A few years ago, psychologist Charles Spence decided to test why potato chips taste so good.

In his experiment, participants were given a hearty sampling of 180 chips and asked to rate their staleness or crunchiness. They also chewed into a microphone while wearing headphones. Behind the scenes, researchers fed the sounds from the microphones, in real time, back to the headphones while varying the volume and frequency of the crunching. The correlation was strong: subjects who heard louder, higher-frequency sounds of chewing found the snacks crisper and fresher.

“Sound is the forgotten flavor sense,” Spence says. “No one thinks of sound as affecting taste, yet it shapes it in so many ways.”

Spence, who is based at Oxford University, is one of the researchers at the forefront of a relatively new field of study—multisensory flavor perception—that measures how all the senses shape our experience of flavor. The influence of culture and upbringing, not to mention genetics and age, on whether someone enjoys a specific food is widely acknowledged. For breakfast, an American might opt for a bowl of cornflakes or gulp down a bold cup of coffee—choices that would seem odd to a Russian raised on breakfasts of buckwheat in hot milk, or, in the case of coffee, too bitter to ultra-sensitive “hypertasters” and children. What is less well known and only beginning to be understood is that humans of all backgrounds experience food with far more than their tongues. It turns out that the sounds of what we are eating—along with the weight of the utensils we’re using, the aroma of each part of the dish, the color of our meal, even the brightness of a room—don’t merely contribute to the experience of eating: they fundamentally form it.

Before diving into this new science of flavor, it’s important to note that “flavor” and “taste” are not interchangeable terms. Taste is one of the five senses. Flavor, on the other hand, is the combined experience of taste and the other four senses—the brain’s effort to integrate a rich set of pathways into one unified experience of what we’re consuming.

“The flavor is not in the food,” says Gordon Shepherd, a neurogastronomist at Yale University. “Flavor is created by our brains from the molecules that are in the food. It’s very much like how we create color, not from color that’s in the things we’re seeing but rather from the wavelengths that are reflected by what we see. Our sense of flavor is so deeply embedded because our brains create this sense.”

For decades, the study of flavor and taste concentrated on the tongue. The textbook “tongue map,” which divided the organ into regions perceiving sweet, sour, bitter, and salty tastes, has been largely debunked by recent science. This erroneous diagram actually resulted from a mistranslation of German data into English. “Even though the basic foundation was incorrect, the allure of having a tongue map was so appetizing and seductive that it captured the imagination of the public,” says Charles Zuker, a molecular geneticist at Columbia University.

What was wrong with the picture? For one, the original tongue map left out a crucial fifth taste—“umami,” a Japanese word for savory (think meat or mushrooms). And while certain regions of the tongue may be slightly more sensitive to bitter foods than others, it turns out that no part of the tongue holds a monopoly on any one taste. It’s the individual taste receptors, which are distributed across the tongue, that are wired to send a particular taste to the brain, as Dr. Zuker’s research revealed. These receptors go far beyond the tongue, too, and have been found all the way down to the gut and even in the lungs.

In fact, a complete anatomical map of flavor should show
The Tools of Taste

Scientists use a number of tools to study human flavor perception.

Brain Scans Neuroimaging technologies such as fMRIs allow researchers to visualize what happens in the brain during food consumption by mapping brain activity in real time.

Olfactometers and Gustometers These devices deliver precisely measured pulses of aromas and tastes, respectively, to subjects in brain scans. They make it possible to study the activity in real time.

Neuroimaging technologies such as fMRIs allow researchers to visualize what happens in the brain during food consumption by mapping brain activity in real time.

Even if that something’s a fizzing ball of gin and tonic.

Our Global Kitchen: Food, Nature, Culture
Opens Saturday, November 17

Celebrate cooking and cultural heritage in our annual exhibition. Our Global Kitchen: Food, Nature, Culture explores the science of how food and drink affect human preferences and behavior. Whether it’s something we want. (Even texture—hard to pin down. Not only do we lack a word to associate with the taste, but the texture itself is a crucial clue when it comes to flavor identification: in experiments, subjects have been shown to manipulate the color and brightness of room lighting to an effect on people’s flavor perception of wine and coffee. Wine tastes sweeter under red light and spicier and fruitier in blue or green. Coffee consumption, too, is increased under bright lighting—at least by those who take their coffee strong.)

