—: EVOLUTION :-

* Evolutionary Biology is history of life forms on earth
* The word evolution means 'to unfold' or to reveal hidden potentialities. In its broadest sense, evolution simply means an orderly change from one condition to another.
  - when the matter, elements change in time - Inorganic evolution
  - when the changes are in the organism over the course of generations - Biological or organic evolution.
    - It is descent with modification.
    - It is conversion of simpler form into complex one.

7.1 Origin of life :→

* Events in the history of life :- It consists of two events
  1st - origin of life
  2nd - evolution of life
* origin of universe → . universe is 20 billion years old. Huge clusters of galaxies comprise the universe.
  - Galaxies are made up of stars, clouds of gas and dust.
  - Most accepted theory for origin of universe is Big-Bang theory. This was proposed by Abbe Lemaitre. It talks of a singular huge explosion unimaginable in physical terms. The universe expanded and hence the temperature came down.
  - Hydrogen and Helium formed sometime later.
  - Galaxies of present day universe were formed by condensation of gases due to gravitation.
  - In the solar system of milky way galaxy, earth and other planets was supposed to have been formed about 4.5 billion years back.
  - There were no atmosphere on early earth.
  - H_2O vapour, CH_4, CO_2 and NH_3 released from molten mass covered the surface.
  - The UV-rays from sun broke up H_2O

$$H_2O \xrightarrow{\text{UV-rays}} H_2 + O_2$$

H_2 → "escaped" → because lighter in weight

  - O_2 combined with NH_3 and CH_4 to form H_2O, CO_2 and others.
  - Then O_3 layer was formed
  - As water vapour cooled, fell as rain, to fill all the depressions and forms ocean.

*** "on earth lithosphere formed 1st, Atmosphere 2nd and hydrosphere in last when the earth cooled down to a temperature below 100°c."

*** • Life appeared 500 million years after the formation of earth i.e. almost four billion years back.

Theories of the Origin of Life :→

1. Theory of Panspermia or Cosmozoic Theory or Spore Theory :→ This theory was proposed by Richter. According to this theory protoplasm reached the earth in form of spores or germs or other simple particles from some unknown part of universe with the cosmic dust, and subsequently evolved into various life forms.

   Helmholz speculated that protoplasm in some form reached earth with falling meteorites.

   Arrhenius postulated Panspermia theory and stated that organisms exist throughout the universe and their spores could freely through space from one star to the others. In fact Panspermia theory is alternative name of cosmozoic theory.

2. Theory of spontaneous generation (Abiogenesis or Autogenesis) :-

   This theory states that life originated from non-living things in a spontaneous manner. It was belived that life came out of decaying or rotting matter like straw, mud etc. These belief have no scientific grounds and hence are discarded.

   ** evidences against the theory of spontaneous generation

   Noted scientist who experimentally challenged the theory were Francesco Redi, Spallanzani and Louis Pasteur.

   *** Louis Pasteur (famous for "Germ Theory of disease and immunology) finally disapproved abiogenesis and proved biogenesis.

   But according to biogenesis, life originated from pre-existing life which does not explain the origin of life. So biogenesis is also disapproved.

   • Louis Pasteur showed that in pre-sterilised flasks, life did not come from killed yeast while in another flask open to air, new organism arose from killed yeast.

   Spontaneous generation theory was dismissed once and for all. However, this did not answer how the first life came on earth.

3. Theory of special creation :- Supported by Father Saurez

   This theory has three connotations.

   (i) All living organisms (species or types) that we see today were created as such.

   (ii) Diversity was always the same since creation and will be same in future also.

   (iii) The earth is about 4000 years old.

   According to bible first man - Adam
   first women - eve

   According to Hindu mythology
   first man - Manu
   first women - Shradha

   Special creation lack scientific evidences, on account of which it is not accepted.

(4) Modern Theory or Oparin-Haldane theory of origin of life :-

Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules (eg RNA, proteinets) and that formation of life preceded by chemical evolution - i.e. formation of diverse organic molecules from inorganic constituents.

