Some Lessons from the BIG TREE:
Map of the Biological Record

1. Single origin for all life on Earth...

- Central Dogma intact.
- ATP and PMF are universal themes.
- Uniformity among chiral carbon compounds, i.e., amino acids and sugars.

2. General topology

- Three "primary lines of evolutionary descent."
- The Eucarya *"nuclear"* lineage almost as old as the prokaryote lines.
- Prokaryotes split between *Bacteria* and *Archaea*.
- Shown for only a limited number of representative org's.
- Mitochondria and chloroplasts proven to be of bacterial origin.

3. Evolutionary clock is NOT constant between different lineages

- Terminal nodes NOT all the same length, so not constant for all organisms either!
- Endosymbionts sped up very fast (semi-autonomous organelles).
- Eucarya – fast clocks
- Archaea – slow clocks
- Bacteria – Intermediate clocks

4. Rooting the three domain “BIG TREE” is not straight forward.

- Lacks an outgroup....
- Can use gene duplications to show root near Bacteria.
- This means that Eucarya and Archaea shared a common history after the divergence from Bacteria!

5. Origin of Life Implications

- Common ancestor was thermophilic – Might have lived at hydrothermal vents.
- Common ancestor was chemosynthetic & anaerobic – Probably oxidized H_2, remember the redox tower.
- When did photosynthesis hit the scene....after chemosynthesis! It only appears in peripheral branches
- Where’s the Eucarya? High-temp ether-lipid rep?

6. What does whole genomic’s add?

- The central information processing machinery encompasses core genome.
- Metabolic functions, relationships get murky.
- Endosymbiosis involved more than organelles, i.e., two-way transfer.