

**Aim: How did life begin on Earth?**

**Do Now: 1. About how old is the sun? The Earth?  
2. What conditions are necessary for life?**

**Homework: Rd. pp. 447- 449, p.449 # 1, 2, 3**

Wed 9/ 23 LE 3 p. 447-449. P.449 #1, 2, 3 + Essay 1st draft  
LE 5 Complete 1st draft Vaccine persuasive essay  
Thurs 9/24 LE 5 p. 449 # 1, 2, 3

Sep 23-8:39 PM

- Earth is formed about 4.8 b.y.a

**Early Conditions on Earth**

- Earth is a violent place w/ volcanic eruptions, severe lightning and no life
- Earth's atmosphere had no protective Ozone layer, allowing UV rays in.

**Elements & Compounds hypothesized to be present:**

- Hydrogen (H)
- Nitrogen (N)
- Sulfur (S)
- Carbon (C)
- Oxygen (O)
- Water (H<sub>2</sub>O)
- Methane (CH<sub>4</sub>)
- Ammonia gas (NH<sub>3</sub>)

**Miller & Urey Experiment**

- In the 1960's Miller & Urey created a model of Earth's early atmosphere: H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>4</sub>. The gases were heated in a closed system & exposed to electrical sparks to simulate lightning.

**Results: After several day, Miller & Urey discovered organic compounds in the collecting chamber including: Amino acids, fatty acids & hydrocarbons**

Sep 23-9:41 PM

**Two Theories of Origin of Life**

**Miller & Urey Experiment**

In the 1960's Miller & Urey created a model of Earth's early atmosphere: H<sub>2</sub>O, NH<sub>3</sub>, CH<sub>4</sub>. The gases were heated in a closed system & exposed to electrical sparks to simulate lightning.

**Results: After several day, Miller & Urey discovered organic compounds in the collecting chamber including: Amino acids, fatty acids & hydrocarbons**

**"Bubble Theory"**

became popular in the 1980's

- Discovered at Hydrothermal Vents
- located miles below the ocean surface, water almost 0°C
- mineral rich iron, nickel, copper, etc.
- underwater volcanoes heat water to almost boiling creating "mineral chimneys"
- Recent studies suggest that heat-loving microbes are not living fossils.
- instead, they may have descended from less hardy species and evolved new defenses against heat.
- Some skeptics also wonder how delicate RNA molecules could have survived in boiling water.

No single strong hypothesis has taken the hot start's place although suggestions include tidal pools or oceans covered by glaciers

RNA

LE 3 notes

Sep 23-11:48 PM

**Stanley Miller & Donald Urey's Experimental Model**

formaldehyde, cyanide, glycine, alanine and even ATP

Sep 24-12:03 AM

**Where did life begin on Earth?**

"The short answer is we don't really know how life originated on this planet."

Andy Knoll

Professor of biology at Harvard and author of *Life on a Young Planet: The First Three Billion Years of Life*.

**Hydrothermal Vents** - became popular in the 1980's

- located miles below the ocean surface, water almost 0°C
- mineral rich iron, nickel, copper, etc.
- underwater volcanoes heat water to almost boiling creating "mineral chimneys"
- Recent studies suggest that heat-loving microbes are not living fossils.
- instead, they may have descended from less hardy species and evolved new defenses against heat.
- Some skeptics also wonder how delicate RNA molecules could have survived in boiling water.
- although suggestions include tidal pools or oceans covered by glaciers

Sep 23-10:14 PM

**Chemosynthesis Theory of Life (Miller & Urey)**

**Stage 1**

Random Molecules + other random molecules → hydrocarbons, amino acids, fatty acids

UV Light, radiation, other energy

**Stage 2**

hydrocarbons + hydrocarbons → Carbohydrates, polypeptides & proteins, lipids (Organic Molecules)

amino acids + amino acids

Fatty acids + fatty acids

**Stage 3**

Macromolecules organized into bodies with definite shape, unity and properties which resemble those of living things.

**Coacervates (Microspheres)**

- small, membrane-bound spherules, theorized to have been early ancestors of cells.
- share a few important characteristics of modern cells: have a boundary, reproduce by dividing by fission, grow by accumulating additional molecules undergo simple metabolism

**Ribozyme** - an RNA molecule that can act like an enzyme

- theorized that it catalyzed the formation of these first proteins

**Stage 4**

- Appearance of nucleic acids (Building blocks of RNA & DNA)
- These molecules can reproduce themselves into exact copies
- Improved organization of Coacervates

**Stage 5**

- beginning of evolutionary development
- these organisms that could use energy most efficiently could reproduce more rapidly

**Stage 6**

- appearance of autotrophic bacteria
- self-sufficient: could directly synthesize nutrients with energy provided by the sun.

Game of Life <http://library.thinkquest.org/C003763/index.php?page=gol>

**The Proof for this Theory?**

- number of molecular similarities between all life forms that indicate that all life did indeed evolve from a single ancestor
- molecules of living organisms are rich in hydrogen-containing carbon compounds, indicating that there was no free oxygen on primitive Earth

Sep 23-10:44 PM

Summary: Origin of Life

Vocabulary

Organic Molecule	Chemosynthesis
RNA	Carbohydrate
DNA	Protein
Hydrocarbon	Lipids
Amino acid	Ribozyme
Fatty Acids	Enzyme
Hydrothermal Vents	macromolecule
Urey- Miller	microsphere

1. There are 2 theories of how life began: 1. Urey-Miller's chemosynthesis (Lightning in a jar) 2. Bubble Theory that life started at hydrothermal vents deep on sea floor.
2. Urey- Miller theorized that gases exposed to lightning & heat would create organic molecules.
3. Organic molecules- hydrocarbons, amino acids, & fatty acids- form macromolecules
4. Macromolecules are: carbohydrates, proteins (enzymes) & lipids.
5. Nucleic acids eventually form and combine to form RNA & DNA.
6. Bacteria form from these replicating molecules.

Sep 24-10:28 AM