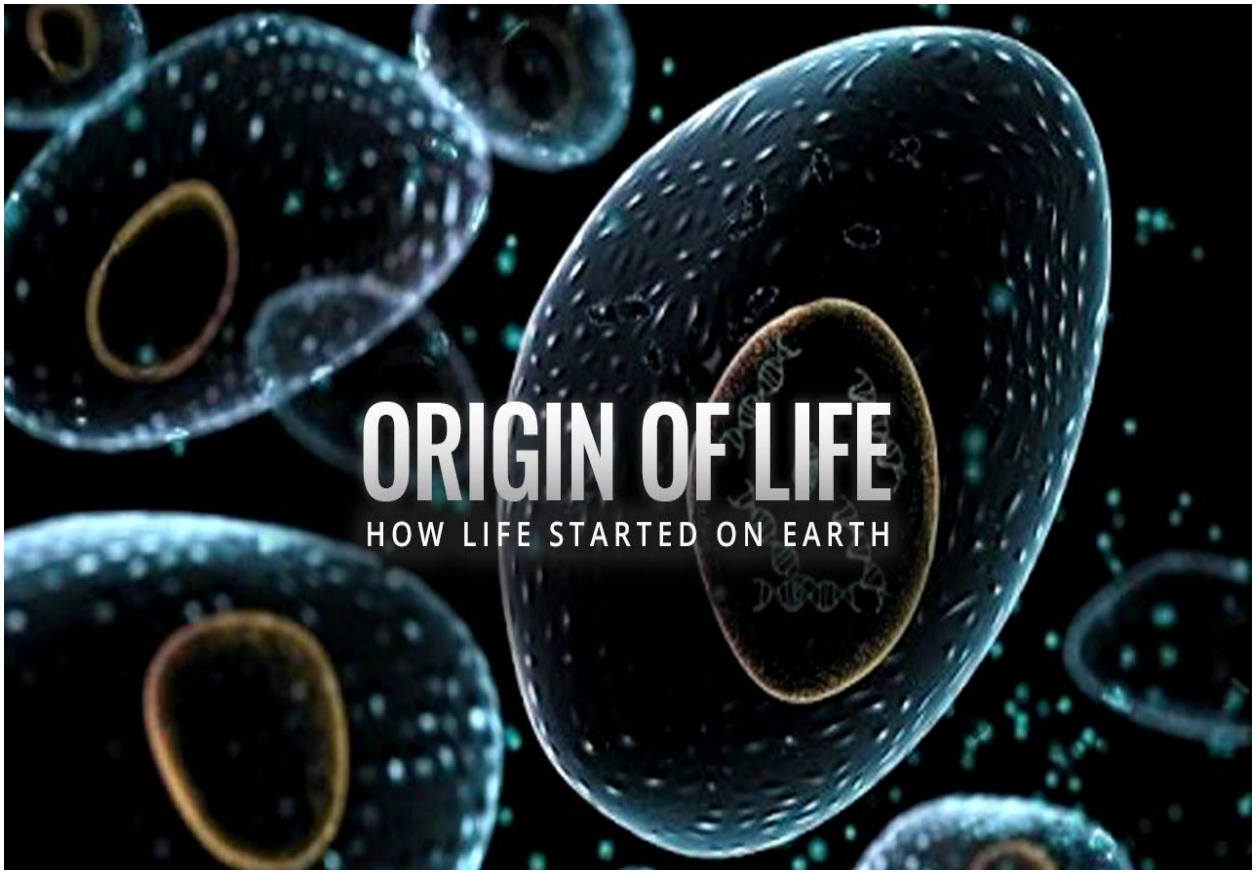
B.Sc. – II Zoology (Paper-II)

Animal distribution, evolutionaryBiology and Development . MM: 50

Unit-I
Animal distribution: Geological and geographical distribution with their characteristic fauna; fossils.
Unit-II
Origin of Life, concept of species (classical & modern concept)
Evolution: Evidences (including physiological and serological); Theories of evolution (including
Neo-Lamarckism, Darwin-Wallace theory of natural selection,
Neo-Darwinism, Modern(Synthetic theory)
. Evolution of Man. Mutation
Unit-III
Developmental Biology I:Aims and scope of Developmental Biology.
Gametogenesis, Fertilization, Egg: structure and types.
Types & patterns of cleavage
Unit-IV
Developmental Biology

Process of Blastulation & Gastrulation. Fate Map.
Development of Chick up to formation of Primitive streak and mammal (in out line)
Extra embryonic membranes of chick.
Placentation and types of Placenta.

