

Lecture Series 1
**Introduction to Cellular
and Molecular Biology 205**

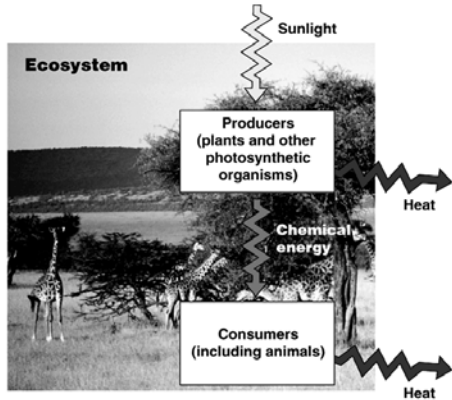
Reading Assignments

- Read Chapter 1
- Review Chapter 2
(I am assuming you know this stuff!)

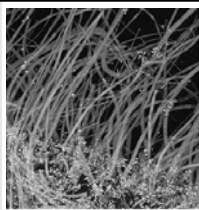
A. Evolutionary Milestones

- A major theme in evolution is increasingly diverse ways of capturing external energy for biologically useful reactions.
- This means many different ways to make ATP! Especially considering relatively recent discovery of microbial diversity.
- Microbiology is the original cell biology.

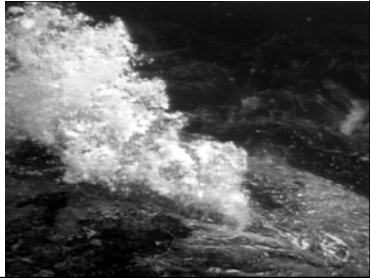
An introduction to energy flow and energy transformation in an ecosystem



Chemosynthesis: Hydrothermal Vents



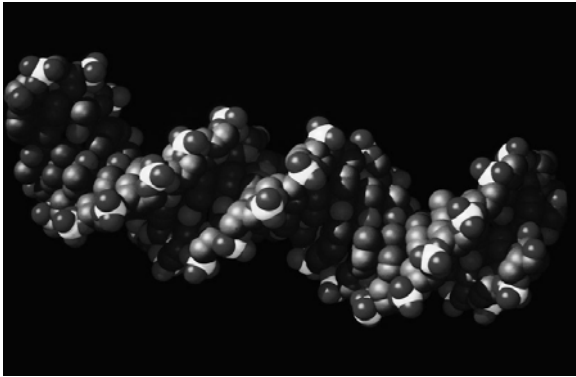
Magnified view of bacteria that inhabit vents.



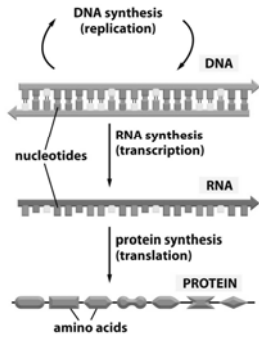
A. Evolutionary Milestones

- All living organisms contain the large molecules—carbohydrates, lipids, proteins, and nucleic acids.
- Ordered “bags of biochemistry” insulated from the chaos of the environment. Not a closed system.
- Storage, transfer and expression of genetic information.

DNA



Languages of the cell



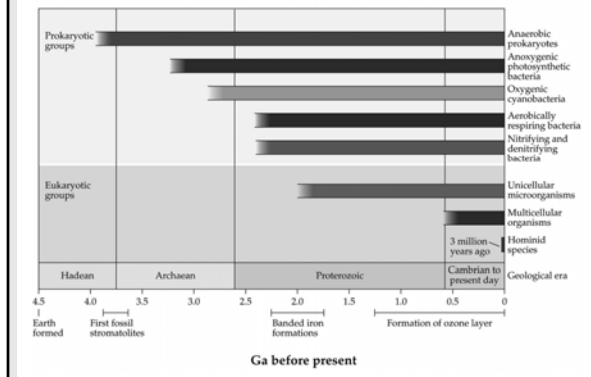
A. Evolutionary Milestones

- Life arose from nonlife about 3.8 to 4.0 billion years ago.
- This process occurred over only a couple hundred million years! Not 2 billion.
- Now all cells come from cells.....why?

