THE SCIENCE OF CRAVING

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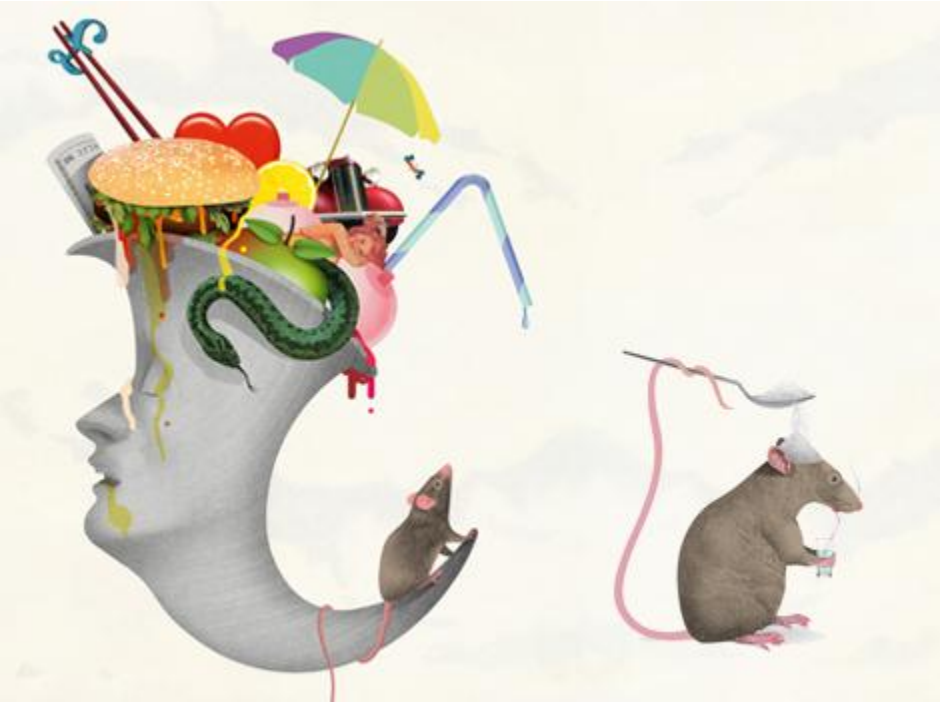


At the meeting of the Society for Neuroscience in Washington, DC, there are 30,000 delegates. And one of them has changed the way the others look at desire. Amy Fleming meets Dr Kent Berridge

THE STATELY STRETCH of New York Avenue, in Washington, DC, that runs between the White House and Mount Vernon Square is bookended by Starbucks. The branch on the corner of 14th Street, Barack Obama's local, welcomes a flow of freezing bodies this brisk November lunchtime. They file in like lemmings with skins to shed, loosening scarves and peeling off gloves. Then they pull out their phones and stand there transfixed, picking up messages, scanning the news, finding stuff to buy, and—above all—gazing at pictures of friends, acquaintances and celebrities, in which the grass is nearly always greener.

The air is heady with cocoa powder and steamed milk, and the counter is overloaded with treats: cheesecake brownies, devil's food doughnuts, salted-caramel squares. The cold weather only sharpens the temptation to go from a tall latte to an extra-large vente or super-sized grande. The average working American spends $1,000 on coffee annually, and global consumption is projected to rise by 25% over the next five years.

One block along the avenue, in an incongruously squat building, is a branch of McDonald's. Here you can buy sugar-laced fries, or an 850-calorie milkshake, or any number of burgers sitting in a bun whose third-biggest ingredient (after flour and water) is high-fructose corn syrup. Sugar, we now know, can be as addictive as drugs and alcohol.

