4. Umami and the Human Body

How we Taste Umami

Taste buds, which serve to recognize different tastes, are found on the raised protrusions of the tongue's surface called papillae. There are taste receptors on these taste buds called taste cells, and the body uses them to recognize various tastes. The relationship between glutamate and the umami taste receptors is similar to that between a key and a keyhole. When umami taste receptors on the taste buds come into contact with glutamate, this information is relayed to the brain via the taste nerves. The umami taste is then recognized by the brain.

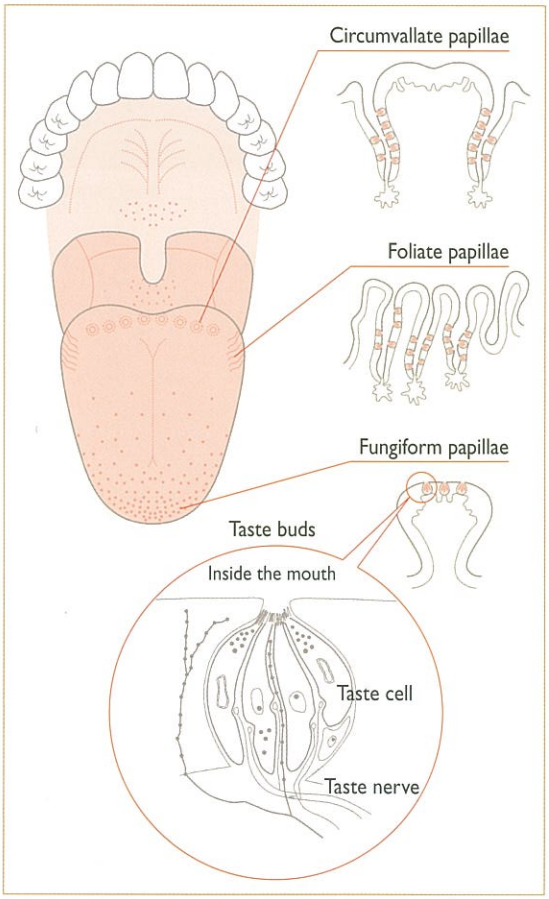
Umami: Signaling the Presence of Proteins

Our sense of taste plays a role in conveying information to us about which foods are good for us and which are harmful. A sweet taste signals a source of energy such as sugars and carbohydrates, a salty taste signals the presence of minerals that are essential to help maintain the optimal balance of body fluid. A sour taste warns us when food is rotten or unripe. A bitter taste, meanwhile, signals that something such as a toxin is harmful to the body. Umami comes from amino acids or nucleotides and signals the presence of proteins which are essential to human life.

The New Role of Glutamate

Recent research has shown that there are glutamate receptors not only on the tongue but also in the stomach. And it has been learned that the gastric vagal nerve reacts only to umami substances — glutamate is the only amino acid that it responds to. This suggests that when a piece of food enters the stomach, and glutamate receptors detect the presence of glutamate, this information is relayed to the brain through the gastric vagal nerve . A signal is then sent from the brain to the stomach to prepare for the digestion of protein.

Fig. 3 The Perception of Taste



T. Yamamoto, Brain and Taste, Kyoritsu. Tokyo, 1996. (in Japanese)

Fig. 4 The Process Behind our Response to the Five Basic Tastes

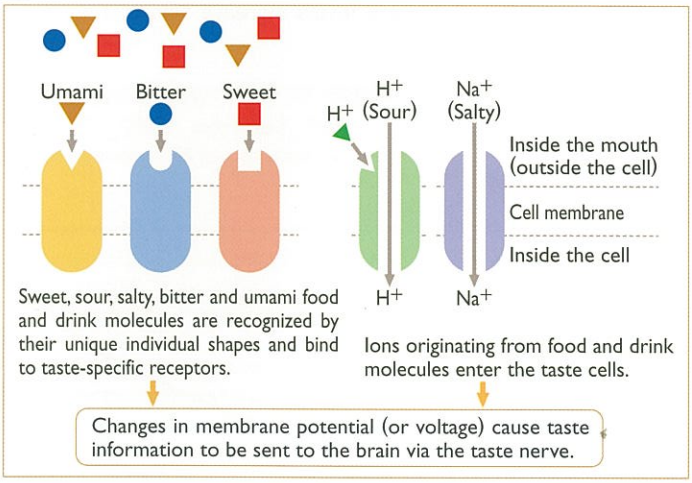
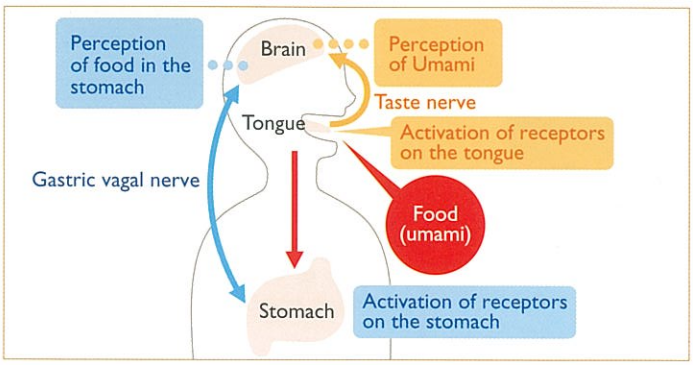


