

Chapter 5

VARIETY OF LIFE

Q.1 Define classification and taxonomy. What are the basis of classification? Give various units of classification.

Ans. **CLASSIFICATION**

Arrangement of organisms into groups and subgroups on the basis of similarities among them is known as classification.

Taxonomy:

The branch of biology which deals with naming and classification of organisms is known as taxonomy.

Basis of Classification:

Classification is based on relationship among the individuals. This relationship is in the shape of similarities in form and structure of an organism. The similarities among the organism can be measured by following:

- Homologies
- Comparative Biochemistry (protein, Carbohydrates, fats etc.)
- Cytology (cells and tissues)
- Genetics (genes and chromosomes)

Units of Classification:

The organisms are divided into various units of classification in species and heist is kingdom

Following are various units of classification.

Kingdom: It is *large unit* of classification. The similarities among the organism in this group based on some general characteristics e.g. *absence or presence of chlorophyll* in animals and plants respectively.

Phylum: Each kingdom contain smaller groups known as phyla (phylum).

Class: Each phylum is further divided into smaller units called as classes.

Order: Classes are grouped into orders.

Family: An order constitutes many families of organisms. A family is a unit of classification that have many genera (sing:- genus).

Genus: A group of closely related species are placed in a unit of classification that is known as genus.

Species: The basic unit of classification is known as species. The species can be defined as:

“A group of closely resembled organisms which can interbreed freely and produce fertile off springs is known as species.”

Interbreeding cannot be used a criterion for species definition for asexually reproducing organisms.

- Each species has its own prominent structure, ecological status and behavioural characteristics.
- Species is independent evolutionary units.
- The unit of classification is also called as taxa by some biologist.

Q.2 Give Biological Classification of Corn.

Ans. Following is hierarchic description of Zea mays (corn).

Classification of Corn:

Kingdom	Plantae
Division (Phylum)	Anthophyta (Tracheophyta)
Class	Monocotyledonae
Order	Poales
Family	Poaceae
Genus	<i>Zea</i>
Species	<i>mays</i>

- *The name of genus and species must be underlined or in italic.*

Q.3 Describe various classification system of living organism.

Ans. Different classification system have been introduced from the time of human civilization. Most famous system of classification are:

- Two kingdom classification.
- Five kingdom classification.

Two Kingdom Classification System

It is the **most primitive** system of classification. By this system living organism have been classified into two groups i.e. two kingdom.

- (a) Plants (b) Animals.

(a) Plants:

This kingdom includes the **autotrophic organism**. The organism that can prepare their own food from simple inorganic material and store energy are known as autotrophic. Bacteria were placed with plants.

(b) Animals:

This is the kingdom of **heterotrophic organisms**. Heterotrophic organism are those which cannot synthesize their own food from simple inorganic material. These organism depend for their food on autotrophs or decaying organic matter

Many biologist think that two kingdom classification is satisfactory while other groups of biologist raised some objection on two kingdom classification system.

OBJECTION ON TWO KINGDOM CLASSIFICATION:

The biologist raised objection on some organism that are not fit in two kingdom classification system. Some of the organisms are listed below.

(1) Euglena:

The Euglena is an organism that shows properties of both plants and animals.

Animal Like Characters of Euglena:

- Absence of cell wall.
- Motile locomotion takes place by flagella.
- Loose chlorophyll when placed in dark for a long period of time.
- Autotrophic i.e., due to presence of chlorophyll they can synthesize their own food.

Due to dual nature of Euglena Ernst Haeckel (1866) placed Euglena, Euglena like organism and bacteria in a separate kingdom known as protista.

(2) Bacteria and Blue Green Algae:

In 1937, **E. Chatton** introduced two terms by raising objection on bacteria and blue green algae

- (i) *Procariotique* (ii) *Eu-Cariotique*

Procariotique:

It is derived from two Greek words *pro means before* and *karyon means nucleus*. The organism made up of cells that has not prominent nucleus were placed in group pro-cariotique. i.e. Bacteria and Blue green algae.

Eu-cariotique:

It is also derived from two Greek words *Eu-meaning true and karyon meaning nucleus*. The organisms that are made up of well developed nucleated cells were placed in the group eucariotique.

(3) Fungi:

A group of biologists also disagree with the classification of fungi due to the following reasons.

- Fungi resemble plants (algae) but are not autotrophic.
- The cell wall is mainly composed of chitin.
- Special heterotrophic (decomposers) that obtain energy by the break down of substances.

FIVE KINGDOM CLASSIFICATION

It is a relatively recent system of classification and was proposed by *Robert Whittaker in 1969*.

This system of classification is based on three levels of cellular organization associated with three main modes of nutrition viz.

- Photosynthesis.
- Absorption.
- Ingestion.

The five kingdoms proposed by Robert Whittaker are as follows.

(1) Kingdom Monera

It includes:

- (i) **Prokaryote:** They have *no nucleus*.
- (ii) **Unicellular:** They are *unicellular*.
- (iii) **Heterotroph and Autotroph:** They are heterotrophic (non-photosynthetic) or autotrophic (photosynthetic).

Examples: Bacteria and blue green algae (cyanobacteria).

(2) Kingdom Protista

- (i) **Eukaryote and Unicellular:** They consist of eukaryotic predominantly unicellular organisms.

(ii) **Colony:** Some of them forms colonies.

(iii) **Heterotroph and Autotrophs:** (a) They are heterotrophic or autotrophic.

Examples: Euglena and Amoeba.

(3) **Kingdom Plantae**

(i) **Eukaryotes:** The organism of this kingdom includes eukaryotic organisms.

(ii) **Multicellular:** They are multicellular organisms.

(iii) **Autotrophs:** Plants are photosynthetic. They can produce their food from CO_2 and H_2O .

Examples: Liverworts, Mosses, Gymnosperms and Angiosperms.

(4) **Kingdom of Fungi**

(i) **Eukaryotes:** Organisms of this group are composed of eukaryotic cells.

(ii) **Heterotrophic:** They are non photosynthetic and non chlorophyllous.

(iii) **Absorptive mode:** Having absorptive mode of nutrition.

(iv) **Decomposers:** Decomposers that live on organic material.

(v) **Enzymatic:** Having well developed enzyme system by which they digest organic food into small molecules. These small molecules are then absorbed.

(5) **Kingdom Animalia**

This kingdom includes:

Eukaryotes and Multicellular:

Organisms composed of eukaryotic multicellular body.

(i) **Heterotrophs:** Gain food by ingestion which is digested in special cavities. Animals are Heterotrophs.

(ii) **Locomotory:** Organisms that move from place to place.

(iii) **No Cellulose:** Cellulose does not take part in cellular organization. e.g; Fish, amphibians, reptile, birds and mammals.

In five kingdom classification all eukaryotes that are not fit in the definition of plants fungi or animalia were included in protista. Most protists are unicellular but some are simple multicellular which are believed to be direct descendants of unicellular protista.

