Acid-Evolved Strains Grow Faster in Acid and Show Mutated RNA Polymerase

Experimental evolution of *Escherichia coli* K-12 under stress conditions selects for enhanced growth under stress, often mediated by mutations in genes that differ from those revealed by single-gene studies. Led by undergraduates, Harden et al. (1932–1941) propagated *E. coli* populations for 2,000 generations at a level of acidity that enteric bacteria experience during transit from the pylorus to the duodenum (pH 4.6 to 4.8). Evolved clones outcompeted the ancestor in acid, though not at high pH. The resequenced genomes show novel mutations in RNA polymerase and in acid response regulators. Surprisingly, all acid-evolved strains downregulate lysine decarboxylase, a major acid stress enzyme.

Anoxygenic Photosynthesis Controls Oxygenic Photosynthesis in a Cyanobacterium from a Sulfidic Spring

Cyanobacteria capable of simultaneous oxygenic and anoxygenic photosynthesis are nowadays rare but likely played a role of global importance during the Proterozoic. Klatt et al. (2025–2031) isolated a cyanobacterium from a sulfidic spring and showed that the transition between its photosynthetic modes is regulated in a remarkably simple kinetic manner by H$_2$S. This simplicity reveals that anoxygenic photosynthesis is such an essential part of the photosynthetic metabolism that it even regulates oxygenic photosynthesis. The transition between photosynthetic modes is accompanied by a shift in the C:N assimilation ratio, which was possibly important for element cycling in the stratified Proterozoic oceans.

Pili and Probiotics

Pili play key roles in the adhesion of bacteria to surfaces and host tissues, and they were recently also discovered on various probiotic bacteria, such as *Lactobacillus rhamnosus* GG. Here, Vargas García et al. (2050–2062) show that in addition to their involvement in adhesion, the *spaCBA*-encoded pili of *L. rhamnosus* GG play an important role in their uptake by and cytokine modulation in macrophages. The findings of these authors suggest that the presence of pili promotes close contact between probiotics and immune cells, resulting in, for example, increased expression of cytokines such as interleukin-10, which is an important immunoregulatory cytokine for probiotic immune effects.

Diversity of Heterotrophic Flagellates in the Arctic Ocean

Heterotrophic marine flagellates (HF) are ubiquitous in the world’s oceans and have a major role in carbon and nutrient recycling but are rarely identified by conventional microscopy. Phylogenetic placement algorithms and short reads generated by high-throughput sequencing provided a means of identifying HF from environmental samples and a tool for tracking HF distributions over time and space. This pan-Arctic study by Thaler and Lovejoy (2137–2148) examined species- and ecotype-level diversity in Cryomonadida, Telonemia, Picozoa, choanoflagellates, and marine stramenopiles. While many phylotypes were widespread, others—especially within the Cryomonadida and Telonemia—were specific to regions and environments.

Novel Insights into Bacterial Species Consuming Plant-Derived Carbon in the Root Environment of Rice Plants

Bacteria in the root environment of plants are critical for plant health, and organic compounds delivered to roots and exuded into the rhizosphere enrich this belowground community. To identify the bacteria using rice plant material, Hernández et al. (2244–2253) used a stable-isotope-probing approach to label plants and track the incorporation of isotope into bacterial populations. Surprisingly, labeled bacteria included members of phyla not generally recognized as plant associated, such as *Verrucomicrobia* and *Armatimonadetes*. This study widens our knowledge of microorganisms associated with rice plants and can direct studies toward better elucidation of microbial contributions to plant health.