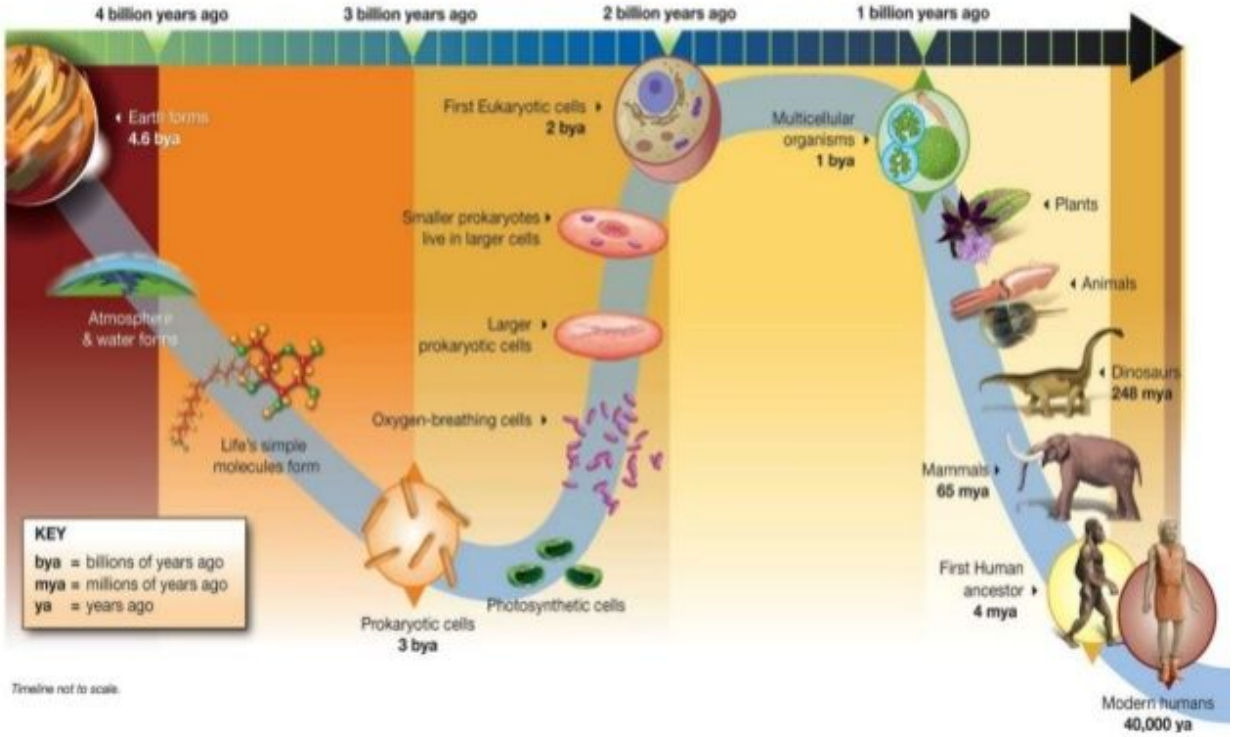

ORIGIN OF LIFE
HOW LIFE STARTED ON EARTH

ORIGIN OF LIFE

- ✓The origin of life on Earth is a scientific problem which is not yet solved. There are plenty of ideas, but few clear facts.
- ✓It is generally agreed that all life today evolved by common descent from a single primitive life form.
- ✓It is not known how this early form came about, but scientists think it was a natural process which took place perhaps 3,900 million years ago. This is in accord with the philosophy of naturalism: only natural causes are admitted

iTutor

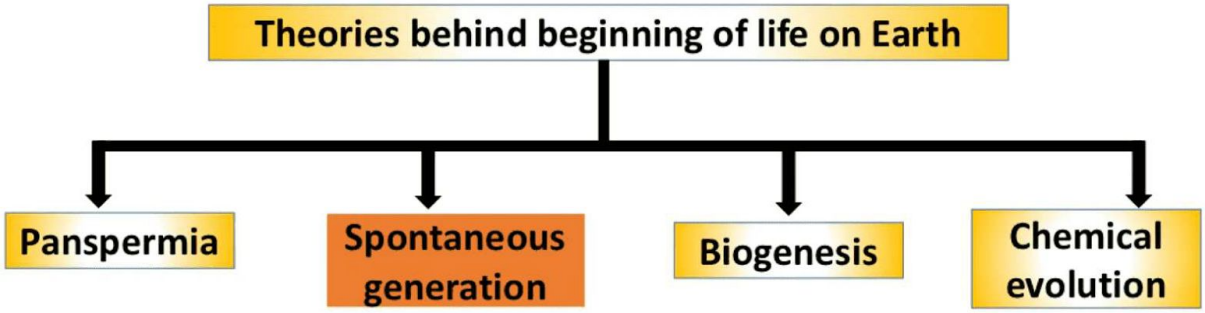
Life Timeline



1. THEORY OF SPECIAL CREATION

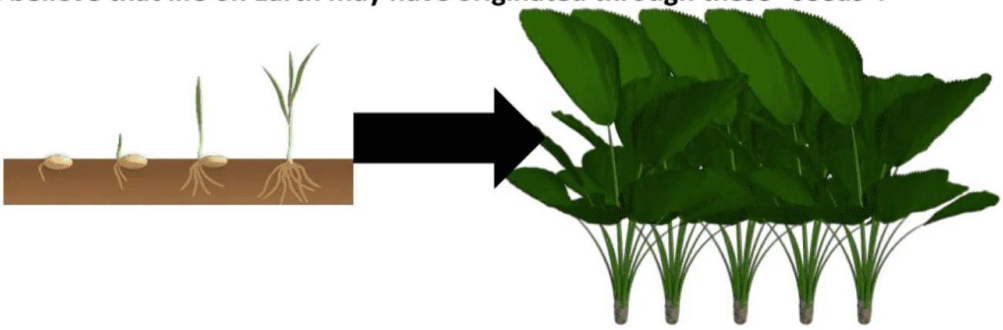
- All the different forms of life that occur today on planet earth : created by super natural power.
- This idea is found in the ancient scriptures of almost every religion.
- Hindu mythology : Lord Brahma, the God of Creation,
- Christian : God created this universe, plants, animals and human beings in about six natural days.
- Sikh mythology : all forms of life including human beings came into being with a single word of God.