Fig. 5 Intake of Umami-Rich Food

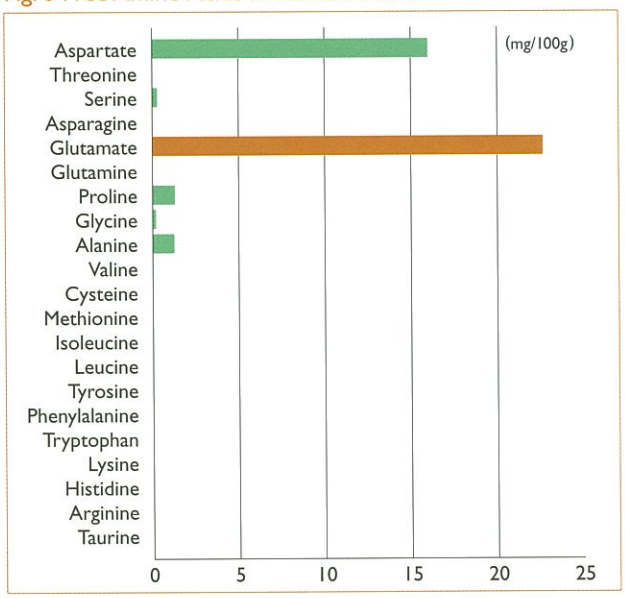


5. Human Breast Milk and Umami

Our First Encounter with Umami

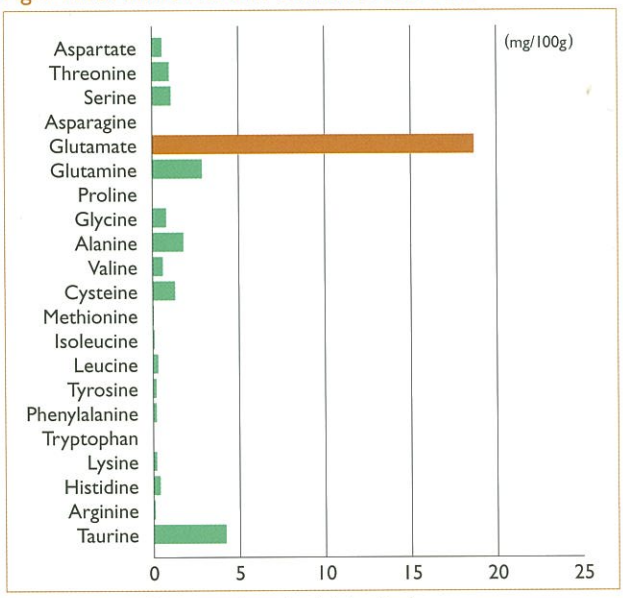
The graphs below show the levels of free amino acids — amino acids that do not have peptide bonds — found in kombu dashi and human breast milk when nursing a seven-day old baby. In human breast milk, glutamate is the predominant amino acid, accounting for over half of the entire free amino acid content, so all breastfed babies first taste umami via their mother's breast milk. But the baby's first true introduction to umami happens even before birth since amniotic fluid also contains glutamate — 2.2mg/100ml (approximately 0.27 oz/3.4 fl oz) which is at a lower concentration than human breast milk. The levels of glutamate found in kombu dashi, however, are almost the same as those found in human breast milk.

Fig. 6 Free Amino Acids in Kombu Dashi



Kombu dashi: 30g (approximately 1 oz) of kombu heated in 1.8 liters (approximately 61 fl oz) of 60°C (140°F) water for 60 minutes.

Fig. 7 Free Amino Acids in Human Breast Milk



Human breast milk: seven days after birth of baby
Source: K Ninomiya, Food Rev. Int., 14 (2&3) 177-211 (1998)
Note; asparagine, tryptophan and proline not included in the analysis.

These images show the reactions of babies after tasting umami, sweet, sour and bitter. They display happy facial expressions after tasting something sweet and screw up their faces after consuming sour and bitter liquids. After consuming something umami, they display expression of contentment similar to those of when they had consumed something sweet.

Sweet Sour Bitter Umami

Note; In the 1990s, it was thought that babies did not have the ability to sense salt, so the babies' reactions to salt were not tested in this experiment. It has now been reported, however, that babies are indeed able to taste salt — they display an expression that suggests unpleasantness when given salty foods.