

Evolution Lecture #1 -- **The big picture and the big questions -- biodiversity!** -- Nov. 3, 2008

## A. Introduction.

We are now making a transition in the course from our coverage of ecology to consideration of evolutionary processes that have influenced how life actually has evolved. As people we want to consider the age-old question: *Why are we here?* And as scientists we particularly want to ask: *How do we know what we think we know?*

## B. What is the big picture?

The *Tree of Life*:

One of the most intellectually important, unifying ideas you will learn in college:

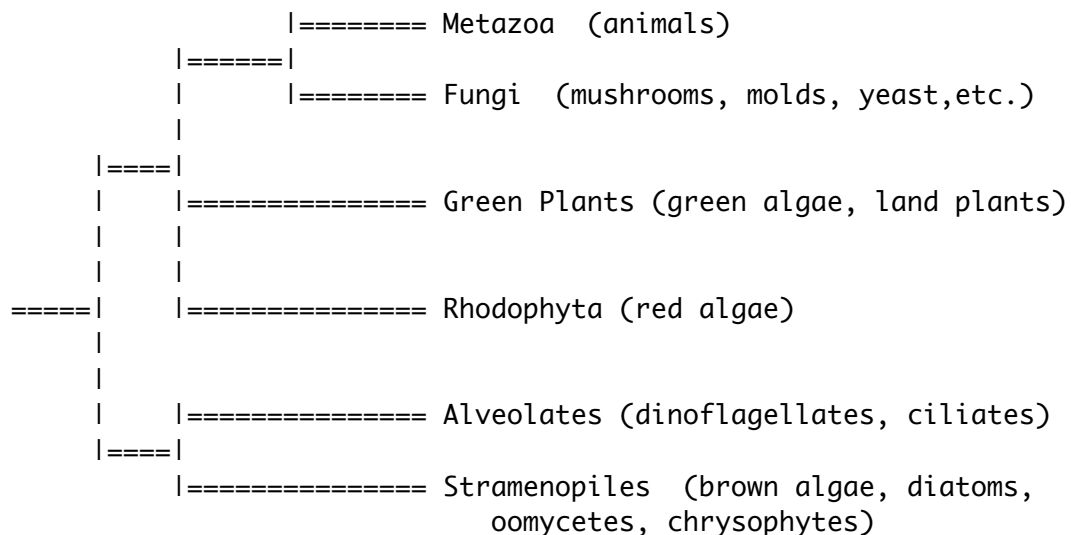
**We are not all that special** -- just one tiny twig on a strange, gigantic tree that took root on one little planet in an infinite universe.

The really big picture: RNA-based phylogenies of life

-- The three domains

-- Eukaryotes & how they were assembled

**Crown Eukaryotes** (simplified from the Tree of Life page by Mitchell L Sogin and David J. Patterson): [http://phylogeny.arizona.edu/tree/eukaryotes/crown\\_eukaryotes.html](http://phylogeny.arizona.edu/tree/eukaryotes/crown_eukaryotes.html)



## C. A quick run through the 6 big clades of crown Eukaryotes (given in the above figure)

## D. What is Biodiversity?

It is the tree of life! A single, magnificent genealogy connecting all organisms alive today.

Another of the most intellectually important, unifying ideas you will learn in college:  
**We are all related** -- not just in the John Muir sense of all being part of the same worldwide ecosystem, but literally genealogically related!

This should inform our moral treatment of other living things.

If you can truly come to grips during this course with the many implications of these two deceptively simple ideas, you will have achieved the ability to think synthetically and creatively about biological diversity.

E. What are the basic units of biodiversity?

traditional approach: genetic - taxonomic - ecological

better approach: replicators vs. interactors (due to David Hull)  
lineages vs. functional groupings  
genealogical hierarchy vs. ecological hierarchy

F. Natural selection introduced (another of the greatest ideas in the history of human thought):

*replicator* -- any entity that passes its structure on with high fidelity

*lineage* -- a sequence of ancestor/descendent replicators

*interactor* -- an entity that interacts with other entities such that replication is differential  
*evolution by natural selection*:

1. heritable variation in a trait causing...
2. differential reproductive success of one replicator lineage over others...
3. due to competition among interactors within a common environment.

(more in later lectures...)

G. What is the value of biodiversity?

- ethical: each lineage is a thread in an heirloom fabric that we have the responsibility to pass on to future generations.
- intellectual: we have a basic need to understand the world, how it came to be, and where we fit in it.
- ecological: a diversity of interactors is needed for proper function of ecosystems, and a diversity of a replicators is needed as the raw material for natural selection (future evolutionary potential).
- economic: natural lineages are a potential source for a myriad of products of direct economic benefit (medicines, food, esthetics, shelter, etc.).

H. What are the big questions for this part of class?:

- How did it all start? (the origin of life; Earth history)
- What are the major patterns in biodiversity? (the fossil record)
- How did all this diversity get generated? (mechanisms of evolution)
- Where is it all going?
- What relevance is evolution for humans?