ORIGIN OF LIFE



Panspermia

- Panspermia is a Greek word that translates literally as "seeds everywhere".
- Some scientist believe that life originated from space and came on earth in the form of spores (seeds)
- The panspermia hypothesis states that the "seeds" of life exist all over the Universe and can be propagated through space from one location to another. Some believe that life on Earth may have originated through these "seeds".

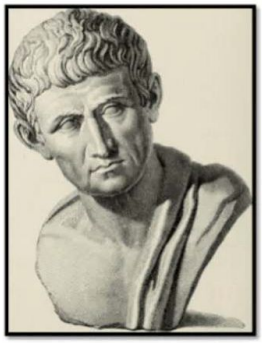


Origin of Life

- The theory of spontaneous generation
- Also called abiogenesis
- Idea that living things can arise from nonliving matter
- Idea lasted almost 2000 years
- Conclusions based on untested observations

ORIGIN OF LIFE

- Aristotle Proposed the theory of spontaneous generation
- Idea that living things can arise from nonliving matter
- Idea lasted almost 2000 years



ABIOGENESIS: Generation of life from non-living matter, now it is known as spontaneous generation.

ORIGIN OF LIFE

- For centuries, people based their beliefs on their interpretations of what they saw going on in the world around them without testing their ideas
- They didn't use the scientific method to arrive at answers to their questions
- Their conclusions were based on untested observations

SPONTANEOUS GENERATION EXAMPLE #1

- **Observation:** The farmers stored grain in barns with thatched roofs. As a roof aged, it start leaking. This could lead to spoiled or moldy grain, and of course there were lots of mice around.
- **Conclusion:** It was very obvious for the people of that time to estimate that the mice came from the moldy grain.

Mice spontaneous generation on stored grains

Thatched roofs

SPONTANEOUS GENERATION EXAMPLE #2

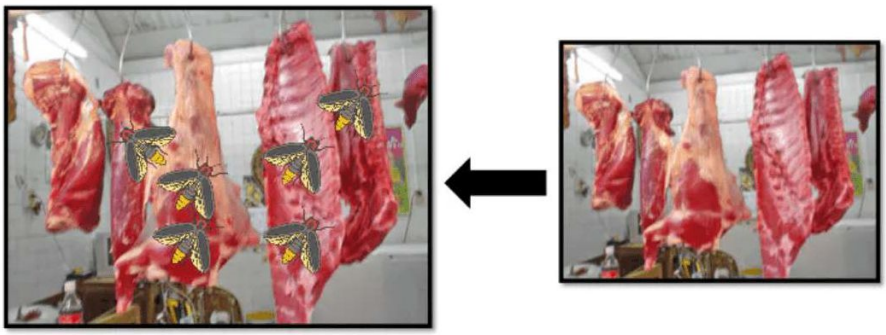
- **Observation:** In the cities centuries ago, there were no garbage trucks, no electricity, and no refrigeration. Sewage flowed down the streets and left over food were thrown out into the streets each morning. Many cities also had major rat problems and a disease called Bubonic plague.
- **Conclusion:** Obviously, all the sewage and garbage turned into the rats.

SPONTANEOUS GENERATION EXAMPLE #3

- Observation-Every year in the spring, the Nile River flooded areas of Egypt along the river, leaving behind nutrient-rich mud that enable the people to grow their year's crop for food. However, along with the muddy soil, large numbers of frogs appeared that weren't around in drier times
- Conclusion -It was perfectly obvious to people back then that muddy soil gave rise to the frogs

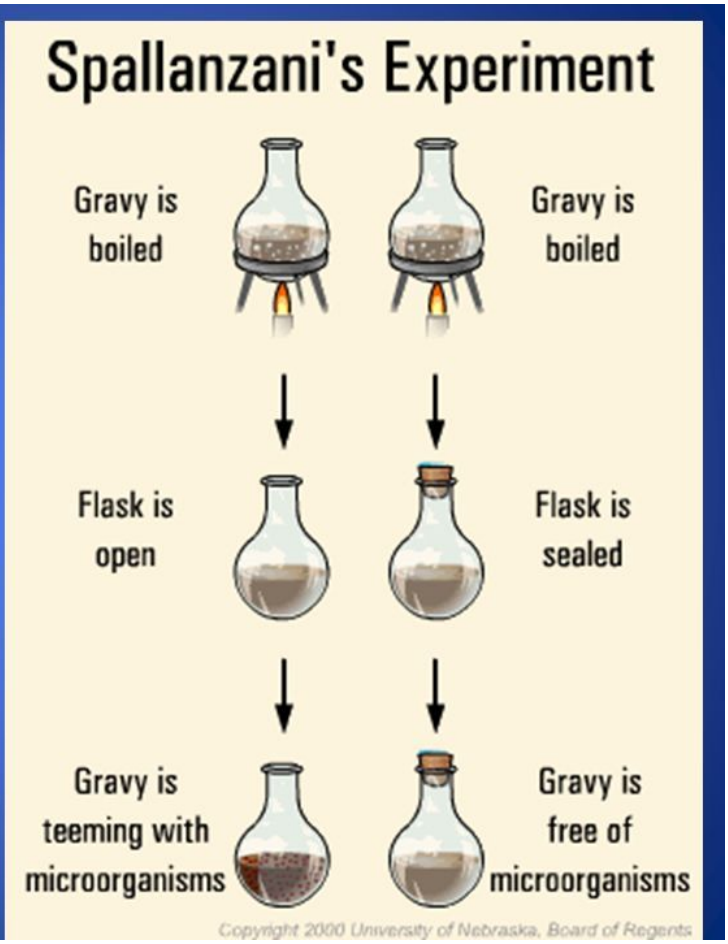
SPONTANEOUS GENERATION EXAMPLE #4

- Observation: Since there were no refrigerators, at butcher shop, especially in summer, the flies start to feed on meat if it hang for long time in open shop.
- Conclusion: Obviously, the rotting meat that had been hanging in the sun all day was the source of the flies.



