

Variety of Life

CHAPTER – 5

BASIS OF CLASSIFICATION OF LIVING ORGANISMS

The living organisms are classified on the basis of Homology, comparative Biochemistry cytology and Genetics.

- (a) Homology
- (b) Cytology.
- (c) Bio-chemistry.
- (d) Genetics

(A) HOMOLOGY

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The organisms placed in a particular group, all have many fundamental similarities in their structure.

EXAMPLE

The flipper, wing and arm are, all build on the same pattern but during the course of evolution, each has been modified from its basic pattern to serve a particular and usually highly specialized function, due to its adaptation different to environment or habitate. (Structures that are similar because of their common origin but may differ functionally is known as Homologus)

(B)BIOCHEMISTRY

It is particularly useful, when we classify organism like bacteria, which may all look alike and have an identical cellular structure with the help of chromatography and electrophoresis we can compare the amino acid sequence in the protein of different organisms or the order of bases in their DNA.

(C)CYTOLOGY

Microscopic observations of cell structure are also used to make a fundamental split in the classification of living things. They can be useful at the level of generic and species level. This sort of technique can show delicate difference between species or sub-species, which are identical in many other respects. Specie → Genus → Family → Order → Class → Division → Kingdom

(D)GENETICS

All the morphological, Bio-chemical properties and cytological aspects of an individual, or of a species depend on its genetic constitution. Hence the final tool helping in classifying an organism is Genetics.

TAXONOMIC HIERARCHY

The basic unit of the biological classification is specie. Closely related species are grouped-together into Genera. Genera are grouped into Families, families into order, orders into classes, classes into phyla and phyla or divisions into

kingdoms. Each grouping of organisms within the hierarchy is called taxon and each taxon has a rank and a name. For example class "mammalia" or Genus "Homo". This ascending series of successively larger, more inclusive groups make up the "Taxonomic Hierarchy".

CHANGES PROPOSED BY MARGUILES AND SCHWARTZ IN THE FIVE-KINGDOM SYSTEM

Marguiles and Schwartz were American Biologists, put forward a modification of Robert Whittaker's scheme. According to this modification.

- The multicellular alga should be removed from the plant kingdom and placed along with all unicellular organisms, in a new kingdom called "PROTOCTIST" which would replace Whittaker's Protista kingdom.
- This modification made the plant kingdom a more natural group.
- Due to this modification the kingdom Protoctista became a kingdom that contains all those organisms, which cannot be fitted into any of the other kingdom.

VIRUS

Viruses are very minute non-cellular bodies considered between living and non-living organisms.

DISCOVERY OF VIRUS

The word virus is derived from a Latin word meaning "Poison". A Russian Biologist Iwanosky in 1892 discovered Virus.

CHARACTERISTICS OF VIRUS

1. Viruses are non-cellular parasitic entities (obligate parasite)
2. Viruses cannot live and reproduce outside the living cells because they lack the machinery to do so by themselves.
3. The size of the viruses is in the range 20nm-250nm.
4. Viruses are either virulent destroying the cell in which they occur. While temperate Viruses become integrated into their host genome and remain stable for long period of time.

STRUCTURE OF VIRUS

1. The viruses may be small sphere like or golf balls, like rod shape tadpole and polyhedral.
2. They mainly consist of viral genome, capsids, envelopes and tail Fibers.

(A) GENOME

Viral genomes may consist of a single or several molecules of DNA or RNA.

(B) PROTEIN CAPSID (PROTEIN CORE)

The protein coat that encloses the viral genome is called Protein capsid. It may be of different shapes and mainly made up of proteins sub units called "capsomeres"

(C) VIRAL ENVELOPES

In some viruses accessory structure called Viral Envelopes are present that help them in infecting their host. They are membranes that enclose the protein core.

TAILS AND TAIL FIBRES

Many viruses possesses thread like long tail and tail fibers. These structures help in infecting the host. FIGURE / 5.5 (THE STRUCTURE OF BACTERIOPHAGE) PAGE # 91

CLASSIFICATION OF VIRUSES

(A) ON THE BASIS OF MORPHOLOGY

Viruses are generally classified on the basis of Morphology and nucleic acids they contain. e.g. On the basis of morphology, Viruses are classified into rod shape (TMV), spherical (Polio Virus) and Tadpole (Bacteriophage Virus).

(B) ON THE BASIS OF MODES OF ORIGIN

Viruses can be classified on the basis of their mode of origin, which provide a systematic idea of some of their diversity.

Following are the main characteristics of these groups:

1. Unenveloped plus strand viruses.
2. Enveloped plus strand RNA Viruses.
3. Minus strand RNA Viruses.
4. Viroids
5. Double strand RNA Viruses.

6. Small genome DNA Viruses.

7. Medium genome and large genome DNA Viruses.

8. Bacteriophage.

LIFE CYCLE OF THE BACTERIOPHAGE

The virus that infects the bacteria (mostly E.coli) is known as "Bacteriophage"

Bacteriophage can reproduce by two alternative mechanisms.

1. The lytic cycle

2. The Lysogenic cycle.

(1) THE LYTIC CYCLE

The life cycle of the bacteriophage that eventually ends in death of the host cell is known as "A LYTIC CYCLE"

The following are the stages of lytic cycle.

