

Chapter {2} Biological Classification

Two Kingdom system of classification

Aristotle was the earliest to attempt a most scientific basis for classification. He use simple for morphological characters to classify plants into trees, shrubs and herbs. He also divided animals into two groups, those which had Red blood and those that did not.

Carolus Linnaeus, in 1758 suggested the two Kingdom system of classification

- ① Kingdom Plantae
- ② Kingdom Animalia

Five Kingdom system of classification

Robert H Whittaker, in 1969 an American Taxonomist living world divided into five Kingdoms. Monera, Protista, Fungi, Plantae and Animalia. Note viruses are connecting link between living and non-living

Criteria for Five Kingdom system of classification -

- (1) Complexity of cell structure
- (2) Complexity of organism body
- (3) mode of nutrition
- (4) Modes of energy utilisation.
- (5) Phylogenetic Relationship.

- (1) Complexity of cell structure (Prokaryotes and Eukaryotes).

On the basis of nucleus and structural complexity two types of cells are recognised.

- (a) ~~Simple primitive Prokaryotic type.~~
eg → Bacteria, Blue green algal
Rickettsia.

- (b) Complex eukaryotic type eg → Protista, Fungi, Plants and animals.

- (2) Complexity of organism body.
(Unicellular and multicellular)

- (3) ← Mode of nutrition →

Autotrophic nutrition, heterotrophic nutrition.

Mode of energy utilisation

On the basis of energy utilisation Organism have been put into three categories.

- (1) Producers.
- (2) Consumers.
- (3) Decomposers.

Phylogenetic Relationship

Fossils records can provide such relationship this record is incomplete therefore, Phylogenetic Relationship are ascertain from morphology, Cyclopedia, genetic Biology, Chemistry and Physiology for a correct grouping of organism.

The Five Kingdoms

Kingdom I - Monera

Kingdom Monera include the most ancient the smallest and the simplest prokaryotes.



Characteristics

- ① They are unicellular, microscopic prokaryotic organism living in moist condition.
- ② In some prokaryotes, cells aggregate to form short chains and filaments.
- ③ They lack a definite cell nucleus.
- ④ They have a rigid cell wall made up of Peptidoglycans, but lack ~~membrane~~ bound cell organelles.

Bacteria are the sole member of a Kingdom Monera. They live in extreme habitat such as hot spring, lizard snow and deep oceans, they also present live in or on other organism as Parasites.

Note :-> Bacteria are grouped under four categories based on their shape:-
Spherical (Coccus), Rod shaped (Bacillus), Coma shaped (Vibrium) and the spiral (Spirillum).

- (6) Kingdom Monera includes two major groups Eu-bacteria and Archaal - Bacteria.
- (7) Eu bacteria includes cyanobacteria or blue green algae and Archaal bacteria.
- (8) Archaal Bacteria can thrive under extreme conditions of environment which resemble the condition on Primitive earth. These may be halophilic, thermoacidophilic and Methanogens.

Kingdom Protista (Unicellular Eukaryotes)

Kingdom Protista includes diverse kinds of unicellular and primarily aquatic Eukaryotes.

Characters -

- (1) They contain typical Eukaryotic cell organelles such as Nucleus, Mitochondria, Endoplasmic reticulum, Golgi bodies and Plastids.

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(2) They open their plasma or cilia with ⁹⁺² external Micro tubular structure.

(3) Cell wall is present, is made of cellulose.

(4) Nutrition may be autotrophic, saprotrophic or Parasitic.

(5) Some protists are related for consumers protozoans.

Kingdom Fungi (Multicellular Decomposers):

Kingdom Fungi includes molds, mushrooms, puffballs and bracket Fungi.

(1) They are unicellular (yeast) or multicellular Eukaryotes organism without chlorophyll.

(2) Their mode of nutrition is heterotrophism they obtain their nutrition by extra cellular digestion and absorption of organic matter.

(3) Thallus consist of delicate threadlike hyphal network of mycellium. The hyphal form may be uninucleate or multinucleate.

(4) The cell wall is made up of chitin and the Reserve food in the form of glycogen.

(5) They reproduce asexually by spores or Conidia.

Kingdom Plantae (multicellular producer)

Kingdom Plantae include all multicellular photosynthetic plant.

← Characteristics →

(1) They are multicellular eukaryotes with chlorophyll.

(2) Cells with a large central vacuole and a cell wall is made up of cellulose.

- (3) Plants are immobile and do not exhibit locomotion.
- (4) They synthesise their organic food from process of photosynthesis.
- (5) They are major producers on land.

Kingdom Animalia (Multicellular consumers).

Kingdom Animalia includes diverse forms of animals such as sponges, Cnidarians, flat and round worms and arthropods, Molluscs and chordate.

Characteristics -

- (1) They are multicellular eukaryotes also known as Metazoa.
- (2) They lack chlorophyll and show holozoic mode of nutrition. They ingest and digest it and then absorb it.

- ③ Except primitive metazoans like sponges, they lead mobile way of life in pursuit of food.
- ④ The mobility is due to the development of muscles and nerve cells.
- ⑤ Some animal groups have become parasite, e.g., tapeworm and roundworm.

Note :- Six kingdom system of classification proposed by charl whaese. Archae, bacteria, Eubacteria, Protista, Fungi, Plantae, Animalia, Monera is divided into Archaeobacteria and Eubacteria.

Viruses [The Biologists Puzzle]

Viruses are the most primitive noncellular and noncytoplasmic infectious agent formed of nucleic acid and protein.

They were discovered in 1892 by Anwanowsky who showed

That tobacco was caused by microorganism smaller than bacteria.

Shape and size of viruses

Viruses are smallest entity.

They may be spherical or golf ball-like (Herpesvirus, Polio virus) rod-shaped (TMV - Tobacco Mosaic Virus), helical (Influenza virus), or polyhedral (adenovirus).

The size ranges from 10 nm
(Virus causes foot and
mouth disease of cattle)

- 17 nm (Alfalfa mosaic virus)
- 300 nm x 175 nm (TMV)
- 1300 nm x 6 nm (Pseudomonas P.F)
- 1250 nm x 40 nm (Belt yellow virus)

Types of viruses

Holmes (1948) has divided by into three groups.

Plant virus (Phytophaginal)
They cause disease in plants.
More than 300 Plant viruses
are known TMV, Potato Mosaic
virus PMV, Banana Bunchal
Top virus, Tomato Leaf Curl
Virus and Turnip Yellow virus
TYV.

Note :- Plant viruses contain
RNA, Cauliflower mosaic virus
is the DNA virus

Animal virus (zoophaginae)

They Parasite animal including male some of them influenza virus, small pox virus hepatitis virus, mumps.

Some groups of animal viruses containing RNA as hereditary

- Ra Myxovirus → Rabies, influenza, Measles, mumps etc.
- Pico rna virus (Pico-RNA-virus) viruses causing foot and mouth disease in cattle
- Arbo virus - viruses that causing yellow fever, Haemorrhagic fever

Human Viral Diseases

Common Cold, influenza, measles, hepatitis B, mumps, herpes, small pox, chicken pox, polio, myelitis, dengue, encephalitis, AIDS, swine flu and Rabies. Encephalitis.

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Animal Viral Diseases

Foot and mouth disease of cattle, Rinder pest, Ranikhet disease of fowl, Newcastle of fowl, Bird flu.

Plant Viral Diseases

Potato mosaic disease
Tobacco mosaic disease
Pumpkin mosaic
Apple mosaic, Potato leaf roll, Papaya leaf curl, Tomato Bunchy top and Banana Bunchy top, Cauliflower mosaic, Potato motifs

Structure of Virus

Virus are acellular. Virus has a central core of nucleic acid (either DNA or RNA) enclosed in a protein coat called capsid. They lack their own enzyme system and depend on the host for their multiplication.

Capsid or Protein Coat

The protein coat is called Capsid. It is made of many identical protein sub unit called **Capsomeres**. In a virus the capsomeres give a specific shape to a particular virus.

Envelope

It is a loose membranous covering that occurs in some animal viruses. Viruses containing envelope are called enveloped virus, without an envelope called naked virus. Surface of envelope can be smooth or have out growth called spikes.

