An Overture

Focus on Archaebacteria

In recent years, biology textbooks have tended to neatly categorize all living cells into two categories: prokaryotes and eukaryotes. This cellular classification scheme is being challenged by a small, but enlarging, group of life scientists who propose a third basic category: the *archaebacteria.*

Organisms belonging to this proposed taxonomic category are all bacteria, and thus would ordinarily be considered prokaryotes. But it has become increasingly apparent on the basis of evidence gathered by biochemical taxonomists that archaebacteria are perhaps no more closely related to "ordinary" bacteria (eubacteria) than they are to eukaryotic cells of fungi or animals.

Like the prokaryotic eubacteria, archaebacteria lack membrane-enclosed cell organelles. However, they differ from eubacteria in a number of significant ways:

1) They are biochemically unique—studies of sequencing of nucleotides in ribosomal RNA of many different species indicate that archaebacteria are a group quite unlike either prokaryotes or eukaryotes. Chemical studies of transfer RNA molecules, antibiotic sensitivity, and membrane structure also support the uniqueness of archaebacteria;
2) Cell walls of archaebacteria never contain the peptidoglycans typically found in eubacteria; and
3) Archaebacteria are capable of highly unusual metabolic processes, enabling them to live in extreme environments.

Three groups of archaebacteria are presently known: methanogens, extreme halophiles, and thermoacidophiles. Methanogens are anaerobes uniquely capable of producing methane gas from hydrogen and carbon dioxide. Extreme halophiles can only live in high concentrations of salt. And, thermoacidophiles thrive in hot, acid environments totally uninhabitable by other organisms.

In this special issue, Robert Evans and John Lennox and his colleagues conduct a guided tour through the Never-Never Land of biologically bizarre archaebacteria. A rationale for placing these organisms in a separate taxonomic category is presented, and forefront technological applications for some of the archaebacteria are explored. And, all of this is punctuated by a good number of practical classroom activities focused on this unusual biological group.

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