

Winner of The Pulitzer Prize

MICHAEL MOSS

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**How
The Food
Giants
Hooked
Us**

Salt Sugar Fat

How the Food Giants Hooked Us

Michael Moss



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“The Company Jewels

Minneapolis was having a blustery spring evening on April 8, 1999, when a long line of towncars and taxis pulled up to the office complex on South 6th Street and discharged their well-dressed passengers. These eleven men were the heads of America’s largest food companies. Among them, they controlled seven hundred thousand employees and \$280 billion in annual sales. And even before their sumptuous dinner was served, they would be charting a course for their industry for years to come.

There would be no reporters at this gathering. No minutes taken, no recordings made. Rivals any other day, the CEOs and company presidents had come together for a meeting that was as secretive as it was rare. On the agenda was one item: the emerging epidemic of obesity and how to deal with it.

Pillsbury was playing host at its corporate headquarters, two glass and steel towers perched on the eastern edge of downtown. The largest falls on the Mississippi River rumbled a few blocks away, near the historic brick and iron-roller mills that, generations before, had made this city the flour-grinding capital of the world. A noisy midwestern wind gusting to 45 miles an hour buffeted the towers as the executives boarded the elevators and made their way to the thirty-first floor.

A top official at Pillsbury, fifty-five-year-old James Behnke, greeted the men as they walked in. He was anxious but also confident about the plan that he and a few other food company executives had devised to engage the CEOs on America’s growing weight problem. “We were very concerned, and rightfully so, that obesity was becoming a major issue,” Behnke recalled. “People were starting to talk about sugar taxes, and there was a lot of pressure on food companies.” As the executives took their seats, Behnke particularly worried about how they would respond to the evening’s most delicate matter: the notion that they and their companies had played a central role in creating this health crisis. Getting the company chiefs in the same room to talk about anything, much less a sensitive issue like this, was a tricky business, so Behnke and his fellow organizers had scripted the meeting carefully, crafting a seating chart and honing the message to its barest essentials. “CEOs in the food industry are typically not technical guys, and they’re uncomfortable going to meetings where technical people talk in technical terms about technical things,” Behnke said. “They don’t want to be embarrassed. They don’t want to make commitments. They want to maintain their aloofness and autonomy.”

Nestlé was in attendance, as were Kraft and Nabisco, General Mills and Procter & Gamble, Coca-Cola and Mars. The companies present were the dominant players in processed industrial food, fiercely aggressive competitors who, when not gathering in secret, were looking to bludgeon one another in the grocery store.

Just that year, the head of General Mills had muscled his company past Kellogg to become the country’s largest cereal maker, hooking shoppers with a dazzling lineup of new products and flavors, sold at reduced prices to boost sales all the more. General Mills was dominating

in the dairy aisle as well, showing the rest of the industry just how easy it was to influence America's eating habits. The company's Yoplait brand had already transformed traditional unsweetened breakfast yogurt into a dessert-like snack. It now had twice as much sugar per serving as Lucky Charms, the company's cloyingly sweet, marshmallow-filled cereal. And yet because of yogurt's well-tended image as a wholesome, life-giving snack, sales of Yoplait were soaring, with annual revenue topping \$500 million. Emboldened by the success, General Mills' development wing pushed even harder, inventing a yogurt that came in a squeezable tube—perfect for kids—eliminating the need for a spoon. They called it Go-Gurt, and rolled it out nationally in the weeks before the CEO meeting. (By year's end, it would hit \$100 million in sales.)

So while the atmosphere at the meeting was cordial, the CEOs were hardly friends. The stature was defined by their skill in fighting each other for what they called “stomach share” or the amount of digestive space that any one company's brand can grab from the competition. If they eyed one another suspiciously that evening, it was for good reason. By 2001, Pillsbury's chief would be gone and the 127-year-old company—with its cookie biscuits, and toaster strudel—would be acquired by General Mills.

Two of the men at the meeting rose above the fray. They were here to represent the industry titans, Cargill and Tate & Lyle, whose role it was to supply the CEOs with the ingredients they relied on to win. These were no run-of-the-mill ingredients, either. They were the three pillars of processed food, the creators of crave, and each of the CEOs needed them in huge quantities to turn their products into hits. These were also the ingredients that more than any other, were directly responsible for the obesity epidemic. Together, the two suppliers had the salt, which was processed in dozens of ways to maximize the jolt that taste buds would feel with the very first bite; they had the fats, which delivered the biggest load of calories and worked more subtly in inducing people to overeat; and they had the sugar whose raw power in exciting the brain made it perhaps the most formidable ingredient of all, dictating the formulations of products from one side of the grocery store to the other.

