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Contact WhatsApp Number: +92 331 5014353

BIODIVERSITY / ACELLULAR LIFE

MDCAT BIOLOGY COMPENDIUM 2024

Taxonomy:- (S.T.B)

→ Taxis means arrangement

→ Nomos means Law.

Law of arrangement of organisms

→ Taxonomy is based upon characteristics of organisms

e.g Petal colour is characteristic but white petal colour is expression.

< Basis of Taxonomy:-

* Homology:-

Homo means same | logy means study.

→ Study of same type of things (nuclei)

e.g fore arm for human (for grasping)
limb of cat (walking)

Fins of shark

2

Wings of Birds

All four (wings, etc.)

All four (Wings, Fins, forelimb) have same structure and set of bones.

Biochemistry:-

- ① Used when homology is not applicable.
- ② Classify organisms (bacteria) on the basis of amino acids sequence or on the order of bases on their DNA.
- ③ Techniques used are chromatography and electrophoresis.

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Cytology:-

- ① Classification is based upon microscopic studies resulting in a separate kingdom for bacteria and cyanobacteria.
- ② Useful at generic and species level.
For example:- Number of chromosomes can enable entomologist to classify locusts and grasshopper.
- ③ Surface features of seeds and pollen grains are also revealed.

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Genetics:-

- ② Organisms are classified on the basis of genes such as DNA sequence.

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General Hierarchy:- (STB and PTB)

King → Kingdom

Played → Division/Phylum

Chess → Class

On → Order

Fine → Family

Grain → Genus

< Sand → Species

① Species:-

A species is a group of organisms which have numerous physical features in common and which are normally capable of interbreeding and producing fertile offsprings.

② Genera / Genus (Singular) :-

① Closely related species grouped together.

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③ Family :- Group of genera.

④ Order :- Group of family.

⑤ Classes :- Group of orders.

⑥ Phyla :- Group of classes.
Group of

⑦ Kingdoms :- Group of Phyla.

IMPORTANT POINTS :- (Hierarchy)

① When classifying plants and bacteria division is used instead of phyla.

② A subphylum may be inserted between phylum and class.

② A subclaw may be inserted
between class and order
and so on....

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1 Hierarchy of corn, zeamays:-
(PTB)

Kingdom → Plantae

Division → Anthophyta (tracheophyta)

Class → Phylum Angiospermae

Order → Poales

Family → Poaceae

Genus → Zea

Species → Mays

Hierarchy of
Wheat (STB):-

Kingdom → Plantae

Division → Tracheophyta

Class → Monocotyledons

Order → Poales

Family → Poaceae

Genus → Triticum

Species → Triticum indicum

Classification of
House Fly (STB):-

Kingdom → Animalia

Phylum → Arthropoda

Class → Insecta

Order → Diptera

Family → Muscidae

Genus → Eumusca

Species → Musca domestica

Hierarchy of Meadow Buttercup (STB) :-

Kingdom → Plantae

Phylum → Angiospermatophyta

Class → Dicotyledoneae

Order → Ranales

Family → Ranunculaceae

Genus → Ranunculus

Species → Ranunculus acris

Common Name → Meadow
buttercup

Hierarchy of Earthworm (STB) :-

Kingdom → Animalia

Phylum → Annelida

Class → Clitellata

Order → Terricolae

Family → Lumbricidae

Genus → Lumbricus

Species → Terrestris

Common Name → Earthworm

Hierarchy of Humans - (STB)

Kingdom → Animalia

Phylum → Chordata

Class → Mammalia

Order → Primata

Family → Hominidae

Genus → Homo

Species → Homo sapiens

Common Name → Humans

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Binomial Nomenclature :- (PTB + STB)

Animal name list published in 1758 (PTB)

① Discovered in 18th century by
Carlous Linnaeus. (PTB)

② Published in 1753. (PTB) Plant name list

③ Latin words are used. (PTB)

④ Bell shaped flowers → common name blue
bells (PTB)

⑤ Black bird common name → crow/raven (PTB)

⑥ Binomial Nomenclature

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Two Parts

Genus
name

Species
name

Written first

Written Second

First letter is
capitalized

Not Capitalized

Genus name is
capitalized (STB)

Binomial Nomenclature :- (PTB + STB)

Animal name list published in 1758 (PTB)

① Discovered in 18th century by
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② Published in 1753 (PTB) Plant name list

