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Gut study divides people into three types

Bacterial populations fall into three distinct classes that could help to personalize medicine.

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Just as there are a few major blood types that divide up the world, so too, a study has found, there are just three types of gut-microbe populations. The result could help to pinpoint the causes of obesity and inflammatory bowel disease, and to personalize medicine.

"This is important. Say you want to compare ill people and healthy people; you better match them properly [by gut type]," Dusko Ehrlich told Nature at a human microbiome conference in Vancouver, Canada, in March. Ehrlich, a senior researcher on the paper published in Nature today1, is director of the Microbial Genetics Research Unit at the National Institute for Agricultural Research in Jouy-en-Josas, France, and part of a European consortium aiming to unpick links between gut microbes and disease.

The finding of just three types of gut-microbe population was an unexpected result that fell out of the team's early analysis. The types aren't related to age, gender, nationality or diet. "What causes it? We don't know," says Ehrlich.

One possible explanation, which the team is testing, is that a person's gut-microbe make-up is determined by his or her blood type. Alternatively, it might be determined by metabolism: there are three major chemical pathways by which people get rid of excess hydrogen gas created during food fermentation in the colon, and the gut type might be linked to those. Or, perhaps the first microbes a baby is exposed to as his or her immune system is developing determines the type.

A person's gut type might help to determine whether people can eat all they like and stay slim, whether they will experience more gut pain than others when sick and how well they can metabolize a certain drug.

It's unclear whether a person's gut type might change over time, either naturally or in response to something such as a steady diet of probiotic yoghurt.

Little helpers

Researchers have only recently begun to appreciate the importance of the bacterial cells that grow on and in our bodies, outnumbering our own cells by about ten to one. In rodents, gut microbes are known

to influence weight and immunity against disease (see 'For mice, swapping fecal bacteria can mean life or death'). In the United States, the Human Microbiome Project is aiming to catalogue all the microbes living in our nose, mouth, skin, gut, and urinary and genital tracts; in Europe, the Metagenomics of the Human Intestinal Tract (MetaHIT) Consortium, the group to which Erlich belongs, is focusing on the gut.

For this paper, the team used genetic screening to identify the microbes present in faecal samples from 22 Europeans enrolled in other gut-microbe studies, and compared the results with samples from 17 people in the United States and Japan. When they looked to see how similar the samples were, the researchers found that they clustered neatly into three groups. "We were very surprised," says Peer Bork of the European Molecular Biology Laboratory in Heidelberg, Germany, also a senior author on the paper. Although the number of samples in this paper is small, Bork says that his team now has results from more than 400 samples and that the clustering is still evident.

"I was surprised too. I thought it would be much more chaotic," says Brett Finlay, a microbiologist at the University of British Columbia in Vancouver.

Fat or thin

The team has named the clusters after the dominant genus: Bacteroides, Prevotella and Ruminococcus. Bacteroides are known to be good at breaking down carbohydrates, so it is possible that people of this type might, for example, struggle more with obesity, says Bork. Prevotella tend to degrade slimy mucus in the gut, which could conceivably increase gut pain. And some Ruminococcus help cells to absorb sugars, which might contribute to weight gain.

Bork cautions, however, that each person carries a complex mix of perhaps a few thousand bacterial species, and too little is known to make sweeping generalizations about the implications of the different gut types. The team has, however, found hints that one particular disease — Bork won't yet say which one — is found only in people of one microbial gut type.

The team also has a host of as-yet-unpublished results that link specific gut-bacteria species to individual characteristics. "If I have a stool sample I can tell how old you are," says Bork. "That seems useless because you already know how old you are, but it's proof of principle that it could maybe be used for all sorts of other things." Ehrlich says that his team can diagnose obesity with an accuracy of 80-85% from half a dozen bacterial species.

"The real question is: what is the gene set we need in our guts to be healthy?" says Finlay. That has yet to be answered.

References

1. Arumugam, M. et al. Nature Advance online publication doi:10.1038/nature09944 (2011).