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Sense of Taste

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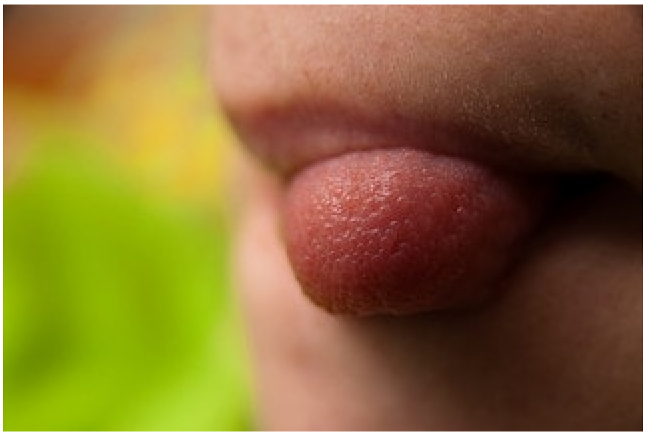
Candies, salt, vinegar, coffee beans – these foods differ when it comes to taste. Taste is one's capability to recognize taste molecules called tastants that come from foods, drinks, and just about anything that reaches the tongue. Taste receptor cells on the tongue help us detect which food tastes which.

Anatomy

Gustatory receptor cells are taste receptor cells that form clusters in the taste buds located on the tongue. Taste buds have pores that enable the taste molecules and ions to be transferred into the gustatory receptors. Researchers discovered that there are about 50 to 100 taste receptor cells in a single taste bud. These taste receptors cells represent all of the five primary taste sensations.This means to say that the textbook diagrams showing that there are 4-5 separate taste areas on the tongue are incorrect.

The gustatory receptors are found on each taste cell's apex. These receptors are actually proteins that eiter admit ions (salt sensation) or bind molecules. With the exception for bitter receptors, most single taste cells are limited to having only one type of receptor.
When tastants stimulate a taste receptor cell, an action potential is generated. This action potential travels to the brain for recognition and perception. Since one sensory neuron can have connections to some taste cells of different taste buds, a person may experience more than one taste sensation at a time.



Tastebuds. Photo by Eric Herot

Taste Sensations

There are dozens of taste sensations [1] that are recognized all over the world. But basically, there are five primary taste sensations, namely: sweet, sour, salty, bitter, and umami.

Sweet

Taste cells have G-protein-coupled receptors or GPCRs on their surfaces. When tastants of sweet substances such as sugar goes into the mouth, they bind to the GPCRs, particularly gustducin. This leads to the release of calcium ions (Ca++) and influx of sodium ions (Na+) into the cell, causing it to depolarize and release ATP. The release of ATP generate action potentials in a sensory neuron nearby.

Salty

Current research on salt sensation tells us that sodium chloride or table salt stimulates an ion-channel receptor that admits the sodium ions into the cell. When this happens, the cell undergoes depolarization. When the limit or threshold for cell depolarization occurs, action potentials are generated in a neighboring sensory neuron.

Sour

Sour substances, mainly acids, libreate hydrogen ions or protons (H+). These protons are detected by sour receptors. Once detection of H+ occurs, potassium ion channels (K+) closes, leading to cell depolarization. Then, a neurotransmitter called serotonin is released into the synapse with a nearby neuron.

Bitter

Just like the sweet sensation, bitter sensation also includes the binding of bitter taste molecules on the GPCRs coupled to the protein gustducin. There are about 25 varying bitter receptors or T2Rs encoded in human genes.

Umami

"Umami" is a Japanese word which means "delicious", "yummy", "savory", or "pleasant taste".

It is a meaty taste sensation that corresponds to the salts of glutamic acid. Umami became more popular with the use of monosodum glutamate (MSG) as a glavor enhancer in many Asian, particularly Japanese, dishes. The umami tastants bind in GPCRs, and thus, they have a signaling sequence similar to that of the bitter and sweet sensations.

Links
[1] http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/T/Taste.html