Past the second Starbucks, at Mount Vernon Square, stands the Walter E. Washington Convention Centre—all 2.3m square feet of it. Inside, the Society for Neuroscience's annual meeting is under way. It's a five-day event to which 31,000 brain buffs have come to clock the latest progress in unravelling the mysteries of the mind, from circadian rhythms, memory and intelligence to the gamut of mental illness. Most of the 15,000 studies selected for presentation are mounted on boards in a vast hall which becomes a frenetic trading floor for new ideas. A hush falls over the 7,500-seat auditorium reserved for lectures by eminent neuroscientists, as Dr Kent Berridge, of the University of Michigan, is called on stage to present his pioneering research into pleasure and

desire. If anyone can reveal why so many of us can't say no to the grande or the milkshake, despite knowing the consequences, it is Berridge.

For almost three decades, he has swum against the tide of established thinking, to map the brain mechanics of the reward system—the part of the brain that lights up on scans when people enjoy something, whether it's cake, snogging, heroin or Facebook. It has been a long and winding journey, featuring cameos from Iggy Pop and the Dalai Lama, and a supporting cast of hedonistic lab rats.

THE REWARD SYSTEM exists to ensure we seek out what we need. If having sex, eating nutritious food or being smiled at brings us pleasure, we will strive to obtain more of these stimuli and go on to procreate, grow bigger and find strength in numbers. Only it's not as simple in the modern world, where people can also watch porn, camp out in the street for the latest iPhone or binge on KitKats, and become addicted, indebted or overweight. As Aristotle once wrote: "It is of the nature of desire not to be satisfied, and most men live only for the gratification of it." Buddhists, meanwhile, have endeavoured for 2,500 years to overcome the suffering caused by our propensity for longing. Now, it seems, Berridge has found the neuro-anatomical basis for this facet of the human condition—that we are hardwired to be insatiable wanting machines.

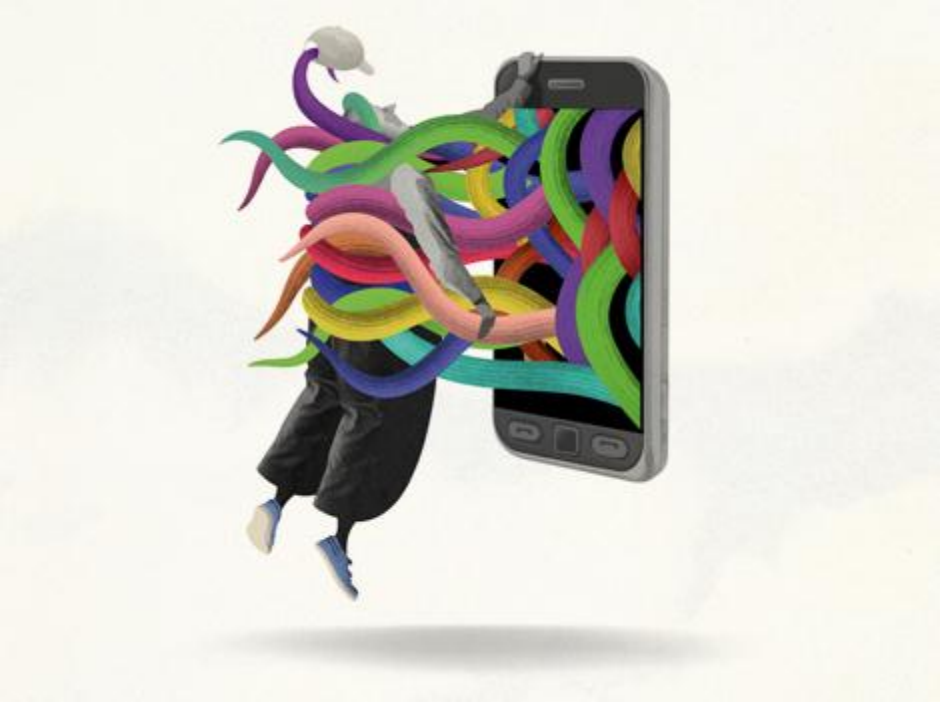
If you had opened a textbook on brain rewards in the late 1980s, it would have told you that the dopamine and opioids that swished and flickered around the reward pathway were the blissful brain chemicals responsible for pleasure. The reward system was about pleasure and somehow learning what yields it, and little more. So when Berridge, a dedicated young scientist who was more David than Goliath, stumbled upon evidence in 1986 that dopamine did not produce pleasure, but in fact desire, he kept quiet. It wasn't until the early 1990s, after rigorous research, that he felt bold enough to go public with his new thesis. The reward system, he then asserted, has two distinct elements: wanting and liking (or desire and pleasure). While dopamine makes us want, the liking part comes from opioids and also endocannabinoids (a version of marijuana produced in the brain), which paint a "gloss of pleasure", as Berridge puts it, on good experiences. For years, his thesis was contested, and only now is it gaining mainstream acceptance. Meanwhile, Berridge has marched on, unearthing more and more detail about what makes us tick. His most telling discovery was that, whereas the dopamine/wanting system is vast and powerful, the pleasure circuit is anatomically tiny, has a far more fragile structure and is harder to trigger.

