

## Biology Notes Chapter 4

### The Origins of Life

**The Big Bang** – 15 billion years ago, all matter compressed within a single ultra dense point

The point exploded, sending matter flying randomly into space

The stars, through gravity, organized themselves in galaxies

The stars pulled planets, the planets pulled moons

**Earth** – formed 4.6 billion years, moon formed around the same time

Age based on the age of the oldest rocks

**Prehistoric Earth** – covered with magma, volcanoes, hot springs

Crust began to cool/harden, gases escaped from cracks to form atmosphere

Early atmosphere contains  $N_2$ ,  $CO_2$ ,  $CO$ ,  $H_2O_{(g)}$ ,  $H_2$

Gases from volcanic eruptions, no trace of  $O_2$

Radiation from rocks, cosmic rays, heat, extreme temperature variation

Considered too harsh to support life, but organisms lived there

**Today** –  $N_2$  – 78%,  $O_2$  – 21%, Other Gases – 1%

**Anaerobic** – animals that don't need  $O_2$  – primitive life must be anaerobic

Free  $O_2$  didn't appear till plants and photosynthesis

First animals lived in the ocean; UV rays arrange DNA and causes mutations

$O_2$  is hit by UV rays to form Ozone in the upper atmosphere

### The Four Theories of the Origins of Life

1. Evolution from inorganic Matter – silicon based life
2. Life from outer space – From meteorites and asteroids and comets
3. Creation – Adam and Eve
4. Chemical Evolution – Inorganic matter underwent complex changes to produce living cells

### Chemical Evolution

**Oparin/Haldane** – the **Heterotrophe Hypothesis**

The 1<sup>st</sup> living organisms couldn't make their own food

They fed off organic compounds in the thin soup and other heterotrophes

Amino acids were found in the thin soup

**Thin Soup/Primordial Ooze** – The first primitive oceans. Place for early living orgs

Life was made by  $CH_4$ ,  $NH_3$ ,  $H_2$ ,  $H_2O_{(g)}$

Gases chemically rearranged in the atmosphere, found organic compounds, spread by rain

More reactions in the oceans, organic compounds  $\rightarrow$  cells

Simple Gases  $\rightarrow$  complex gases  $\rightarrow$  Thin Soup  $\rightarrow$  Organic Compounds  $\rightarrow$  Life

$H_2$ ,  $CO_2$ ,  $CO$      $CH_4$ ,  $NH_3$ ,  $H_2O$

$H_2$ ,  $H_2O$

From organic Compounds  $\rightarrow$  Life known as **“The Miracle”**

**Urey/Miler** – University of Chicago – Simulated prehistoric conditions

Built Glass World, put in gasses, NRT, heat,  $H_2O$ , Day and Night

On 7<sup>th</sup> day, saw variety of organic compounds, amino acids

## Life from Space

Found **amino acids** in meteorites in Australia

Found **formaldehydes**, needed for RNA synthesis, on tail of Hales Comet

**Precambrian** – 4.6 billion – 580 million years ago

**Paleozoic** – 580 million to 245 million years

**Mesozoic** – 245 – 50 million years

**Cenozoic** – 50 – Present

**Coacervates** – Oparin – clusters of proteins held together w/o membranes, the first cell

**Woese** – Greenhouse effect, similar to Venus, meteorite dust spread by the wind, with water

## 1<sup>st</sup> forms of Life

Models of Precells

**Cains Smith** – Clay absorbs minerals, starts self replicating – naked cells

**Coacervates** – **Oparin** - Organic compounds with water based membranes

**Microspheres** – same as coacervates - **Fox**

**Protenoids** – super heated amino acids to form proteins

**Water Droplets Condensing on Dust Particles** – **Woese**

**Properties very close to that of a virus**

**Prokaryotic Cells** – 1<sup>st</sup> cells, no membrane around DNA

No nucleus, lacks organelles found in common cells

Only modern cell that's prokaryotic is bacteria

**Organelle** – carries out the work of the cell – Mitochondria is an organelle

**Eukaryotic Cells** – Cells with nucleus and organelles – all modern cells are eukaryotic

**Microfossils** – fossils of microorganisms

Oldest rocks are **3.8 billion** years old

Oldest fossilized remains are **3.5 billion** years old

Oldest eukaryotic cells are **1.3 billion** years old

**Endosymbiont Hypothesis** – Links Prokaryotic to Eukaryotic Cells

Inorganic cells  $\not\approx$  organic cells  $\not\approx$  Prokaryotic  $\not\approx$  Organelles  $\not\approx$  Eukaryotic

**Gaia Hypothesis** – the living Earth, all of Earth is alive, everything feeds off it

They Found Amino Acids on the **Murchison** Meteorite in Australia