That tastes -- sweet? Sour? No, it's definitely calcium!

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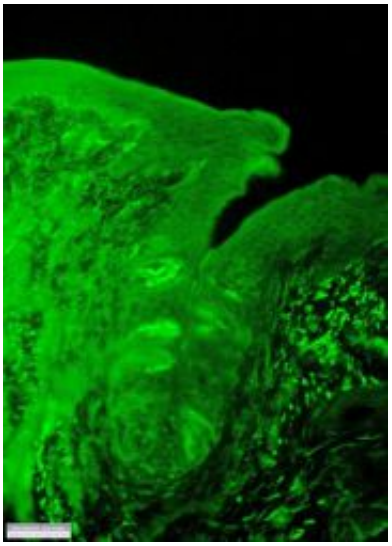

A section of a rat tongue stained for the calcium-sensing receptor, CaSR, which is in the central, bright green onion-shaped taste bud. Credit: Michael Tordoff

Chemists in Philadelphia are reporting a discovery that could expand the palate of human tastes — sweet, sour, salty, bitter, and savory — to include a new taste sensation that they term "calcium."

In a report scheduled for presentation here today at the 236th National Meeting of the American Chemical Society, scientist Michael G. Tordoff, Ph.D., and colleagues with the Monell Chemical Senses Center in Philadelphia describe research they say demonstrates that a taste for calcium exists in mice. With mice and humans sharing many of the same

genes, the findings suggest that people also may have such a taste, which could have a range of practical applications.

"People don't consume as much calcium as nutritionists would like," Tordoff said, "and one reason for this is that foods high in calcium don't taste good to many people. Tweaking its taste could encourage a calcium-deficient population to consume more of this key nutrient.

"By understanding how calcium is detected in the mouth, we can either make it easier to consume by reducing its bad taste or even make pharmacological agents that make it taste better."

Tordoff's team used genetic methods to pinpoint two receptors involved in tasting calcium. A receptor is a molecule either on the surface of or inside a cell that serves as the binding or docking site for a specific substance. When that substance — calcium, for instance — attaches to the receptor, a specific effect occurs, such as a release of signals resulting in the sensation of taste.

The research shows that the taste of calcium is detected by two receptors on the tongue. One is a calcium-sensing receptor called CaSR that has been found by other researchers in the parathyroid glands, kidney, brain and gastrointestinal tract. "We didn't know it was on the tongue before," Tordoff said. The other is a receptor known as T1R3. This is a component of the "sweet-taste" receptor — a finding that researchers described as "very unexpected."

The researchers measured the calcium preferences of 40 different strains of mice. "Most mice dislike calcium, but we found a very unusual strain that drinks it avidly," Tordoff said. "By comparing the genes of this strain with other strains, we were able to identify the two calcium taste genes."

"It remains to be seen if what we have discovered in mice—the existence of two calcium taste genes-- holds true for humans," Tordoff said. "We know people have the sweet-taste gene, Tas1r3, and the gene involved with the calcium-sensing receptor, CaSR. We don't know if we have the same forms of genes as the mice have, but it seems pretty likely they have the same function."

Calcium is a mineral with critical roles in building and sustaining strong bones. Without it, children develop weak bones; calcium-deficient adults risk the progressive loss of bone mass known as osteoporosis, a major cause of fractures in older people. Studies also have linked low calcium intake to an increased risk of heart disease, high blood pressure, and certain cancers.

The recommended daily intake of calcium, which varies with age and gender, is 1,200 milligrams for young adults. But Tordoff points out that around 70 percent of men and 90 percent of women in the United States don't consume enough calcium.

And the taste of calcium? "Calcium tastes calciumy," Tordoff said. "There isn't a better word for it. It is bitter, perhaps even a little sour. But it's much more because there are actual receptors for calcium, not just bitter or sour compounds."

Tordoff described a delicate balance in the way people respond to calcium in drinking water. "In tap water, it's fairly pleasant. But at levels much above that, the taste becomes increasingly bad." Dairy products, such as milk, have a nutritious level of calcium, but Tordoff believes they are special because the calcium in them binds to fats and proteins, which prevents it from being tasted.

High-calcium vegetables include collard greens, bok choy, kale and bitter melon. Tordoff notes a strong correlation between bitterness in

certain vegetables and their calcium level, adding that one reason people avoid them, he believes, is because of the taste associated with such high calcium content.

The modification of the sense of taste using genetic research could be an indispensable, widespread tool to increase nutrition, Tordoff said. "I'm not saying people can't take tablets to get enough calcium, but eating real food is a great pleasure. With salt, sweet and fat, the problem is to reduce intake without reducing palatability. For calcium, it's a problem of being not palatable enough."

Credit: American Chemical Society

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