Evolution Class 12 Key Points

CBSE Class 12 Biology · NCERT · for boards, NEET and JEE revision

ChapterNotes

Origin of Life

Oparin–Haldane: chemical evolution under a reducing atmosphere (CH_4, NH_3, H_2, H_2O · no free O_2)

Earth ~4.5 bya; life in water ~3.8 bya.

- Pasteur disproved spontaneous generation (swan-neck flask)
- Oparin–Haldane proposed chemical evolution from inorganic molecules
- Sequence: chemical evolution → coacervates/protobionts → first cell

Miller–Urey Experiment

$CH_4 + NH_3 + H_2 + H_2O \rightarrow$ (electric discharge) $\rightarrow$ amino acids

Miller & Urey, 1953; experimental support for Oparin–Haldane.

- Closed flask with CH_4, NH_3, H_2 and water vapour
- Electric discharge mimicked lightning/UV energy
- Produced amino acids - building blocks of life

Evidences for Evolution

Homologous → divergent evolution · Analogous → convergent evolution

Homology = common ancestry; analogy = common function.

- Fossils show changing forms over rock layers (Eohippus → Equus)
- Homologous organs: same structure, different function (whale, bat, human forelimbs)
- Analogous organs: different structure, same function (butterfly vs bird wing)

Lamarckism vs Darwinism

Darwin: overproduction → struggle → survival of the fittest (natural selection)

Fitness = reproductive success. Wallace independently proposed natural selection.

- Lamarck: inheritance of acquired characters + use & disuse (disproved by Weismann)
- Darwin (Origin of Species, 1859): branching descent + natural selection
- Variations favourable to the environment are selected and passed on

Mutation Theory & Neo-Darwinism

Neo-Darwinism = natural selection + Mendelian genetics + mutation

de Vries' mutations: random, large (saltation); Darwin's variations: small, directional.

- de Vries gave the Mutation theory from Oenothera (evening primrose)
- Variation arises by mutation + recombination
- Selection types: stabilising, directional, disruptive

Hardy–Weinberg Principle

$p + q = 1 \cdot p^2 + 2pq + q^2 = 1$

p^2 = homozygous dominant, 2pq = heterozygous, q^2 = homozygous recessive.

- Holds only if: large population, random mating, no mutation, no gene flow, no selection
- Any disturbance changes allele frequencies = evolution
- Deviation from expected frequency measures the extent of evolutionary change

Factors That Cause Evolution

Gene flow · genetic drift · mutation · recombination · natural selection

Founder effect = an extreme form of genetic drift in small populations.

- Genetic drift = random change in small populations
- Gene migration (gene flow) shifts alleles between populations
- Natural selection, mutation and recombination also alter frequencies

Adaptive Radiation & Speciation

Adaptive radiation: one ancestor → many species in different habitats

Two radiations giving similar forms in isolated areas = convergent evolution.

- Darwin's finches (Galapagos): one ancestor → many beak types
- Australian marsupials radiated from a common ancestor
- Drives formation of new species (speciation)

Human Evolution

Dryopithecus → Australopithecus → H. habilis → H. erectus → Neanderthal → H. sapiens

Trend: rising cranial capacity + erect bipedal posture.

- H. habilis = first tool-maker (~650-800 cc); H. erectus (~900 cc) probably ate meat
- Neanderthal (~1400 cc) used hides and buried the dead
- H. sapiens arose in Africa; Cro-Magnon is an early modern form

Quick revision

- Origin: Oparin-Haldane (chemical evolution); Miller-Urey (amino acids formed from simple gases + electric discharge)
- Darwin: natural selection; Lamarck: use/disuse (disproved)
- Homologous: same origin, different function; Analogous: different origin, same function
- Hardy-Weinberg: $p^2 + 2pq + q^2 = 1$; disturbed by 5 factors
- Industrial melanism: directional selection (peppered moth)
- Modern humans: Homo sapiens sapiens; originated in Africa

Full chapter notes with solved examples and practice questions: https://chapternotes.in/cbse/class-12-biology/evolution-class-12-notes/