



Sweet Sour

Robert Lustig, MD '80, is sounding the alarm about what he sees as dangerous levels of sugar in the American diet

BY BETH SAULNIER

In April 2011, the *New York Times Magazine* ran a cover story that asked a pithy, pointed question: Is sugar toxic? Its author, Gary Taubes, opened the piece by noting that a lecture on the subject given by a pediatric endocrinologist prominent in the anti-sugar movement had gotten more than 800,000 hits on YouTube since it had been uploaded in July 2009. And the video was adding some 50,000 views each month—"fairly remarkable numbers for a ninety-minute discussion of the nuances of fructose biochemistry and human physiology."

Nearly five years after that story was published, the YouTube tally for "Sugar: The Bitter Truth" stands at more than 6.1 million. And the physician-scientist who gave the talk—Robert Lustig, MD '80, an expert on childhood obesity at the University of California, San Francisco—is continuing to lead the charge against what he sees as the Western world's leading dietary demon. He doesn't mince words. "Fructose is a poison," Lustig says in his much-viewed lecture—an allegation he has repeated in books, articles, media

interviews, documentaries, and countless other talks. "We've had our food supply adulterated, contaminated, poisoned, tainted, on purpose. And we've allowed it."

Lustig isn't just worried about sugary beverages like soda and juice—though he is plenty concerned about them—or dessert items like ice cream, candy, and cupcakes. It may come as a surprise that he enjoys a slice of Junior's cheesecake whenever he visits New York, or a bowl of bread pudding with whiskey sauce when he goes to New Orleans. His wife is an avid baker—"she's Norwegian; I can't stop her; it's therapy"—who makes cookies for their kids on a weekly basis, though she generally cuts the sugar in any recipe by a third. "I eat her cookies, because they're worth it; if you're going to eat dessert, make it a damn good one," says Lustig, chatting with CAM over (unsweetened) coffee at an outdoor café near his UCSF office last fall. "I'm not a hard-ass, and I'm not a sugar teetotaler in the classic sense. I eat dessert, but it's got to be a really good one for me to spend my sugar allotment on it." ▶



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MAN ON A MISSION:
ROBERT LUSTIG, MD '80,
CALLS EXCESSIVE FRUCTOSE
CONSUMPTION A PUBLIC
HEALTH CRISIS.



One of Lustig's central concerns is the sugar that's hidden in the American diet—what's lurking in products that we don't think of as particularly sweet. "Fifty percent of the sugar that we consume is in sodas and things we identify as dessert—and that means 50 percent is not," he says. "Half of the sugar we consume is in foods we didn't know had it." That includes such things as pasta sauce, yogurt, salad dressing, breakfast cereal, ketchup, bread, barbecue sauce, and nutrition bars. The food industry, Lustig says, adds all that sugar to make its products more palatable, shelf-stable, and appealing to humans—who, after all, evolved to crave the taste of sweet things at a time of scarcity, when ingesting as many calories as possible held a Darwinian advantage. And by "sugar," Lustig doesn't just mean the granular white stuff, but also the more than fifty sweeteners commonly used in processed foods—from wholesome-seeming products like maple syrup, honey, and agave nectar to the now-reviled high-fructose corn syrup and more obscurely named ingredients like evaporated cane juice.

According to figures from the USDA (last updated in mid-2015), the average American consumes about seventy-seven pounds of added sugars a year, about twenty-three teaspoons per day—a figure that includes granulated sugar, high-fructose corn syrup, and other caloric sweeteners (but, Lustig notes, does not include fruit juice). The most recent nutritional guidelines, released in January, call for added sugars to comprise no more than 10 percent of daily calories, totaling around ten to twelve teaspoons per day, roughly equal to what's in a single can of soda. The FDA is currently reviewing proposed changes to nutritional labeling that, for the first time, would break out added sugars—so, for example, it would be clear how many of the grams listed on a container of fruit-flavored yogurt were due to added sweeteners rather than to lactose,

THE AVERAGE
AMERICAN CONSUMES

77

POUNDS OF ADDED
SUGARS PER YEAR



the sugar naturally occurring in milk.

