

# You know you want to...

Subtle differences in how we respond to food are what truly determine who's fat and who's thin, finds **Elie Dolgin**

**Y**OU'VE just finished an indulgent meal, the plates have been cleared and you sit back in your seat, stuffed. You couldn't possibly manage another bite. But then it turns out they have sticky toffee pudding, your favourite dessert. Oh go on then, you can make room.

We all succumb to temptation. And it's no secret that people have big differences in appetite – some eat like birds, others like horses. But only some of these differences reflect our energy needs.

The driving factors for weight gain tend to get oversimplified: studies show that most people still think obesity is down to laziness and gluttony. Others tend to shrug and blame “big bones” or “bad genes”.

Genes play a part: they may be responsible for as much as two-thirds of our variation in weight. But they aren't betraying us in the way many assume. Some slow down our metabolic rate, leading to a build-up of fat, but they are the exception. Instead, most make people chubby in a more insidious way: by subtly affecting how appealing food seems to us, and how quickly we feel full.

Not only that, but these genetic effects kick in even from the first weeks of life. In other words, the deck may be stacked against you right from the start. Understand that, and we may each have the key to maintaining a healthy weight – and might finally make inroads against the obesity epidemic.

Measuring how our response to appealing

food and to feelings of fullness can influence weight is something that can be traced back to 2007. That's when the late British health psychologist Jane Wardle first proposed the idea that genetic differences in appetite raise the risk of overeating in food-rich conditions. This “behavioural susceptibility theory” offered an explanation for why weight gain can be both highly heritable and highly responsive to environmental influences.

To identify innate differences in appetite and disentangle the impact of genes from all the other factors that can alter our food choices – from social pressures to comfort eating – Wardle and her colleagues turned to twins. Specifically, the Twins Early Development Study, a UK survey of more than 15,000 pairs of identical and fraternal twins.

The beauty of such twin studies is that siblings grow up in the same circumstances. That's important, says Jed Friedman, a molecular nutrition researcher at the University of Colorado, Denver, because babies get all sorts of nutritional cues from their mums, both in the womb and during the first months of life, that can have “a profound effect on developmental systems that regulate appetite”.

At around age 11, children in the study were weighed and parents filled in questionnaires about their eating behaviours, ranking statements such as “My child is always asking for food” and “My child gets full up easily”.

That snapshot in eating behaviours >

## ARE THE KIDS ALRIGHT?

More than half of parents now fail to recognise when their children are overweight. A recent US study led by Jian Zhang at Georgia Southern University found that parents' ability to identify excess weight in their preschool kids has declined by 30 per cent over the past 20 years.

Part of the problem is a shift in attitudes about what's "about right". Packing a few extra pounds is "just a social norm now", says Connie Tompkins, a childhood obesity researcher at the University of Vermont. If a child's peers are all the same size, parents won't see a problem.

To counteract such perceptions, in 2005 the UK Department of Health established a National Childhood Measurement Programme, through which all children in England are weighed and measured as they enter and leave primary school. Parents of overweight or obese children receive a letter informing them of their child's weight and its potential health implications.

"Without recognition, there's not going to be any behavioural change," says Hayley Syrad at University College London.

But knowing doesn't necessarily mean things will change for the better. Eric Robinson, a behavioural psychologist at the University of Liverpool, UK, and his colleagues have shown that children's weight trajectories align with their parents' perceptions, and kids correctly identified as overweight tended to gain more, not less, than peers with oblivious parents.

Robinson suspects the shame attached to being heavysset is to blame. "If you think about the world we live in and how we stigmatise and point fun at people who are fat, who would want to identify as overweight? You're not going to feel good about yourself," he says.

But that doesn't mean parents should wilfully ignore how their children tip the scales. You just need to face weight problems in a more covert way, Robinson says. Perhaps with smaller plates that can't hold quite as much mac-n-cheese.

showed Wardle and her team that appetite and weight were linked: children who were more responsive to food and slower to feel full were more likely to carry excess weight. But the researchers couldn't tell if the eating traits caused the weight gain or if being overweight was changing kids' habits around food.

### Back to the start

"If we wanted to try and get any kind of causal grip on the relationship between appetite and weight," says Clare Llewellyn, who worked with Wardle and studies behavioural obesity at University College London, "we had to go right back to the beginning of life, when these things first started to emerge."

