amino acids, or other metabolites that a dependent bacterium cannot synthetize for itself,” says Eric Stewart, another member of the Lewis group. Helpers also may modify the external environment, according to Stewart. For example, antioxidant-producing marine bacteria reduce hydrogen peroxide in seawater, thereby allowing sensitive Prochlorococcus to grow, he says.

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RESEARCH ADVANCES

Tissue Microbiota Implicated in a Wide Variety of Diseases

Shannon Weiman

Microbial communities of the gut, mouth, and skin may indicate—and, in some cases, play roles in causing—various diseases, according to several researchers who presented their findings during the poster session “Human Microbiome,” at the 2013 ASM General Meeting held in Denver last May. Changes in microbial communities correlate with a widening range of disorders, including inflammatory bowel disease (IBD), cancers, diabetes, and vector-borne infectious diseases. These distinctive patterns may serve as the basis for diagnostics, in some cases at the early stages when intervening might prevent full-blown disease development. If these microbial irregularities, called dysbiosies, cause disease, modulating microbial communities with antibiotics, prebiotics, or probiotics might prevent, delay, or help treat conditions that later can prove more difficult or impossible to treat.

Mice with disrupted gut microbial communities tend to have more tumors in tissues of the gut than do mice whose gut microbiotas are in balance, according to Joseph Zackular of the University of Michigan, Ann Arbor, who also spoke during the ASM Live session, “The Role of the Gut Microbiome in Colon Cancer.” Germ-free mice that are inoculated with tumor-associated microorganisms develop more tumors than do mice inoculated with a “healthy” microbiota, he says. Because the shift in the microbiota preceded the first signs of colon cancer, he adds, this change in microorganisms might be useful for predicting tumor development. Furthermore, “manipulation of the gut microbiome with antibiotic treatment resulted in a dramatic reduction in the number of tumors.” Prebiotics or probiotics might similarly reduce colon tumors in mice—or humans, he suggests.

Changes in gut microbiota may signal and possibly contribute to the development of IBD, says Erin McClure of Juniata College in Huntingdon, Penn. She is tracking gut microbial dynamics in IBD patients, confirming that microbiota differ among individuals with Crohn’s disease (CD), those with ulcerative colitis (UC), and those with neither of these conditions. “However, some IBD samples from remission time points clustered with healthy controls,” she says. “Significant shifts were noted . . . during flare-up events. Enterobacteriaceae most commonly correlated to flare-up time points, while Prevotellaceae, Ruminococcaceae, Bifidobacteriaceae, and others correlated with healthy controls.” Gut microbial communities are most diverse in healthy individuals, she adds.

Prebiotics and probiotics are also being investigated as treatments for metabolic diseases such as diabetes and obesity, says Regina Lamendella, also of Juniata College. Diets high in fiber-like resistant starch alter gut microbial communities in insulin-resistant individuals who are at a high risk for becoming diabetic, leading to improved insulin, glucose, and triglyceride levels. “Patients who responded to the high-resistant-starch diet with decreased triglyceride components had a higher abundance of Ruminococcaceae, while patients who responded . . . with decreased insulin levels had higher levels of Lachnospiraceae and Veillonellaceae,” she says.

“Oral bacteria are being increasingly correlated with systemic disease, such as heart disease, preterm labor, and cancer,” says Erin Fletcher of San Diego State University. She is investigating whether changes in oral microbiota can be used as early predictors for pancreatic or other digestive system cancers, which are difficult to detect in their early stages of development.

Changes in skin microbiota can affect an individual’s susceptibility to infectious diseases by attracting or repelling insects that act as vectors, according to Daniel Tabares of Universidad de los Andes in Bogota, Columbia, who presented findings during the poster session, “Symbiosis.” He is identifying skin bacteria that repel Rhodnius prolixus, the insect that serves as a vector for Chagas disease. His aim is to extract and characterize volatile chemical components that might be used to reduce vector transmission of this disease.