MODIFICATION OF FIVE KINGDOM CLASSIFICATION SYSTEM

Lynn Margulis and Karlene Schwartz in 1988 modified five kingdom classification of Whittaker by considering,

- Cellular Organization.
- Mode of Nutrition.
- Cytology.
- Genetics.
- Organelles of symbiotic origin (Mitochondria and chloroplast).

These five kingdoms of Lynn and Schwartz are:

- (i) Prokaryotae (Monera).
- (ii) Protocista (Protists)
- (iii) Plantae.
- (iv) Animalia.
- (v) Fungi.

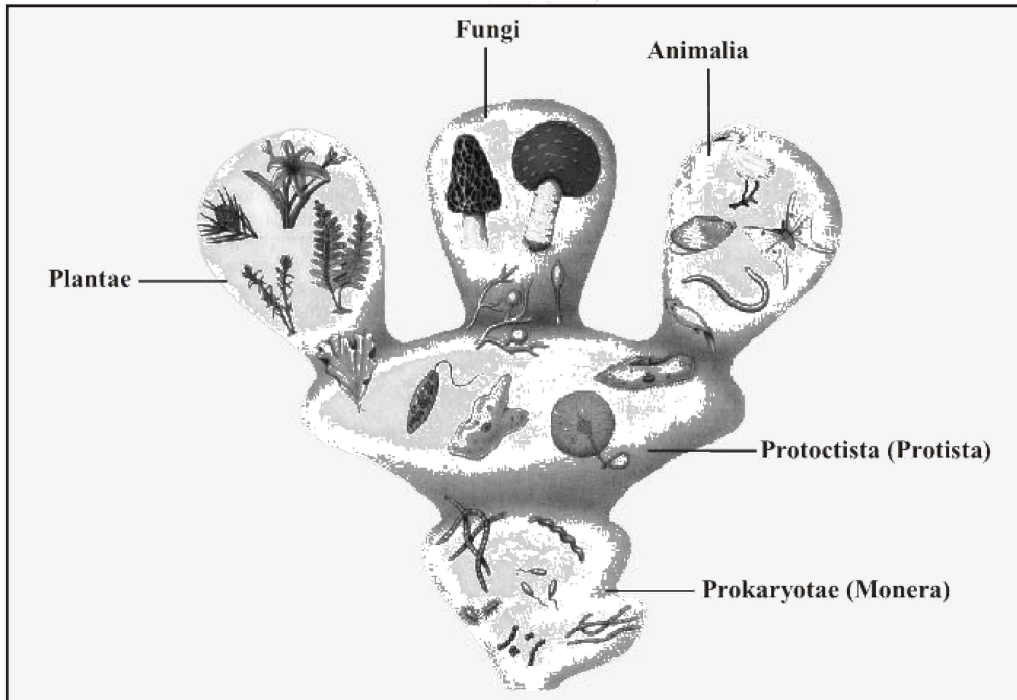


Fig. Relationship of five kingdom

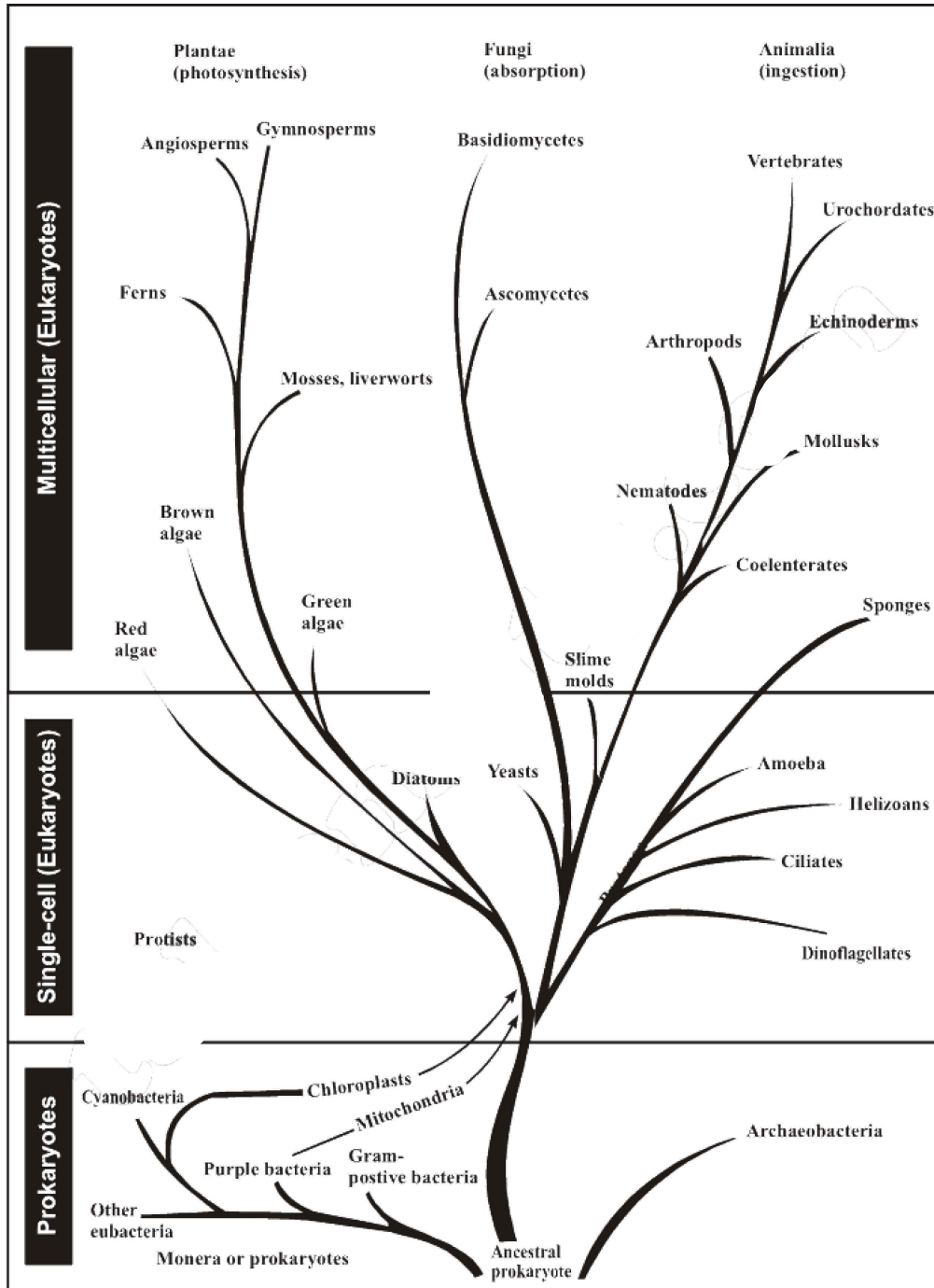


Fig. Five kingdom classification by Whittaker

Q.4 What do you mean by nomenclature? Write a note on Binomial nomenclature. Why is there need of binomial nomenclature?

Ans. **NOMENCLATURE**

The art of naming to any object in nature is called as nomenclature.

