

Research shows that gut bacteria tells their hosts what to eat

New research part-supported by the EU-funded FLIACT project has shown that gut bacteria 'speak' to the brain to control food choices, identifying two specific species of bacteria that have an impact on animal dietary decisions.



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What we eat influences the balance of microbes in our digestive tracts. We may choose a BLT sandwich for lunch or go for something dairy-based, and this decision can increase the numbers of some bacteria in our guts and reduce the populations of others. As their relative numbers change, they secrete different substances, activate different genes and absorb different nutrients.

Now, in a <u>paper</u> published in the Opean Access journal 'PLOS Biology', neuroscientists have found that specific types of gut

flora help a host animal detect which nutrients are missing in food and then finely titrate how much of those nutrients the host really needs to eat. 'What the bacteria do for appetite is kind of like optimizing how long a car can run without needing to add more petrol to the tank,' commented senior author Carlos Ribeiro.

The team conducted experiments using the fruit fly Drosophila melanogaster, a model organism that allowed the scientists to dissect the complex interaction of diet and microbes and its effect on food preference. First, they fed one group of flies a sucrose solution containing all the necessary amino acids. Another group got a mix that had some of the amino acids needed to make protein but lacked essential amino acids that the host cannot synthesize by itself. For a final third group of flies, the scientists removed essential amino acids from the food one-by-one to determine which was being detected by the microbiome.

After 72 hours on the various diets, flies in all three groups were presented with a

buffet offering their usual sugary solution alongside protein-rich yeast. The results initially showed that flies deprived of amino acids showed decreased fertility and increased preference for protein-rich food. Indeed, the team found that the removal of any single essential amino acid was sufficient to increase the flies' appetite for the protein-rich food.

The research team then tested the impact on food choices of five different species of bacteria that are naturally present in the guts of fruit flies in the wild. The results exceeded the scientists' expectations: two specific bacterial species could abolish the increased appetite for protein in flies that were fed food lacking essential amino acids. 'With the right microbiome, fruit flies are able to face these unfavourable nutritional situations,' commented team member Zita Carvalho-Santos.

'In the fruit fly, there are five main bacterial species; in humans there are hundreds,' adds co-author Patrícia Francisco. This highlights the importance of using simple animal models to gain insights into factors that may turn out to be crucial for human health.

So the killer question was, how could the bacteria act on the brain to alter appetite? 'Our first hypothesis was that these bacteria might be providing the flies with the missing essential amino acids,' Santos explains. However, the team realised that their experiments did not support this hypothesis. Instead, the gut bacteria 'seem to induce some metabolic change that acts directly on the brain and the body, which mimics a state of protein satiety,' elaborates Santos.

Microbes in the gut may have their own evolutionary reasons for communicating with the brain - they feed on whatever the host animal eats and For they need host animals to be social so they can spread through the wider population. The data is limited to animal models so far, but Ribeiro believes that gut-brain communication can provide fertile ground for developing treatments for humans in the future. 'It's an interesting therapeutic window that could be utilised to improve behaviours related to diet one day,' he concludes.

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