Amid the murk of 'gut flora,' vitamin D receptor emerges as a key player

July 7 2010

Within the human digestive tract is a teeming mass of hundreds of types of bacteria, a potpourri of microbes numbering in the trillions that help us digest food and keep bad bacteria in check.

Now scientists have found that the vitamin D receptor is a key player amid the gut bacteria - what scientists refer to matter-of-factly as the "gut flora" - helping to govern their activity, responding to their cues, and sometimes countering their presence. The work was published online recently in the American Journal of Pathology.

The findings deliver a new lead to scientists investigating how bacteria might play a role in the development of inflammatory bowel diseases such as Crohn's disease or ulceractive colitis. The work complements studies suggesting that Salmonella infection can increase the risk of inflammatory bowel disease.

"Vitamin D deficiency is a known factor in the pathology of inflammatory bowel disease and colon cancer," said microbiologist Jun Sun, Ph.D., of the University of Rochester Medical Center, "but there have been very few reports about how bacteria might play a role by targeting the vitamin D receptor. Our work suggests one possible mechanism, by working through the vitamin D receptor, a sensor and regulator for the majority of functions of vitamin D."

Sun specializes in the actions of bacteria in the body and how their interactions within the body contribute to disease. She has shown that

bacteria often found in the human intestine affect molecular signals known to contribute to inflammatory response and cell growth.

Her work with the vitamin D receptor takes place at a time when the molecule is coming under increasing scrutiny. Scientists have associated vitamin D and the receptor with many types of cancer, as well as osteoporosis, heart disease, diabetes, inflammatory bowel disease, and infection.

Sun's team took a close look at the vitamin D receptor in mice and its interactions with bacteria in the colon. The team studied normal mice; mice in which the vitamin D receptor had been knocked out; and mice that were completely free of any germs. Scientists observed how the mice responded to infection with either a harmless strain of E. coli or a pathogenic strain of Salmonella Typhimurium.

The team found that Salmonella is able to regulate the vitamin D receptor, increasing its activity and determining where in the colon the receptor is active. In the presence of Salmonella, the receptor was more prevalent than usual deep within folded intestinal structures known as crypts.

Sun's team also discovered that the vitamin D receptor plays a key role in defending the body from assault by Salmonella and squelching inflammation. The receptor stops a molecule known as NF-Kappa B, a well-known master player in the world of inflammation, by binding to it and preventing it from activating other inflammatory molecules. While scientists have known that the receptor interacts with NF-Kappa B, details of the interaction modulated by bacteria in the colon are new.

The scientists found that Salmonella was much more virulent and aggressive in mice in which the vitamin D receptor had been turned off. These mice showed higher levels of activity of inflammatory molecules,

and they lost weight more quickly and were much more likely to die in response to infection.

"We live together in a mutually beneficial state with most of the bacteria in our gut," said Sun, assistant professor in the Gastroenterology and Hepatology Division of the Department of Medicine. "They help us digest foods like fruits and vegetables, and we provide them a place to live and thrive. We co-exist peacefully - most of the time.

"But we aren't able to culture most of these bacteria in the laboratory, and we don't know what most of them are doing. We need to understand our gut flora much more than we do. This is particularly important for understanding how we might manipulate the natural gut flora to stop an invader like Salmonella," added Sun, who also has appointments in the James P. Wilmot Cancer Center and the Department of Microbiology and Immunology.

Provided by University of Rochester Medical Center

Citation: Amid the murk of 'gut flora,' vitamin D receptor emerges as a key player (2010, July 7) retrieved 28 April 2024 from https://medicalxpress.com/news/2010-07-murk-gut-flora-vitamin-d.html