In Lustig's 2012 book *Fat Chance: Beating the Odds Against Sugar, Processed Food, Obesity, and Disease*, he notes that a tally of the McDonald's menu found only seven sugar-free items: French fries, hash browns, sausage, Chicken McNuggets (sans the dipping sauce), Diet Coke, black coffee, and unsweetened iced tea. In casual conversation, he can reel off—from memory,

and with no small measure of horror—the amount of sugar in a single serving of Trader Joe's frozen Spicy Beef and Broccoli: fifty-two grams, equal to thirteen teaspoons. (The company has since reformulated it to reduce the sugar to twenty-seven grams.) "A little sugar's OK; a lot is not," he says. "The point is, if you have a cupcake, you know what you're eating. But if you have a yogurt, a hot dog, or chicken teriyaki, you don't know what you're eating."

'Is Sugar a Food?'

When Lustig discusses the issue, he tends to favor the Socratic method, posing questions that prompt the listener to radically reconsider the conventional wisdom. One of his standards is this: "Is sugar a food?"

Lustig argues that it is not. He deems it a "food additive," one whose closest analog is alcohol: a substance that may provide energy but is harmful and addictive when consumed in excessive quantities, and is not chemically essential to life. (In 2013, he published an article in the journal *Advances in Nutrition* entitled "Fructose: It's Alcohol Without the Buzz.") "We add sugar to food to make it sweeter; I'm not arguing that," he says. "But is it required? No, not by any organ. Fructose has no use in the human body; there is not one biochemical reaction that requires it. And when you purify it, it's a drug. It does the same things that alcohol does: it lights up the brain's reward system, and it's addictive. So the same criteria that we judge alcohol by, we should be judging sugar by." His ultimate aim: to have sugar removed from the so-called GRAS list of substances that are "generally recognized as safe," and therefore exempt from regulation and limitation under the Federal Food, Drug, and Cosmetic Act of 1938.

The crux of Lustig's argument about sugar's harmful effect on the body—and the subject of some hard-core biochemistry in his YouTube lecture—is the way in which the body processes fructose, which he calls "the Voldemort of the dietary hit list."

The *CliffsNotes* version starts with the fact that sugar—a.k.a. sucrose—is made up of one molecule each of glucose and fructose. The glucose by itself isn't the problem; glucose is commonly known as the "energy of life," and every cell in the body can metabolize it. What concerns Lustig is how the massive doses of fructose ➤

'Sugar Scare Me'



Lewis Cantley, PhD '75, warns of fructose's link to cancer

Among the scientists who are firmly in Lustig's camp on the sugar toxicity issue is one of the most prominent members of the Medical College faculty: cell biologist and biochemist Lewis Cantley, PhD '75. The director of Weill Cornell's Meyer Cancer Center and a doctoral alumnus of the Ithaca campus, Cantley has some hefty scientific bona fides. When he was at Harvard in the Eighties, his lab discovered a signaling pathway, known as PI3-kinase, that's key to cell growth and to the proliferation of many cancers. That work, and his subsequent research in the field, has brought him numerous accolades including the \$3 million Breakthrough Prize in Life Sciences; in January he won the Wolf Prize, considered Israel's answer to the Nobel.

When it comes to the sweet stuff, Cantley—who, like Lustig, was interviewed by Dr. Sanjay Gupta for a "60 Minutes" story on sugar toxicity in 2012—puts it baldly: "Sugar scares me." For years, he has scrupulously avoided it in his own diet, and confesses to being "incredibly frustrated" at how hard it is to find cereal or yogurt that doesn't have sugar added. Regarding the dozens of arcane terms for sweeteners on food labels, he says: "The way the packaging ingredients are being obscured, it would be hilarious if it weren't so sad."

For Cantley, the perils of sugar go beyond the diseases of metabolic syndrome. He says that its connection to cancer is becoming increasingly clear, based on analyses showing that people with type 2 diabetes—a state of extreme insulin resistance—have much higher rates of a variety of cancers, including those of the endometrium, breast, pancreas, colon, and brain. "Insulin is the best of all activators of PI3-kinase—and PI3-kinase is arguably the most mutated pathway in all of cancer," he explains. "So if you follow the logic that anything that drives activation of PI3-kinase ultimately results in cancer, and that insulin is the best way to do it, then that suggests that having high levels of insulin is likely to drive your cancer. And what drives insulin levels is sugar."

