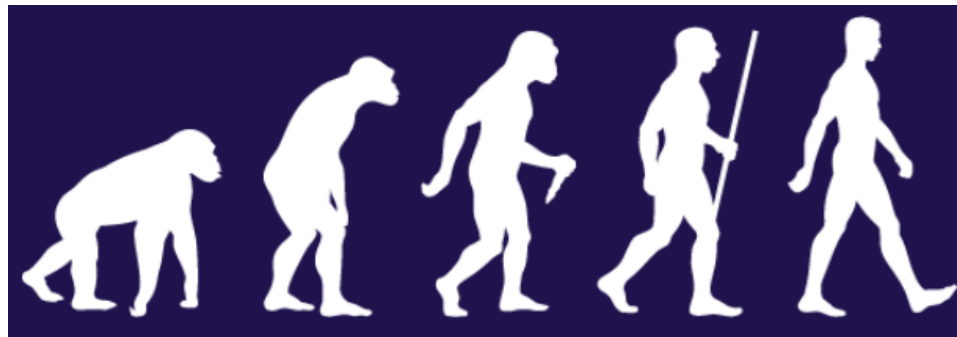


# Mohanlal Sukhadia University

Department of Botany

B.Sc. II year Paper III

## Lecture 1 – Evolution (Introduction)



- **LIFE**

“The ability of an organism to reproduce, grow, produce energy through chemical reactions to utilize the outside materials”.

1. How life originated on earth?
2. How different kinds of organisms are formed in the world?

- **Earth** formed around **4.54 billion years ago**
- Earth originally had two components:
- Lithosphere
- Atmosphere And later Hydrosphere

❑ The formed earth consists of three parts.

1. **Baryosphere:** it is the central core of the earth. It is filled with molten magma with large quantity of iron and nickel. Baryosphere has two zones: inner core region (~800 miles radius) and outer core region (~1400miles radius).
2. **Pyrosphere:** it is the middle part of the earth, also known as mantle. It is ~1800 miles in thickness and mainly consists of silica, manganese and magnesium.
3. **Lithosphere:** it is the outermost region of the earth, also known as crust. It is 20-25 miles in thickness and mainly has silica and aluminum.

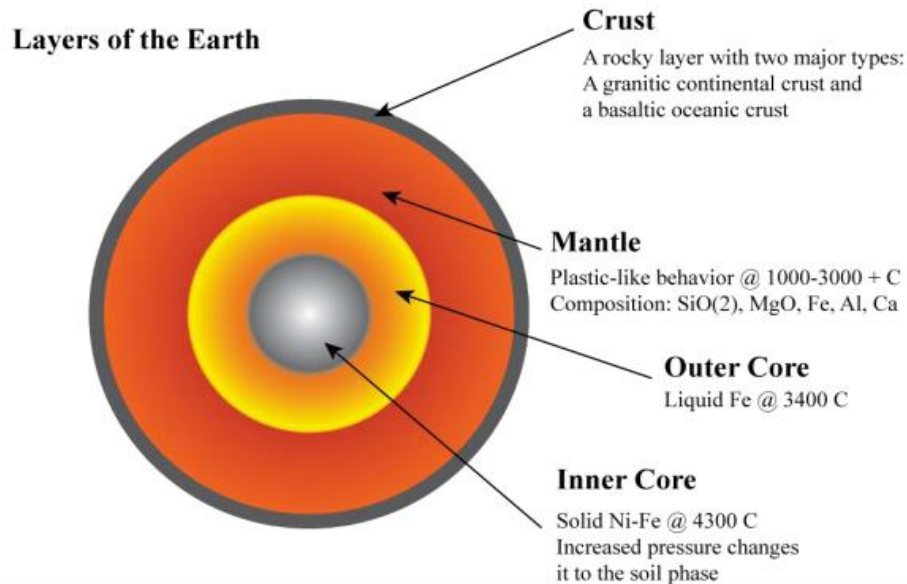


Figure 3.1 - Cross section of Earth

## ❑ **Pre-requisite of life on earth?**

- Primitive earth with little or no oxygen.
- presence of hydrogen and hydrogen compounds with water such as methane ( $\text{CH}_4$ ) and ammonia ( $\text{NH}_3$ ).
- The reducing environment of primitive earth will help to synthesize organic compounds from interaction of inorganic substances.

