In the narrow room of cubbies, the kitchen sounds are muted, but the smell of bacon pervades. Finally, the windows open. Hands clad in purple latex gloves push lone slices of bacon, each on a foam plate labeled with a three-digit number, toward those seated.

The testing will now begin. This is the taste lab of NC State’s Sensory Service Center in Schaub Hall, where food scientists gather information from panels of volunteers who come to eat small bits of food and record their responses. The center’s mission is to isolate the myriad variables that make a food taste not just good, but delicious—and help food manufacturers determine how to make best use of their discoveries. Here, scientists use training and experience in disciplines including chemistry, biology, nutrition, psychology, sociology and statistics to examine edibles from sour cream to pork loin to wine, and to explain to their makers why they may or may not appeal to consumers. When bacon makers want to make bacon taste better, for instance, they seek the help of a sensory analysis lab.

At NC State, that means enlisting the help of MaryAnne Drake, director of the Sensory Service Center. “We want to know. ‘What do you think about this product?’” Drake says. “From a research perspective, that’s very powerful.”

The field is relatively new. Its roots stretch to the early 1900s, but interest in the science took off with the convenience food boom that followed World War II. In the second half of the 20th century, food morphed from being something Americans primarily grew at home or traded across the country or around the world. Those who made and sold food no longer knew their customers on a first-name basis. As this relationship disappeared, manufacturers determine how to make best use of their discoveries. Here, scientists use training and experience in disciplines including chemistry, biology, nutrition, psychology, sociology and statistics to examine edibles from sour cream to pork loin to wine, and to explain to their makers why they may or may not appeal to consumers. When bacon makers want to make bacon taste better, for instance, they seek the help of a sensory analysis lab.

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In addition to general and applied research for the dairy industry, the Sensory Service Center lab contracts with food manufacturers, who prefer anonymity, Drake says. The lab has recently conducted tests on a wide range of processed foods including bacon, flavored coffees, stuffed chicken breasts, deli meats and pork loin.

The goal is to unravel the desires of the consumer, and the approach is three-pronged. Consumer taste testing in Schaub Hall is just one facet of the process. During the testing, groups recruited from the general population—including many NC State students—eat food samples and answer questions about what they like and why: Is it more salty or sweet? More crunchy or chewy? Does it meet their expectations? Most important: Would they buy it? "Just because they like it doesn't mean they will buy it," Drake says.

No expertise is required of consumer panelists, just a healthy appetite and modest powers of discrimination. The tests can take many forms, depending on what the food maker is hoping to home in on. Panelists might consider a product, as a consumer would, or a strip of bacon, for example, presented unadorned, or they could also be asked for their opinions about the packaging and the price. Manufacturers and marketers can explore how the presentation, the price and the brand, as well as the taste, contribute to a product's marketability.

Gathering consumer opinions is just the beginning. "What you see in the booths is the tip of the iceberg," Drake says. The second part of the process uses what's called "descriptive panels"—graduate students and staff scientists in the Sensory Service Center who have received exhaustive training. Each panel consists of at least eight people who have logged at least 100 hours each learning to identify flavors and textures and to describe them using the vocabulary particular to that food. When analyzing bacon, for example, analysts evaluate samples for the five basic tastes—sweet, salty, sour, bitter and umami (savory)—then seek to identify flavors such as smoke, sweet aromatics, brown sugar, pepper, cooked pork flavor, rancidness and many more. The number of flavors in any given product can display ranges from five to 30. Panelists taste the foods in question on numerous occasions. Those results are considered facts, not just opinions.

"We would treat that data as output from an instrument," Drake says. That information can be combined with consumer preferences to help manufacturers understand if they need to make changes in their processes.

Becoming adept at descriptive analysis takes practice. "You sit down with people who know what they're doing and start learning that, feeling that, tasting that," Drake says. She likened it to the way that wine aficionados learn to discern hints of mango and cut grass in a sauvignon blanc, through rounds of tasting and gleaming knowledge from those with more experienced palates.

With her extensive training and constant immersion in research, Drake says she seldom uses her abilities to analyze taste when dining for pleasure. And she does have high-dollar tastes. "There's nothing better than a really good wine to open a meal, to feel a little queasy.

The final piece arrived, a thick meaty slab with a tiny streak of fat running down the middle. It had a perfect balance of salt and fat and cured flavor that struck all the right notes. Some sauce and crispy fried potatoes followed. I was nearing my limit. By the arrival of the fourth piece, a shriveled specimen covered in something akin to the wood of apple trees. But how could I know what that tastes like?

I had never been more ready to eat applewood bacon—whatever it is—in my life. I took a bite. The salt, sugar and fat reached the various regions of my tongue that respond to each, sealing my fate as a bacon lover.

As for applewood bacon, I suppose my guess is as good as anyone's. With her extensive training and constant immersion in research, Drake says she seldom uses her abilities to analyze taste when dining for pleasure. And she does have high-dollar tastes. "There's nothing better than a really good wine to open a meal, to feel a little queasy.

Consumer tasters—the folks who sit in the booths outside the kitchen—and descriptive analysis panelists do not function interchangeably. "Once somebody has been trained, they make bad consumers," Drake said. They make skilled sensory analysts, though, which makes them attractive recruits for the food industry.

