benefits beyond those furnished by commensal bacteria, he says, noting “Its ability to trigger inflammatory pathology in particular mutant mice even in the presence of commensal bacteria “suggests that this virus and commensal bacteria evoke nonoverlapping responses from the host, at least under certain conditions.”

David C. Hoizman is the Microbe Journal Highlights Editor.

RESEARCH ADVANCES

By Dominating Wastewater Niche, Candidatus Microthrix Orchestrates Resource Use

Barry E. DiGregorio

While growing as part of microbial consortia in wastewater tanks, the filamentous bacterium Candidatus Microthrix parvicella (Microthrix) fine tunes resource use within its community, orchestrating overall yields of fatty acids, according to Paul Wilmes of the University of Luxembourg in Esch-sur-Alzette, Luxembourg, and his collaborators there and at other institutions in the United States and Europe. In practical terms, their detailed analysis of microbial dynamics within this setting could help in making it a source for biodiesel fuels, they note. Details appeared November 26, 2014 in Nature Communications (doi: 10.1038/ncomms6603).

“Such knowledge will be of paramount importance once we try to reengineer biological wastewater treatment plants to favor growth of Microthrix for subsequent lipid reclamation and biofuel synthesis from chemical energy-rich wastewater,” Wilmes says. Instead of yielding energy, however, it usually requires energy to run wastewater treatment plants, he points out. The comprehensive use of mixed culture processes is not likely to prove successful until microbiologists and biotechnology experts learn how to engineer specific niches into such systems, he and his collaborators note.

Lipid-accumulating microorganisms are found on the surface of the anoxic tank at the wastewater treatment plant in Schifflange, Luxembourg, throughout the year, according to Wilmes and his collaborators. Furthermore, colder temperatures apparently enhance lipid production at this particular facility, they note. “We link this pronounced lipid accumulation phenotype to optimal foraging behavior by Microthrix,” he says. Indeed, the bacteria continue to accumulate large amounts of fatty acids during the coldest part of winter.

“The prevalence of lipid-rich biomass at the air-water interface of such systems is a well-known fact worldwide and absolutely not limited to the Schifflange biological wastewater treatment plant,” and there is nothing “peculiar” about this particular facility, Wilmes continues. Thus “findings are generalizable to other biological wastewater treatment plants worldwide.” Whether the Microthrix-dominated consortium can be transferred to other similar facilities will depend on developing a better understanding of “the ecology of biological wastewater treatment systems,” he adds. Then it may become possible to “predictably steer them towards particular endpoints, such as enrichment and maintenance of lipid-accumulating organisms in bio-

MINITOPIC

New, Unusual Approaches to Testing Antibiotic Susceptibility, Flu, and Tracing Foods

Recent developments involving devices, software, or tests for detecting infections agents and, in some cases, determining their susceptibility to antimicrobial drugs include:

• A test called single-cell analysis morphological (SCMA) for tracking growth and changes in shape of individual bacterial cells can be used to determine antibiotic susceptibilities within about four hours, according to Sung hoop Kwon at Institute for Basic Science in Seoul, Republic of Korea, and collaborators. Details appeared 17 December 2014 in Science Translational Medicine (doi/10.1126/scitranslmed.3009650).

• A software package, called OSPREY, can help to predict specific mutations that enable methicillin-resistant Staphylococcus aureus—and, likely, other microbial pathogens as well—to develop resistance to particular antimicrobial drugs, according to Bruce Donald of Duke University in Durham, N.C., Amy Anderson at the University of Connecticut at Storrs, and their collaborators. Details appeared 31 December 2014 in Proceedings of the National Academy of Sciences (doi: 10.1073/pnas.1411548112).

• The U.S. Food and Drug Administration in January granted its first CLIA waiver to allow the marketing of a rapid, nucleic acid-based test for the influenza virus. The Alere i Influenza A & B test, which is conducted on nasal swab specimens and can be completed within 15 minutes, is manufactured by Alere Scarborough, Inc., of Scarborough, Maine.

• DNA Trax, particles consisting of carbohydrate and DNA molecules, can be sprayed on foods (or other materials) that, if and when they become contaminated by microbial pathogens, can serve as barcode markers for use in tracing those contaminated products, according to officials at DNA Trek in Livermore, Calif., who licensed this technology from scientists at nearby Lawrence Livermore National Laboratory.
logical wastewater treatment systems.”

“There are two aspects of this paper that I find particularly exciting,” says Holly Bik of the University of Birmingham in Birmingham, England. “First, the authors used an extraction protocol that obtained DNA, RNA, proteins, and small molecules all from the same sample fraction—ensuring that the different omics datasets are focused on the same slice of the microbial community. Second, the reconstruction of composite genomes from environmental data is a great result. Previously, genome binning has mostly been focused on simplistic microbial communities such as acid mine drainage, and here the authors show that this method is now becoming possible for much more complex microbial assemblages.”

Barry E. DiGregorio is a freelance writer in Middleport, N.Y.

RESEARCH ADVANCES

Uncertainties in Tracking West Nile Virus Undermine Vaccine Development

Jeffrey L. Fox

Soon after West Nile virus (WNV) appeared in the United States (US) in 1999, several vaccine efforts were launched, leading to a vaccine deemed suitable for horses by 2001, according to Thomas Monath of Harvard Medical School in Boston, Mass. By last year, however, nearly all other WNV vaccine development efforts had stopped, leaving human populations fully vulnerable to this mosquito-transmitted disease, he says. The practical abandonment of vaccine efforts is but one peculiarity during the brief history of vector-borne WNV disease in North America. It was the focus for several discussions last September during a workshop, “Vector-Borne Diseases: Exploring the Environmental, Ecological, and Health Connections,” convened by the Forum on Microbial Threats, which operates under the auspices of the Institute of Medicine (IOM) in Washington, D.C.

The obstacles to developing a WNV vaccine for humans “are not technical,” Monath says. Instead, they are mainly matters of economics along with regulatory idiosyncrasies. For example, although the elderly are particularly vulnerable to WNV, it is difficult to say who within this population group would take a vaccine, if one were available, in large part because outbreaks tend to be regional but do not follow regular patterns from year to year. Another challenge is that Food and Drug Administration (FDA) officials indicated that they would require efficacy data from a human vaccine trial to approve a WNV vaccine and would not rely on the FDA Animal Rule, a provision that accepts efficacy data from animal studies along with safety data from testing in humans. The irregular nature of WNV outbreaks would greatly complicate planning any clinical efficacy trials, he points out.

WNV infected as many as 5.2 million individuals in the US since 1999, but only about 1.2 million were made ill from those infections, says Lyle Petersen of the Centers for Disease Control and Prevention (CDC) in Atlanta, Ga. Although it now causes infections throughout the country, its geographic incidence pattern is highly irregular. In recent years, he notes, “South Dakota has had the highest incidence, which is odd for a ‘tropical’ virus.” The incidence is also high in densely populated states such as California and cities such as Chicago and Phoenix.

Another peculiarity is that the three biggest outbreaks of neuroinvasive WNV, the most serious form of such infections, occurred “during heat waves” in 2002, 2006, and 2012, Petersen adds. Whether weather affects such incidence patterns is under debate, however. “Our data don’t support the idea that heat waves are responsible for WNV outbreaks,” says Marm Kilpatrick of the University of California, Santa Cruz. “In Texas, for example, the severity of winters appears to be more important.” If human behaviors change in response to local fluctuations in weather, he adds, “predictions go out the window.”