Taste Tests

Food science’s state-of-the-art Sensory Evaluation Center helps academia and industry unlock the secrets of flavor

By Beth Saulnier
Reprinted from the March/April 2018 issue on CornellAlumniMagazine.com. All rights reserved.

About once a week during the semester, a handwritten notice appears on a whiteboard in the Stocking Hall lobby, aimed at tempting passersby to venture down the hall. “Coconut Water Study!” it said one day in late January, above a room number and an arrow pointing in the right direction.

The destination in question, 118 Stocking, houses the Sensory Evaluation Center—a state-of-the-art facility that’s the epicenter of Cornell’s research on how humans experience foods and beverages. Opened in 2015 following a major renovation of the food science building, it replaced a decades-old facility formerly housed in the Stocking basement. Bright and modern, the new center hosts taste tests to support research by undergrads, grad students, and faculty—which together comprise some 60 to 70 percent of its projects—as well as for corporate clients, whose fees help support its academic work. “Cornell has a strong dairy presence, so we do a lot of dairy products—milk, yogurt, cheese, dips, sour cream,” says Alina Steleck, MS ’05, the center’s manager since the reopening. “We do a lot of wine and hard cider, sometimes beer. The rest of it is a hodgepodge of things. It can be crackers, cookies, chicken nuggets, pasta. We test a really wide range.”

The Sensory Evaluation Center is part laboratory, part stage set: one essential element is that study participants are shielded from the back-of-house activities on the other side of the wall, home to a small commercial kitchen. After signing in at the center’s office and reception area—where, among other paperwork, they’re informed of any potential allergens—the tasters are positioned at one of eight stations, each separated by a Plexiglas partition. Samples are slid on trays through small hatches that connect to the kitchen; a special air-handling system even keeps the tasters from smelling the odors of food preparation. “We want to cut people off from any interaction, any bias related to the test,” says the center’s director, Robin Dando, assistant professor of food science. “You don’t want people to think of what the product looks like when it’s being prepared or who’s making it for them.”

The center’s kitchen houses standard equipment—stove, freezer, oven, refrigerator, microwave, heat lamps for keeping food warm—but it’s designed for maximum flexibility; staff can wheel in, say, blenders or ice cream makers as a study demands. In the tasting room the lighting can be manipulated to become brighter, dimmer, or tinged red (to mask a food’s visual characteristics). Sometimes, researchers even employ sound—as Dando did for a study a few years ago on how airplane noise affects palate. For that work, which he and Kimberly Van, MPS ’15, published in the Journal of Experimental Psychology: Human Perception and Performance in 2015, they had subjects don headphones and listen to the roughly 80-decibel background noise of an airplane (or, as a control, to nothing). They found that while the sound dampened subjects’ ability to taste sweetness, for as-yet-unknown reasons it heightened their perception of umami—the savory flavor found in foods like mushrooms and red meat.

The findings helped explain the anecdotal observation that tomato juice—a beverage heavy in umami—is much more popular at 30,000 feet than on terra firma. The work made international headlines—although, as Dando notes with a chuckle, the project didn’t actually involve serving Bloody Marys to lucky volunteers, as some of the news stories implied. “Every now and then one of our studies will be picked up like crazy, and it will be everywhere,” he observes. “And we find that the more it gets picked up, the more it drifts away from the actual facts.”

For another study that got covered in the mainstream media, Dando and his team ventured outside the Sensory Evaluation Center—to Lynah Rink, where they explored how mood affects taste perception. Sports games, he notes, offer a handy way to study the concept, since a fan can be euphoric at a victory one day and then heartstruck at a loss the next. So the researchers attended every home game of the 2013–14 men’s hockey season, totting samples of two frozen desserts: a lemon-lime sorbet and a salted caramel pretzel ice cream. “We sort of unofficially hinted that we were refining a new flavor for the Dairy Bar, but it was the same sample the whole year through,” says Dando, who conducted the study with grad student Corinna Noel. “We were looking at how people rated them when they won versus when they lost.”

They found that while hockey fans’ opinion of the sorbet—a more tart, less indulgent dessert—was heavily dependent on how the Big Red did, their enjoyment of the ice cream was not affected by a game’s outcome. As a writer for Forbes later summed it up: “This may be part of the comfort food effect: sweet, fatty foods retain their appeal no matter what happens, while other foods, with more aversive or contrasting tastes, may lose their appeal when you’re feeling disappointed or down.” The results were published in the journal Appetite in 2015. Such findings, Dando says, could help explain the drivers behind the unhealthy choices people make through “emotional eating.” “When you’re in a bad mood,” he muses, “do you have to go straight to the salted caramel pretzel, because the lemon-lime sorbet tastes terrible to you?”

Feast for the Senses

As associate professor of food science Gavin Sacks, PhD ’05, notes, there’s a difference between “taste” and “flavor.” While “taste” may be a blanket term to the layperson, for experts in the field the word refers only to the sensations detected by the receptors on your tongue’s taste buds—salty, sweet, sour, bitter, and umami. But as Sacks points out, the burning sensation we get from spicy peppers or the cooling feeling of menthol isn’t “taste” per se; furthermore, some of what we perceive as taste doesn’t even involve the tongue. “One of the classic experiments that all kindergarteners do is take nose clips and taste different juices, and realize that a lot of what you’re calling ‘taste’ is actually aroma,” he says. “Apple and grape juice are nearly indistinguishable with your nose pinched. Then you take the clip off and perceive the volatile aroma compounds in the juices, tongue. “One of the classic experiments that all kindergarteners do is take nose clips and taste different juices, and realize that a lot of what you’re calling ‘taste’ is actually aroma.”

