

15 - Abiogenesis and the Precambrian Earth

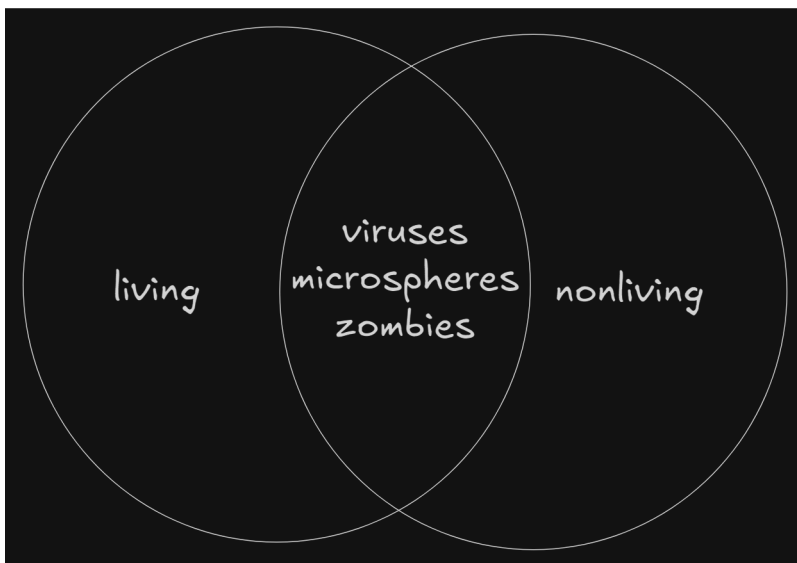
Precambrian Earth

- It is difficult to find rocks from the Precambrian period (4.6 BYA - 540 MYA)

Living Things

- Practice chemical activity (metabolizes nutrients)
 - Metabolism
 - Breaking down of nutrients produces energy and compounds, such as proteins and DNA
- Can reproduce
- Reacts/adapts to its environment

Differentiating Living and Non-living Things



Making Living Things

- Creating extremely complicated organic molecules from simple, non-organic ingredients

Abiogenesis

- Spontaneous generation of life from non-living things
- Appropriate elements to build organic molecules (C, H, N, O, S, P)
- Energy to promote chemical reactions
 - Lightning, volcanoes, UV light
 - Can form simple molecules called Monomers

Early Earth

- Rocky, barren landscapes
 - Nothing alive
- Strong tides
- Storms, lightning
- Volcanoes on land and underwater
- Sun rises and sets like 3 hours later
- Earthquakes and lava everywhere
- No O_2 in atmosphere

Stanley Miller's Experiment

- Energy from sparks was able to synthesize all 20 of the amino acids that organic material is made from
- The goop in the vessel was called primordial soup
- Not alive; molecules too simple

Microspheres

- Dry up the primordial soup
- Re-add water
- the proteins rearrange themselves into a shape
- these "microspheres" randomly divide

Clay Grains

- Natural atoms line up in divots between crystalline structure
- Make it easier for chemical reactions to happen on these atoms

Life Arose (3.8 - 4.0 BYA)

- Earliest form of life
- Simple bacteria (prokaryotes)
- Lived in shallow water
- Single celled
- Reproduced asexually
- Archaea vs Bacteria
 - Archaea can survive in extreme environments (ex. geothermal vents)
 - Split into branches billions of years ago but didn't change much more (punctuated equilibrium)
 - Cyanobacteria
 - first organism to perform photosynthesis

- all other life arose from it

The Great Oxygenation Event (2.3 BYA)

- Most of our atmosphere came from the gases that escaped from volcanoes
- Free oxygen is not one of them; oxygen came from photosynthesis
- Formed the ozone layer
- Abundant iron in the ocean reacted with oxygen and formed layers of hematite (Fe_2O_3) on the ocean floor

Eukaryotes (2.1 BYA)

- Were single celled at first
- Membrane surrounding cell nucleus
- Reproduces sexually, aerobic (oxygenated - breathing)
- Endosymbiosis
 - Where one organism lives inside the other
 - What we think happened is that the mitochondria and chloroplasts invaded the main cell (or the other way around) and created a cell within a cell

Multicellular Organisms (1.6 BYA)

- Replacement of cells that die

Ediacaran Fauna (550 - 635 MYA)

- No bones or anything yet, all weird squishy small organisms
- No predatory practices, mostly filter feeders