

2nd position
2016-17

Medical & Dental Admission Program-2020

BIOLOGY

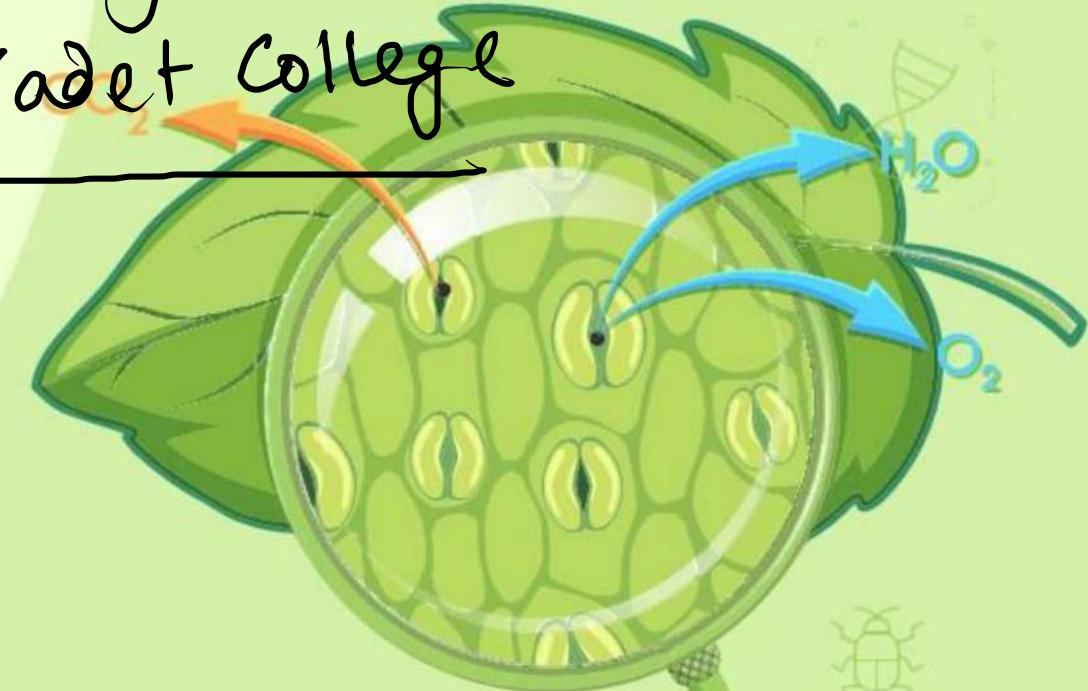
Lecture : B-01

Chapter 04 : Microorganisms

Shuvo Mohajan
DMC, 4th Year

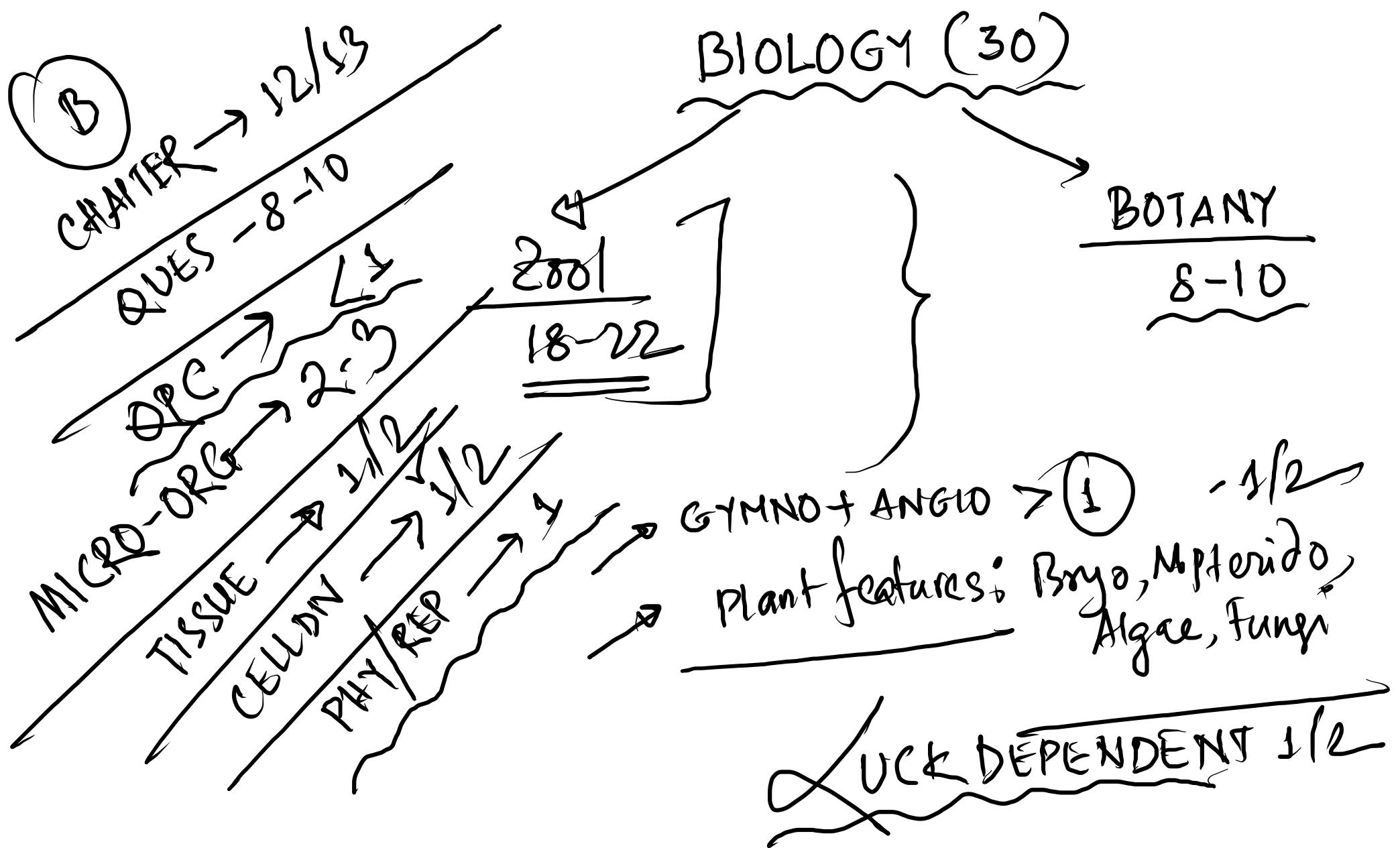
HSC ; Faizdorhat

Cadet College



Important topics from this chapter for Medical and Dental admission test:

	Topics	Admission test years
●●●	Virus	MAT: 19-20, 18-19, 13-14, 12-13, 09-10, 08-09, 05-06, 03-04; DAT: 17-18, 10-11, 09-10, 07-08, 06-07, 05-06, 02-03, 00-01
●●●	Economical importance of Virus	MAT: 17-18, 16-17, 15-16, 13-14, 09-10, 07-08, 04-05, 02-03; DAT: 19-20, 04-05, 02-03
●●●	Viral diseases	MAT: 14-15; DAT: 16-17, 05-06
●●●	Bacteria	MAT: 17-18, 15-16, 12-13, 11-12, 10-11, 07-08; DAT: 02-03
●●●	Economical importance of Bacteria	MAT: 15-16, 14-15, 13-14; DAT: 18-19, 17-18, 16-17, 09-10
●●●	Malaria parasite	MAT: 13-14, 12-13, 11-12, 09-10, 07-08, 06-07, 05-06, 04-05, 02-03, 00-01; DAT: 18-19, 09-10, 08-09, 06-07, 05-06



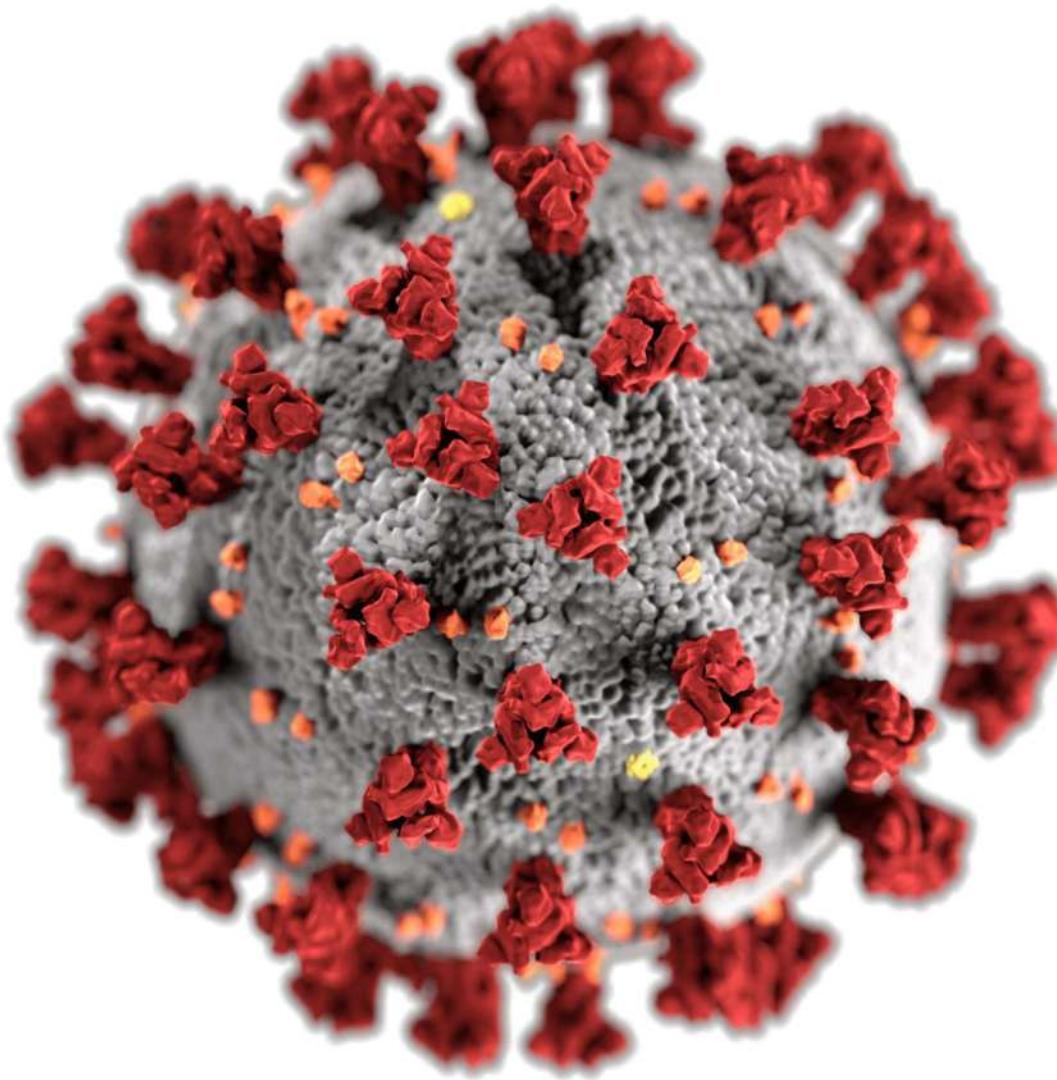
BOTANY QUES PATTERN: ???

→ Characteristics *** 100%

→ DIFFERENCE *** 100%

→ Examples Book + Exam Ques solve

Virus



out of body

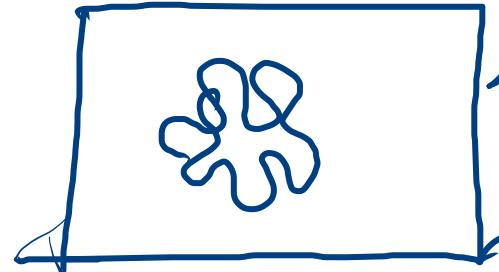
Inert / Chemical properties:

- ❖ Virus body doesn't contain cellular characteristics like cell wall, cell membrane and cytoplasm, that's why virus are **acellular and ultra-microscopic**. They do not have cytoplasm, cell membranes, cell walls, ribosomes, and mitochondria. They have no metabolic enzymes and nutrients.
- ❖ Virus does not have reproductive power independently without the help of the cell.
- ❖ **The virus is not filterable in bacteria-resistant filters.**
- ❖ Virus can be crystallized, centrifuged, dissipated; suspension can be made mixing with water and frozen.
- ❖ The virus is inactive as a chemical particle outside the cell. There is no physical growth of virus.
- ❖ **Virus is resistant to acids, alkali and salt, and antibiotics cannot act on their body.**

