

Příloha - výchozí text

Exploiting the Biology of the Child

The first thing to know about sugar is this: Our bodies are hard-wired for sweets. Forget what we learned in school from that old diagram called the tongue map, the one that says our five main tastes are detected by five distinct parts of the tongue. That the back has a big zone for blasts of bitter, the sides grab the sour and the salty, and the tip of the tongue has that one single spot for sweet. The tongue map is wrong. As researchers would discover in the 1970s, its creators misinterpreted the work of a German graduate student that was published in 1901; his experiments showed only that we might taste a little more sweetness on the tip of the tongue. In truth, the entire mouth goes crazy for sugar, including the upper reaches known as the palate. There are special receptors for sweetness in every one of the mouth's ten thousand taste buds, and they are all hooked up, one way or another, to the parts of the brain known as the pleasure zones, where we get rewarded for stoking our bodies with energy. But our zeal doesn't stop there. Scientists are now finding taste receptors that light up for sugar all the way down our esophagus to our stomach and pancreas, and they appear to be intricately tied to our appetites.

The second thing to know about sugar: Food manufacturers are well aware of the tongue map folly, along with a whole lot more about why we crave sweets. They have on staff cadres of scientists who specialize in the senses, and the companies use their knowledge to put sugar to work for them in countless ways. Sugar not only makes the taste of food and drink irresistible. The industry has learned that it can also be used to pull off a string of manufacturing miracles, from donuts that fry up bigger to bread that won't go stale to cereal that is toasty-brown and fluffy. All of this has made sugar a go-to ingredient in processed foods. On average, we consume 71 pounds of caloric sweeteners each year. That's 22 teaspoons of sugar, per person, per day. The amount is almost equally split three ways, with the sugar derived from sugar cane, sugar beets, and the group of corn sweeteners that includes high-fructose corn syrup (with a little honey and syrup thrown into the mix).

That we love, and crave, sugar is hardly news. Whole books have been devoted to its romp through history, in which people overcame geography, strife, and overwhelming technical

hurdles to feed their insatiable habit. The highlights start with Christopher Columbus, who brought sugar cane along on his second voyage to the New World, where it was planted in Spanish Santo Domingo, was eventually worked into granulated sugar by enslaved Africans, and, starting in 1516, was shipped back to Europe to meet the continent's surging appetite for the stuff. The next notable development came in 1807 when a British naval blockade of France cut off easy access to sugar cane crops, and entrepreneurs, racing to meet demand, figured out how to extract sugar from beets, which could be grown easily in temperate Europe. Cane and beets remained the two main sources of sugar until the 1970s, when rising prices spurred the invention of high-fructose corn syrup, which had two attributes that were attractive to the soda industry. One, it was cheap, effectively subsidized by the federal price supports for corn; and two, it was liquid, which meant that it could be pumped directly into food and drink. Over the next thirty years, our consumption of sugar-sweetened soda more than doubled to 40 gallons a year per person, and while this has tapered off since then, hitting 32 gallons in 2011, there has been a commensurate surge in other sweet drinks, like teas, sports ades, vitamin waters, and energy drinks. Their yearly consumption has nearly doubled in the past decade to 14 gallons a person.

Far less well known than the history of sugar, however, is the intense research that scientists have conducted into its allure, the biology and psychology of why we find it so irresistible.

For the longest time, the people who spent their careers studying nutrition could only guess at the extent to which people are attracted to sugar. They had a sense, but no proof, that sugar was so powerful it could compel us to eat more than we should and thus do harm to our health. That all changed in the late 1960s, when some lab rats in upstate New York got ahold of Froot Loops, the supersweet cereal made by Kellogg. The rats were fed the cereal by a graduate student named Anthony Sclafani who, at first, was just being nice to the animals in his care. But when Sclafani noticed how fast they gobbled it up, he decided to concoct a test to measure their zeal. Rats hate open spaces; even in cages, they tend to stick to the shadowy corners and sides. So Sclafani put a little of the cereal in the brightly lit, open center of their cages—normally an area to be avoided—to see what

would happen. Sure enough, the rats overcame their instinctual fears and ran out in the open to gorge.