James Behnke was all too familiar with the power of salt, sugar, and fat, having spent twenty-six years at Pillsbury under six chief executive officers. A chemist by training with a doctoral degree in food science, he became the company's chief technical officer in 1979 and was instrumental in creating a long line of hit products, including microwavable popcorn. He deeply admired Pillsbury, its employees, and the warm image of its brand. But in recent years, he had seen the endearing, innocent image of the Pillsbury Doughboy replaced by new pictures of children too obese to play, suffering from diabetes and the earliest signs of hypertension and heart disease. He didn't blame himself for creating high-calorie foods that the public found irresistible. He and other food scientists took comfort in knowing that the grocery store icons they had invented in a more innocent era—the soda and chips and TV dinners—had been imagined as occasional fare. It was society that had changed, changed so dramatically that these snacks and convenience foods had become a daily—even hourly—habit, a staple of the American diet.

Behnke's perspective on his life's work, though, began to shift when he was made a special advisor to Pillsbury's chief executive in 1999. From his new perch, Behnke started to get a different view of what he called the “big tenets” of his industry—taste, convenience, and cost. He worried, especially, about the economics that drive companies to spend as little

money as possible in making processed foods. “Cost was always there,” he told me. “Companies had different names for it. Sometimes they were called PIPs, or profit improvement programs, or margin enhancements, or cost reduction. Whatever you want to call it, people are always looking for a less expensive way.”

In the months leading up to the CEO meeting, Behnke was engaged in conversation with a group of food science experts who were painting an increasingly grim picture of the public's ability to cope with the industry's formulations. These discussions were sponsored by a food industry group, the International Life Sciences Institute, for which Behnke was the incoming president, and the topics—from the body's fragile controls on overeating to the hidden power of some processed foods to make people feel hungrier still—convinced Behnke and the other insiders who organized the meeting that an intervention was needed. It was time to warn the CEOs that their companies may have gone too far in creating and marketing products to maximize their allure.

The discussion took place in Pillsbury's auditorium. The executives took the first two rows of seats, just in front of the stage, which was raised slightly from the floor. The first speaker was a man named Michael Mudd, and he was not some white-coated researcher from the Pacific Northwest. He was from Chicago, one of the industry's own: a vice president of Kraft.

Routinely ranked at or near the top of the industry with tens of billions of dollars in annual sales, Kraft has a power lineup of more than fifty-five brands that can carry the consumer through an entire day, from breakfast to midnight snack. For breakfast, it has stuffed bageles in eight varieties, with fully cooked bacon you can store in the cupboard right next to Tang, and its powdered drink you can substitute for real orange juice. For lunch it has hot dogs, macaroni and cheese, and a TV dinner-like tray of meat and cheese called Lunchables. For dinner, it has the Velveeta Cheesy Skillets dinner kit, Shake 'n Bake, and Stove Top Stuffing. And for snacking, it has the king of cookies, the Oreo, which, at 490 billion cookies sold since its introduction a century ago, holds the crown as the most popular cookie of all time. As Kraft CEO, Bob Eckert, would tell a reporter later that year, his singular aim was to dominate the industry: “If I ask who's the undisputed leader of the food industry, you might say Kraft. Then again, you might say Nestlé, Kellogg, General Mills, Nabisco. There is a whole cadre of companies performing well, but nobody's really broken away from the pack. And that's what I'd like to see Kraft do.”

Mudd had risen through Kraft's corporate affairs office to become a company spokesman and much more. He tracked how consumers viewed the company generally, watched for signs of trouble from regulators, and helped guide the company's rapid response to any significant threats, like the tempest that had arisen a few years earlier over trans fats. He was deeply attuned to public sentiment, a seasoned fixer highly skilled in dealing with critics. His insights had garnered so much respect that—at least in the view of other senior Kraft officials—Mudd became something of a consigliere to the company's chief executives, the adviser whose whisperings helped guide the boss's every move. As he stood on the stage that evening, the CEOs in the audience knew that it was in their interest to listen.

