**Friendly Bacteria Cheer Up Anxious Mice**

Probiotics affect behaviour and brain chemistry

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Most everyone knows that stress can cause a clenched, gurgling, unhappy stomach. What's less well known is that the relationship goes both ways.

Beneficial gut bacteria, or probiotics, have been shown in the past to alleviate symptoms of stress and anxiety, but it wasn't clear whether the bugs could have an impact on the brains of healthy animals. Now, John Cryan, a pharmacologist with the Alimentary Pharmabiotic Center at University College Cork, Ireland, and colleagues have found that probiotics have a direct impact on mood neurotransmitters in mice1. The findings further support the idea that one way to heal problems of the mind might be through the stomach.

Cryan's group fed a strain of *Lactobacillus rhamnosus* — a species found in some yoghurts — to 16 healthy mice. The dose they used was roughly the same as the amount of probiotic cultures claimed to be in a pot of Actimel yoghurt.

The team then ran the mice, along with 20 mice fed a bacteria-free broth, through a battery of stress tests. In negotiating a maze, the mice that received probiotics ventured out into open spaces more than twice as often as the control mice, suggesting that they were less anxious. And when forced to swim, the bacteria-fed mice were slightly more prone to struggle — rather than give up — than their broth-fed brethren. "These mice were more chilled out," says Cryan, adding that the effects of the probiotics were similar in magnitude to those seen in mice for antidepressant drugs. Cryan and his colleagues report their results in *Proceedings of the National Academy of Sciences* this week.

**Chemical confirmation**
Mice dosed with probiotics showed differences in brain chemistry, too. After the forced swim, bacteria-fed mice had about half as much corticosterone, a stress hormone, in their blood as control mice. The bacteria also seemed to cause redistribution of brain receptors for the neurotransmitter GABA (γ-aminobutyric acid) — the same receptors affected by anti-anxiety medications such as valium — into a pattern most common in non-depressed animals. When the researchers snipped the vagus nerve — which is important in the communication between the brain and the guts — these differences between the mice disappeared.

"It's not just behaviour and not just brain chemistry, it's the whole package," says Cryan.

"It's pretty convincing," says Brett Finlay, a microbiologist at the University of British Columbia in Vancouver, Canada. "These days our microbiota are being implicated in just about everything."

**Mental boost**
Previous work has shown that probiotics can improve the moods of patients with chronic fatigue syndrome or irritable bowel syndrome. And, in a study published earlier this year2, a French research group showed that a concoction of Lactobacillus helveticus and *Bifidobacterium longum*, given over 30 days, improved healthy volunteer scores in a range of surveys designed to assess mental health.

Cryan used to eat probiotic yoghurts himself until he was put off by the amount of sugar they contained. He says that it is difficult to extrapolate results from mice to people, and more work needs to be done to determine the precise effects of different bacterial strains. But, he adds, "if I was in any way stressed I wouldn't mind taking this in tablet form".

"Whether you should be taking probiotics for depression or not, time will tell," says Finlay.

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**New Study: Probiotics shown to mitigate depression and anxiety**

New research at the University of Toronto, found that a two month protocol of probiotics not only boosted chronic fatigue syndrome (CFS) patients "good" bacteria in the gut but also led to a significant decrease in their depression and anxiety symptoms.

It has long been known that probiotics, “Good bacteria” taken in pill or powder form, help maintain healthy gut flora beneficial to general health. Countless studies have shown them to perform a wide variety of healthy functions, including improved digestion, regularity, and improved immune system functioning. But, this new study, published in the journal BMC Gut Pathogens breaks new ground, specifically their effect on the feel-good neurotransmitter L-tryptophan. "We were quite excited with the fact that these were positive results and we felt that probiotics truly have a role to play in the management of neurophysiological disorders such as anxiety, such as depression and other symptoms associated with that," said Rao, the research leader. "Rather than going into medications, which may result in side effects, it's a safe, it's a very easy way to manage problems such as that."



The study, led by A. Venket Rao and co-authored by Dr. Alison C. Bested, administered 39 CFS patients either three doses of Lactobacillus casei Shirota a day, or a placebo, for two months. They found that 73 per cent of subjects taking the probiotic experienced an increase in levels of Lactobacillus and Bifidobacteria in the gut, which corresponded with a significant decrease in anxiety symptoms. In the placebo group, only 37.5 per cent showed an increase in Bifidobacteria, while only 43.8 per cent showed an increase in Lactobacillus bacteria. The researchers found no statistically significant change in anxiety symptoms among this group.

Dr. Alison C. Bested, the co-author of the study, says Bifidobacteria appears to increase levels of tryptophan in the brain, a chemical that 'helps people feel better.'

Rao and Bested believe that probiotics "crowd out" the more toxic stomach bacteria linked to depression and other mood disorders. “Bifidobacteria appears to increase levels of tryptophan in the brain, a chemical that "helps people feel better." Patients taking the probiotic also showed a marked improvement in their digestion, experiencing less bloating and gas and a reduction in inflammation. The findings are "huge," Bested said. "The subjects felt less anxious, they felt calmer, they felt better able to cope with their illness, they were sleeping better, had fewer heart palpitations and less symptoms of anxiety," she said. "We were pleasantly surprised, that people who were taking probiotics were able to lower their anxiety."

Rao explained that the good bacteria produce "compounds that get to the brain and help the brain to manage problems associated with behavioural and mood problems, such as anxiety and depression." He said the findings open "a door to a whole new field, and that is the relationship of gut micro flora, or gut bacteria, to many disorders - mental disorders being one of them. So it opens a door to many future research and applications in this area."