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18/mhs07/021

Pharmacology

200 level

Phs 212 Assignment

Question

Elucidate the pathway involved in Taste

## Taste

The tongue contains small bumps called papillae, within or near which taste buds are situated. In the tongue’s taste buds, the taste receptors receive sensory input via two important mechanisms –

* depolarization and
* neurotransmitter release.

Intake of salty foods leads more sodium ions to enter the receptor, causing the said mechanisms. The same is true with intake of sour foods (hydrogen ions) and sweet foods (sugar molecules), both of which result to the closing of K+ channels upon their entry.

From the axons of the taste receptors, the sensory information is transferred to the three taste pathways via the branches of cranial nerves VII, IX and X. The chorda tympani of CN VII (facial nerve) carries the taste sensory input from the tongue’s anterior two-thirds. Then, the rest of the taste sensations from the throat, palate and posterior tongue are transmitted by the branches of CN IX (glossopharyngeal nerve) and CN X (vagus nerve). From these cranial nerves, taste sensory input travels through the nerve fiber synapses to the solitary tract, the ventral posteromedial thalamic nuclei , and the thalamus. In these three locations, there are clustered neurons which respond to the same taste (sweet, sour, salty or bitter).The thalamus relays the information to the primary gustatory cortex located in the somatosensory cortex. The primary gustatory cortext is where the perception of a particular taste is processed.

A **taste receptor** is a type of [receptor](https://en.m.wikipedia.org/wiki/Receptor_%28biochemistry%29) which facilitates the sensation of [taste](https://en.m.wikipedia.org/wiki/Taste). When food or other substances enter the mouth, molecules interact with saliva and are bound to taste receptors in the oral cavity and other locations. Molecules which give a sensation of taste are considered "sapid".

|  |
| --- |
| ***Taste receptor*** |
| Taste receptors of the tongue are present in the taste buds of papillae. |

Taste receptors are divided into two families:

* Type 1, [sweet](https://en.m.wikipedia.org/wiki/Sweetness),
* Type 2, [bitter](https://en.m.wikipedia.org/wiki/Bitter_%28taste%29), In humans there are 25 known different bitter receptors, in cats there are 12, in chickens there are three, and in mice there are 35 known different bitter receptors.

Visual, olfactive, "sapictive" (the perception of tastes), trigeminal (hot, cool), mechanical, all contribute to the perception of *taste*. Of these, transient receptor potential cation channel subfamily V member 1 ([TRPV1](https://en.m.wikipedia.org/wiki/TRPV1)) vanilloid receptors are responsible for the perception of heat from some molecules such as capsaicin, and a [CMR1 receptor](https://en.m.wikipedia.org/wiki/TRPM8) is responsible for the perception of cold from molecules such as [menthol](https://en.m.wikipedia.org/wiki/Menthol), [eucalyptol](https://en.m.wikipedia.org/wiki/Eucalyptol), and [icilin](https://en.m.wikipedia.org/wiki/Icilin).

