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Variants of 'umami' taste receptor contribute to our individualized flavor worlds

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Using a combination of sensory, genetic, and in vitro approaches, researchers from the Monell Center confirm that the T1R1-T1R3 taste receptor plays a role in human umami (amino acid) taste.

They further report that variations in the genes that code for this receptor correspond to individual variation in sensitivity to and perceived intensity of umami taste.

"These findings bolster our understanding of human taste variation and individual differences in tastes for essential nutrients," says senior author Paul A.S. Breslin PhD, a sensory geneticist at Monell.

Umami is the taste quality associated with several amino acids, especially the amino acid L-glutamate. High levels of glutamate are present in many protein-rich foods, including meats and cheeses, in vegetables such as mushrooms, peas, and tomatoes, and in human breast milk.

Amino acids are the building blocks of protein, an essential macronutrient.

Commenting on clinical implications of the work, Breslin says, "Protein-energy malnutrition is one of the leading causes of death in children worldwide. Increased understanding of amino acid taste receptors may help nutritionists target the appetites of protein-malnourished children to provide good-tasting dietary supplements that kids will readily accept."

The findings, published online in the American Journal of Clinical Nutrition, strengthen the claim that umami is a fundamental human taste quality -- similar to sweet, salty, bitter and sour -- that indicates the presence of amino acids, peptides and related structures.

In the study, Breslin and his team first conducted sensory tests on 242 individuals, who were asked to discriminate the taste of weak L-glutamate from salt. Approximately 5% were unable to tell the two tastes apart, indicating that certain people are highly insensitive to umami and thus have difficulty detecting low levels of this taste quality.

An additional 87 individuals were asked to assess the intensity of glutamate's umami taste. The subjects tasted five concentrations of glutamate and rated the umami intensity of each on a scale that ranged from 'no sensation' to 'the strongest imaginable.'

The researchers next examined DNA from these 87 individuals to look for variations in the genes that code for T1R1 and T1R3, two protein subunits that combine to form the G-protein coupled receptor T1R1-T1R3. Comparing DNA structure to the glutamate taste responses of each individual, they found that variations (known as SNPs; single nucleotide polymorphisms) at three sites on the T1R3 gene were associated with increased sensitivity to glutamate taste.

A fourth set of studies used in vitro cell biology techniques to provide additional evidence that T1R1-T1R3 is a human amino acid taste receptor. When human T1R1-T1R3 receptors were expressed in a host cell line, these cells were able to respond specifically to L-glutamate.

Together, the findings demonstrate that the T1R1-T1R3 receptor significantly affects human sensitivity to umami taste from glutamate, and that individual differences in umami perception are due, at least in part, to coding variations in the T1R3 gene.

"We want to further understand the degree to which these genes account for umami taste perception," said Breslin. "This will in turn help in the discovery of other taste receptors that may play a role in umami taste and aid in our understanding of protein appetites."

He also speculates that because these same receptors are also found in the gastrointestinal tract, liver and pancreas, coding variation in the T1R3 gene may also influence how proteins and amino acids are processed metabolically.

Source: Monell Chemical Senses Center (news : web)

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