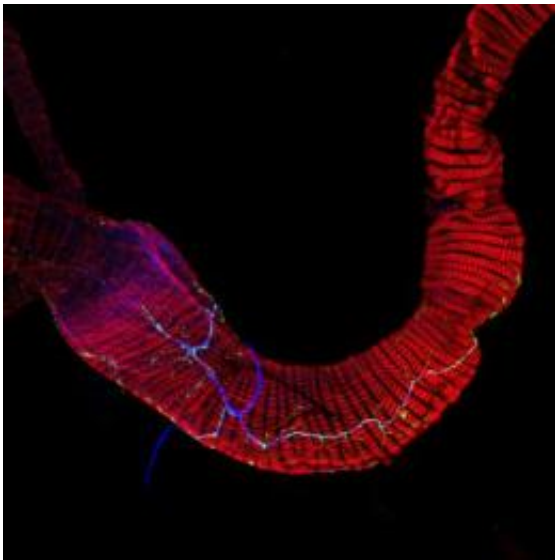


Pregnant, constipated and bloated? Fly poo may tell you why

January 4 2011



These are nerve cells in the gut of the *Drosophila melanogaster*. Credit: Irene Miguel-Aliaga, University of Cambridge

Clues about how the human gut helps regulate our appetite have come from a most unusual source – fruit fly faeces. Scientists at the University of Cambridge are using the fruit fly to help understand aspects of human metabolism, including why pregnant women suffer from bloating and constipation, and even the link between a low calorie diet and longevity.

Although scientists have known for some time that there are as many as 500 million nerve cells in our gut, the sheer complexity that this presents

means that little is known about the different types of nerve cell and their functions.

Now, researchers led by Dr Irene Miguel-Aliaga, with funding from the Wellcome Trust and the Biotechnology and Biological Sciences Research Council, have used the fruit fly, *Drosophila melanogaster*, to investigate the function of these intestinal neurons. The fly has simpler versions of our nervous and digestive systems, which lend it to genetic manipulation. Their findings are published today in the journal *Cell Metabolism*.

"We reasoned that what comes out of the gut may be able to tell us about what is going on inside," explains Dr Miguel-Aliaga. "So, we devised a method to extract information about several metabolic features from the flies' faecal deposits – which are actually rather pretty and don't smell bad. Then we turned specific neurons on and off and examined what came out."



These are nerve cells in the gut of the *Drosophila melanogaster*. Credit: Irene Miguel-Aliaga, University of Cambridge

Dr Miguel-Aliaga and colleagues found that these intestinal neurons have very important and specialised functions, such as regulating [appetite](#) or adjusting intestinal water balance during reproduction.

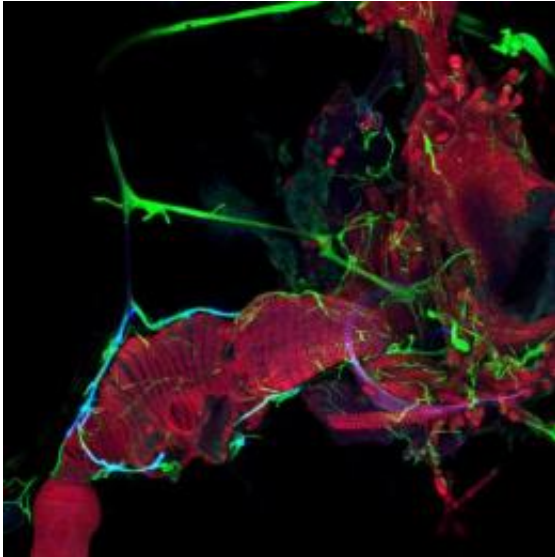
Female flies in their reproductive stage get constipated – their gut emptying rate is reduced even though they are eating more food; at the same time, they retain more water and the contents of their intestines become more concentrated. The researchers showed that these intestinal changes are triggered by the sex peptide, a hormone that males inject into the female during copulation, which activates a small group of gut neurons. This shares the same function as the sex hormones found in humans, such as progesterone, oxytocin and oestrogen.

"Humans and [fruit flies](#) reproduce in very different ways, yet the associated symptoms of constipation and bloating and their cause – a reproductive hormone – are the same," explains Dr Miguel-Aliaga. "This suggests that this mechanism has been conserved through evolution. These intestinal changes may provide a benefit at a time of high nutritional demand by maximizing nutrient absorption."

The research also provides tantalising clues about the link between calorie intake and longevity. Intestinal changes which help maximize nutrient absorption would likely be active all the time, as they would provide a selective advantage when food is scarce. However, in flies – and possibly in humans – this may come at a cost: a shorter lifespan.

It has been known for some time that when female flies mate and receive the sex peptide, this shortens their lifespan; however, this is not caused entirely by their increased food intake or because they are laying many eggs, the two most obvious effects of this sex peptide. The explanation, argue the researchers, may lie in the intestinal changes

triggered by the [sex peptide](#) that lead to constipation and water retention.



These are nerve cells in the gut of the *Drosophila melanogaster*. Credit: Irene Miguel-Aliaga, University of Cambridge

"A mechanism that maximises nutrient absorption by slowing the passage of food through the intestine is fine when food is scarce or during reproduction," says Dr Miguel-Aliaga, "but when we are eating a normal diet, constipation may lead to the build up of waste products produced during internal metabolism. Similarly, it could lead to changes in the composition of the gut bacteria, which are essential to regulating metabolism.

"Our research suggests that in addition to paying attention to what we eat, which has been the focus of longevity research, we may also have to consider what our body does with the food and what goes on in our guts."

Provided by Wellcome Trust

Citation: Pregnant, constipated and bloated? Fly poo may tell you why (2011, January 4)
retrieved 28 April 2024 from

<https://phys.org/news/2011-01-pregnant-constipated-bloated-poo.html>

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