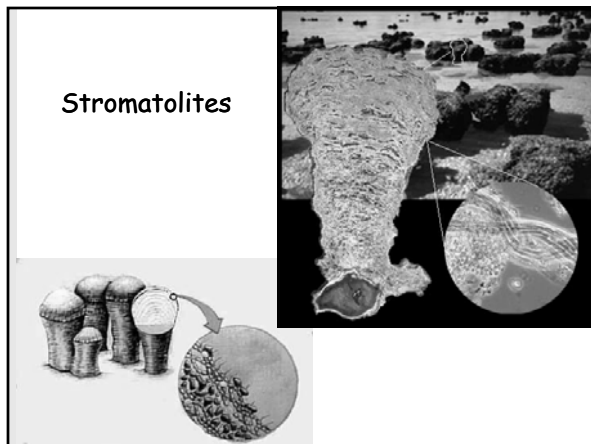
A. Evolutionary Milestones

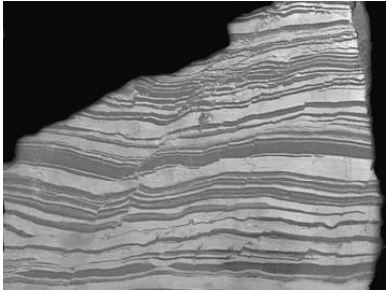
- Photosynthetic single-celled organisms released oxygen, allowing oxygen-based metabolism of large cells and eventually multicellular organisms.
- Oxygen began getting released very early on, but only accumulated in atmosphere after "Rust the Crust" and movement onto land occurred only after an Ozone shield.

Its a Microbial World ... Afterall



Stromatolites



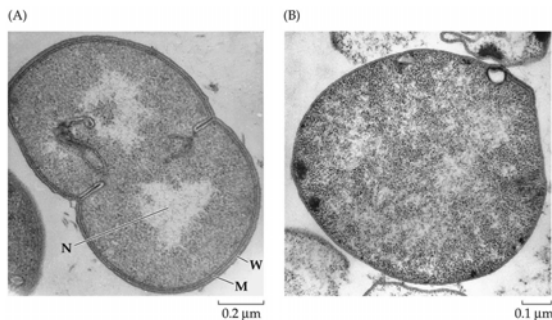


BIFs aka Banded Iron Formations

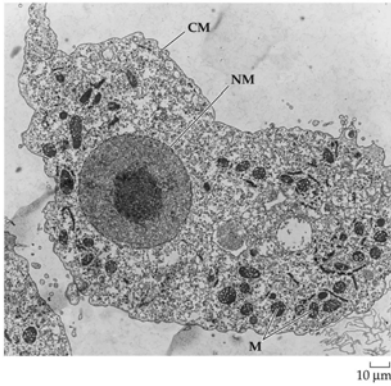
A. Evolutionary Milestones

- Complex eukaryotic cells evolved from bacterial cells. Eukaryotic cells developed into multicellular organisms whose cells became modified for specific functions.
- The evolution of sexual reproduction enhanced the ability of organisms to adapt to changing environments.
- Adaptation to environmental change is the result of evolution by natural selection, the filter for innate variability.

Structural organization of Bacterial and Archaeal cells



Structural organization of Eucaryotic cell

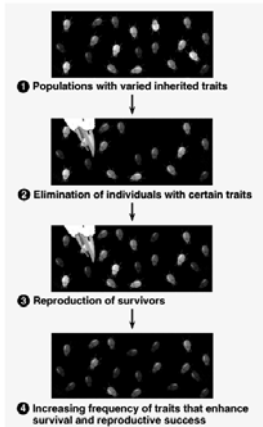


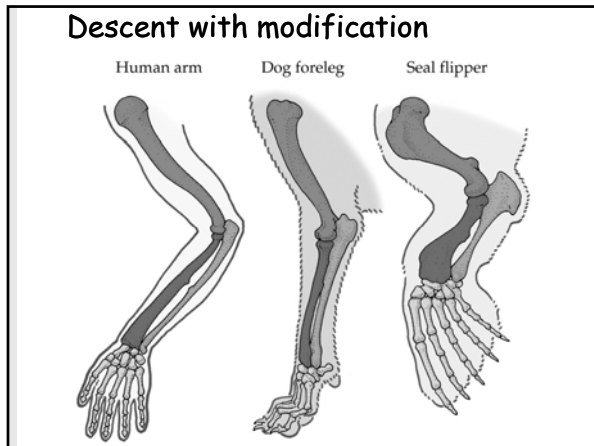
• The evolutionary view of life came into sharp focus in 1859 when Charles Darwin published *On the Origin of Species by Natural Selection*