1. Initially the bacteriophage uses his tail fibers to stick to specific receptor present on the outer surface of E-coli bacteria.
2. The sheath of the viral tail contracts, thrusting a hollow core through the bacterial wall and membrane of the bacterial cell and then phage injects its DNA into the cell.
3. The empty capsid of the phage is left outside the cell.
4. The bacterial cell's DNA is destroyed (hydrolyzed).
5. The phage DNA takes control over the bacterial metabolic machinery and uses it to produce phage proteins and viral nucleotide.
6. Copies of the phage genome are developed and different parts of the phage come together forming daughter phages.
7. In the last stage of lytic cycle the daughter phages released, hydrolytic enzymes "lysozymes", which digest the bacterial cell wall.
8. Due to osmosis, bacterial cell swells and finally burst releasing 100-200 daughter phage particles.

FIGURE 5.6 (THE LYTIC CYCLE OF PHAGE-T4) PAGE #

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2. THE LYSOGENIC CYCLE

The life cycle of the Bacteriophage in which the viral genome replicates without destroying the host cell is known as lysogenic cycle.

Viruses that are capable of using both modes of reproduction within a bacterium are called "Temperate Viruses".

The following are the stages of lysogenic cycle.

- (1) In this cycle infection of the E-coli cell begins when the phage binds to the surface of cell and injects its DNA.
- (2) Within the host cell, the phage DNA molecule forms a circle.
- (3) The DNA molecules of Viruses incorporated by genetic recombination into a specific site on the host cell's chromosome. Now it is known as "Prophage cycle"
- (4) The phage genome is mostly silent within the bacterium.
- (5) When E-coli cell prepares to divide, it replicates the phage DNA also, and passes the viral copies to the daughter cells.
- (6) This mechanism enables the virus to propagate without killing the host cell upon which it depends.

At some point, prophage give rise to the active phages that lyse their host cells. It is usually an environmental trigger such as radiations, or the presence of certain chemicals that convert the virus from the lysogenic to the lytic mode.

FIGURE 5.7 PAGE # 95

VIRAL DISEASES

1. ANIMAL DISEASES

- (1) Poliomyelitis.
- (2) Colds
- (3) Encephalitis.
- (4) Dengue fever.
- (5) Yellow fever.
- (6) AIDS
- (7) Rabies.

- (8) Measles.
- (9) Mumps.
- (10) Hepatitis.

2. PLANT DISEASES

- (1) Tobacco Mosaic Virus (TMV) (Tobacco leaves disease) or (Tobacco Mosaic Disease)

AIDS

CAUSITIVE AGENT

AIDS is stand for Acquired Immuno-Deficiency Syndrome, caused by Human Immune Deficiency Virus (HIV)

SYMPTOMS

- (1) Short flu like illness.
- (2) Pneumonia like conditions.
- (3) Disfiguring form of Skin Cancer (Kaposi's Sarcoma)
- (4) Weight loss and fever.
- (5) Dementia (loss of thoughts)
- (6) Diarrhea (loose motion with increasing frequency)
- (7) Septicemia (Blood Poisoning)

Severity of the Immuno-Deficiency varies and bouts of illness may persist for years.

HIV mostly infects lymphocytes and causes brain cell damage, in more than 50% of cases. Irreversible dementia and eventual death occurs.

TRANSMISSION

- (1) The HIV virus can only survive in the body fluids and transmitted by blood or semen.
- (2) In 90% of cases the transmission occurs by sexual contact. Some other modes of transmission are as follow:
 - Unsterilized syringes and needles mostly in intravenous drug abusers.
 - By giving blood or blood products already infected with HIV.
 - Close contact between infected and non-infected people.

- From an infected pregnant women to her baby through placenta or through breast milk.

CONTROL AND TREATMENT

No particular drug is available for treatment of AIDS but there are some drugs, which are effective against this disease like Azidothymidine, Zidovudine and sumarin.

PREVENTION

- Use of the clean needles and sterilize syringes.
- Education and public awareness about the disease and restricted sexual contacts with preventive measures.
- Transfusion of screened blood and blood products.

HEPATITIS

Hepatitis is an inflammation of the liver cells caused by viral infections, toxic agents or drugs.

SIGNS AND SYMPTOMS

- Jaundice.
- Abdominal pain.
- Liver enlargement.
- Fatigue and fever.

TYPES OF HEPATITIS

There are various types of Hepatitis few of them are as follow:

(1)HEPATITIS "A"

- Cause by non-enveloped RNA virus.
- Transmitted by contact with faeces from infected individual.
- Most common form of Hepatitis world wide.

(2)HEPATITIS "B" (SERUM HEPATITIS)

- Caused by DNA viruses.
- More common in Asians, Africans and male homosexuals.
- Often persist in carrier form without causing any symptoms.

- Transmission mostly occurs through skin contacts, blood transfusion and other medical procedures. (Surgery, NG tube, Catheters)
- The virus of this disease can cause liver cancer mostly in carriers.

TREATMENT AND PREVENTION

New vaccines against the virus have been produced which are of great importance especially for person who required frequent blood transfusion.

(3) HEPATITIS "C"

- Transmission occurs through mother to child during pregnancy.
- By sexual contacts.
- Most common transfusion associated Hepatitis.
- It causes liver cancers more often than HBV.

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