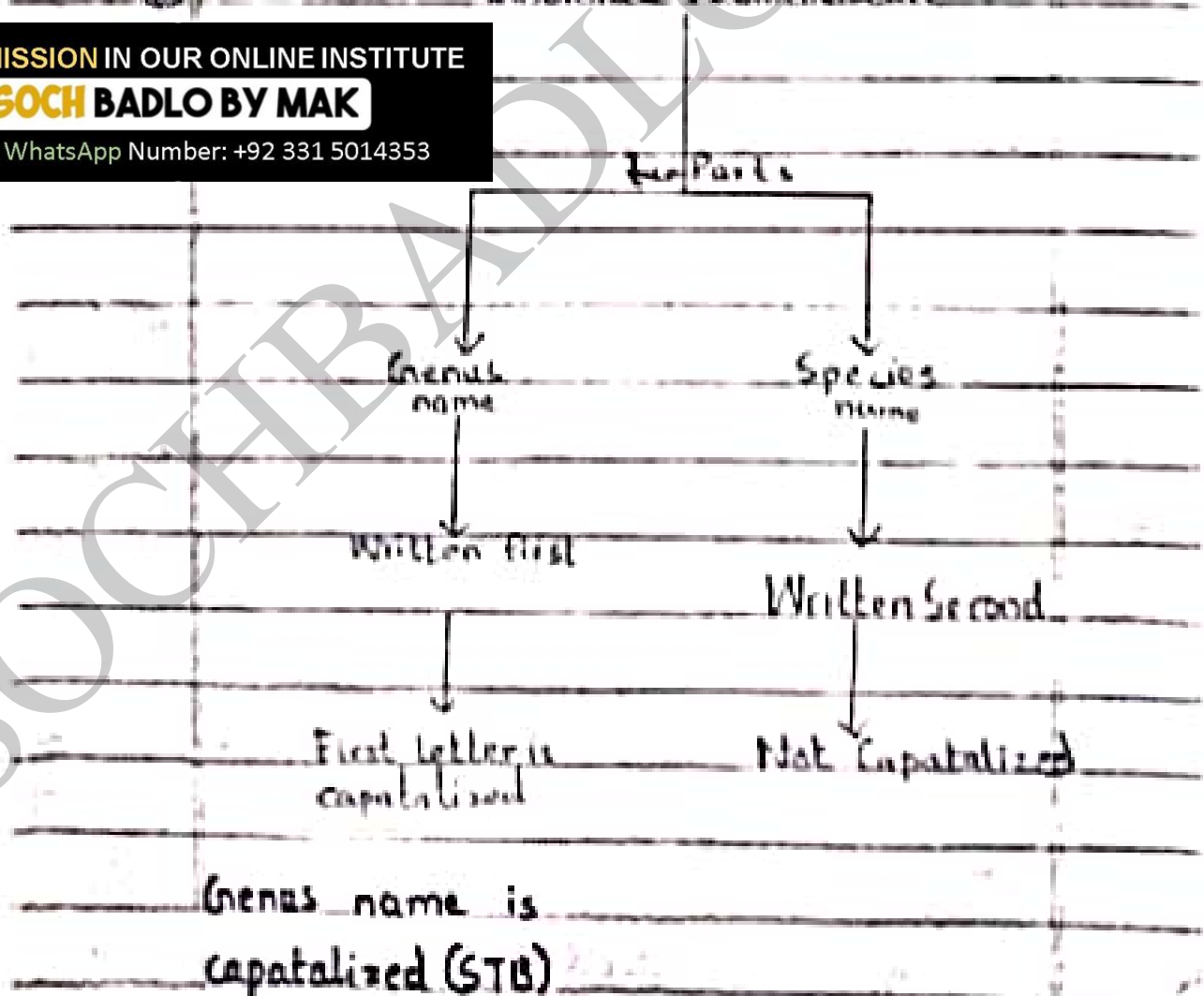
③ Latin words are used (PTB)

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⑥ Binomial Nomenclature

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Examples:-

- ① Onion → *Allium cepa*
- ② Amaltas → *Cassia fistula*
- ③ Man → *Homo sapiens*
- ④ Potato → *Solanum tuberosum*
- ⑤ Brinjal → *Solanum melongena*

Two to Five Kingdom Classification System :-

Two Kingdom Classification System:-

- ① Proposed by Carlous Lennaeus.
- ② Kingdom plantae and animalae (including ^{protista})
- ③ Plants (autotrophs), Animals (Heterotrophs)
- ④ Bacteria ^{and fungi} were included in plantae.

Defects:-

- ① Unworkable for unicellular ^{flagellar} organisms.
- ② Euglena has plant like (presence of chlorophyll) and animal like (lack of cell wall) characteristics. (PTB)
- ③ Fungi lack chlorophyll and feed heterotrophically (STB)
- ④ Bacteria and cyanobacteria are prokaryotes. (STB)

Fire Kingdom by Robert Whittaker (1969):-

- ① Based upon mode of nutrition.
- ② Before this system many system were proposed all having more than two system. (one had 18)
- ③ Involved prokaryotics, unicellular eukaryotics and multicellular eukaryotics. (STB)

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④ Eukaryotics greek word "eu" meaning true & "karyons" meaning nucleus.

⑤ Prokaryotics greek word "pro" means before.

Kingdom Monera:-

- ① Prokaryotics unicellular organisms.
- ② Feed by different methods.
- ③ For example :- Bacteria.

Kingdom Protista:-

- ① Predominant eukaryotics unicellular.
- ② Feed by different methods.

③ Examples - Euglena, Amoeba

Kingdom Fungi:-

① Eukaryotes multicellular absorptive heterotrophs.

② Feed by absorption.

③ Example:- Mushrooms.

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Kingdom Plantae:-

① Eukaryotes multicellular autotrophs.

② Feed by photosynthesis.

③ Example:- Plants.

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Kingdom Animalia:-

① Eukaryotes multicellular ingestive heterotrophs.

② Feed by Ingestion → digestion → absorption.

③ Example:- Animals.

DEFECTS:-

① Defects in kingdom protista:

- Most protists are unicellular but this system include multicellular organisms.

- Defective organisms protozoans and
- ~~Algae~~ Unicellular were included in plantae)

Five Kingdom by Margellis and Schwartz:-

- ① American biologists replaced protista by protactista
- ② Multicellular algae removed from plantae placed in protactista
- ③ Kingdom protactista include euglena, paramecium, chlamydomonas, plasmodium etc. (STB).
- ④ Primitive fungi and multicellular algae are included. (STB).

⑤ Discovery of virus

Discovery of Virus:-

→ Basic timeline.

→ For dates/years follow your board book.

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~~Edward~~ F.T.B + P.T.B + K.P.K

discovered
bacteria

Louis Pasteur and Robert Koch

↓
discovered bacteria but causative
agents of some diseases (T.M.V) were not identified.

Invented
porcelain
paper

Charles Chamberland

↓
discovered rabies via self-invented
disease (In B.T.B Chamberland
comes on top)
porcelain filter paper.

discovered
viruses

Iwanovsky

↓
did experiments from Tobacco plant and
first discovered filterable viruses

isolated
TMV

W.M Stanley

↓
isolated / crystallized TMV

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Year	Scientist	Contribution
1796	Edward Jenner	Used cowpox material to vaccinate against smallpox, demonstrating a form of immunization.
1884	Louis Pasteur	Developed a rabies vaccine using the technique pioneered by Jenner.
1892	Dmitri Ivanovski	Showed that the agent causing tobacco mosaic disease was filterable and smaller than bacteria.
1898	Martinus Beijerinck	Coined the term "virus" and demonstrated that it reproduces only within living cells.
Early 20th Century	Charles Chamberland	Invented porcelain filters which were crucial for the study of viruses.
1915 & 1917	Frederick Twort & Félix d'Hérelle	Independently discovered bacteriophages, viruses that infect bacteria.
1935	Wendell Stanley	Crystallized the tobacco mosaic virus, proving viruses consist of nucleic acid and protein.

