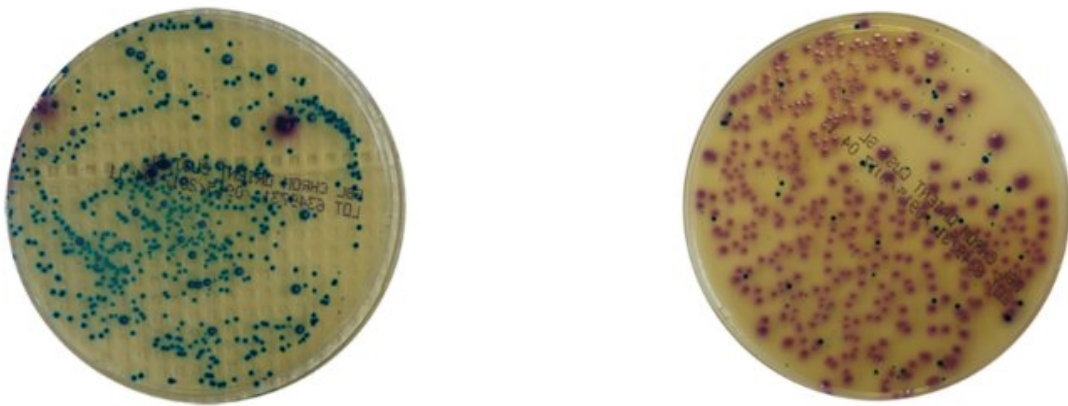


# Gut bacteria hold clues to improving mental health after spinal injury

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Bacteria from fecal matter of rats before (left) and after (right) spinal cord injury Credit: Schmidt et al, 2020

Could feces offer hope to survivors of spinal cord injuries?

It's a question University of Alberta physical therapy researcher Karim Fouad never thought he'd ask. But the expert in spinal cord injuries said the [digestive tract](#) could help explain the link between spinal injuries and changes in mental health, such as increased anxiety and depression.

"You would think that if you have a stroke or [spinal injury](#), 'no wonder you're depressed,'" said Fouad. "But it turns out there might be more to it than that."

In a new study in *PLOS ONE*, Fouad's team discovered that rats with spinal injuries experienced changes to their [gut bacteria](#) and a rise in anxiety-like behaviour. When rats with spinal injuries were given fecal transplants from healthy rats, their behaviour—and gut bacteria—remained normal.

Fouad suggests that bacteriotherapy, in the form of "poop pills," could one day be used to improve well-being following spinal cord injuries and diseases of the central nervous system.

"I think it has huge potential," Fouad said. "The beauty of it is that if this translates to humans, we'd have a simple tool that could potentially improve mental health."

## **Gut health**

Researchers have long observed a deterioration of [mental health](#) following spinal cord injuries.

Patients who experience paralysis are at an increased risk of suicide. The increased prevalence of depression also means patients often miss their best window for recovery by losing interest in rehab, Fouad said, leading to a worse quality of life.

Connections between poor intestinal health and mental state have also been found outside of spinal cord research. Research at the U of A has even pointed to how gut health could help explain a disease like multiple sclerosis.

Fouad decided to test for similar connections on spinal cord injuries. When rats received minor [spinal cord injuries](#), he observed a dramatic change in gut flora. It took up to four weeks for digestive tracts to return to normal.

To test anxiety-like behaviour, Fouad and his team also tested the rats on an elevated plus maze, gauging their willingness to risk venturing onto an exposed platform. Three weeks after recovery, injured rats remained far more reluctant to overcome their natural aversion to open spaces than the typical rats.

The next part of the experiment flipped those findings upside down. Some of the injured rats were given a fecal transplant. They made an astonishing recovery, becoming even more willing to venture out on the exposed platform.

"It's dramatic," said Fouad. "Diseases and injuries seem to trigger changes of the microbiome, and this can have much further effects."

## Implications

Fouad hopes to test the effectiveness of [fecal transplants](#) over time, and to see whether anxiety could be induced simply by adding the wrong gut bacteria to animals raised in sterile environments.

He said there could be wider implications for these findings. Scientists often house animals together in experiments. But since rats are notorious omnivores—known to eat the feces of other [rats](#)—researchers may have inadvertently skewed thousands of experiments in which gut health was a potential modifying factor.

"How many generations of experiments have been done where microbiome changes were a potential influence and animals were eating

the poo and maybe negating the effect?" Fouad said. "That's a scary thought."

Fecal transplants might not have the same allure as stem cells for spinal cord patients, Fouad said, but for patients facing a condition in which incremental gains can make a pivotal difference, poop pills could make a big difference.

"Is it going to cure spinal [injury](#)? No," he said. "But if you're in a wheelchair and dealing with it in a good mindset, it could make a big difference."

**More information:** *PLOS ONE*, [journals.plos.org/plosone/article?id=10.1371/journal.pone.0226128](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0226128)

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