

EVOLUTION

SYNOPSIS:

- Big bang theory explained the origin of universe.
- Earth was supposed to have been formed about 4.5 billion years back.
- Panspermia/ spores with life were transferred from other planets to earth.
- Theory of Spontaneous generation explained the concept that life was originated from nonliving matter.
- Louis Pasteur disapproved the concept of spontaneous generation by Swan-neck flask experiment.
- Oparin and Haldane proposed chemical evolution. It explained that diverse organic molecules are formed from inorganic constituents.
- Miller and Urey demonstrated the concept of chemical evolution, They created a electric discharge in closed flask with CH_4 , H_2 , NH_3 and water vapour at 800°C . They observed the formation of amino acids, sugars, nitrogen bases and fats.
- Haldane described the ocean as Hot Dilute Soup or prebiotic soup.
- Protobionts are described as Coacervates by Oparin and Microspheres as Sydney Fox..
- The sequence of formation of living organisms....

ORGANISMS	SOURCE OF ENERGY	CHARACTER	remarks
1. Anaerobic heterotrophs	Fermentation	Clumps of nucleoproteins & one molecule of DNA	Similar to monerans
2. chemoautotrophs	CO_2 and produce energy	Can survive at high temperature	Similar to Iron, sulphur bacteria
3. Anoxygenic photoautotrophs	Bacterial chlorophyll from metalloporphyrin and trapped solar energy		Similar to purple green sulphur bacteria
4. Oxygenic photoautotrophs	True chlorophyll and fixed solar energy	Released free oxygen into atmosphere and converted into oxidising atmosphere	Cyanobacteria

- Homologous organs are common in origin with same fundamental structures but perform different functions.
- It is due to adaptations to new different environmental conditions.
- Homologous organs explain Divergent evolution or Adaptive radiation.
- Examples for homologous organs are fore limbs of frog, lizard and bird; mouthparts of insects; legs of insects; mouthparts of insects..
- Examples for adaptive radiation or divergent evolution are ... Marsupial mammals and placental mammals ; Finches of Galapagos islands
- Analogous organs differ in their origin and structure but have similar functions.
- Analogous organs explain homoplasy or convergent evolution.
- Examples for analogous organs are wings of insects, birds and bats; sting of honey bee and sting of scorpion; eyes of vertebrates and cephalopods. ; Fins of fishes and whales.
- Parallel evolution is shown by closely related animals when develop similar adaptations in the same habitat or environment. Eg., *Echidna*, *Myrmecophaga* and *Myrmecobius*.
- Organs which are reduced or functionless are known as vestigial organs.
- Vestigial organs in man are... vermiform appendix, plica semilunaris, auricular muscles of external ear, hair on chest of males, clitoris of female, coccyx or tail bone, segmented muscles of abdomen.
- Vestigial organs in other animals are ... Ratitae birds with reduced wings., pelvic girdle and hind limbs in python, hind limbs in whales, eyes in deep sea animals
- Reappearance of ancestral characters suddenly in present organisms is known as atavism.. Human beings with tail, huge hair on the body; large canines.
- Connecting links

GROUP	CONNECTING LINK	GROUP
Annelida	Peripatus	Arthropoda
Annelida	Neopilina	Mollusc
Choanoflagellates	Proterospongia	Porifera
Fishes	Eusthenopteron	Amphibians
Cartilage fishes	Chimaera	Bony fishes
Amphibia	Seymouria	Reptilia
Reptilia	Archaeopteryx(missing link)	birds
Reptilia	Ornithorhynchus(prototheria)	Mammals

- Embryological evidences for evolution ... development of heart, kidneys and brain among vertebrates.

- Ernst Haeckel proposed recapitulation theory or biogenetic law which states that Ontogeny repeats Phylogeny. Ontogeny is embryonic development of individual while Phylogeny is the evolutionary history of individual.
- Serological tests or precipitations tests to know similarities among different organisms are introduced by H.F.Nuttal.
- More precipitation of blood samples of organisms indicate more closely related phylogenetically.
- Father of palaeontology – Leonard da Vinci.
- Father and founder of modern palaeontology -- Georges Cuvier.
- Most of the fossils are formed in sedimentary rocks which formed by the sedimentation of minerals.
- The first geological time scale was developed by Gilvanni Arduino.
- Age of the earth was about 4600 million years /4.6 billion years.
- The sequence of different periods of earth are

EONS -- ERAS -- PERIODS -- EPOCHS

- Evolution of horse --- *Eohippus(Hyracotherium)* – *Orohippus* - *Mesohippus* -- *Miohippus* – *Parahippus* - *Merychippus* -- *Plobihippus* - *Equus*.
- Six realms are -- Nearctic, Neotropical, Palaearctic, Oriental, Ethiopian, and Australian.
- India belongs to Oriental realm.
- Lamarckism proposed the influence of environment on the development of new characters and formation of new species.
- Lamarck concentrated on use and disuse of organs.
- Main critic of Lamarckism was August Weismann who conducted decaudalisation experiment.
- August Weismann proposed germ plasm theory or germinal selection theory.
- Charles Darwin is considered as father of evolution. He proposed Natural selection theory.
- Industrial melanism is the experimental verification of natural selection by using peppered moths, *Biston betularia*..
- Hardy- Weinberg equilibrium explained that allelic frequency and genotypic frequencies are constant in a population which maintains some conditons.

In that population -- $p + q = 1$ or $P^2 + 2pq + q^2 = 1$ where

p = dominant allelic frequency

q = recessive allelic frequency

p^2 = Homozygous dominant genotypic frequency

$2pq$ = Heterozygous dominant genotypic frequency

q^2 = recessive genotypic frequency.

- When the population is present in H.W. Equilibrium, the rate of evolution is zero. Any deviation in the conditions leads to change in either allelic frequencies or genotypic frequencies which led to the formation of new species.
- Mutation theory was proposed by Hugo Devries.
- Stabilizing selection operates in stable environment. In this process extreme members from both the ends are eliminated.. It maintains phenotypic stability within the population over generations.
- Directional selection operates in response to gradual changes in environmental conditions. Average value of fitness is constantly shifting towards the other end of the phenotypic distribution.
- Disruptive selection or centrifugal selection is a rare type of selection but plays a crucial role in the creation of new species. It can split the population into two or more sub populations known as species populations. It occurs due to adaptive radiation.
- Random changes in gene frequencies in a smaller populations occurring by chance are called genetic drift or the Sewall Wright effect.
- Anagenesis or phyletic evolution is the process of formation new species in a sequence.
- Cladogenesis is the diversification of a species into different species.
- Formation of new species due to geographical isolation is known as allpatric speciation.
- Formation of new species within same geographical area is known as sympatric speciation;
- Human evolution is DRYOPITHECUS -- RAMAPITHECUS -- AUSTRALOPITHECUS -- HOMO HABILIS -- HOMO ERECTUS - EARLY HOMO SAPIENS -- CROMAGNON MAN AND NEANDERTHAL MAN --- HOMO SAPIENS SAPIENS