Out of living body

VIRUS

→ non living
chemical
compound



RIBO X → NO PRO

MITO X → NO ATP

CHLO X → NO FOOD

I want
to have
my children

VIRUS

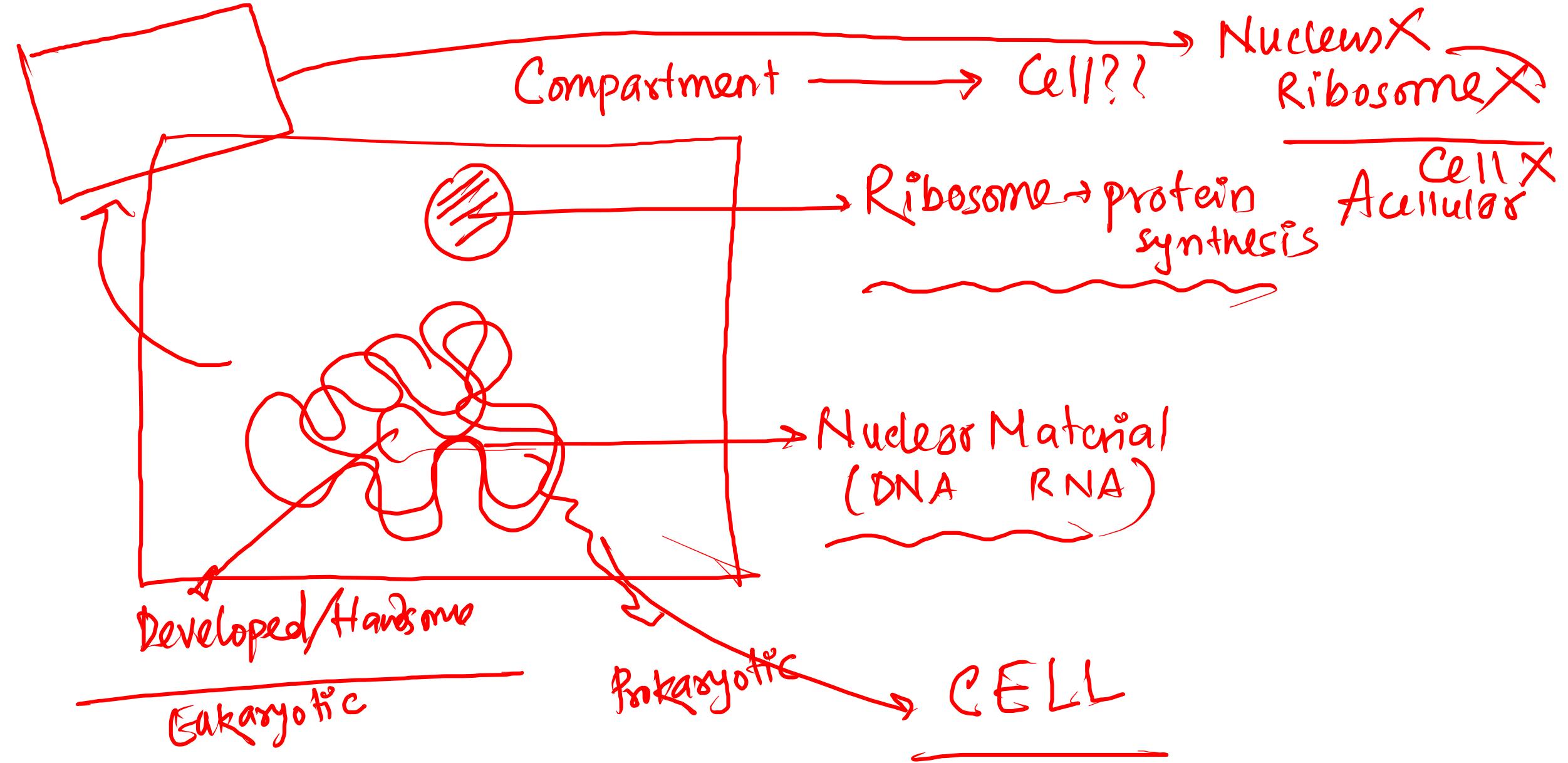
SOS

LIVING CEL

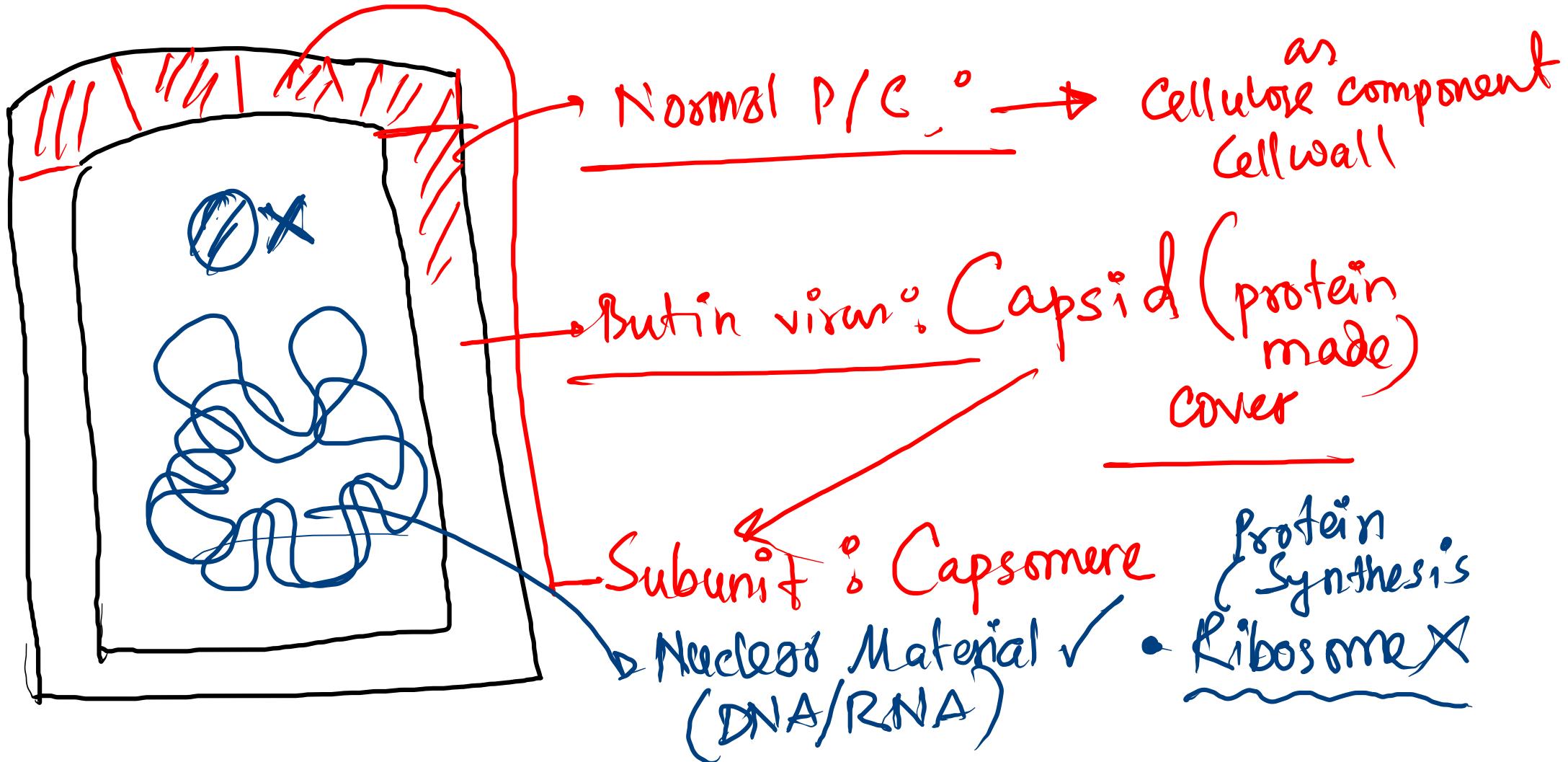
food

ATP





VIRUS → Only Acellular micro-organisms



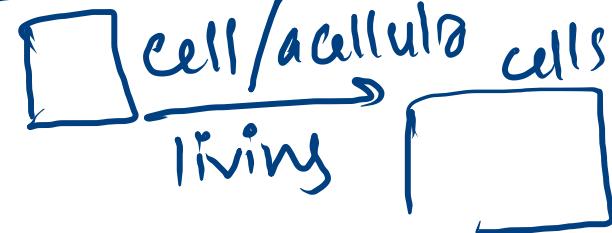
Living characteristics

- ❖ Viruses can multiply inside host cell.
- ❖ The new virus maintains the properties of the parent virus.
- ❖ Structurally, there are nucleic acids (DNA or RNA) in the virus.
- ❖ Virus is a precisely obligatory parasite.
- ❖ Virus is able to cause mutation and make variations.
- ❖ Genetic rearrangement is seen to happen.

reproduction

living as

parasite ↗?



Structure of Virus :

Nucleic acids (central component): DNA/RNA.

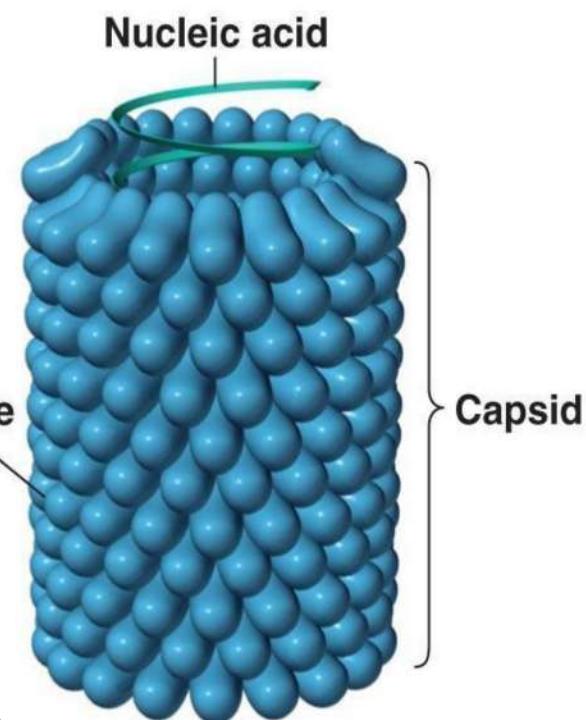
Generally there is RNA in plant virus and DNA in animal virus.

Capsomere

Protein (Capsid): Capsid protects the inner materials (DNA & RNA) and they act like antigens too.

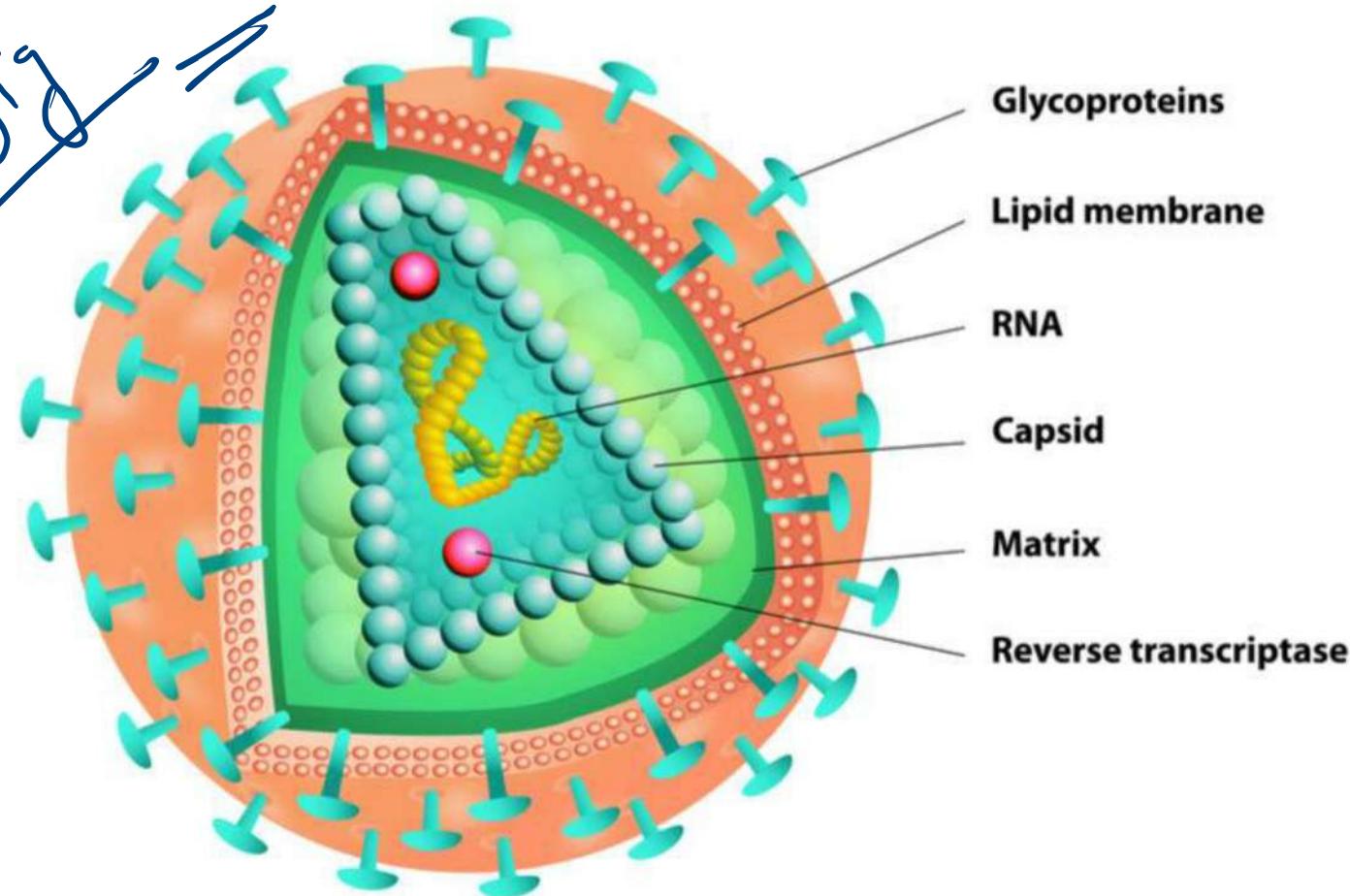
Outer covering: Such as Influenza virus, Herpes virus, HIV.