- *The Origin of Species* articulated two main points
 - ◆ Descent with modification
 - ◆ Natural selection

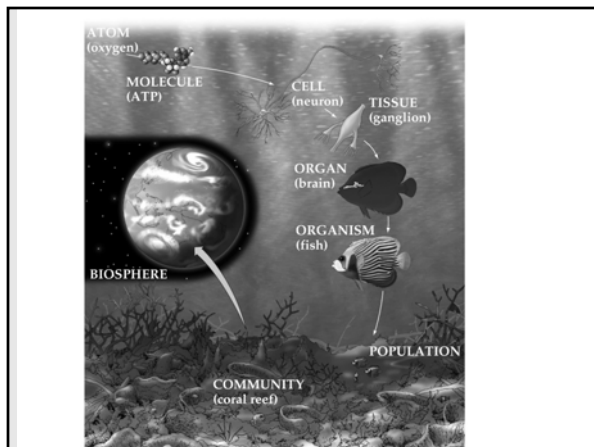
Natural selection



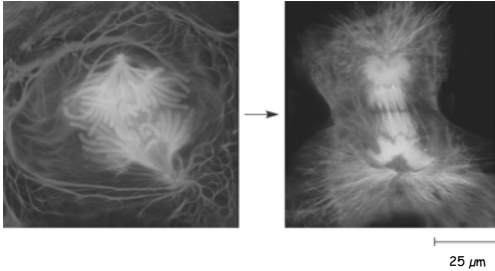


B. The Hierarchy of Life

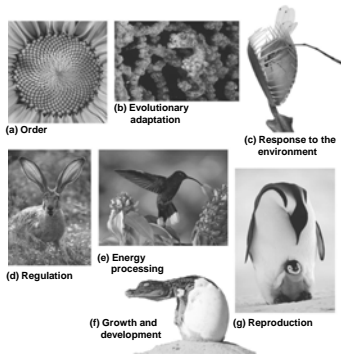
- Biology is organized into a hierarchy of levels. Each has "emergent properties" not found at lower levels.
- Emergent properties are where the sum is greater than the parts.
- Basic unit of biology is the "cell", we go up or down from there.



- The cell is the lowest level of organization that can perform *all* activities required for life

