

## **St. Joseph's Healthcare Hamilton Researchers Discover New Nerve Pathway with Potential to Treat Anxiety and Depression**

**Monday, April 28<sup>th</sup> 2014 – Hamilton, ON** – Researchers at [St. Joseph's Healthcare Hamilton](#) have identified a previously unknown nervous relay system in mice that successfully sends the signals of an antidepressant and anti-anxiety microbe from the abdomen to the brain. Targeting this newly-discovered nerve pathway in the abdomen changes the way researchers previously understood the nervous system's ability to transmit signals to the brain and opens the potential for new treatments for individuals diagnosed with depression or anxiety. This study was mainly conducted by St. Joseph's Healthcare Hamilton researcher Dr. Azucena Perez-Burgos, a postdoctoral fellow working in a laboratory lead by Dr. Wolfgang Kunze, affiliated with the Brain-Body Institute. Dr. Wolfgang Kunze, associate professor at McMaster University and researcher at St. Joseph's Healthcare Hamilton, designed the study as its principal investigator. The study has been published in the newest issue of the [FASEB Journal](#).

"This discovery will alter traditionally held beliefs regarding sensory nerves in general," explains Dr. Wolfgang Kunze, Researcher, St. Joseph's Healthcare Hamilton. "It was previously thought that the vagus nerve only responds directly at its endings, but we have shown that there is a prior nervous relay system within the gut that can act as a 'gatekeeper' for information flowing from microbes in the intestine to the brain. This new sensory relay provides an attractive novel target for developing new treatments for psychiatric mood disorders."

As part of the study, Dr. Wolfgang Kunze's research team successfully sent signals from specific probiotic bacteria that have antidepressant and anti-anxiety properties through the vagus nerve - a major nerve present in mammals – into the brain of mice. While these specific probiotics are not commercially available at the moment, this discovery opens the door for the possibility of a probiotic or biological treatment for anxiety and depression in the future.

"If this system acts in the same way in humans, it could allow us to use existing treatments for anxiety and depression differently," explains Dr. John Bienenstock, Director of the McMaster University Brain-Body Institute at St. Joseph's Healthcare Hamilton. "Because this newly-discovered relay system has a different chemical makeup from sensory nerves themselves, previous treatments can potentially be made more effective, and new treatments might become possible."

The nervous system in the abdomen includes a massive network of connections and relay stations, having been referred to by academics as "the little brain". Food and bacteria in the abdomen communicate with the immune and nervous systems, which can signal and control activities in the brain.

The vagus nerve is a sensory nerve that helps to control breathing, heart-rate and digestion. It also activates the parasympathetic nervous system, which manages our relaxation responses that help to bring bodily functions down to baseline after excitement or stress.

Dr. John Bienenstock and Dr. Wolfgang Kunze are currently exploring the ramifications of the "gut-brain axis" in order to better understand the human body, and ultimately develop treatments that will improve the quality of life for patients.

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## **More Information**

### **About the Study**

In 2013, Dr. Wolfgang Kunze and Dr. John Bienenstock published a study in [Nature Communications](#) that demonstrated that the vagus nerve was able to send a specific type of bacteria from the abdomen to the brain of a mouse causing the mouse to become less anxious. If the vagus nerve was cut at the diaphragm however, the probiotics in the abdomen were unable to reach the brain. The implications of this study could be summarized succinctly by stating that bacteria in the abdomen were shown to influence brain function and behavior.

Research conducted by McMaster University's [Farmcombe Group](#), which works closely with Dr. Wolfgang Kunze and Dr. Bienenstock, also [suggested](#) that certain bugs in the gut can affect the brain through the vagus nerve. It was assumed that the vagus nerve must be picking up the signals only at the nerve endings which exist in the brain and in abdominal organs. The nerve was believed to be only in contact with the body through these two pathways.

This study, entitled "The gut-brain axis rewired: adding a functioning vagal nicotinic sensory synapse," has shown the existence of a novel nervous relay system which allows the vagus nerve to not only communicate with the brain, but with other nerves as well. Rather than only receiving sensory input through the ends of the nerve, the results of the study show that this newly-discovered relay system allows the vagus to pick up signals from other nerves before contacting the brain.

The discovery of this nervous relay system provides the opportunity for scientists to be able to signal the brain and many nervous mechanisms in the gut targeted at this previously-unrecognized pathway. Because the chemical composition of this relay system is different from the chemical composition of the vagus nerve itself, previous antidepressant and anti-anxiety medications can now be chemically targeted at the relay system and provide different effects. New medications that were previously chemically incompatible with the vagus nerve itself can be tested for effectiveness in treating anxiety and depression.

As specific probiotic bacteria were used to conduct the experiment, probiotic and biological treatments for anxiety and depression may become possible in the future due to these findings. While the specific probiotics used in the study are not commercially available at the moment, probiotic bacteria that have antidepressant and anti-anxiety properties could potentially become isolated and extensively reproduced in the future. A probiotic treatment for depression and anxiety has the potential to become a significant alternative to psychiatric medications, as probiotics typically have less side effects than commonly-used medications for anxiety and depression.

### **About the Researchers**

[Dr. Wolfgang Kunze](#) served as the senior lead author and academic supervisor of the study. He has been part of the Brain-Body Institute since its inception in 2001, and has since focused on the nervous system and its connection with the brain and abdomen. This project was envisioned and designed by Dr. Wolfgang Kunze, and was conceptually based on the research that he conducted in Australia, Germany and Canada. Dr. Wolfgang Kunze works closely with [Dr. Azucena Perez-Burgos](#), an SJHH post-doctoral researcher that has significantly contributed to this research study. [Dr. John Bienenstock](#) is the Director of the Brain-Body Institute, and a world-renowned researcher in the field of immunology. Colloquially referred to as the one of the 'fathers of mucosal immunology,' he pioneered the concept of the common mucosal system, which led to new approaches in immunization as a result of an increased scientific understanding of the human body.

### **About Research at St. Joseph's Healthcare Hamilton**

St. Joseph's Healthcare Hamilton is an academic health sciences centre fully affiliated with the Faculty of Health Sciences at McMaster University. Our researchers aim to better understand prevalent medical and mental health issues today's society in order to develop advanced therapies and treatments that will improve the quality of life for patients in our community and around the world. In pursuit of this goal, research in the areas of clinical science, mental health, nephrology, respirology (Firestone Institute for Respiratory Health) and virology attract over \$25 million annually in grants and research support funding. For more information about research at St. Joseph's Healthcare Hamilton, please visit [www.stjoes.ca/research](http://www.stjoes.ca/research).

### **About St. Joseph's Healthcare Hamilton**

St. Joseph's Healthcare Hamilton is a regional leader in patient-centred care providing acute care, research, teaching, community and international outreach programs throughout our network. Since being founded by the Sisters of St. Joseph in 1890, our hospitals span three specialized campuses in the Greater Hamilton Area (Charlton Campus, West 5th Campus and King Street Campus), with St. Joseph's Villa Dundas providing long-term care and St. Joseph's Home Care providing personalized home care traversing the reach of our region. For more information about St. Joseph's Healthcare Hamilton, please visit [www.stjoes.ca](http://www.stjoes.ca).