Enzyme: Virus body doesn't always contain enzyme



Follow us book's
Fig

STRUCTURE OF THE HUMAN IMMUNODEFICIENCY VIRUS (HIV)



Contributions of the scientists:

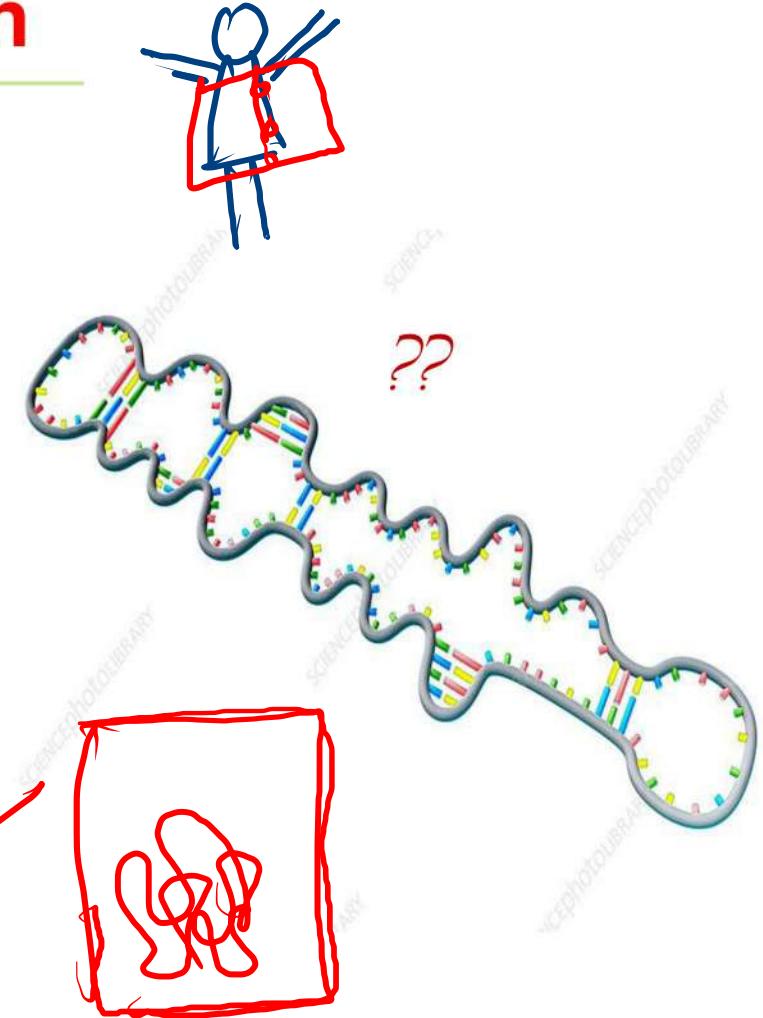
~~W. Reed~~ Reed = Yellow Fever Virus

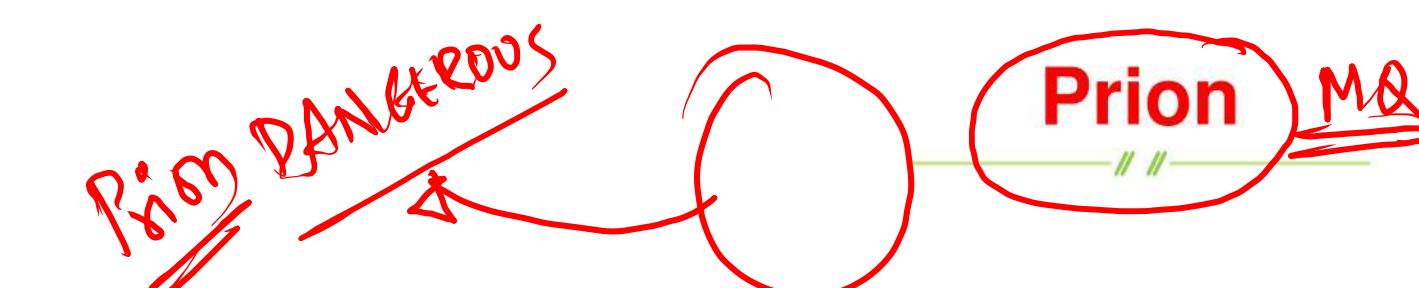
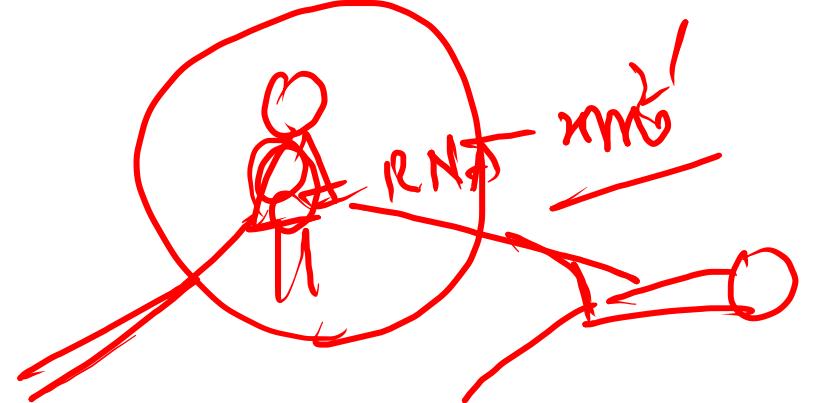
ScientistZ	Contribution
Beijerinck	<ul style="list-style-type: none"> Coined the term virus.
Dmitri Ivanovsky	<ul style="list-style-type: none"> Proved that Tobacco Mosaic Disease is caused by virus. He is the discoverer of Virus.
Wendell Stanley	<ul style="list-style-type: none"> Proved that body of virus is made of nucleic acid and protein. Father of Virology.
Bawden and Pirie	<ul style="list-style-type: none"> Described the chemical structure of virus.
Safferman and Morris	<ul style="list-style-type: none"> Discovered Cyanophage virus.
D'Herelle felix	<ul style="list-style-type: none"> Named -Phage as Bacteriophage or Phage.
Twort	<ul style="list-style-type: none"> Discovered Virus.

Some Special Information

50%

Virion	<ul style="list-style-type: none">Nucleic acid + Capsid = Complete virusInfective
Viroid	<ul style="list-style-type: none">One single stranded circular RNA.Can produce disease only in plant body.Produces cadang disease in coconut trees.
Nucleocapsid	Nucleic acid + Capsid = Complete virus but NonInfective



- 
- 
- It is a nucleic acid-free **protein coating**.
 - Kuru** and **Creutzfeldt** disease in the human central nervous system, **Scrapie** disease of sheep and goat are developed from prion
 - Link was found between much talked **Mad Cow** disease and prion.
- DISEASE**
- P for Prion , P for Protein**

Emerging virus: NESHa.

N Nile virus E Ebola S SARS Ha HIV

Difference between RNA &DNA: VVI



Classification of virus

Example

❖ Classification of virus according to shape:

Rod shaped- ATM.

A	T	M
Alpha mosaic virus	Tobacco mosaic virus	Mumps

Cubical shaped

হা	ভা র	কিউব
হাপ্সি (Herpes)	(Vaccinia)	Cubical

Tadpole shaped- All T (T_2, T_4, T_6)

Oval- In dia.

In dia > ডিস্কার (Oval)

Influenza

Cylindrical ইবলিস

ইবলি
স (Cylindrical)
ইবোলা (Ebola)

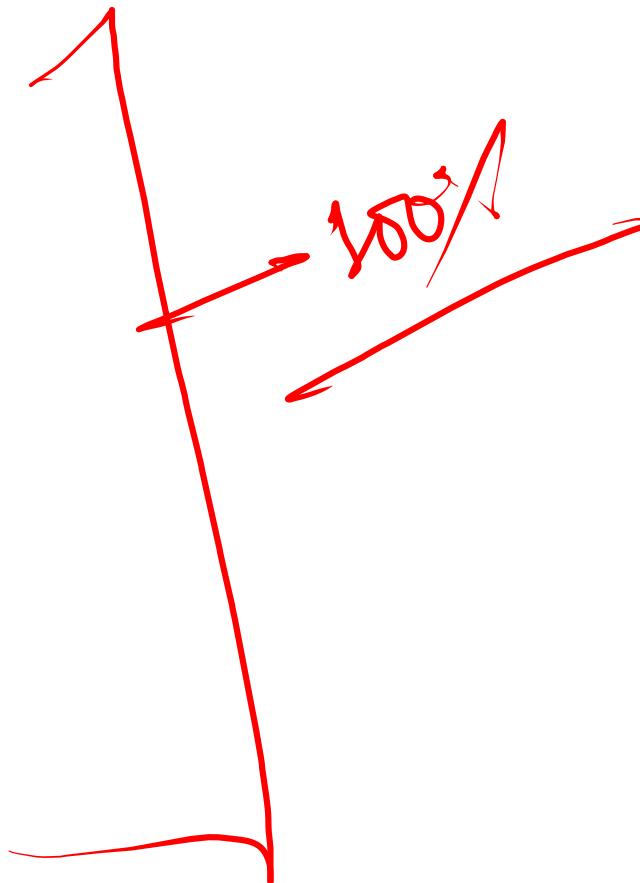
Spherical- T. Ph. Dr

T
TIV

P
Polio virus

h
HIV

Dr
Dengue virus



Virus is of two types based on nucleic acid: DNA and RNA

Example of DNA Virus

টিপুর
↓
TIV

ভাই
↓
Variola

টিটু
↓
T₂

ভ্যানিলা
↓
Vaccinia

হতে
↓
Herpis,

ফ্রান্সে
↓
ফুলকপি

মোজাইক
Hepatitis B

Cauliflower mosaic

এল
↓
Adeno

→ 100% 888

Virus is of two types based on outer layer:



Non-enveloped/Naked virus	Enveloped virus
TMV, T₂ virus	<u>Influenza, herpes, HIV</u> virus (lipovirus).

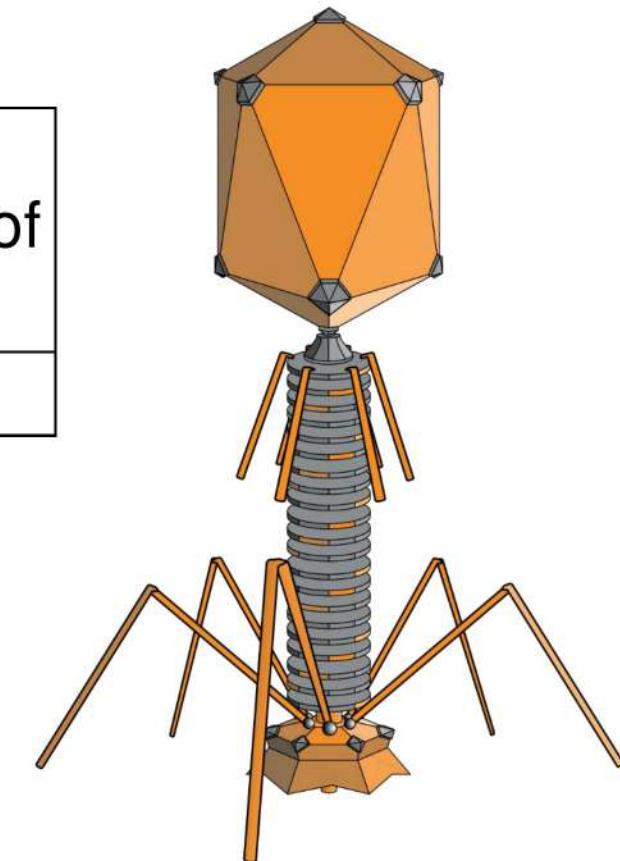


Not S03
NSS

T2 Bacteriophage: *Reading*

- T2 virus particle can be divided into two parts. Such as-

Head	<ul style="list-style-type: none">• Length is almost 93-100nm and width is 65nm.• DNA is composed of 60,000 base pairs (50% of total weight) and it contains 150 gene.
Tail	<ul style="list-style-type: none">• Length is 95-110nm and width is 15-25nm.



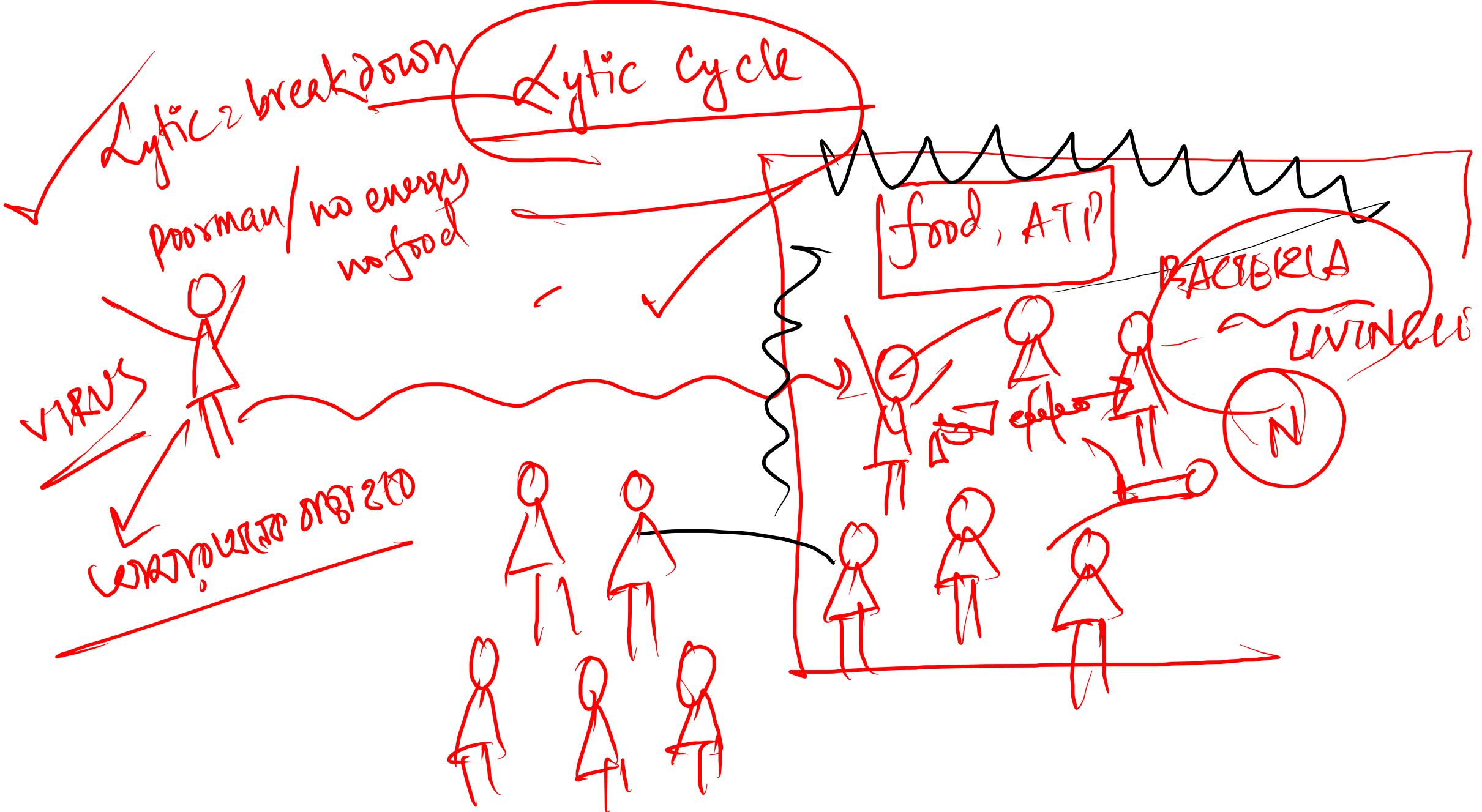
Replication cycle of virus:

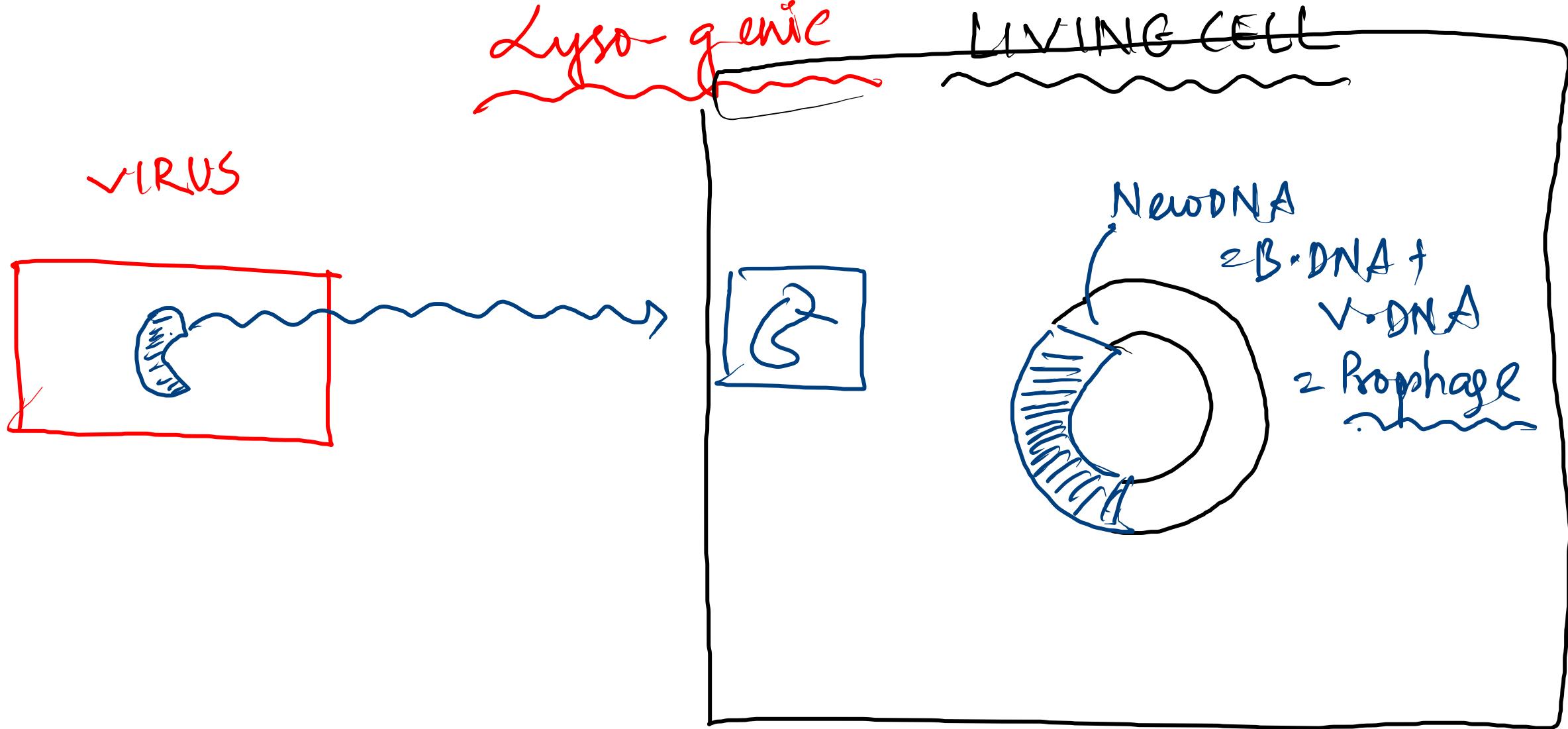
Lytic cycle

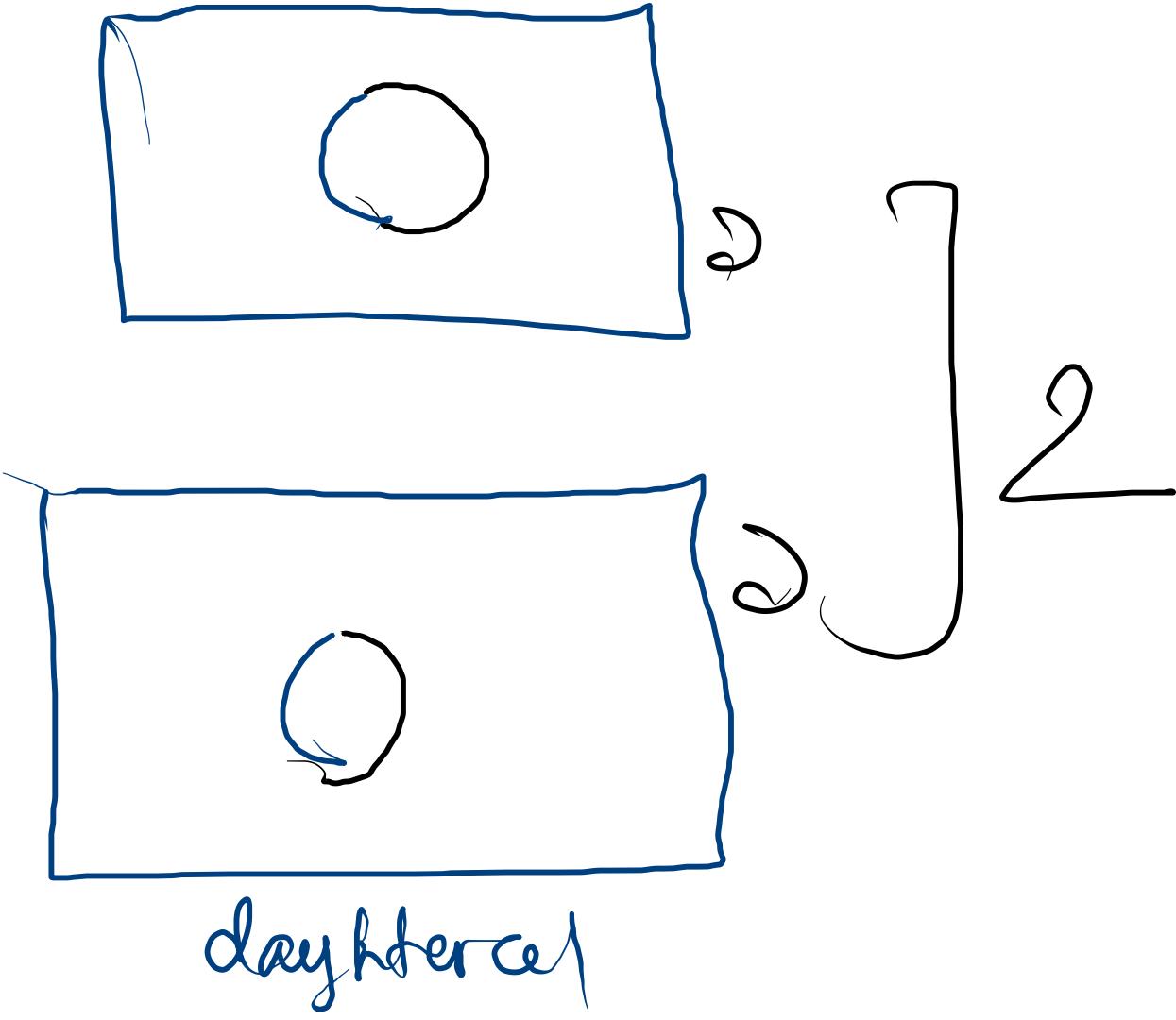
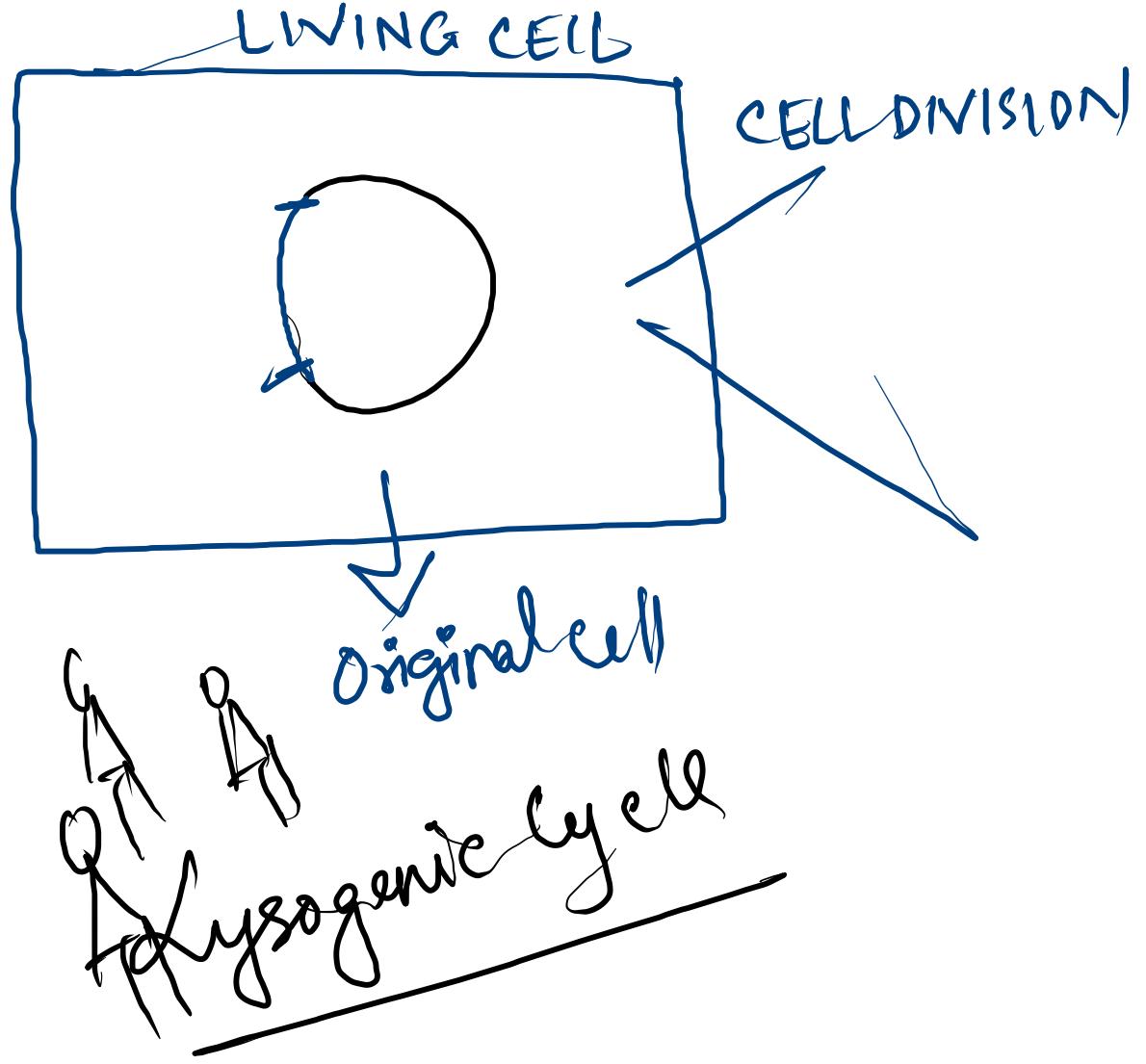
- Step-1: Attachment / Landing: T₂ bacteriophage attacks E. coli.
- Step-2: Entry of phage DNA (Penetration)
- Step-3: Replication
- Step-4: Assembly of virus paricles (Assemble)
- Step-5: Release of new virus (Release)

Lysogenic cycle

- It is seen in lambda phage that infects E. coli.
In this cycle, phage DNA enters E. coli. Rather than destroying host DNA, it gets integrated into E. coli DNA.

