Articles of Significant Interest in This Issue

Bioelectrochemical Nitrogen Fixation by *Pseudomonas stutzeri*

Increasing attention is being given to bioelectrochemical nitrogen fixation for its energy-saving property and high selectivity. Chen et al. (e01998-20) demonstrated that the diazotroph *Pseudomonas stutzeri* A1501 can produce extracellular NH$_4^+$ without chemical suppression or genetic manipulation when the extracellular electrode is used as the sole electron donor, and the electron uptake pathway from the extracellular electron-donating partner to *P. stutzeri* was mediated by its endogenous redox electron shuttle phenazines. Since both *P. stutzeri* and potential electron-donating partners are abundant in diverse soils and sediments, this finding has broader implications for the improvement of nitrogen fertilization in the natural environment.

Nitrogen-Fixing Symbioses from the Sea to the Soil

Chemosynthetic sulfur-oxidizing bacteria are widespread symbionts of a range of marine animals. They are primary producers that provide their animal hosts with organic carbon for their nutrition. Recently, after 40 years of study on these symbioses, the first nitrogen-fixing chemosynthetic symbionts were discovered in a family of marine bivalves, lucinidae. Petersen and Yuen (e02129-20) outline the significance of this discovery and highlight the many open questions about nitrogen fixation by chemosynthetic symbionts. Their comparison of these intracellular symbioses in marine clams with the nitrogen-fixing intracellular symbioses that have evolved in nodulating land plants reveals some surprising similarities.

Myxobacterial Predation Mechanisms

Myxobacteria are potent bacterial predators, but their complex predation behavior is poorly understood on the molecular level. By dissecting *Myxococcus xanthus* predation on four bacterial species, Arend and colleagues (e02382-20) demonstrate that different mechanisms are used for different prey: Gram-negative bacteria are killed and lysed by an unknown, cell contact-dependent mechanism within minutes, whereas lysis of Gram-positive species requires the activity of secreted bacteriolytic proteins. The work highlights the role of individual *M. xanthus* cells for prey killing and widens our understanding of bacterial predator-prey relationships.

Novel Insecticidal Proteins, Mpp75Aa, from *Brevibacillus laterosporus* for Control of *Diabrotica virgifera virgifera*

Developing new insecticidal traits with commercial-level *Diabrotica virgifera virgifera* (western corn rootworm [WCR]) efficacy from sources other than *Bacillus thuringiensis* (Bt) to control Bt-resistant WCR is becoming more critical. Bowen et al. (e02507-20) describe three closely related proteins, identified from *Brevibacillus laterosporus* using next-generation sequencing technologies, which are lethal to WCR upon feeding. Maize expressing an mMpp75Aa protein was protected from feeding damage and showed significant reduction in adult emergence by susceptible and Bt-resistant WCR, demonstrating that proteins from *B. laterosporus* can be as efficacious as Bt proteins in controlling pests such as WCR.
Inoculation of legumes with symbiotic N₂-fixing bacteria (rhizobia) is a key component of sustainable agriculture, particularly when these plants are introduced species. Horizontal gene transfer from inoculant *Mesorhizobium* strains was previously shown to result in the evolution of suboptimal N₂-fixing rhizobia that outcompete the original inoculant. Hill et al. (e02558-20) showed that the chickpea commercial inoculant strain, *M. ciceri* CC1192, has mobile symbiosis genes that support high rates of N₂ fixation following either environmental or laboratory transfer into diverse *Mesorhizobium* recipients. This raises important questions about how interactions between the host genome and symbiosis genes influence the selective forces driving the evolution of symbiotic N₂ fixation.