As Gupta explained on "60 Minutes," about a third of cancers have insulin receptors—meaning that if you consume more sugar than your body can process without causing insulin levels to spike, it essentially feeds tumor growth. "To me, that's what's really scary," Cantley says. "Almost 50 percent of Americans now have some level of insulin resistance; in other words, they're eating so much sugar that their insulin levels are high all the time, and that's bound to be driving their cancers—and it correlates. That's what we're seeing in retrospective studies. In my mind, the mechanism is very clear."

Mindful Munching



Professor Brian Wansink, director of Cornell's Food and Brand Lab, studies how subtle alterations in environment and behavior can change dietary habits for the better—the subject of his popular books Mindless Eating and Slim by Design. CAM asked him for some practical tips for reducing sugar consumption.

Distraction leads to satisfaction: Wansink has found that you can cut your chocolate consumption by 75 percent, but feel as content, if you follow a simple formula.

After eating a quarter of what you think will satisfy you—say, two squares of a Hershey bar instead of eight—put it away and distract yourself with a task. “Fifteen minutes later, people rate themselves as equally full, equally satisfied, and less guilty” than if they’d eaten the whole portion, Wansink says.



Opt for “fun sizes”: “We’ve found in our research that [to feel satisfied], the average amount of calories that somebody eats of a sweet snack is about 192, but the average candy bar is about 260,” Wansink says. “If we had our way, we’d eat two-thirds of a candy bar and feel happy. Effectively, smaller sizes help with that.”



Location, location: Wansink has found that moving a candy jar just six feet farther away can reduce consumption by a whopping 50 percent. “For instance, it cuts down the amount of calories of chocolate a person eats in a day from an average of about 225 to closer to 100. Over the course of a year, that adds up to about eleven pounds he or she would have gained in weight.” Also, if the jar is opaque rather than see-through, it reduces consumption by about a third.

Don’t eat out of the package: If you crave a treat, transfer a portion to a plate or bowl. If you dig into the bag or box, “you wind up on average eating 22 percent more.”

Stretch the sweetness: A standard snack in the Wansink household—a habit he picked up in college—is a large bowl of buttered popcorn mixed with a small bag of M&Ms. Wansink notes that it has the advantage of “splitting one bag of M&Ms across five people, instead of having five bags.”

Mood matters: In a collaboration with Weight Watchers, Wansink found that contentment makes people opt for healthy snacks over chocolate. To induce a positive mindset before choosing a snack, subjects were asked to name something for which they were grateful. “It’s only a difference in calories of around 11 percent,” he observes, “but it’s a difference in healthfulness of about 80 percent.”

delivered by a Western diet heavy on sweet beverages and processed foods affects the liver—the only organ that can metabolize it—and how this impaired liver function in turn damages human health. (Fructose consumed in whole fruit doesn’t have the same negative effects, he stresses, since fruit is packed with fiber that slows the rate, and reduces the overall amount, of fructose absorption in the digestive system. He also points out that sugar is consumed far more readily in juice form—since, for example, an eight-ounce glass of o.j. is squeezed from four oranges, far more than most people would eat in one sitting.)

Lustig still remembers the day in 1993 when he saw his first pediatric patient whose liver was mottled with fat—a condition normally seen in adults suffering from conditions like alcoholism, obesity, or diabetes. For the physician, it was something of a shot across the bow. Coupled with the rising numbers of obese kids and those with type 2 diabetes—once known as the “adult-onset” form of the disease due to its connection to lifestyle factors—he started to worry that something was going seriously awry.

Through his own research and that of colleagues, he homed in on the fact that when fructose is ingested quickly and in large

For Lustig, there’s a direct line from overconsumption of fructose to the perils of metabolic syndrome.

quantities, it leads to a vicious cycle of what’s known as “insulin resistance”—when cells stop responding to the hormone, and the pancreas tries to compensate by overproducing it—and the build-up of liver fat, which leads to even more insulin resistance. That puts the body on the path toward metabolic syndrome, most commonly defined as having at least three of the following conditions: obesity, diabetes, hypertension, heart disease, and elevated levels of so-called “bad” cholesterol. A major risk factor for premature death, metabolic syndrome is now at epidemic levels throughout the Western world: a study published in the *Journal of the American Medical Association* in May 2015, based on 1999–2006 statistics from the National Health and Nutrition Examination Survey, found that more than a third of U.S. adults suffer from it. Among those over sixty, the rate was nearly half.