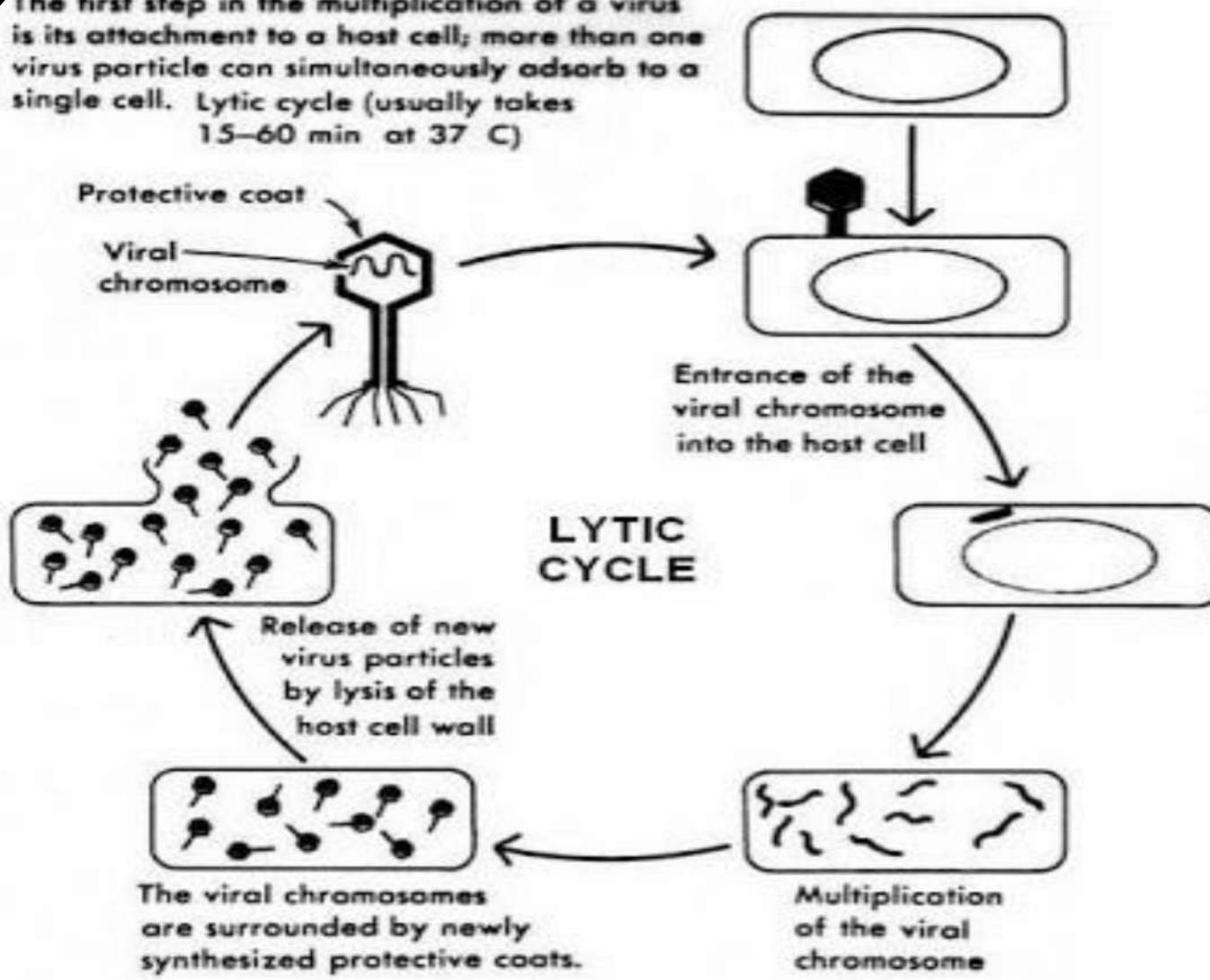






Lytic cycle:

The first step in the multiplication of a virus is its attachment to a host cell; more than one virus particle can simultaneously adsorb to a single cell. Lytic cycle (usually takes 15–60 min at 37 °C)



Lysogenic cycle:

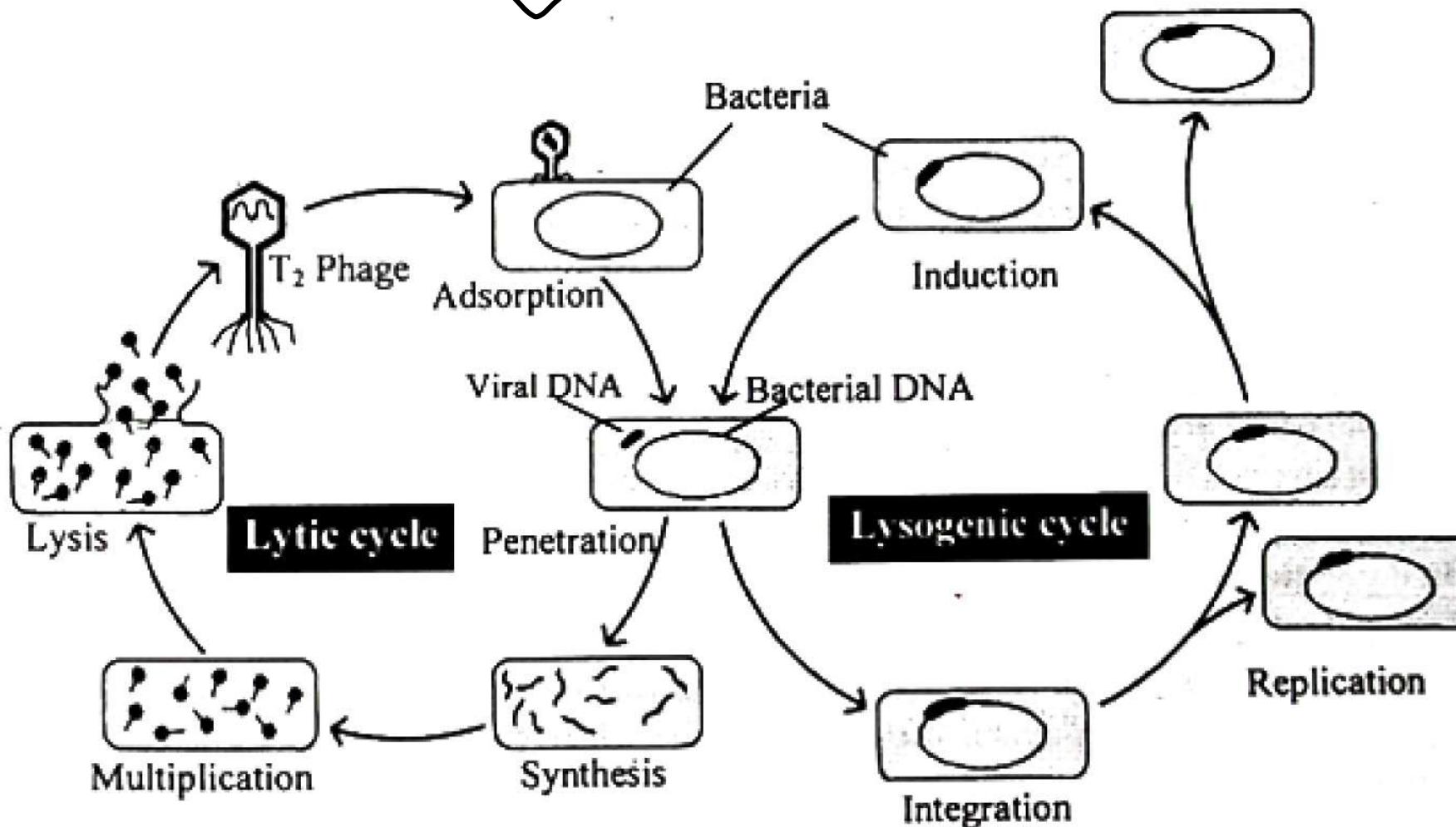


Fig 4.5 Life cycle of T_2 Phage

Difference Between lytic and lysogenic cycle: VVI

□ Special Information

Lysogenic cycle	<ul style="list-style-type: none">• Seen in λ series phage
Lytic cycle	<ul style="list-style-type: none">• Seen in T series phage
Prophage	<ul style="list-style-type: none">• The combined DNA of E.coli and phage is called Prophage.• Prophage is the latent condition of bacteria.

Reading NSS

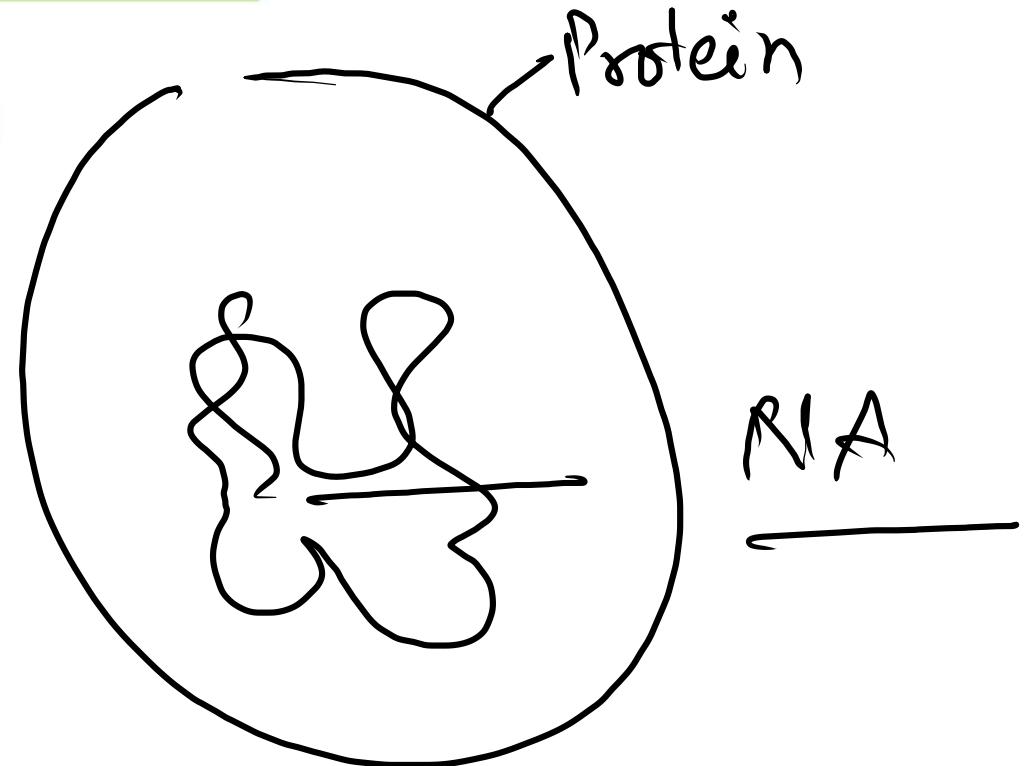
Special Information

Transformation	<ul style="list-style-type: none">• DNA from the environment can cause recombination by entering the recipient cell, which is called transformation.
Transduction	<ul style="list-style-type: none">• DNA transfer occurs from one bacteria to another bacteria by the means of bacteriophage.
About Enzyme	<ul style="list-style-type: none">• Nuclease enzymes splits bacterial DNA.• Integrase enzyme connects the bacteria DNA to E.coli DNA.

Poll Question: 01

Which of the following comprises virus?

- (a) Lipid and nucleic acid
- (b) Only nucleic acid
- (c) Protein and lipid
- (d) Protein and nucleic acid



Poll Question: 02

Which one is a DNA Virus??

- (a) Hepatitis-B
- (b) Chikungunya
- (c) Tobacco mosiac
- (d) Dengue

Poll Question: 03

Which of the following is not an example o RNA virus?

- (a) Mumps virus
- (b) Rabies virus
- (c) Polio virus
- (d) Variola virus

Economical importance of virus

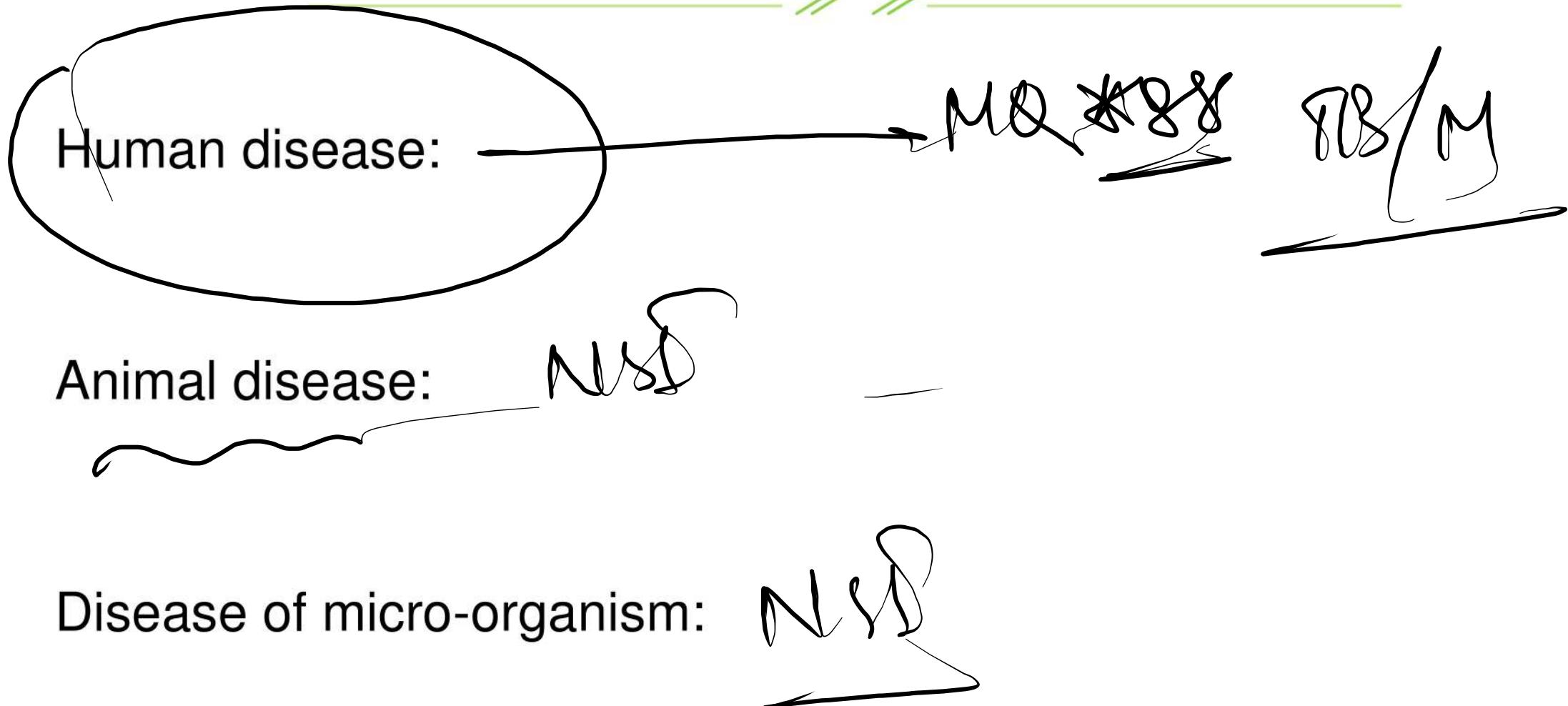


Benefits of Virus: Only example

- i) As vaccine
- ii) As medicine
- iii) To enhance beauty
- iv) As an insecticide
- v) Rabbit control
- vi) Genetic Engineering
- vii) Controlling harmful bacteria