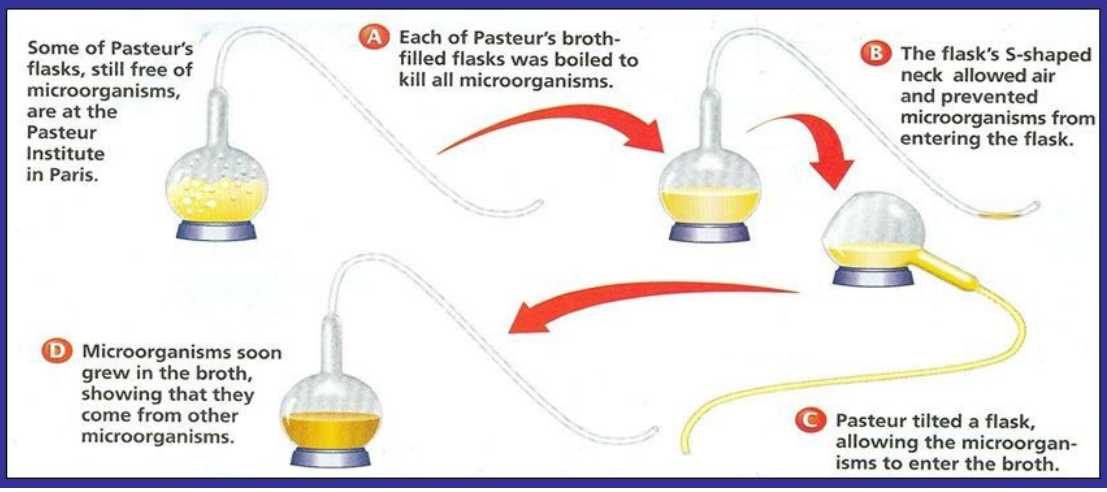
Lazzaro Spallanzi - 1768

- Modified Spallanzani's experiment.
- Boiled the broth for an hour.
- Partially evacuated the jars and sealed the vessels right after boiling.
- No growth was observed.
- Some felt that air was necessary for spontaneous generation to occur.



Origins of Life

- **Louis Pasteur**
  - **Disproved the spontaneous generation of microorganisms**
  - **Experiments with broth**



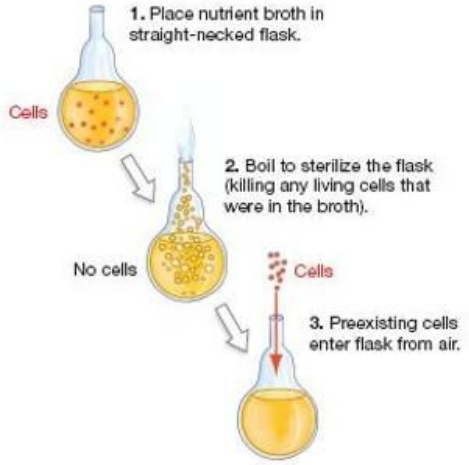
EXPERIMENT

QUESTION: Do cells arise spontaneously or from other cells?

SPONTANEOUS GENERATION HYPOTHESIS: Cells arise spontaneously from nonliving materials.

ALL-CELLS-FROM-CELLS HYPOTHESIS: Cells are produced only when preexisting cells grow and divide.

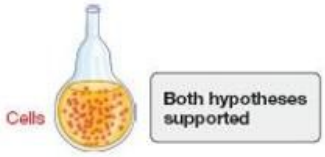
(a) Pasteur experiment with straight-necked flask:



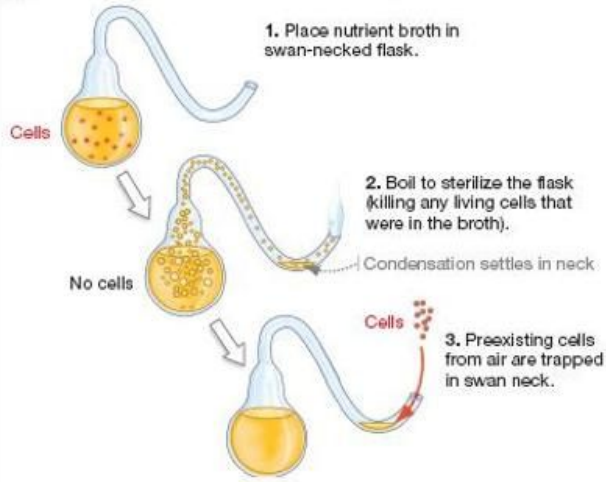
PREDICTION OF SPONTANEOUS GENERATION HYPOTHESIS:
Cells will appear in broth.

PREDICTION OF ALL-CELLS-FROM-CELLS HYPOTHESIS:
Cells will appear in broth.

RESULTS:

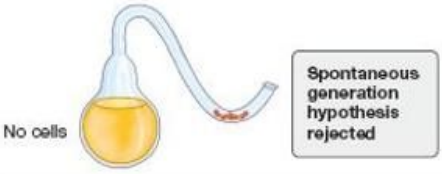


(b) Pasteur experiment with swan-necked flask:



PREDICTION OF SPONTANEOUS GENERATION HYPOTHESIS:
Cells will appear in broth.