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Characteristics of Virus:-

- ① 250nm (mopox virus) to 20nm (parvo virus)
- ② ~~20nm~~ There are 10 to 1000 times smaller than bacteria.
- ③ They are obligate intracellular parasites.
- ④ They contain enzymes for protein synthesis and gene replication but more complex ones have upto 200 genes. (STB).

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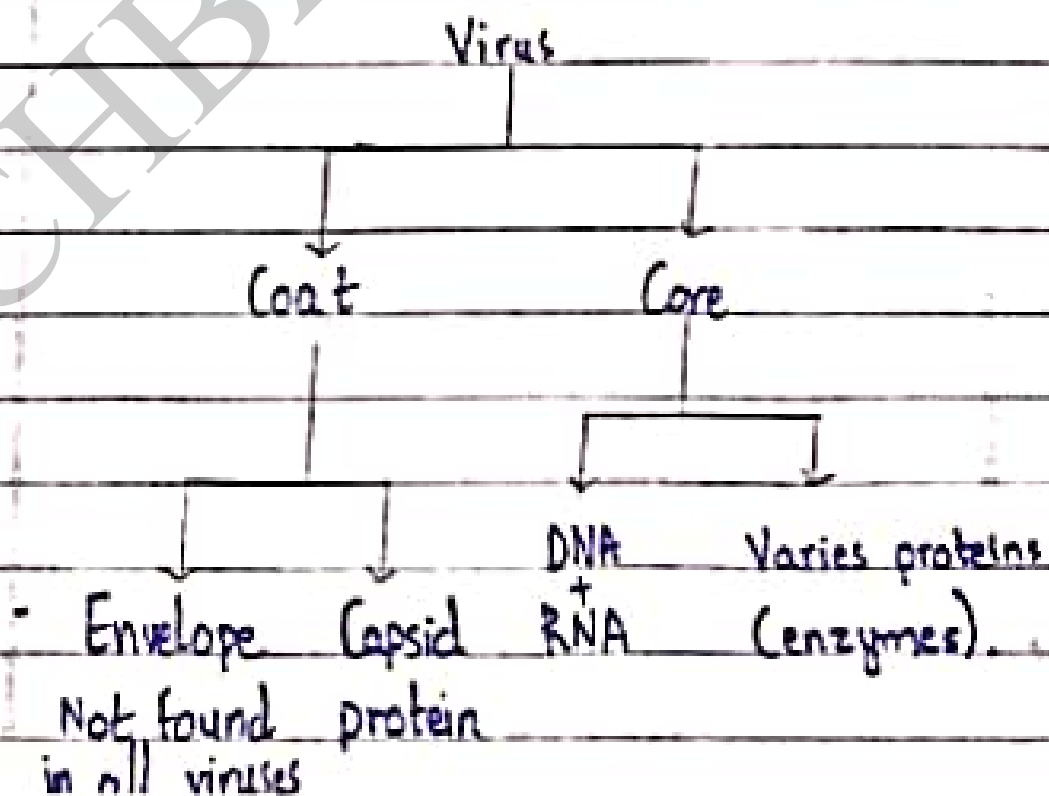
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Living Characteristics of Viruses:-

- ① Viruses occur in different varieties or strains.
- ② They have genetic material (DNA, RNA).
- ③ They reproduce using metabolic machinery of host.
- ④ They get destroyed by UV rays.
- ⑤ Intracellular obligate parasites.
- ⑥ Destroyed by chemicals. (BTB)

Non-Living Characteristics of Viruses:-

- ① They lack cellular structures enzymes and own metabolic machinery.



Coat :-

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Capsid :-

① It is a polymer made up of capsomeres (capsomers) which are monomers.

② Herpes virus 162 capsomeres

③ Adeno virus (common cold) has 252 virus.

④ Bacteriophage has capsid has 12 vertices and 20 faces. Two types of capsomeres constitute the icosahedral capsid - pentagonal (pentons) at vertices and hexons at faces. There are always 12 pentons but number of hexons varies. (FTB).

⑤ HIV capsid have 12 pentamers and 100 + hexamers. (FTB).

⑥ Number of capsomeres in polio virus is 32.

⑦ Icosahedral, polyhedral, spherical consists of 20 triangles in capsomeres.

⑧ Helical capsid is a rod shaped capsid.

⑨ - Ambideno Virus has 60 capsomeres (S-T-B)

Envelope:-

- ① Made up of lipoprotein
- ② Derived from cell membrane of host

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Spikes:-

- ① Made up of glycoprotein
- ② Has to recognize other cells.

Genomes:-

- ① DNA and RNA single stand or double strand

Core proteins:-

- ① Convert ~~small~~ ssRNA into ~~dt~~ ds
- ② Convert ssRNA into dsRNA.
- ③ Retro virus and HBV contain reverse transcriptase to convert ssRNA into dsDNA.

Group	Type of Genetic Material	Description
I	Double-stranded DNA	Uses its DNA directly to make mRNA.
II	Single-stranded DNA	Converts its single-stranded DNA into double-stranded form before making mRNA.
III	Double-stranded RNA	Uses one strand of its RNA as a template to make mRNA directly.
IV	Single-stranded RNA (Positive Sense)	The RNA itself acts as mRNA and can be directly translated into proteins by the host cell.
V	Single-stranded RNA (Negative Sense)	The RNA is complementary to mRNA and must be converted to mRNA before translation.
VI	Reverse Transcribing RNA (Retroviruses)	Uses reverse transcription to convert its RNA into DNA, which then produces mRNA.
VII	Reverse Transcribing DNA	Involves an RNA intermediate from its DNA, which is reverse transcribed back into DNA.

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NOTE

Best Suitable for
Federal Text Book

Other Boards' Texts may vary.
So, it is advisable to
crosscheck before learning.