Although Lustig has his share of detractors—those who say that the science is inconclusive, and that he is over-reaching—for him and his fellow anti-sugar activists, there’s a direct line from overconsumption of fructose to the perils of metabolic syndrome. But on the bright side, he says, that means that cutting fructose can have dramatic health benefits. In October 2015, the journal *Obesity* published an NIH-funded study that supports that position. The article, with Lustig as lead author, reported the effects



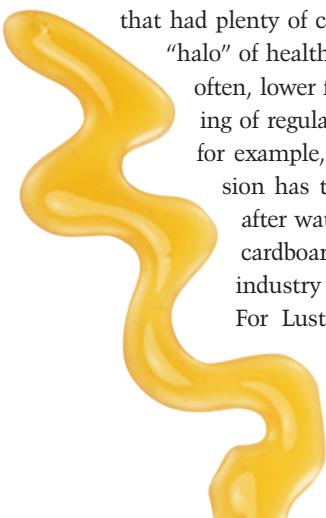
of cutting added sugar from the diets of forty-three obese children and teens, who also had at least one other disease of metabolic syndrome. "We basically replaced sugar with starch," he says. "We took the chicken teriyaki out and put the turkey hotdogs in. We took the sweetened yogurt out and put the baked potato chips in. We took the pastries out and put the bagels in." Since the kids were given the same number of calories as before, their amount of subcutaneous fat—the kind right under the skin, such as a "spare tire"—didn't change. But their visceral fat—the metabolically dangerous type that bathes the internal organs—dropped 7 percent, and their insulin sensitivity improved. And most remarkably: their liver fat went down a striking 22 percent.

The Calorie Conundrum

The *Obesity* study underscores one of Lustig's central messages: not all calories are created equal. For decades, the received wisdom has been that it didn't matter whether a calorie came from kale or candy: it would fuel the body in the same way. "At MIT, I majored in nutritional biochemistry; I knew back in 1975 that different calories did different things in the body," Lustig observes. "And then I went into medicine, and they kind of beat it out of you. Any problem was related to total calories, and it's been that way ever since; a calorie's a calorie. If you eat more than you burn, you gain weight; if you eat less than you burn, you lose weight. That's how I used to practice. Anytime I saw an obese patient, it wasn't an endocrine problem, it was a behavioral problem. The only answer was 'eat less and exercise more.' I believed that, just like everybody else did—and virtually everyone still does."

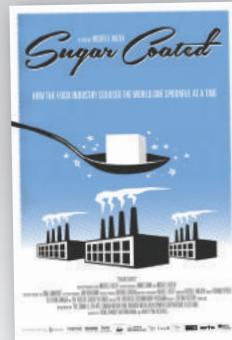
But if—as Lustig believes, and as some studies now seem to be bearing out—the body processes large doses of fructose in a way that is uniquely deleterious to human health, it could go a long way toward explaining why so many Americans have become increasingly fatter, sicker, and less active over the past several decades. Lustig and others trace the rise in fructose consumption to a proverbial perfect storm of factors in the Seventies: changes in federal agricultural policy that promoted investment in commodity crops like corn and sugar beets; the introduction of high-fructose corn syrup; and the prescription of a high-carb, low-fat diet in the belief—now widely considered to have been based on faulty science—that it was the key to preventing heart disease. That ushered in the era of the SnackWells cookie: a plethora of products that had plenty of calories, sugar, and refined carbs, but a "halo" of health due to their low-fat designation. And often, lower fat translates into higher sugar; a serving of regular Hidden Valley Ranch salad dressing, for example, has one gram, while the fat-free version has triple that (and the second ingredient, after water, is corn syrup). "Non-fat tastes like cardboard," Lustig says. "So what did the food industry do? They put sugar in."

