HOW THE MODERN FOODSCAPE GOT US ADDICTED TO EATING

ACCIDENTAL GLUTTONS

BY KAREN SCHROCK SIMRING I ILLUSTRATIONS BY BRETT RYDER

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I am a glutton.

Most Americans are, it seems: more than two thirds of the population is overweight or obese, and that proportion continues to rise, even as public awareness of the importance of healthy eating is at an all-time high. I know what a healthy diet looks like, and I certainly don’t enjoy being fat, so why is eating less such a difficult process? It turns out that every decision we make about eating is influenced by mental and physiological forces that are often outside of our awareness and control.

The path to gluttony looks something like the following. We start with the occasional experience of eating too much—say five handfuls of chips instead of two or a huge helping of dessert, before realizing we are uncomfortably full. The way a particular food looks, tastes and feels in our mouth can trick our brain into eating well past necessity from an energy standpoint, and modern foods (think: processed, packaged goods) are especially effective at this beguilement. “The brain response to high-sugar, high-fat foods is much stronger than to foods found in nature,” says clinical psychologist Ashley Gearhardt, an addiction researcher at the University of Michigan. “In the food industry, they amp up that stuff to a point where our brain is really going to react.”

New research is revealing that those occasional bouts of overeating and eating for pleasure, rather than out of hunger, can push us further down the path to gluttony, priming our brain to want that hedonistic experience more and more. Humans who overeat may develop the same patterns of neural activity in areas of the brain associated with rewarding experiences as drug addicts do, and many rodent studies have found that eating high-sugar or high-fat diets prompt cycles of craving and withdrawal along with brain changes akin to those that accompany drug addiction. For many people, these brain changes lead to addictionlike behaviors with certain foods—for instance, consistently consuming more than they intended to or feeling regret and shame after many meals.

Although the concept of food addiction is still controversial, many scientists now believe that considerably more than half the population struggles with its symptoms, in large part because of the ubiquity of high-sugar, high-fat foods. “We may not all be equally at risk or equally vulnerable, but the fact that we’re all in this environment makes us all vulnerable to some degree,” says neuroscientist Brian A. Baldo of the University of Wisconsin–Madison.

The good news is that knowing how our surroundings push us toward gluttony, we can push back, psyching ourselves into eating less and feeling better. “We’re battling an environment that is completely cueing us to eat all the time,” Gearhardt says. “The goal is to eat more foods that are minimally processed. Keep that bowl of fruits and vegetables on the counter, the pack of almonds in your purse.” In other words, be a glutton for nourishment.

Oops, I Ate the Whole Bag

Eating is at once a great pleasure and a dire necessity. Early studies in the mid-20th century largely focused on the necessity component: scientists successfully teased out how our body regulates our appetite in response to changing energy demands. For instance, when a casual runner starts training for a marathon, she needs to consume more calories daily to power her muscles over those longer distances, so her appetite increases. This internal regulation is the product of a complex system of hormones and neurotransmitters that make us feel hungry when we need more energy and sated when we have enough in the tank. Past attempts to develop drugs for weight control focused on these appetite mechanisms, but many researchers now feel that was a mistake.

“We don’t want people to not eat; we want them to not eat just for pleasure,” explains neuroscientist Nicole M. Avena, a pioneer of food addiction research who runs laboratories at the University of Florida and Princeton University. By shifting the focus to the hedonistic aspect of eating, scientists in the past two decades have uncovered many additional psychological and neural mechanisms that contribute to overeating—not only in one sitting, when a food’s taste and texture influence our desire to keep eating, but also in the long term, when addiction-like behaviors can set in.

When I bite into, say, a potato chip, the sensory experience is immediate and intense: crunchy, salty, rich. My desire for those chips depends more on these sensory qualities than my need for sustenance; I will stop eating them when I am tired of putting crunchy, salty things in my mouth. Scientists call that halting point “sensory-specific satiety,” and research has shown that it has nothing to do with metabolic satiety, which is the feeling of “fullness” that signals the body has consumed enough energy. We have all heard the advice to eat slowly, so your body has a chance to sense when it is full—but that takes at least 20 min-
utes, which is far longer than we typically spend on a snack or a light meal. “Sensory-specific satiety theoretically happens a lot sooner,” in minutes or even a few bites, explains nutritional scientist Agnes Tey of the University of Otago in New Zealand.

