July 13th 2017 The Times

Scenting victory in the battle with obesity

Mice with no sense of smell can eat without getting fat, which looks like great news for humans

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In the global fight against weight gain there's no doubt who's winning. The fat cells are coasting to victory everywhere. Worldwide obesity rates have more than doubled since 1980, according to the World Health Organisation: 40 per cent of all adults are now overweight or obese, and rising, and we don't know how to reverse it.

People who eat less and move more can prevent themselves from gaining weight, but the same strategy rarely works to get rid of it. The gloomy fact is that bodies seem programmed to hang on to fat once we have it, with 80 per cent of dieters unable to maintain even a 5 per cent weight loss over five years. Only the drastic option of gastric surgery has a long-term record of success, with most patients losing half their excess weight. Good news for potential dieters is hard to find.

Until last week, when a group of American scientists came up with what could be the first big breakthrough in obesity research since laparoscopic bariatric surgery 20 years ago. A team at the University of California, Berkeley discovered that mice that had their sense of smell knocked out turned into fat-burning machines. They were given the same high-fat, high-calorie diet as ordinary mice, and the normal mice doubled in size over three months, becoming obese. The smell-deficient mice ate just as much as the ordinary mice and were no more active, but stayed at a normal weight.

This was not remotely what the researchers had expected and they are as stunned by the results as everybody else. Andrew Dillin, the professor of cell and molecular biology who led the team, told me that they set out to test the role of smell in weight gain because it's such an unexplored area. It is well known that people who lose their sense of smell get thin. The assumption has always been that they eat less because they are depressed, or because food becomes tasteless.

That was what the team thought they would document: mice that no longer cared for food. Instead they discovered a previously unknown link between what the brain smells and how the body prepares to process food. The sense of smell isn't just a pleasure. It sends messages to the body which change its metabolism.

> Do the morbidly obese eat so much because they're supersmellers?

When the mice could smell nothing, they transformed their subcutaneous beige fat, the kind that accumulates around our hips and stomachs, into brown fat, which acts as a furnace to produce energy. They also lost substantial amounts of white fat, the dangerous variety which swaddles our organs. The normal mice, on the other hand, eating the same high-fat diet, not only grew obese but also developed the insulin resistance that leads to diabetes.

That wasn't all. The obese mice then had their smell capacity knocked out. They went on eating just as before but lost most of their excess weight and regained insulin control. Remarkably, they didn't lose muscle, bone or organ mass, as is normally the case with dieters. They lost solely fat, an outcome that is the dieters' holy grail.

This was the eureka moment for Dillin. When the results came in they were so surprising that he assumed the team "had made a mistake. So this paper has more controls and checks than anything I've done in my life."

It is revolutionary because it snaps the link between calories in and calories out. It confirms that bodies are much more complex than that equation suggests.

Dillin tested his thesis, that the ability to smell our food makes us fatter, by going on to monitor mice bred to be super-smellers. He was proved right. The smell-sensitive mice got fat when they were fed the same food that kept ordinary mice slim.

The researchers' theory is that our sense of smell is sharp when we are hungry, and dulled when we have been fed. If we can smell nothing the body takes it as a signal that we have eaten and have energy to burn, so it fires up. If our sense of smell remains acute, the body assumes we still need fuel and must store fat.

What everyone wants to know now is: what does this mean for us? Dillin thinks this could be "tremendously big" as long as he can develop a drug that temporarily kills off humans' sense of smell without damaging anything else. He is "optimistically cautious" that there are enough similarities between mice brain circuits and humans for this to work, but will proceed very carefully, testing on dogs and pigs before any human trials. One red flag is that smell-deficient mice have high stress levels, often linked to heart attacks. He is already besieged by companies courting him, overtures he intends to ignore.

Dillin says his first priority would be the morbidly obese. Are they, he wonders, supersmellers? Do they crave 55 Snickers bars a day and get so fat because their olfactory systems are constantly signalling hunger? Their bodies and senses obviously operate differently to the rest of us; is smell the key to why?

This research offers hope to everyone; the enticing prospect of losing fat without willpower or lengthy deprivation. Dillin is full of hope but also fears the pitfalls. Might fast food companies develop a spray and fill their restaurants with it to make customers eat more? Might a drug encourage people to gorge? "It's new and it's a Pandora's box," he says, "and I want to be very very sure it works ... But it's one of those connections that now it's there you wonder: why did we never think of this before?"