# Evolution

Origin Of Universe – 20 Billion Years Ago (Big Bang Theory)
Formation of Earth – 4.5 bya
First sign of life – 4 bya
First Macromolecules – 3 bya
First cell – 2 bya

## Theories Of Origin Of Life On Earth →

### ① Theory of Special Creation →

Life was created by superpower in 6 days.
There is no change in forms of life
No Evolution ⊛
Earth is 4000 yrs old.
Given by Father Sauvez ⊛

### ② Theory of Abiogenesis / Theory of Spontaneous Creation →

Given by → Von Helmont ⊛
A → Without, Bio → life, Genesis → To form
→ Life Originated from non-living matter spontaneously.
→ eg → Mud of Nile, when heated by sun, gave rise to crocodiles.
→ Disapproved by Louis Pasteur.
→ Swan Neck Experiment

### ③ Theory of Biogenesis →

Omnis Vivum ex. Vivo.
Life Comes from life.
Proved by Redi, Spallanzini and pasteur ⊛
Life originates only from pre-existing life.
Pasteur performed Swan Neck Experiment

### ④ Panspermia / Cosmozoic Theory →

Life came from outer space.
Arrhenius – Life originates from spores from meteroids.
Panspermia states that life is present throughout the universe.

### ⑤ Oparin Haldane Hypothesis / Theory of Chemical Evolution →

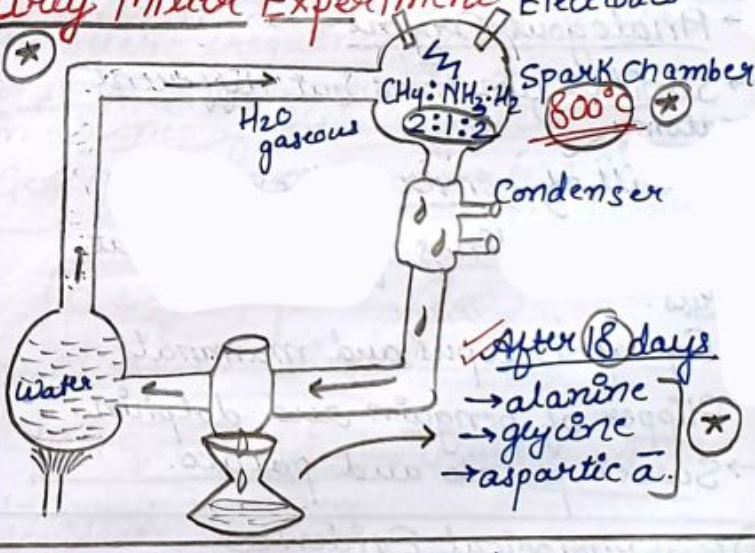
Most accepted theory
Abiogenesis first, biogenesis thereafter.
Life originated in hot dilute soup of oceans where chemicals interacted with each other to form first life.

(reducing)
$CO_2$, $H_2$, $CH_4$, $NH_3$ ⊛ —(UV rays, Lightening)→ amino a., Nucleotides, fatty a. (micromolecule) → RNA, protein, polysaccharides (bio-macromolecules) → protobionts (no genetic material) → Coacervates, microspheres → Cells

(no $O_2$) Imp

## Experimental Evidence for Chemical Evolution →

Urey Miller Experiment ⊛




## ⊛⊛ First Cell → Anaerobic Heterotrophs (prokaryotes)

↓ Chemo autotrophs
↓ Anoxygenic photoautotrophs (Blue Green Algae)
↓ Oxygenic Photoautotrophs
↓ Eukaryotes.

# Evidences Of Evaluation →

## ① Palaeontological Evidences

→ Fossils → Preserved remains of the organisms.
→ Nature and number of fossils differ in different layers of Earth.
→ Missing Link – Archeopteryx ★

| Reptilian Features | Avian Features |
|---|---|
| → Bones not pneumatic | → Beak |
| → Jaws with teeth | → Feathers |
| → Fingers with claws | → Wings |

## ② Homologous and Analogous Structures → Imp

↳ Homologous Organs →
→ Similar anatomy but different functions.
→ Indicates common ancestry. ★
→ Result of divergent Evolution ★
Examples → Forelimbs of whale, bat, cheetah.
→ Vertebrate hearts and brains.
→ Thorns of Bougainvillia and tendrils of Cucurbita.
→ Analogous Organs →
→ Similar functions but different anatomy.
→ Result of convergent evoluation
Example → Wings of butterfly, bat, birds.
→ Eye of Octopus and mammals.
→ Flipper of penguin and dolphin.
→ Sweet potato and potato.