Before his lecture, we meet for coffee; there's another Starbucks in the convention centre. I'm surprised to find that someone so practised at public speaking has pre-performance jitters. Shortly after arriving, Berridge turns white and bolts from the queue to retrieve the laptop with his presentation on, which he has accidentally left in his hotel lobby. Nor is he immune to the desires and pleasures he studies. Without hesitating, he orders a "grande" chestnut praline latte and slice of coffee cake. "It's easy to turn on intense wanting," he says, when we eventually sit down. "Massive, robust systems do it. They can come on with the pleasure, they can come on without the pleasure, they don't care. It's tricky to turn on the pleasure." He hadn't expected his findings to turn out this way, but it made sense. "This may explain", he later tells his audience, "why life's intense pleasures are less frequent and less sustained than intense desires."

In recent years, Berridge's doubters have steadily dispersed, and reams of research have been applying the disparity between liking and wanting (or pleasure and desire, enjoyment and motivation) to the clinical study of conditions such as depression, addiction, binge eating, obsessive-compulsive disorder and Parkinson's disease. It is also increasingly present in psychological and philosophical discussions about free will, relationships and consumerism.

Berridge is an intriguing mixture of humble and self-assured. He is not a blagger or a showman, nor does he court the media or pitch for the bestseller lists. He has worked at the University of Michigan for almost 30 years, preferring it to the University of Pennsylvania, where he completed his PhD. He concedes that Penn, which is Ivy League, has a higher concentration of bright students. "But it's a means to an end for many.

Michigan students are authentic, it's an end in itself too. They're excited by it," he says, as we drive through the frozen rural Midwest, the day after his lecture, to collect his dog, Toby, from the kennels.



Originally from California, Berridge feels most at home in the unassuming college town of Ann Arbor, near Detroit, which lies on a snowbelt fed by water blown off the Great Lakes. "If you're an academic, and are really into your work," he says, steering through its orderly calm, unruffled by the ice, "it's an easy place to be." He has lived at the same address for 25 years—an 1860s, wooden, Greek-revival farmhouse on what was, at the time of purchase, the wrong side of the tracks (it's a pleasant neighbourhood now, although not quite gentrified, and he and Toby have no desire to move to the more salubrious side of town). Berridge won a conservation award for restoring the house to its former glory, complete with tasselled curtains and wall-mounted civil-war swords. Even the ceilings have patterns on them, and the sheer ornateness of it all stands in stark contrast to him. The decor is less an expression of Berridge's personal style, more a reflection of his strong sense of history, a desire to do right by things and have them as they ought to be.

After dropping Toby at home, he takes me downtown for dinner at his favourite restaurant, a pan-Asian place where he orders us cockle-warming spiced mojitos. Reserved, a little formal, but obliging, he talks about the workings of the mind with childlike wonder, expressing convoluted thoughts at a rate that only allows him to take in sharp gulps of air. Tucking in to seared tuna with ginger and wasabi and sipping red wine, he describes past neuroscientific models as though they were concertos: "beautiful, crystal-clear, spare and elegant". He says he's not a reductionist who believes we can explain away our minds by these brain mechanisms. "It's just I think these brain mechanisms are part of our minds." He doesn't even discount the existence of God—for good scientific reasons: we cannot disprove it.