Their predilection for sweets became scientifically significant a few years later when Sclafani—who'd become an assistant professor of psychology at Brooklyn College—was trying to fatten some rats for a study. Their standard Purina Dog Chow wasn't doing the trick, even when Sclafani added lots of fats to the mix. The rats wouldn't eat enough to gain significant weight. So Sclafani, remembering the Froot Loops experiment, sent a graduate student out to a supermarket on Flatbush Avenue to buy some cookies and candies and other sugar-laden products. And the rats went bananas, they couldn't resist. They were particularly fond of sweetened condensed milk and chocolate bars. They ate so much over the course of a few weeks that they grew obese.

"Everyone who owns pet rats knows if you give them a cookie they will like that, but no one experimentally had given them all they want," Sclafani told me when I met him at his lab in Brooklyn, where he continues to use rodents in studying the psychology and brain mechanisms that underlie the desire for high-fat and high-sugar foods. When he did just that, when he gave his rats all they wanted, he saw their appetite for sugar in a new light. They loved it, and this craving completely overrode the biological brakes that should have been saying: Stop.

The details of Sclafani's experiment went into a 1976 paper that is revered by researchers as one of the first experimental proofs of food cravings. Since its publication, a whole body of research has been undertaken to link sugar to compulsive overeating. In Florida, researchers have conditioned rats to expect an electrical shock when they eat cheesecake, and still they lunge for it. Scientists at Princeton found that rats taken off a sugary diet will exhibit signs of withdrawal, such as chattering teeth. Still, these studies involve only rodents, which in the world of science are known to have a limited ability to predict human physiology and behavior.

What about people and Froot Loops?

For some answers to this question, and for most of the foundational science on how and why we are so attracted to sugar, the food industry has turned to a place called the Monell Chemical Senses Center in Philadelphia. It is located a few blocks west of the Amtrak station, in a bland five-story brick building easily overlooked in the architectural

wasteland of the district known as University City—except for “Eddy”, the giant sculpture that stands guarding the entrance. Eddy is a ten-foot-high fragment of a face, and he perfectly captures the obsessions of those inside: He is all nose and mouth.

Getting buzzed through the center’s front door is like stepping into a clubhouse for PhDs. The scientists here hang out in the corridors to swap notions that lead to wild discoveries, like how cats are unable to taste sweets, or how the cough that results from sipping a high-quality olive oil is caused by an anti-inflammatory agent, which may prove to be yet another reason for nutritionists to love this oil so much. The researchers at Monell bustle to and from conference rooms and equipment-filled labs and peer through one-way mirrors at the children and adults who eat and drink their way through the center’s many ongoing experiments. Over the last forty years, more than three hundred physiologists, chemists, neuroscientists, biologists, and geneticists have cycled through Monell to help decipher the mechanisms of taste and smell along with the complex psychology that underlies our love for food. They are among the world’s foremost authorities on taste. In 2001, they identified the actual protein molecule, T1R3, that sits in the taste bud and detects sugar. More recently they have been tracking the sugar sensors that are spread throughout the digestive system, and they now suspect that these sensors are playing a variety of key roles in our metabolism. They have even solved one of the more enduring mysteries in food cravings: the marijuana-induced state known as “the munchies.” This came about in 2009 when Robert Margolskee, a molecular biologist and associate director of the center, joined other scientists in discovering that the sweet taste receptors on the tongue get aroused by endocannabinoids—substances that are produced in the brain to increase our appetite. They are chemical sisters to THC, the active ingredient in marijuana, which may explain why smoking marijuana can trigger hunger pangs. “Our taste cells are turning out to be smarter than we thought, and more involved in regulating our appetites,” Margolskee told me.