“I very much appreciate this opportunity to talk to you about childhood obesity and the growing challenge it presents for us all,” Mudd began. “Let me say right at the start, this is not an easy subject. There are no easy answers—for what the public health community must do to bring this problem under control. Or for what the industry should do as others seek

hold it accountable for what has happened. But this much is clear: For those of us who've looked hard at this issue, whether they're public health professionals or staff specialists at your own companies, we feel sure that the one thing we shouldn't do is nothing."

As he spoke, Mudd clicked through a deck of slides—114 in all—that were projected on a large screen behind him. This would be straight-up, in-your-face talk, no sugar-coating on his part. The headlines and phrases and figures were nothing short of staggering.

More than half of American adults were now considered overweight, with nearly one quarter of the population—40 million adults—carrying so many extra pounds that they were clinically defined as obese. Among children, the rates had more than doubled since 1980, the year when the fat line on the charts began angling up, and the number of kids considered obese had shot past 12 million. (It was still only 1999; the nation's obesity rates would climb much higher.)

"Massive social costs estimated as high as \$40–\$100 billion a year," announced one of Mudd's slides in bright, bold lettering.

Then came the specifics: diabetes, heart disease, hypertension, gallbladder disease, osteoarthritis, three types of cancer—breast, colon, and that of the uterus lining—all on the rise. To varying degrees, the executives were told, obesity was being cited as one of the causes for each of these health crises. To drive the point home, they were shown how to calculate obesity using the body mass index, a simple ratio of height to weight, and given a few moments to determine their own BMIs with the formula that flashed up on the screen. (On this count, most of the men in the room could rest easy. They had personal trainers, gym memberships, and enough nutritional awareness to avoid diets that were heavy in the foods they manufactured.)

Mudd then brought them back to the reality as experienced by their middle-class customers, who were spending their gym time working a second job to make ends meet and not thinking too hard about their own diets. The media were having a field day with these people, he said, churning out front-page stories on obesity and the industry's role in fostering overconsumption. Up on the screen, he played a snippet from a new PBS *Frontline* report called "Fat," which featured the chair of Harvard's Department of Nutrition, Walter Willett, pointing the finger directly at the food companies. "The transition of food to being an industrial product really has been a fundamental problem," Willett said. "First, the actual processing has stripped away the nutritional value of the food. Most of the grains have been converted to starches. We have sugar in concentrated form, and many of the fats have been concentrated and then, worst of all, hydrogenated, which creates trans-fatty acids with very adverse effects on health."

Food manufacturers were getting heat not only from powerful critics at Harvard, the federal Centers for Disease Control and Prevention, the American Heart Association, and the Cancer Society, Mudd said. They were now losing key allies. The secretary of agriculture, over whom the industry had long held sway, had recently called obesity a "national epidemic." And it didn't take much effort to see why the USDA chief felt compelled to bite the hand that feeds. The agency promoted healthy eating through its food pyramid, with grains at the base and far smaller quantities of sweets and fat squeezed into the top. The companies, Mudd told the executives, were promoting the *opposite* habits. "If you mapped the categories of food advertising, especially advertising to kids, against the Food Guide Pyrami

it would turn the pyramid on its head,” he said. “We cannot pretend food isn’t part of the obesity problem. No credible expert will attribute the rise in obesity solely to decreased physical activity.”

He flashed another slide up on the screen. “What’s driving the increase?” it asked. “Ubiquity of inexpensive, good-tasting, super-sized, energy-dense foods.” In other words, the very foods on which these executives, along with their brethren in the fast food chains, had staked the success of their companies.

Having laid the blame for obesity at the feet of the CEOs, Mudd then did the unthinkable. He touched the third rail of the processed food industry, drawing a connection to the laziest thing in the world the CEOs wanted linked to their products: cigarettes. First came a quote from a Yale University professor of psychology and public health, Kelly Brownell, who had become an especially vocal proponent of the view that the processed food industry should be seen as a public health menace: “As a culture, we’ve become upset by the tobacco companies advertising to children, but we sit idly by while the food companies do the very same thing. And we could make a claim that the toll taken on the public health by a poor diet rivals that taken by tobacco.”