PREDICTION OF ALL-CELLS-FROM-CELLS HYPOTHESIS:
Cells will not appear in broth.



CONCLUSION: Cells arise from preexisting cells, not spontaneously from nonliving material.

Theory of Biogenesis

- In 1858, when the German scientist Rudolf Virchow challenged the case for spontaneous generation with the concept of biogenesis, the claim that

  '**living cells can arise only from preexisting living cells**'.

- In 1961, French scientist Louis Pasteur demonstrated that

  '**microorganisms are present in the air and can contaminate sterile solutions, but that air itself does not create microbes**'.

ABIOGENESIS

VERSUS

BIOGENESIS

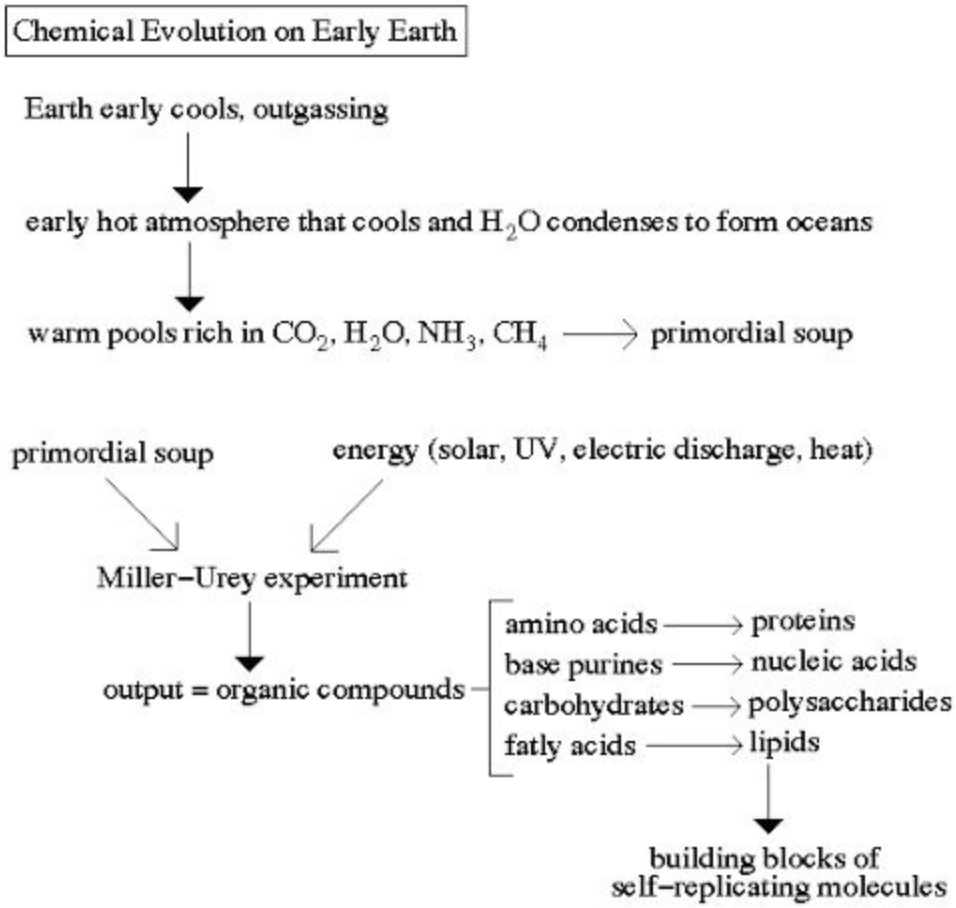
ABIOGENESIS	BIOGENESIS
Supposed production of living organisms from non-living matter, as inferred from the apparent appearance of life in some supposedly sterile environments	The hypothesis that living matter arises only from other living matter
Francesco Redi, Alexander Oparin, Stanley Miller, and Harold Urey were some proponents	William Harvey, Theodore Schwann, Lazzaro Spallanzani, John Needham, and Louis Pasteur were some proponents
States that life on earth originated from non-living compounds	States that life on earth originated from the pre-existing living forms
Has not been scientifically proved	Has been proved by scientific experiments
Based on observations and rational thoughts	Based on practical experiments and material evidence

CHEMICAL EVOLUTION

- The notion that complex molecules could have evolved naturally from simpler ingredient found on the primitive Earth.
- The first experimental verification of the theory was provided in 1953 by University of Chicago scientists Harold Urey and Stanley Miller
- Nucleosynthesis, the creation of chemical elements in the universe either through the Big Bang, or supernovae
- Abiogenesis , the transition from nonliving elements to living systems
- Molecular evolution evolution at the scale of molecules
- Gas evolution reaction, the process of a gas bubbling out

(or evolving) from a solution

- Oxygen evolution, the process of generating molecular oxygen through chemical reaction


Chemical Evolution on Early Earth
Earth early cools, outgassing
early hot atmosphere that cools and H_2O condenses to form oceans
warm pools rich in CO_2, H_2O, NH_3, CH_4 → primordial soup
primordial soup
energy (solar, UV, electric discharge, heat)
Miller–Urey experiment
output = organic compounds
amino acids → proteins
base purines → nucleic acids
carbohydrates → polysaccharides
fatly acids → lipids
building blocks of
self–replicating molecules