They needed a new kind of study. So for the past decade, Llewellyn has helped run Gemini, the largest-ever twin study of childhood weight and appetite, which involves more than 2400 pairs of twins born in England and Wales in 2007. She and her colleagues have found that genetic differences in how we respond to food are apparent from the first weeks of life, and can influence our weight for the rest of our lives.

"Weight gain is deceptively simple really," says Llewellyn. "Small differences in appetite on a regular basis can catch up with you."

By just a few months of age, the twin study found that babies show clear differences in how they react to milk and how soon they'll stop feeding once they feel full. By 15 months, twins with strongly divergent eating traits can show as much as a 1-kilogram difference in body weight. That is about 10 per cent of each child's weight. Project that into adulthood, and deep-rooted dining habits may be adding centimetres to your girth.

Gemini revealed that a heartier appetite during the first three months of life fuelled



CAVAN IMAGES/PLAINPICTURE

early weight gain into toddlerhood, not the other way around. "This is the only study to show us that the genetic influences of appetite are visible right from birth," says Susan Carnell, a behavioural scientist now at Johns Hopkins University School of Medicine in Baltimore, Maryland, who developed behavioural susceptibility theory with Wardle.

By the time the Gemini twins turned 2, there was also a distinct divergence in consumption: if you compared two children at opposite extremes of satiety responsiveness, there was a difference of about 37 calories per meal, the equivalent of half a digestive biscuit. Those extra bites quickly add up to more than five extra days' worth of food consumption per month.

So it's not that overweight children are eating fattier or more sugary foods. They just eat a little bit more at each meal or snack. The same appears true for grown-ups. "It's not just what you eat, but how you eat," says Llewellyn.

This work changed thinking in the field of obesity research, says Jason Halford, a health psychologist at the University of Liverpool, UK. "Everyone now knows that the



BILDHUSE/PLAINPICTURE

Little by little: just a few extra mouthfuls at each meal can quickly add up



## RUN OFF THOSE EXTRA CALORIES

If your genes put you at risk of overeating (see main story), you should be able to cancel out those extra calories by hitting the treadmill or going for a bike ride, right? It's not so simple.

"Most people can't do enough exercise to offset their calorie surplus," says Todd Miller, director of the weight management and human performance lab at George Washington University in Washington DC.

An analysis of more than 10,000 people in the US who lost at least 14 kilograms and kept the weight off for a year or more shows that just 2 per cent shed the pounds solely through exercise.

Part of the reason why physical activity alone isn't effective has to do with "metabolic compensation": the more energy you burn from exercise, the less energy your body needs for basic functioning while at rest. In fact, some research indicates that energy expenditure can reach an upper limit and then plateau.

But the main culprit could be hunger, says Diana Thomas, an obesity researcher at the West Point military academy in New York state. Those who up their exercise respond to their body's increased energy needs by eating more, often without even realising they're doing it. "It's really easy to rack up those calories by just licking a spoon of peanut butter one more time," Thomas says.

environment is very much driving obesity," Halford says. The work of Wardle and her collaborators showed that, while by no means the only factor, genetic weaknesses or genetic protections put people on developmental trajectories from birth that influence their appetite.

With calorie-rich fare now abundant in kitchens and supermarkets throughout much of the world, people whose genes put them at risk of overeating will consume to excess in a way that wouldn't have been possible in earlier times (see "In your genes", page 34). "We're past the days when we had to be vigilant about plate-cleaning," Llewellyn says. "But unfortunately, that seems to have remained in the culture around eating."

And unless we take action to counteract our genetic predilections, waistlines will continue to grow where food is plentiful – and so will the attendant health problems.

This fact has an increasing number of people seeking out a more high-tech solution to their weight problem: DNA tests. Numerous companies sell tests that promise diet and lifestyle recommendations purportedly

informed by your personal genetic make-up. Tests usually include a sample of the 200 to 300 gene regions tied to weight in some way.

