FREE NOTES · NCERT + NEET LEVEL

Biological Classification

From two kingdoms to Whittaker's five kingdoms; Monera (bacteria, archaebacteria, cyanobacteria, mycoplasma), Protista, Fungi, Plantae and Animalia; and viruses, viroids, prions and lichens.

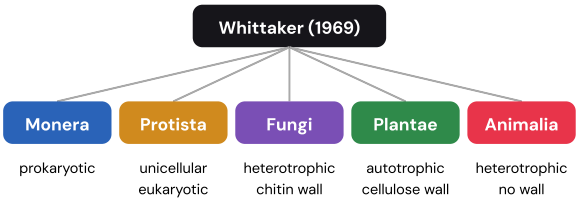
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01 Systems of classification

Aristotle: plants into trees, shrubs, herbs; animals by red blood. **Linnaeus**: two kingdoms, Plantae and Animalia; this couldn't separate prokaryotes/eukaryotes, unicellular/multicellular, or photosynthetic/non-photosynthetic (fungi) organisms.

R.H. Whittaker (1969): five kingdoms based on cell structure, body organisation, mode of nutrition, reproduction and phylogeny.

02 Five kingdom classification



Whittaker's five kingdoms

	Monera	Protista	Fungi	Plantae	Animalia
Cell	Prokaryotic	Eukaryotic			
Wall	Non-cellulosic (polysaccharide + amino acid)	Present in some	Chitin	Cellulose	Absent
Body	Cellular	Cellular	Multicellular, loose tissue	Tissue/organ	Tissue/organ/system
Nutrition	Auto- & heterotrophic	Auto- & heterotrophic	Heterotrophic (saprophytic/parasitic)	Autotrophic	Heterotrophic (holozoic)

03 Kingdom Monera (bacteria)

- Shapes: coccus (round), bacillus (rod), vibrium (comma), spirillum (spiral).
- **Archaebacteria:** live in extreme places: halophiles (salty), thermoacidophiles (hot springs), methanogens (marshes, gut of cattle; make methane/biogas). Different cell wall.
- **Eubacteria:** true bacteria with a rigid wall. **Cyanobacteria** (blue-green algae, e.g. *Nostoc*, *Anabaena*): photosynthetic, some fix N_2 in **heterocysts**, form blooms.
- Chemosynthetic autotrophs oxidise inorganic substances (nitrates, ammonia) for energy.
- Heterotrophic bacteria: decomposers, curd, antibiotics, N_2 fixation in legumes; some cause diseases (cholera, typhoid, tetanus, citrus canker).
- Reproduce by **binary fission**; spores in bad conditions; DNA transfer by a kind of sexual reproduction.
- **Mycoplasma:** no cell wall, smallest living cells, survive without O_2, many are plant/animal pathogens.

04 Kingdom Protista

Group	Key features	Example
Chrysophytes	Diatoms, desmids; silica walls ⇒ diatomaceous earth; chief producers in oceans	Diatoms
Dinoflagellates	Marine, two flagella, cellulose plates; red tides (*Gonyaulax*)	*Gonyaulax*
Euglenoids	Fresh water, no wall but protein-rich **pellicle**; photosynthetic in light, heterotrophic in dark	*Euglena*
Slime moulds	Saprophytic, form **plasmodium**; spores very resistant	—
Protozoans	Heterotrophs: amoeboid (*Amoeba*, *Entamoeba*), flagellated (*Trypanosoma* – sleeping sickness), ciliated (*Paramoecium*), sporozoans (*Plasmodium* – malaria)	—

05 Kingdom Fungi

Heterotrophic; body of **hyphae** forming a **mycelium**; cell wall of **chitin**. Coenocytic hyphae = multinucleate without septa. Symbiotic forms: lichens (with algae), mycorrhiza (with roots).

Class	Mycelium	Asexual / sexual spores	Examples
Phycomycetes	Aseptate, coenocytic	Zoospores, aplanospores / zygospore	*Mucor*, *Rhizopus*, *Albugo*
Ascomycetes (sac fungi)	Septate, branched	Conidia / **ascospores** in asci	Yeast, *Penicillium*, *Aspergillus*, *Neurospora*, morels, truffles
Basidiomycetes	Septate	Usually no asexual spores / **basidiospores**	Mushroom, *Agaricus*, rusts (*Puccinia*), smuts (*Ustilago*)
Deuteromycetes (imperfect fungi)	Septate	Only conidia; sexual stage unknown	*Alternaria*, *Colletotrichum*, *Trichoderma*

Sexual cycle: plasmogamy → karyogamy → meiosis. In asco/basidio, a **dikaryon** (n + n) stage occurs.

