Current Topics

ASM GENERAL MEETING

Studies Link Gut Inflammation, Obesity, Diabetes to Microbiome

Shannon Weiman

Specific bacterial species within the gut can influence physiology, including conditions and diseases such as inflammation, obesity, metabolic syndrome, and type 2 diabetes—but how? One key factor is gut barrier functions that keep bacteria safely within the gut in healthy individuals, but apparently fail in ways that can prove harmful to the host, according to several researchers who spoke during several sessions of the 2014 ASM General Meeting in Boston last May.

Mucus that lines the intestine is an important component of the gut barrier, keeping bacteria away from the surface of gastrointestinal (GI) epithelial cells, according to Andrew Gewirtz of Georgia State University in Atlanta. In mice with metabolic syndrome, a cluster of symptoms that includes obesity, type 2 diabetes, and type 2 diabetes in humans, he says.

Specific bacterial species that promote gut barrier functions can prevent or reverse such changes, says Patrice D. Cani of the Université catholique de Louvain in Brussels, Belgium. For example, Akkermansia muciniphila bacteria in the gut increase the number of host goblet cells, increasing the thickness of the mucosal barrier while also increasing expression of RegIIIγ, an antimicrobial peptide that helps to keep other bacteria from entering this zone. “A. muciniphila may represent 3–5% of the microbial community in healthy subjects, and its abundance inversely correlates with body weight and type 2 diabetes in mice and humans,” he says. Prebiotic agents such as oligofructose and gastric bypass surgery can increase the population of this bacterial species. “Restoration of the physiological abundance of A. muciniphila reduced diet-induced body weight gain, fat mass development, and fasting hyperglycemia without affecting food intake,” he says.

Methanogens also protect against obesity and metabolic syndrome, according to Ruth Ley of Cornell University in Ithaca, N.Y. These methane-producing bacteria are enriched in the microbiomes of lean people, while missing among the obese, she says. In mice, methanogens confer less weight gain and higher short-chain fatty acid content in stool, representing food energy that the host does not use. However, instead of mediating these effects directly, the methanogens make the gut hospitable for gram-negative Christensenella minuta, which remain after methanogens are lost to mediate long-term improvements in metabolic syndrome, she says. This species is over-represented in lean humans, she points out.

Shannon Weiman is a freelance writer in San Francisco, Calif.

RESEARCH ADVANCES

Light-Harvesting Proteins in Algae May Be Part of Coherent Quantum Process

Barry DiGregorio

The light-capturing proteins from several cryptophyte algae oscillate between two quaternary structures, called open and closed, that act like an on-off switch, according to Paul Curmi of the University of New South Wales in Sydney, Australia, Gregory Scholes of Princeton University in Princeton, N.J., and their collaborators in Canada, Italy, and Germany. Their findings could mean that some steps in photosynthesis involve quantum coherence (QC), reinforcing expectations among biophysicists that “quantum processes play a nontrivial role in biology.” Details appeared 1 July 2014 in the Proceedings of the National Academy of Sciences (doi:10.1073/pnas.1402538111).

The soluble light-harvesting phycobiliproteins (PBPs) from cryptophyte algae are the focus of Curmi’s research. These proteins act as antennae, absorbing light energy that is delivered to chlorophyll, driving photosynthesis in these cells. Each PBP is a dimer of αβ subunits in which the structure of the αβ monomer is conserved. However, those subunits can assume “two dramatically distinct quaternary confor-