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Cancer-causing gut bacteria exposed

Normal gut bacteria are thought to be involved in colon cancer but the exact mechanisms have remained unknown. Now, scientists from the USA have discovered that a molecule produced by a common gut bacterium activates signalling pathways that are associated with cancer cells. The research, published in the October issue of the *Journal of Medical Microbiology*, sheds light on the way gut bacteria can cause colon cancer.

There are more bacteria in our bodies than there ever have been people on the Earth. In fact, there are more bacteria in the colon than there are human cells in our bodies. Most of the bacteria in our guts are harmless and many are beneficial to our health. However, for several decades scientists have thought that some microbes living in the gut may play a role in the formation of sporadic colorectal cancer.

Enterococcus faecalis is a normal gut bacterium. Unlike most gut bacteria, it can survive using two different types of metabolism: respiration and fermentation. When the bacteria use fermentation they release by-products. One of these is a kind of oxygen molecule called superoxide, which can damage DNA and may play a role in the formation of colon tumours.

"We wanted to investigate how colon cells respond to normal gut bacteria that can damage DNA, like *E. faecalis*," said Professor Mark Huycke from the Department of Veterans Affairs Medical Center in Oklahoma City, USA. "We found that superoxide from *E. faecalis* led to strong signalling in immune cells called macrophages. It also altered the way some cells in the gut grew and divided and even increased the productivity of genes that are associated with cancer."

The team found that 42 genes in epithelial cells in the gut are involved in the regulation of the cell cycle, cell death and signalling based on the unique metabolism of *E. faecalis*. This suggests that cells of the lining of the colon are rapidly affected when *E. faecalis* switches to fermentation. It also indicates that *E. faecalis* may have developed novel mechanisms to encourage colon cells to turn cancerous.



Intestinal cancers occur almost exclusively in the colon where billions of bacteria are in contact with the gut surface. For years scientists have tried to identify links between gut bacteria and people who are at risk of colon cancer. This has been made difficult by the enormous complexity of the microbial communities in the intestine.

"Our findings are among the first to explore mechanisms by which normal gut bacteria damage DNA and alter gene regulation in the colon that might lead to cancer," said Professor Huycke. "This research puts n to perspective the complexity of the effects normal gut bacteria can have on the health of an individual."

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