seek to understand drug sensitivity and cell wall biogenesis an important new place—the mitochondrion—to look for answers.”

David C. Holzman is the Microbe Journal Highlights Editor.

RESEARCH ADVANCES

Gutless Worm Harnesses Carbon Monoxide; Tara Vessel Explores Plankton

John Otrompke

The marine worm *Olavius algarvensis* furnishes its closely associated bacteria with carbon monoxide and hydrogen as energy sources, while they, in turn, enabled it to rid itself of its gut and kidneys by drawing on its metabolites to meet their need for organic carbon compounds, according to Nicole Dubilier and Manuel Kleiner at the Max Planck Institute for Marine Microbiology in Bremen, Germany, and their collaborators. Separately, the diversity of marine microorganisms exceeds current estimates, basing his estimates on an early analysis of samples from the recently completed Tara Oceans expedition, a three-year voyage to sample marine plankton ecosystems as well as viruses and bacteria, says Jeroen Raes of Vrije Universiteit in Brussels, Belgium. He and Dubilier spoke last June, during the conference “Marine Microbes: Bridging the Gaps from Genomes to Biomes,” held in Lucca, Italy.

“The worm has been able not only to reduce its digestive system, but also its kidney-like excretory organs, something that has not been discovered in any other marine animal,” Dubilier says. She and her collaborators uncovered this unusual marine worm, which is about 3 cm long but only 0.5 mm wide, along the coast of Portugal in 1998 and again in 2002 near the island of Elba. The researchers were amazed to discover unusually high levels of carbon monoxide in the nutrient-poor sandy sediments in which it is found. Within this nutrient-poor environment, the worm affiliates with at least five previously unknown bacteria, whose genetic endowments render them capable of metabolizing carbon monoxide, she says. Details describing this research appear in the April 18, 2012 *Proceedings of the National Academy of Sciences* (doi: 10.1073/pnas.1121198109).

The benefits of these associations flow both ways, according to Dubilier. “One of the key things the worm does for the bacteria is to help them to gain energy,” she says. “They need compounds in the deeper sediment layers, and also oxidized compounds in the...
upper sediment layers. When the bacteria are free living, they can only live in a narrow area where both exist, but if they are hitched onto a worm, the worm moves for them. And, in order to deal with the nutrient-poor environs, organisms have developed the ability to transport carbon compounds across the cell walls by means of high-affinity transporters, which we found in the worm’s symbiotic bacteria."

“The fundamental biochemical attributes of any of these partners might not be that surprising,” says Peter Girguis at Harvard University. “We know that some microbes can use carbon monoxide, and the worm is likely to be physiologically comparable to all other animals. It’s this symphony of the whole that’s most exciting.”

Meanwhile, findings from the Tara Oceans voyage reveal far greater biodiversity among microscopic marine organisms from 35 sampling sites than scientists expected, Raes says. “We’re already seeing spectacular biodiversity in all kingdoms. But that’s also because we didn’t really know what to expect, especially on the protist and virus front.”

This phase of the Tara Expedition, sponsored by the United Nations Programme for the Environment, was a focused “attempt to make a global study of marine plankton . . . to better understand planktonic ecosystems by exploring the countless species, learning about interactions among them and with their environment,” its organizers note. “Studying plankton is like taking the pulse of our planet.”

John Otrompke is a writer based in Chicago.

RESEARCH ADVANCES

Proteins from Magnetotactic Bacteria, Templates for Nanoscale Devices—or Not
Barry E. DiGregorio

A protein from Magnetospirillum magneticum can be used to lay out magnetic nanoparticles uniformly along surfaces on a nano scale—an early, but potentially important step toward fabricating devices such as computer components, according to Sarah Staniland at the University of Leeds in the United Kingdom and her collaborators. Although some call this research a “proof of principle,” others consider it an impractical alternative to the conventional development of nanoscale data storage devices. Details of the research at Leeds appear in the January 2012 Small [11/2011; DOI: 10.1002/smll.201101627].

The magnetotactic bacterium M. magneticum uses its Mms6 protein to produce the mineral magnetite, a renewable and potentially economical source for nanoparticles in hard drives or other devices for data storage, according to Staniland. This species is one of a few magnetic bacteria that can be cultured and whose genomic sequence was analyzed, she says. Instead of using intact cells, she and her collaborators used an immobilized version of Mms6 to produce a 20-μm checkerboard array, and then coated it with 340-nm magnetite particles. That protein “controls the crystallization of magnetite in vitro—controlling shape, size, and crystallinity,” she says.

“I think that [the research at Leeds] is an important proof of concept that may form the basis of future applications,” says Arash Komeili of the University of California, Berkeley, referring to the nanoscale array studies. "They build on previous work in demonstrating the sufficiency of Mms6 for controlling the properties of magnetic minerals produced in vitro. One interesting finding is that attaching Mms6 to a surface leads to more uniform size distribution of magnetic nanoparticles than when Mms6 is presented in bulk."

However, other experts are not convinced that harnessing bacterial proteins will help efforts to develop ever-smaller data storage devices. There is “little advantage” to this Mms6 protein-based fabrication method, according to Michael Morris of Trinity College in Dublin, Ireland. “I use a block copolymer self-assembly approach to create such patterns,” he says. “The authors suggest that [their pattern] could be smaller, but it is nowhere near the 20-nm dimensions achievable by established lithographic methods,” he says. “Further, it is not only the size but the spacing of each particle to its neigh-

MINITOPIC

World Health Assembly Urges Global Access to Vaccines

Ministers of Health from 194 countries attending the World Health Assembly (WHA) last May endorsed a Global Vaccine Action Plan aimed at preventing millions of deaths by providing more equitable access to vaccines. In recognizing that only four of five children receive a basic set of vaccinations, WHA officials are seeking to extend that coverage by 2020 while also introducing new and improved vaccines, eradicating polio, and spurring research and development into future vaccine products. “The plan promotes greater coordination and synergies between immunization and other childhood, adolescent, and reproductive health interventions leading to healthier communities everywhere,” says Flavia Bustreo of the World Health Organization. “By supporting countries to strengthen their health systems and introduce powerful vaccines that prevent the biggest killers of children, we can have a dramatic impact on the lives of millions of people,” adds Seth Berkley, CEO of the Gavi Alliance, which fosters public-private partnerships to foster vaccine development and use.