An expert in analytical chemistry, Sacks primarily does research relating to wine—work that often by definition requires understanding how the ensuing libation will be received by consumers. One project that Sacks recently began involves devising ways to remove the sweet, jam-like aroma from Concord grape juice—a product that’s widely produced in New York State but that fetches low prices per ton, since juice is no longer a breakfast staple in many households. The aim, he says, is to broaden the market for Concord by...
Ideally, each study in the Sensory Evaluation Center involves about 100 subjects; a tasting takes around fifteen minutes and usually pays $5. “Generally, four to five products is the most you’d want them to try—after that, everything starts to taste the same,” Dando says. "People are human, and they get bored." Occasionally, studies that are more time-consuming—like one on toothpaste flavors that required taking samples home and filling out online surveys—can pay $20 or more. While some other on-campus research groups may offer academic credit for participation, Stelick says, monetary compensation allows for a broader demographic range of subjects, from students to staff to local retirees. She also points out that to create realistic testing conditions, the center doesn’t conduct studies on alcohol in the morning, or on coffee in the late afternoon. "These are not psychology experiments where we try to understand the person’s behavior," Stelick explains. "We’re interested in the product—we’re not really interested in the people." January’s coconut water study offered a typical example of how the center functions. Volunteers were asked to evaluate three samples, served sequentially in clear plastic cups that were slid through the hatch from the adjacent kitchen. Using a scale from “dislike extremely” to “like extremely,” tasters had to weigh in on the samples’ appearance, aroma, mouthfeel, and more—prompted by questions on their station’s computer screen—and to describe attributes like sweetness, sourness, and refreshing quality. To cleanse the palate between samples, volunteers had access to water and unsalted crackers—as well as a “spit cup” if they opted not to swallow. Finally, the tasters received all three samples together, so they could compare them to each other and rank them according to preference.

The study was essential to a project being conducted by Emile Punzalan, a graduate student from a university in the Philippines who’s spending eight months on the Hill as a visiting researcher. Punzalan is studying the viability of using non-thermal methods of concentrating coconut water, a growing export crop for his nation. "There are some heat-sensitive nutrients and properties of coconut water that are being lost when you do it by thermal concentration," he explains. "We want to concentrate it without using heat, so the quality is much better compared to what is currently available, and more comparable to fresh." While the study participants didn’t know it, each sample they tasted was processed differently: one was fresh, one thermally concentrated, and the other concentrated using a non-thermal method. "The study we conducted is important," says Punzalan, who’s still evaluating the data, “because we want to know if consumers will detect a difference.”

Over the years, Cornell’s food science students have taken top honors in numerous national product development competitions, including winning the prestigious Institute of Food Technologists contest seven times since 1991. (The most recent win, in 2017, was for Jack’d Jerky, a vegan snack made from jackfruit.) They owe their success, in part, to the sensory center, which allows for thorough and precise evaluation of how a product is received by potential consumers. This academic year, a trio of grad students—Andreea Punzalan, a graduate student from a university in the Philippines who’s spending eight months on the Hill as a visiting researcher. Punzalan is studying the viability of using non-thermal methods of concentrating coconut water, a growing export crop for his nation. "There are some heat-sensitive nutrients and properties of coconut water that are being lost when you do it by thermal concentration," he explains. "We want to concentrate it without using heat, so the quality is much better compared to what is currently available, and more comparable to fresh." While the study participants didn’t know it, each sample they tasted was processed differently: one was fresh, one thermally concentrated, and the other concentrated using a non-thermal method. "The study we conducted is important," says Punzalan, who’s still evaluating the data, “because we want to know if consumers will detect a difference.”

About eighty people participated in the trio’s testing, in which the team tested two versions that had slightly different textures. “We had good feedback,” says Beldie. “Some people were really excited, because the product is something you can’t find on the market.” Such testing, she says, “is very important, because when you develop a product you need to know what the consumer wants, what their expectations would be.” It paid off: their team was one of six that made the finals, to be judged in April. The top three finishers will be invited to present their products at the American Dairy Science Association meeting in Tennessee in June. "We want it to be sort of an energy snack," says Cheng, "something to replace granola bars, energy bars, or nuts, but taste great at the same time.”

In addition to Ortiz’s work on the project and her doctoral research in Sacks’s lab, she’s a member of the center’s Cheese Descriptive Sensory Panel. Distinct from the regular taste tests, the group is made up of about a dozen people who’ve undergone forty hours of paid training on how to evaluate and describe five major varieties: cheddar, Muenster, Gouda, Swiss, and Havarti. Stelick points out that the panel—which is regularly tapped by industry for product-development purposes—is the only one of its kind in the Northeast. (The center trained a similar descriptive panel devoted to kale, which did evaluations until last fall.) Members, who are asked to serve on the panel for three years, come in for tastings about twice a week in the middle of the day. “A lot of them are cheese lovers,” Stelick says with a smile, “and this is their cheese lunch.” Ortiz, a cheese fan who worked in the dairy industry in her native Mexico, says she devotes around eight minutes to evaluating each sample, which comes in a lidded plastic cup to allow the product’s aroma—or “head space”—to develop. “You have to be as blank as possible, have no cell phone, nothing around,” she says of her evaluation process. “You take a bite, close your eyes, and focus.”