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Viruses(Mnemonics)

DOUBLE STRANDED GENOME

Pox HBA

POX → Small Pox
H → Hepes
B → HBV
A → Adeno Virus

SINGLE STRANDED GENOME

All Other Viruses

ENVELOPED VIRUSES

Hae-PAPar

Hae → HAV & HEV
P → Polio Virus
A → Adeno Virus
Par → Parvo Virus

NON-ENVELOPED VIRUSES

All Other Viruses

DNA GENOME VIRUSES

B B - HAPPY

B → HBV
B → Bacteriophage
H → Herpes Virus
A → Adeno Virus
P → Pox Virus
P → Parvo Virus
Y → **Nothing**

RNA GENOME VIRUSES

PRIME AC

P → Polio Virus
R → Retro Virus
I → Influenza Virus
M → Measles & Mumps
E → Hepatitis-E
A → Hepatitis-A
C → Hepatitis-C

Classification of Virus (FTB) + (BTB) :-

(a) On Host :-

① Bacteriophage Virus -

(i) Attacks bacteria

(ii) DNA virus

(iii) Polyhedral head and a tail (rod shaped)

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② Plant Virus :-

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② Plant Virus:-

- (i) More than two thousand types.
- (ii) TMV (RNA genome + rod shaped capsid)
- (iii) Potato yellow dwarf virus (rod shaped capsid).

→ Plant viral diseases spread via Horizontal or Vertical transmission (S.T.B)

③ Animal Virus:-

- (i) Aphtho virus (Foot and mouth disease in livestock)
- (ii) Rabies virus cause Rabies.
- (iii) Rous, sarcoma virus cause cancer in animals.
- (iv) Arbo virus cause dengue, yellow fever, encephalitis
- (v) Papo virus (warts).
- (vi) Poxi virus (small pox).
- (vii) Picorna virus (poliohepatitis A).
- (viii) Paramyxo virus (measles, mumps).
- (ix) Orthomyxo virus (cold, flu).

(b) On Capsid:-

- (i) Helical capsid (TMV).
- (ii) Polyhedral capsid (Adeno virus).
- (iii) Enveloped Virus (Influenza).
- (iv) Complex Capsid (Bacteriophage)

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(c) Onconome:-

- (i) dsDNA:- small pox virus
- (ii) ssDNA:- mild rash virus
- (iii) dsRNA:- diarrhoea virus
- (iv) ssRNA serves as mRNA: rubella virus
- (v) ssRNA: templates for mRNA synthesis:-
Influenza virus
- (vi) ssRNA templates for DNA synthesis:-
HIV

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Classification of Virus (STB):-

① Unenveloped ^{plus} Stranded RNA Virus:-

① ^{plus} stranded RNA:-

They act directly as mRNA.

Examples:- polio virus, rhinovirus, Cold

② Enveloped ^{plus} stranded RNA:- Virus:-

HAV and HCV

:- They contain envelopes

③ Minus Strand RNA:- Virus:-

:- Minus strand RNA is complementary to mRNA.

:- Rhabdo virus (Rabies, pox virus)

④ Retro Virus:-

- Contain reverse transcriptase
- Example:- HIV (ssRNA)
- HBV (dsDNA)

⑤ dsRNA-

- Reo Virus

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⑥ Small genome DNA Virus:-

- For Example:- Parvo Virus.
- 20nm in diameter cause hepatitis and warts.

⑦ Medium and large genome DNA Virus:-

- For Example:- Herpes Simplex Virus

⑧ Bacteriophage:-

- DNA Virus

More than 200 old types of old virus.

Parasitic nature of Virus: **FTB/BTB**

- They are highly specific to their host.
- Bacteriophage → Bacteria
- TMV → Tobacco plant.
- Rabies Virus infect mammals.

In Humans:-

- HIV → WBCs
- Poliovirus → Spinal Nerve cells.
- Hepatitis Virus → Liver
- Cold → Respiratory Tract

Fact:-

- Non-enveloped viruses can survive more outside the host than enveloped viruses.
- Enveloped viruses rely on proteins on their surface which are sensitive to degradation by sunlight and normal cleaning procedure.

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Small pox: Smallpox, which is caused by pox viruses (the DNA enveloped virus) is an ancient disease that is known to have occurred as epidemic in China as early as the twelfth century B.C. Until the early twentieth century, small pox was a common disease throughout the world. In small pox, raised fluid-filled vesicles are formed on the body which become pustules later on and form pitted scars, the **pocks**. By 1950's immunization and other control measures had largely decreased the danger, but it is still present in the third world countries where many people are affected. In 1980, it was declared by World Health Organization that small pox has been eradicated from the world.

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Mumps and Measles: Mumps and Measles viruses belong to group **paramyxoviruses**. They are large, enveloped, RNA viruses. Mumps is highly contagious, wide spread, but seldom fatal. About 60% of adults are immune to it. Measles is one of the commonest diseases of the childhood and adult human population is equally susceptible the world over. This disease develops immunity in its victim.

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Coronaviruses:

Large family of viruses that cause illness ranging from common cold to severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS). A novel [>] coronations (nCoV) is a new strain that has not been identified in humans.

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5.2.2 Survival of viruses inside a host cell

However, host body has a strong defence against viruses but viruses respond the host immune system by inhibiting the actions carried out by immune system (discussed in chapter 13) and by changing their own genetic constitution so rapidly that vaccines or antibodies of host against them become ineffective. These are different ways that how a virus survives inside a host cell, protected from immune system.

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5.5.1 Virus Evasion of Immune Responses

Viruses have evolved many mechanisms by which they can tackle the immune system. Some of the prominent ways are as under:

- Any foreign agent entering the body faces phagocytosis which is carried out by macrophages and neutrophils. In certain viruses capsules, protein, and fibrin coats do not bind the adhesion molecules used by macrophages and neutrophils so they are safe from being phagocytosed
- Some viruses cover, like bacteria, their cell walls with host proteins. So in this way body immune system is unable to recognize them as foreign body.
- Many viruses produce mutants (antigenic variations) at regular basis. A vaccine developed to control the spread of one mutant virus becomes ineffective against the new mutant so controlling them is a continuous challenge. For example influenza virus and HIV.

Bacteriophage Viruses:-

→ Phage meaning eating so bacteriophages are bacteria eating.

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→ Size:-

→ Discovery:-

* Discovered by Friedrich as he observed that bacteria population gradually decreased.

* Bacteria species were: E. coli **PTB**

* Named by D. Hershey.

Shapes

→ Tadpole Shaped **(F.T.B + P.T.B) (S.T.B)**

→ ~~Col~~

S.T.B states that they are made up of 5 different proteins which make up

i) Head

ii) Tail

iii) Molecules of capsid

iv) Base plate + tail fibres

v) A long DNA coiled within the head.

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Size of Bacteriophage:-

→ They are 24 - 200nm in length.

