



## ASHEVILLE INTEGRATIVE MEDICINE

James Biddle, M.D.

Sudeshna Dasgupta-O'Brien, M.D.

Anne Walch, MHS, P.A.-C.

### THE BRAIN IN THE GUT

Human beings actually have two brains, rather than one. And sometimes, one can cause problems for the other.

The term “Second Brain” was coined by Dr. Michael Gershon in 1996. It was the name he gave to the brain in the gut or the “enteric nervous system”. Although this system had been described as early as 1921, it had been largely forgotten and not studied in detail. Our knowledge of the second brain, therefore, is quite new. Dr. Gershon is a neurobiologist who, along with other researchers, has been studying the workings of this amazingly complex brain and the neurotransmitters it produces, particularly serotonin. (Neurotransmitters are molecules that relay signals between nerve cells.)

The function of our second brain is to control every aspect of digestion, from the esophagus (or food pipe) to the stomach, small intestine and colon. Our brain in the gut accomplishes this task with a sophisticated network of nerve circuits, neurotransmitters and proteins. Moreover it functions usually with minimal awareness on our part. This is so we do not have to devote, as Dr. Gershon puts it, “our cerebral energy to visceral matters”.

Are our two brains connected? Yes, by a long cable called the vagus nerve. However, if the vagus nerve is severed, the enteric nervous system continues to function independently.

Communication between the two brains can present as distress signals. For example, mental anxiety about an event, can lead to a queasy feeling in the stomach or diarrhea. And conversely, communication from the brain in the gut to the brain in the head is also often unpleasant. It is usually achieved by way of serotonin. For example, some drugs used for cancer chemotherapy, like doxorubicin, can induce serotonin release in the gut which then results in nausea and vomiting.

The brain in the gut and the gut-brain connections are a relatively new field of study called neurogastroenterology. Many neurotransmitters are released by the second brain, such as: serotonin, dopamine, glutamate, acetylcholine, nor epinephrine and nitric oxide. Dr. Gershon and his fellow researchers have studied the actions of serotonin extensively. The actions of serotonin on the gut are quite complex and not yet fully understood: there are at least seven different receptors for serotonin in the gut! Serotonin is secreted by both nerve cells and specialized non-nerve cells in the gut mucosal lining called enterochromaffin cells. Serotonin is what causes nerves to start the process of peristalsis (the forward propulsive movement of the gut). It also causes the secretion of mucous and starts digestive juices flowing. 95% of the body's serotonin is found in the gut.

832 Hendersonville Road, Asheville NC 28803

(828) 252-5545 • FAX (828) 281-3055

[www.docbiddle.com](http://www.docbiddle.com)

In the brain, an important function of serotonin is mood regulation. Low serotonin levels are associated with depression and anxiety. SSRIs or selective serotonin reuptake inhibitors such as Prozac are used to treat depression. Because of its effects of raising serotonin levels, 25% of the time Prozac has gastrointestinal side effects, such as nausea, vomiting, diarrhea and finally constipation.

Depression, anxiety, Parkinson's disease, Alzheimer's disease, ulcers, irritable bowel syndrome and ulcerative colitis are some conditions that have manifestations at both the brain and gut level. As we increase our understanding of the two brains and how they function, there is new hope for those afflicted. Research is now focusing on serotonin-based drugs targeted at the gut: "intestinal antidepressants" that are aimed at producing visceral analgesia in conditions like irritable bowel syndrome. In addition, Robert Stern, a psychology professor at Penn State has found that biofeedback can help people to consciously increase and enhance gastrointestinal activity, thus using one brain to help another.

Some interesting facts about the brain in the gut:

1. The second brain has a 100 million neurons, more than the number of neurons in the spinal cord.
2. It makes every neurotransmitter that is found in the brain, about two dozen neuropeptides, enkephalins (a member of the endorphin family) and benzodiazepines (psychoactive chemicals with actions like Valium and Xanax)