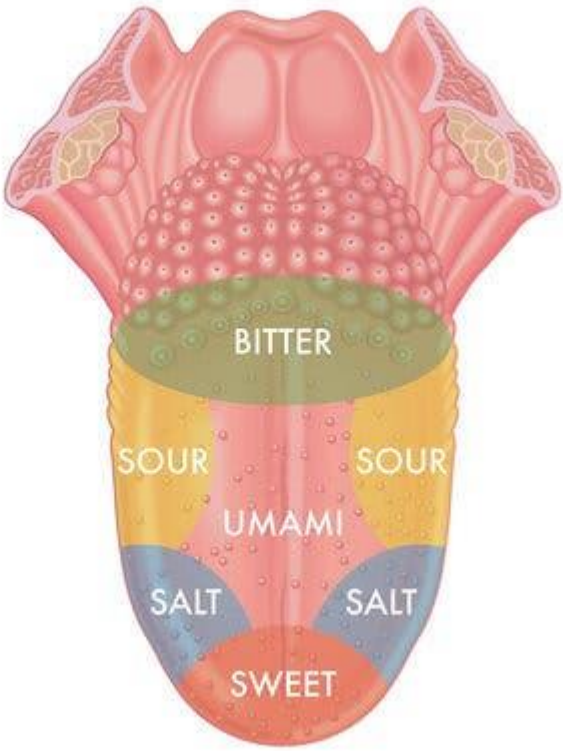
The Textbooks Were Wrong About How Your Tongue Works

The perception of taste is remarkably complex, not only on the tongue but in organs throughout the body.



The taste bud diagram, used in many textbook s over the years, originated in a 1901 study but was actually showing the sensitivity of different areas of the tongue.Credit...Alamy

By Joanne Silberner

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Think for a minute about the little bumps on your tongue. You probably saw a diagram of those taste bud arrangements once in a biology textbook — sweet sensors at the tip, salty on either side, sour behind them, bitter in the back.

But the idea that specific tastes are confined to certain areas of the tongue is a myth that "persists in the collective consciousness despite decades of research debunking it," according to a

review published this month in The New England Journal of Medicine. Also wrong: the notion that taste is limited to the mouth.

The old diagram, which has been used in many textbooks over the years, originated in a study published by David Hanig, a German scientist, in 1901. But the scientist was not suggesting that various tastes are segregated on the tongue. He was actually measuring the sensitivity of different areas, said Paul Breslin, a researcher at Monell Chemical Senses Center in Philadelphia. "What he found was that you could detect things at a lower concentration in one part relative to another," Dr. Breslin said. The tip of the tongue, for example, is dense with sweet sensors but contains the others as well.

The map's mistakes are easy to confirm. If you place a lemon wedge at the tip of your tongue, it will taste sour, and if you put a bit of honey toward the side, it will be sweet.

The perception of taste is a remarkably complex process, starting from that first encounter with the tongue. Taste cells have a variety of sensors that signal the brain when they encounter nutrients or toxins. For some tastes, tiny pores in cell membranes let taste chemicals in.

Such taste receptors aren't limited to the tongue; they are also found in the gastrointestinal tract, liver, pancreas, fat cells, brain, muscle cells, thyroid and lungs. We don't generally think of these organs as tasting anything, but they use the receptors to pick up the presence of various molecules and metabolize them, said Diego Bohórquez, a self-described gut-brain neuroscientist at Duke University. For example, when the gut notices sugar in food, it tells the brain to alert other organs to get ready for digestion.

Dr. Breslin likens the system to an airport preparing for a plane landing.

"Think about if a plane landed at an airport terminal that wasn't ready," he said. No one would be prepared to guide the plane to the gate, clean it up or unload the luggage.

Taste, he said, gets things ready. It wakes up the stomach, stimulates salivation and sends a little insulin into the blood, which in turn transports sugars into the cells. Ivan Pavlov, a Russian physiologist who won a Nobel Prize for his studies on digestion in 1904, showed that lumps of meat placed directly into a hole in the dog's stomach would not be digested unless he dusted the dog's tongue with some dried meat powder to start things off.

Dr. Bohórquez was inspired to hunt for a gut-brain connection two decades ago, when he was in graduate school and a friend who had undergone bariatric surgery asked him why she no longer hated sunny side up eggs. Dr. Bohórquez thought that perhaps the taste receptors in her now-diminished gut were sensing that she wasn't receiving enough nutrients and began signaling to her brain that, hey, eating runny egg yolks would be a good idea now.

He and his colleagues found a connection in the lab. Taste-receptor-bearing cells in the gut, which he called neuropods, make direct contact with nerve cells that let the brain know a nutrient is in the gut.

“Taste perception is more complex than just taste buds,” Dr. Bohórquez said.

Newer studies are only making the matter more complex. Umami, a savory taste found in foods like fish sauce and ketchup, began to be accepted as the fifth category of taste by researchers in the late 1980s and early 1990s, nearly 80 years after it was proposed by Kikunae Ikeda, a Japanese chemist. More than 2,100 research papers about umami are now listed by the National Library of Medicine.

Several years ago, an Australian research team suggested that there might be a special taste receptor for fat. Dr. Breslin and others are studying how taste receptor cells identify fat, information that could be useful in figuring out why some people overeat.

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