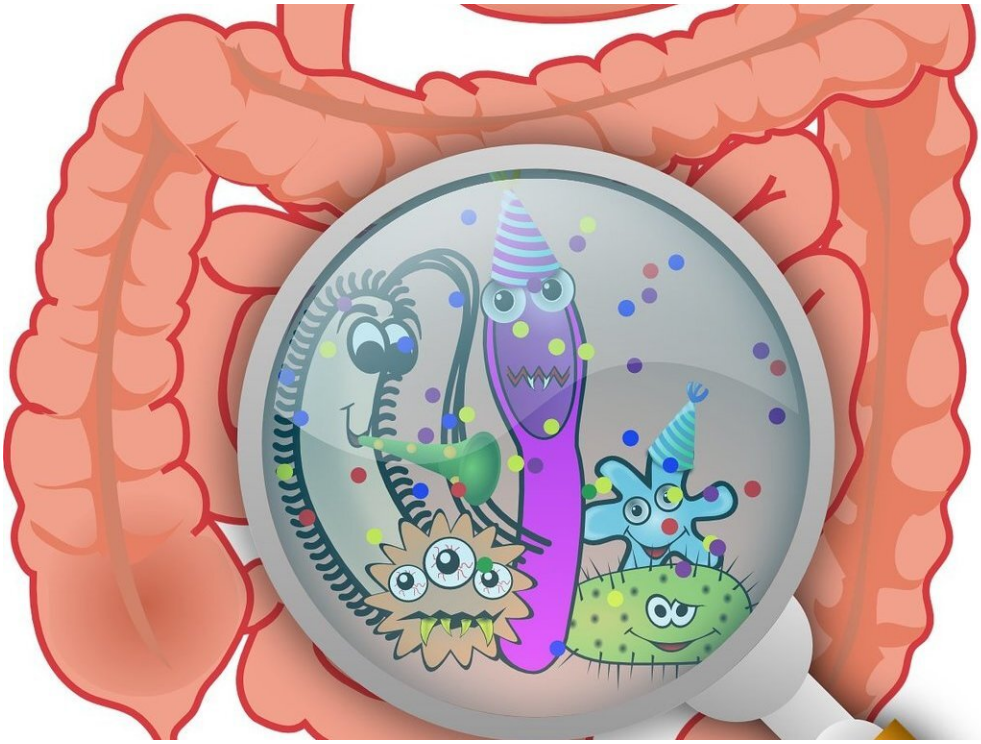
Gut bacteria help control healthy muscle contraction in the colon

February 5 2020



Credit: CC0 Public Domain

Micro-organisms in the gut support healthy digestion by helping nerve cells within the intestine to regulate the contraction and relaxation of the muscle wall of the colon, according to new research from the Crick and Bern University.

The study, published in *Nature*, identified how the contraction and relaxation of muscles in the colon, which is regulated by nerve cells and is needed to push food along, is influenced by the bacteria resident in our gut. When such microbes are present, a specific gene called Ahr is activated in intestinal nerves, resulting in healthy contraction and relaxation of the colon (peristalsis). This relationship can be disrupted in cases of intestinal disorders, like irritable bowel syndrome (IBS).

"There is a clear link between the presence of microbes in the colon and the speed at which food moves through the system. If this relationship goes off-kilter it could cause considerable harm," says Yuuki Obata, lead author and postdoc in the Development and Homeostasis of the Nervous System Laboratory at the Crick.

A healthy gut contains trillions of microorganisms which help the digestion of food and promote the fitness of gut tissues, such as the epithelial lining of the lumen and the vast collection of immune and nerve cells within the gut wall. The levels and types of microorganisms in the gut vary from person to person and are affected by diet and commonly used drugs, such as antibiotics, which often result in abnormal gut contractions. The work described in this paper helps us understand how nerve cells sense the microbes in the gut and how they could coordinate their function with other gut tissues.

"Disturbances of intestinal motility are extremely common and cause a lot of suffering in patients after surgical operations or in conditions such as irritable bowel syndrome. This work provides a foundation to unravel why patients that are colonised with different groups of microbes are susceptible to these intestinal problems", explains Andrew Macpherson, Professor of Medicine and Director of Gastroenterology at the University Hospital of Bern.

"By drawing on different teams at the Crick and internationally with

Bern University, we've combined expertise on the gut and how environmental signals from microbiota and diet are passed to cells, to gain understanding of how gut physiology and digestion are affected by these signals," says Brigitta Stockinger, co-lead author and group leader in the AhRimmunity Laboratory at the Crick.

"While it's been well-documented that the micro-organisms in our gut influence the function of many organs in our body, including the brain, there's less understanding about the role they play in maintaining the healthy functioning of the millions of nerve cells within digestive system itself. The work we describe here shows that AhR, a molecule which is very important for the function of immune and epithelial cells in the gut, is also used by intestinal nerve cells to sense the presence of microbes and regulate peristalsis, and in doing so, promote healthy digestion," says Vassilis Pachnis, co-lead author and group leader in the Development and Homeostasis of the Nervous System Laboratory at the Crick.

"In the future, the use of microbial products that change the activity of AhR in nerve cells could help us alleviate the consequences of abnormal gut peristalsis that is often associated with gastrointestinal diseases," continues Vassilis.

More information: Neuronal programming by microbiota regulates intestinal physiology, *Nature* (2020). DOI: 10.1038/s41586-020-1975-8 , nature.com/articles/s41586-020-1975-8

Provided by The Francis Crick Institute