* The [gustatory system](https://en.m.wikipedia.org/wiki/Gustatory_system) consists of taste receptor cells in [taste buds](https://en.m.wikipedia.org/wiki/Taste_bud). Taste buds, in turn, are contained in structures called [papillae](https://en.m.wikipedia.org/wiki/Lingual_papillae). There are three types of papillae involved in taste: [fungiform papillae](https://en.m.wikipedia.org/wiki/Fungiform_papilla), [foliate papillae](https://en.m.wikipedia.org/wiki/Foliate_papilla), and [circumvallate papillae](https://en.m.wikipedia.org/wiki/Circumvallate_papilla). (The fourth type - [filiform papillae](https://en.m.wikipedia.org/wiki/Lingual_papilla#filiform_papillae) do not contain taste buds). Beyond the papillae, taste receptors are also in the [palate](https://en.m.wikipedia.org/wiki/Palate) and early parts of the [digestive system](https://en.m.wikipedia.org/wiki/Digestive_system) like the [larynx](https://en.m.wikipedia.org/wiki/Larynx) and upper [esophagus](https://en.m.wikipedia.org/wiki/Esophagus%22%20%5Co%20%22Esophagus). There are three [cranial nerves](https://en.m.wikipedia.org/wiki/Cranial_nerve) that innervate the tongue; the [vagus nerve](https://en.m.wikipedia.org/wiki/Vagus_nerve%22%20%5Co%20%22Vagus%20nerve), [glossopharyngeal nerve](https://en.m.wikipedia.org/wiki/Glossopharyngeal_nerve), and the [facial nerve](https://en.m.wikipedia.org/wiki/Facial_nerve). The [glossopharyngeal nerve](https://en.m.wikipedia.org/wiki/Glossopharyngeal_nerve) and the [chorda tympani](https://en.m.wikipedia.org/wiki/Chorda_tympani) branch of the [facial nerve](https://en.m.wikipedia.org/wiki/Facial_nerve) innervate the TAS1R and TAS2R taste receptors. Next to the taste receptors in on the tongue, the gut epithelium is also equipped with a subtle chemosensory system that communicates the sensory information to several effector systems involved in the regulation of appetite, immune responses, and gastrointestinal motility

In 2010, researchers found bitter receptors in lung tissue, which cause airways to relax when a bitter substance is encountered. They believe this mechanism is evolutionarily adaptive because it helps clear lung infections, but could also be exploited to treat [asthma](https://en.m.wikipedia.org/wiki/Asthma) and [chronic obstructive pulmonary disease](https://en.m.wikipedia.org/wiki/Chronic_obstructive_pulmonary_disease)

