

Appendix isn't useless at all: It's a safe house for bacteria

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Long denigrated as vestigial or useless, the appendix now appears to have a reason to be – as a “safe house” for the beneficial bacteria living in the human gut.

Drawing upon a series of observations and experiments, Duke University Medical Center investigators postulate that the beneficial bacteria in the appendix that aid digestion can ride out a bout of diarrhea that completely evacuates the intestines and emerge afterwards to repopulate the gut. Their theory appears online in the *Journal of Theoretical Biology*.

“While there is no smoking gun, the abundance of circumstantial evidence makes a strong case for the role of the appendix as a place where the good bacteria can live safe and undisturbed until they are needed,” said William Parker, Ph.D., assistant professor of experimental surgery, who conducted the analysis in collaboration with R. Randal Bollinger, M.D., Ph.D., Duke professor emeritus in general surgery.

The appendix is a slender two- to four-inch pouch located near the juncture of the large and small intestines. While its exact function in humans has been debated by physicians, it is known that there is immune system tissue in the appendix.

The gut is populated with different microbes that help the digestive system break down the foods we eat. In return, the gut provides nourishment and safety to the bacteria. Parker now believes that the

immune system cells found in the appendix are there to protect, rather than harm, the good bacteria.

For the past ten years, Parker has been studying the interplay of these bacteria in the bowels, and in the process has documented the existence in the bowel of what is known as a biofilm. This thin and delicate layer is an amalgamation of microbes, mucous and immune system molecules living together atop of the lining the intestines.

“Our studies have indicated that the immune system protects and nourishes the colonies of microbes living in the biofilm,” Parkers explained. “By protecting these good microbes, the harmful microbes have no place to locate. We have also shown that biofilms are most pronounced in the appendix and their prevalence decreases moving away from it.”

This new function of the appendix might be envisioned if conditions in the absence of modern health care and sanitation are considered, Parker said.

“Diseases causing severe diarrhea are endemic in countries without modern health and sanitation practices, which often results in the entire contents of the bowels, including the biofilms, being flushed from the body,” Parker said. He added that the appendix’s location and position is such that it is expected to be relatively difficult for anything to enter it as the contents of the bowels are emptied.

“Once the bowel contents have left the body, the good bacteria hidden away in the appendix can emerge and repopulate the lining of the intestine before more harmful bacteria can take up residence,” Parker continued. “In industrialized societies with modern medical care and sanitation practices, the maintenance of a reserve of beneficial bacteria may not be necessary. This is consistent with the observation that

removing the appendix in modern societies has no discernable negative effects.”

Several decades ago, scientists suggested that people in industrialized societies might have such a high rate of appendicitis because of the so-called “hygiene hypothesis,” Parker said. This hypothesis posits that people in “hygienic” societies have higher rates of allergy and perhaps autoimmune disease because they -- and hence their immune systems -- have not been as challenged during everyday life by the host of parasites or other disease-causing organisms commonly found in the environment. So when these immune systems are challenged, they can over-react.

“This over-reactive immune system may lead to the inflammation associated with appendicitis and could lead to the obstruction of the intestines that causes acute appendicitis,” Parker said. “Thus, our modern health care and sanitation practices may account not only for the lack of a need for an appendix in our society, but also for much of the problems caused by the appendix in our society.”

Parker conducted a deductive study because direct examination the appendix’s function would be difficult. Other than humans, the only mammals known to have appendices are rabbits, opossums and wombats, and their appendices are markedly different than the human appendix.

Parker’s overall research into the existence and function of biofilms is supported by the National Institutes of Health. Other Duke members of the team were Andrew Barbas, Errol Bush, and Shu Lin.

Source: Duke University

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