"Kent is one of those great pioneers," says Morten Kringelbach, senior research fellow at Oxford and professor of neuroscience at Aarhus University in Denmark, who has been collaborating with Berridge since 2006 on books and academic papers. "He's such a modest man, and got there by ignoring what everybody told him." It wasn't until 2000 that Berridge finally convinced funders that his wanting-versus-liking research was worth supporting. Until then, he had to fit it in around other projects.

Potential clinical applications are always on his mind, Berridge says, "and in one sense are the reason for doing the work. They're the reason that society funds the work." His revelation that desire and dread share the same

brain operations, like two sides of the same coin, could help ease schizophrenia symptoms. This is where Iggy Pop, another Michigan man, comes in. His 1998 album "Live on the King Biscuit Flower Hour" was used in conjunction with bright lights to generate dread in the rats for these experiments. (It worked.) A trial drug has had some success in reducing delusions by restricting a certain dopamine neuron that produces fear.

It would be impossible to keep up with every new academic study citing Berridge, but when he hears about interesting research projects based on his findings, he has mixed feelings. He is delighted, he says. "But also I cross my fingers because there's an enthusiasm on the part of the user. They see a relationship to the problem they're studying. I hope it works. I hope it's true. If it leads them down the wrong path, then it's a disservice."

There are few certainties in this game. Berridge views science as a cacophony of ideas shouting at each other. "You place your bets, the wheel spins..." He thought at first that his hypothesis would maybe have a life of five to ten years, just like the old dopamine-pleasure model. "I'm sure, ten years from now, they will take pity upon us," the realist in him says. But he also points out that some truths are eternal, and his thesis has already had a much longer life than the previous one.

IN THE CORRIDOR of the University of Michigan's psychology block hangs a rail of pristine lab coats and a print of "The Scream" by Munch—"a reminder", Berridge says, "of what we have to fix". Inside his laboratory, there are brain atlases, surgical tools and abundant supplies for his hedonistic rats: M&Ms, rat-food pellets, cocaine. The coke is kept in a safe and comes courtesy of the National Institute of Drug Abuse, which currently funds much of Berridge's work. Rats are as susceptible as humans to the drug's dopamine rush, followed by a smattering of natural opioids.

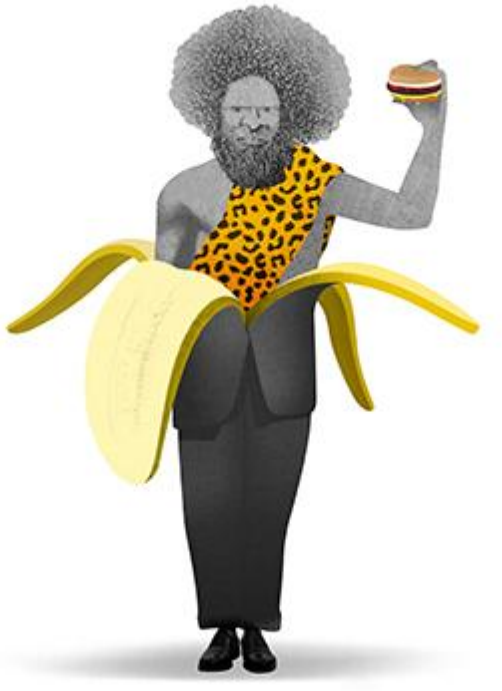
They also share much of our brain circuitry, says Berridge, "especially for things like motivation". And by working with rats, he is able to study the intricacies of the brain in a way that he couldn't in humans. "Sometimes one has to be able to turn things on and off in order to establish causations," he says, before assuring me that his rats don't suffer any more than your average pet. He will stimulate a part of the brain, with drugs or lasers, to see what psychological function becomes more pronounced and intense. "It rises up like a mountain peak. You can see it, measure it, assess it and get its signature."