The stickiest subject at Monell, however, is not sugar. It’s money. Taxpayers fund about half of the center’s \$17.5 million annual budget through federal grants, but much of the rest of its operation comes from the food industry, including the big manufacturers, as well as several tobacco companies. A large golden plaque in the lobby pays homage to PepsiCo, Coca-Cola, Kraft, Nestlé, Philip Morris, among others. It’s an odd arrangement, for sure, one that evokes past efforts by the tobacco industry to buy “research” that put

cigarettes in a favorable light. At Monell, the industry funding buys companies a privileged access to the center and its labs. They get exclusive first looks at the center's research, often as early as three years before the information goes public, and are also able to engage some of Monell's scientists to conduct special studies for their particular needs. But Monell prides itself on the integrity and independence of its scientists. Some of their work, in fact, is funded with monies from the lawsuits that states brought against the tobacco manufacturers.

"At Monell, scientists choose their research projects based solely on their own curiosity and interests and are deeply committed to the pursuit of fundamental knowledge," the center said in response to my questions about its financial structure. Indeed, as I would discover, though Monell receives industry funding, some of its scientists sound like consumer activists when they speak about the power their benefactors wield, especially when it comes to children.

This tension between the industry's excitement about the research at Monell and the center's own unease about the industry's practices dates back to some of the center's earliest research on our taste buds—based on age, sex, and race. Back in the 1970s, researchers at Monell discovered that kids and African Americans were particularly keen on foods that were salty and sweet. They gave solutions of varying sweetness and saltiness to a group of 140 adults and then to a group of 618 children aged nine to fifteen, and the kids were found to like the highest level of sweet and salty—even more than the adults. Twice as many kids as adults chose the sweetest and saltiest solutions. (This was the first scientific proof of what parents, watching their kids lunge for the sugar bowl at the breakfast table, already knew instinctively.) The difference among adults was less striking but still significant: More African Americans chose the sweetest and saltiest solutions.

One of Monell's sponsors, Frito-Lay, was particularly interested in the salt part of the study, since the company made most of its money on salty chips. Citing Monell's work in a 1980 internal memo, a Frito-Lay food scientist summed up the finding on kids and added, "Racial Effect: It has been shown that blacks (in particular, black adolescents) displayed the greatest preference for a high concentration of salt." The Monell scientist who did this groundbreaking study, however, raised another issue that reflected his anxiety about the food industry. Kids didn't just like sugar more than adults, this scientist,

Lawrence Greene, pointed out in a paper published in 1975. Data showed they were actually consuming more of the stuff, and Greene suggested there might be a chicken-and-egg issue at play: Some of this craving for sugar may not be innate in kids but rather is the result of the massive amounts of sugar being added to processed foods. Scientists call this a learned behavior, and Greene was one of the first to suggest that the increasingly sweet American diet could be driving the desire for more sugar, which, he wrote, “may or may not correspond to optimum nutritional practices.”

In other words, the sweeter the industry made its food, the sweeter kids liked their food to be.

I wanted to explore this idea a bit more deeply, so I spent some time with Julie Mennella, a biopsychologist who first came to Monell in 1988. In graduate school, she had studied maternal behavior in animals and realized that no one was examining the influence that food and flavors had on women who were mothers. She joined Monell to answer a set of unknowns about food. Do the flavors of the food you eat transmit to your milk? Do they transmit to amniotic fluid? Do babies develop likes and dislikes for foods even before they are born?

“One of the most fundamental mysteries is why we like the foods that we do,” Mennella said. “The liking of sweet is part of the basic biology of a child. When you think of the taste system, it makes one of the most important decisions of all: whether to accept a food. And, once we do, to warn the digestive system of impending nutrients. The taste system is our gatekeeper and one of the research approaches has been to take a developmental route, to look from the beginning—and what you see is that children are living in different sensory worlds than you and I. As a group, they prefer much higher levels of sweet and salt, rejecting bitter more than we do. I would argue that part of the reason children like high levels of sweet and salt is a reflection of their basic biology.”

Twenty-five years later, Mennella has gotten closer than any other scientist to one of the most compelling—and, to the food industry, financially important—aspects of the relationship kids have to sugar. In her most recent project, she tested 356 children, ages five to ten, who were brought to Monell to determine their “bliss point” for sugar. The bliss point is the precise amount of sweetness—no more, no less—that makes food and drink most enjoyable. She was finishing up this project in the fall of 2010 when she agreed

to show me some of the methods she had developed. Before we got started, I did a little research on the term bliss point itself. Its origins are murky, having some roots in economic theory. In relation to sugar, however, the term appears to have been coined in the 1970s by a Boston mathematician named Joseph Balintfy, who used computer modeling to predict eating behavior. The concept has obsessed the food industry ever since.