B.T.B + K.P.H

→ Volume of phage is 1/1000 of its host **P.T.B**

Types **P.T.B**

→ T₂ and T₄ phages

→ T₄ are mainly used in studies.

→ T stands for type.

Head :- (Nucleocapsid)

→ Icosahedral in shape **F.T.B**

→ Some heads are filamentous **K.P.K**

→ Elongated pyramidal (having two triangular

structures with a common base),
hexagonal, prism-shaped, (P.T.B)

Coat of Head:- (BTB)

Hexagonal shaped

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Core of Head:-

- Consists of ssDNA genome **[F.T.B]**
- Consists of dsDNA genome **[P.T.B]**
- Consists of DNA or RNA **[B.T.B + P.T.B]**
- No. of genes in a bacteriophage genome are from few to over 100 **[B.T.B]**

Neck/Collar:-

- Narrow
- Separate head from tail
- Not covered by sheath

Tail:-

- Hollow tube made up of proteins through which nucleic acid can pass through infection.

- Covered by Sheath (contractile protein).
- Sheath contracts during infection.
- Tail is not present in all phages **K.P.K.**

Base plate and Fibres:-

- Distinctive feature of T₄ phage **K.P.K.**
- Single base plate having numerous pins.
- Six tail fibres
- Lysozyme is present in base plate **B.T.B.**
- Lysozyme is present in the end of core tube of tail **F.T.B.**
- Serve in attachment.

Notes (F.T.B):-

- Prophage contains many genes and when a cell gets lysogenized, extra genes get expressed in the host.
- This process is called lysogenic conversion or phage conversion.
- For Example *Clostridium Botulinum* a bacterium that causes food poisoning make several toxins, two of which are encoded by prophage genome.

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Life Cycle of Phage

→ Lytic cycle and lysogenic cycle

→ Initial steps of both cycles

(P.T.B) (F.T.B) (S.T.B)

* Also called Infection process

* Same for both cycles.

* Cycles are named Lytic or lysogenic depending upon replication in host.

a) Adsorption:-

→ Phage ~~now~~ attach to specific receptors on the host

→ This step is mediated by tail fibres and tail pins

b) Penetration:-

→ Sheath contracts → releases lyszyme → digests bacterial envelope and a hole is made

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- The tail is inserted/penetrated via hole. as the name shows penetration

c) Genome injection:-

- Viral DNA is injected in the host cytoplasm which further carries out lytic or lysogenic cycle.

- Remaining of Phage remains outside which is called ghost

S.T.B

Lytic Cycle:-

- Bacteriophage = T₄ / Bacteria = E. COLI.

- Bacterial colonies are destroyed in a few hours

S.T.B

- Also called Lytic / Virulent Phage.

- Master-Slave Relationship is developed.

- Host DNA is disintegrated by DNase.

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→ Viral DNA has undergone modification therefore such enzymes do not effect it

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→ Viral DNA now hijacks the host cell.

→ Following steps occur for replication

i) Synthesis of Phage components:-

→ Phage specified mRNAs and proteins begin to produce soon after disintegration of host DNA.

→ Structural Proteins (head, tail) that comprise the phage as well as well as the proteins needed for lysis of host cell are synthesized separately.

ii) Assembly:-

Nucleic acid is packaged into the head and a tail is added into the head

iii) Maturation:-

After assembly, phages are matured

into pure infectious particles

• Within 20-24 min approximately 200 phages are produced

• Approximately (100-200) phages are produced **S.T.B**

iv) Lysis and Release:-

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→ Phages again release Lysozyme that digest the cell wall

→ Phages are released into the medium.

v). Examples:-

ly phage

Lysogenic Cycle:-

→ Bacteriophages that perform lysogenic cycle are called lysogenic or temperate phages

→ Multiply via lytic cycle or enter

a dormant state in the cell

→ It develops host guest relationship

i) Integration:-

→ Viral DNA integrates into the host DNA.

→ Host Integrated state of Phage DNA is called prophage.

ii) Replication:-

→ Phage DNA is replicated along with host DNA and passes to daughter cells.

→ This process is called lysogeny and the bacteria (lysogenic bacteria).

iii) Example:-

Lambda (λ) DNA.

- also used as vector.

→ **Induction:-**

a Termination of lysogenic state of bacteria is called Induction.

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→ Conditions for Induction:-

→ denaturation

→ Exposure to UV or Ionizing radiation

→ Exposure to mutagenic chemicals.

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Uses of Bacteriophages In Genetic Engineering

[F.T.B]

→ They are used as vectors for carrying genetic information from host to donor to host.

→ They are used in development of genomic library (a collection of bacteria or phage clones which contain multiple copies of all gene of an organism.)

→ Phage therapy is the application of genetically engineered phages that kill pathogenic bacteria. It is better than Antibiotic therapy because antibiotics have a broad range while phages have the ability to kill specific bacteria without killing normal good bacteria.

- Bacteriophages are used for as antibacterial nanomedicines in which they are used as targeted drug-delivery vehicles.

AIDS / HIV :-

- Better for (K.P.k) (Sindh) (P.T.B) :-
→ extracted from B.T.B / F.T.B

a) Discovery :-

S.T.B

- HIV was discovered in 1985

F.T.B / B.T.B / P.T.B

- It was identified in 1984 by research team from Pasteur Institute in France and National Institute of Health in U.S.A

- Named as H.I.V in 1986.

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→

Receptor Cells

(B.T.B) (F.T.B) (K.P.K) (Sindh)

→ Main Receptors are T_H (Helper T cells) and
or CD_4 Cells (CD_4 = Cluster of differentiation)

→ Both Helper T cells and killer T cells are effected

→ Other receptors are Macrophages, lymphocytes.

