Researchers Launch Open-Access Gut Project

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After Rob Knight’s daughter was born, he began taking fecal samples from her diaper every day to see what kind of microorganisms resided in her tiny gut. Now that she is potty trained, her patience for contributing to science has waned, but Knight is still busy analyzing fecal matter. The pediatrics and computer science and engineering professor at the University of California, San Diego, is a cofounder of American Gut (www.americangut.org), an open-access, citizen-science project launched in 2013 that now has more than 6000 participants and has raised close to $1 million.

Until recently, scientists knew little about the billions of single-cell organisms teeming in the human gut. That has changed thanks to next-generation sequencing and advances in computational techniques. Knight and his lab members can quickly and cheaply distinguish and classify the unique genes of the creatures in each sample. He and his colleagues are creating a master list of these human gut flora and fauna and how they vary in different populations depending on geographic location, diet, exercise, and other lifestyle influences. More than 50 scientists have volunteered their time, lab space, or their own specimens to be sequenced.

Such work may one day help researchers better understand a range of diseases, from Alzheimer’s to diabetes. “Ultimately, it will be useful for developing clinical tests that link certain microorganisms in the gut to a particular condition,” Knight says. His colleague Jack Gilbert, a microbial ecologist at Argonne National Laboratory, adds, “Microorganisms in our gut have a tremendous impact because they’re interacting with our human cells. They’re training our immune system, affecting our moods, digesting our food, determining whether we are susceptible to certain diseases or not.”

The project is similar to the Human Microbiome Project (HMP), in which Knight was also involved. As with American Gut, the HMP, which ran from 2007 to 2012, sought to understand the microbial communities that live on and in the human body and their associations with health and disease. The HMP was funded with a $115 million National Institutes of Health grant, though, and access to its data was initially restricted to members of the HMP consortium, a group of scientists competitively selected for the project. In contrast, American Gut is paid for through the crowdfunding site FundRazr. Participants contribute $99 and receive a home sampling kit that they then send into Knight’s lab. Later, they receive information about what microorganisms reside in their guts and how their results compare with those of others in the study. The project’s data is available for anyone to use. “One of the biggest problems with a lot of academic research is that researchers want to keep the data a secret until it’s published and then continue to keep it a secret so they can write more papers,” Knight says. Adds Gilbert, “We know we aren’t the only people who can come up with potential therapeutics. We can’t see everything. We can’t do everything. So it’s very, very important that we make these resources available for all clinicians, all researchers, even companies so everyone can benefit.”

Already, several studies have been published using American Gut data. One conducted by National Institutes of Health staff researchers, published in the December 2014 issue of EBioMedicine, found a distinct difference in the composition of the fecal microbiota of adult volunteers who were born by cesarean section compared with that of those born vaginally. (The researchers used logistical regression to control for a variety of differences that might occur from birth to adulthood.) Meanwhile, Knight and his colleagues are close to publishing their first paper. “We’re really interested in scale,” Knight says of the type of research they are pursuing. “What has a big effect on your microbiome and a small effect? We’re trying to understand whether things act independently or do they interact with each other in complicated ways? For instance, does an antibiotic have the same effect on your gut microbe when you’re 20 as when you’re 80?”

So far, the majority of participants have been US residents—including a few well-known ones, such as food writer Michael Pollan of the University of California, Berkeley, and ultrarunner Dean Karnazes—although the project has samples from around the world. Private foundations and government funding have paid for sampling efforts in indigenous communities in Africa and South America. “We want to know what microbiomes are like in [remote] communities where the people don’t use antibiotics and spend much more time in the outdoors,” Knight says. They have also incorporated data sets from other researchers to add more ethnic diversity to the pool. International participation should increase with the recently created offshoot, British Gut (www.britishgut.org).

The project will continue as long as there is public interest. Knight says, “Getting 10,000 participants would be a good start.”

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doi:10.1093/biosci/biv180