

- Digestive system / Digestion

## HOW THE GUT IS THE HEART OF WELL-BEING

Your digestive tract is your ‘second brain’, and what happens there can affect your mood and stress levels, as well as your physical health

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Almost 25 years ago, Michael Gershon, a professor of pathology and cell biology at Columbia University in New York, published his groundbreaking book, *The Second Brain*.



His 30 years of research had led to the discovery that nerve cells in the gut act as a “brain” that controls the stomach.

Our two brains, he wrote, must cooperate, otherwise there is chaos in the gut and misery in the head, everything from “butterflies” to cramps, diarrhoea and constipation.

More research over the years has helped us understand the function of “the second brain” and the interdependence of the gut microbiota and the brain, the so-called gut-brain axis.

Kara Holmes, nurse and author of *The Gut Health Reset*, says it’s helpful to think of it as a phone line that’s always open – a signalling system supported by immune cells, the enteric nervous system (ENS), gut bacteria and the vagus nerve, the largest nerve in the autonomic nervous system, which extends from the brain to the colon and plays a key role in heart, lung and digestive function.

The ENS is the focus of University of Melbourne professor Joel Bornstein’s research.

Bornstein explains that this system of neurons and cells runs the length of the gastrointestinal tract, from the oesophagus to the anus. That’s why, he suggests, the gut-brain axis should really be called the gut-microbiota-ENS-brain axis.

The ENS is the largest nervous system in the body apart from the brain, with 200 million to 600 million nerve cells that form 20 or more different interconnected functional subgroups.

The gastrointestinal tract is the only organ in the body with a nervous system that can operate without input from the central nervous system.

Professor Ng Siew Chien from the department of medicine and therapeutics at the Chinese University of Hong Kong (CUHK) is director of the Microbiota I-Center (MagIC) and an expert on the gut microbiome.

She explains the difference between microbiota – all live microbes – and the microbiome, which includes microbes, their genetic material and the gut environment. As a simple analogy, consider the microbiome as a house, and microbiota as the inhabitants.

Gut microbiota produce large amounts of metabolites when the body digests food. Depending on what we eat, these might be inflammatory or they may stimulate and regulate the action of nerve cells, influencing mood.

It’s why diet is a key influence on gut microbiota, and has an impact on mental health and other conditions.

About 95 per cent of the “happy hormone” serotonin is made in the gut, says Holmes. Gut bacteria create other neurotransmitters, she says, and “we need an abundance of helpful ones to be in optimal mental health”.

While good gut bacteria promote good mental health, stress can upset an otherwise happy balance.

The problem, says Holmes, is that many of us are in a persistent state of stress, so our systems become desensitised to high levels of the stress hormone cortisol. This in turn affects our digestive system and can cause leaky gut – an unhealthy gut lining that may have cracks or holes, allowing partially digested food, toxins and bugs to penetrate the tissues beneath it – leading to chronic inflammation.

“This is one of the ways our gut can suffer from our brain constantly triggering a stress response,” Holmes says.

Current evidence strongly indicates that gut microbiota can affect mood, notably anxiety, and other elements of brain function.

Holmes can attest to this. In 2018, she found that making small, powerful changes in her diet transformed her from the inside out – and helped her recover from an 11-year battle with an eating disorder and pre-diabetes.

Ng notes that an unhealthy gut microbiome is closely related to intestinal and non-intestinal disorders, including irritable bowel syndrome, allergies, asthma, cardiovascular disease and obesity, as well as mental health disorders, so nurturing a healthy environment for our microbiota is crucial.

Everyone’s microbiota differ slightly in the types and quantities of microbes, Bornstein says. Generally, the more diverse the microbiota, the better.

The microbiota get all their nutrients from what we eat, so to change the relative numbers of different microbes we need only change the composition of our diet, he says.

What’s exciting about this is that, while we may not be able to change our genetic make-up, we can modulate our gut microbiome to relieve diseases or promote better health. This is an entry point for the development of precision medicine.

Advances in biotechnology, Ng says, have successfully used the gut microbiome in a number of important clinical conditions.

For example, the US Food and Drug Administration has approved the use of an oral gut microbiome formulation to treat a recurrent and potentially lethal condition, the *Clostridium difficile* infection.

At CUHK, the first microbiome-based diagnostic test for early colorectal cancer and recurrent colorectal adenomas has been commercialised.

Ng anticipates that advances in biotechnology will make it easier to isolate next-generation probiotic bacteria with specific health benefits against colorectal cancer, diabetes, obesity, autism, and possibly even dementia.