Intestinal bacteria and the brain

Scientists who study brain-related issues suggest that some bacteria that normally live in the gut have an influence on human health. They are not certain precisely how this effect occurs but perhaps studies in animals can provide clues.

Experiments with mice and rats suggest that chronic stress can change the balance of microbes in the gut. In turn, as different bacteria become more common because of stress, the walls of the intestine may become weaker and allow the entry of harmful bacteria. These harmful bacteria can release proteins that are absorbed by the blood and spread throughout the body, causing inflammation. The scientists who study brain-related issues have noted that “emotional stress and depression have been shown to increase prevalence of disorders of the digestive system.”

Researchers have found that some bacterial proteins can interact with cells of the immune system that travel to, and in some cases take up residence in, the brain. In turn, these cells of the immune system release chemical signals that influence brain cells.

Scientists have conducted experiments with mice that do not have any bacteria in the gut and found that these animals have altered levels of neurotransmitters—compounds that the brain and nerves use to communicate—compared to mice with gut bacteria. This suggests that gut bacteria play some role in the health of the brain and nerves.

In other experiments, scientists have found that giving large doses of harmful bacteria to animals can cause what they describe as “anxiety-like behaviour.” They have also found that giving friendly bacteria to the same animals can result in apparent relief from anxiety.

When researchers conducted further experiments to better understand these findings, they found that in order for the bacteria to have helpful or harmful effects on the brain, the nerves that reach from the intestine to the brain must be intact. Scientists think that bacteria release proteins that have an indirect or direct effect on nerve cells in the intestine and these effects are relayed to the brain.

Depression

Some studies have found that there is a difference in the population of bacteria in the gut of people with depression vs. healthy people without depression. Whether this difference in gut bacteria was a factor that contributed to the onset of depression or is a result of depression is not clear. In experiments with young rats who have depression, certain friendly bacteria appear to relieve depression, perhaps by reducing inflammation. That there is a link between inflammation and depression is suggested by the results of pilot studies of the antibiotic doxycycline, which has anti-inflammatory activity, in some people with depression.

Thinking and gut bacteria

Other experiments with mice suggest that gut bacteria, particularly a group of bacteria called lactobacilli, can have an impact on memory and learning. As yet there is no evidence for a similar effect of these bacteria on people. However, research in this area is slowly advancing and one team of scientists has found that giving people probiotics “can alter the functional activity of the areas in the brain that are involved in cognitive functions.”

Understanding the effect of gut bacteria on the brain is still in its infancy; many clinical trials lie ahead.

A note about clinical trials

Most recent studies of probiotics and their effects on the brain or immune system have tested one, two or three
strains of bacteria or fungi. Since the gut contains many different types of bacteria (and fungi), clinical trials with many strains of probiotics are likely to have a greater effect than just a few strains.

—Sean R. Hosein

REFERENCES:


Disclaimer

Decisions about particular medical treatments should always be made in consultation with a qualified medical practitioner knowledgeable about HIV- and hepatitis C-related illness and the treatments in question.

CATIE provides information resources to help people living with HIV and/or hepatitis C who wish to manage their own health care in partnership with their care providers. Information accessed through or published or provided by CATIE, however, is not to be considered medical advice. We do not recommend or advocate particular treatments and we urge users to consult as broad a range of sources as possible. We strongly urge users to consult with a qualified medical practitioner prior to undertaking any decision, use or action of a medical nature.

CATIE endeavours to provide the most up-to-date and accurate information at the time of publication. However, information changes and users are encouraged to ensure they have the most current information. Users relying solely on this information do so entirely at their own risk. Neither CATIE nor any of its partners or funders, nor any of their employees, directors, officers or volunteers may be held liable for damages of any kind that may result from the use or misuse of any such information. Any opinions expressed herein or in any article or publication accessed or published or provided by CATIE may not reflect the policies or opinions of CATIE or any partners or funders.

Information on safer drug use is presented as a public health service to help people make healthier choices to reduce the spread of HIV, viral hepatitis and other infections. It is not intended to encourage or promote the use or possession of illegal drugs.

Permission to Reproduce

This document is copyrighted. It may be reprinted and distributed in its entirety for non-commercial purposes without prior permission, but permission must be obtained to edit its content. The following credit must appear on any reprint: This information was provided by CATIE (the Canadian AIDS Treatment Information Exchange). For more information, contact CATIE at 1.800.263.1638.

© CATIE

Production of this content has been made possible through a financial contribution from the Public Health Agency of Canada.

Available online at: