

NEET (UG) · CLASS 11 & 12

Road Maps in Biology

Every NCERT chapter as a visual road map:
flowcharts, comparison tables and NEET traps

32 Chapters

NCERT Sequence

Botany + Zoology



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How to use this book

1. Road Map first. Read the chapter's map top to bottom. Each card is one branch of the chapter; finish one card before moving to the next.

2. Flow strips. Blue strips show a process in order (cycles, pathways, life stages). Recite the steps aloud without looking.

3. Tables. Comparison tables hold the "difference between" questions NEET asks most often.

4. Red box. NEET traps and one-line facts. Revise this box on the last day before the exam.

Road Maps in Biology for NEET (UG) and Class 11 and 12

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Every fact in this book has been checked against the current NCERT Biology textbooks for Class 11 and 12. Chapter numbering follows the rationalised NCERT syllabus.

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PART A

Class 11

Chapters in NCERT sequence

ROAD MAP · The Living World

The Living World

Defining features of life

- **Growth:** increase in mass and number of cells; intrinsic in living (extrinsic accumulation in non-living)
- **Reproduction:** not a defining feature (mules, sterile workers, infertile couples do not reproduce)
- **Metabolism:** sum of all chemical reactions; defining feature
- **Consciousness:** response to environment; defining feature (humans are self-conscious)
- **Cellular organisation:** defining feature of life

Diversity

- About 1.7–1.8 million species described
- **Biodiversity:** number and types of organisms on earth

Nomenclature

- **Binomial system:** Carolus Linnaeus
- **Codes:** ICBN (plants), ICZN (animals)
- Rules
 - Latin or Latinised names, printed in italics
 - First word genus (capital), second word specific epithet (small)
 - Handwritten names underlined separately
 - Author's name abbreviated after epithet, e.g. *Mangifera indica* Linn.

Classification

- **Taxonomy:** characterisation, identification, nomenclature, classification
- **Systematics:** also includes evolutionary relationships
- **Taxonomic hierarchy:** 7 obligate categories

Taxonomic categories

- **Species:** group of individuals with fundamental similarities
- **Genus:** group of related species
- **Family:** group of related genera
- **Order:** group of families; e.g. Polymoniales, Carnivora
- **Class:** group of orders; e.g. Mammalia
- Phylum (animals) / Division (plants)
- **Kingdom:** highest category

Taxonomic hierarchy (lowest to highest)

Species → Genus → Family → Order → Class → Phylum / Division → Kingdom

Classification of some organisms (NCERT)

Common name	Genus	Family	Order	Class	Phylum/Division
Man	Homo	Hominidae	Primata	Mammalia	Chordata
Housefly	Musca	Muscidae	Diptera	Insecta	Arthropoda
Mango	Mangifera	Anacardiaceae	Sapindales	Dicotyledonae	Angiospermae
Wheat	Triticum	Poaceae	Poales	Monocotyledonae	Angiospermae

NEET Traps & Quick Recall

- Defining property of life: metabolism, consciousness and cellular organisation (not growth or reproduction).
- Going up the hierarchy, number of common characters decreases; going down, it increases.
- Lowest category = species; highest = kingdom.
- *Panthera leo*, *P. tigris*, *P. pardus*: same genus, different species. *Felis* (cat) also in family Felidae.
- Housefly, mosquito, beetle: all class Insecta. Humans, monkeys, cats: class Mammalia.
- *Solanum* (potato, brinjal) is a genus; Solanaceae is a family.
- Name ends with "-aceae" for plant families and "-idae" for animal families.

Biological Classification

Whittaker's five kingdoms, plus viruses, viroids, prions and lichens.

ROAD MAP · Biological Classification

Five Kingdom Classification (R.H. Whittaker, 1969)

Monera

- Prokaryotic; cell wall of peptidoglycan (polysaccharide + amino acids)
- **Archaeobacteria**: halophiles (salty), thermoacidophiles (hot springs), methanogens (marshy areas, gut of ruminants: methane from dung)
- **Eubacteria**: true bacteria; rigid cell wall; motile ones have flagella
 - **Shapes**: coccus, bacillus, vibrium, spirillum
 - **Cyanobacteria**: chlorophyll a; e.g. Nostoc, Anabaena (heterocysts fix N_2); form blooms
 - **Chemosynthetic autotrophs**: oxidise nitrites, nitrates, ammonia
 - **Heterotrophs**: decomposers; curd (Lactobacillus), antibiotics, N_2 fixers
- **Mycoplasma**: no cell wall; smallest living cells; survive without oxygen
- **Reproduction**: fission; spores; DNA transfer (primitive sexual)

Protista

- Unicellular eukaryotes; link with plants, animals, fungi
- **Chrysophytes**: diatoms and desmids; silica walls; diatomaceous earth; chief producers in oceans
- **Dinoflagellates**: marine, cellulose plates, 2 flagella; Gonyaulax causes red tides
- **Euglenoids**: pellicle (protein-rich) instead of wall; photosynthetic in light, heterotrophic in dark; Euglena
- **Slime moulds**: saprophytic; plasmodium; spores with true walls
- **Protozoans**: amoeboid (Amoeba, Entamoeba), flagellated (Trypanosoma: sleeping sickness), ciliated (Paramecium), sporozoans (Plasmodium: malaria)

Fungi

- Heterotrophic; chitin cell wall; hyphae form mycelium
- **Coenocytic hyphae**: multinucleate, no septa
- **Phycomycetes**: aseptate coenocytic; zoospores/aplanospores; Mucor, Rhizopus, Albugo
- **Ascomycetes (sac fungi)**: conidia; ascospores in asci, fruiting body ascocarp; Penicillium, Aspergillus, Claviceps, Neurospora, yeast (unicellular)
- **Basidiomycetes**: basidiospores on basidia; no sex organs; Agaricus, Ustilago (smut), Puccinia (rust)
- **Deuteromycetes (imperfect fungi)**: only asexual phase known; decomposers; Alternaria, Colletotrichum, Trichoderma

