FREE NOTES · NCERT + NEET LEVEL

Evolution

Jeevan ki utpatti, evolution ke saboot, adaptive radiation, Darwin ki theory, evolution ka mechanism, Hardy–Weinberg principle, evolution ka saar aur insaan ki utpatti.

01 Jeevan ki utpatti
02 Evolution ke saboot
03 Adaptive radiation
04 Darwin aur evolution ka mechanism
05 Hardy–Weinberg principle
06 Saar aur insaan ki utpatti
07 Extra + tricks
08 Important Q&A
09 Common mistakes
10 Practice (NEET style)
11 Quick revision

01 Jeevan ki utpatti

- Brahmand ~20 arab saal purana; Big Bang theory. Dharti ~4.5 arab saal pehle bani; jeevan ~4 arab saal pehle.
- **Panspermia**: antriksh se spores. **Spontaneous generation** ko **Louis Pasteur** ne galat saabit kiya (pehle se sterilised band flask me jeevan nahi; khule me aaya).
- **Oparin aur Haldane**: pehla jeevan nirjeev organic molecules se (chemical evolution); purana vaayumandal CH_4, NH_3, H_2O vapour, H_2 (free O_2 nahi), garmi, UV, bijli.
- **S.L. Miller** (1953): band flask me CH_4, H_2, NH_3, bhaap, 800 °C pe electric discharge ⇒ amino acids bane. Doosron ne sugars, nitrogen bases, pigments, fats dekhe.
- Pehla non-cellular jeevan ~3 arab saal pehle (RNA, proteins); pehle cellular roop ~200 crore saal pehle, ek-koshiya, paani me.

02 Evolution ke saboot

Saboot	Example
Palaeontological (fossils)	Alag umar ki chattanon me alag jeev; dinosaurs vilupt; ghode ka evolution
Homologous organs (divergent evolution)	Same banawat, alag kaam: whale, chamgaadad, cheetah, insaan ke forelimbs; vertebrates ke heart, brain; *Bougainvillea* ke kaante aur *Cucurbita* ke tendrils
Analogous organs (convergent evolution)	Alag banawat, same kaam: titli aur pakshi ke pankh; octopus aur mammals ki aankh; penguin aur dolphin ke flippers; shakarkand (root) aur aloo (stem)
Biochemical/molecular	Alag jeevon me milte-julte proteins, genes
Natural selection hote dekhna	England me **industrial melanism**: industry se pehle safed moths zyada; baad me kaale badhe (pollution se lichens mare, chaal kaali); herbicide, pesticide, antibiotic resistance

03 Adaptive radiation

- Ek geographical area me ek jagah se shuru hokar alag habitats me alag species ka banna.
- **Darwin's finches** (Galapagos): asli beej khane walon se kai chonch types (keede khane wale aadi).
- **Australian marsupials**: ek purvaj se Australia me kai marsupials (koala, kangaroo, wombat, Tasmanian wolf, sugar glider, marsupial mole, bandicoot).
- Alag-thalag areas me ek se zyada adaptive radiation = **convergent evolution**: Australia ke placental mammals marsupials jaise (placental wolf vs Tasmanian wolf).

04 Darwin aur evolution ka mechanism



Natural selection ke types (grey = asli population)

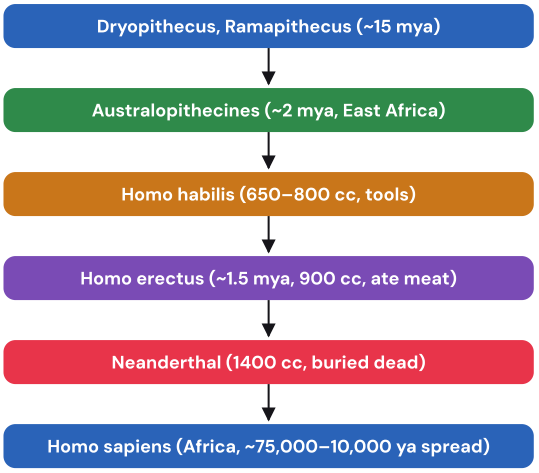
- Darwin (HMS Beagle yatra) aur Alfred Wallace (Malay Archipelago): **natural selection**; **fitness** = reproductive fitness. Mukhya vichaar: branching descent aur natural selection; variation virasat me; populations zyada bachche paida karti; jeevan sangharsh; survival of the fittest.
- **Lamarck**: organs ka use aur disuse (jiraafe ki gardan); galat saabit.
- **Hugo de Vries** (*Oenothera*, evening primrose): **mutation** theory; bade achanak badlav = **saltation**; mutations random aur disha-heen, Darwin ke variations chhote aur dishawaan.
- Variation ke srot: mutation, recombination, gene flow.

05 Hardy–Weinberg principle

- Population me allele frequencies peedhi-dar-peedhi sthir (genetic equilibrium): **$p^2 + 2pq + q^2 = 1$** ($p + q = 1$).
- Paanch factors santulan bigadte: **gene flow**, **genetic drift** (sanyog se; chhota group nayi population banaye to **founder effect**), **mutation**, **genetic recombination**, **natural selection**.
- Natural selection: **stabilising**, **directional**, **disruptive** (upar figure).
- Example: q^2 (recessive homozygous) = 0.16 ho to q = 0.4, p = 0.6; heterozygotes 2pq = 0.48.

