

BIOCHEMISTRY OF TASTE

Taste is one of our vital qualities developed in the process of evolution as a protective mechanism and is an important factor that determines successful adaptation and human health. What we refer to as “taste” is basically a bundle of different sensations. It is not only the taste perceived by the tongue – the smell, texture, and temperature of food play a role too. Taste sensations can change with age, depend on gender, and have seasonal dynamics.

Taste is a two-phase chemical reaction. It is caused by the chemical compounds of foods which interact with sensory cells in your taste buds (taste buds are the little bumps on your tongue known as papillae). On average, a person has around 10,000 taste buds which are replaced around every 2 week. However, as you get older, fewer of these taste buds get replaced. This is why foods often don't taste as strong to adults as they do to children.

There are five main tastes: sweet, sour, salty, bitter, and umami and each of them activates different mechanisms in cells, which leads to the appearance of nerve signals. The receptors are like locks, and the salty, bitter, sweet and umami molecules are like keys: they snap together in specific ways, and when they do, the cells send signals to the brain reporting the presence of molecules.

Salty taste is felt due to cations such as Na^+ (sodium), K^+ (potassium) and NH_4^+ (ammonium). The main mechanism is the passage of ions through special sodium channels. However, salinity may change due to the composition of saliva or changes in receptor proteins.

Sour taste is associated with the acidity of food, that is, with hydrogen ions (H^+). These ions block certain sodium channels creating an acidic sensation. The sour taste helps identify spoiled or unripe food which could be dangerous. In addition, the sour taste often indicates the presence of vitamin C in fruits, which improves health.

Bitter taste is caused by various substances such as cations, amino acids, peptides and complex compounds. It is recognized through several mechanisms, including special carrier proteins, channels, and G proteins. In total, there are about 35 different proteins in the sensory cells that respond to bitter substances. From an evolutionary standpoint, this can be explained by the many different bitter species of plants, some of which were poisonous.

A sweet taste occurs when molecules of sugars and other sweeteners bind to receptors, activating a system of secondary messengers. One of the chemical carriers of sweetness is hydroxyl groups in large organic molecules – polyols. The sweetest substance ever known is the lugduname substance. Lugduname has been estimated to be between 220,000 and 300,000 times as sweet as sucrose, but it has never been legalized as a dietary supplement.

The fifth basic taste called umami was the last to appear. It is associated with protein-rich foods and has helped people find protein-rich foods that are needed for body growth and repair. This became especially important when humans became omnivorous. Umami sensation is produced by free amino acids, particularly glutamic acid, which can be found in fermented and aged foods (for example, in parmesan), soy sauce, and fish sauce. They are also found in a large number of unfermented foods: walnuts, grapes, broccoli, tomatoes, mushrooms and, to a lesser extent, in meat.

It's important to note that the sensation of spiciness or "heat" is not technically a taste. Instead, it's a form of pain perception. Spicy foods contain compounds like capsaicin (found in chili peppers), which activate pain receptors. These receptors normally respond to heat, that is why spicy food feels "hot" even though its temperature might not be high. The brain interprets this stimulation as burning, even though there's no real thermal damage. This reaction also causes increased salivation, sweating, and even endorphin release which explains why some people enjoy the rush of spicy foods.

Overall, taste perception is not just a sensory experience but a key biological function that has influenced human dietary choices, health, and adaptation to different environments throughout history. Understanding the biochemical and evolutionary aspects of taste can provide valuable insights into nutrition, food pREFERENCES, and even the development of new dietary strategies for health and well-being.

REFERENCES

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