→ Some brain cells are also effected **(F.T.B)**

K.P.K additional info
regarding immunity:
Lymphocytes (WBCs)

B cells

release antibodies

T cells (CD_4 cells)

directly attack
infected cells

Helper T cells

recognize antigens
and activate killer
T cells

killer T cells

destroy the
antigen

Structure of HIV:-

Size:-

A. 120 nm in diameter

A.T.B

K.P.K

R. 100-150 billionths of a meter
in diameter

Same as 0.1 micron / 100,000th of an inch

One twentieth of length of E. coli

One seventh of diameter of human CD4 or T_H cell

Structure/Morphology:-

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1) It is a retro virus

2) It is spherical in shape

3) Outer covering is a lipoprotein Envelope which consists of two layers of lipids

4) The two layers of lipids are

→ Spikes are 72 in number

K.P.K

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SPIKES

glycoprotein gp 120

needed to attach
to host cell

transmembrane gp 41

critical in cell fusion
process→ gp is a stands for protein length **[kPp]**

• Beneath envelope matrix proteins are present

• Matrix proteins are P17 **[kPp]**

• HIV capsid is conical in shape which is shaped somewhat like a sphere.

• HIV core is made up of P24 proteins **[kPp]**

→ P stands for protein number is P17/P24

→ Its genome is made up of two single strands of HIV RNA.

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Core Enzymes are

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i) Reverse Transcriptase :-

Converts Viral
RNA genome to Viral DNA genome.

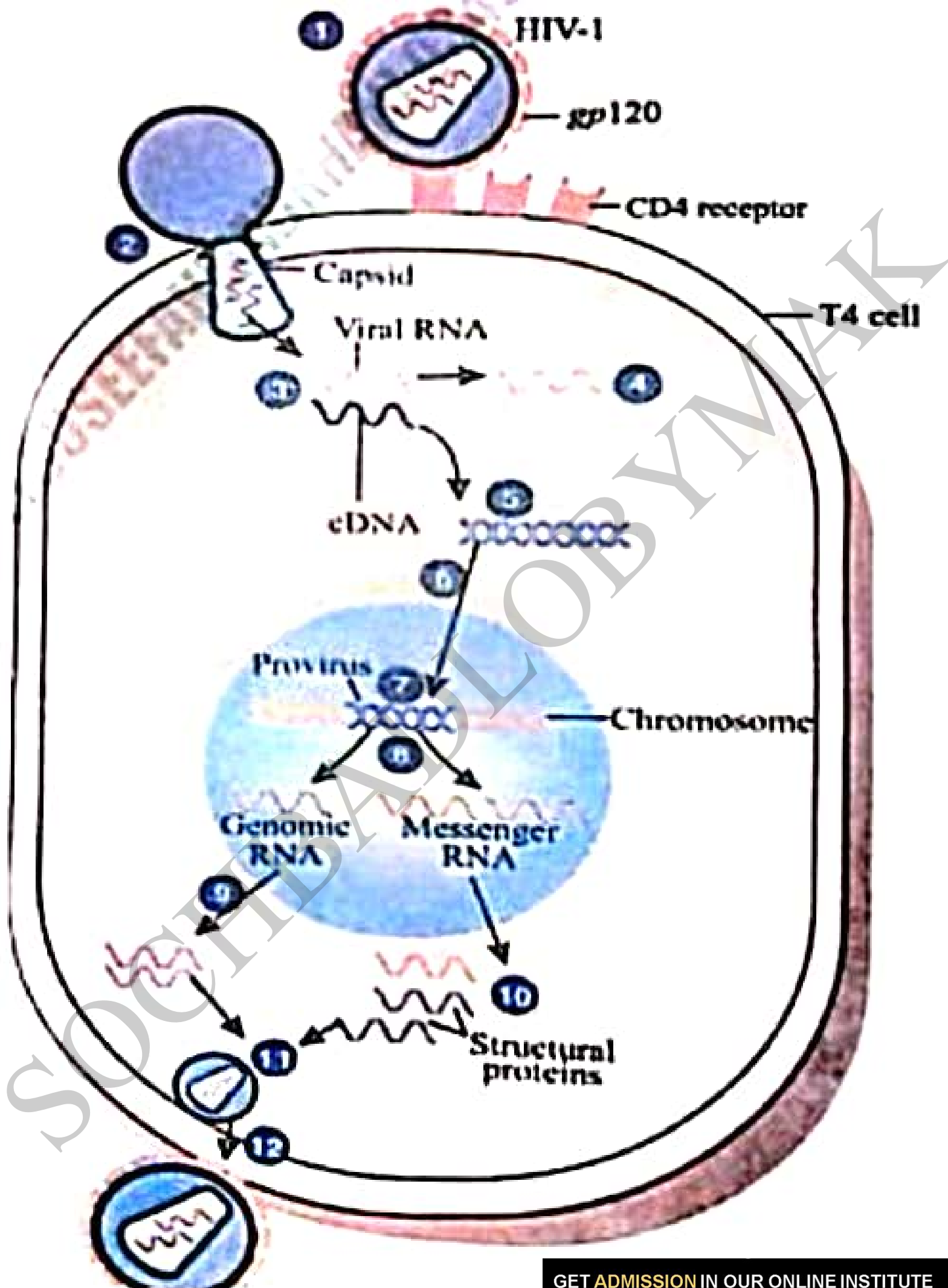
ii) Integrase :-

Incorporates Viral DNA into
Host DNA.

iii) Protease :-

→ Break large structural proteins
into smaller subunits.

→ These structural proteins are encoded by
three out of nine viral genes.



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Life Cycle of HIV :-

For All Boards
(Extracted from F.T.B)

→ < Step-I

Adsorption of HIV to CD4 receptor
cells via gp120

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→ Step-II

- Fusion of HIV via gp120 spike.
- uncoating of HIV occurs
- Viral RNA injected in cytoplasm of host.

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→ Step-III

Reverse transcriptase is used to convert ssRNA to ssDNA called complementary DNA. based upon

→ Step-IV

After reverse transcription, genomic RNA is disintegrated by RNAse reverse Transcriptase Enzyme

→ Step V:-

The is complementary.
DNA is replicated to form
ds cDNA

→ Step VI:-

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→ ds cDNA integrates into host DNA
via integrase Enzyme

→ Step - VII:-

The integrated DNA
is now called Provirus

→ Step - VIII:-

Viral mRNA is
now transcribed from the proviral
DNA by the host cell RNA Polymerase

→ Step IX:-

Not only viral mRNA
are transcribed during this transcription
but viral genomic RNA is also
produced

→ Step X:-

→ Viral mRNA are translated by host ribosomes into large proteins.

→ These are then cleaved by viral ~~integrase~~ to form protease to form virion structural particles.

→ Step XI:-

Assembly and maturation.