The third facet of the science of taste relies on the use of a gas chromatography-mass spectrometry machine to identify volatile compounds—what we call "chemical sexy," Drake says. This machine allows the lab to "smell" a product as it comes out of the oven or as it is being prepared. "We use the machine for research and quality assurance," Drake says.

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—Mary Anne Drake
Director, Sensory Service Center

The ovens in the taste test kitchen stay busy, top: using codes to keep track of products; and getting ready to dish out samples to a new round of taste testers, bottom.

TAKING THE TEST
A bacon-lover samples the wares at NC State’s Sensory Service Center.

I the question is "Bacon?" my answer is "Yes." Or so I thought before taking a turn as a consumer taste tester at NC State’s Sensory Service Center. Not only did the test allow me to eat bacon at will, it also gave me brief pause to examine perception and reality.

Sitting in front of the computer, I began answering demographic questions—age, sex, household income—followed by bacon-specific queries: When was the last time you ate bacon? The last time you bought bacon? And how do you expect applewood bacon to compare to regular bacon?

Now, I am as familiar with the term "applewood bacon" as anybody who’s recently perused a restaurant menu. But I’d never considered what applewood bacon really was. The poetry of the name always seemed enough. Apples, wood, bacon—all hold whole-some, delicious connotations.

When I stopped to examine the words for their literal meaning, I decided that I should expect applewood bacon to taste like bacon that had been smoked over a fire made from the wood of apple trees. But how could I know what that tastes like?

What I know about bacon is this: Long ago someone who loved me fried up a few strips of cured pig meat, filling the kitchen air with its deep, smoky sweet scent. The word “bacon” wafted through the air alongside the scent, and both entered my brain. Shortly afterward, I took a bite. The salt, sugar and fat reached the various regions of my tongue that respond to each, sealing my fate as a bacon lover.

As for applewood bacon, I suppose my guess is as good as anyone’s. Before the tasting, I answered more questions, drilling down on my expectations of applewood bacon. Should it be saltier, sweeter, smokier? Should it taste like apples? Would you pay more for it than other bacon? As I clicked on the last box of pre-tasting questions, the scent of cooking pork was getting to me. I had never been more ready to eat applewood bacon—whatever it is—in my life.

Out came the first strip. The fat had an orange ring. I chopped down to a mouthful of flavors—salt, fat, umami and a hint of cardboard. It was crispy. After three bites, my appetite was sated. Did it meet my expectations? Not really.

A thicker, chewier piece arrived, followed by a less flavorful textural twin. I was starting to feel a little queasy.

By the arrival of the fourth piece, a shriveled specimen covered in something akin to pie crust dust, I was nearing my limit. The final piece arrived, a thick meaty slab with a tiny streak of fat running down the middle. It had a perfect balance of salt and fat and cured flavor that struck all the right notes. Something about the combination of flavors clicked, and I decided this was exactly how applewood bacon should taste. I gave it the highest rating possible.

—Ambé Nimocks
www.alumni.ncsu.edu
“When you and I talk about flavor, more than ninety percent of what we’re talking about happens in our nose...”

—MaryAnne Drake, Director, Sensory Service Center

TASTE 101
A primer on the palate.

How does our sense of taste work? We all have taste buds in the tiny bumps on our tongues. The taste buds contain receptor cells that respond to the chemical signals contained in food. A chemical signal will bind only to the taste receptor that responds to it—so a certain taste will not register with all taste receptors. When the taste receptor responds, it sends a signal to the brain, which fires a group of neurons. That’s when we experience taste.

How many distinct tastes do our taste buds detect? Five: salty, sour, sweet, bitter and umami, also called savory. Umami is Japanese for delicious. It’s the flavor associated with the flavor additive MSG. It’s similar to salty, but there are distinct receptors for it.

Why are some tastes more intense than others? It depends on how highly concentrated the chemical signals are in the food that is on the tongue. Some people can pick up some tastes at lower concentrations than others. But if there’s not enough of a chemical in a substance, the tongue’s receptors won’t detect it. This is similar to stimuli for other senses—the eyes can’t see light that is too low, the touch sensors don’t detect contact that is too faint.

Do some people taste more acutely than others? Yes. Some people have comparatively more of the tiny bumps—called papillae—on their tongues. Those people are called super-tasters, and they experience tastes more intensely than those with fewer papillae. Bitter is more bitter, sweet is sweeter.

How does our sense of smell affect taste? They are distinct but complementary senses. Smell works by detecting chemicals in the air. When you eat a food, you smell it just before you taste it and while you’re eating it. If you lose your sense of smell, your experience of taste is diminished.

Does our sense of taste change as we get older? Scientists know that our senses of taste and smell continue to develop as we age, but researchers do not know for certain if or how long-term brain development affects these senses.

To learn more about the Sensory Service Center or register to be a taste-tester, go to: www.ncsu.edu/sensory/

A researcher checks one of the machines used to determine why some products have certain flavors, top; a gas chromatography-mass spectrophotometry machine; and making whey protein, bottom. Below, the door to the Dairy Pilot Plant Research Lab.

Amber Nimocks is a Raleigh-based food writer.

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