

That anxiety may be in your gut, not in your head

McMaster research finds link between gut bacteria and behaviour

Hamilton, ON (May 17, 2011) - For the first time, researchers at McMaster University have conclusive evidence that bacteria residing in the gut influence brain chemistry and behaviour.

The findings are important because several common types of gastrointestinal disease, including irritable bowel syndrome, are frequently associated with anxiety or depression. In addition there has been speculation that some psychiatric disorders, such as late onset autism, may be associated with an abnormal bacterial content in the gut.

"The exciting results provide stimulus for further investigating a microbial component to the causation of behavioural illnesses," said Stephen Collins, professor of medicine and associate dean research, Michael G. DeGroot School of Medicine. Collins and Premysl Bercik, assistant professor of medicine, undertook the research in the Farncombe Family Digestive Health Research Institute.

The research appears in the online edition of the journal *Gastroenterology*.

For each person, the gut is home to about 1,000 trillion bacteria with which we live in harmony. These bacteria perform a number of functions vital to health: They harvest energy from the diet, protect against infections and provide nutrition to cells in the gut. Any disruption can result in life-threatening conditions, such as antibiotic-induced colitis from infection with the "superbug" *Clostridium difficile*.

Working with healthy adult mice, the researchers showed that disrupting the normal bacterial content of the gut with antibiotics produced changes in behaviour; the mice became less cautious or anxious. This change was accompanied by an increase in brain derived neurotrophic factor (BDNF), which has been linked, to depression and anxiety.

When oral antibiotics were discontinued, bacteria in the gut returned to normal. "This was accompanied by restoration of normal behaviour and brain chemistry," Collins said.

To confirm that bacteria can influence behaviour, the researchers colonized germ-free mice with bacteria taken from mice with a different behavioural pattern. They found that when germ-free mice with a genetic background associated with passive behaviour were colonized with bacteria from mice with higher exploratory behaviour, they became more active and daring. Similarly, normally active mice became more passive after receiving bacteria from mice whose genetic background is associated with passive behaviour.

While previous research has focused on the role bacteria play in brain development early in life, Collins said this latest research indicates that while many factors determine behaviour, the nature and stability of bacteria in the gut appear to influence behaviour and any disruption, from antibiotics or infection might produce changes in behaviour. Bercik said that these results lay the foundation for investigating the therapeutic potential of probiotic bacteria and their products in the treatment of behavioural disorders, particularly those associated with gastrointestinal conditions such as irritable bowel syndrome.

The research was funded by grants from the Canadian Institutes of Health Research (CIHR) and the Crohn's and Colitis Foundation of Canada (CCFC).

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