## ❑ **Energy source on primitive earth**

- Solar radiation
- Electric discharge
- Volcanic eruptions
- Heat
- Cosmic Rays
- Radioactive Decays

## ❑ HOW LIFE ORIGINATED ON EARTH?

Six major theories:

Theory of Special Creations

Theory of spontaneous generations

THEORY OF CATASTROPHISM

THEORY OF COSMOZOIC

THEORY OF ETERNITY OF LIFE

MODERN THEORY

# THEORY OF SPECIAL CREATIONS

- Supported by Father Suarez.
- life on earth is created by a supernatural power, the Almighty (God).
  - a. All living organisms were created same day [**NO DIFFERENCE IN THEIR APPEARANCE**].
  - b. They were created in the present form [**NO EVOLUTION**].
  - c. Their bodies and organs are fully developed to meet the requirement to run the life [**NO ADAPTATION**]

## **OBJECTIONS TO THE THEORY OF SPECIAL CREATION:**

- It was purely based on religious belief.
- There was no experimental evidences to support the assumptions.
- The age of different fossils proves that living organism appear on earth in different time frame.

# THEORY OF SPONTANEOUS GENERATIONS

- It assumes that non-living material in a spontaneous manner give rise to life.
- Observations supporting this theory:
  - Hair of horse tail dipped in the water gives rise to horsehair worm, gordius.
  - Fly larvae develops on rotten meat.
  - Van Helmont claimed, he can produce mice from the dirty shirt and handful of wheat grains kept in dark cupboard in 3 weeks.



flies are created spontaneously  
when meat rots!!

## EVIDENCES AGAINST The Theory of spontaneous generations

- Criticized by **Lazzaro Spallanzani**, **Francisco Redi** and **Louis Pasteur**.
- They proved that all living cells **arise from pre-existing** cells by division. ( “**omne vivum ex vivo**” ).

### 1. Redi's experiment

- He placed meat and fishes in 3 separate jars.

