

Origin of Species

Chapter 16 (finish!)



Stanley Miller - 1953

- Spontaneous synthesis of complex organic compounds

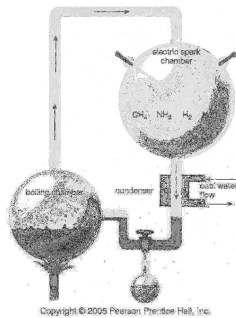


How did life begin? A scientific perspective

1. Chemical evolution is thought to have preceded life

- ❖ Miller & Urey conducted experiments in atmosphere of methane, ammonia, hydrogen and water vapor, but no oxygen
 - Hypothesized to be earth's prebiotic atmosphere.

- Result: able to generate organic molecules



How did life begin? A scientific perspective

2. Accumulation of organic molecules could have occurred

- ❖ Not "used up" by organisms
- ❖ Not split by oxygen
- ❖ NOTE: Would be split by UV radiation, so could only accumulate where protected from UV
 - Beneath ledges
 - Bottom of shallow seas



How did life begin? A scientific perspective

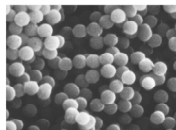
- Additional proposed steps

3. Larger organic molecules formed (when at high concentrations)

- Was RNA the first self-replicating molecule?

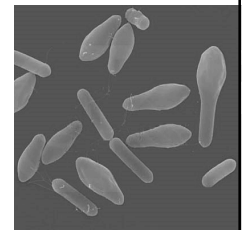
4. Formation of microspheres

- Balls with lipid "membranes" and aqueous internal environments
- Can form by agitating proteins and lipids in water.



The earliest organisms

- Prokaryotes (i.e. like Bacteria and Archaea)
 - ❖ No nucleus or membrane-bound organelles
 - Only ribosomes
- Anaerobic respiration
 - ❖ No oxygen in atmosphere
- Anaerobic bacteria species still exist



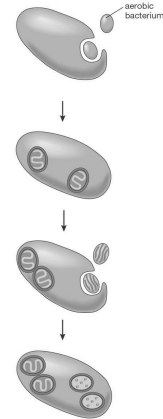
Anaerobic bacteria that causes botulism

Photosynthetic prokaryotes

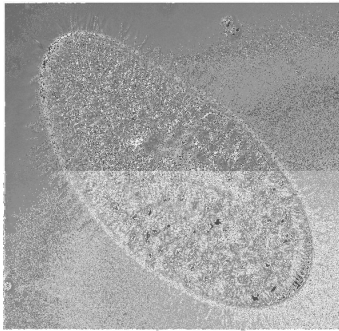
- Some organisms developed the ability to use the sun's energy to build organic molecules.
 - ❖ Oxygen as bi-product
 - Oxygen combined with iron to create iron oxides (rust!!)
 - Increased oxygen in atmosphere
 - Reacts with and breaks down organic molecules
 - Probably led to extinction of some anaerobic organisms
 - Aerobic metabolism
 - Uses oxygen (so decreases its destructive power)
 - Generates useful energy for cells

Origin of eukaryotes: Endosymbiont hypothesis

- Evidence
 - ❖ Biochemical similarities between organelles and living bacteria
 - ❖ Both mitochondria and chloroplasts contain their own, distinct DNA
 - ❖ Current, symbiotic relationships such as coral and its protist symbionts, or...



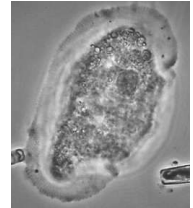
Paramecium with algal symbionts



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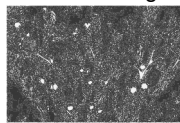
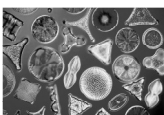
First eukaryotes: single-celled

- Similar to the present-day Protista
 - ❖ *Paramecium*, euglena, amoeba
- Diversification of Protista occurred
 - ❖ Some photosynthetic/autotrophic
 - ❖ Some heterotrophic



Protista gave rise to multicellular organisms

1. Photosynthetic Protista → Multicellular algae



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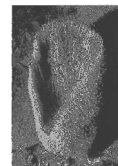
2. Heterotrophic Protista → Fungi and Animalia



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Animals originated & diversified in the ocean

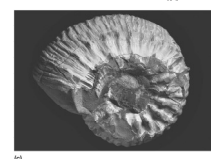
- First animals = sponges (Phylum Porifera)
- Later diversified



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Plants adapted to dry land

- Algae/ Primitive plants required water not only for photosynthesis but for fertilization
- More derived plants adapted more fully to dry land (i.e. pollen grains travel on the wind or via animals)



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Some animals adapted to land



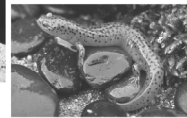
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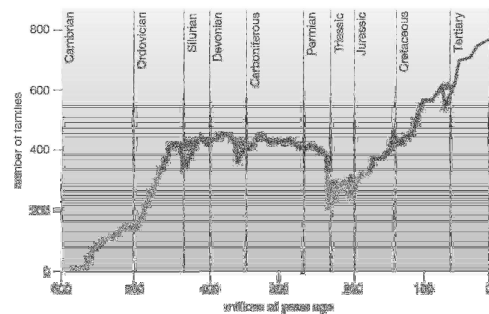
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Re-entrants to the ocean world



Role of extinction



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