Sweet, Sour, Salty, Bitter... and Umami

by Robert Krulwich

Morning Edition, November 5, 2007 · So here's a question you don't hear every day: How many tastes can a person taste? There's sweet, of course. Then sour. Then salty. And when the Greek philosopher Democritus took up the question several thousand years ago, he added bitter. So that makes four.

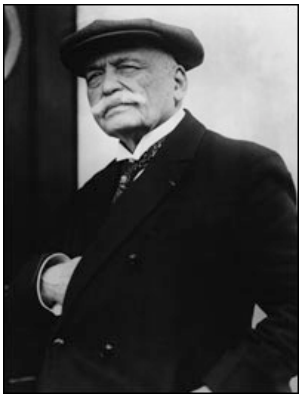
Democritus said (not because he did any experiments; being a philosopher, he thought for a living) that when you chew on your food and it crumbles into little bits, those bits eventually break into four basic shapes.

When something tastes sweet, he said, it is because the bits are "round and large in their atoms." Salty is isosceles triangle bits on your tongue, Bitter is "spherical, smooth, scalene and small," while sour is "large in its atoms, but rough, angular and not spherical." And that's it, said Democritus. Everything we taste is some combination of those four ingredients. And that made sense to Plato, and made sense to Aristotle, and pretty much ever since even modern scientists have said that's the number: four.

When taste buds were discovered in the 19th century, tongue cells under a microscope looked like little keyholes into which bits of food might fit, and the idea persisted that there were four different keyhole shapes.

So four it is. Four it was. And then, along came Auguste Escoffier.

What the Chef Tasted



Escoffier was a chef. Not just a chef, in Paris in the late 1800s he was the chef. He had opened the most glamorous, most expensive, most revolutionary restaurant in the city. He had written a cookbook, The Guide Culinaire. And, says science writer Jonah Lehrer (a colleague of mine on NPR/WNYC's Radio Lab), he also created meals that tasted like no combination of salty, sour, sweet and bitter; they tasted new. Escoffier invented veal stock.

And should you choose to listen to our broadcast on Morning Edition, you will hear Jonah and I "cooking" (the sounds were snatched from sound effects records, but I think you will drool anyway) what was then considered a spectacularly new sauce that seemed to deepen and enrich the flavor of everything it touched.

"It didn't just taste good," Jonah says. "This was an epiphany. This was the best food you ever tasted in your life."

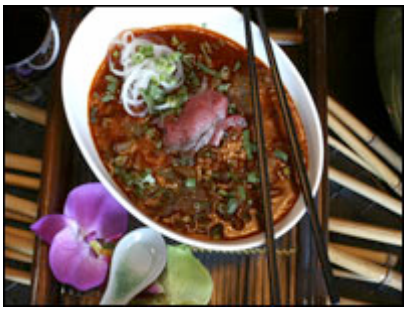
But because it was neither sweet, bitter, sour, salty nor any combination of those four, as far as the scientists were concerned, it wasn't real. People may smack their lips, drool, savor and pay enormous amounts of money to M. Escoffier, but what they were tasting wasn't really there. It was all in their heads.

What the Japanese Soup Lover Tasted

Meanwhile, halfway across the world, a chemist named Kikunae Ikeda was at the very same time enjoying a bowl of dashi, a classic Japanese soup made from seaweed. He too sensed that he was tasting something beyond category. Dashi has been used by Japanese cooks much the way Escoffier used stock, as a base for all kinds of foods. And it was, thought Ikeda, simply delicious.

But what was it? Being a chemist, Ikeda could find out. He knew what he was tasting was, as he wrote, "common to asparagus, tomatoes, cheese and meat but… not one of the four well-known tastes." Ikeda went into his lab and found the secret ingredient. He wrote in a journal for the Chemical Society of Tokyo that it was glutamic acid, but he decided to rename it. He called it "umami," which means "delicious" or "yummy" in Japanese.

Umami



Glutamate is found in most living things, but when they die, when organic matter breaks down, the glutamate molecule breaks apart. This can happen on a stove when you cook meat, over time when you age a parmesan cheese, by fermentation as in soy sauce or under the sun as a tomato ripens. When glutamate becomes L-glutamate, that's when things get "delicious." L-glutamate, said Ikeda, is a fifth taste. When Escoffier created veal stock, he was concentrating umami. When Japanese made their dashi, they were doing the same thing. When you bite into an anchovy, they are "like glutamate speedballs. They are pure umami," Jonah writes. "Aristotle was wrong. Plato was wrong. We have five tastes, not four. But when Ikeda's findings were published," Jonah says, "nobody believes him."

So Who Was Right?

It turns out, almost 100 years after Escoffier wrote his cookbook and Ikeda wrote his article, a new generation of scientists took a closer look at the human tongue and discovered, just as those two had insisted, that yes, there is a fifth taste. Humans do have receptors for L-glutamate and when something is really, really yummy in a non-sweet, sour, bitter or salty way, that's what you're tasting. In 2002, this became the new view. It's in the textbooks now and scientists decided to call this "new" taste, in Ikeda's honor, "umami." If you want to get an umami headache, add some monosodium glutamate (MSG) to your next bowl of noodles.

The Moral

In his new book, *Proust Was a Neuroscientist*, Jonah tells eight stories that share a common theme. In each case, (he chooses Marcel Proust, Walt Whitman, George Elliot, Paul Cezanne, Igor Stravinsky, Gertrude Stein, Virginia Wolf and, yes Auguste Escoffier) an artist is busy about his/her work and happens to observe something or sense something about the real world that scientists have not yet noticed, or that scientists say is not true. But because artists are so good at describing what it's like to experience the world, so intent on delivering the truth of what it feels like to be alive, so intuitive, in each of these eight cases, the artists learn something that the scientists don't discover until years later.

Art, Jonah reminds us, describes the same world that science does; art just does it by a different route. And sometimes, more often than you would suppose, the artists get there first.