Mudd then flashed a big yellow caution sign with the words, “SLIPPERY SLOPE,” up on the screen. “If anyone in the food industry ever doubted there was a slippery slope out there, imagine they are beginning to experience a distinct sliding sensation right about now,” he said. “We all know that the food and tobacco situations are not the same,” but the same trial lawyers who were flush with the spoils of tobacco litigation were now lurking, poised to strike the food industry as well. Moreover, the surgeon general—whose office had produced the landmark attack on cigarettes back in 1964—was preparing a report on obesity. In the hands of these lawyers and politicians, one aspect of the obesity crisis in particular would leave the food industry exposed: the public nature of overeating and its consequences. The sight of an overweight adult trudging down the grocery aisle or an overweight kid on the playground was galvanizing. “Obesity is an utterly visible problem,” Mudd said. “As its prevalence increases, it will be obvious to all.”

Then Mudd shifted gears. He stopped with the bad news and presented the plan he and the other industry insiders had devised to address the obesity problem. Merely getting the executives to acknowledge some culpability was an important first step, he knew, so his plan would start off with a small but crucial move. The industry, he said, should take up the obesity crisis and use the expertise of scientists—its own and others—to gain a much deeper understanding of what exactly was driving Americans to overeat. Once this was achieved, the effort could unfold on several fronts. To be sure, there would be no getting around the role that packaged foods and drinks play in overconsumption. Some industry officials had already begun discussing the power of foods to create cravings and to overwhelm the best intentions of dieters. To diminish these cravings, they would have to pull back on their use of salt, sugar, and fat, perhaps by imposing industry-wide limits—not on the meager-selling low-fat or low-sugar items that companies put on the grocery shelf for dieters, but on the big-selling mainline products themselves, which had a huge effect on the nation’s health. However, these three ingredients and their formulas were not the only tools the industry wielded to create the greatest possible allure for their products. The schemes they used to advertise and market their products were critical, too. In keeping with his desire to avoid alienating the executives

entirely, Mudd emphasized this aspect of their trade. He proposed creating a “code to guide the nutritional aspects of food marketing, especially to children.”

He also suggested that they begin promoting the role of exercise in controlling weight, since no one could expect to get trim—or stay that way—sitting on the couch. This could include public service announcements, he said, or a powerful, full-blown advertising campaign like that deployed by the Partnership for a Drug-Free America, in which tobacco and pharmaceutical industries had joined forces to produce iconic ads like the 1980s commercial that showed a man cracking an egg into a frying pan while saying, “This is your brain on drugs.”

“I want to be very clear here,” Mudd said in closing, and he underlined words in his written presentation to make sure he hit the right notes. “In saying that the obesity problem will take a long time to solve, or even by using the word ‘solve,’ we are not for a moment suggesting that this program or the food industry alone can possibly solve the problem. Our goal is that *that’s* the measure of success for this program. We *are* saying that the industry should make a sincere effort to be *part* of the solution. And that by doing so, we can help to defuse the criticism that’s building against us. We don’t have to singlehandedly *solve* the obesity problem in order to address the criticism. But we have to make a sincere effort to be *part* of the solution if we expect to avoid being demonized.”

What happened next was not written down. But according to three participants, when Mudd stopped talking, all eyes turned to the one CEO whose recent exploits in the grocery store had awed the rest of the industry. His name was Stephen Sanger, and he was also the person—as head of General Mills—who had the most to lose when it came to dealing with obesity. His \$2 billion lineup of sugary cereals, from Count Chocula to Lucky Charms, was now drawing more fire from consumer advocates than soda. Under his leadership, General Mills had transformed entire sections of the grocery store, capitalizing on society’s hunger for faster, more convenient food. Sanger had been sitting front and center, in a seat that reflected his position atop the pecking order. Now he stood, his body tense, to address Michael Mudd, and he did so visibly upset.

Sanger began by reminding the group that consumers were “fickle,” as were their ivory tower advocates. Their concerns about the health implications of packaged foods waxed and waned. Sometimes they worried about sugar, other times fat. But most often, he said, they bought what they liked, and they liked what tasted good. “Don’t talk to me about nutrition,” he said, taking on the voice of a typical consumer. “Talk to me about taste, and if this stuff tastes better, don’t run around trying to sell stuff that doesn’t taste good.”

Besides, Sanger said, the industry had always managed to ride things out—the trans fat panic, for instance, or the desire for more whole grains—by making adjustments. In fact, the industry had not only weathered these squalls, it had acted responsibly, to the public *and* to its shareholders. To go further, to react to the critics, would jeopardize the sanctity of the recipes that had made his products so successful. General Mills would not pull back, Sanger said. He would push his people onward, and he urged his peers to do the same. Then he sat down.