Food technicians typically refer to the bliss point privately when they are perfecting the formulas for their products, from sodas to flavored potato chips, but oddly enough, the industry has also sought to use the bliss point in defending itself from criticism that it was jamming the grocery store with foods that create unhealthy cravings. In 1991, this view of the bliss point as a natural phenomenon took center stage at a gathering of one of the more unusual industry associations. Based in London, the group was called ARISE (Associates for Research into the Science of Enjoyment), and its sponsors included food and tobacco companies. ARISE saw its mission as mounting a “resistance to the ‘Calvinistic’ attacks on people who are obtaining pleasure without harming others.” The meeting, held in Venice, Italy, started off with a British scientist who discussed what he called “moreishness,” in which the early moments of eating—as in appetizers—were shown to be valuable in the pursuit of pleasure by actually making you hungrier still. Monell’s own director, Gary Beauchamp, gave a presentation in which he detailed the varied responses that infants have to tastes. Children developed a taste for salt as early as four or five months, he told the assembled scientists, while their liking for sweet appears to be in place the moment they are born.

The next presenter was an Australian psychologist named Robert McBride, who captivated the audience with a presentation he called “The Bliss Point: Implication for Product Choice.”

Food manufacturers need not fear the implication of pleasure in the word bliss, he began. After all, he said, who among us chooses food based on its nutritional status? People pick products off the grocery shelf based on how they expect them to taste and feel in their mouths, not to mention the signals of pleasure their brains will discharge as a reward for choosing the tastiest foods. “Nutrition is not foremost on people’s mind when they choose their food,” he said. “It’s the taste, the flavor, the sensory satisfaction.”

And when it comes to these attributes, none is more powerful—or more conducive to being framed by the bliss point—than the taste of sugar, he said. “Humans like sweetness, but how much sweetness? For all ingredients in food and drink, there is an optimum concentration at which the sensory pleasure is maximal. This optimum level is called the bliss point. The bliss point is a powerful phenomenon and dictates what we eat and drink more than we realize.”

The only real challenge for companies when it comes to the bliss point is ensuring that their products hit this sweet spot dead on. Companies are not going to sell as much ketchup, Go-Gurt, or loaves of bread if they’re not sweet enough. Or, put a different way, they will sell a lot more ketchup, Go-Gurt, and loaves of bread if they can determine the precise bliss point for sugar in each of those items.

McBride ended his presentation that day in Venice with words of encouragement for the food company attendees. With a little work, he said, the bliss point can be computed and totted up like so much protein or fiber or calcium in food. It may not be something that companies would want to put on their labels, like they do in boasting about a product’s infusion with vitamins. But the bliss point was, nonetheless, just as real and important to their customers. “Pleasure from food is not a diffuse concept,” he said. “It can be measured just as the physical, chemical, and nutritional factors can be measured. With more concrete status, the capacity of food flavors to evoke pleasure may start to be regarded as a real, tangible property of products, along with their nutritional status.”

Julie Mennella, the biopsychologist at Monell, agreed to show me how the bliss point is calculated. I returned to the center on a warm day in November, and she took me into a small tasting room, where we met our guinea pig: an adorable six-year-old girl named Tatyana Gray. Tatyana had brightly colored beads in her hair and a pink T-shirt that read “5-Cent Bubble Gum” across the front. The expression on her face was one of cool professionalism: This was a job she could handle.

“What’s your favorite cereal in the whole world?” Mennella asked Tatyana, just for fun.

“My favorite cereal is ... Cinnamon CRUNCH,” Tatyana replied.

Tatyana sat at a small table, with little stuffed versions of Big Bird and Oscar the Grouch perched next to her. As a lab assistant started to assemble the food to be tested, Mennella

explained that the protocol for this experiment had been derived from twenty years of trials and was designed to elicit a scientifically measurable response. “We are dealing with foods that are very well liked, and so we’re going to ask the child which one they like better. The one they like better, they are going to give to Big Bird because they know he likes things that taste good. We’re looking at a wide range of children, as young as three, and we don’t want language to play a role here. The child doesn’t have to say anything. They either point to the one they like, or in this case, they give it to Big Bird. It’s meant to minimize the impact of language.”