→ Step XII:-

→ Virions are released by budding off from host cell.

→ They enclose a portion of host cell membrane.

→ Host cell size decreases so that it may become non-functional.

Effects of HIV

→ Helper T-cells regulate immunity, decrease in T cell number decrease immunity.

[F.T.B]

→ Effect Brain cells so dementia may occur in 50% of cases i.e. loss of memory, mental agility and behavioural changes.

[S.T.B]

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Symptoms of AIDS:-

→ 1-2% of HIV infected persons will develop AIDS each year. **[S.T.B]**

→ 5-10% of AIDS people will develop symptoms each year. **[S.T.B]**

→ Cause of death is a rare type of pneumonia **[S.T.B]**

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1) Asymptomatic carrier:-

→ Fever → chills → aches → continued pain
→ Swollen lymph glands → itchy rash

* No symptoms disappear after some days and no other symptoms for nine months or longer.

* HIV test becomes positive during this period.

ii) AIDS related complex:-

→ Swollen lymph glands in neck, armpit of groin that persists for months.

→ night sweats, cough, fever, persistent diarrhoea, loss of memory depression.

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iii) Full Blown AIDS

→ immune system is suppressed.

→ Stage of opportunistic disease.

→ loss of weight, weakness, diarrhoea.

Opportunistic diseases:-

→ Skin infection

→ fungal infection

→ Viral infection

→ Respiratory infection

→ Nervous system disorder

→ Eye diseases.

→ Kaposi's sarcoma (skin cancer) **S.T.B + B.T.B**

→ Cervical cancer and cancer of lymphatic system **B.T.B**

Treatment of AIDS

P.T.B

- New vaccine against HIV has been synthesized and its experimental administration in humans started in early 2001 in South Africa.

P.T.B

S.T.B

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- Two lines of research
- a) Drugs developing to control the disease
 - b) Vaccine to prevent the disease.
- Both researches are at their initial stages.

Drug administration:-

- (i) Best known drug used by 1987 was azidothymidine or zidovudine (formerly known as AZT) which slows disease progression especially in brain.
- (ii) Ribavirin is used as antiviral drug
- (iii) Antiparasitic drugs are used to (sumarin) are used to inhibit viral replication.

(F.T.B + B.T.B):-

- Antiretroviral therapy (ART) **[FTB]** or highly active antiretroviral therapy i.e. (HAART) **[BTB]** is a combination of medicines given.
- Helps patient to live a normal life.
- Lessens quality of life.
- It is toxic, costly.
- Strict daily pill taking.

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Transmission of AIDS

[B.T.B + S.T.B]

i) Sexual contact:

- 90% of HIV is transmitted by sexual contact.

ii) Via Blood/Serum.

- a) Intravenous drug users spread HIV by using unsterilized syringes.
- b) Blood transfusions with HIV infected blood.
- c) Cuts and open wounds come in contact with HIV blood.
- d) From Mother to newborn via pregnancy.

during delivery or breast feeding.

→ Can spread via blood razors etc

Prevention

→ Don't use unsterilized syringes.

→ Blood transfusions should be screened.

→ Don't share blades, razors, toothbrushes, towels with AIDS person.

→ Surgical instruments must be properly sterilized.

→ Refrain from immoral sexual activities.

→ Mothers having HIV should not feed their babies.

Notes :-

AIDS is not transmitted by :-

→ coughing, sneezing, hugging.

→ Inanimate objects i.e door knobs etc

→ By Mosquitoes.

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KPK Board :-

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Structure of flu Virus:-

Different shapes from round balls to long, spaghetti like filaments.

Genome of virus consist of five different viral proteins and surrounded

< by lipid membrane. >

Eight separate pieces of RNA are present which is 12000-15000 nucleotides.

Each piece of RNA specifies the

... .. of

Genra/Types of Influenza:- **K.P.K**

• Influenza A, Influenza B, Influenza C.

• Influenza A and C.

These cause infection in different vertebrates including humans.

• Influenza B:

exclusively affects humans.

Vaccination / drugs:- **K.P.K**

→ Vaccines and drugs are available for Influenza virus.

→ But viral flu viruses develop resistance in these genes.

→ So new vaccines and drugs have to be formulated.

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Hepatitis:-

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→ Inflammation of Liver

→ Chronic Hepatitis

[F.T.B]

→ recent infection

→ Relatively Rapid onset

→ Slowly progressive forms

→ long period of time

Acute Hepatitis

[F.T.B]

→ Recent infection

→ Relatively rapid onset.

→ Caused by viral infection

→ Rarely caused by toxicity of drugs.

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VIRAL Diseases

Name	Common Name	Incubation Period (K-P)	Cause	Transmission	Symptoms	Treatment	Prevention	Vaccine	Additional Board discrepancy
Hepatitis A	Infectious Hepatitis	2-6 weeks	HAV	Facial-oral route → when a person comes in contact with faeces	Fever, loss of appetite, nausea, jaundice, vomiting, Dark urine / Pale faeces are also seen.	Antiviral therapy is available.	Observation of proper hygiene	Inactivated HAV vaccine is available.	
Hepatitis B	Serum Hepatitis	4-20 weeks	HBV	→ Via blood → sexual contact → Mother to newborn → saliva (B.T.B)	Same	Alpha interferon is effective → nucleoside analogs are used (B.T.B)	All blood transfusions should be screened	Recombinant DNA vaccine	→ May cause liver cancer and death → Common in Asia, China, Middle East, Africa → HBV genome has 3.5 kb nucleotide → 500 million

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Name	Common Name	Incubation Period	Cause	Transmission	Symptoms	Treatment	Prevention	Vaccine	Additional
Hepatitis C	Infection Hepatitis (non-A non-B) hepatitis (P.T.B)	2 to 26 weeks	HCV	via blood → S.F.B i) blood ii) mother to child iii) sexual contact	Same	→ Combination of α interferon and ribavirin → Proven to eliminate virus in 50% of infected people (KPH)	→ Blood transfusions should be screened	No vaccine	→ May cause chronic hepatocellular carcinoma and death (B.T.B)
Hepatitis D	Delta Hepatitis (B.T.B)	-	Virail (only human disease)	→ Blood → serum transfusion	Same but more severe	→ Combination of α interferon	→ Blood transfusion should be screened	→ HBV vaccine	→ Virial RNA enters cell by enclosing itself with the capsid that contain HBV binding proteins (P.T.B) → It is treated by blocking HBV (B.T.B)
Hepatitis E	Pig Hepatitis	-	HEV	→ Faecal oral route → contact with faeces	Same as HAV	→ No antiviral treatment	→ Observation of proper hygiene	No vaccine	→ Hal Baur and co-workers revealed that pigs could be the source HEV (P.T.B) in 20 → Can be lethal during pregnancy (B.T.B)

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Hepatitis (Extra Reading Material)

Hepatitis F virus (HFV) is a hypothetical virus linked to hepatitis. Several hepatitis F virus candidates emerged in the 1990s; none of those reports have been substantiated.