But even if you add up all the known genetic risk factors, they collectively account for maybe 5 per cent of the variation in body weight. How can that be, if, as twin studies have shown, up to two-thirds of this difference may be down to heritable factors? It's either

**"Weight gain is deceptively simple - small differences in appetite on a regular basis can catch up with you"**

that we haven't identified all the genes at play yet or that they affect behaviour in a more complicated way than we understand.

*FTO*, for instance, is perhaps the most extensively studied gene thought to affect appetite. But recent efforts to confirm findings that *FTO* increases food intake, instead found that the "skinny" and "fat" variants of the gene influenced how people

store or burn calories. The effect on appetite seems to be more subtle and indirect.

The trouble is, while we can identify and measure differences in food and satiety responsiveness, see how they relate to changes in weight and know that these effects are down to our genes, it is harder to pin down precisely which genes, or combinations of them, are responsible. There may be a lesson here from attempts to use drugs to govern appetite. For years, it was hoped that drugs targeting chemical pathways critical to appetite would be the key to tackling obesity. But it turns out that if you block one pathway, the body will find a workaround. The same may be true with expression of the various genes that affect appetite.

## Extreme hunger

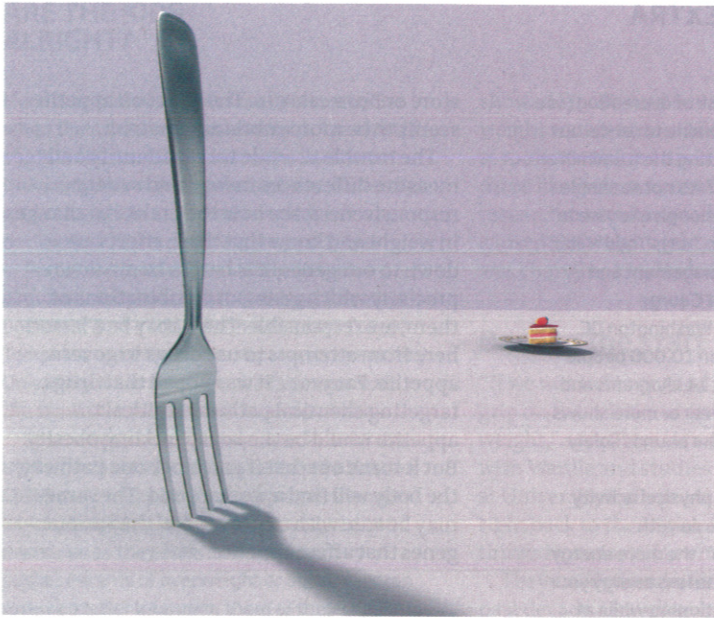
There are some rare disorders, such as congenital leptin deficiency, in which a single-gene defect is responsible for extreme hunger and obesity. In these cases, genetic testing is warranted. For everyone else, the tests are all "bullshit", says Ruth Loos, director of the Genetics of Obesity and Related Metabolic Traits Program at Icahn School of Medicine at Mount Sinai in New York City.

Loos worries about the pendulum swinging away from the misconception that overweight people lack willpower to a deterministic fatalism that there's nothing to be done as the problem lies in your genes. The truth, she says, is harder to swallow. It's not a level playing field. "Some people just have to work harder not to gain weight."

That brings us to the big question. If our genes predispose us to eat more than our body needs, what can we do about it?

Pay close attention to the ways you respond to food, says Llewellyn. Do you always go back for seconds? Do you leave food on your plate if you feel too full? Llewellyn says her "trigger food" is spaghetti bolognese. "I just go absolutely mad for it and I can't control myself," she says. So she never cooks more than a single portion's worth of pasta. And as soon as her food is plated, she sticks any leftover sauce in the fridge. Otherwise, she says, "I will invariably go back and eat more until I feel physically sick."

There might be a way to nudge overweight individuals in the right direction, without explicitly lecturing them about eating habits, says Claudia Hunot, a dietician at the University of Guadalajara in Mexico. She gave adults a questionnaire about their eating habits, and then offered email tips tailored



Some people are slower to register feelings of fullness

what to do." Maybe this is why some believe that less of the burden of addressing the obesity crisis should be placed on the individual. Theresa Marteau, director of the Behaviour and Health Research Unit at the University of Cambridge, thinks the UK government should start placing restrictions on the portion sizes of unhealthy foods.