Not everyone at the meeting shared Sanger’s views. But his stance was so forceful, so persuasive and, yes, so comforting to the other executives that no one else sought to counter the position he voiced. Sanger’s response effectively ended the meeting.

Years later, his words still stung. “What can I say,” Behnke said. “It didn’t work. The guys weren’t as receptive as we thought they would be.” Behnke chose his words slowly and deliberately, to paraphrase them as best he could. He wanted to be fair. “Sanger felt very strongly that, ‘Look, we fortify our cereals. We are very concerned about nutrition. We’ve got a big range of products. You know, you tell me what you’re interested in, and we’ve got a product that serves your needs. And so why should we adjust our sights and move the whole portfolio towards some lower calorie, lower sugar level, lower fat level kind of product line? There is no need to do that. We already have those alternatives. And we’re selling all of those things. You guys are overreacting.’”

“Sanger,” Behnke added, “was trying to say, ‘Look, we’re not going to screw around with the company jewels here and change the formulations because a bunch of guys in white coats are worried about obesity.’”

And that was that. The executives got up and took the elevators to the 40th floor for dinner, where the talk was polite and insubstantial. Except for Kraft, all eleven of the major food manufacturers at the meeting spurned the idea of collectively down-formulating their products to ease their effects on Americans’ health. They even largely ignored Mudd’s request that they start fighting obesity by contributing to a modest \$15 million fund for research and public education. “I don’t think anything ever came of that as a group effort,” recalls John Cady, who was president of the National Food Processors Association, one of two trade organizations at the dinner.

Instead, America’s food companies charged into the new millennium. Publicly, there would be some overtures toward better nutrition, especially when it came to reducing salt in their products. General Mills—eight years later, after intense public pressure—even began lowering the sugar loads in its cereals and later announced, in 2009, that it would take another half a teaspoon of sugar out of the cereals it advertised to children, steps that some health advocates dismissed as late and disappointingly small. The reality was that behind the scenes, having resolved to ignore obesity, the CEOs and their companies picked up right where they had left off, using, in some cases, more salt, more sugar, and more fat to edge out the competition.

Even Kraft set aside its initiative to fight obesity and got caught up in this fervor in 2006 when Hershey began cutting into its share of the cookie aisle. Hershey was famous for its chocolates, but to expand its sales it introduced a new line of products that combined its chocolate with wafers to create chocolate cookies like its S’more product. The company’s chocolate already had lots of fat, but the S’more took the allure to new heights by adding more sugar and salt to the mix. Each of these mega-rich cookies weighed less than two ounces and contained five teaspoons of sugar. Alarmed by this incursion, Kraft responded with force. Daryl Brewster, who ran the Nabisco division at the time, told me that Hershey’s move “put us in one of those interesting squeezes that big companies can find themselves in. To be competitive, we’ve got to add fat.” Its biggest seller, the Oreo, got a slew of rich, fat-laden variations, from Banana Split Creme Oreo to Triple Double Oreo to Oreo Fudge Sundae Creme. Kraft then went out and acquired its very own chocolate maker, Cadbury, one of the world’s biggest confectionaries. It would use Cadbury’s marketing arm to spread this new lineup to places like India, where, starting in 2011, the country’s 1.2 billion people got hit by Oreo ads that caught them up on some of the American processed food industry’s mo-

compelling eating instructions: “Twist, Lick, Dunk.”

As in slam dunk, for Kraft.

I was five months into the reporting and research for this book when I heard about the secret CEO meeting. I found it remarkable, first and foremost, for the insider admissions of guilt. This kind of frankness almost never happens in large corporations; it is tantamount to a bunch of mafia dons getting together to express remorse for breaking heads. But I was also struck by how prescient the organizers of the sit-down had been. Ten years after the meeting, concerns over obesity had not only continued, they had reached hurricane strength: from Washington, where Army generals testified publicly that eighteen-year-olds were getting too fat to recruit; to Philadelphia, where city officials banished TastyKake pastries—a hometown favorite—from school cafeterias in declaring an all-out war to help overweight kids; to Los Angeles, where doctors reported a rise in maternal deaths because excessive weight was increasingly hampering surgical needs in cesarean births. On both coasts and in between, there were too many millions of obese people to believe that they had all done themselves in, either by failing to exert enough willpower or because of some other personal flaw. Children had become especially vulnerable. Excessive weight among kids went from double to triple the rate it had been in 1980, when the trend began to surface. Diabetes was up, too, and not just in adults—doctors had begun spotting the early signs of this debilitating disease in young children. Even gout, an exceedingly painful and rare form of arthritis once dubbed “the rich man’s disease” for its associations with gluttony, now afflicted eight million Americans.

