Gut bacteria tell the brain what animals should eat

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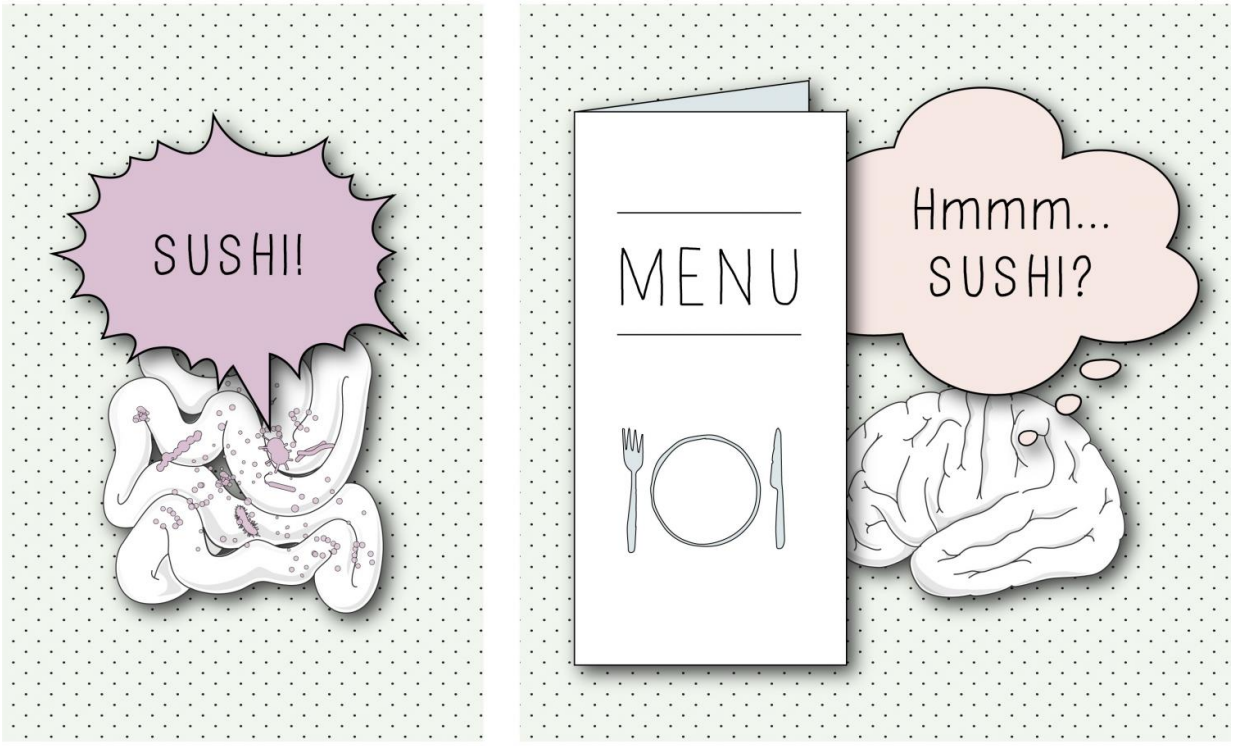

Gut bacteria tell the brain what animals should eat. Credit: Gil Costa

Neuroscientists have, for the first time, shown that gut bacteria "speak" to the brain to control food choices in animals. In a study publishing

April 25 in the Open Access journal *PLOS Biology*, researchers identified two species of bacteria that have an impact on animal dietary decisions. The investigation was led by Carlos Ribeiro, and colleagues from the Champalimaud Centre for the Unknown in Lisbon, Portugal and Monash University, Australia.

There's no question that nutrients and the microbiome, the community of bacteria that resides in the gut, impact health. For instance, diseases like obesity have been associated with the composition of the diet and the microbiome.

However, the notion that microbes might also be able to control behavior seems a big conceptual leap. Yet that's what the new study shows.

Experiments conducted using the fruit fly Drosophila melanogaster, a model organism allowed the scientists to dissect the complex interaction of diet and microbes and its effect on food preference. The scientists 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 protein-rich food.

Furthermore, the scientists 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 unfavorable nutritional situations," says 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 be crucial for human health.

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 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," Santos says.

In sum, this study shows not only that gut bacteria act on the brain to alter what animals want to eat, but also that they might do so by using a new, unknown mechanism.

More information: Leitão-Gonçalves R, Carvalho-Santos Z, Francisco AP, Fioreze GT, Anjos M, Baltazar C, et al. (2017) Commensal bacteria and essential amino acids control food choice behavior and reproduction. *PLoS Biol* 15(4): e2000862. DOI: 10.1371/journal.pbio.2000862

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