## ③ Embryological Evidence.

↳ Resemblance of Vertebrate embryos.
Ernest Haeckal → Biogenetic Law.
↳ Ontogeny recapitulates phylogeny.
Rejected By → Ernst Von Baer
Temporary embryonic structures.
(Fish → amphibians → Reptile → Mammals)
gill slits → tail

## ④ Natural Selection as evidence of Evolution → Vimp ★

↳ Before Industrial Revolution/ melanism (1850's), more white winged moths than melanised moths. ↳ Lichens
→ After Industrial Revolution, (1920's), more melanised / dark winged moths, as they can camoflage easily ↳ Lichens Bark Brown
Reason → Nature selected the trait increasing survival rate, (hence reproduction) in the given environment.
This changed the allelic frequencies (Evolution).

## ⑤ Artificial / Man Made Selection

→ Man has created several breeds by intensive breeding.
→ Why can't nature do same, over million of years.

## Adaptive Radiation — Vimp

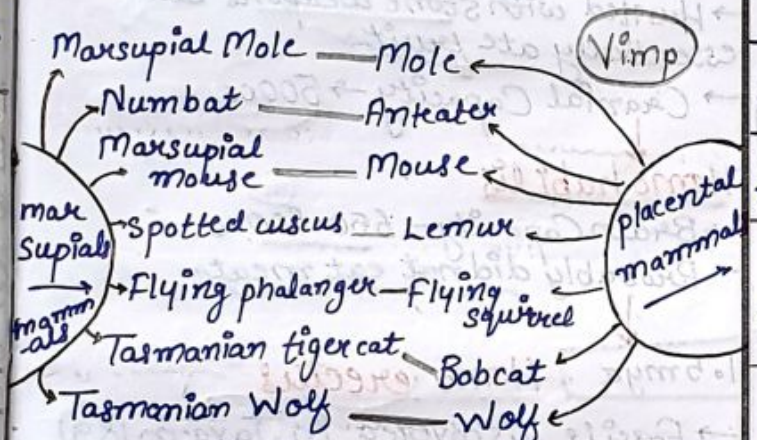
Process of evolution of different species in a given geographical area, starting from a point and literally radiating to other areas of geography (habitats).

Example → 1 →
→ Darwin finches on Galapagos Island.
→ Many finches species (like vegetarian and insectivorous finches) evolved from original seed eating finches on the same island.
→ Ship - HMS Beagle

Example → 2 →
→ 2 adaptive radiations occured on Australian Continent. ★
→ One is of marsupial mammals in which different marsupials

arose in different parts of Australia from common ancestors.


→ Second adaptive radiation in Australia is of placental mammals.
→ When more than one adaptive radiation occur in an area, one can call this convergent evolution.




## Theories Of Evolution

### ① Theory Of Inheritance of Acquired Characters / Use and disuse of Organs →

→ Given by Lamark.
→ New needs lead to use or disuse of Organs.
→ Continuous use lead to enlargement/development of organ.
→ Acquired characters are passed on to next generation.
→ Not believed any more.

### ② Darwinian Theory Of Evolution →

→ Charles Darwin. ★ ★
→ Influenced by Thomas Malthus.
→ Inheritable variations which make resource utilisation better for few individuals (better adopted to environment) will enable only those to reproduce and leave more progeny.
→ 2 Key Concepts → Branching descent and Natural Selection. ★
→ Darwin's variation were small and directional. ★
→ Similar results were concluded by Alfred Wallace, working in Malay Archipelago. ★

### ③ Mutation Theory →

→ Hugo de Vries. ★
→ Worked on evening primrose ★
→ Mutations cause Evolution
→ Mutations are random and directionless. ★
→ Saltation ★ → Single step large mutation causing speciation

