

The Archaea

Aristotle divided living things into two principal groups, “plants” and “animals”. The principal distinction was one of mobility; animals tended to move and plants didn’t. This might also be a reasonable division based upon metabolism: plants are usually things that utilize photosynthesis to convert water and carbon dioxide into plant material while releasing oxygen as a waste product whereas animal generally reverse the process taking in oxygen and organic material and exhaling carbon dioxide.

Modern scientific taxonomy chose to regard structure rather than mobility or metabolism as more fundamental and built a classification scheme beginning with two initial domains or kingdoms, the procaryotes (bacteria) and eukaryotes (everything else). Eukaryotes had nucleated cells, prokaryotes did not.

In the second half of the twentieth century studies of extremophiles, life forms prospering under extreme conditions of temperature, pressure, and chemical environments led to the suggestion by Woese, *et al.*, that they represented the descendants of third Domain of living things, the Archaea. Some presently existing archaea are methane producers and not all are found in extreme environments.

Questions:

1. How do archaea differ from the bacteria and eukaryotes? Why are these differences considered significant enough to justify considering them members of a third domain of living things - basically as another form of life?
2. What basic features do the archaea share with the bacteria and/or eukaryotes? (What do bacteria and eukaryotes have in common, for that matter?)
3. What do they eat?
4. Phylogenic trees generally show the archaea and eukaryotes sharing a common ancestral form which had, in turn, shared ancestry with the bacteria. What do you think were the likely structural characteristics of the archaean/Eukaryote ancestor? (For example, did the archaea branch off from eukaryotes or *vice versa*?)

Squeeze your answers onto a page or two and turn them in on 17 November.



Has anyone considered the possibility that the archaea might not share a common ancestor with either the bacteria or eukaryotes? Could they be of completely separate origin? (Consider the questions addressed in the upcoming “class project”.)