## "People with genes to savour the 'sensory loveliness' of food may take those extra bites after they feel full"

Economic analyses suggest that this would make a massive dent in the country's public health burden from obesity. "Smaller portions, packages and tableware could reduce daily energy intake by significant amounts," Marteau says.

Yet few governments are willing to implement such heavy-handed legislation. New York City perhaps came closest when it tried to introduce a ban on large soda containers in 2013. The move caused a public outcry and met fierce opposition from the beverage industry. It was eventually struck down by the courts.

So, for now at least, we are on our own. But acknowledging that it might be more difficult for you than for others to turn down that tempting yet unneeded pudding doesn't have to prompt feelings of helplessness. Instead, knowing there is a reason for your powerful urge can provide a sense of relief, says Beeken. "There is a lot of stigma around weight and ability to lose weight," she says. "People know that they find it hard, and knowing that there is a reason they find it hard takes some of that blame and guilt away."

And perhaps there are reasons to celebrate these differences. Danielle Reed at the Monell Chemical Senses Center in Philadelphia, Pennsylvania, likens the propensity for overeating to genetic differences in vision. Just as someone who sees more colours might linger longer at the Louvre than someone who is colour-blind, so someone who has the genes to savour the "sensory loveliness of food" might take those extra bites even after they're full. If you struggle to refuse that extra slice, perhaps it is some consolation that you might be able to taste in technicolour and better appreciate all the glorious flavours. ■

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to participants' food-related foibles – be it emotional eating, eating too quickly or feasting past the point of fullness. "We could give them accessible and simple information that spoke to their own personal traits," Hunot says. If the results suggested someone was very responsive to food, for instance, she might suggest keeping certain foods out of the house or avoiding the table of treats at work. Another strategy is to build up resistance over time: if chocolate is a weakness, buy a small bar and carry it around but don't eat it. The idea is that over time you will become less tempted to indulge.

Feedback from the 32 people who've tried the intervention so far has been positive, says Rebecca Beeken, an obesity researcher at University College London who collaborated with Hunot. "People felt empowered by the knowledge that they could be genetically predisposed to find it harder," she says.

But to truly tackle a proclivity for pigging out, the twin studies seem to suggest that interventions have to start much earlier – perhaps even during the first months of life. A common refrain in parenting books and even on government websites is that you can't overfeed a breastfed baby, but, says Llewellyn, "our data suggest that's not completely true".

Ian Paul, a paediatrician at Penn State Children's Hospital, advocates "responsive parenting". This basically involves paying attention to your child's needs and learning the difference between cries of hunger, overstimulation and tiredness, for instance, and then tailoring your responses accordingly – instead of turning to food as a default solution. Paul and his colleagues

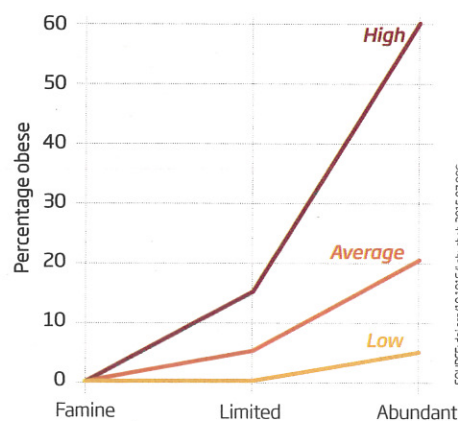
studied about 300 first-time mothers, half of whom were trained in responsive parenting, the other half on infant safety. Those in the first group were half as likely to have an overweight 1-year-old and one-tenth as likely to have an obese 2-year-old.

"Part of responsive parenting is limit-setting," says Paul. That simply means being sensible about portion sizes if you have a child who will overeat given the chance (see "Are the kids alright?", page 32).

This might sound simple, but it's "a lot harder to do in practice" when your baby is crying, says Carnell. "It's a very tricky topic," Llewellyn says. "No parent wants to be told

### In your genes

The amount of available food influences whether people become obese, but models show that a more important factor could be whether you have a **high, average** or **low** genetic susceptibility to obesity, which affects what and how much you want to eat



SOURCE: [doi.org/10.1016/j.physbeh.2015.07.006](http://doi.org/10.1016/j.physbeh.2015.07.006)