From the ancient times plants and animals have been given common names by people. Since no system was introduced in choosing (giving) common names to the organisms. Due to lack of a definite system in many cases various regions had their own name for plants and animal. e.g., onion has different common name in different region of Pakistan.

COMMON NAMES OF ONION:

Piaz in urdu language

Ganda in Punjabi language

Basal or *vassal* in saraiki language.

Similarly ammaltas, orgvad, gurmala golden shower and purging cassia are different common names of the same plant.

In some cases, different plants or animals have single name in different region. e.g., All plants with bell shape flower are known by the name of blue bells. Similarly the name "black bird" is given to a crow as well as to a raven.

"Fish" as a common name

Common name have no scientific basis e.g. Fish in the view of biologist is a vertebrate animal with back bone, fin and gills. But silver fish is insect (arthropod) cray fish also an arthropod. Jelly fish is a coelenterate. Star fish is an echinoderm. All these do not fit into definition of a fish.

Binomial Nomenclature:

During 18th century, a Swedish botanist "Carlous Linnaeus." (1707 – 1778) introduced a system for naming and classification of all organism known to him. He took the scientific name from Latin word. The scientific name of each organism had two parts. So the Linnaeus system of giving name of species is known as binomial nomenclature.

Genus

First name is the name of genus and is called generic name which always *begins with capital letter*.

Species

Second name is species name and *begin with small letter*. The scientific name referred to some characteristics of organism or the person who collect the plant or animal.

LINNAEUS SYSTEM

The Linnaeus System is used today internationally. Following are some scientific names of plants and animal according to this system:

Some Scientific Names	
Onion:	<i>Allium cepa.</i>
Amaltas:	<i>Cassia fistula.</i>
Potato:	<i>Solanum tuberosum</i>
Tomato:	<i>Solanum esculentum.</i>
Human:	<i>Homo sapiens</i>
Cat:	<i>Felis domesticus.</i>

Some genus of tomato and potato, cat and lion shows a close relationship between these two species of plants and animals.

NEED OF BINOMIAL NOMENCLATURE:

Binomial nomenclature is necessary for species exactness. Common name had long caused confusion. When they came under discussion among the scientists of all over the world. So binomial nomenclature provides single name of an organism to avoid this confusion of scientists (biologists). A specific name has the advantage for a single kind of an organism through out the world.

Linnaeus Publications:

Linnaeus published the list of names of plant since 1753 his system become so popular that re-published a list of names of animals in 1758.

Many names of plants and animals are in use today.

INITIAL CATEGORRY WAS BASED ON MORPHOLOGY:

Initially the classification was based on morphology of plants and animals. But with the advancement in field of cytology, physiology, genetics and molecular biology the classification of organism has been modified.

Q.5 Define virology, give history of discovery of virus.

Ans. VIROLOGY

“The branch of biology which deals with the study of virus is known as virology.”

History of Virus Discovery:

About a century ago at the time of **Louis Pasteur** (1822 – 1895) and **Robert Brown** (1843 – 1910) the word virus was generally referred to as *‘poison’* associated with disease and death of living organism.

In 1884 **Charles Chamberland** (one of the Pasteur's associates) found that bacteria cannot pass through porcelain filters while agents responsible for rabies can pass through filters.

The filterable agents are known as filterable viruses.

Ivanowski in 1892 discovered that the agent which caused tobacco mosaic disease was filterable. He obtained bacteria free filterable from infected plants and applied it on healthy leaves of tobacco the healthy plant got disease.

Similarly ultramicroscopic agents which can pass from filter were seen in the victims of mainly diseases like foot and mouth disease (1898) and yellow fever (1901).

Finally the secret of filterable agent was disclosed by *W.M. Stanley in 1935*. Stanley was successful in crystallizing "TOBACCO MOSAIC VIRUS" (TMV) for the first time in the history of virology.

The chemical analysis of crystallized particles showed that they consist of only nucleic acid protein. This suggests that viruses that have simple organization, are nucleoprotein in nature.

Q.6 Define virus. What are the important features of virus?

Ans. **VIRUSES**

Definition:

The word virus is derived from Latin language and means a "poisonous liquid or poison".

Viruses as "infectious nucleoprotein". Viruses may be generalized to define as:

"Such very small-sized disease that are capable of passing through filters that retain even bacteria, increase only in the presence of living cell, and give rise to new strains by mutation."

IMPORTANT DISTINGUISHING FEATURES:

- (1) **Non Cellular:** Viruses do not fall into category of unicellular organisms (bacteria, mycoplasma etc.) because they do not possess a cellular organization.
- (2) **One Type of Nucleic Acid:** Viruses contain only one type of nucleus, either DNA or RNA but never both. However all other microorganism (bacteria, fungi, mycoplasmas etc.) contain both DNA as well as RNA.
- (3) **Obligate Intracellular Parasite:** They are obligate intracellular parasites and show their extreme dependence upon living organism for their existence and multiplication.
- (4) **Lack Enzyme:** Viruses lack the enzyme necessary for protein and nucleic acid synthesis. For replication, they depend on the synthetic machinery of host cell.

- (5) **Virion:** The structural unit of a virus particle is called virion.
- (6) **Size:** In size they range between *10nm* (foot and mouth disease viruses) *to 250 nm* (poxviruses). They are therefore submicroscopic and can be seen only with the help of electron microscope.
- (7) **No binary Fission:** Viruses do not multiply by binary fission.
- (8) **Resistant to Antibodies:** Antimicrobial antibodies do not show any affect on viruses.
- (9) **Crystal:** Viruses can be crystallized like chemicals.
- (10) **High Molecular Weight:** Viruses consist of high molecular weight *nucleoprotein*.

Q.7 Give the name of some human viral diseases.

Ans. **SOME HUMAN VIRAL DISEASES**

In human beings the viral disease are very common, ranging from minor ailments such as *common cold* to highly fatal such as *small pox*. They may be sporadic (*mumps*) epidemic (*measles*) endemic (*rabies*) or panedemic (*influenza*). Some of the viral diseases are world wide e.g., **Herpes**. Some of the viruses may even be the cause of many dreadful disease. Such as cancer in animals, birds as well human beings.

AIDS and *hepatitis* are also important viral diseases.

Q.8 (a) Define virus and give structure of typical viruses.
(b) Classify viruses on structural basis.

Ans. (a) **VIRUSES**

“Infectious agents which have no independent metabolism and replicate only within living cell are called viruses.”

Structure of Typical Viruses:

The complete, mature and infectious particle is known as virion. A typical virion is composed of following parts.

(a) Genome (b) Capsid (c) Envelope

(a) **Genome:** The virion is composed of a central core made up of *nucleic acid* (DNA or RNA) known as genome.

(b) **Capsid:** The genome is surrounded by a *protein coat* called as capsid.

Capsid gives definite shape to virus.

The capsid is made up of protein subunits known as *capsomers*. Capsomers is characteristics of a particular viruses e.g.