If the problem was much smaller in 1999, the opportunity to change course had never been greater. This was a time when we, as consumers, trusted more than we doubted. We didn’t question, or understand, what we were putting into our bodies—at least not like we do today. At that point, the media still fawned over the release of every new food or drink designed to be handheld, for the road, convenient. “Slow food” was a complaint, not a social movement.

In some ways, the officials at Pillsbury and Kraft who organized the CEO meeting went even further than I was prepared to go, more than a decade later, in assessing the effects of their work, especially with their talk of cancer. Nutrition science is so notoriously mushy that blaming even a fraction of our cancer on processed foods requires a leap I am not comfortable making. Food studies don’t have the rigor of the double-blind randomized trials that are the norm in drug company research, and blaming any single food product for our health troubles is particularly fraught. Yet here they were, linking their own products to a significant part of the country’s health troubles, from diabetes to heart disease to cancer.

Their lack of reticence raised a tantalizing question: If industry officials were willing to go this far, this fast, in accepting responsibility, what else did they know that they were not saying publicly?

The lengths to which food companies will go in order to shield their operations from public view were already apparent to me from my own recent reporting odyssey, which had started in early 2009 in southwest Georgia, where an outbreak of salmonella in a decrepit peanut factory left eight people dead and an estimated nineteen thousand in forty-three states sick. It took a long, winding hunt for me to track down the secret inspection report that revealed our

of the root causes: Food manufacturers like Kellogg had relied on a private inspector, paid by the factory, to vouch for the safety of the peanuts. The report the inspector wrote in visiting the factory shortly before the outbreak cited none of the obvious warning signs, like the rain and the leaky roof.

Later, in attempting to trace an *E. coli*-tainted shipment of hamburger that had made hundreds ill and paralyzed a twenty-two-year-old former dance teacher in Minnesota named Stephanie Smith, I found the federal government to be of little help. Not only that, the Department of Agriculture is actually complicit in the meat industry's secrecy. Citing competitive interests, the public agency refused my requests for the most basic facts, like which slaughterhouses had supplied the meat. I ultimately obtained the information from an industry insider, and the smoking-gun document—a detailed, second-by-second account of the hamburger production process called a “grinding log”—showed why the government is so protective of the industry it is supposed to be holding accountable. The burger that Stephanie ate, made by Cargill, had been an amalgam of various grades of meat from different parts of the cow and from multiple slaughterhouses as far away as Uruguay. The meat industry, with the blessing of the federal government, was avoiding steps that could make their products safer for consumers. The *E. coli* starts in the slaughterhouses, where feces tainted with the pathogen can contaminate the meat when the hides of cows are pulled off. Yet many of the biggest slaughterhouses would sell their meat only to hamburger makers like Cargill if they agreed *not* to test their meat for *E. coli* until it was mixed together with shipments from other slaughterhouses. This insulated the slaughterhouses from costly recalls when the pathogen was found in ground beef, but it also prevented government officials and the public from tracing the *E. coli* back to its source. When it comes to pathogens in the meat industry, ignorance is financial bliss.

Salt, sugar, and fat are an entirely different game. Not only are they not accidental contaminants like *E. coli*, the industry methodically studies and controls their use. The confidential industry records that came my way in the course of reporting this book show exactly how deliberate and calculating a matter this is. To make a new soda guaranteed to create a craving requires the high math of regression analysis and intricate charts to plot what industry insiders call the “bliss point,” or the precise amount of sugar or fat or salt that will send consumers over the moon. At a laboratory in White Plains, New York, industry scientists who perform this alchemy walked me, step by step, through the process of engineering a new soda so that I could see the creation of bliss firsthand. To understand how the industry deploys fat in creating allure, I traveled to Madison, Wisconsin, home of Oscar Mayer and the man who invented the prepackaged whole meals called Lunchables, a colossus among convenience foods that radically changed the eating habits of millions of American kids. He went into his cabinets to pull out the company records that weighed the pros and cons of using real pepperoni versus pepperoni flavor and described the allure of fat-laden meat and cheese in cuddly terms like “product delivery cues.” Both fat and salt are at the heart of Frito-Lay's operations in Plano, Texas, and some of the company's favorite methods for manipulating these two ingredients were relayed to me by a former chief scientist there named Robert I-San Lin. These include a remarkable effort by company officials to reduce the ideal snack to a mathematical equation of taste and convenience—“ $P = A_1T + A_2C + A_3U + B_1\$ - B_2H - B_3Q$,” with the P standing for Purchase and the allure of fat and salt easily

overcoming the *H*, or the public's health concerns.

