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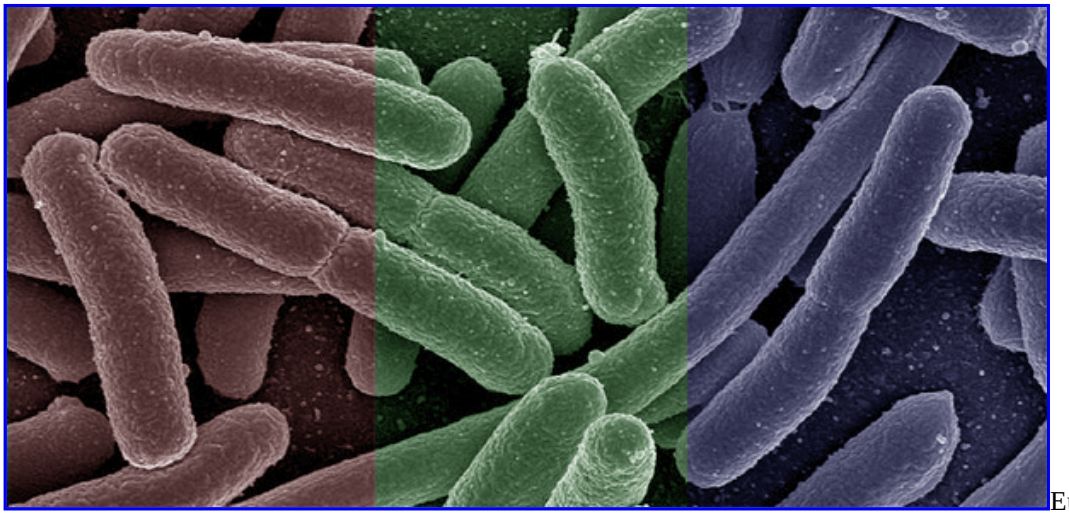
Divided by language, united by gut bacteria – people have three common gut types



Europe is a divided land. For such a relatively small continent, it is split into 50 different countries and its people speak hundreds of languages. But within their guts, there is common ground. The intestines of Europeans, like those of all humans, harbour massive communities of bacteria. According to a new study, these microscopic worlds fall into just three different groups, which transcend the borders of geography and politics. In gut bacteria, we are united.

Our gut contains trillions of bacteria, known collectively as the microbiome. Their cells outnumber our own by ten to one. We are, to the closest approximation, thriving communities of bacteria encased in a human shell. No two people have quite the same collection – we differ slightly in the species we contain, and there can be hundreds jostling for space.

But this variation isn't infinite. Previous studies have shown that once people reach adulthood, their microbiomes become remarkably stable. Even after the communities are rocked by antibiotic assaults, they rebound to their old selves, recruiting members in the same proportions as before. Now, Manimozhiyan Arumugam and Jeroen Raes from the European Molecular Biology Laboratory (EMBL) have found that these constraints go even further. There seem to be just three preferred ways of building a community of gut bacteria.

The duo collected stool samples from 22 Europeans from Denmark, France, Spain and Italy, sequenced all the DNA within them, and compared them to 13 similar samples from Japan. They found that these sequences collapsed into three general groups, which they called enterotypes. Arumugam and Raes also showed that sequences from 154 Americans and 85 Danes, taken from other studies, fit within the three groups.

The enterotypes transcend boundaries of countries and continents. That is surprising – two years ago, John Novembre showed that the genetic variation in Europe mirrors its geography with startling precision. But human genes are outnumbered by those of their gut bacteria by a hundred to one, and these bacterial genes are apparently far more straight-forward.

Enterotypes aren't quite as well-defined as, say, blood groups, but they could have similar uses as medical markers. The microbiome helps us to digest our food and it affects our susceptibility to diseases; the enterotypes could reflect these roles. Each enterotype was dominated by a specific genus of bacteria, and varied in the proportions of the other members. They produce energy in subtly different ways, they're particularly efficient at breaking down different nutrients, and they specialise at creating different vitamins.

These are clues, but they stop short of telling us what the three enterotypes signify. Peer Bork, who led the study, says that the groups don't seem to be driven by diet. However, his team has only looked at Westernised or developed countries. It's possible that more enterotypes lurk in the guts of hunter-gatherers from remote villages; after all, one earlier study found that African villagers have different gut bacteria to Europeans.

The enterotypes aren't driven by the age, gender, nationality, or body weight of their hosts either. However, they could be affected by their hosts in more subtle ways. For example, the gut bacteria of older people contain more genes that are involved in breaking down carbohydrates than those of youngsters, but they have fewer genes that help them cope with harsh conditions. These changes could reflect the bacteria's responses to their ageing human hosts, whose failing digestive systems need more help and whose weakening immune systems pose less of a problem.

It's clear that this line of research is just beginning. "This is the first hint that there might be types of gut microbiome that are reproducible in different populations," says Rob Knight, who also works on gut bacteria. "It will be fascinating to determine in future work whether these enterotypes are associated with disease risk and reproducible in other populations and ages."

"I do think the enterotypes will have an impact on human health," says Bork. His team has found hints that everyone with a certain disease belong to just one enterotypes, although for now, he isn't revealing which disease it is. That will come in time…

Reference: Arumugam, Raes et al. 2011. Enterotypes of the human gut microbiome. Nature http://dx.doi.org/10.1038/nature09944

INTRODUCTION

You could be sitting alone and still be completely outnumbered for your body is home to trillions upon trillions of tiny passengers – bacteria. Your body is made up of around ten trillion cells, but you harbour *a hundred* trillion bacteria. For every gene in your genome, there are 100 bacterial ones. This is your 'microbiome' and it has a huge impact on your health, your ability to digest food and more. We, in turn, affect them. Everything from the food we eat to the way we're born influences the species of bacteria that take up residence in our bodies.

This slideshow is a tour through this "universe of us". Every slide has links to previous pieces that I've written on the subject if you want to delve deeper.

Image by David Gregory & Debbie Marshall, Wellcome Images

April 20th, 2011 by Ed Yong in Bacteria, Microbiome | 3 comments | RSS feed | Trackback >

3 Responses to "Divided by language, united by gut bacteria – people have three common gut types"

1. 1. *Robert S-R* Says:
   April 20th, 2011 at 1:30 pm

   Wow. This seems huge. I wonder what medicines might work differently for people with different "gut types," or what treatments might become less risky after knowing which type someone has. Very cool stuff!

2. 2. *Chris Lindsay* Says:
   April 20th, 2011 at 2:29 pm

   Sort of an un-related question…can you measure and compare organisms' gut bacteria with other organisms (of a different species) to determine evolutionary relatedness?

3. 3. *Ed Yong* Says:
   April 20th, 2011 at 2:57 pm

   @Robert S-R – Yeah, those are the questions that Bork and his crew are asking. Pretty cool, no?

   @Chris Lindsay – Sort of. Certainly, the evolutionary relationships of the gut bacteria in great apes accurately recaps the evolution of the apes themselves. I wrote about this last year.

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