✓ from TB / Medificks

Disadvantage of virus: Importants only

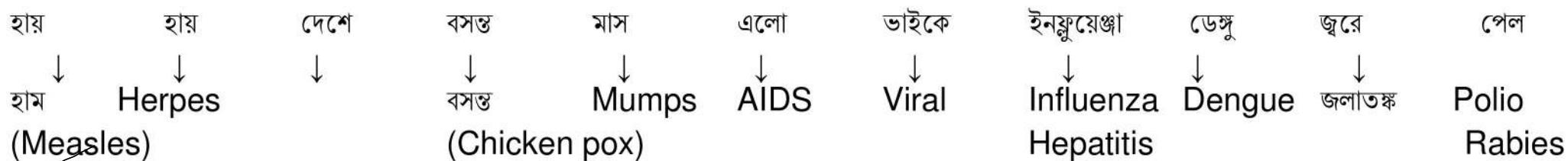


Antidote

Creating antidote by using virus



Deases infecte virus



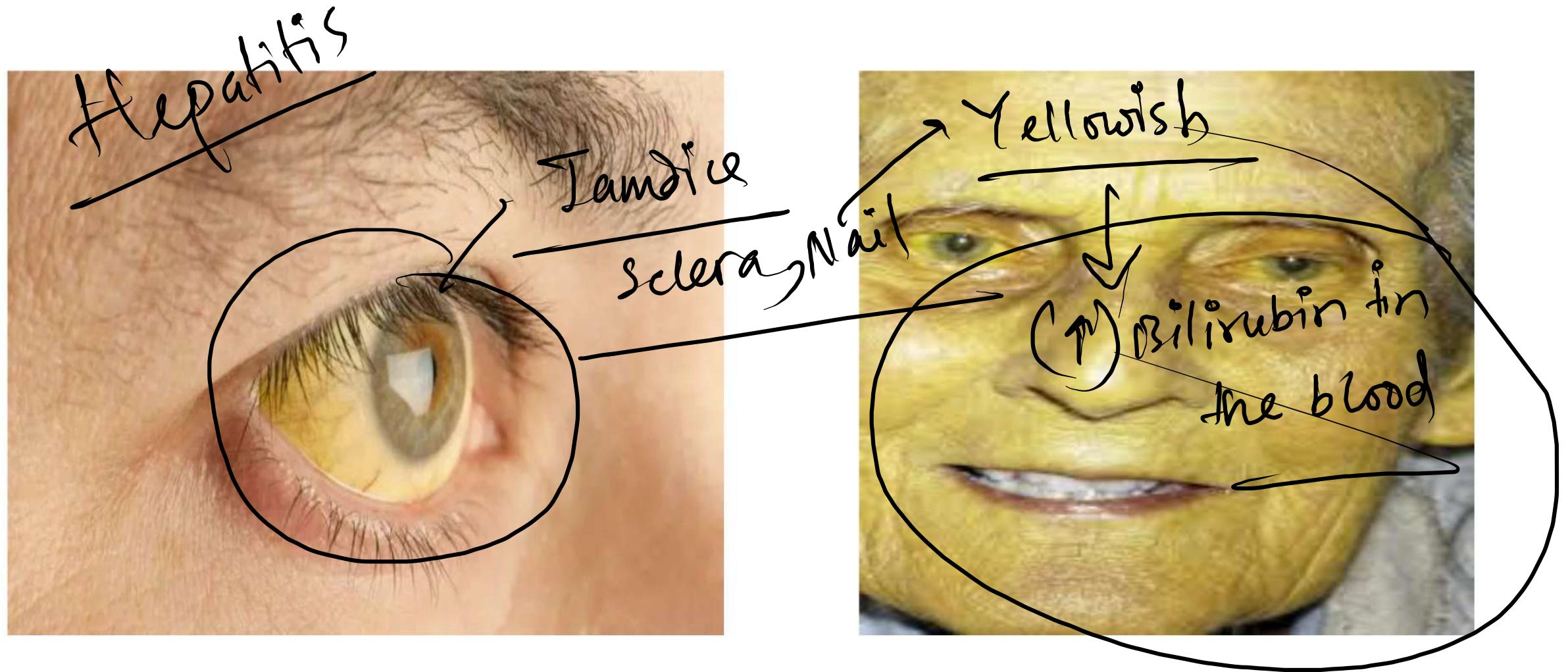


Viral Hepatitis

- ❖ Viral hepatitis is an inflammatory disease of liver..
- ❖ HAV and HEV spread by water. The rest spread by blood.
- ❖ Most hepatitis is caused by HBV.
- ❖ **HCV is called silent killer.**
- ❖ Liver cirrhosis, liver cancer is caused by hepatitis B and C virus.

Characteristics of Hepatitis Virus

Characteristics	HAV	HBV	HCV	HDV	HEV
Virus group	Enterovirus	Hepadna virus	Flavi virus	Incomplete virus	Calici virus
Nucleic acid	RNA	DNA	RNA	RNA	RNA
Size	27 nm	42 nm	30-38 nm	35 nm	27 nm
Latent period	14-28 days	45-180 days	14-180 days	21-49 days	21-56 days





Dengue Fever:

Aedes aegypti, Aedes albopictus (RNA Virus)

Symptoms

i) General dengue fever	<ul style="list-style-type: none">❖ Fever ranges from 103 – 105°F.❖ Generally, fever is seen within 2-7 days of bites from dengue mosquito.❖ Pain in the muscle, bones, joint and waist along with spinache is <u>special symptom</u> of this disease. It is called breakbone fever.
ii) Hemorrhagic dengue fever	<ul style="list-style-type: none">❖ Bleeding is seen in nose, mouth, jaw and skin of patient.❖ Platelets reduce drastically in blood and blood cannot clot.
iii) Dengue shock syndrome	<ul style="list-style-type: none">❖ <u>Hemoconcentration</u> is seen.



Some disease caused by virus:



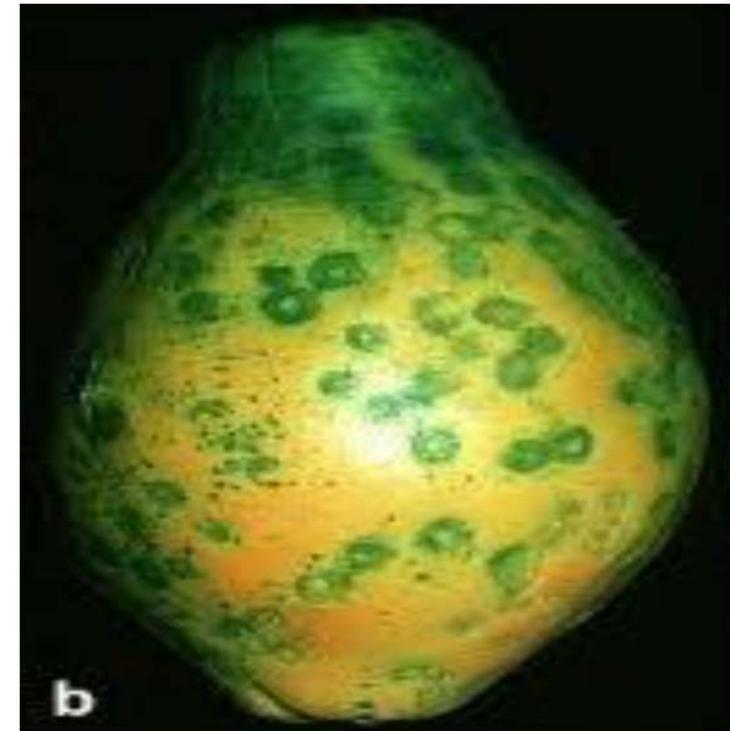
Chikungunya:

- It is an RNA virus. Its carrier include *Aedes aegypti*, *A. albopictus*.
- This virus was first discovered in Tanzania of Africa.

Symptoms: High fever, joint pain, body rash, headache, weakness etc.

Papaya ringspot or mosaic disease:

- Papaya ringspot virus or PRSV.
- This virus has two serotypes. (P type & W type)



Nipah virus caused disease:

- It is an RNA virus of family Paramyxoviridae. Its carrier is bat.
- This virus can spread into human body through raw date juice.

MO
X

Zika virus caused disease:

- It is an RNA virus. Its carrier include *Aedes aegypti*, *A. albopictus*. It can cause **microcephali** in newborn by infecting pregnant mother.

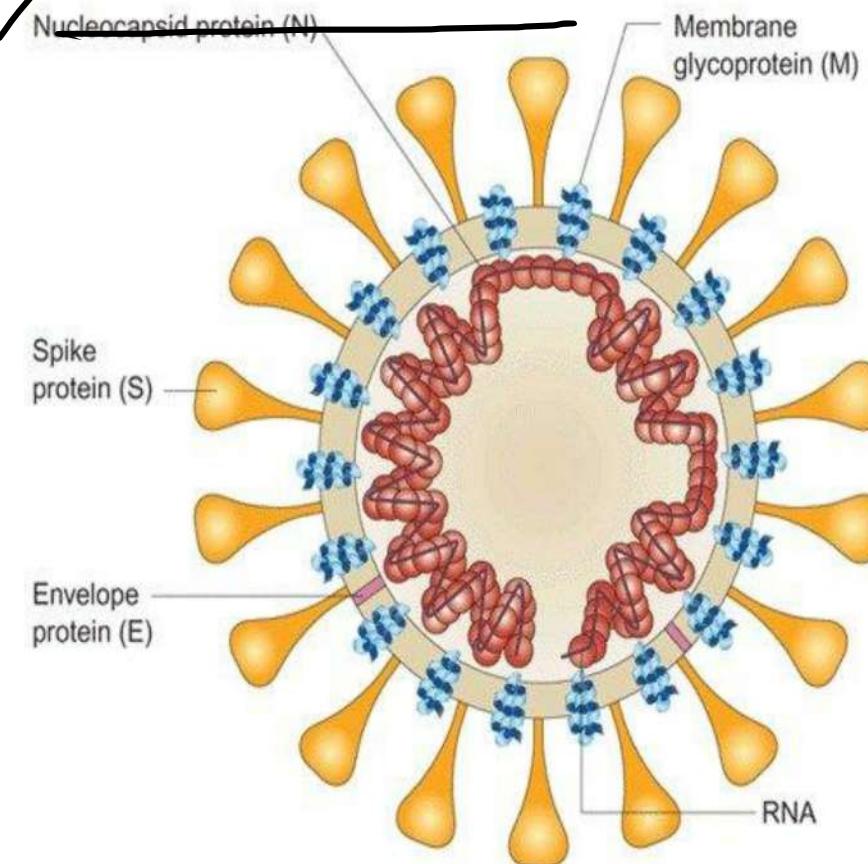


Corona virus:

EMERGING VIRUS

PANDEMIC

- It is an RNA virus of family Coronaviridae and of Orthocoronavirinae subfamily.
- Enveloped and Single stranded RNA virus.
- Spread through respiratory droplets.
- **Sign-Symptoms** includes fever, dry cough, breathlessness, sore throat, diarrhea, headache etc.



Poll Question: 04

Which carrier transmits Zika virus into human body?

- (a) Aedes male
- (b) Aedes female
- (c) Anopheles male
- (d) Anopheles female

Poll Question: 05

Which plant is infected by Tungro virus?

- (a) Rice
- (b) Wheat
- (c) Corn
- (d) Pea

Poll Question: 06

Which virus cause dengue?