The easiest way to study pleasure is through the most universal route to it: eating. The brain systems involved, Berridge says, "are shared among all kinds of rewards—cognitive, social, music, other sensory pleasures". When rats taste something sweet, they do what human babies do—poke their tongues out and lick their lips. The more they enjoy a taste, the more their tiny tongues waggle with delight. "It helps to like animals in this field," he says. Tongue-waggling and lip-licking, believe it or not, are Berridge's pleasure barometers.

It was an experiment using this method that gave rise to his original discovery about dopamine. The dominant reward-centre thesis in the 1980s had been laid down by Roy Wise, then at the Centre for Studies in Behavioural Neuro-biology at Concordia University in Montreal. Shortly before Christmas 1986, Wise called Berridge, who had recently become an assistant professor at the University of Michigan, suggesting that they join forces. Wise wanted to apply Berridge's adeptness at reading rats' facial expressions to testing his thesis. Berridge admired Wise's work (he used to "marvel at the beauty of his demonstrations") and was excited by the prospect of collaborating with him. The concept was simple: they would give a rat a drug that would suppress dopamine, and "the pleasure reactions would go down, because dopamine was pleasure: everybody knew that."

It didn't work. "The facial reactions for pleasure were absolutely fine," Berridge says. He and Wise were disappointed, but didn't take the findings too seriously because "sometimes you do an experiment, and it just doesn't work." But when he repeated the experiment on his own, the result was the same. So he tried it again, using a neurotoxin which attacks dopamine and "completely takes it out". The dopamine-free rat wouldn't eat or drink of its own accord, but if you dropped sugar water on its tongue, it made its usual yummy face.

Wise insisted Berridge was wrong for years, until the evidence became too convincing to dismiss. Many peers told Berridge he was wasting his time with his strategy for mapping pleasure and desire. They have since eaten their words.



Berridge and his team (mostly PhD students, who physically do the experiments) plotted pleasure by administering microinjections of opioids to tiny spots throughout the brain, one by one, and recording in which areas this enhanced the rats' liking, using the tongue-waggling as a barometer. (This is the abridged version; other substances were injected separately, for more in-depth information about what the neurons were up to and how they talked to each other.) He then—look away now—"euthanised" the rats, as he puts it, and dissected their brains, to check precisely which neurons had been activated. A protein called Fos is produced when neurons fire, which becomes visible once the brain is opened up, in tiny, droplet-shaped plumes.

Gradually, he says, a pattern of pleasure-generating areas started to emerge. "Lo and behold, it wasn't random. All the sites that were doing it were clustered together in various brain regions." The clusters were about a cubic millimetre in rats (so probably no more than a cubic centimetre in humans), and he called them hedonic hotspots—a series of tiny islands, scattered across a number of brain regions, but all connected to the same circuit. From the evidence so far, it looks as though this same entire circuit is activated for any pleasure, from food and sex to higher-order delights including monetary, musical and altruistic. The same gloss applied to very different events.

Needless to say, there are limits to how much animal studies can tell us about ourselves, which is why Berridge and Kringelbach started working together. Kringelbach is fascinated by the same mechanisms as Berridge, and his findings from studying people, often using neuroimaging, deep brain stimulation and computer modelling, have correlated with Berridge's. They have become a neuroscientific dynamic duo, although they could hardly seem less alike: it is hard to picture Berridge sharing Kringelbach's penchant for raves.

Kringelbach has the slouchy demeanour of a student rather than a senior research fellow, as he sits at the head of the grand dining table at Queen's College, Oxford, in his cycling gear and hoodie. "Mention a pleasure and I've probably studied it in some form," he says over a post-prandial camomile tea. It's true: he has covered everything from sex, drugs and rock'n'roll to art, via the sound of babies laughing.