Why not just ask the kids straight out if they like it? I asked.

“It just doesn’t work, especially for the young ones,” she said. “You can give them everything and they will say yes or no. Though, in this context, it tends to be yes. Children are smart. They’ll tell you what they think you want to hear.”

We tested this notion out by asking Tatyana which she preferred: broccoli or the Philadelphia-made snack called the TastyKake.

“Broccoli,” she said, ready for a pat on the head.

For our bliss point test, Mennella’s assistant had whipped up a dozen vanilla puddings, each at a different level of sweetness. She started by putting two of the variations into small plastic cups and setting them in front of Tatyana. Tatyana tasted the one on the left, swallowed, and took a sip of water. Then she tasted the one on the right. She didn’t speak, but she didn’t have to. Her face lit up as her tongue pressed into the roof of her mouth, pushing the pudding into the thousands of receptors waiting for sweetness. Being an old hand at the test, she ignored the stuffed animals and simply pointed to the cup she preferred.

There was one problem with watching Tatyana work her way through the puddings, though. So much was going on in creating the bliss she felt that was invisible to us. Each little spoonful disappeared into her mouth, and we could see her facial expressions and, ultimately, her decision. But in between tasting and choosing, a whole chain of events was unfolding inside her body, starting with her taste buds, that was critical to understanding how and why she was so happy.

To better understand what, exactly, was going on, I turned to another Monell scientist, Danielle Reed, who had trained in psychology at Yale. Reed, when we met, was using quantitative genetics to examine how inheritance might affect the pleasure we derive

from sensations like tasting sugar, but her research on the sweet taste has also focused on the mechanics. Reed was among the group at Monell who discovered T1R3, the sweet receptor protein. She told me that Tatyana's swoon for the sugar in the pudding begins with her saliva. After all, we don't call tasty food "mouthwatering" for nothing. The mere sight of a sugary treat will start the saliva flowing, which in turn primes the digestive system. "The sugar, or sweet molecule, dissolves in your saliva," Reed said. Our taste buds are not smooth little bumps like we might imagine, she explained. They have clumps of tiny, hair-like fronds that rise up from the bud, and it's these fronds, called microvilli, that hold the cell that detects and receives the taste. "And that sets off a series of chain reactions inside the cell. So that the taste receptor cell talks to its friends in the taste bud. There is a lot of microprocessing of that signal, and then eventually it decides that what is in your mouth is sweet, and it squirts out neurotransmitters onto the nerve, which then goes to the brain."

Like most everything that goes on inside the brain, what happens up there in relation to food is still being sorted out. But researchers are beginning to chart the pathway that sugar takes—which Reed described as more of a deliberate march. "There is a very orderly progress of pathways in the brain that people are just now starting to learn," she said. "It stops at the first relay station and moves forward and forward and it eventually ends up in the pleasure centers, like the orbital frontal cortex of the brain, and that's when you have the experience, 'Ahh, sweet.' The good aspect of sweet.

We don't even have to eat sugar to feel its allure. Pizza will do, or any other refined starch, which the body converts to sugar—starting right in the mouth, with an enzyme called amylase. "The faster the starch becomes sugar, the quicker our brain gets the reward for it," Reed said. "We like the highly refined things because they bring us immediate pleasure, associated with high sugar, but obviously there are consequences. It's sort of like if you drink alcohol really fast, you get drunk really fast. When you break down sugar really fast your body gets flooded with sugar more than it can handle, whereas with a whole grain it is more gradual and you can digest it in a more orderly fashion."

