Microbiome meets big social science: What's the potential?

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Over the last decade or so, biologists have mustered an ever-growing appreciation for the essential role of microbial communities in a diversity of environments.

"We're recognizing that the biosphere is run by microbes at every level," notes UW-Madison Professor of Medical Microbiology and Immunology Margaret McFall-Ngai. "They are the pivotal, central players in the health of the planet."

They are also, of course, essential protagonists in human health. In the average human gut, for example, three pounds of microorganisms, mostly bacteria representing hundreds of species, churn in symbiotic harmony to keep us healthy and robustly functional.

The new understanding of the role of microbial communities in human health, and the growing community of researchers studying the microbiome—the totality of microbes and their genomes in a given environment—could soon begin to emerge in the large longitudinal studies that have long been a hallmark of the social sciences at UW-Madison. A September workshop sponsored by the Center for the Demography and Health and Aging and the Center for Demography and Ecology, sought to bring UW-Madison biologists and social scientists together to explore the microbial dimensions of human health.

"Until recently, the biologists and the social scientists weren't talking to each other," explains Alberto Palloni, a professor of sociology and an

organizer of the recent workshop. "We want to see if we can push things beyond small projects by linking to these larger population studies."

UW-Madison is home to half a dozen very large longitudinal population health studies, including MIDUS (Midlife in the United States), the Wisconsin Longitudinal Study, the Beaver Dam Eye Study and Epidemiology of Hearing Loss Study, the Wisconsin Sleep Cohort Study and the Survey of the Health of Wisconsin (SHOW). The studies follow large cohorts of human subjects for long periods of time. The Wisconsin Longitudinal Study, for example, has tracked the life course of more than 10,000 members of the Wisconsin high school class of 1957.

As they exist, the studies gather critical information about human health and well-being and how it changes over time. Palloni and others, however, see enormous potential in tracking not only the human subjects, but also in profiling and looking at changes in the populations of microorganisms—the vast majority of them benign or beneficial—that live in and on people.

Lita Proctor, who directs the National Institutes of Health Human Microbiome Project, told workshop participants about a wide range of implications for human microbiome research, much of which could ultimately be accessible through large population health studies.

"The microbiome changes over a lifetime," she notes. "In the elderly, it looks very different. There are also (microbiome) differences between healthy and diseased people."

The field, she says, is taking off as scientists begin to explore the idea that disturbances in the microbiome could lead to disease. Tentative links have been found for conditions such as Crohn's disease, cystic fibrosis and some cancers.

Scientists are also recognizing that each individual human may be host to a unique composition of microbes, with as many as 1,000 species present in niches ranging from the gut to the belly button. An individual's microbiome, in fact, may be a more exact identifier for individuals than a fingerprint.

The intelligence community, Proctor notes, is developing technologies to track people according to their unique microbiome signatures.

McFall-Ngai, who also helped organize the workshop, says our mushrooming understanding of the human microbiome suggests that our association with large numbers of microbes represents a normal, healthy and co-evolved relationship.

"Animal biology at all levels is dependent on the microbial world," according to McFall-Ngai, "but we didn't even know it existed until the advent of high-throughput sequencing."

A number of prominent UW-Madison faculty—biologists and social scientists—were represented at the workshop, and Palloni expressed confidence that once demographers and biologists start talking and exploring their parallel interests, UW-Madison will be well positioned to blaze new trails at the intersection of population health and the human microbiome.

Pilot studies involving both biologists and population health researchers are already being explored, Palloni adds, and a working group to organize small annual workshops is being formed.

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