Human bitter taste receptor genes are named TAS2R1 to TAS2R64, with many gaps due to non-existent genes, pseudogenes or proposed genes that have not been annotated to the most recent human genome assembly. Many bitter taste receptor genes also have confusing synonym names with several different gene names referring to the same gene. See table below for full list of human bitter taste receptor genes:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class** | **Gene** | **Synonyms** | **Aliases** | **Locus** | **Description** |
| type 1(sweet) | [TAS1R1](https://en.m.wikipedia.org/wiki/TAS1R1) |  | GPR70 | 1p36.23 |  |
| [TAS1R2](https://en.m.wikipedia.org/wiki/TAS1R2) |  | GPR71 | 1p36.23 |  |
| [TAS1R3](https://en.m.wikipedia.org/wiki/TAS1R3) |  |  | 1p36 |  |
| type 2(bitter) | [TAS2R1](https://en.m.wikipedia.org/wiki/TAS2R1) |  |  | 5p15 |  |
| TAS2R2 |  |  | 7p21.3 | pseudogene |
| [TAS2R3](https://en.m.wikipedia.org/wiki/TAS2R3) |  |  | 7q31.3-q32 |  |
| [TAS2R4](https://en.m.wikipedia.org/wiki/TAS2R4) |  |  | 7q31.3-q32 |  |
| [TAS2R5](https://en.m.wikipedia.org/wiki/TAS2R5) |  |  | 7q31.3-q32 |  |
| TAS2R6 |  |  | 7 | not annotated in human genome assembly |
| [TAS2R7](https://en.m.wikipedia.org/wiki/TAS2R7) |  |  | 12p13 |  |
| [TAS2R8](https://en.m.wikipedia.org/wiki/TAS2R8) |  |  | 12p13 |  |
| [TAS2R9](https://en.m.wikipedia.org/wiki/TAS2R9) |  |  | 12p13 |  |
| [TAS2R10](https://en.m.wikipedia.org/wiki/TAS2R10) |  |  | 12p13 |  |
| TAS2R11 |  |  |  | absent in humans |
| [TAS2R12](https://en.m.wikipedia.org/wiki/TAS2R12) | TAS2R26 |  | 12p13.2 | pseudogene |
| [TAS2R13](https://en.m.wikipedia.org/wiki/TAS2R13) |  |  | 12p13 |  |
| [TAS2R14](https://en.m.wikipedia.org/wiki/TAS2R14) |  |  | 12p13 |  |
| TAS2R15 |  |  | 12p13.2 | pseudogene |
| [TAS2R16](https://en.m.wikipedia.org/wiki/TAS2R16) |  |  | 7q31.1-q31.3 |  |
| TAS2R17 |  |  |  | absent in humans |
| TAS2R18 |  |  | 12p13.2 | pseudogene |
| [TAS2R19](https://en.m.wikipedia.org/wiki/TAS2R19) | TAS2R23, TAS2R48 |  | 12p13.2 |  |
| [TAS2R20](https://en.m.wikipedia.org/wiki/TAS2R20) | TAS2R49 |  | 12p13.2 |  |
| TAS2R21 |  |  |  | absent in humans |
| TAS2R22 |  |  | 12 | not annotated in human genome assembly |
| TAS2R24 |  |  |  | absent in humans |
| TAS2R25 |  |  |  | absent in humans |
| TAS2R27 |  |  |  | absent in humans |
| TAS2R28 |  |  |  | absent in humans |
| TAS2R29 |  |  |  | absent in humans |
| [TAS2R30](https://en.m.wikipedia.org/wiki/TAS2R30) | TAS2R47 |  | 12p13.2 |  |
| [TAS2R31](https://en.m.wikipedia.org/wiki/TAS2R31) | TAS2R44 |  | 12p13.2 |  |
| TAS2R32 |  |  |  | absent in humans |
| TAS2R33 |  |  | 12 | not annotated in human genome assembly |
| TAS2R34 |  |  |  | absent in humans |
| TAS2R35 |  |  |  | absent in humans |
| TAS2R36 |  |  | 12 | not annotated in human genome assembly |
| TAS2R37 |  |  | 12 | not annotated in human genome assembly |
| [TAS2R38](https://en.m.wikipedia.org/wiki/TAS2R38) |  |  | 7q34 |  |
| [TAS2R39](https://en.m.wikipedia.org/wiki/TAS2R39) |  |  | 7q34 |  |
| [TAS2R40](https://en.m.wikipedia.org/wiki/TAS2R40) |  | GPR60 | 7q34 |  |
| [TAS2R41](https://en.m.wikipedia.org/wiki/TAS2R41) |  |  | 7q34 |  |
| [TAS2R42](https://en.m.wikipedia.org/wiki/TAS2R42) |  |  | 12p13 |  |
| [TAS2R43](https://en.m.wikipedia.org/wiki/TAS2R43) |  |  | 12p13.2 |  |
| [TAS2R45](https://en.m.wikipedia.org/wiki/TAS2R45) |  | GPR59 | 12 |  |
| [TAS2R46](https://en.m.wikipedia.org/wiki/TAS2R46) |  |  | 12p13.2 |  |
| [TAS2R50](https://en.m.wikipedia.org/wiki/TAS2R50) | TAS2R51 |  | 12p13.2 |  |
| TAS2R52 |  |  |  | absent in humans |
| TAS2R53 |  |  |  | absent in humans |
| TAS2R54 |  |  |  | absent in humans |
| TAS2R55 |  |  |  | absent in humans |
| TAS2R56 |  |  |  | absent in humans |
| TAS2R57 |  |  |  | absent in humans |
| TAS2R58 |  |  |  | absent in humans |
| TAS2R59 |  |  |  | absent in humans |
| [TAS2R60](https://en.m.wikipedia.org/wiki/TAS2R60) |  |  | 7 |  |
| TAS2R62P |  |  | 7q34 | pseudogene |
| TAS2R63P |  |  | 12p13.2 | pseudogene |
| TAS2R64P |  |  | 12p13.2 | pseudogene |