Important Themes in This Course

- Evolution and Natural Selection explain the unity and diversity of life
- Levels of organization in biology
- Emergent properties
- Structure follows function
- Cells make up all living things
  - Prokaryotic vs. eukaryotic cells
- Energy and energy flow in living things
- Heredity - information transfer between generations of cells and organisms

Characteristics of Living Things

Darwin's observations:

- 1. Organisms reproduce faster than necessary to replace themselves.

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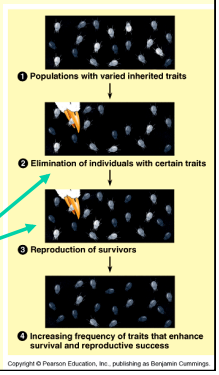
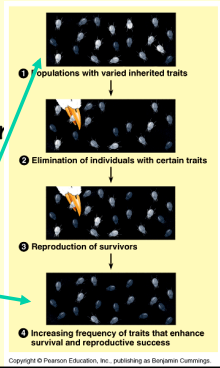
- 2. Organisms vary, and that variation is often inherited.
3. Some variants survive or reproduce better than others.



Darwin Concluded:

- If only some variants survive and reproduce, then the next generation will resemble the successful variants.
- Populations will change, or evolve, over time.

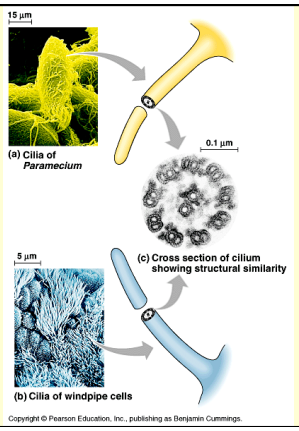


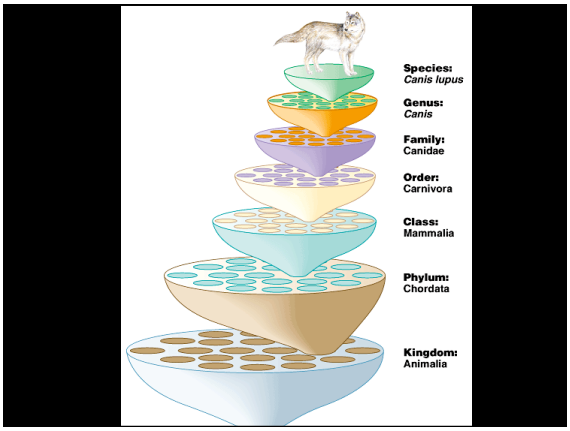
Origin of Species

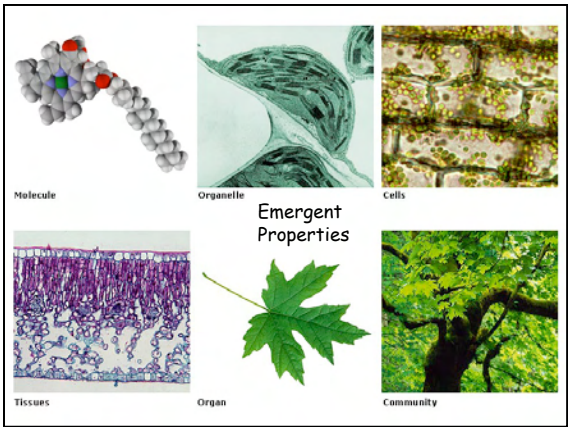
- Lyell, a contemporary of Darwin, established the great age of the earth
- Given enough time, evolution by natural selection has produced the diversity of species we see today

Importance of Evolution to Biologists

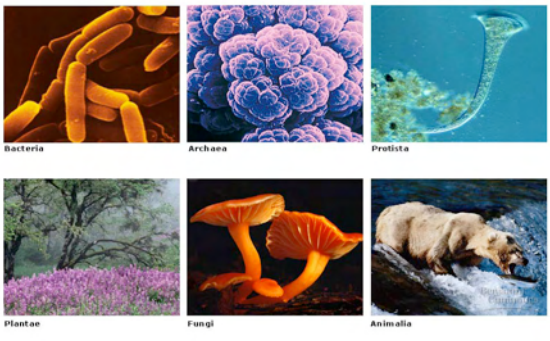
- 1. Because all living things are related (much evidence supports this conclusion), lessons learned in one species apply to others.
- 2. Adaptation through natural selection what made living things the way they are. Understanding that process puts biology in context. "Why" questions…
- T. Dobzhansky: "Nothing in biology makes sense except in the light of evolution."







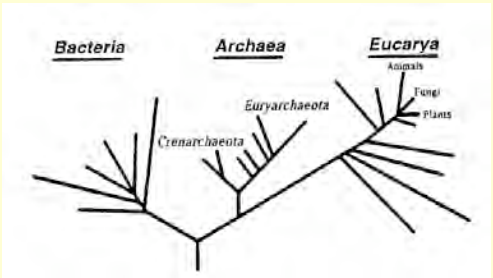
How Many Kingdoms are There?



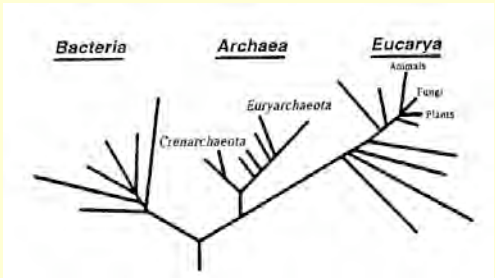
Carl Woese and rRNA genes: a new view of similarities

- rRNA genes are present in all forms of life
- Very similar in close relatives
- Different in distant groups
- A tool for examining relatedness, independent of external form
- 16S rRNA changes very slowly


Carl Woese, microbiologist



Distance between branch tips of this tree is scaled to genetic differences in rRNA genes



A new (even higher) level in the tree of life - the three domains