In the testing that Mennella conducted to calculate Tatyana's bliss point for sugar, the six-year-old worked her way through two dozen puddings, each prepared to a different level of sweetness. The puddings were presented to her in pairs, from which she would choose the one she liked more. Each of her choices dictated what pudding pair would come next,

and slowly Tatyana moved toward the level of sweetness she preferred most of all. When Mennella got the results, it was plain to see that there was no way Tatyana would ever have fed Big Bird a twig of broccoli over a Krimpet, a Kreamie, or anything else from the TastyKake line. Tatyana's bliss point for the pudding was 24 percent sugar, twice the level of sweetness that most adults can handle in pudding. As far as children go, she was on the lower side; some go as high as 36 percent.

"What we find is that the foods that are targeted to children, the cereals and the beverages, they are way up," Mennella said. "Tatyana's favorite cereal is Cinnamon Crunch, and what we'll do, we'll measure the level of sweetness that the child prefers in the laboratory with a sucrose solution and it matches the sugar content of the most preferred cereal. There are individual differences, but as a group, in every culture that has been studied around the world, children prefer more intense sweetness than adults."

Beyond the basic biology, there are three other aspects of sugar that seem to make it attractive to children, Mennella said. One, the sweet taste is their signal for foods that are rich in energy, and since kids are growing so fast, their bodies crave foods that provide quick fuel. Two, as humans, we didn't evolve in an environment that had lots of intensely sweet foods, which probably heightens the excitement we feel when we eat sugar. And finally, sugar makes children feel good. "It's an analgesic," Mennella said. "It will reduce crying in a newborn baby. A young child can keep their hand in a cold water bath longer if a sweet taste is in their mouth."

These are huge, powerful concepts—concepts that are crucial to understanding why so much of the grocery store food is sweet, and why we feel so drawn to sugar. We need energy, and Cinnamon Crunch delivers it quickly. We've been intimate with sweet taste since we were born, and yet our ancestors had nothing as thrilling as Coke. Sugar will even make us feel better, and who doesn't want that?

Mennella has become convinced that our bliss point for sugar—and all foods, for that matter—is shaped by our earliest experiences. But as babies grow into youngsters, the opportunity for food companies to influence our taste grows as well. For Mennella, this is troubling. It's not that food companies are teaching children to like sweetness; rather, they are teaching children what foods should taste like. And increasingly, this curriculum has been all about sugar.

“What basic research and taste in children is shedding light on—and why the foods that they’re making for children are so high in sugar and salt—is they are manipulating or exploiting the biology of the child,” she said. “I think that anyone who makes a product for a child has to take responsibility because what they are doing is teaching the child the level of sweetness or saltiness the food should be.

“They’re not just providing a source of calories for a child,” she added. “They’re impacting the health of that child.”

This much is clear from the research at Monell: People love sugar, especially kids. And up to a certain point—the bliss point—the more sugar there is, the better.

We may not yet know all the twists and turns that sugar takes in racing from our mouths to our brains, but the end results are not in dispute. Sugar has few peers in its ability to create cravings, and as the public gradually came to understand this power, sugar turned into a political problem for the manufacturers of processed food—a problem for which they would turn, once again, to Monell for help.

The money that the big food companies give to Monell accords them one special privilege: These corporate sponsors can ask the center’s scientists to conduct special studies just for them. A dozen times or so each year, companies bring vexing problems to Monell, like why the texture of starch is perceived so differently by people, or what causes the terrible aftertaste in infant formula, and Monell’s scientists will put their PhD brains to work in solving these puzzles. In the 1980s, however, a group of Monell funders asked for help with a more pressing matter: They needed assistance in defending themselves from public attack.

Sugar was coming under heavy fire from several directions. The Food and Drug Administration had taken it up as part of an effort to examine the safety of all food additives. The report it commissioned didn’t recommend regulatory action, but it did contain several warnings: Dental decay was rampant, sugar was possibly tied to heart disease, and consumers had all but lost control of its use. Getting rid of the sugar bowl at home would barely help to cut back on consumption, the report said, as more than two-thirds of the sugar in America’s diet was now coming from processed foods.