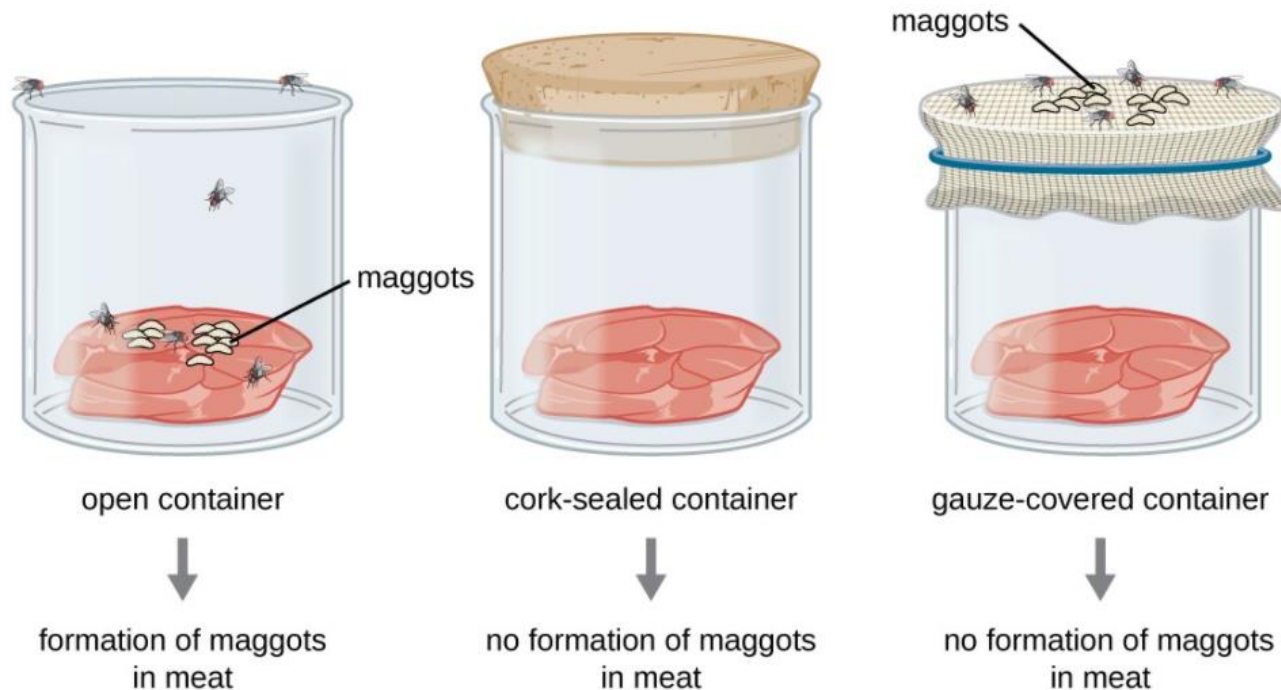
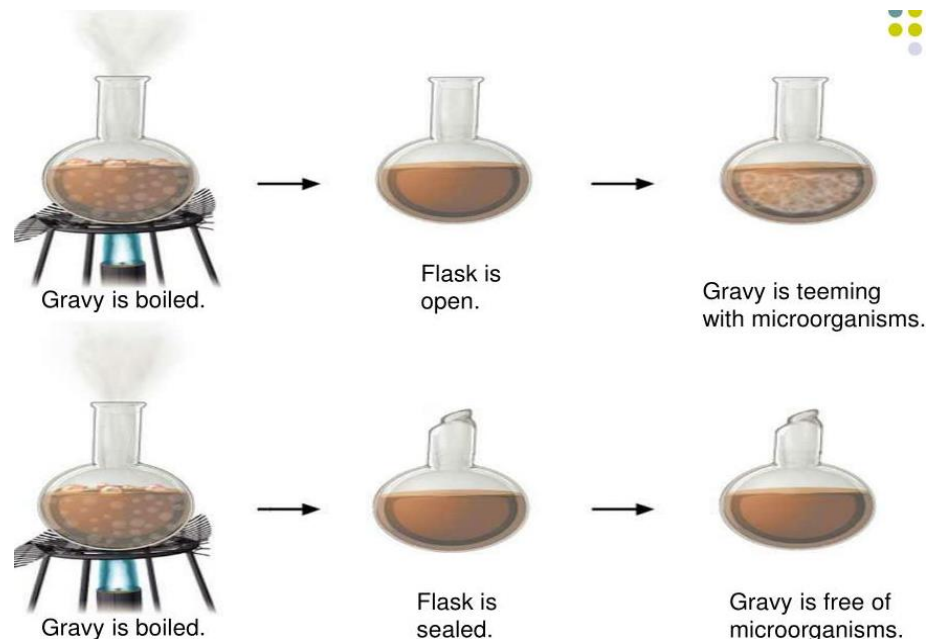


Figure 1. Francesco Redi's experimental setup consisted of an open container, a container sealed with a cork top, and a container covered in mesh that let in air but not flies. Maggots only appeared on the meat in the open container. However, maggots were also found on the gauze of the gauze-covered container.