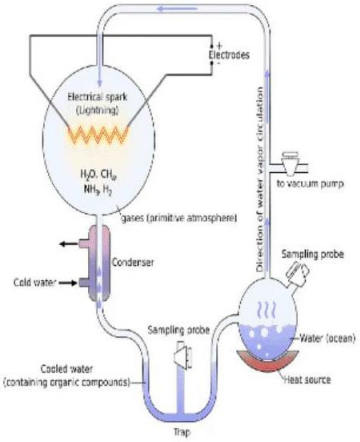
Oparin and Haldane

- Early earth Environment was having very high temperature
- Light present
- Reduced environment (no oxygen)
- Heavy rain + mixture of organic molecules created a Primordial soup in oxygenless atmosphere through the action of sunlight.these would combined in more complex way to form Coacervate Dropletes.
- These droplets would grow by fusion with other droplets, and reproduce through fission into the daughter droplets.

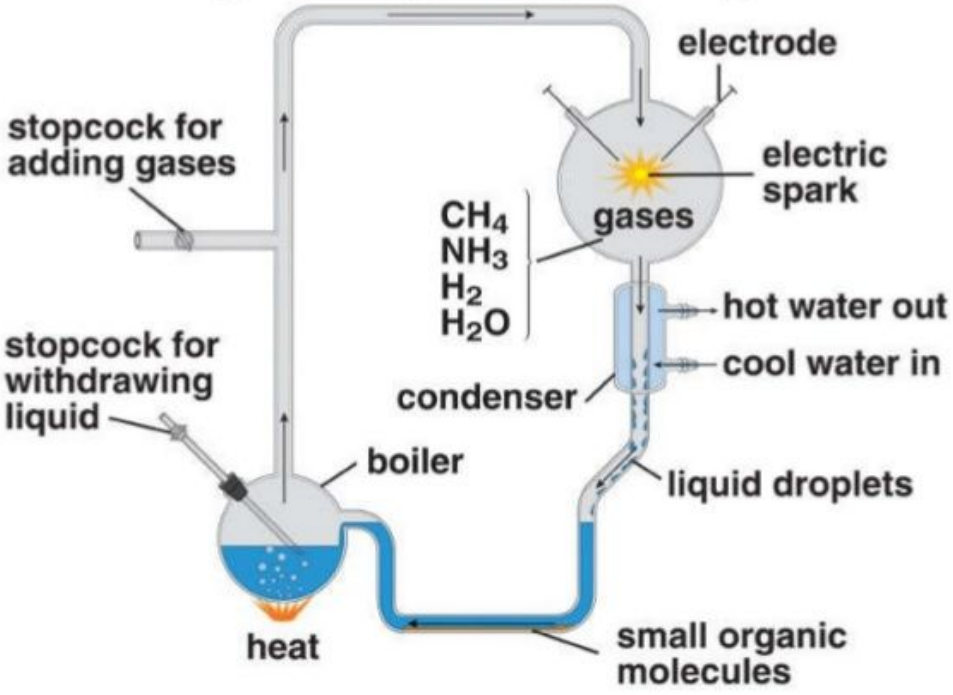
Miller-Urey Experiment

- The Miller–Urey experiment (or Miller experiment) was a chemical experiment that simulated the conditions thought at the time to be present on the early Earth, and tested the chemical origin of life under those conditions.
- With their experiments they established that the Earth's primitive Atmosphere was capable of producing the building block of life form from inorganic materials.

- It is also established that the primitive Earth's Atmosphere was capable of producing organic molecules like amino acids.
- They created a closed chamber resembling the primitive earth's condition (CH4, H2, NH3 where introduced in water containing flask)
- To stimulate the lightening discharge, Miller supplied the system with electrical current.
- After few days Miller, observed that the flask contain organic compounds and some amino acids the serves as building block of proteins
- Thus miller-Urey experiments demonstrated , how some biological molecules such as simple amino acid, could have arisen abiotically.