- 162 capsomers are present in the capsid of herpes viruses.
 - 252 capsomers are present in adenovirus which cause some types of common cold.
- (c) **Envelope:** In some animal viruses the *nucleocapsid* (genome and capsid) is covered by another membrane known as envelope. The envelope is derived from the host cell.

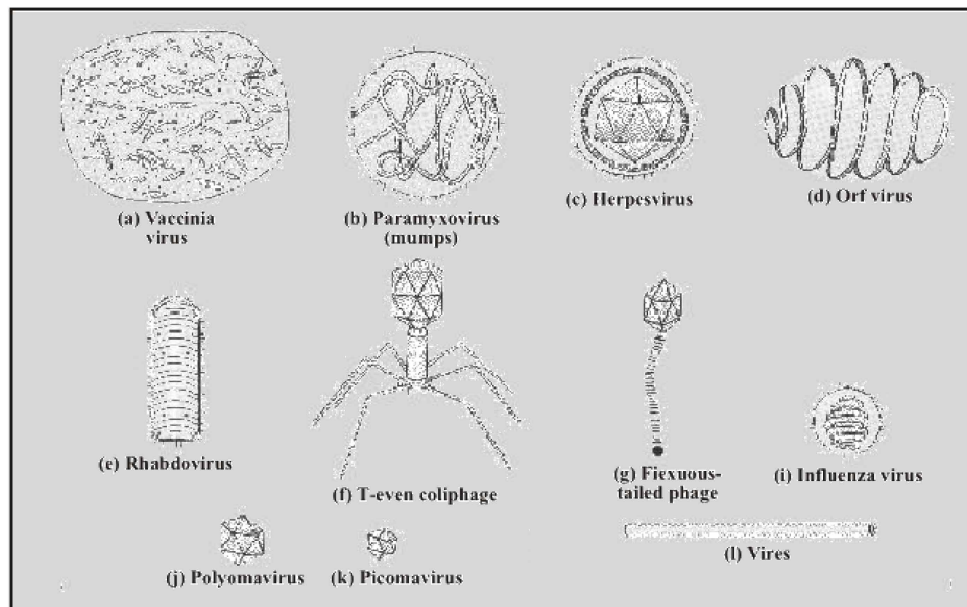


Fig. Different types of viruses

(b) **CLASSIFICATION OF VIRUSES**

On the basis of morphology viruses can be classified as under:

- Rod Shaped:** Animals and plant viruses.
- Polyhedron:** The virus having many sides are known as polyhedron.
- Helical:** The viruses having spiral morphology.
- Tadpole Like:** Mostly bacteriophage that infects bacteria. Bacteriophage occur in structural forms having cubical or helical symmetry.
- Cubical Phage:** These phages are regular solid or Icosahedral (having 20 sides).
- Helical Phage:** These are rod shaped viruses found in nature.
- Phages with head and Tail:** Many phages consist of head and tail in these cases heads or polyhedron but tails are rod shaped.

Q.9 Why viruses are considered as living and non-living?**ONLY FOR SPECIAL ATTENTION****Ans. DISPUTE OF LIVING AND NON-LIVING:****Nature and Origin:**

The nature and origin of virus is still not clear because it is not easy to define. Then within excepted framework of living on non-living organism. Thereby biological status is still not crystal clear. Some virologist regard viruses as animate object whereas, other consider them inanimate.

Viruses are Living Because:

- (1) They show *growth*.
- (2) They show *mutation*.
- (3) They can be *transmitted* from the diseased host to healthy once.
- (4) They *react to heat* chemicals and radiations.
- (5) They have *genetic material* i.e., DNA or RNA.
- (6) They are capable to *multiply* in no of same genetic type.
- (7) Viruses show *irritability*. A character of only living organism.
- (8) The are capable to bring about *enzymatic change in vitro*.
- (9) They have the ability to *infect*.

Viruses are non-living because:

- (1) They can be *crystallized*.
- (2) They are *inert outside* the host.
- (3) A cell wall or cell membrane of any type absent in viruses.
- (4) *They do not show functional anatomy*.
- (5) *They do not respire or excrete*.
- (6) Their sedimentation according to their molecular weight is like that of non-living.
- (7) They are dependant upon living organism.
- (8) They lack any energy producing enzyme system.

Specific Characters of Viruses Neither in Living Nor in Non-living

- (1) Presence of *only one type of nucleic acid* either DNA or RNA.
- (2) Capacity to reproduce from their sole nucleic acid.
- (3) Viruses do not undergo binary fission.
- (4) They make use of ribosome of their host cell.

Because of such characters some virologist consider viruses as a transition stage between living and non-living world. They are living organism with some non-living characters.

Q.10 What are virioids?

Ans. **VIRIIDS**

The term virioid has been introduced by the **Diener (1971)** for a new class of subviral plant pathogens. They contain a genome much smaller than that of known viruses. They are also characterized by the absence of an extracellular dormant phase (virion). The virioids consist solely of a protein free low-molecular weight (75,000, 125,000 daltons) double standard RNA. Such a RNA is resistant to heat and organic solvents. But sensitive to nucleus. The virioids were first identified in potato spindle tuber disease (PSTV).

In short, *“the virioids are protein free plant pathogens with low molecular weight RNA.*

Q.11 Define: (i) Adenovirus (ii) Virion (iii) Herpes.

Ans. **ADENOVIRUSES**

The viruses causing *diseases of upper respiratory tracts* or common colds are called adenoviruses.

Virion: The complete viral particle which can infect a living cell and found in crystal form without cells is called Virion.

Herpes: The *inflammatory skin disease* marked by the formations of small viruses in cluster in human as herpes.

Herpes Virus: A group of viruses causing diseases like chicken pox and herpes is called herpesvirus.

Q.12 Define the followings:

- (i) **Hepatitis** (ii) **Hepatitis A** (iii) **Hepatitis B** (iv) **Hepatitis C**
 (v) **AIDS** (vi) **Retrovirus** (vii) **Provirus** (viii) **HIV**

Ans.

- (i) **Hepatitis** The viral disease of *liver inflammation* in which *abdominal pain, jaundice, liver enlargement* and *fever* like symptoms appeared is known as hepatitis.
- (ii) **Hepatitis A:** The *short terms* and less severe hepatitis due to attack of RNA type virus. HAV is called hepatitis A.
- (iii) **Hepatitis B:** The recoverable DNA viral hepatitis with symptoms like jaundice and fatigue in which *patient ultimately immuned* is called hepatitis "B".
- (iv) **Hepatitis C:** The chronic liver abnormality due to attack of RNA virus (HCV) is called hepatitis "C".
- (v) **AIDS** The viral disease which *decreases immunity* with symptoms like loss of weight, swollen of lymphs and pneumonia etc. is called A.I.D.S.
- (vi) **Retrovirus** Those specific viruses which cause disease like AIDS and Cancer etc. are called retroviruses or **oncovirus**.
- (vii) **Provirus** The single stranded virus which is converted into double stranded DNA and infect host cell and also incorporate into host genome may cause cancer is called provirus.
- (viii) **HIV** The "*Human Immunodeficiency virus*" which causes AIDS is called HIV.

Q.13 What are meanings of syndrome?

Ans. SYNDROME

A set of symptoms occurring together in an organism due to physiological and morphological abnormalities is called syndrome.

Examples.

- *Acquired immune deficiency syndrome (AIDS)*
- *Klinefelter syndrome*
- *Down's syndrome*
- *Turner syndrome*

Q.14 What do you know about TMV?

Ans. The filterable virus which causes *Tobacco Mosaic Disease* is called *Tobacco Mosaic Virus (TMV)*.

“(Mosaic means organism with more than one kind (lines) of cells with differed genes from the same zygote)

Q.15 Define Genome.

Ans. The complete set of hereditary factors contained in the haploid set of chromosome is known as genome.

Q.16 What do you know about capsid and capsomeres?

Ans. The coat of virus which is made up of protein is called **capsid**. This coat of capsid gives the definite shape to virus. The morphological units of capsid are known as **capsomeres**. Chemically, these are proteins.

HELP LINE

Q.17 Write a brief note on viral nucleic acids.

(Just Concept)

Ans: Nucleic Acid (DNA and RNA):

The nucleic acid is only of one type in a virus, i.e. either DNA or RNA. Both the types of nucleic acids are not present in any virus. The single major character separates them from all known living organisms, all of which contain both DNA and RNA. The viruses possessing DNA are called DNA viruses (*Deoxyviruses*), whereas those possessing RNA are called RNA viruses (*Riboviruses*). There may be only a single strand or double strand of nucleic acid. Four categories of viruses may be recognized on the basis of single double stranded nature of nucleic acid.

- (1) Viruses with *single stranded* DNA . e.g; colliphage viruses.
- (2) Viruses with *double stranded* DNA e.g; Herpes simples and vaccinia.
- (3) Viruses with *single stranded* RNA e.g; TMV and poliviruses.
- (4) Viruses with *doubled stranded* RNA e.g; Retrovirus.

ATTENTION

Majority of the animals and bacterial viruses are DNA, whereas a majority of plant viruses are RNA viruses. However few plants viruses are also known to posses DNA (cauliflower mosaic virus) and a few animal and bacterial viruses posses RNA.

Generally more amount of nucleic acid is present in larger sized viruses. The nucleic acid molecule is linear in a majority of the viruses. However a few viruses posses circular molecule of nucleic acid.

Q.18 What are some minor components of viruses?

(For concept only)

Ans. Minor Components of Viruses

Some viruses remain enveloped by a limiting membrane derived from cell or nuclear membrane of host cell. This membrane contain lipids or lipoproteins, and these viruses are called “*Lipoviruses*”. A few animal viruses (influenza virus) are also known to contain carbohydrates.

Q.19 What are shapes of viruses?

Ans. **Shape**

The shape of the viruses is highly variable in different groups of viruses. They may be *rod shaped bullet shaped, brick shaped, oval, irregular and pleomorphic* or even like a piece of *coil rope*. A majority of the animal viruses are roughly *spherical*.

Virions fall in two major groups with respect to shape i.e. (i) Polyhedral forms e.g; Adenovirus. and (ii) Helical forms e.g.; TMV. However, in tailed or J. Bacteriophage the virion is made up of complex head region showing a polyhedral form, and an attached tail that is helical e.g. bacteriophage T. Rabies or Rhabdovirus are bullet shaped whereas poxviruses are brick shaped.

Q.20 Give life Cycle of Bacterio phage (Phage virus)?

Ans. **LIFE CYCLE OF PHAGE VIRUS**

Bacteriophage replicates only in the bacterial cell the life cycle is completed in following steps. Two types of life cycles are found in bacteriophage.

(i) Attachment or Absorption

In first step bacteriophage attached to cell wall of bacterium at a specific site known as receptor site. During attachment a weak chemical union developed between virion and receptor site takes place.

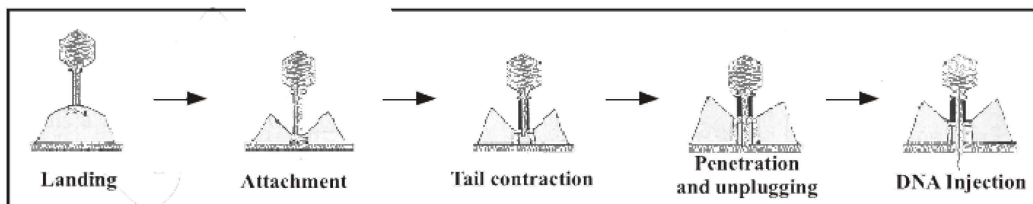


Fig. A phage injecting its DNA in to host

(ii) Penetration:

The tail of virion release enzyme known as *Lysozyme* which dissolve a small portion of bacterial cell wall. Now the tail sheath contract and inject DNA into the cell. The protein coat of virion remains out side the cell. However many animal virus enters as a whole in the cell.

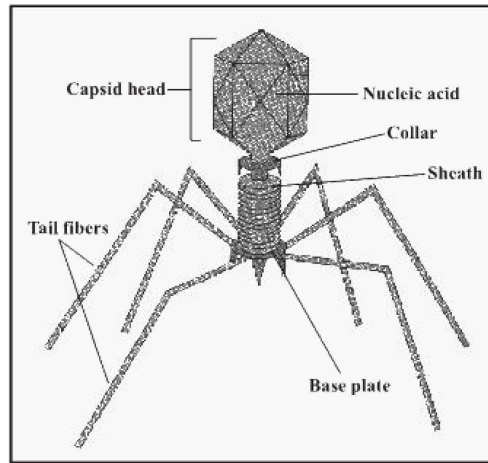


Fig. A Bacteriophage

(iii) Multiplication of Virion:

After entering host cell the *virion DNA takes over the control of biosynthetic machinery of host cells* and forces the host cell to synthesize necessary viral component (DNA and protein). In this way virus start multiplying. After 25 minutes of initial infection 200 new bacteriophages are found in bacterial cell.

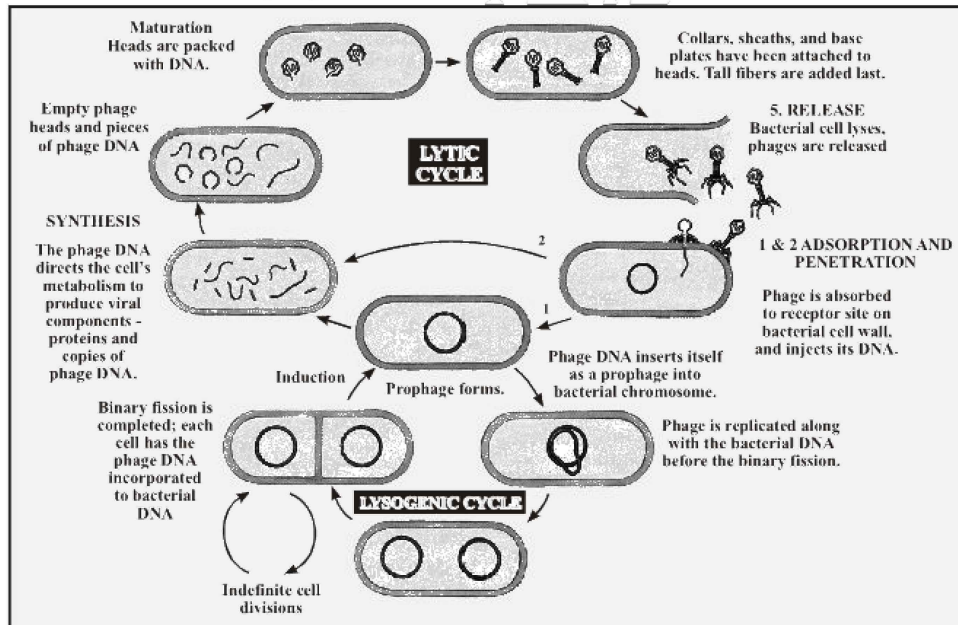


Fig. Replication of a bacteriophage. After adsorption and penetration, the virus undergoes prophage formation (1) In the Lysogenic cycle, phages can exist harmlessly as a prophage with in the host cell for long periods of time. Each time the bacterial chromosome is replicated, the prophage also is replicated, all daughter bacterial cell are "infected" with the prophage. Induction involves either a spontaneous or environmentally induced excision of the prophage from the bacterial chromosome. (2) A typical lytic cycle, involves synthesis and maturation of phage and new phages are released. (Note: Read it Compulsory)

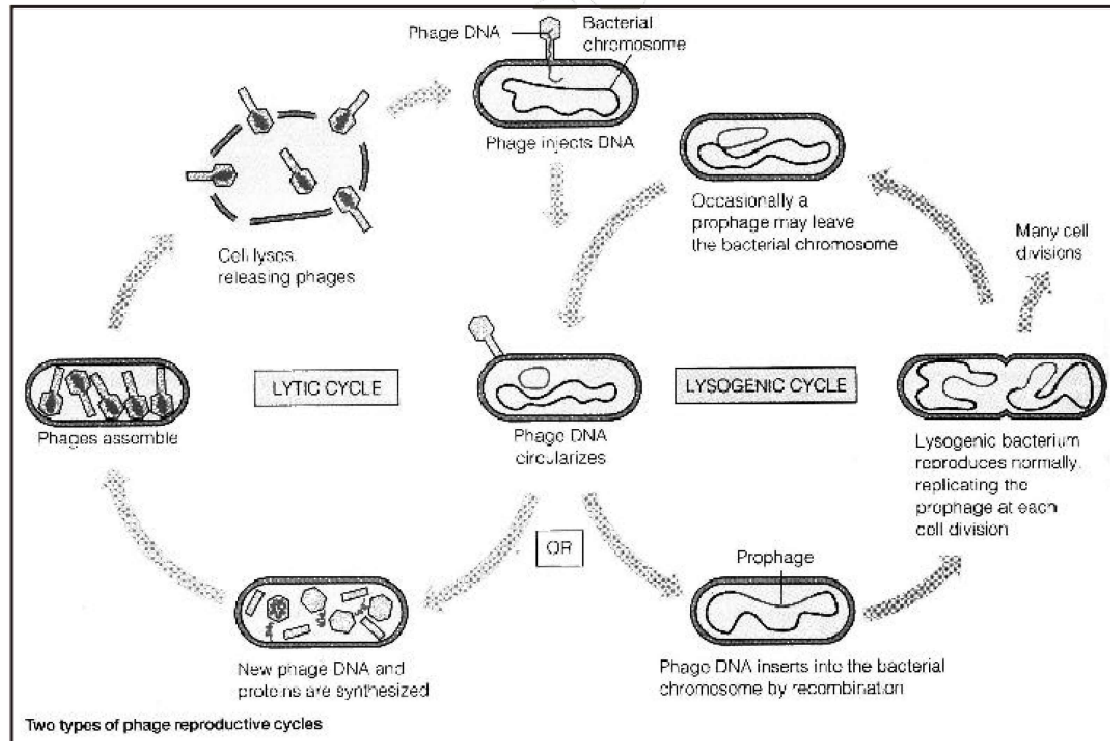
(iv) Lysis:

In the final step the bacterial cell bursts. This process is called as lysis of bacterium. Newly formed phages are released to infect another bacterium to start the life cycle again.

This cycle which causes lysis of bacterium is known as lytic cycle and the phage is known as lytic or virulent phage.

(v) Lysogenic cycle:

All bacteriophage do not cause lysis of bacterium. Such phages are known as temperate (lysogenic) phages and show another kind of life cycle. The steps of attachment and penetration of phages are some as in lytic cycle. In this cycle instead of taking over the control of biosynthetic machinery of host DNA of phage **incorporated into the bacterial chromosomes**. Now the DNA of phage is called *prophage* and this process is known as *lysogeny*. In this condition bacterium do not lyse, live and reproduce normally. The virus DNA remains attached to bacterial chromosomes for many generations until the process of induction takes place. In this process viral DNA gets detached from the bacterial chromosomes and start lytic cycle again.

HELP LINE

Q.21 What are prions?

Ans. **Prions**

These are most recently discovered in 1983 and least understood microorganism. **These are defined as infectious proteins.** The chemical nature of prions is very controversial. They contain only protein that contain information which codes for their own replication, prions were first introduced in 1983 and are responsible for mad cow infection and mysterious brain infection in man.

- (Like prions only infectious DNA particles are present which are known as virioids.)

Q.22 Write note on following:(i) *Bacteriophage*(ii) *Viral Diseases*(iii) *Retrovirus*(iv) *AIDS*(v) *Hepatitis.*

Ans. **Bacteriophage**

Bacteriophages are viruses which infect bacteria.

They were discovered independently, by "T wort" in "1915" and D. Herelle in 1917. Twort observed that bacterial colonies, some time undergo lysis i.e. dissolve and disappear. This process of lysis can be transferred from one colony to other. If a very diluted material from lysed colony applied to the bacterial colony, it has enough power of transferring the lytic effect. However, if the filtrate is heated it losses the lytic properly from all above mentioned observation. Twort conclude that lytic agent might be a viruses. **D' Herette** rediscovered this process and define the bactriophage as bacteria eater.