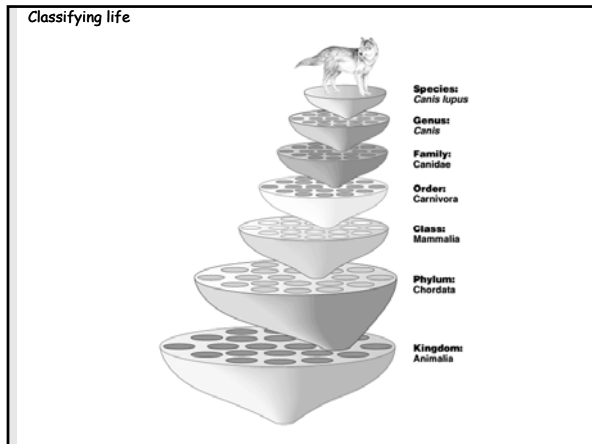


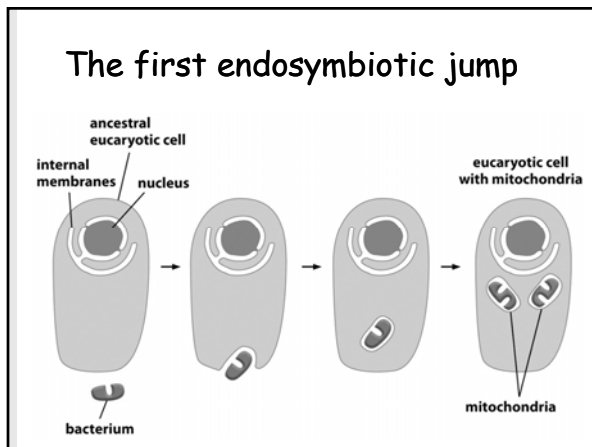
- Some emergent properties of life

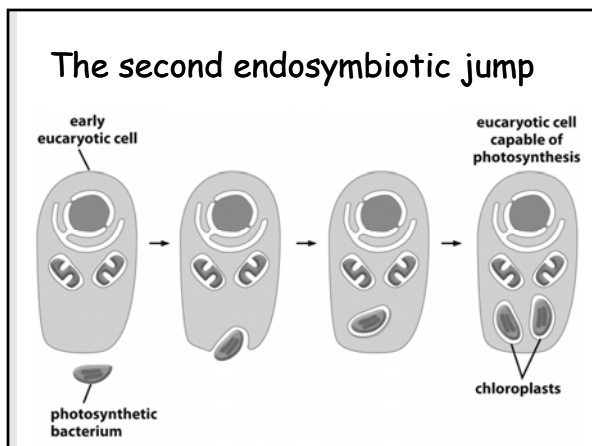


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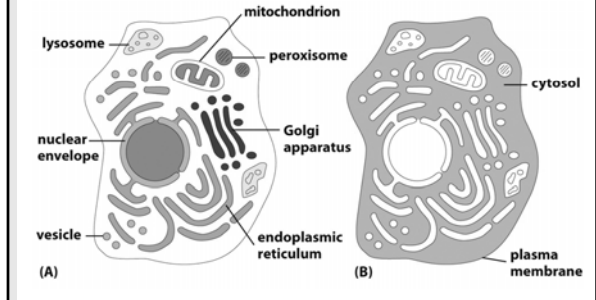
- Domains vs Kingdoms...etc.
- Species are classified into the Domains Archaea, Bacteria, and Eucarya.
- Eucarya contain the protists and the kingdoms Plantae, Fungi, and Animalia.
- Crown Groups all require endosymbiosis!