Structure of Tobacco mosaic virus (TMV)

Plant virus

TMV was discovered by Iwanowsky in 1892. It is a rod shaped virus measuring about 3000 \AA (300 nm) in length and 175 \AA (17.5 nm) in diameter.

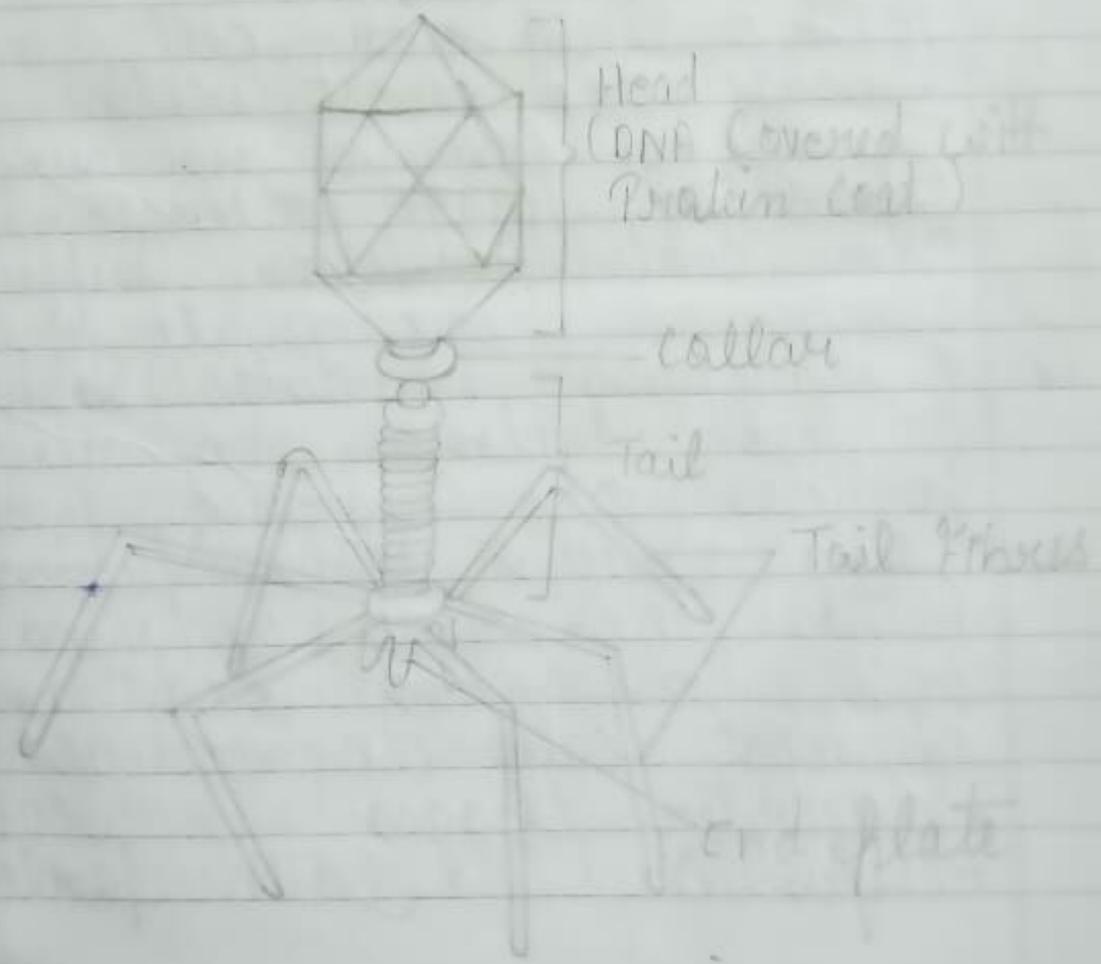
It is made up of RNA and Protein. The capsid is made up of approximately 2100 identical capsomers. These are arranged around the central axis in helical manner. RNA is single stranded and is helically coiled. TMV is naked virus i.e. without any additional covering outside the capsid.