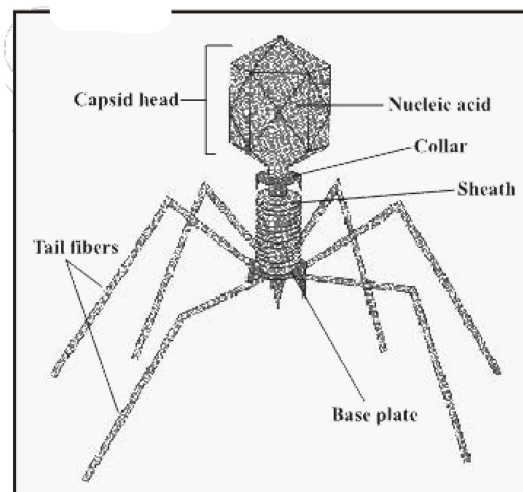


Fig. A Bacteriophage

The most popular phages that *Escherichia coli* (E. Coli) are known as T phage e.g (T.Type) T₂T₄ are mainly use in molecular studies. Electron microscopic structures of T₄ shows following parts.

- (i) **Head:** The head is elongated pyramidal (having two triangular structures with common base) hexagonal and prism shaped structures within the head double stranded DNA molecule is present.
- (ii) **Tail:** A straight rod like structure attached to the head is known as tail. The structures of phage tail is more complex than head. It has following parts.
 - (a) **Core:** A layer of protein form the inner most tube known as core.
 - (b) **Sheath:** The core is enclosed in sheath made up of another type of protein.
 - (c) **Collar:** On the upper side near the head the sheath has a structure known as collar.
 - (d) **Base plate:** The lower most end of sheath has a plate like structures known as base plate or end plate.
 - (e) **Tail fibres:** Six tail fibres are attached to the end plate. Tail fibres structures of attachment.
 - The volume of phage is about 1/1000 of the host.

Viral Diseases:

There are many diseases which are caused by viruses. Following are most common in Pakistan.

(i) **Small Pox**

Small pox is caused by pox virus. Pox virus is DNA enveloped virus. Small pox is ancient disease that occurred as *epidemic* in China in twelfth century B.C. Until early 20th century small pox was a common disease through out the world by 1950. Immunization and other prevention decrease the danger but it is still present in third world countries.

Symptoms:

- First of all raised *fluid filled vesicles* (جکڑے) are formed on the patient's body.
- Lastly they are converted into *pitted scars* known as *pocks*.

Herpes Simplex

Herps virus is DNA viruses. It is a naturally occurring disease of mankind. In this disease *vascular lesions in the epithelial layers of ectodermal tissues* are formed. Most commonly this disease occur in mouth, *on lips* and at other *skin sites*.

Influenza

These are enveloped **RNA** viruses that cause influenza. It is a wide spread disease in man and occur in epidemic forms.

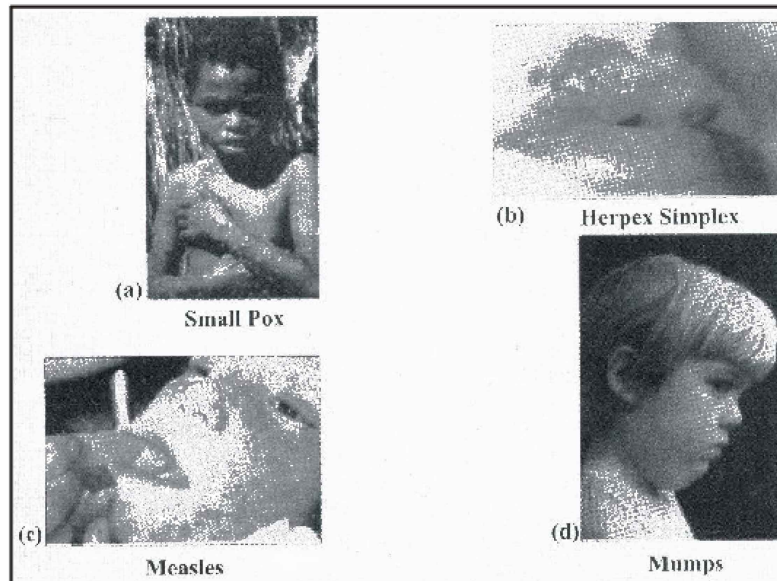


Fig. Some common human viral diseases

Mumps and Measles

The group of mumps and measles virus is known as *para myxoviruses*. They are large enveloped **RNA** viruses. Mumps is highly contagious, wide spread but seldom fatal. About 60% adults are immune to it. Measles is the one of the commonest disease of the childhood and adult human population is equally susceptible. This disease develops immunity in its victim.

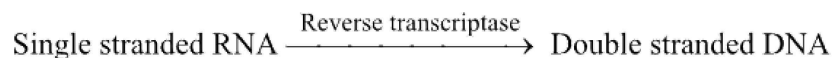
Polio

Poliomyelitis is caused by polio virus. It is found all over the world. This disease occur in *childhood*. The age at which primary infection depends on social and economic factors. The polio viruses are *smallest* known viruses that contain **RNA** in a *spherical capsid*.

Q.23 Why a virus is called retroviruses?

Ans. **Retroviruses**

The viruses which have a special enzyme known as *reverse transcriptase*. Due to presence of this enzyme viruses have ability to convert single stranded RNA genome in to double stranded viral DNA. This process of conversion is known as *reverse transcription* hence the viruses are called as retroviruses.



Infections:

The double stranded viral DNA not only infect the host cell but also incorporated into genome of the host as **poxvirus**. In this way a normal cells converted into cancerous cells. The viruses that have ability to convert normal, cell into cancer cells are known as “**oncoviruses**”.

Spherical Structure:

Retroviruses are spherical in form, **100 nm** in diameter and enveloped by a host plasma membrane. Few retroviruses are nonspecific that is they can infect **any** cell most of them infect only those host cell which have required receptors. **Human** immuno deficiency **virus (HIV)** which cause acquired Immune deficiency syndrome (AIDS) and many echoviruses are

EXAMPLE OF RETROVIRUSES:**Using Receptors:**

- **AIDS virus enters the host** cell by using a receptor which is meant for penetration of many kinds of leukocytes and tissue cells.
- **Leukocytes are WBC.** (white blood cells).

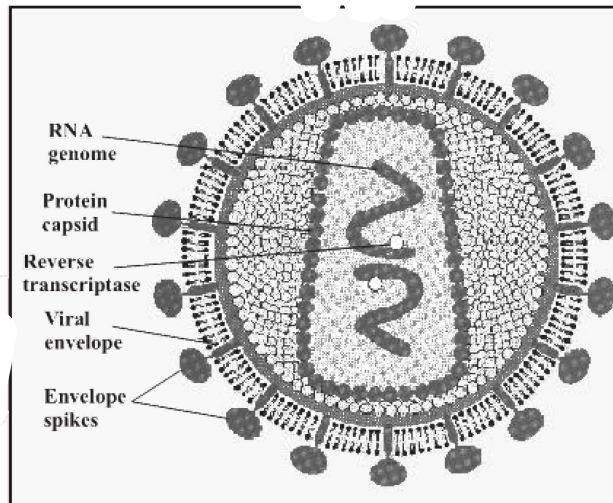


Fig. Human immunodeficiency virus (HIV)

Q.24 Write an account on AIDS.

Ans. AIDS

AIDS was first reported by physicians in early 1980's in young male having one or more complex symptoms.