For Lustig and other detractors of processed foods, there are clear analogies to Big Tobacco: an industry that peddles an addictive, harmful product; that ➤



SCREEN SHOTS

Sugar toxicity is the subject of three recent documentaries, two of them featuring Lustig on camera:



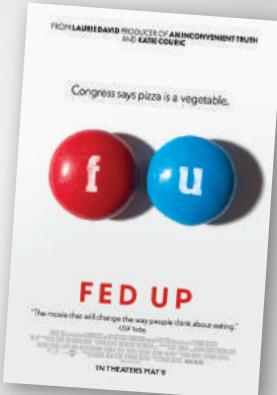
Sugar Coated

Lustig has a starring role in this Canadian-made film—which, among other topics, contemplates the parallels between the food industry and Big Tobacco. Among its evidence: reams of discarded internal documents from Colorado's Great Western Sugar Company, discovered by a

dentist turned anti-sugar researcher. The film is currently playing at festivals and at special screenings, but is not yet available on video in the U.S.

Fed Up

Narrated and executive-produced by Katie Couric, this advocacy film explores the causes behind rising rates of obesity in the U.S., particularly in children. Said the *New York Times* review: "It's a call to action that pinpoints the problems, identifies the players, and stresses that obese people aren't to blame ... even as, somewhat contradictorily, it encourages greater self-control." Available for streaming and DVD rental on Netflix.



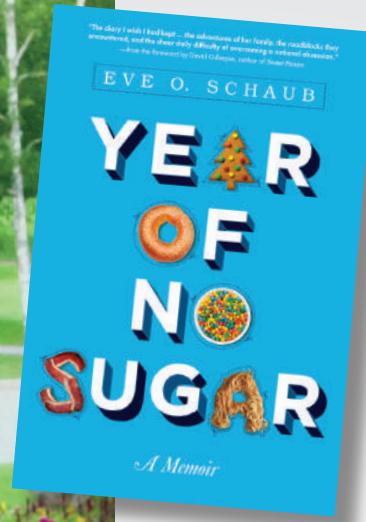
That Sugar Film

It's fructose's answer to Morgan Spurlock's fast-food screed *Super Size Me*. After learning that the average person in his native Australia eats forty teaspoons of sugar per day, director Damon Gameau matches that intake for two months, with severely deleterious effects to his health.

(While Lustig doesn't appear on screen, he served as a scientific adviser to Gameau, who also cites his research on the film's associated website.) Available for streaming on Amazon Video and DVD rental on Netflix.

SWEET RELIEF

Eve Ogden Schaub '92, BA '93, BFA '93, on her sugar-free year



FAMILY AFFAIR: Schaub's husband and two daughters joined her in eschewing added fructose for twelve months.

Of the millions of people who've viewed Lustig's video on YouTube, it's safe to say that few have taken his message as much to heart as Eve Ogden Schaub '92, BA '93, BFA '93, did. "I watched it all the way through, then I clicked 'start' and watched it again," recalls Schaub, a writer based in rural Vermont who earned dual degrees in photography and English literature on the Hill. "All of a sudden, a lot of things made sense to me in a way that they never had before. It was like a flash of lightning. It was as if he had lifted a veil from my eyes."

Schaub—a self-confessed sugar lover with a passionate attachment to Reese's Peanut Butter Cups—was so moved that her family embarked on a year-long experiment. Throughout 2011, she, her husband, and their two young daughters all but eliminated added fructose from their diets; they also eschewed artificial sweeteners and fruit juices. Schaub chronicled their experiences in *Year of No Sugar*, a memoir published by Sourcebooks in April 2014.

What was it about Dr. Lustig's talk that you found so convincing? Americans are getting fatter and more diabetic; we're having more health problems, not fewer. I'd been thinking for a long time that there had to be something basic that we were missing. He put that puzzle piece into place. After that, my brain was on fire. I had to do something.

When you broke the news to your daughters, how did they react? When kids hear "no sugar for a year," they hear "no fun forever." They immediately burst into tears, which was a really tough moment for me as a parent.

What rules did you set? No added sugar in our food; we were extremely strict about that. The exception—and this was specifically instituted to keep morale up, and to keep my kids on board—was that once a month, we'd have a sugar-containing treat of some sort. Also, each of us could pick one thing that we thought, "I could get through the year if I just had that." For my husband it was diet soda. I decided to have wine. I persuaded the kids to pick jam, because I thought they'd get a lot of mileage from it.