According to research in the 1990s, sensory-specific satiety is processed in the orbitofrontal cortex, a region of the brain just behind the brow involved in sensory integration, reward processing and decision making. Neurons in that region respond strongly when we first taste a food, and the response gets weaker with each subsequent bite. When a different food is introduced, neuron activity jumps back to the high initial levels, instigating a response that can spur us to eat more even if we are full, as long as the next bite has a radically different sensory profile than what we had previously eaten. In other words, there is always room for dessert. This work suggests that you can reduce your intake by limiting your choices. “Try to avoid having a variety of foods in one meal; avoid the smorgasbord,” Tey says.

Over time, on the other hand, you may need some variety to get around another fattening phenomenon. In the first long-term study of sensory-specific satiety published in 2012, Tey, along with nutrition scientist Rachel Brown and their Otago colleagues, asked 118 study participants to eat either chocolate, hazelnuts or potato chips every day for 12 weeks. Afterward the participants were slower to reach sensory-specific satiety when eating their assigned snack food. The familiar banality of the food, the authors speculate, seems to prevent it from becoming unpalatable. As a result, people robotically consume it. So although it may be wise to stick to one or two foods at every meal, do not eat the same foods day in and day out, or you may gradually eat more, perhaps without knowing it.

Studies on sensory-specific satiety also reveal that the flavor profile of the food you eat makes a dramatic difference in how much of it you want in one sitting. People reach this type of satiety much more quickly when they eat foods that have complex, intense or unfamiliar flavors, as opposed to mild or one-note taste profiles. So if your goal is to eat less without really thinking about it, choose spicy and rich over bland and light: a fiery curry instead of your go-to chicken soup, extra-dark rather than milk chocolate, Granny Smith apples—or better yet, a fruit you have not tried before—over Red Delicious. The more exciting the flavor, the quicker you will feel satisfied.

When Indulgence Triggers Compulsion

The occasional episode of overeating, in theory, should not be problematic for our body to handle. We should simply feel full longer, as our body waits for the energy it just consumed that you can open the refrigerator or go to 7-Eleven, this response is absolutely unnecessary,” explains addiction expert Nora Volkow, director of the National Institute on Drug Abuse. “But your brain is still operating in a way that is producing a rewarding response.”

Being surrounded by a large variety of extremely delicious food plays a key role in triggering this rewarding brain response in some people. Studies on the rodent equivalent of a nearby 7-Eleven—unlimited access to a variety of high-sugar, high-fat foods—find that this food environment makes rats start eating compulsively. For example, in May 2010 neuroscientists Paul M. Johnson and Paul J. Kenny of the Scripps Research Institute in Florida reported that rats that could eat whenever they wanted from a buffet of highly palatable foods
ate more and more over time, became obese, and showed a disruption of the reward function in their brain compared with control rats fed normal amounts. The obese rats had fewer receptors for the neurotransmitter dopamine, which signals pleasure, in the striatum, a brain area activated by rewarding stimuli. Fewer receptors suggest a lowered sensitivity to a substance such as food, an effect that may motivate an animal to consume more to get the same “high.” Similar decreases in dopamine receptors are seen in overweight people, as well as rodents and humans addicted to cocaine and heroin.

Another risk factor for overindulging is, well, having overindulged. That is, once a person has binged, the behavior can trigger more of the same. In a study published in 2011 researcher Kimberly D. Oswald and her colleagues at the University of Alabama at Birmingham compared rats bred to be prone to binge eating with those bred to be resistant. As expected, the binge eaters ate uncontrollably when given access to unlimited food, even crossing a metal plate that gave them a foot shock to get to that food. The binge-resistant rats refused to cross the plate—until the researchers began feeding them a cyclic diet of massive amounts of food followed by very little food. These rats then began overeating when given the chance and even endured the shock to get to the food. Being willing to endure pain to get to a desired substance is a hallmark of addiction.

If humans are like rats, then dieters who break a strict diet with a binge may be putting themselves at risk for addiction. The cycle of caloric restraint followed by overindulgence could make the brain even more sensitive to food cues, according to Gearhardt. “The psychology of this binge-restrict pattern might really set people up to have an addictive response,” she says.

Other work suggests that frequently eating extremely palatable food high in sugar and fat may trip a kind of trigger for overeating in the nucleus accumbens, a brain site that evolved to direct us toward things that were evolutionarily advantageous, according to Baldo. In previous work, scientists had seen that rats would frantically binge after injections into their nucleus accumbens of a drug that mimicked the neurotransmitter gamma-aminobutyric acid (GABA).