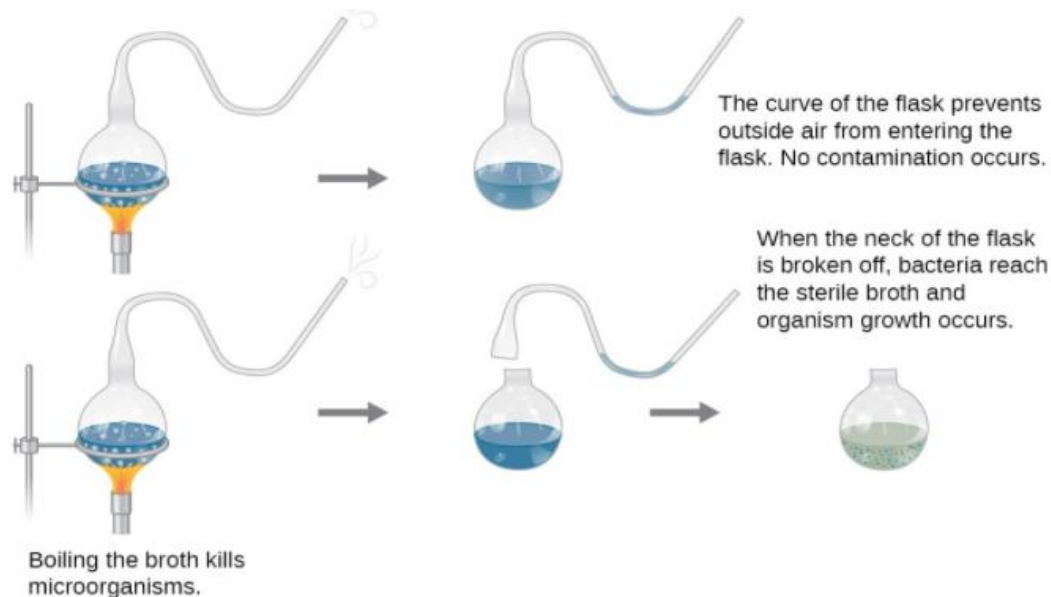
## 2. Spallanzani's Experiment

- Spallanzani prepared animal or vegetable broth and boiled them for several hours and then either remained open or sealed the flask immediately.
- These broth remained free from microorganism growth.
- He concluded that high temperature boiling had killed all microorganisms and in the absence of microorganism life could not appear.
- The broth left open or exposing of sealed broth shows growth of microorganisms.



### 3. Louis Pasteur Experiment

- Pasteur had designed experiment in a flask with “S” shaped curve tube( swan neck flask) . Pasteur articulated “*Omne vivum ex vivo*” (“**Life only comes from life**”)
- He took hay infusion in the flask and boiled for several minutes.
- After cooling, the steam condensed into the lower part of tube and act as barrier to stop the entry of microorganisms.
- No life appeared in the flask for several months. Analysis of condensed water indicates appearance of microorganism in the neck of the tube.
- Breaking of “S” tube allowed the growth of microorganisms in the flask.



# THEORY OF CATASTROPHISM

- This is the extension of the theory of special creation.
- This theory assumes that life is originated by the creation and it is followed by catastrophe due to geographical disturbances.
- Each catastrophe destroyed the life completely whereas each creation forms life different from the previous one. Hence, each round of catastrophe/creation is responsible for evolvement of different types of organisms on earth.
- The criticism of the current theory is same as previous one, No scientific experiment to support the hypothesis and mostly be based on imaginary concepts.

# THEORY OF COSMOZOIC

- Also known as “theory of panspermia or spore theory”.
- This theory was put forward by Richter and strongly supported by Arrhenius.
- The theory assumes that life was present in the form of resistant spores and appeared on earth from other planet.
- Since the condition of earth was supporting the life, these spores grew and evolved into different organisms.
- The theory initially got the support from the fact that fossils of microorganism were found in meteorites in 1961. But no mechanism is known about the transfer of spores from other planet or whether these spores could survive the journey in space.
- The absence of life forms on any planet except earth and no details about the spores, its origin and mechanism of crossing interplanetary space and reaching earth.
- No scientific experiment were given to support the theory. As a result, the hypothesis didn't receive much attention.

# THEORY OF ETERNITY OF LIFE

- This theory assumes that life had no beginning or end.
- It believes that life has ever been in existence and it will continue to be so ever.
- It further believe that there is no question of origin of life as it has no beginning or end.
- The theory is also known as **steady state theory**.
- The main objection against the proposed theory that it could not be able to explain; evidences support that initially earth forms and then life appeared on it. Where life exist before the formation of earth?