

The Columbus Dispatch

Senses working overtime

OSU researchers want to know how people perceive the taste, smell, texture and appearance of food

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What do you get when you put a chemist, a psychologist and a food scientist in the same lab?

Ideally, the perfect Oreo cookie.

The mass-produced sandwich cookie has to taste, smell and crunch the same whether it's sold in California or Connecticut.

Consumers demand it, said Ohio State University food-science professor Jeannine Delwiche, whose specialty is sensory science.

A relatively new field, sensory science aims to measure and quantify how people perceive the taste, smell, texture and appearance of food.

The OSU Sensory Science Group was founded in November 2000, but the applied science can trace its roots to the battlefields of World War II, when U.S. soldiers regularly lost weight.

A U.S. military study concluded the culprit wasn't a lack of calories, but a dearth of flavor. K rations weren't tasty enough, Delwiche said.

Making front-line meals tastier required more than the usual cadre of chemists and technicians to oversee preparation and packaging — it called for real people to evaluate what tasted good and why.

Sensory science took off in the 1960s with the growth of prepackaged foods. Before then, packaged foods were limited to "cans of soup or cake mixes," Delwiche said.

Each year, the average American consumes 1,300 pounds of food, more and more of it prepackaged. As part of evaluating consumer taste, Delwiche has studied everything from why Americans turn up their noses at chocolate bars flavored with green pepper — an award-winning European concoction — to consumers' ability to discern between pond-raised and wild trout.

While it may sound eclectic, the research is critical to the food industry, which to stay competitive must produce foods that taste good, look appealing and keep their flavor for the duration of their shelf life.

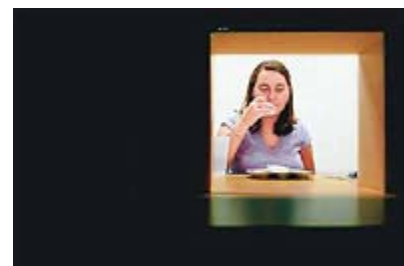
Flavor and texture can deteriorate long before the contents of a can reach the expiration date, Delwiche said.

Once the production process is perfected, it would seem to follow that a can of ravioli or processed cheese would taste the same whether it's produced here or there.

If only it were that simple, she said.

For example, soil conditions can impact the flavor of wheat. Vanilla from one supplier can taste different than another's.

Sensory analysts are expected to be able to adjust the ingredients and processing techniques to achieve uniform flavor. When it comes to the production line and the bottom line, consistency is king.



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Graduate student Amanda Hubbard taste-tests water in a lab at the Ohio State Parker Food Science and Technology building.



Food-science professor Jeannine Delwiche has studied everything from why Americans don't fancy green-pepper-flavored chocolate bars to the difference in taste between wild and farm-raised fish.



CHRIS RUSSELL | DISPATCH PHOTOS

Food-science researcher Karen Fligner isolates water-soluble flavor compounds in cheese at the Ohio State University sensory science laboratory.



"Your Oreo better not vary," Delwiche said.

Measuring crispiness

For years, food-science researchers asked consumers to describe as best they could how foods tasted or smelled. Now the goal, Delwiche said, is creating a more-precise measurement scale.

How bitter is bitter? How salty is salty?

Graduate student Christi Goerlitz is designing a study to measure the crispiness of icecream cones for Norse Dairy, a Green Bay, Wis., company.

Study participants will be asked to rate the crispiness of waffle, sugar and wafer cones on a scale of one to 10.

While machines can measure texture, they can't measure crispiness, said Goerlitz, who also helped develop new hot dogs and sausages as a summer intern at Sara Lee/Hillshire Farms in Cincinnati.

What's at stake for the study's sponsors? Consumer dollars. Knowing what people like before launching a new line of ice-cream cones is critical because only one in four new products succeeds, Delwiche said.

Before Glory Foods in Columbus launched its line of canned collard greens and kale, sweet-potato casserole and red beans in 1992, they tested their canning methods at Ohio State, and then asked food scientists to evaluate the results. Researchers there gave the company technical support, said Dan Charma, vice president of operations. While candied yams might taste good the day after they're packaged, the real test is time.

"What happens in a can is very much like what happens with wine. If you don't taste it over time, you don't know what it's going to taste like," Charma said.