I would find out that one of the most compelling, and unsettling, aspects of the role of salt, sugar, and fat in processed foods is the way the industry, in an effort to boost their power, has sought to alter their physical shape and structure. Scientists at Nestlé are currently fiddling with the distribution and shape of fat globules to affect their absorption rate and, as it's known in the industry, their "mouthfeel." At Cargill, the world's leading supplier of salt, scientists are altering the physical shape of salt, pulverizing it into a fine powder to hit the taste buds faster and harder, improving what the company calls its "flavor burst." Sugar is being altered in myriad ways as well. The sweetest component of simple sugar, fructose, has been crystallized into an additive that boosts the allure of foods. Scientists have also created enhancers that amplify the sweetness of sugar to two hundred times its natural strength.

Some of the physical reconfiguration of salt, sugar, and fat is couched as an effort to reduce the consumption of any one ingredient, as in low-fat or low-sugar products; a super salt, for instance, might mean that less salt is needed. But one facet of processed food is held sacrosanct by the industry. Any improvement to the nutritional profile of a product can in no way diminish its allure, and this has led to one of the industry's most devious moves: lowering one bad boy ingredient like fat while quietly adding more sugar to keep people hooked.

As powerful as they are, salt, sugar, and fat are just part of the industry's blueprint for shaping America's eating habits. Marketing is a full partner to the ingredients. Lunchables, for one, are a marketing powerhouse, specifically designed to exploit the guilt of working moms and the desire of kids for a little empowerment. These ready-to-eat meals typically include pieces of meat, cheese, crackers, and candy, allowing kids to assemble them in whatever combination they desire. Food marketers wield pinpoint psychological targeting, and they didn't disappoint on the Lunchables ads: The ads stressed that lunch was a time for them, not their parents.

The marketing side of processed food, it became clear in the research for this book, is also where the industry's hold on federal regulators is most evident. Federal officials do more than shield company records from public view. The biggest government watchdogs show no teeth when it comes to controlling the industry's excesses in promoting sugary, high-calorie fare, not only on TV but also in the full range of social media now used by the food industry in its pursuit of kids. Moreover, the government has grown so cozy with food manufacturers that some of the biggest industry coups would not have been possible without Washington's help. When consumers tried to improve their health by shifting to skim milk, Congress set up a scheme for the powerful dairy industry through which it has quietly turned all that unwanted, surplus fat into huge sales of cheese—not cheese to be eaten before or after dinner as a delicacy, but cheese that is slipped into our food as an alluring but unnecessary extra ingredient. The toll, thirty years later: The average American now consumes as much as thirty-three pounds of cheese a year.

The industry's pursuit of allure is extremely sophisticated, and it leaves nothing to chance. Some of the largest companies are now using brain scans to study how we react neurologically to certain foods, especially to sugar. They've discovered that the brain lights up for sugar the same way it does for cocaine, and this knowledge is useful, not only in formulating foods. The world's biggest ice cream maker, Unilever, for instance, parlayed its

brain research into a brilliant marketing campaign that sells the eating of ice cream as “scientifically proven” way to make ourselves happy.

The manufacturers of processed food have also benefited profoundly from a corner of the consumer goods market where shrewdness in marketing has no equal: the tobacco industry. This relationship began in 1985, when R. J. Reynolds bought Nabisco, and reached epic levels a few years later when the world’s largest cigarette maker, Philip Morris, became the largest food company by acquiring the two largest food manufacturers, General Foods and Kraft. A trove of confidential tobacco industry records—81 million pages and growing—opened to public viewing by the states’ legal settlement with the industry reveals that top officials at Philip Morris were guiding the food giants through their most critical moments, from rescuing products when sales foundered to devising a strategy for dealing with the public’s mounting health concerns. In fact, the same year that the CEOs met to consider obesity, Philip Morris was undergoing its own strategic shift in how it discussed and handled the health aspects of nicotine. Bludgeoned by media attacks and the public’s growing concern about smoking, the company privately warned and prepared its food executives to deal with similar blood battles over the heart of their operations: namely, the salt, sugar, and fat.