At the same time, a select committee of U.S. senators—including George McGovern, Bob Dole, Walter Mondale, Ted Kennedy, and Hubert Humphrey—caused a stir by releasing

the federal government's first official guideline on how Americans should shape their diet. The committee had started out looking at hunger and poverty but quickly turned its attention to heart disease and other illnesses that experts were linking to diet. "I testified that Americans should eat less food; less meat; less fat, particularly saturated fat; less cholesterol; less sugar; more unsaturated fat, fruits, vegetables and cereal products," an adviser to the Agriculture Department, Mark Hegsted, wrote in an account of the proceedings. On top of that, Michael Jacobson, an MIT-trained protégé of the consumer advocacy superstar Ralph Nader, was lighting a fire under the Federal Trade Commission. Jacobson's group, the Center for Science in the Public Interest, had gathered twelve thousand signatures from health professionals in urging the agency to ban the advertising of sugary foods on children's television.

The headlines from these and other attacks on the processed food industry had led to a surge in consumer awareness and concern. A federal survey found that three in four shoppers were reading and acting on the nutritional information provided on labels; half of these consumers said that they studied the labels to avoid certain additives, including salt, sugar, fats, and artificial colors. Even more troubling than that for the processed food industry, there was a growing public sentiment that its use of sugar, as well as colors, flavors, and other additives, was causing hyperactivity in children and overeating by adults. "It was coming from the general public, and there are always voices, activist voices, that say this is fact, that sugar causes over-activity," recalled Al Clausi, who retired in 1987 as a senior vice president and chief research officer for General Foods. "That was one of the folklore. That and flavors make you eat more of something that otherwise you wouldn't." With Clausi as the leader, officials from Kellogg and General Mills formed a group called the Flavor Benefits Committee, and they asked Monell to conduct research that would help quiet the nay-sayers, putting sugar and other food additives in a more favorable light by emphasizing their nutritional benefits.

Monell was an obvious choice for the industry. With limited funds from the government, the center had begun soliciting monies from food companies, keeping them apprised of research that would interest them. In a 1978 letter to Clausi, Monell's former director, Morley Kare, thanked General Foods for its latest check and suggested that center scientists conduct a seminar for product developers at the company. "We currently are emphasizing the growth of our program on taste and nutrition," Kare wrote. "A study with

adolescents is being planned, focusing on their desire for high concentrations of sweeteners, saltiness and, evidently, the flavor and texture of fat.”

By 1985, there were nine scientists at the center working on the industry’s Flavor Benefits project, and some of their findings were things the industry could relish only in private. One discovery would have been a morale booster in food company labs where technicians had qualms about their employers’ heavy reliance on sugar: Monell helped to establish that sugar is inherently loved by newborn babies. This enabled companies to argue, at least, that sugar was not something “artificial” they were thrusting upon an unsuspecting public. Rather, sugar was sinless, if not entirely wholesome. “Sweet was very important to us,” Clausi said. “And when Monell found that of all the basic flavors, sweet is the only one a neonate shows a preference for, that said to us, ‘Hey, there is something natural we are dealing with. This is not something we created out of whole cloth.’ ”

Monell, on behalf of the food manufacturers, also dug into the question of whether sugar causes people to overeat, and in this area the scientists made some troubling discoveries. For instance, it wasn’t enough for food to have an attractive taste, they found. To be really enticing, these products had to be loaded with sugar and fat. Only these two ingredients, along with salt, seemed to have the power to excite the brain about eating. With this in mind, Monell turned to an item on the grocery shelf that was starting to have perhaps more impact on the American diet than anything else the food industry sold: soda, which people were starting to drink in unprecedented amounts.

Much of the work on soda at Monell was undertaken by one of the center’s brightest scientists, Michael Tordoff, who had earned his doctoral degree at the University of California at Los Angeles in one of science’s most challenging disciplines, a division of behavioral science called physiological psychology. (This is the field of research that looks at things like the role of the hippocampus in learning and memory.) Tordoff had already shown that he was capable of work that could open some interesting doors for the food industry. With a colleague, he invented a sweet compound dubbed Charmitrol, which could work in opposite ways, both of them potentially lucrative. The animal studies he performed indicated that the compound could cause people to eat larger amounts of food. Or, applied differently, it could cause them to eat less. “It made fat rats thin and thin rats fat,” he told me. Two companies licensed the substance from Monell but turned up neurological hazards that nixed its commercial utility.