The beauty of Berridge's work (and he really does think it's beautiful), he says, "is that he can take out the nucleus accumbens or the ventral pallidum, and show that it's only if you remove the ventral pallidum that you get a complete abolition of the liking." Berridge's findings here are backed up by human outcomes. Occasionally part of the ventral pallidum is accidentally removed during brain surgery, rendering the patient unable to experience pleasure.

"One of the key things in pleasure", says Kringelbach, whose default timbre sits just above whisper level, "is that it comes in cycles." Wanting and liking wax and wane like candle flames. The hungry, wanting state before a meal could be studded with moments of pleasure from a social encounter, or anticipation of good food. Then, as we eat, pleasure dominates, but wanting still crops up—more salt, a drink of water, a second helping. Before long, the satiety system steps in to render each mouthful less delicious until we stop. If we switch to another food—dessert, cheese, petits fours—we can prolong the pleasure until we're stuffed, although we may regret it.

PLEASURE IS SOMETIMES elusive and always transient. If only we could bottle it. Music, according to Kringelbach, is the closest we'll come. "It is a tension-and-release kind of thing. You can keep it going for the longest time, waxing and waning, wanting and liking. If you've done one of these all-night dancing sessions, it's fantastic. There's a reason people do it, even if they have to break the law."

In spring 2014, Kringelbach and colleagues from Oxford and Aarhus released a research paper on groove – music that makes people want to get up and dance and is, as the study puts it, "frequently observed in…funk, hip-hop and electronic dance music". They took 50 drum tracks, 34 from existing funk songs, the rest designed for the experiment using Garageband software, and tested them on participants who were asked to report how much they liked them, and how much they made them want to move. "Good Old Music" by George Clinton's Funkadelic (1970) scored among the highest. The secret, they found, is a perfect balance of complexity and predictability. "Medium degrees of syncopation elicited the most desire to move and the most pleasure," says Kringelbach. "The pleasure of groove is about balancing the pull and push of tension and release."

Part of music's appeal is that it unites us—dancing with someone is infinitely more fun than doing it alone. "If you want to talk about euphoric experiences," Kringelbach says, "it's all about other people." Social pleasures, he says, are the most important. "They also make the link with well-being." The amount of love and attention we receive from our carers during the first 18 months of life, Kringelbach says, "sets our hedonic threshold". People who don't get enough positive interaction early on are much more likely to become anxious or depressed young adults.

Although desire and pleasure often go hand in hand, it is perfectly possible to want something without liking it. Think of the crazy impulse purchases that are more about the frisson of shopping than the product itself. The cake that disgusts you, but you eat it anyway. The drugs you crave, even though they're no fun any more. And as for that ex-lover...

A team at Stanford University have found that if we don't get something we want, we desire it more while liking it less. For their 2010 study entitled "Lusting while Loathing", 60 participants were recruited online to test (they were told as a cover story) new gaming and payment systems, with the chance to win prizes. Some of them won prizes, while others did not. Those who didn't win even exhibited increased liking for items merely similar to the prizes they didn't win.

Discussions of free will have arisen out of Berridge's work because wanting and liking can happen both consciously and unconsciously. This is why urgent desires can be irrational and inconsistent, and fly in the face of what we know is best for us in the long run. Unconscious wanting can defy our best-laid plans to end an unhealthy relationship or not polish off that box of chocolates.

One of Kringelbach's studies pinpoints the complex contrast between wanting and liking. Men and women who were not parents were given two tasks. First, they were asked to rate the cuteness of a series of babies' faces. Men rated all the babies less attractive than the women did. Conclusion: men don't like babies' faces as much as women. But Kringelbach wondered if it was that men aren't supposed to be moved by babies as much as women are—they are apt to feel that it's not macho, or even that they might be taken for paedophiles.

For the second task, the subjects could press buttons either to keep the babies on the screen or make them go away. This time, the men made as much effort as the women to keep the adorable faces in view (both were equally ruthless in banishing the less cute). Conclusion: men want to look at cute baby pictures just as much as women do. "Here's a really nice interesting difference between wanting and liking," Kringelbach says, "based on a cultural phenomenon."