“The tobacco wars are coming to everyone’s neighborhood,” one Philip Morris strategy paper warned back in the 1990s. “For beer, we have evidence of rising anti-alcohol sentiment in the U.S. And for food, it is clear that the biotech issue, already so ripe in Europe, is spreading internationally. There are also the continuing issues of food safety and the health effects of certain food elements such as fat, salt and sugar.”

To win these wars, the strategy paper continued, the company would have to explore and study its vulnerabilities and even open dialogues with its critics. “This means we have to engage. No more bunkers.”

More and more, consumers have come to focus on these same three ingredients, whether out of concern for obesity and heart disease or simply a desire to eat food that is less processed and more real. There has been a commensurate push from elected officials too, from the White House to City Hall in New York, where salt, sugar, fat, and calories in processed food have come under heightened criticism. The response from food manufacturers has been to give health-conscious consumers more of a choice by turning out better-for-you versions of their mainline products. The further they go down this path, however, the harder they bump up against two stark realities of their industry.

First, the food companies themselves are hooked on salt, sugar, and fat. Their relentless drive to achieve the greatest allure for the lowest possible cost has drawn them, inexorably, to these three ingredients time and time again. Sugar not only sweetens, it replaces more costly ingredients—like tomatoes in ketchup—to add bulk and texture. For little added expense, a variety of fats can be slipped into food formulas to stimulate overeating and improve mouthfeel. And salt, barely more expensive than water, has miraculous powers to boost the appeal of processed food.

The industry’s dependence on these ingredients became starkly evident when three of the biggest food manufacturers let me in to observe their efforts to cut back on salt. Kellogg, for one, made me a saltless version of their mega-selling Cheez-Its, which normally I can keep

eating forever. Without any salt, however, the crackers lost their magic. They felt like straw chewed like cardboard, and had zero taste. The same thing happened with the soups and meats and breads that other manufacturers, including Campbell, attempted to make for me. Take more than a little salt, or sugar, or fat out of processed food, these experiments showed, and there is nothing left. Or, even worse, what is left are the inexorable consequences of food processing, repulsive tastes that are bitter, metallic, and astringent. The industry has boxed itself in.

The second obstacle the industry faces in exacting any real reforms is the relentless competition for space on the grocery shelf. When PepsiCo in 2010 launched a campaign to promote its line of better-for-you products, the first drop in sales prompted Wall Street to demand that the company return to promoting its core drinks and snacks: those with the most salt, sugar, and fat. At Coca-Cola, meanwhile, PepsiCo's move was immediately seized upon as an opportunity to gain ground by pumping more money and effort into doing the one thing they do best—selling soda.

“We are doubling down on soft drinks,” Coke's executives boasted to Jeffrey Dunn, former president of Coca-Cola North America and Latin America who left the company after trying, and failing, to instill some health consciousness at Coke. Dunn, who would share some of the soda industry's most closely held secrets with me, said that Coke's reaction was understandable, given the fierce competition, but indefensible in the context of surging obesity rates. “To me, that is like damn the torpedoes, full speed ahead. If they choose that path, they have to be accountable for the social costs of what they are doing.”

In the end, that is what this book is about. It will show how the makers of processed food have chosen, time and again, to double down on their efforts to dominate the American diet, gambling that consumers won't figure them out. It will show how they push ahead, despite their own misgivings. And it will hold them accountable for the social costs that keep climbing even as some of their own say, “Enough already.”

Inevitably, the manufacturers of processed food argue that they have allowed us to become the people we want to be, fast and busy, no longer slaves to the stove. But in their hands, the salt, sugar, and fat they have used to propel this social transformation are not nutrients as much as weapons—weapons they deploy, certainly, to defeat their competitors but also to keep us coming back for more.

“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 cereals 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 romance 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 shadowed corners and sides. So Sclafani put a little of the cereal in the brightly lit, open center of the 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 earlier 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 14 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 the 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 the 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 Mennell, 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," Mennell 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 most 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 the companies would want to put on their labels, like they do in boasting about a product 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 was 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 “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

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