As you scrutinized the products you'd been eating, what things were you most surprised to find had added sugar? There were so many, from salad dressing to gravy. Pretty much every condiment you can think of, but also things like cold cuts. At this point most people know there's sugar in ketchup and barbecue sauce. But did you know it's in mayonnaise and chicken broth, and baby food and formula? Those were the things that kept blowing me away, over and over.

What kind of reaction did you get from friends and family? People were apprehensive. To a lot of them, we were the fun squashers. There was a little anger too, because people are very sensitive when they perceive that they're being told that they aren't eating in the best way—even though that was absolutely not what we were trying to do.

Overall, how hard was it to avoid sugar for a year? The short answer: It was very hard! The long answer: It was hard, but often not in the ways we expected. And at other times it was unexpectedly easy. For instance, once I figured out all the different things we couldn't buy,

which was most of the things in the supermarket—Dr. Lustig notes that over three-quarters of items have added sugar in them—I completed my shopping for the week in half the time that I used to. Most everything I could buy lay on the perimeter of the store—fruits, vegetables, meat, and dairy—and there were only a few items I could buy on the interior aisles. One of the key things I learned during our year was that if it comes in a package, it's extremely likely there's sugar in it.

What would you say was the toughest thing? I expected it would be feeling deprived, but it turned out that the social isolation was what blindsided us. People felt that saying, "No, I can't have that piece of cake" was a rejection of them, of their love and affection. That was tough, because in our society we use sugar to celebrate, to make ourselves feel better when we're sad. It was like we had taken away that tool; people didn't know what to replace it with.

'It was hard, but often not in the ways we expected.'

How did not having sugar affect your palate? We became very sensitive to tiny amounts of sweetness. We'd have a treat that once upon a time we would have greatly enjoyed, and we didn't like it anymore; it was actually kind of disgusting. I was astonished that we could reverse that process so completely.

Did not eating sugar make you feel physically different? I had an impressive change in my energy level. When I was eating sugar, I'd have crashes in the middle of the afternoon on a regular basis. It was terrible—it interfered with my life—but I thought it was just part of me. I didn't realize it was solvable.

At midnight when 2011 ended, you had a Reese's Peanut Butter Cup. How was it? It was so anticlimactic! I didn't enjoy it all that much. I still do love them; if I'm going to have a treat, that's what I'll choose. But you get two in the package, and I'd never eat both. I'd feel yucky, get a headache, feel edgy. It's your body telling you, "That was too much."

More than four years after your experiment, does your family still avoid sugar? We're at a slightly more moderate—but really quite stubborn—position on it. We have it sometimes, but in much smaller amounts. If we go to a restaurant, we might order one dessert for the four of us, and everybody leaves feeling satisfied. The first two or three bites of a dessert are always the best ones anyway.

'Just as the tobacco industry fought any form of regulation or legislation, the big food companies are doing the same thing today, for the same reasons.'

funds studies to vindicate itself; that fights government regulation (such as the New York City soda limits that Mayor Michael Bloomberg tried and failed to enact); and that dismisses negative scientific findings as inconclusive. A couple of years ago, Lustig even went back to school to earn a master of law degree from the University of California, Hastings—in part, he admits, to "learn the tobacco playbook." Says Lustig: "Just as the tobacco industry fought any form of regulation or legislation, the big food companies are doing the same thing today, for the same reasons. So it's my job to bring the science to the fore, to debate it in public wherever I can. I'm not a zealot. The science brought me here."

In Lustig's view, all the extra sugar in the Western diet amounts to an environmental toxin—one that explains the current health crisis far better than the oft-repeated axiom that we all just eat too much and exercise too little. One of his central arguments to that effect centers on the ubiquity of metabolic diseases even among people who aren't obese—those who don't have much subcutaneous fat but lots of unhealthy visceral fat. There's even a name for them: TOFI, for "thin outside, fat inside." Conversely, some 20 percent of obese people don't suffer the associated metabolic diseases and live normal life spans. (There's a name for them, too: MHO, for "metabolically healthy obese.") "Obesity definitely increases your risk—but if normal weight people also get it, how can it be about behavior?" Lustig muses. "There are actually more non-obese people who have metabolic diseases than there are obese people who have them—67 million as opposed to 57 million. When you put them together, that's more than half the U.S. adult population. And if more than half the population is affected, that makes it a public health crisis." ■

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