- (a) Flavi
- (b) Ebola
- (c) Adeno
- (d) Poty

Structure of Bacteria:

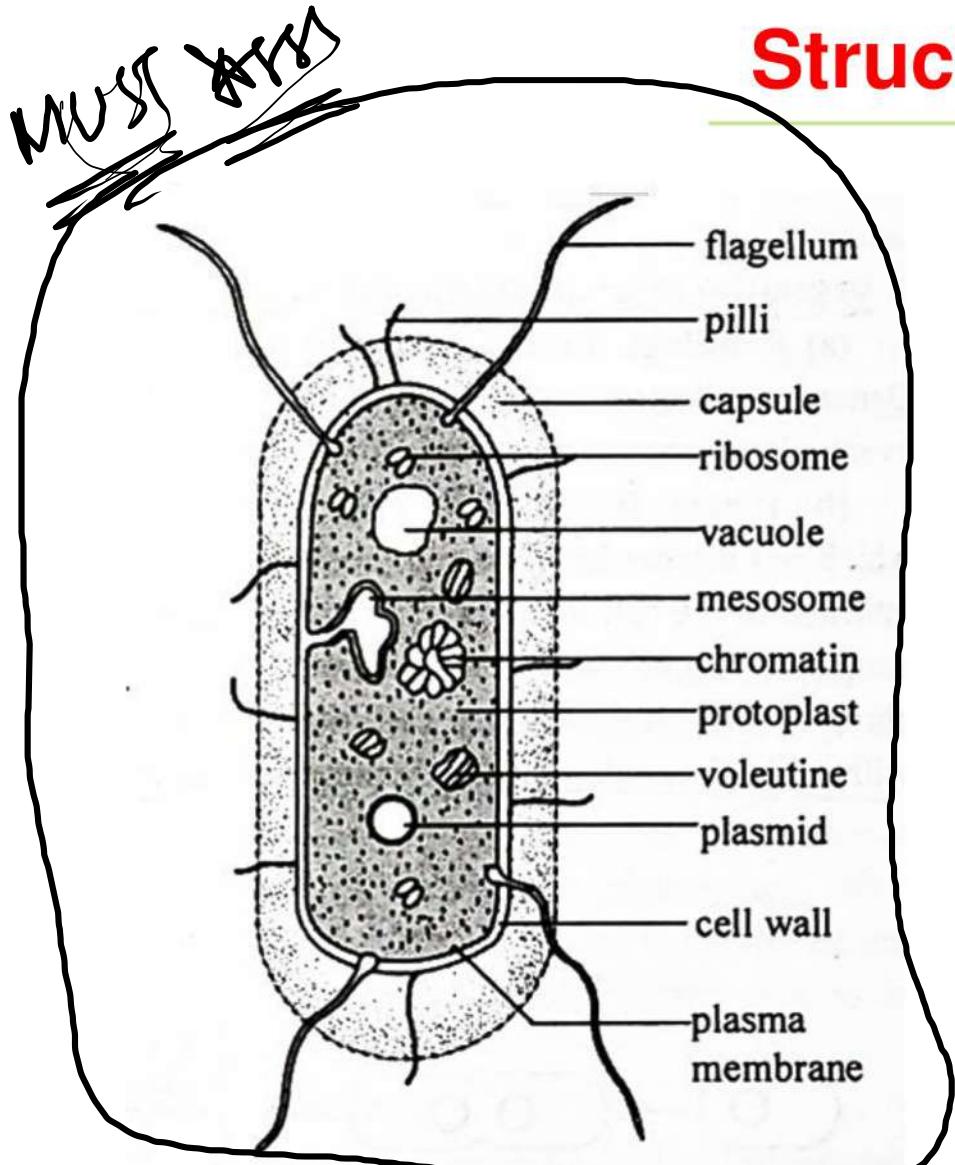
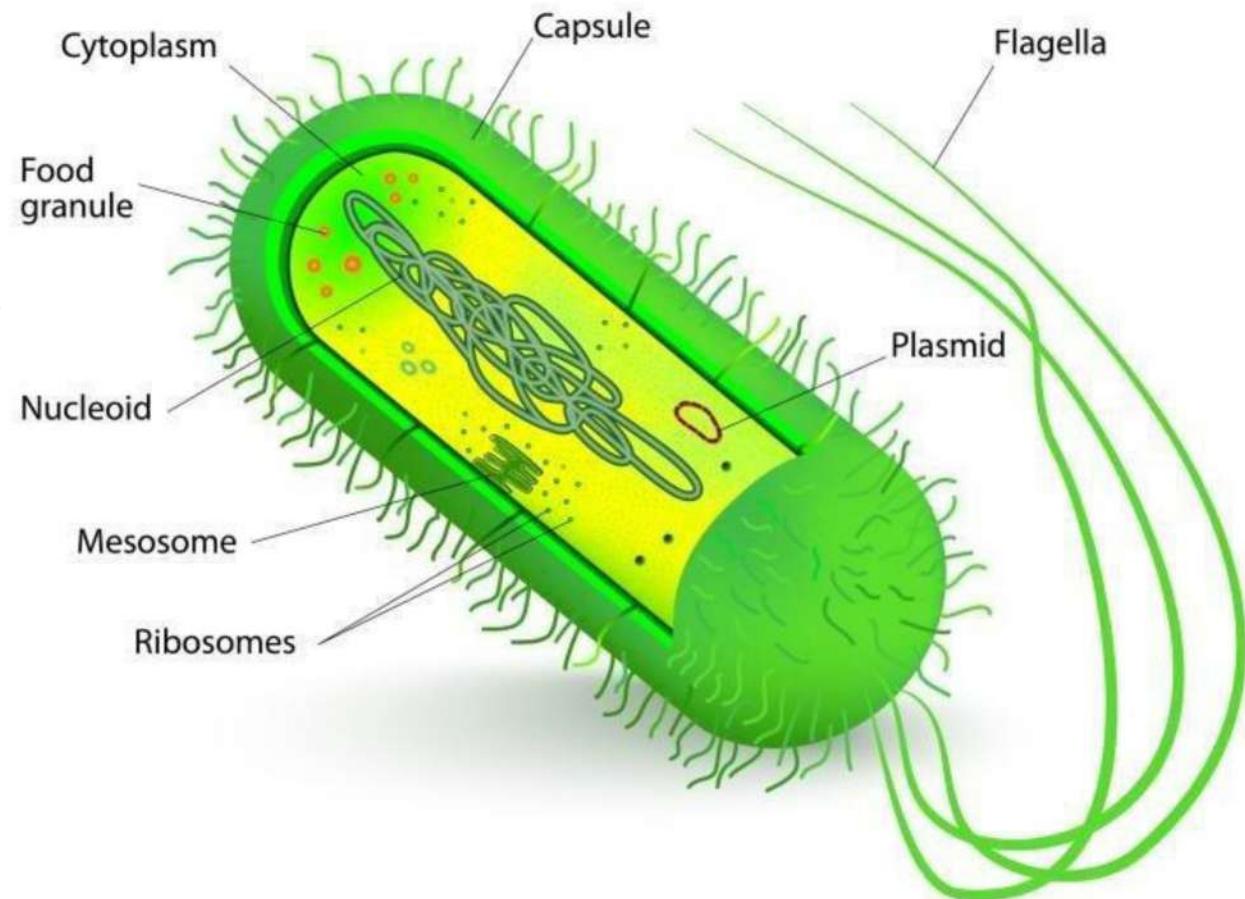
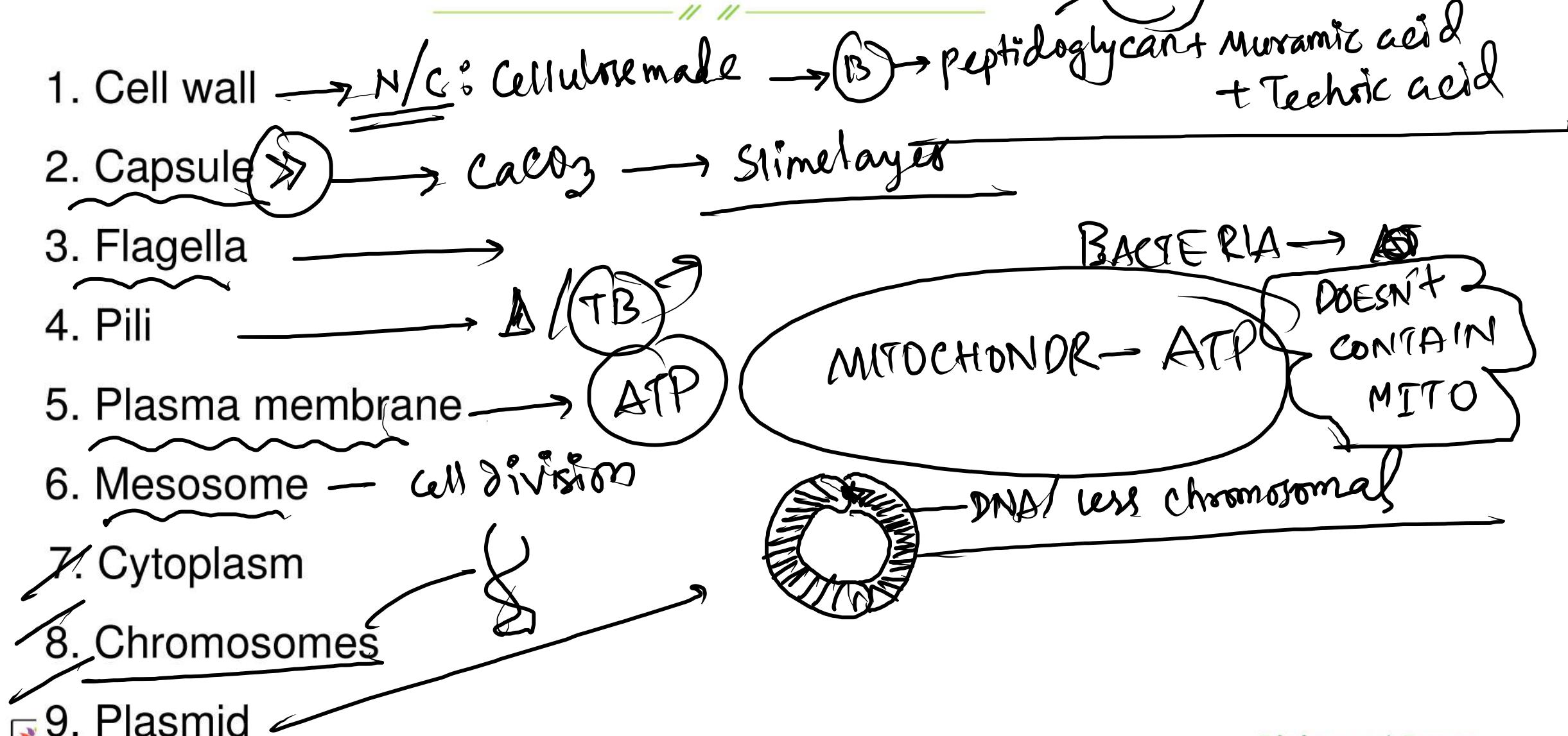


Fig 4.10 Structure of a typical bacterium



Structure of Bacteria:



Classification of Bacteria:

(a) Based on shape:

Coccus Bac

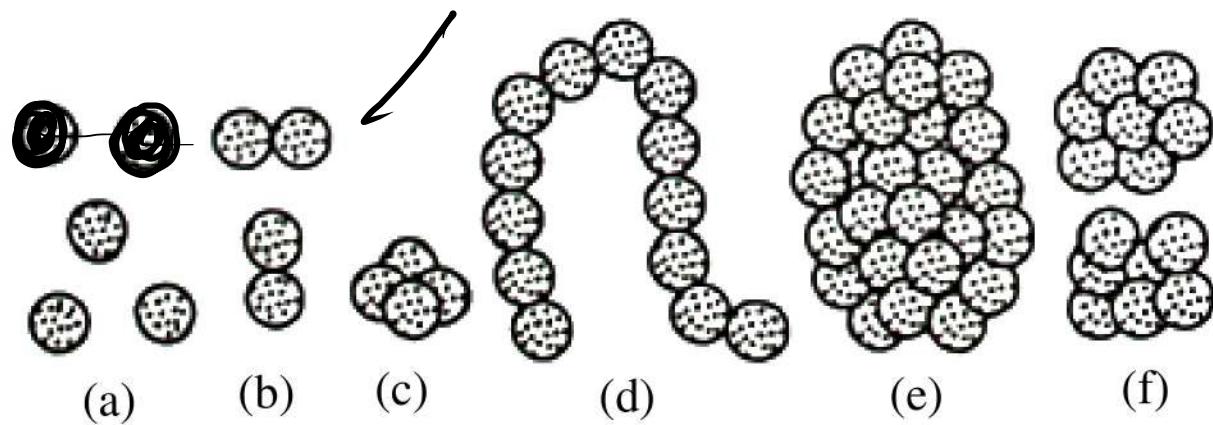
(b) Based on presence, position and number of Flagella:

(b) Based on presence, position and number of Flagella:

(d) Based on Oxygen Requirement:

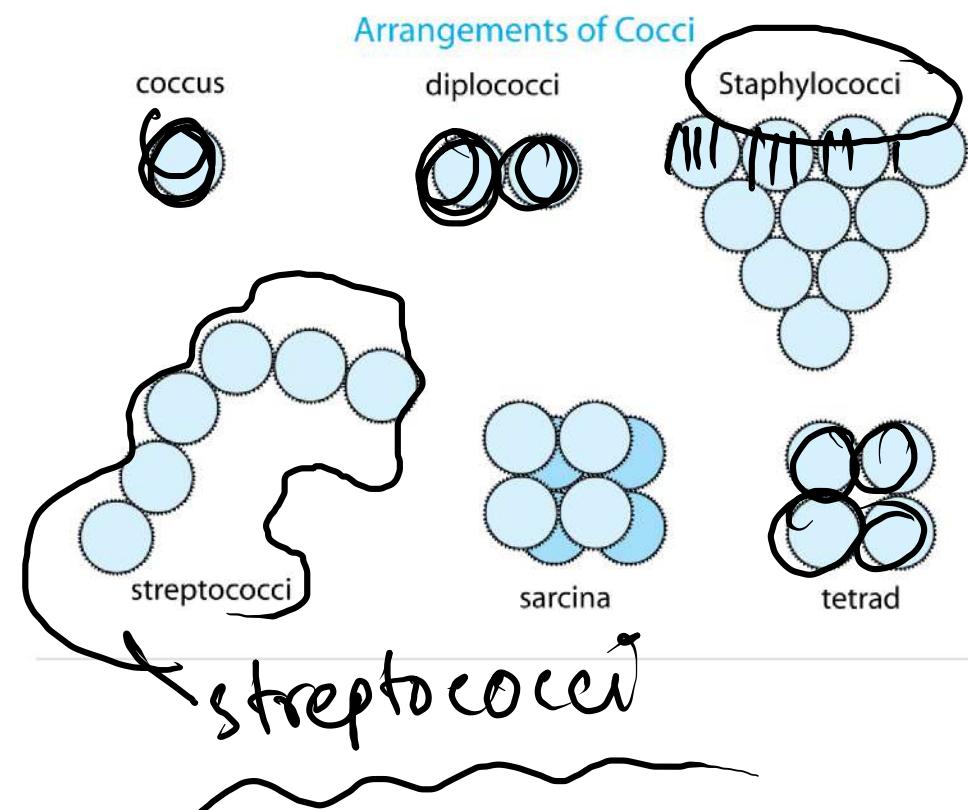
TB/Medi

Aer 50%



(a) Monococcus (b) Diplococcus (c) Tetracoccus
 (d) Streptococcus (e) Staphylococcus (f) Sarcina

