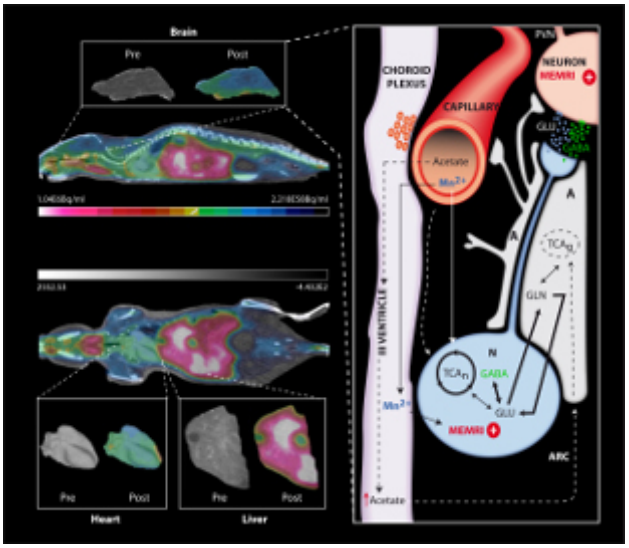
Another Way Fiber Is Filling

Acetate, a short-chain fatty acid released following the fermentation of dietary fiber in the gut, accumulates in the brain and can affect appetite in mice.

By Tracy Vence | April 29, 2014



Acetate, a molecule produced from fermentation of dietary fiber in the colon, leads to increase anorectic signaling in the hypothalamus
CERAN AND PEREZ

Researchers have long realized that consuming a fiber-rich diet can suppress appetite and reduce food intake in mice and humans alike, a phenomenon previously attributed to the release of gut hormones. Writing in *Nature Communications* today (April 29), Imperial College London's Gary Frost and his colleagues showed that small amounts of the short-chain fatty acid acetate, released as a result of the fermentation of dietary fiber in the mouse gut , accumulates within certain neurons in the animal's hypothalamus, a part of the brain that helps regulate hunger.

For the first time, the researchers have traced "a link between fermentation in the lower part of the gut—the colon—with activity in the brain," said Patrice Cani, who co-leads the Metabolism and Nutrition Research Group at Université Catholique de Louvain in Belgium, and was not involved in the work. "The originality was to show that acetate can in fact circulate and reach the brain . . . and affect appetite."

Frost's team was among the many that had been focusing on gut hormones, such as peptide YY and glucagon-like peptide-1, finding that these could directly affect neurons within the hunger-regulating hypothalamus. But using manganese-enhanced MRI (MEMRI) the researchers found "unusual brain signaling" in appetite-suppressed mice fed a fiber-rich diet, Frost said. "You'd usually expect that the actual activation levels [of hypothalamic neurons] to fall if the animal's appetite is suppressed, but they actually go up."

fermentation in the gut and implicated in brain-based appetite regulation. Fatty acids propionate or butyrate have been well-studied, for example, but acetate—the most abundant short-chain fatty acid produced in the colon—has been "neglected so far—at least in the context of appetite regulation," said Cani.

To investigate the role of acetate in appetite suppression, Frost and his colleagues used ^{13}Carbon labeling to image the fatty acid from the mouse gut within the brain, and found that around 5 percent of the acetate was preferentially taken up by the hypothalamus. (Most acetate is processed within the colon itself, or by the liver—through a well-studied process related to the metabolism of alcohol.) They also showed that colonic administration of acetate was associated with reduced appetite and food intake in mice.

"Gary [Frost's team] already demonstrated the in-brain activity of neurons involved in food intake," said Cani, referring to a 2007 *PLOS ONE* paper, "but he couldn't at that time really link the molecules sending the signals from the gut." Little did anyone realize that "acetate was one of those molecules," he added.

Of course, the biggest question at this point is whether acetate has similar appetite-suppressing effects in humans. "Currently, in western society, we probably consume somewhere between 12 to 14 grams of dietary fiber per day," said Frost. "Our work [in mice] suggests that to reliably see appetite-suppressive effects, you'd need around 30 to 35 grams—nearly three times what we normally eat."

He added that his team is now also working to determine whether targeted delivery of acetate could be a viable therapeutic option for conditions like obesity down the line.

G. Frost et al., "The short-chain fatty acid acetate reduces appetite via a central homeostatic mechanism," *Nature Communications*, doi:10.1038/ncomms4611, 2014.

Tags

nutrition, neuroscience, neurons, hunger, GABA, diet and acetate

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Comments

Jan M Woy
Posts: 1

April 30, 2014

The picture in this piece has nothing to do with the "acetate" from the reported studies.

As per link in the picture caption, the picture comes from a set (assembled for forensic purposes) showing various FIBERS . "Acetate" in this context is a jargon shortcut for "cellulose acetate" (which, in non-scientific language, is a sub-type of "rayon").

For the visualization of the acetate ion (or acetate esters) that the article describes, the magnification of 40X would be rather insufficient (by many orders of magnitude) . A better illustration would be a bottle of ...vinegar (usually ~10% acetic acid).

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vincehradil
Posts: 3

Replied to a comment from Jan M Woy made on April 30, 2014

April 30, 2014

So now I don't know whether I should drink vinegar or eat a some fabric? I bet eating my shirt would make me feel full.

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tvence
Posts: 819

Replied to a comment from Jan M Woy made on April 30, 2014

May 1, 2014

Thanks for reading! We've replaced the image with a figure provided by the authors.

All the best,

Tracy Vence

News Editor, *The Scientist*

Sign in to Report

colmstead
Posts: 1

Replied to a comment from Jan M Woy made on April 30, 2014

May 5, 2014

This is interesting. My grandmother taught that before manufactured insulin was available, an old "home remedy" for those who suffered from diabetes was to consume a small amount of vinegar 30 to 60 minutes before the main meal--often as salad dressing. This, she explained, slows the digestion of starches and keeps blood sugar from spiking so rapidly. Based upon Jan M Woy's remark, I wonder if this home remedy was an exploitation of the same sort of acetate ion chemistry this article is describing. It just sounds so very familiar.

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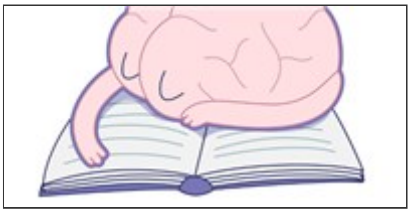

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By Ashley P. Taylor

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