Symptoms:

- *Severe pneumonia.*
- *Rare vascular cancer.*
- *Sudden weight loss.*
- *Swollen lymph nodes.*
- *General loss of Immune function.*

Primarily one thing that was common in all patients is that all they are involve in homosexual habit but soon it was noticed that disease was present in those persons who were not involve in this habits but got transfusion from males fond of homosexuality.

Discovery of Causative Agent:

In 1984 the agent that cause AIDS was identified by research teams from Pasteur Institute in France and National Institute of Health (NIH) in USA. In 1986 viruses were named as “human Immuno deficiency virus” (HIV). One of the characteristics of HIV is that it is host specific because recent studies tells us that HIV infect and multiply in monkey but do no cause disease in monkey.

Major Target Cells and Systems of HIV:

The major cells of human which are infected by the HIV are helper T-lymphocyte. Helper **T-Lymphocyte** is major component of immune system. The cells of nervous system are also infected by HIV.

Prognosis of AIDS:

As a result of infection in host cells the number of helper T-lymphocytes decrease in the body of patients. *Infection continues at last a failure of immune system* take place. The infected person become susceptible to other disease.

Epidemiology of AIDS. HIV is transmitted by:

- *Sexual contact.*
- *Blood contact (transfusion).*
- *Breast feeding.*

Preventive Measures:

Following preventive measure should be adopted by every human to avoids AIDS.

Restricted to one sexual partner. Do not use common syringes for intravenous drugs administration used sterile needles and surgical instruments.

Vaccination:

A vaccine against HIV has been synthesized and its experimental administration in human started in early 2001 in South Africa.

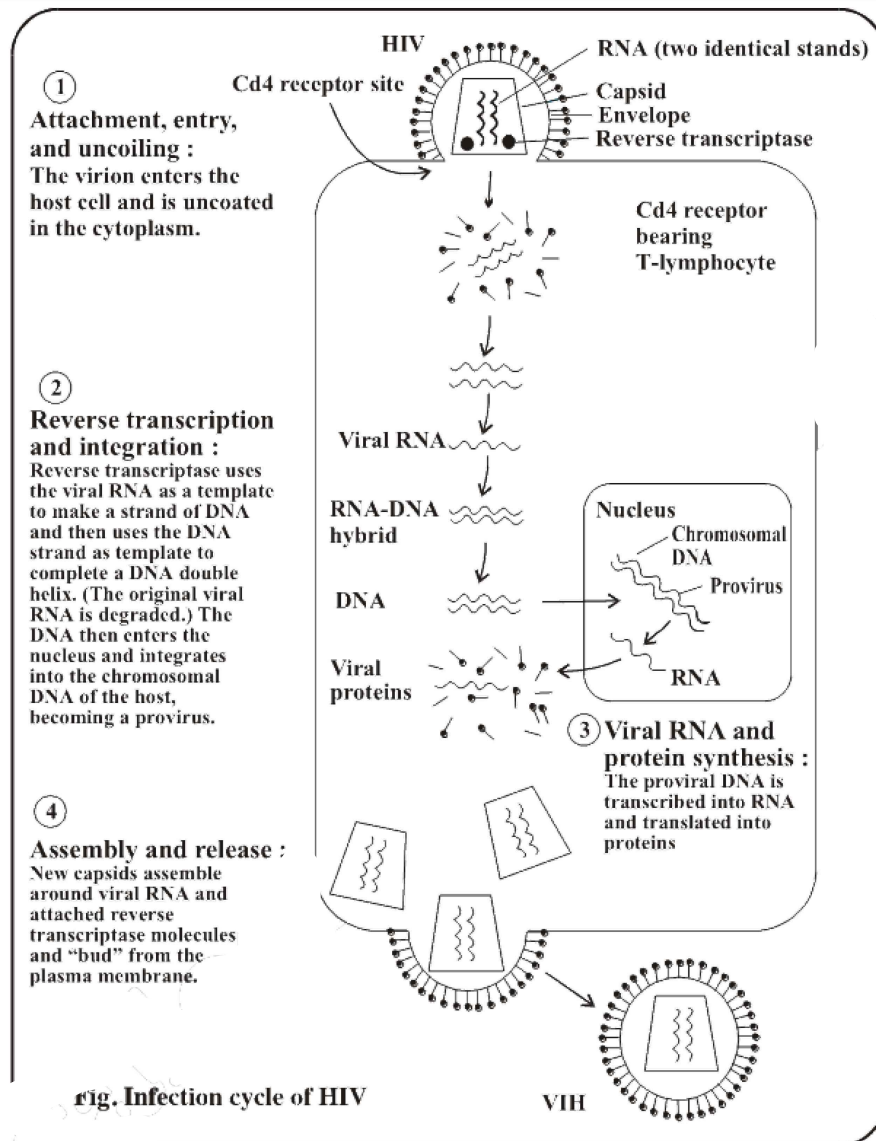


Fig. Infection cycle of HIV

VIH

Fig. Infection cycle of HIV

Q.25 Write an account on Hepatitis.

Ans. HEPATITIS

"The viral disease of Liver inflammation in which abdominal pain, jaundice and liver enlargement occur, is known as hepatitis."

(OR)

"Hepatitis is an inflammation of liver. It is usually a viral infection but toxic substance or drug can initiate the infection."

Symptoms:

- Jaundice.
- Abdominal pain.
- Liver enlargement.
- Muscle fatigue.
- Fever.

Hepatitis may be mild or acute, that can lead to liver cancer.

KIND OF VIRUSES INDUCE HEPATITIS

Following are some of hepatitis that are caused by viruses:

(i) Hepatitis A:

“The short term and less severe hepatitis due to attack of RNA type HAV is called Hepatitis A”. (OR) “Formerly it was known as infectious hepatitis that is transmitted by contact with faces from injected individuals.”

The hepatitis “A” virus (HAV) is RNA, non-enveloped virus. The hepatitis A is mild short term and less virulent disease.

(ii) Hepatitis B:

“The recoverable DNA viral hepatitis with symptoms like jaundice and fatigue in which patient ultimately immuned is called hepatitis “B”

It is also virus (HBV) induce disease and second major form of hepatitis. HBV is DNA virus which is very common in Asia, China, Philippines, Africa and the Middle East. Hepatitis B is transmitted by the exchange of body fluid e.g; blood serum, breast milk and saliva. It is also transmitted from mother to child during birth. Sexual contact also leads to the transmission of hepatitis B.

During acute attack of Hepatitis B following Symptom appear.

- Muscle fatigue.
- Loss of appetite and Jaundice.

People with chronic hepatitis infection are at risk of liver damage. Hepatitis can be controlled by adopting hygienic measures, vaccination and Screening of blood/organ/tissue of the donor.

(iii) Hepatitis C:

“The chronic liver abnormality due to attack of RNA virus (HCV) is called hepatitis C”. (OR) Hepatitis C virus (HCV) is also RNA, enveloped virus. It is less severe than hepatitis “A” and “B” Hepatitis C leads to chronic liver disease.