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Structure of bacteriophage (The bacterial virus)

Viruses which parasitise bacteria are called bacteriophages. They were discovered by F.W Twort in England in 1915 and Helen d'Herelle. Bacteriophage has a tadpole like shape with a hexagonal head and a tail. The head is 650 Å in diameter. It has a protein coat in which a double stranded DNA (about 50 μ long) is tightly packed.



← Reproduction in viruses →

Viruses multiply within a host cell and exhibit three types of life cycles: lytic, lysogenic and Pinossetic.

← Lytic life cycle → Virulent phages (Example T₄ - bacteriophage)

multiply in E. coli or other bacterial cells and cause their lysis. Each phage particle attached to the host cell and its DNA pushed into host cell. Inside the host cell the T₄ phage DNA starts synthesis copies of phage DNA, lysogenin and coat proteins. Different component combine to form new phage particles within 30 min about 100 new phage particles are formed from a single virus. The period between the entry of viral DNA into host cells and busting of host cell to release daughter phages is called latent period.

lysis

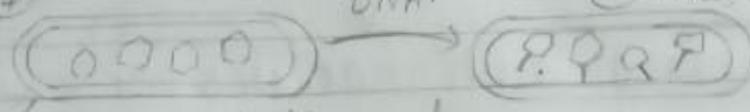
① Empty phage heads are synthesized. (C₂)
- labeled

② The phage infects the cell. Metabolism to produce virulent phage DNA.

④ Binary fission is completed. Each has the phage in each.

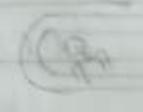
Lysogenic life cycle →

④ Head are packed with DNA. → ⑤ New Phage particles are formed.

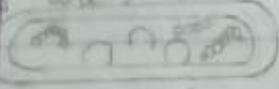


Lytic cycle A

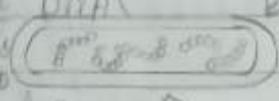
⑥ Bacterial cell lysis is completed & infective phages are released.



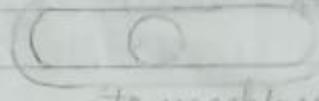
③ Empty phage heads are synthesized.



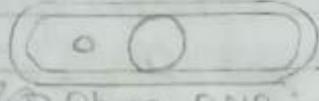
② The phage DNA infects cells. Metabolism to produce viral component broken copies of phage DNA.



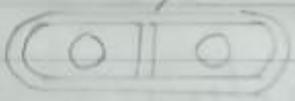
① Phage attaches its receptor sites on a bacterial cell wall, penetrates & insert DNA.



② Phage DNA insert itself into bacterial chromosomes.

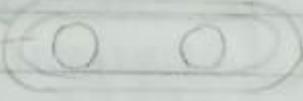
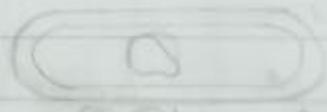


④ Binary fission is completed, each cell has the phage DNA incorporated.



Lysogenic cycle B

③ Phage is replicated along with bacterial DNA prior to binary fission.



Some phages live inside host without causing lysis of bacterial cell. Such non-virulent phages are called temperate phages or symbiotic causes phages. They can cause cell lysis or can behave as a symbiont showing lysogenic life cycle.

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Virus: Connecting link between living and Nonliving.

• Living characters of virus →

- ① Occur in different varieties or strains.
- ② They have their own genetic material.
- ③ They can undergo mutations.
- ④ They reproduce using the metabolic machinery of the host cell.

• Nonliving characters →

- (1) They lack a cellular structure.
- (2) They lack enzyme system and do not have metabolic activity on their own.
- (3) They do not respire.
- (4) They can be crystallised and stored in bottles of crystals.

← Viroids → Viroids are the smallest known self replicating particles. They were first describe in 1971 by I. Diener, a plant

Pathologist. These are smaller than the virus and a composed of RNA only. Virioids are causative agents - of Potato spindle tuber disease (PST)
Chrysanthemum stunt disease,
Cucumber pale fruit disease,
Tomato apical stunt disease.

Prions → Prions are infectious protein particles without nucleic acid. They are resistant to heat and UV rays. The term prion was coined by American neurobiologist Stanley Prusiner.

~~John~~
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