06 Kingdom Plantae & Animalia

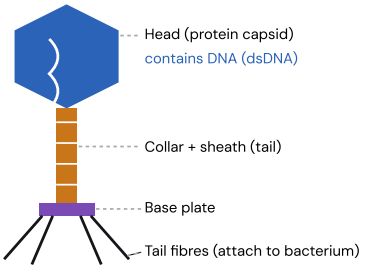
- **Plantae:** eukaryotic, chlorophyll, cellulose walls. Algae, bryophytes, pteridophytes, gymnosperms, angiosperms. Some partially heterotrophic: insectivorous (*Utricularia*, Venus flytrap), parasitic (*Cuscuta*). Show **alternation of generations**.
- **Animalia:** multicellular, heterotrophic, no cell wall; store glycogen/fat; holozoic nutrition; most move; sexual reproduction by copulation.

07 Viruses, viroids, prions & lichens

Entity	Features
Virus (Ivanowsky 1892, TMV; Beijerinck "contagium vivum fluidum"; Stanley crystallised)	Nucleoprotein; protein coat **capsid** of capsomeres; either DNA or RNA. Plant viruses usually ssRNA, bacteriophages dsDNA. Inert outside a host cell. Diseases: mumps, smallpox, herpes, influenza, AIDS; mosaic in plants
Viroid (Diener 1971)	Free RNA, no protein coat; potato spindle tuber disease
Prion	Abnormally folded protein; mad cow disease (BSE), Creutzfeldt-Jakob disease
Lichen	Symbiosis of alga (phycobiont, makes food) + fungus (mycobiont, gives shelter, water); good **pollution indicators** (don't grow in polluted air)

08 Extra + tricks

- Virus = obligate parasite, crystalline outside host; nucleoprotein. Plant viruses mostly ssRNA; animal viruses ss/ds RNA or ds DNA; bacteriophages mostly dsDNA.
- Viral diseases: mumps, smallpox, herpes, influenza, AIDS; plants: mosaic, leaf rolling, curling, yellowing, vein clearing, dwarfing, stunted growth.
- **Viroid** (T.O. Diener, 1971): free RNA without protein coat; potato spindle tuber disease. **Prions**: abnormally folded proteins; BSE (mad cow disease), CJD in humans.
- **Lichens**: alga (phycobiont, food) + fungus (mycobiont, shelter, water); good **pollution indicators** (do not grow in polluted areas).
- Trick for archaebacteria habitats: **S-H-M** = Salty (halophiles), Hot springs (thermoacidophiles), Marshy (methanogens: biogas, in cattle gut).



Bacteriophage (T-even type)

09 Important Q&A

Q1. Why were fungi separated from plants?

Fungi are heterotrophic and have chitin cell walls, while plants are autotrophic with cellulose walls.

Q2. Name the archaebacteria used to make biogas.

Methanogens (in the gut of ruminants and marshy areas).

Q3. Difference between virus and viroid.

Virus has nucleic acid + protein coat; viroid is only free RNA (no coat) and its RNA is of low molecular weight.

10 Common mistakes

- Calling mycoplasma a virus (it's a bacterium without a wall).
- Putting *Euglena* in Plantae (it's a protist).
- Saying viruses have both DNA and RNA.
- Mixing ascospores (Ascomycetes) and basidiospores (Basidiomycetes).

11 Practice (NEET style)

1. Who proposed five kingdom classification?
2. Causal organism of malaria?
3. Fungi with sexual stage unknown are called?
4. N_2-fixing cells in cyanobacteria?
5. Infectious agent that is only protein?

ANSWERS

1) R.H. Whittaker · 2) *Plasmodium* · 3) Deuteromycetes (imperfect fungi) · 4) Heterocysts · 5) Prion

12 Quick revision: 5 minutes before the exam

MONERA

- Archae: extreme habitats.
- Cyanobacteria: heterocysts.
- Mycoplasma: no wall.

PROTISTA

- Diatoms: silica.
- Euglena: pellicle.
- Plasmodium: malaria.

FUNGI

- Chitin, hyphae.
- Asco: ascospores; Basidio: basidiospores.
- Deutero: imperfect.

ACELLULAR

- Virus: DNA or RNA + capsid.
- Viroid: free RNA.
- Prion: protein.

Have a doubt? Ask the AI Doubt Solver at padhaiadda.netlify.app, or take the mock test on this chapter.