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:

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