Baldo was curious about whether this phenomenon was relevant to ordinary eating behavior. In a study published this past May he and his colleagues showed that a high-sugar, high-fat diet prompts the nucleus accumbens of rats to be hypersensitive to GABA. In addition, they found that injecting endogenous opioid peptides, known pleasure molecules, into the nucleus accumbens induced the same hypersensitivity as the palatable diet. The findings explain how a diet consistently high in sugar and fat can prompt overeating: the repeated rushes of opioid peptides that accompany habitual consumption of pleasurable food sensitize the nucleus accumbens so that a small surge
Food Addiction in the Brain

In 2009 psychologists at Yale University got a snapshot of what addiction to food might look like in the brain. They showed pictures of chocolate milk shakes to 48 women who took a test of food addiction. In a brain scan, the more food-addicted women showed higher activity levels in four regions that are also implicated in drug cravings and expectation of reward: the caudate nucleus (purple), the medial orbitofrontal cortex (light blue), the anterior cingulate cortex (dark blue) and the amygdala (red). These women also had increased activity in the dorsolateral prefrontal cortex (yellow), known to be active when people try to resist pleasurable foods. When the women actually drank the milk shake, the women prone to food addiction, like drug addicts, showed diminished activity in the lateral orbitofrontal cortex (brown), a pattern linked to a lesser ability to inhibit responses to cues for rewards such as food or drugs.

Sugar Withdrawal?

In 2006 at Brighton Hospital, a substance abuse treatment center in Michigan, then training director John Hopper was noticing something strange about his patients. Many of them had recently had bariatric surgery, such as a gastric bypass, to lose weight. They had shed pounds—but became saddled with another heavy weight: a drug or alcohol addiction, many for the first time in their lives. Hopper asked Karen K. Saules, an addiction researcher at Eastern Michigan University, to help the hospital staff investigate. In 2010 Saules and Brighton physician Dan Schwartz reported that 2 to 6 percent of the hospital’s clients had had bariatric surgery—a rate at least 100 times higher than in the general population, suggesting that something about bariatric surgery puts people at risk for addiction. Saules believes that bariatric surgery removed these patients’ ability to feed their addiction to food—and so they replaced food with a different “drug.” “These are middle-aged men and women, of modest or good socioeconomic status, suddenly eating pills or drinking boxes of wine, totally out of control,” Saules says.

In the reverse phenomenon, recovering drug and alcohol addicts tend to gain a lot of weight—as if replacing their drug with food. And it has long been known that food and drugs compete for the same reward systems in the brain, bolstering the argument that food has addictive qualities similar to those of drugs.

Some data also suggest that sugars and fats can induce withdrawal: the distress, cravings and pain that can occur when an individual suddenly stops habitually consuming drugs or alcohol. For example, in a study published in 2012 neuroscientist Stephanie Fulton and her colleagues at the Montreal Diabetes Research Center fed rats a high-fat, sugary diet for six weeks. When they abruptly returned the rats to their normal fare, the rodents became anxious, displaying fearful behavior such as avoiding open areas. They also showed increased motivation to get to either high-fat or high-sugar food: they were willing to press a lever more times to obtain a sugar or fat pellet. In the rats’ brain, the scientists also found elevated levels of certain chemicals characteristic of drug withdrawal. In other experiments, the researchers showed that not all fats lead to these withdrawal signs in rats. The monounsaturated fats present in olive oil and avocados seem to be far less problematic than the saturated types prevalent in butter, red meat and many processed foods.

Food addiction is distinct from obesity, Gearhardt points out. Many food addicts have a normal weight, and the rats in Fulton’s study displayed withdrawal symptoms without becoming obese.

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In addition, some obese people are not food addicts. To separate those who might be addicted from those who just tend to gain weight, Gearhardt, then at Yale University, and her colleagues developed a food addiction scale [see box on opposite page].

Though intriguing, the idea of food addiction remains unproved. Not all criteria for drug addiction apply when the putative addictive substance is food. We need food to survive in a way we do not need recreational drugs. For example, irritability, lethargy and a tendency to seek out the substance in its absence are not signs of pathology when it comes to food. We may, after all, just be hungry. As a result, experts need to agree on an adjusted definition of addiction in this case. And unlike drugs, food in general cannot be defined as an addictive substance; scientists still need to tease out which foods or ingredient combinations are the most likely to lead to addiction.

Nevertheless, experts agree that certain foods trigger what are clearly addictionlike behaviors in some people. And the food addiction concept is gaining momentum in the face

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**Screaming for Ice Cream**

Some foods are more “addictive” than others. Psychologist Ashley Gearhardt, then at Yale University, and her colleagues asked about 200 young adults to pick from a list the foods that made them feel out of control: for instance, by triggering strong cravings or consistently causing them to eat more than they had intended. The results (below) suggest creations high in sugar and fat are the most troublesome. “Combining sugar and fat into one package is something that doesn’t occur in nature; it’s a novel result of human processing,” Gearhardt points out.

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**Foods We Crave**

<table>
<thead>
<tr>
<th>Foods We Crave</th>
<th>Percentage of Respondents Who Struggle with These Foods</th>
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<tbody>
<tr>
<td>Ice Cream</td>
<td>60</td>
</tr>
<tr>
<td>Chocolate</td>
<td>50</td>
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<tr>
<td>Cookies</td>
<td>40</td>
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<tr>
<td>Candy</td>
<td>30</td>
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<td>French Fries</td>
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<tr>
<td>Chips</td>
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<tr>
<td>Pasta</td>
<td>0</td>
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<tr>
<td>Doughnuts</td>
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Are You Addicted to Food?

Scientists have developed a food addiction scale based on criteria psychiatrists use to diagnose drug addiction. Scores on the scale correlate with brain activity indicative of addiction. In a study published in 2009 clinical psychologist Ashley Gearhardt, then at Yale University, and her colleagues scanned the brains of 24 women who scored high on the scale and 24 women who scored low while the women looked at images of a chocolate milk shake. Those with high scores had higher levels of activity in brain areas, such as the orbitofrontal cortex and caudate nucleus, known to be involved in craving and motivation. When the women drank the milk shake, those with high addiction scores had suppressed activity in self-control regions, mirroring results seen in drug users.

Portions of the addiction scale are paraphrased at the right. If you identify with some of these statements, you may be struggling with the addictive qualities of certain foods. Although not everyone agrees food can be truly addictive, many people who self-identify as food addicts benefit from talk therapy or 12-step programs such as Overeaters Anonymous. —K.S.S.

☐ I find that when I start to eat certain foods, I end up eating much more than planned.
☐ I eat to the point where I feel physically ill.
☐ I find that when certain foods are unavailable, I go out of my way to obtain them.
☐ There have been times when I have consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with family and friends, or engaging in recreational activities that I enjoy.
☐ There have been times when I avoided professional or social situations where certain foods were available because I was afraid I would overeat.
☐ I have had withdrawal symptoms such as agitation, anxiety or other physical symptoms when I cut down or stopped eating certain foods.
☐ My behavior with respect to food and eating causes me significant distress.
☐ My food consumption has caused significant physical problems or made a physical problem worse.
☐ I have tried to cut down or stop eating certain kinds of food.

of accumulating data supporting it and new thinking about obesity. In June the American Medical Association officially recognized obesity as a disease. Many experts think acceptance of food addiction cannot be far behind. Some say that if society were to embrace the idea that sugary, fatty foods are dangerous enough to be taxed, regulated and avoided the way cigarettes are today, we would have a better chance of reversing the obesity epidemic.

For now we can use the lessons from recent research to put ourselves on a fitter path. To enlist sensory-specific satiety as an aid, choose flavorful or unusual foods and carefully regulate the amount of food choice you give yourself at any given sitting—and over time. In addition, realize that just walking past a vending machine at work or sitting down in front of the television can trigger a craving. “Make sure you are aware of and avoid situations where you are conditioned to eat,” Volkow says. A lot of people eat when they are bored or stressed, she notes, so instead of turning to food at those times, train your brain to want a more beneficial reward, such as taking a walk. And when you do find yourself unable to resist the junk food—at a party for instance—go ahead and have some but keep your portions moderate. Your small indulgence may prevent a far bigger fall off the wagon.

As for me, incorporating unusual international cuisine into my diet and cooking varied, nutritious meals has been a welcome relief after years of boring, restrictive regimens. I find that experimenting with new flavors makes eating healthfully easier and more fun. And now that I know how my brain is poised to overeat and crave certain foods, I think twice about munching mindlessly out of a bag in front of my computer. Yet I still enjoy my favorite treats now and again—an occasional ice cream cone is all the more enjoyable knowing it is helping to steer my inner glutton down a healthier road. M

(Further Reading)

◆ Long-Term Consumption of High-Energy-Dense Snack Foods on Sensory-Specific Satiety and Intake. Siew Ling Tey et al. in American Journal of Clinical Nutrition, Vol. 95, No. 5, pages 1038–47; May 2012.
◆ Food Addiction? Special issue of Biological Psychiatry, Vol. 73, No. 9; May 1, 2013.