06 Saar aur insaan ki utpatti

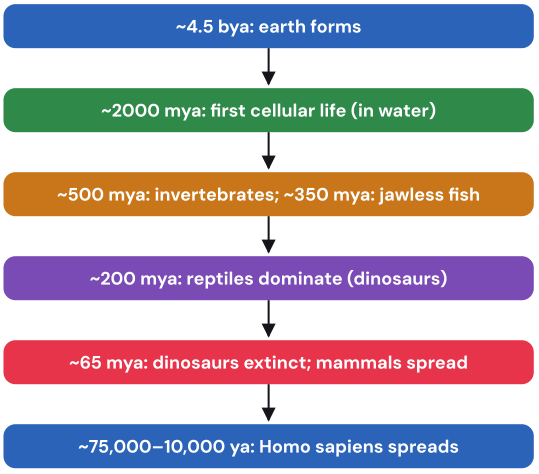
- ~2000 mya pehla cellular jeevan; ~500 mya invertebrates; ~350 mya bina jabde ki machhli; lobefins (coelacanth, vilupt maani gayi, 1938 me South Africa me pakdi) se pehle amphibians; ~200 mya reptiles ka raaj (dinosaurs, *Tyrannosaurus rex* ~20 ft); ~65 mya dinosaurs gayab.
- Paudhe: seaweeds → psilophyton → ferns, gymnosperms; pehle mammals chhachhundar jaise.
- **Homo habilis**: shayad maans nahi khaata. **Neanderthal**: East aur Central Asia, 1,00,000–40,000 saal pehle. **Homo sapiens** Africa me; ice age ~75,000–10,000 saal pehle. Gufa chitra ~18,000 saal pehle; kheti ~10,000 saal pehle.



Insaan ka evolution (saral)

07 Extra + tricks

Theory	Kisne / vichaar
Special creation	Bhagwan ne 6 din me sab banaya; badlav nahi
Catastrophism	Cuvier: baar-baar vinash phir nayi rachna
Spontaneous generation	Sadte padarth se jeevan (Pasteur ne swan-neck flask se galat saabit kiya)
Panspermia	Arrhenius: antriksh se spores
Chemical evolution	Oparin–Haldane: "primordial soup"; Oparin ke **coacervates**; Sidney Fox ke **microspheres**



Saral geological timeline

- **Connecting links**: *Euglena* (paudha–jaanwar), *Peripatus* (Annelida–Arthropoda), *Neopilina* (Annelida–Mollusca), *Balanoglossus* (non-chordate–chordate), *Archaeopteryx* (reptile–pakshi).
- Insaan ke **vestigial organs**: akal daadh, appendix, coccyx, kaan ki muscles, nictitating membrane. **Atavism**: purvajon ka gun wapas (poonch, ghane baal).
- Embryological saboot: **Haeckel ka biogenetic law** (ontogeny repeats phylogeny), **von Baer** ne sakht roop me galat bataya. Modern synthetic theory = Darwin + genetics (mutation, recombination, selection, isolation).

08 Important Q&A

Q1. Homologous aur analogous organs me antar, examples ke saath.

Homologous: same utpatti, alag kaam (chamgaadad ka pankh, insaan ki baanh), divergent. Analogous: alag utpatti, same kaam (pakshi aur titli ke pankh), convergent.

Q2. Population me 9% aa. Heterozygotes ki frequency?

$q^2 = 0.09 \Rightarrow q = 0.3$, $p = 0.7 \Rightarrow 2pq = 0.42$ (42%).

Q3. Miller ke experiment ne kya dikhaya?

Purani dharti jaisi halat me inorganic gases se amino acids jaise organic molecules ban sakte (chemical evolution).

09 Common mistakes

- Aloo aur shakarkand ko homologous kehna (analogous hain).
- Kehna ki industrial melanism ne kaale moths banaye (pehle se the; selection ne sankhya badli).
- Genetic drift aur gene flow mix karna.
- Homo habilis ko maans khane wala kehna (Homo erectus shayad).

10 Practice (NEET style)

1. Spontaneous generation ko galat kisne kiya?
2. Darwin's finches kya dikhate?
3. de Vries ka plant?
4. Hardy–Weinberg equation?
5. Homo erectus ka brain?

ANSWERS

1) Louis Pasteur · 2) Adaptive radiation · 3) *Oenothera* · 4) $p^2 + 2pq + q^2 = 1$ · 5) ~900 cc

11 Quick revision: exam se 5 minute pehle

ORIGIN

- Oparin–Haldane
- Miller: amino acids
- Pasteur: spontaneous generation nahi

EVIDENCE

- Homologous: divergent
- Analogous: convergent
- Industrial melanism

MECHANISM

- Darwin: natural selection
- de Vries: mutation, saltation
- 5 HW factors

MAN

- Habilis 650–800 cc
- Erectus 900 cc
- Neanderthal 1400 cc

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.