Miller's experiment



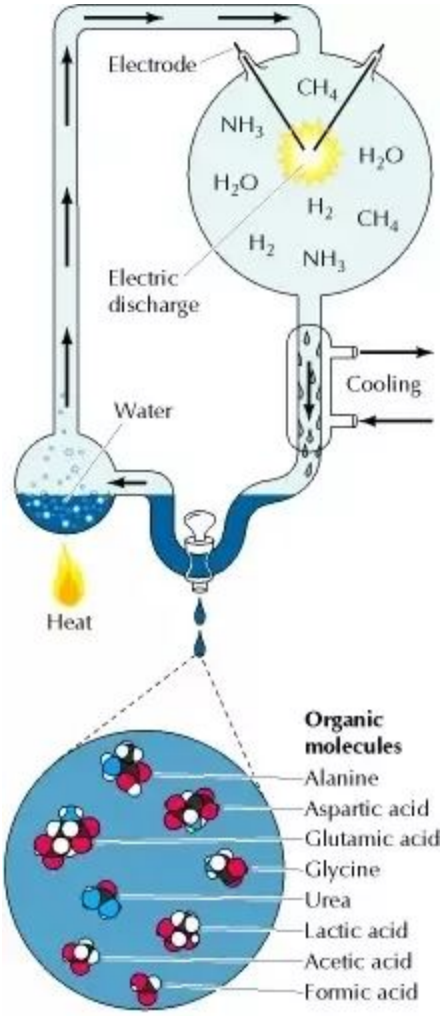
27-24

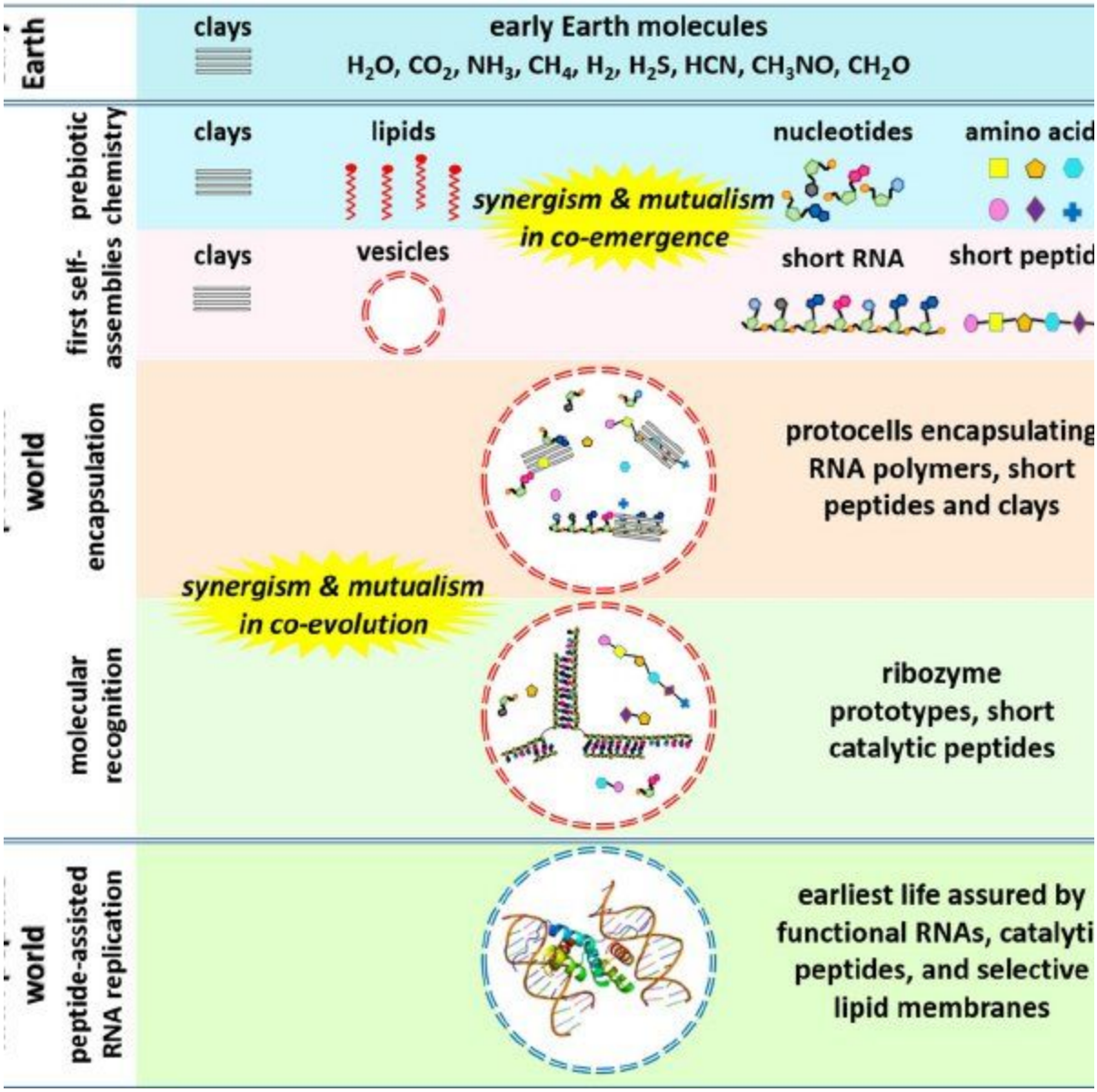
CHROMATOGRAPHY = ALKYNES, GLY GULAT

NH3 : CH4: H2

2:2;1

100C


Electrode
CH_4
NH_3
H_2O
H_2O
H_2
CH_4
H_2
NH_3
Electric discharge
Cooling
Water
Heat
Organic molecules
Alanine
Aspartic acid
Glutamic acid
Glycine
Urea
Lactic acid
Acetic acid
Formic acid



REPRODUCE

C.A OR EIOBIONTS BUDDING .

SULPHUR BACTERIA ,

C.P =

AEROBIC BACTERIA CYANOBACTERIA OZ , OXIDIZING

Hypothesis

Chemical evolution in four stages

Stage 1: Abiotic synthesis of organic monomers

Oparin & Haldane (1920s)

Hypothesis

Conditions on primitive Earth favored chemical reactions that synthesized organic compounds from inorganic compounds.