Neo-Darwinism — Accepted
Darwin's Theory + Mutation Theory

## Hardy-Weinberg Principle. ★

In a large randomly mating population the allelic frequencies will remain constant from generation to generation in absence of disturbing factors ★

Generation 1 → 100 people → 4:1 } No evolution
" 2 → 100 people → 4:1 }

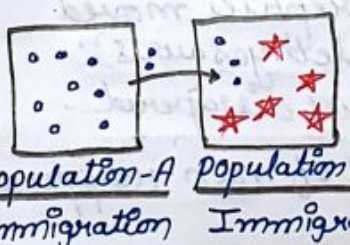
$p + q = 1$
Dominant Recessive.

Vimp

$p^2 + q^2 + 2pq = 1$
Homozygous dominant — Heterozygous — Homozygous recessive

## Factors affecting Hardy-Weinberg Equilibrium (Causing Evolution) →

### ① Gene Migration →




→ Repeated gene migration is called gene flow ★

## (2) Genetic Drift →

→ By chance/ random changes in allelic frequency
→ Operates in smaller population

**Founder effect**
↳ form new population.
→ They have rare genes.

**Bottle neck effect.**
↳ Cheetah population decrease

**NEET SLAYER**

## (3) Mutation →

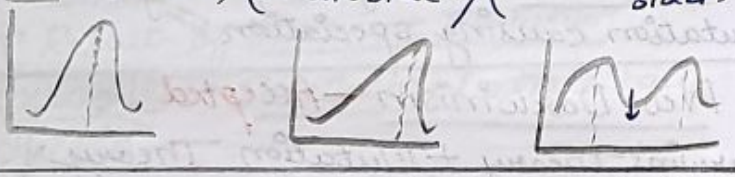
## (4) Gene Recombination →

## (5) Natural Selection

**Stabalising** (mean character is selected)

**Directional** (extreme character selected on one side)

**Disruptive** (extreme character selected on both sides.)



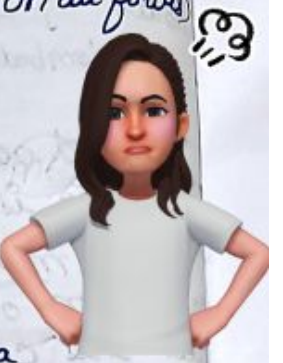
## A Brief Account Of Evolution →

2000 mya → First Cellular forms.
500 mya → Invertebrates were formed and active.
350 mya → Jawless fish evolved.
(320 mya → Sea weeds and few plants existed.)
350 mya → Fish with stout fins could move on land.
(In 1938, Coelocanth (lobefins) fish were caught in South Africa, it was thought to be extinct earlier.
→ These evolved into amphibians.
→ Amphibians evolved into reptiles.
→ For next 200 million years, reptiles dominated the earth.
→ Jurrassia period, Mesosoic Era.
→ 200 mya → Some reptiles moved back to water (eg- lethyosaures)
→ 65 mya → Dinosaures dissapered
→ 15 mya → Ancestors of man reappered.

## Evolution Of Man →

15 mya → Dryopithecus (more ape like) (East Africa) and Ramapithecus (more man like) existed

→ Dryopithecus → Common ancestor of man and apes (walked on all fours)
↓
Ramapithecus
↓
3-4 mya **Australopithecus**
→ Height → 4ft
→ Man like primates
→ Walked upright
→ Lived in Eastern Africa
→ Hunted with stone weapons but essentially ate fruit.
→ Cranial Capacity → 500cc



↓
**Homo habilis**
→ Brain Capacity – 650-800 cc
→ Probably did not eat meat.
↓
1.5 mya **Homo erectus**
→ Fossils discovered in Java in 1891
→ Java Man, Peking Man
→ Brain Capacity – 900cc
→ Probably ate meat

**Homo sapiens neanderthalansis**
→ Neanderthal man
→ 1400 cc
→ Lived near East or central asia between 1 lakh – 40,000 years back.
→ Used hides to protect their body
→ Buried their body
→ Religion

**Homo sapiens fossalis**
→ Cromagnon man
→ 1600 cc
↓
**Homo Sapiens sapiens**
→ 1350 cc

18000 years back
↓
Cave paintings
10,000 years back → agriculture