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Archaea

Special Issue on
Archaea in the Age of Oxygen

CALL FOR PAPERS

Archaea are a metabolically and physiologically diverse domain of life, with widely varying lifestyles including extremes of thermophily, acidophily, halophily, autotrophy and heterotrophy, chemotrophy, lithotrophy, and, distinctively, methanogenesis. While archaeal physiologies are often generally considered to be metabolically "ancient"; these lineages continued to evolve and diversify across the Proterozoic and Phanerozoic Eons, and many show specific adaptations to the presence of oxygen in the environment. Several lineages of Crenarchaeota and Euryarchaeota have evolved to tolerate low levels of oxygen or require oxidized substrates for growth; some have even evolved to be fully aerobic, requiring molecular oxygen for energy metabolism. Aerobic members of the marine Thaumarchaeota may even be among the most abundant organisms on the planet.

Clearly, oxygen has had a major impact on the evolutionary history of Archaea. However, microbiological consequences of the Great Oxygenation Event(s) have generally only been considered from bacterial and eukaryal perspectives. How did the rise of atmospheric oxygen impact archaeal evolution? How did Archaea evolve and/or acquire genes for adapting to the presence of oxygen, and, in some cases, adopting aerobic metabolisms? Did bacterial and archaeal oxygen adaptation coevolve via the transfer of critical genes? Conversely, can the pattern of oxygen adaptation in Archaea across different lineages and environments inform our understanding of the geochemical history of oxygen? Pursuing these questions is essential for a more comprehensive understanding of the third domain of life. Rather than just relics from the earliest ages of microbial evolution, archaeal genomes hold clues to the entire span of Earth's biogeochemical history.

Potential topics include, but are not limited to:

- Evolution of ammonia oxidation within Thaumarchaeota
- Origin of aerobic respiration within Crenarchaeota
- Reverse methanogenesis and redox couplings
- Archaeal oxidation of sulfides and sulfur
- Neoproterozoic oxygenation of deep sea hydrothermal vent systems
- Transitions from anoxic to oxic conditions
- Horizontal gene transfer
- The role of oxygen in acidic hydrothermal systems
- Oxidative stress in archaeal cellular systems
- Archaeal oxidative metabolic pathways and respiration

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