Our Global Kitchen: Food, Nature, Culture was organized by the American Museum of Natural History, New York (amnh.org).

The exclusive corporate sponsor for Our Global Kitchen is J.P. Morgan.

Our Global Kitchen: Food, Nature, Culture Opens Saturday, November 17

In addition to exploring the science of how food and drink affect human preferences and behavior, whether it’s something we want or not, this exhibition also examines the cultural, economic, and political contexts in which food is produced, consumed, and celebrated. It brings together voices from around the world who tell stories of climate change, human migration, and food security. Our Global Kitchen: Food, Nature, Culture is free for Members.

Our Global Kitchen: Food, Nature, Culture Opens Saturday, November 17

Be among the first to view Our Global Kitchen: Food, Nature, Culture, which takes visitors on a journey of growing, transporting, cooking, eating, and celebrating food. It also explores the science of how food and drink affect human preferences and behavior. Whether it’s something we want or not. (Even texture—hard to pin down. Not only do we lack a word to associate with the taste, but the texture itself is a crucial clue when it comes to flavor identification: in experiments, subjects have been shown to manipulate the color and brightness of room lighting to an effect on people’s flavor perception of wine and coffee. Wine tastes sweeter under red light and spicier and fruitier in blue or green. Coffee consumption, too, is increased under bright lighting—at least by those who take their coffee strong.)

Our Global Kitchen: Food, Nature, Culture, which opens on Saturday, November 17, is free for Members.

Member Preview

Wednesday, November 14, 4 to 9 PM

Be among the first to view Our Global Kitchen: Food, Nature, Culture, which takes visitors on a journey of growing, transporting, cooking, eating, and celebrating food. It also explores the science of how food and drink affect human preferences and behavior. Whether it’s something we want or not. (Even texture—hard to pin down. Not only do we lack a word to associate with the taste, but the texture itself is a crucial clue when it comes to flavor identification: in experiments, subjects have been shown to manipulate the color and brightness of room lighting to an effect on people’s flavor perception of wine and coffee. Wine tastes sweeter under red light and spicier and fruitier in blue or green. Coffee consumption, too, is increased under bright lighting—at least by those who take their coffee strong.)

Our Global Kitchen: Food, Nature, Culture, which opens on Saturday, November 17, is free for Members.

Multisensory Health It would seem that as one-rare and biologically valuable sugars and fats became abundant in processed foods, we would be more susceptible to the health consequences of over-consumption. But new research on how all five senses shape food offers hope for engineers of healthier foods that taste as good as the old, processed foods. Recent studies have shown that red food coloring alone can make fruit drinks taste sweeter (and even more nutritious) and reduce the amount of food eaten, even in those who typically eat too much. A recent study of the effects of sensory perception on eating showed that people who were asked to rate the “increasingly multisensory” nature of a particular food (e.g., its color, texture, sound, and aroma) were more likely to eat it.

Member Preview

Wednesday, November 14, 4 to 9 PM

Be among the first to view Our Global Kitchen: Food, Nature, Culture, which takes visitors on a journey of growing, transporting, cooking, eating, and celebrating food. It also explores the science of how food and drink affect human preferences and behavior. Whether it’s something we want or not. (Even texture—hard to pin down. Not only do we lack a word to associate with the taste, but the texture itself is a crucial clue when it comes to flavor identification: in experiments, subjects have been shown to manipulate the color and brightness of room lighting to an effect on people’s flavor perception of wine and coffee. Wine tastes sweeter under red light and spicier and fruitier in blue or green. Coffee consumption, too, is increased under bright lighting—at least by those who take their coffee strong.)

Our Global Kitchen: Food, Nature, Culture, which opens on Saturday, November 17, is free for Members.

Rotunda / fall 2012 / amnh.org