior two third of tongue
2. Glossopharyngeal nerve fibres, which run from posterior one third of the tongue
3. Vagal fibres, 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:

Centre 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 SENSATIONS

Primary or fundamental taste sensations are divided into five types:

1. Sweet
2. Salt
3. Sour
4. Bitter
5. Umami.

Man can perceive more than 100 different tastes. Other taste sensations are just the combination of two or more primary taste sensations.

COMBINATION OF TASTE SENSATION WITH OTHER SENSATIONS

Sometimes, taste sensation combines with other sensations to give rise to a different sensation. For example, combination of taste, smell and touch senses, gives rise to sensation of flavour, combination of taste with pain gives rise to sensation of ginger.

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.

1. 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.

1. SALT TASTE

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

1. SOUR TASTE

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

1. 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.

1. 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, air way swelling and obstruction and cardiac arrhythmia occur.

TASTE TRANSDUCTION

Taste transduction is the process by which taste receptor converts chemical energy into action potentials in the taste nerve fiber. Receptors of taste sensation are chemoreceptors, which are stimulated by substances dissolved in mouth by saliva. The dissolved substances act on microvilli of taste receptors exposed in the taste pore. It causes the development of receptor potential in the receptor cells. This in turn, is responsible for the generation of action potential in the sensory neurons.

TASTE RECEPTOR

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

1. SWEET RECEPTOR: Receptor for sweet taste is GPCR. The sweet substances bind to receptor and cause depolarization via cyclic AMP.
2. 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.
3. 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.
4. 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.
5. 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 However, several other receptors are also involved in taste sensation. Transduction mechanism is different in each taste receptor cells.