Miller and Urey (1953)

- Tested Oparin & Haldane's hypothesis
- Demonstrated that amino acids and other organic compounds may be made from inorganic compounds

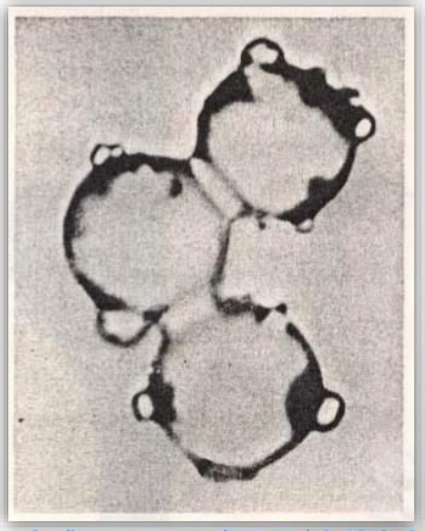
Hypothesis 1

Chemical evolution in four stages

Stage 2: Abiotic synthesis of polymers

Fox (1958)

- Produced proteinoids from clay and organic monomers
- Proteinoids + cold H_2O → self-assembling microspheres



http://www.biology.iupui.edu/biocourses/N100/ch8life.html

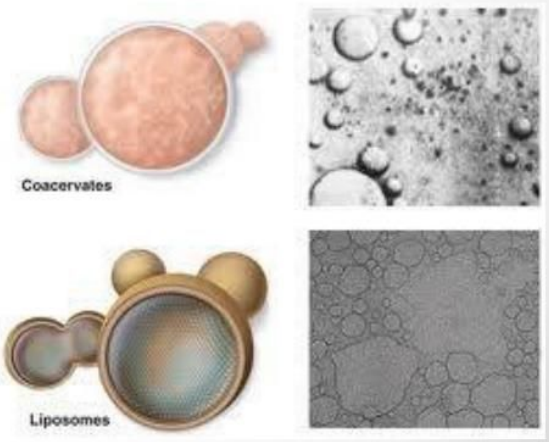
Hypothesis 1

Chemical evolution in four stages

Stage 3: Abiotic synthesis of protobionts

Protobionts

- Aggregates of abiotically-produced molecules
- Not capable of precise reproduction
- Maintain internal environment different from surroundings
- Exhibit metabolism and irritability



http://www.doctortee.com/dsu/tiftickjian/cse-img/biology/evolution/protobionts.jpg

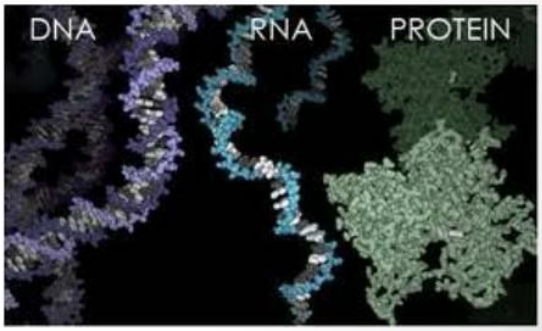
Hypothesis 1

Chemical evolution in four stages

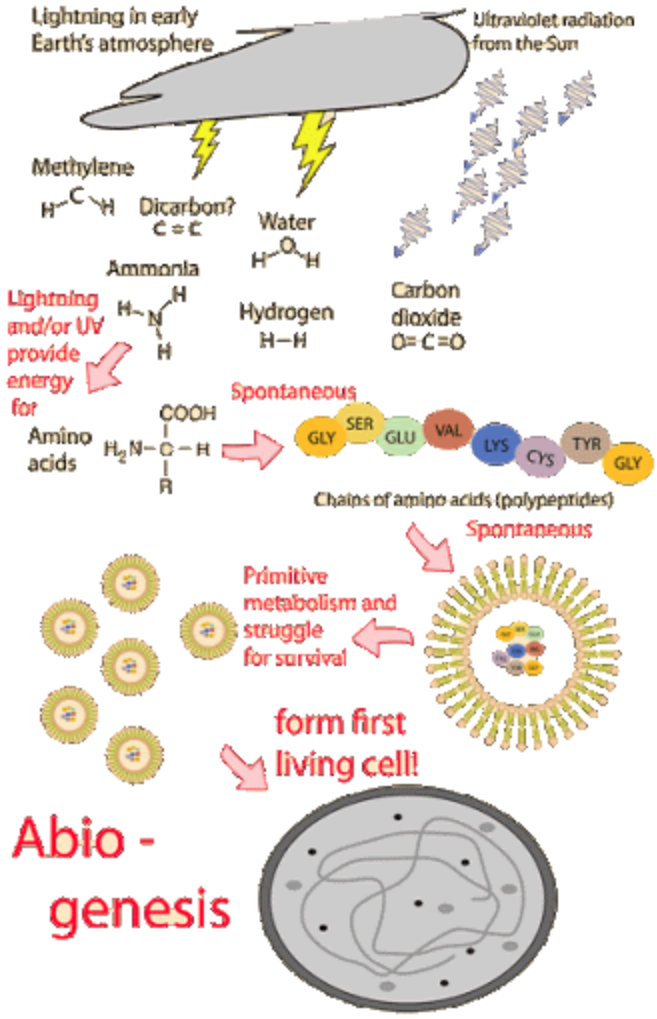
Stage 4: Origin of genetic information

RNA

- may have been the first abiotically-produced genes
- Crick and Orgel (1968) hypothesized that RNA may have been life's first information storage system
- Cairns-Smith and Bernal showed that amino acids and nucleotides stick to clay



http://www.scienceforthepublic.org/blog/wp-content/uploads/2009/09/DNA-RNA-Protein.jpg


Lightning in early Earth's atmosphere
Ultraviolet radiation from the Sun
Methylene
Dicarbon?
Water
Ammonia
Hydrogen
Carbon dioxide
Lightning and/or UV provide energy for
Amino acids
Spontaneous
GLY
SER
GLU
VAL
LYS
CYS
TYR
GLY
Chains of amino acids (polypeptides)
Spontaneous
Primitive metabolism and struggle for survival
form first living cell!
Abio - genesis