A trained palate: Understanding complexities of taste, smell could lead to improved diet

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Tomomi Fujimaru, a student at Oregon State University, tastes green vegetable juice while wearing a nose clip in research on the role of blocked retronasal olfaction. (Photo courtesy of Oregon State University)

Researchers at Oregon State University have made some fundamental discoveries about how people taste, smell and detect flavor, and why they love some foods much more than others.

The findings could lead to the Holy Grail of nutrition – helping people learn to really LIKE vegetables.

As an evolutionary survival mechanism, humans are wired to prefer sweet-tasting foods and avoid bitter substances. In the distant past, that helped us avoid poison and find food that provided energy. Now, it just makes us fat.

In several publications, the most recent in the journal *Chemical Senses*, scientists have outlined exactly how humans use the nose and tongue to recognize the flavor of foods that are safe to eat. When odor and taste components of foods are congruent, like vanilla and sugar, they are perceived as one sensation which seems to come from the mouth.

"This is a trick that the brain plays on us," said Juyun Lim, an OSU assistant professor of food science and technology. "Vanilla has no taste at all. It's a smell, and the pleasant sensation is coming not from your mouth but from the nose, through the passage way between the back of the mouth and the back of the nose."

When flavors are "incongruent" and not as commonly found together – like vanilla and salt – then people believe they are smelling vanilla from their nose rather than tasting it in the mouth.

"This was an amazing part of our experiments, we did not expect a result so compelling," Lim said. "There has been confusion for centuries about exactly how our senses of taste and smell work. We're finally starting to work this out."

There are actually several senses that relate to the perceived "flavor" of a food, Lim said. These include taste, which resides solely in the tongue; smell, which is exclusively in the nose; and somesthesis, which includes things like touch, temperature, and the burn of hot peppers. Even though the mouth and nose are pretty closely connected, taste and smell do not actually interact with each other there at all.

The real action happens in the brain. It decides what you are eating and whether it is safe or not.

In the brain, there's a taste center, and a smell center, and lurking just behind your eyes is a third center called the orbital frontal cortex, where taste and smell sensations are integrated into the perception of a single flavor. That verdict gets relayed back to the tongue and gives the impression of flavor in the mouth.

If you don't believe it, scientists say, there's a simple experiment to demonstrate the point. Take a sip of your favorite drink while pinching your nose, and see what it tastes like. Don't recognize it? Open your nose, and the familiar taste will reveal itself.

The mechanisms of flavor perception, including those that are both congruent and incongruent, probably evolved as a protective mechanism, Lim said. Foods that were sweet or salty were usually safe to eat and provided needed macronutrients, like carbohydrates and salt, and consequently those flavors came to be desired, she said. Sourness and bitterness, by comparison, often meant food was spoiled or contained toxins and were a warning sign not to eat it.

Those mechanisms served well to prevent a cave dweller from starving or getting poisoned, she said, but unfortunately they are still with us, and in today's world lead straight to ice cream, soft drinks and obesity. But even so, Lim said, flavor perception is still largely a learned behavior.

And if it's learned, she said, we should be able to teach it better, or find ways to work around these evolutionary instincts.

"Hardly anyone really likes the somewhat bitter taste of coffee the first time they drink it, but they like the caffeine," Lim said. "Since the coffee makes them feel energized, they learn to like its flavor."

As the understanding improves of how taste and smell actually work to control our perceptions of flavor, she said, it may be possible to use that knowledge to lead humans toward an improved diet. The research team is investigating whether people can learn to like vegetables and the potential mechanisms underlying that process.

"Many people say they don't like the 'taste' of cruciferous vegetables like cauliflower or brussel sprouts, for instance," Lim said. "But what they are mainly reacting to is the smell of these vegetables, which includes a defensive compound that makes even other animals shy away from eating them. Find a way to help improve their smell, and you'll find a way to make people enjoy eating them."

Provided by Oregon State University

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