TOGETHER WITH HIS Michigan colleague Terry Robinson, Berridge has sought to understand why addicts crave drugs, even after years of abstinence, and how this overwhelming desire could be separate from liking the drug of choice. They have found that addictive substances hijack the dopamine system, altering it permanently by a process they call incentive-sensitisation. We now know, he says, that "when exposed to addictive substances—cocaine, amphetamine, heroin, alcohol, nicotine and even sugar—neurons are releasing more dopamine, and also sprouting more receptors for a transmitter that makes them release the dopamine." This is a permanent physical change, which remains even if they stop taking the drug (although dopamine production in general slows as we age).

What's more, brains become sensitised to cues. If you use Pavlovian conditioning on rats to link a certain cue to cocaine or sugar, the rats will eventually end up wanting the cue more than the substance. This behaviour is also common in humans. For many addicts, scoring drugs becomes part of the ritual, eventually rendering the anticipation more pleasurable than the drug. The same may apply to checking our phones.

Studies in humans with Parkinson's disease, which is caused by dopamine neurons dying, have reported that 13-15% of patients treated with dopamine-stimulating drugs experience Impulse Control Disorder (ICD) as a side effect. This is expressed in the form of gambling, compulsive sexual behaviour, binge eating and compulsive shopping and/or internet use. When they stop the medication, the ICD abates.

Dopamine is a powerful motivator, and itself a high, of sorts. When it is stimulated, subjects have reported that everything and everyone seems brighter and more desirable. "There are notions", Berridge told me in Washington, "that dopamine's anticipatory joy is a wonderful thing, and certainly it is, when you think of Christmas morning, window-shopping and things. Even if it's all by itself, without the pleasure coming, people do become addicted to it."

Some still believe that dopamine is a form of pleasure, but Berridge is adamant that they're wrong. "It can be pleasant in situations, and it can exist on its own and almost look like pleasure, but it can also be quite unpleasant." He cites the myth of Tantalus, which gave us the word "tantalise". "Son of Zeus, condemned by the gods for his misdeeds, he's always going to be tempted: fruits and water always just out of reach. A state of eternal maximal anticipation, but it's not pleasant."

ON THIS NOVEMBER day, Ann Arbor is awash with rosy-cheeked undergraduates sipping Thanksgiving-themed coffee, tapping away on gleaming MacBook Airs. Surely the choice and messages we're offered at every turn are feeding our dopamine system, in a similar way to addictive drugs? "That is a legitimate notion," Berridge says. "The advertising, the availability of it all, these are tempting cues urging us to want...We are in a constant state of dopaminergic excitation in these cues. It's not the cue itself, and it's not the brain-dopamine activation itself, but put them together in a dopamine-reactive brain and whoof, you have this want."

Some brains are more dopamine-reactive, and thus prone to addiction. "Roughly 30% of individuals are very susceptible." Genetics, traumatic stress during childhood, gender (women are more prone) and other factors are all implicated. Along with pleasure rewards and their cues, novelty also activates dopamine. Even something as simple as dropping your keys once will fire dopamine neurons. Drop them a few more times and the neurons will get bored and take no notice.

It's reassuring to know that, as Peter Whybrow, director of the Semel Institute for Neuroscience and Human Behaviour at UCLA, writes in his new book "The Well Tuned Brain" (W.W. Norton), "our acquisitive mania, with all its unintended consequences, has emerged not because we are evil, but because in a time of plenty, such ancient instinctual strivings no longer serve their original purpose." On the phone, he tells me he is fascinated by the idea that "the consumer wants something continuously if you can give them novelty," and agrees that the market economy has intensified the dopamine-wanting system. "We have yoked fundamental biology, putting wanting, liking and reward together into a cultural vision of what is progress. We've forgotten how you constrain desire."

