

MENTAL HEALTH

# A Shot against Post-Traumatic Stress Disorder

Tweaking the gut microbiome may hold promise for fighting stress, anxiety

• By [Sandra Lamb](#) on May 9, 2017



—[Getty Images](#)

Each night before “Greg” goes to bed he brushes and flosses his teeth. Then he double-checks the instructions on the dark brown bottle his nurse gave him before he unscrews the cap and tips five drops of a light-amber, oily liquid onto a spoon. The brew,

glistening from the light of the bathroom fixture, is tasteless and has no odor he can detect. But it's chock-full of bacteria.

He sloshes the substance around in his mouth and swallows.

Greg hopes that while he sleeps the foreign microbes will wage war with other organisms in his gut, changing that environment to ultimately help him manage some of the post-traumatic stress disorder (PTSD) symptoms that cloud his mind and riddle his days and nights with nightmares, flashbacks, thoughts of suicide and irrational responses to stressful events. The bacteria he is swallowing, his doctors tell him, “may help reduce symptoms of stress.” Each drop of Greg's brew is filled with millions of *Lactobacillus reuteri*, a bacterium isolated and derived from human breast milk. The [Denver VA Hospital](#) orders the substance and prescribes it as part of a PTSD clinical trial involving 40 veterans who either receive the bacteria or a placebo mix of sunflower oil and other inactive substances. (The bacterium is also currently used to treat a dental condition called [chronic periodontitis](#) because it has been shown to help fight inflammation.)

Altering the immune system to help build resilience to stressful events is a roundabout way to fight PTSD. But despite the massive burden of this disorder, there are few treatments for many of its crushing symptoms. Of the more than two million troops deployed in U.S. military conflicts worldwide, an estimated 11 to 23 percent have sustained some level of either traumatic brain injury (TBI) or PTSD. Greg, whose name has been changed in this article to protect his identity, is among them. He served in Operation Iraqi Freedom and was injured when the vehicle he was in detonated a roadside improvised explosive device—killing several of his comrades and leaving him with a badly wounded leg, a traumatic brain injury and the constellation of symptoms that comprise PTSD.

With few options available after he tried a variety of mental health therapies, last year he and 39 other veteran volunteers—all suffering from PTSD and being treated at the Rocky Mountain [MIRECC](#) for Veteran Suicide Prevention center in Denver—volunteered to be part of an early clinical trial to determine if *L. reuteri* can reduce their physiological and psychological responses to stressful situations. The roughly \$200,000 trial is funded by the Department of Veterans Affairs and aimed at evaluating the feasibility, acceptability, tolerability and safety measures for the possible use of the bacterium to treat PTSD.

## **GUT REACTION**

The bacterium was chosen after earlier animal trials suggested it produced anxiety-fighting responses. Last year a team of researchers at the University of Colorado Boulder found that injecting beneficial bacteria into mice helped them become more resilient to the stress of residing with much larger, aggressive mice. In [that study](#) the scientists injected healthy mice with a heat-killed preparation of *Mycobacterium vaccae*—which, like *L. reuteri*, acts like a drug, modulating the mouse’s immune system. (The two microbes are cousins and share a common ancestor.) The injected mice exhibited less anxiety or fearlike behaviors, and behaved more proactively around their aggressors than did those in a control group, which had to make do without the shots.

The vaccinated mice’s amplified calm made sense biochemically: The researchers discovered that the gut-altered mice also had more Tph2, an enzyme involved in the biosynthesis of the calming neurotransmitter serotonin, in the brain. The bacterial brew provided another benefit in the gut as well: Biopsies showed the injected mice were 50 percent less likely to suffer stress-induced colitis, as measured by cellular damage to the colon; and they had less system-wide inflammation. That study was hailed as a major breakthrough and named among the top 10 advancements and breakthroughs of 2016 by the nation’s leading nongovernmental funder of mental health research, the Brain and Behavior Research Foundation. “There is a growing recognition that the microbiome can impact health in general and, more specifically, mental health,” clinician Jeffrey Borenstein, the organization’s president, said in a statement about the research. The mouse work “can potentially be a game changer in our understanding of this, and ultimately lead to new treatments,” he added. “Our study in *PNAS* showed we can prevent a PTSD-like syndrome in mice,” says Christopher Lowry, a professor in the Department of Integrative Physiology at C.U.–Boulder, who headed up the study on mice that demonstrated *M. vaccae*’s effects on stress resilience. Lowry’s results were also consistent with earlier evidence about the powers of *M. vaccae* bacteria: Previous [work](#) established that *M. vaccae* increases serotonin in the prefrontal cortex, an area of the brain that [modulates anxiety](#). (The researchers are not using *M. vaccae* in humans because it is not yet approved for human use whereas *L. reuteri* works along the same immune-regulating pathway and could be tapped without needing further regulatory approvals.)

## **ANSWERS FROM POOP**

The human trials with *L. reuteri* began in August 2016 at the Denver VA Hospital, headed up by Lowry and Lisa Brenner, a psychiatry professor at the University of Colorado Denver School of Medicine. In addition to asking veterans to down a daily allotment of bacteria or placebo—the volunteers are unaware of which substance they are taking—each participant has been asked to keep a diary of gastrointestinal symptoms for about two weeks, and submit to stool tests. Participants then return for

further blood tests covering various biomarkers of inflammation and gut permeability. Then, after eight weeks, the veterans are subjected to stress testing like the mice.

Instead of exposing them to large mice, however, they are asked to do something even more intimidating to many humans: give a speech in front of a group while researchers collect their psychological and physiological stress measures (including heart rate variability and galvanic skin response). Participants also receive final blood and stool tests for biomarkers of inflammation, gut permeability and any changes in the microbiome. Final results from the study are expected in May 2018.

The foundational work behind this study is “very provocative” because it validates the concept of immunizing against a variety of stress-related disorders, says John Cryan, head of the Department of Anatomy and Neuroscience at University College Cork in Ireland, who was not involved with the work. The findings, he says, suggest this may be a promising way to help fight anxiety in PTSD patients.