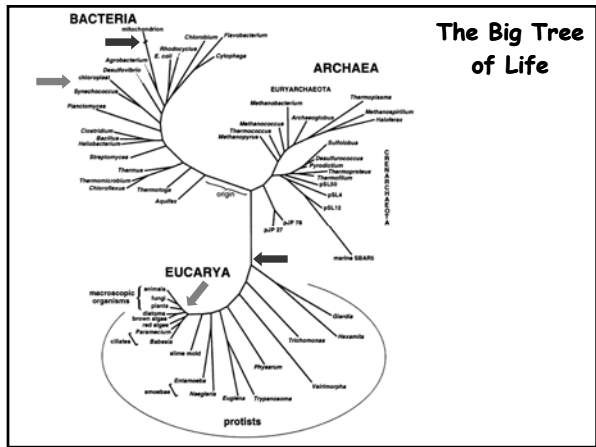


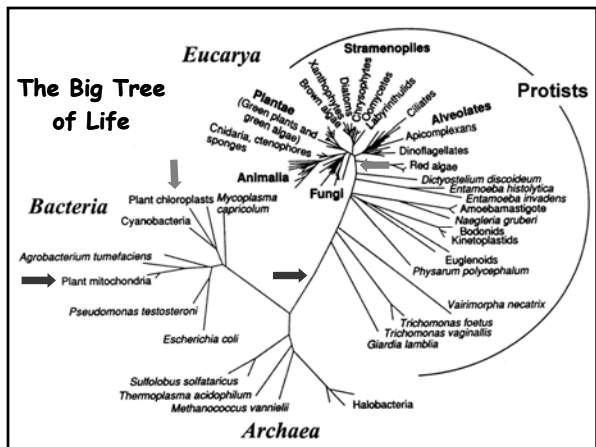


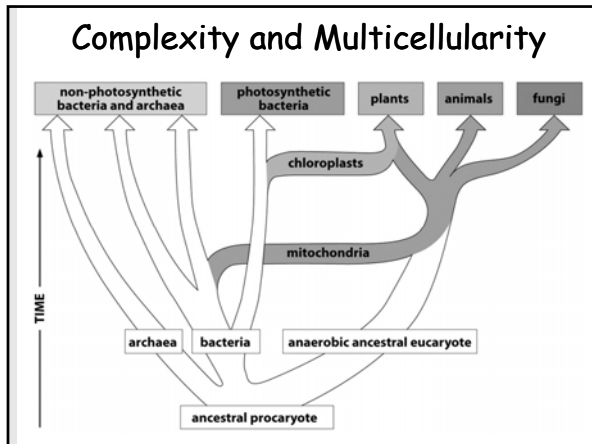


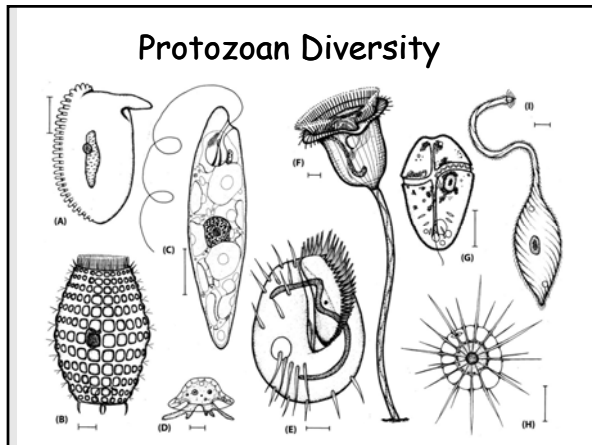
Complexity results in bags within bags

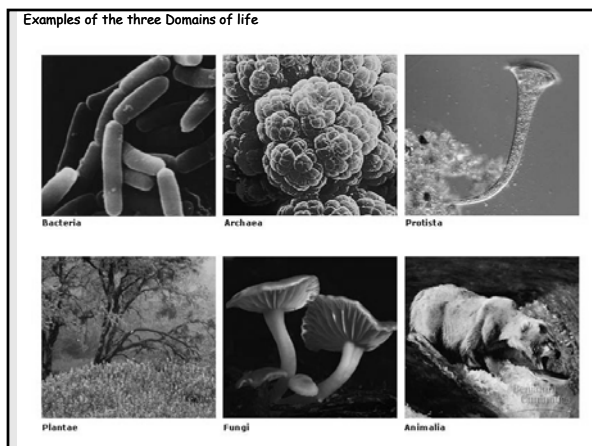


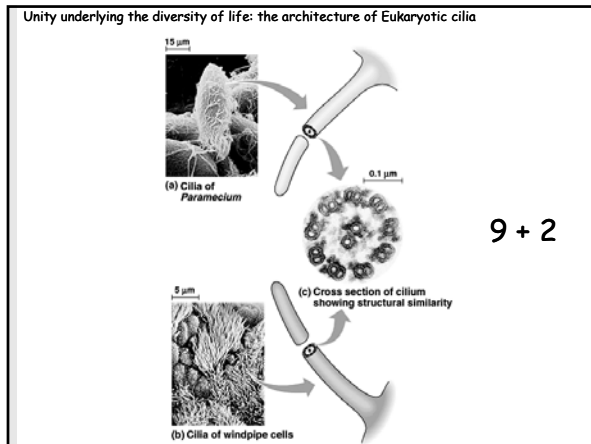


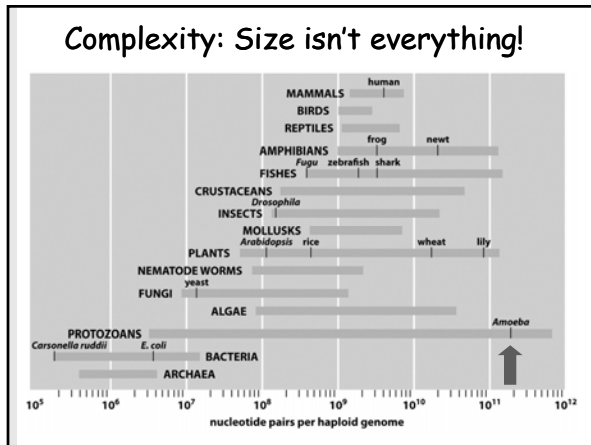












C. Fundamental Concepts Used Throughout Biology

- Evolution unites all of biology. It's mechanism is Natural Selection.
- Emergent Properties
- Hierarchical Organization
- Multicellularity accomplished by "terra forming"
- Hypothesis Testing/Deductive Reasoning