Another potential viral cause of hepatitis that is probably spread by blood and sexual contact was initially identified as Hepatitis G virus. There is very little evidence that this virus causes hepatitis, as it does not appear to replicate primarily in the liver. It is now classified as GB virus C.

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5.5.2 Herpes Simplex

Herpes simplex is a superficial viral infection characterized by one or more painful, fluid-filled sores or blisters (an elevation of the skin) appear on the skin or epithelium of outer openings of the body. Tingling, itching, or burning may be felt on the skin before the blister appear. Blisters break open and often ooze fluid and form a crust, before healing. The sores can last from 7 to 10 days. There are two primary types of herpes i.e., oral herpes and genital herpes.

Sl. No.	Common Name	Incubation period	Cause	Transmission	Symptoms	Treatment	Prevention	Vaccine	Additional
49 Herpes Type-1	Oral Herpes → Cold Sore (BTS)	-	HSV-I	→ via oral secretions and physical contact with sores on skin → sharing utensils, toothbrushes	→ Blisters appear on lips or around mouth → sometimes on face or in tongue	→ Antiviral drugs	→ Avoid contact with affected area of patient	-	-
50 Herpes Type II	Genital Herpes	-	HSV-II	→ Sexual contact with person having HSV-II	→ Sores around penis, vagina, buttocks, anus	→ Antiviral drugs	→ Avoid contact with affected area of patient	-	-

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Name	Common name	Incubation period	Cause	Transmission	Symptoms	Treatment	Prevention	Vaccine	Additional
Polio Virus discovered by Karl Landsteiner in 1908.	Polio disease	5-35 days (7-14 days average)	Polio virus	Faecal-oral route	→ Paralysis of muscle → infantile paralysis (IPV) → non paralytic polio causes flu like symptoms → Paralytic polio causes paralysis	→ No antiserum - Treatment → Free therapy is important	→ Take vaccines → Don't run from them	(A) i) Killed ii) IPV iii) Salt vaccine (B) i) Live ii) Attenuated iii) Weakened iv) OPV vaccine → 90% effective	→ Polio virus is an enterovirus (F.T.B) → M.O.A (F.T.B) → Replicate in oropharynx and respiratory tract → Spread to muscles and CNS → Causes breakdown of motor neurons innervated with these structures
Cotton Leaf Curl Disease	(Lett)	2-3 weeks (KPT)	Begonia virus	Dysentery	→ Development of cupping of leaves → Development of up-shaped leaf like symptoms	→ Use of Bt → Using insecticides to control white fly	→ Use insecticides to control white fly		→ First reports in Malton in 1985

→ Bird Flu (B.T.B)

→ Also called Avian Influenza

- Infects not only birds but humans and other mammals

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→ However most forms are restricted to birds

★ H5N₁ bird flu:-

i) Most common form of bird flu

ii) Also occurs in humans and other primates

iii) H5N₁ are capable to survive for a period of time.

• Transmission:-

i) Infected birds continuously release the virus in their faeces and saliva

ii) When healthy birds come in contact with above mentioned faeces and saliva, they are infected.

1. ...

... cough, diarrhoea, fever, headache

... ...

2. ...

... ... especially ...
... and ...

... cases have been reported in
... ..

PRIONS And Viroids

... STANLEY PRUSHER convinced
majority of biologists that these particles
exist.

Prions:

i) Infectious infectious particles

ii) Smaller than viruses

iii) No nucleic acid (unlike RNA)

iv) Much MORE RESISTANT to
UV rays ^{and heat} than viruses

v) Have a single protein

vi) This protein is encoded by singular
cellular genes

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- e.g. Neurodegenerative disease such as
PRURO in humans and cattle
< have Mad Cow Disease. [FT.B]>
→ Scrapie (cattles), LJD, GSS, FFI, Alpers
Syndrome [KP.K] + [B.T.B]

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Scrapie:

CNS of sheep and goats is affected.

Unhygienic way of feeding.

Human diseases:

CJD: creutzfeld-jacob disease

fatal degenerative disorder. Memory problems, behavioural changes, poor coordination, visual disturbances.

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GSS: Gerstmann-Straussler-Scheinker

Rare genetic degenerative disorder of brain. Common symptom is loss of coordination; unsteadiness of gait, difficult walking, dementia, clumsiness.

FFI: Fatal Familial Insomnia

Rare sleep disorder. Affects thalamus. Insomnia, speech problems, dementia.

Alpers Syndrome:

Neurological disorder. Increased muscle tone with exaggerated reflexes(spasticity), seizures, dementia.

Viroids

(K.P.K.)

→ First Viroid discovered (Potato Spindle tuber disease)

→ Plant Pathogens except Hepatitis D

→ Genome has short, circular, single stranded RNA

→ No protein coat

→ Viroid RNA doesn't code any proteins

→ RNA polymerase synthesizes a new RNA from Viroid RNA template.

→ Some viroids are enzymes (ribozymes) which slow cellular cleavage.

→ ex. Cause diseases in Potato, Ground Apple, peach.

→ ~~Ex. viro~~ Potato spindle tuber disease,

Cucumber pale fruit, citrus exocort disease

and Cadang Cadang disease of coconuts.

(B.T.B + K.P.K.)

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B.T.B. Viroid additional Information

- Viroid first discovered by T.O. Diener in 1971
- Single molecules of circular RNA
- Having 246-270 nucleotides

VIROID:

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- Perfect, mature virus is called virion (F.T.B)
- Range in size from 20nm (0.00000002) meter to 250 nanometer.