Modern views regarding the origin of life include chemical evolution and biological evolution.

A. chemical evolution :-

1. The atomic phase - Early earth had innumerable atoms of all those elements which are essential for the formation of protoplasm.

2. formation of simple molecules :- Hydrogen atoms were most numerous and most reactive in primitive atmosphere. First Hydrogen atoms combined with all oxygen and leaving no free oxygen. Thus primitive atmosphere was reducing atmosphere unlike the present oxidising atmosphere. Hydrogen atoms also combined with nitrogen forming NH_3. So water and NH_3 were probably the first molecules of primitive earth.

3. Formation of simple organic molecules (monomers)

The conditions on earth were - High temperature, volcanic storms, reducing atmosphere containing CH_4, NH_3, etc.

In 1953, S.L. Miller, an American scientist created similar condition in a laboratory scale. He was student of Harold Urey. He created electric discharg in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800°c. He observed formation of amino acids.

- In similar experiments others observed, formation of sugars, nitrogen bases, pigments and fats.
- Analysis of meteorite content also revealed similar compounds indicating that similar process are occuring elsewhere in space
- with this limited evidence, the first part of conjectured story i.e. chemical evolution was more or less accepted.

* We have no idea about how the first replicating metabolic capsule of life arose.

(4) Formation of complex organic molecule :-

In the primaeval atmosphere electrical discharge, lighting, solar energy, ATP and polyphosphate might have provided the source for polymerisation reactions of organic synthesis.

Biological evolution (Biogeny)

conditions for the origin of life - atleast three conditions are needed.

a) There must be supply of replicators i.e. self replicating molecules
b) copying of these replicators must have been subject to error through mutation
c) system of replicators require continuous supply of energy and partial isolation from general environment

* Isolating organic molecules :-

Coacervates (↓ oparin) and microsphere (↓ Sidney W. fox) → Prebionts

* origin of Prokaryotes
* evolution of mode of nutrition

Hetero (chemo) → Auto → chemo → Photo (aneaerobic) → Photo (aerobic) → O_2 ozone → origin of Eukaryote.

* The first non-cellular forms of cell could have originated 3 billion years back. They would have been gaint molecules (RNA, Protein, Polysaccharides etc)
* These capsules reproduced their molecules perhaps.
* The first cellular form of life did not possibly originate till about 2000 million years ago. These were probably single-cells. All life forms were in water environment only.
* This version of a biogenesis - i.e. the first form of life arose slowly through evolutionary forces from non-living molecule is accepted by majority.

7.2 Evolution of life forms :- A Theory

* Based on observations made during a sea voyage in a sail ship called H.M.S. Beagle around the world, Charles darwin concluded that existing living forms share similarities to varing degree not only among themselves but also with life forms that existed millions of years ago.
* Many of life forms do not exist any more. There had been extinctions of different life forms in the years gone by just as new forms of life arose at different periods of history of earth.
* There has been gradual evolution of life forms.
* Any population has built in variation in characteristics. Those charachteristics which enable some to survive better in natural conditions (climate, food, physical factors etc) would outbreed others that are less-endowed to survive under such natural conditions.
* Another world used is fitness of the individual or population. The fitness, according to Darwin, refers ultimately and only to reproductive fitness. Hence, those who better fit in an environment, leave more progeny than others. These, therefore, will survive more and hence are selected by nature. He called it natural selection and implied it as a mechanism of evolution.
* Alfred Wallace, a naturalist who worked in Malay Archipelago had also come to similar conclusions around the same time.
* In due course of time, apparently new types of organisms are recognisable.
* All the existing life forms share similarities and share common ancestors. However, these ancestors were present at different periods in the history of earth (Epoch, periods and Eras).
* The geological history of earth closely correlates with the biological history of earth.
* A common permissible conclusion is that earth is very old, not thousand of years as was thought earlier but billions of years old.