But while companies such as Glory Foods are rigorous in their approach to food research, food scientists often discover the discipline by accident.

Goerlitz thought food science had to do with cooking until an OSU adviser set her straight. Delwiche was working at a psychology lab at the University of California at Davis when a professor of food science gave a lunchtime lecture.

Curious about the psychological factors that cause people to choose one flavor over another, Delwiche chose sensory science, where associations such as memory and color can play a leading role in likes and dislikes.

"Lemon aromas remind me of playing hide-and-go-seek in my grandmother's back yard, a happy memory," Delwiche said.

Color, too, matters. Woe to the manufacturer who attaches the wrong color to a flavor. Tint cherry flavoring orange and people mistake it for orange flavoring.

"Every time they launch a clear cola, it fails."

Understanding smells

Professor Ken Lee, chairman of the OSU Department of Food and Technology, described the traditional food-science researcher as a chemist or biochemist.

Delwiche is different, Lee said.

"With her background in psychology, she understands what motivates people's tastes," he said.

Though the physiology of taste and smell is not Delwiche's research focus, she once worked with a graduate student who lost his sense of smell after damaging his olfactory nerves.

The damaged nerves sometimes grow back, but a common side effect during the regrowth phase is dysnomia, which results in the person smelling feces all the time.

There's not a lot that can be done for people with taste and smell disorders, Delwiche said.

Eventually her student's sense of smell returned, but he had to relearn smells.

"He'd be sitting in a chlorine pool, and he'd be smelling chocolate cake," Delwiche said.

Researchers speculate that olfactory nerves are sensitized to certain odor patterns, a lock-and-key model. But damaged nerves don't always grow back in the same configuration and the odor pattern can be misidentified.

Erroneous, outdated information about taste perception abounds. Even today, some textbooks include a tongue map, which purports to locate where specific taste receptors are located.

"A complete and utter falsity," Delwiche said. "You can taste everything, everywhere on your tongue."

Space - age tortillas

The demand for private-sector sensory analysts is high, making it difficult for universities to recruit faculty members, Delwiche said.

Many companies such as McCormick Spices in Maryland have increased their staff of scientists in the past decade, said Terry Work, manager of the company's sensory-science group.

"We depend on them for the development of new flavors and seasoning," Work said.

McCormick, best known for its line of retail spices, also supplies flavorings to food and restaurant companies, Work said. When a company wants to develop a caramel-apple flavored yogurt, for example, McCormick sends its sensory scientists.

"They act as a go-between between the taste panels, consumers and product development," Work said.

Sensory analysts and food-science researchers who stay in academia, however, can find themselves engaged in strategic research.

Three years ago, OSU food-science professor Yael Vodovotz was conducting a study sponsored by the Ohio Corn Growers Association.

It didn't take long for NASA to become interested. Now the space agency is poring over her preliminary data.

She and other researchers are trying to develop a corn tortilla that can endure time and outer space.

NASA wants its food to have a shelf life of three months for shuttle missions, one year for the space station and as many as five years for a Mars project, Vodovotz said.

"They do have tortillas now in space. But they're wheat tortillas," she said.

Vodovotz said she hopes her work with high-pressure processing will eventually launch long-lasting corn tortillas, a feat that could also have earthly impact. Tortillas are one of the fastest growing food-product lines.

High - tech tasting

The \$17-million Parker Food Science and Technology building on the OSU campus, completed in 2000 with \$6 million in private funds, is home to a score of high-tech chemistry and biochemical laboratories.

There, researchers electrically charge sour cream-and-onion flavoring to better spread it across a potato chip, among other tests.

Private companies sponsor many faculty and student research projects, such as the integrity of juice packaging designed to defend against unwanted flavors.

Applicants to the graduate program must have a background in math, statistics and chemistry, Delwiche said.

"Tasting without stats is just sitting in your kitchen."

This spring, Delwiche will teach graduate students how to apply statistical tests to measure taste.

Her research has spilled over into her personal life, altering her approach to food, especially new "taste sensations."

"I'm a little bit more analytical. If there's something I don't like about it, I think about why," she said. "Is it too sweet? Is it the texture? Whereas most people would just say 'Yuck.' "

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