Plantae

- Eukaryotic, chlorophyll, cellulose wall
- Algae, bryophytes, pteridophytes, gymnosperms, angiosperms
- **Some partially heterotrophic**: insectivorous (bladderwort, Venus fly trap), parasite Cuscuta
- Alternation of generations

Animalia

- Heterotrophic, multicellular, no cell wall
- Store food as glycogen or fat; holozoic nutrition
- Definite growth pattern; most show locomotion

Acellular entities

- **Virus**: nucleoprotein; capsid of capsomeres; RNA or DNA, never both; plant viruses usually ssRNA, animal viruses ss/ds RNA or dsDNA; bacteriophage usually dsDNA
- **Viroid**: free RNA, no protein coat; T.O. Diener (1971); potato spindle tuber disease
- **Prion**: infectious abnormally folded protein; BSE (mad cow), CJD in humans
- **Lichen**: alga (phycobiont) + fungus (mycobiont); pollution indicators (do not grow in polluted areas)

Five kingdoms at a glance

Character	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Non-cellulosic (polysaccharide + amino acid)	Present in some	Present (chitin)	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organisation	Cellular	Cellular	Multicellular / loose tissue	Tissue / organ	Tissue / organ / organ system
Nutrition	Autotrophic and heterotrophic	Autotrophic and heterotrophic	Heterotrophic (saprophytic / parasitic)	Autotrophic	Heterotrophic (holozoic etc.)

Classes of fungi

Class	Mycelium	Asexual spores	Sexual spores	Examples
Phycomycetes	Aseptate, coenocytic	Zoospores (motile), aplanospores (non-motile)	Zygospores	Mucor, Rhizopus, Albugo
Ascomycetes	Septate, branched	Conidia (on conidiophores)	Ascospores in asci	Aspergillus, Claviceps, Neurospora, yeast
Basidiomycetes	Septate, branched	Not common; fragmentation	Basidiospores on basidia	Agaricus, Ustilago, Puccinia
Deuteromycetes	Septate, branched	Conidia	Not known	Alternaria, Colletotrichum, Trichoderma

NEET Traps & Quick Recall

- Two-kingdom system: Linnaeus. Five-kingdom: R.H. Whittaker (1969).
- Virus discovered by Dmitri Ivanowsky (TMV); "contagium vivum fluidum" by M.W. Beijerinck; W.M. Stanley showed viruses can be crystallised.
- Neurospora is used extensively in biochemical and genetic work.
- Euglena: no cell wall, has pellicle; mixotrophic.
- Mycoplasma: no cell wall, pathogenic in animals and plants.
- Heterocysts in Nostoc and Anabaena fix atmospheric nitrogen.
- Dikaryon (n + n) stage occurs in ascomycetes and basidiomycetes.
- Diatomaceous earth is used in polishing and filtration of oils and syrups.

Plant Kingdom

Algae, bryophytes, pteridophytes, gymnosperms and angiosperms, plus plant life cycles.

ROAD MAP · Plant Kingdom

Plant Kingdom

Algae

- Chlorophyll-bearing, simple thalloid, mostly aquatic
- **Reproduction:** vegetative (fragmentation), asexual (zoospores), sexual (isogamy, anisogamy, oogamy)
- **Uses:** half of total CO₂ fixation on earth; agar (Gelidium, Gracilaria); carrageen; Chlorella (protein-rich, used by space travellers); algin from brown algae

Bryophytes (amphibians of plant kingdom)

- Thallus-like; rhizoids; no true roots, stem or leaves
- Main body haploid gametophyte; sporophyte dependent on gametophyte
- **Sex organs:** antheridium (male), archegonium (female, flask-shaped)
- **Liverworts:** Marchantia; gemmae in gemma cups (asexual)
- **Mosses:** Funaria, Polytrichum, Sphagnum; protonema then leafy stage
- **Uses:** Sphagnum gives peat (fuel, packing); mosses with lichens are first colonisers of rocks

Pteridophytes

- First terrestrial plants with vascular tissue (xylem, phloem)
- Main body sporophyte with roots, stem, leaves
- **Leaves:** microphylls (Selaginella) or macrophylls (ferns)
- Sporangia on sporophylls; strobili/cones in Selaginella, Equisetum
- **Gametophyte:** small, free-living, photosynthetic prothallus; needs water for fertilisation
- **Homosporous (most) / heterosporous (Selaginella, Salvinia):** precursor to seed habit
- **Classes:** Psilopsida (Psilotum), Lycopsidea (Selaginella, Lycopodium), Sphenopsida (Equisetum), Pteropsida (Dryopteris, Pteris, Adiantum)

Gymnosperms

- Naked ovules (not enclosed in ovary)
- **Roots:** tap roots; coralloid roots of Cycas (cyanobacteria); mycorrhiza in Pinus
- **Leaves:** needle-like in conifers (thick cuticle, sunken stomata)
- Heterosporous; microsporangia and megasporangia on strobili/cones
- Pollination by wind; seeds not covered
- **Examples:** Cycas, Pinus, Ginkgo; Sequoia (one of the tallest trees)

Angiosperms

- Flowering plants; seeds enclosed in fruits
- Dicots (two cotyledons) and monocots (one cotyledon)
- **Smallest:** Wolffia; tall: Eucalyptus (over 100 m)
- Double fertilisation; triploid PEN (endosperm)