Take the construct of money, he adds. You can eat to the point of being satiated. You can even have enough of sex. But people never feel they have too much money. "So we've built this interesting system which now drives the biology."

PRIDE OF PLACE in Berridge's lab goes to a group photograph of himself, other addiction specialists and the Dalai Lama. Mounted underneath, in the same frame, is a mysterious thin, white rod, which turns out to be an optical fibre used for manipulating the brain with light. "I figured, I won't throw it away," Berridge says. "It's, er, the only optogenetics laser fibre that's been held by the Dalai Lama."

The picture was taken to commemorate the week he spent communing with the Dalai Lama in India in 2013. This meeting of minds had a profound effect on Berridge, and he was particularly struck by the effectiveness of meditation in taming our dopamine desires—not only among Buddhists.

Sarah Bowen, an addiction therapist in Seattle who was also invited on the Dalai Lama trip, has had significant success in helping recovering addicts by using mindfulness meditation. Over 12 months, this treatment reduced substance use more effectively than cognitive-behavioural therapy or the 12-step programme. It's not a cure, and won't work for everyone, because it requires commitment to get the benefits. But mindfulness's tentacles are rapidly spreading throughout the Western world, perhaps because it's one of the few palpable antidotes to the dopamine frenzy of modern life.

It's not that meditation makes the wanting go away. "What it is doing", Berridge says, "is giving the more cognitive mind a way of distancing itself from the urgency of those wants. It's a practised mental gymnastic. A want occurs, but because you're so practised, you can recognise that want, appraise it, feel it all around, focus on that, and the feeling of urgency as a feeling, without engaging in it."

That's not to say that self-control alone doesn't stand a chance. Take the most extreme form of wanting: addiction. There are two main schools of thought on its hold over us, which Berridge and the Cambridge philosophy professor Richard Holton outline in a chapter of a recent book, "Addiction and Self-Control: Perspectives from Philosophy, Psychology and Neuroscience", edited by an Oxford neuroethicist, Neil Levy. The first is the disease model: addicts are driven "by a pathologically intense compulsion that they can do nothing to resist". The second is that addicts' decisions are no different from normal choices, and are dealt with intellectually.

Holton and Berridge call for a middle ground. The strength of dopamine/wanting in an addict's brain is so fierce that it is hard to conquer. Addicted pilots and anaesthetists, who have to take blood and urine tests to keep their jobs, are remarkably good at avoiding drugs and alcohol when they have to. But not all addicts have such clear incentives, and people in these fields may have been disciplined in the first place. For the rest of us, there are ways to give self-control a leg-up.

Walter Mischel's famous marshmallow tests told children that they could forgo one marshmallow for the promise of two if they waited a while. Mischel tracked the children in later life and found a link between self-control and success. The controlled kids had resisted the marshmallow by simply making a decision and moving on without further discussion. They turned away from it, or tugged their pigtails to distract themselves from allowing it to arouse their senses. The children who deliberated, or lingered over the marshmallow, were more likely to cave in.

"It looks as though the best way of resisting is not to open the question," Holton tells me, between mouthfuls of plum crumble in the dimly lit dining hall at Peterhouse, Cambridge. Free will is one of Holton's areas of interest, and having read the empirical literature on the subject, he reckons you're more likely to beat your desires if you rehearse a script, such as "I'm not having dessert," and repeat it to yourself when dessert is offered, shutting down any last-minute internal wrestling. Or, as our grandparents might have put it, forewarned is forearmed. "The one thing you do", Holton says, "is start to make people aware that this is what's happening to them and give them the tools to regulate it themselves."

"If we knew more about the way our brains work," Whybrow says, "then we would know our vulnerabilities."

The Dalai Lama told Bowen (partly, Berridge suspects, to provoke) that her mindfulness for addicts was merely applying a Band Aid to the wound. But while it might be better to cultivate a civilisation in which people are immune to addictions and cravings, or at least where temptation isn't shoved under our noses in the name of profit, this is the world we inhabit. As Berridge says, "we have a lot of wounds."

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