Fig: Different types (shapes) of bacteria



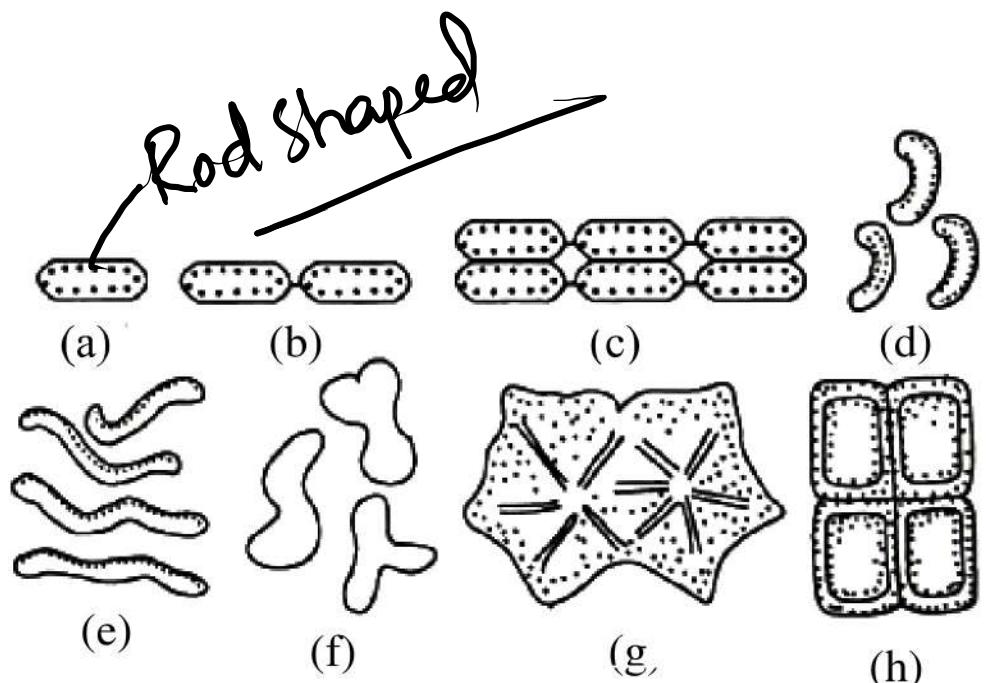
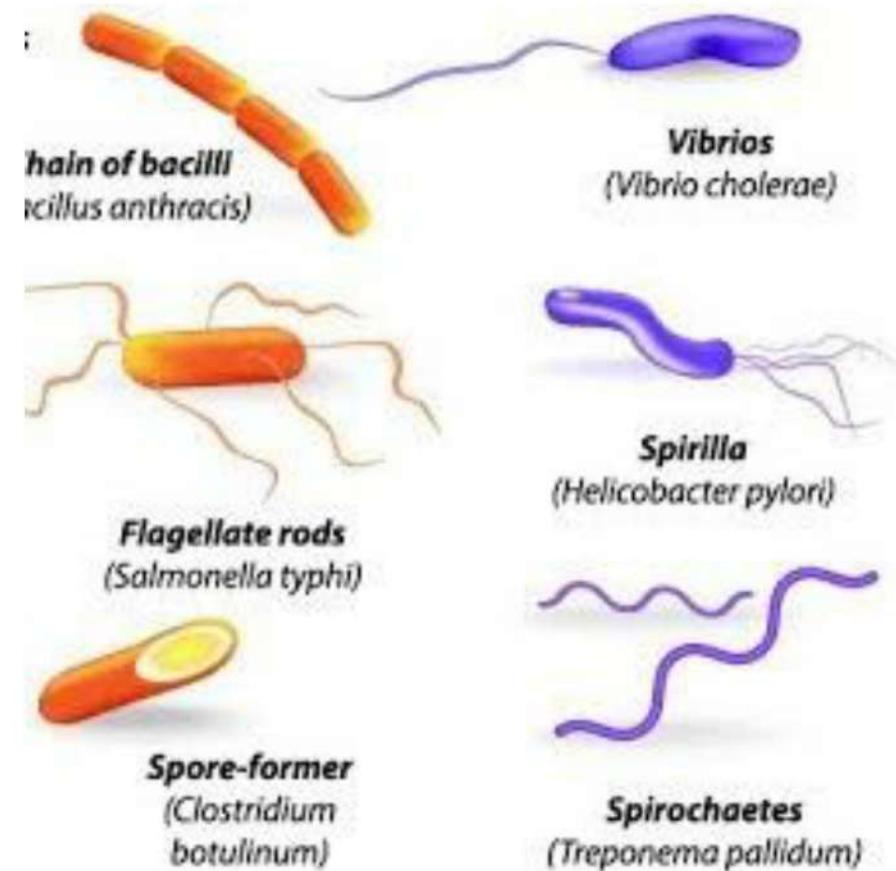


Fig: (a) Monobacillus (b) Diplobacillus (c) Streptobacillus
 (d) Comma/Virio (e) Spirillum (f) Polymorphic (g) Stellate (h) Square



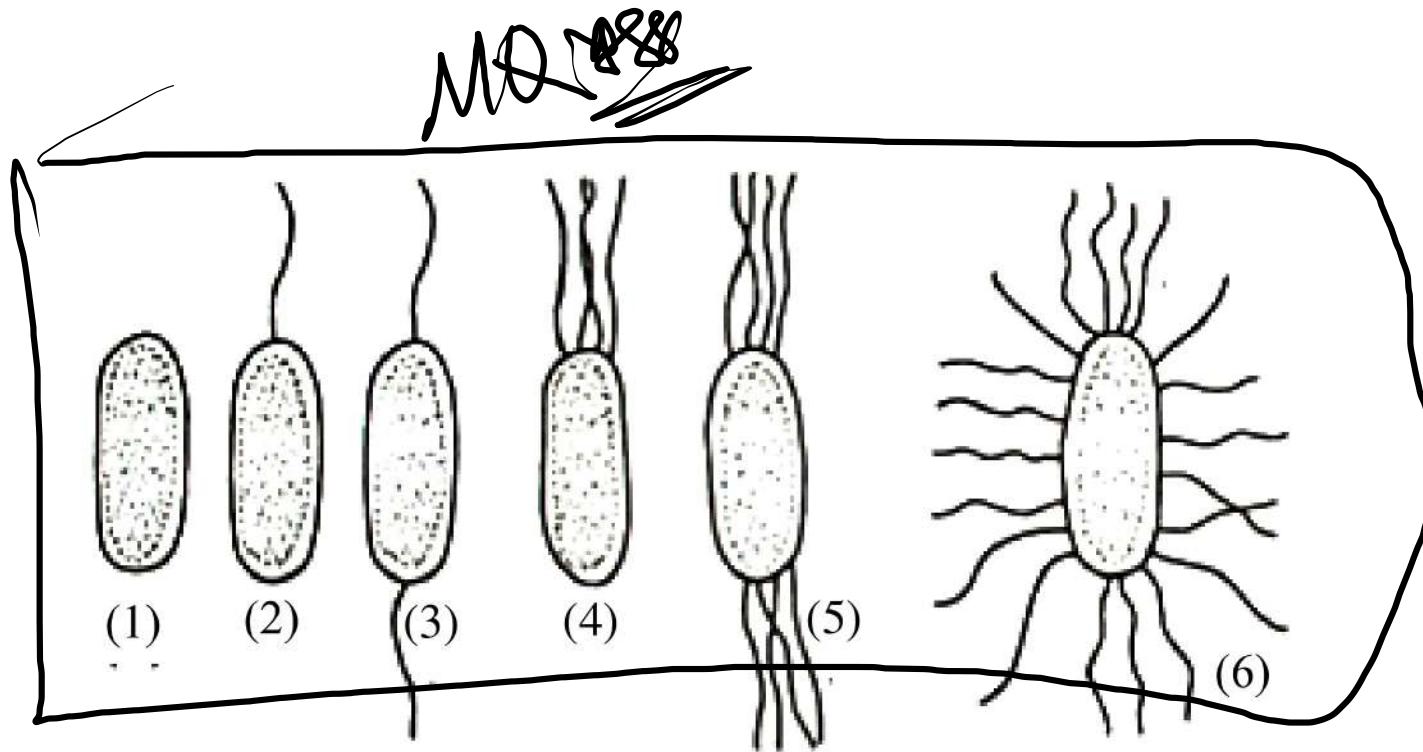
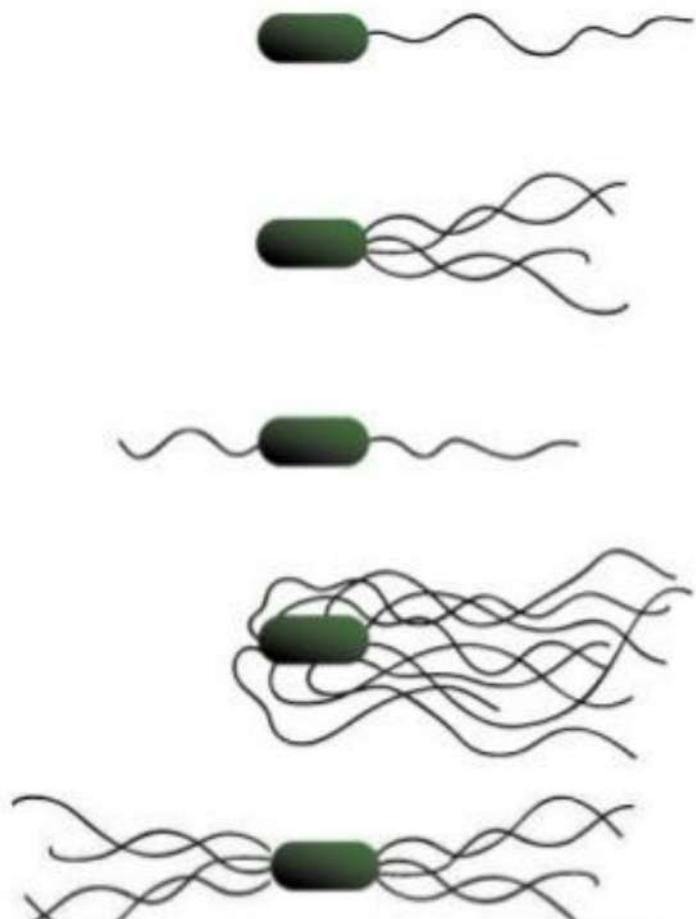


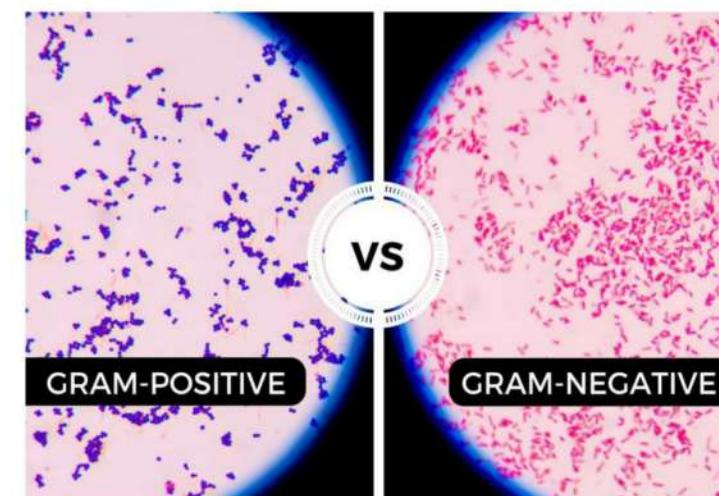
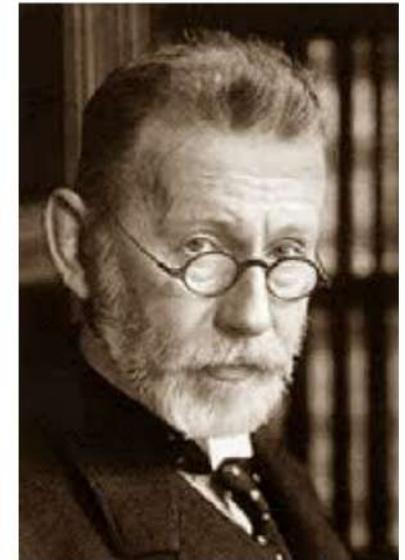
Fig: different type of bacteria based on number and distribution of flagella.
 (1) Atrichous (2) Monotrichous (3) Amphitrichous (4) Cephalotrichous
 (5) Lophotrichous (6) Peritrichous



What is Gram?

BORING JOKES

GRAMSTAINING



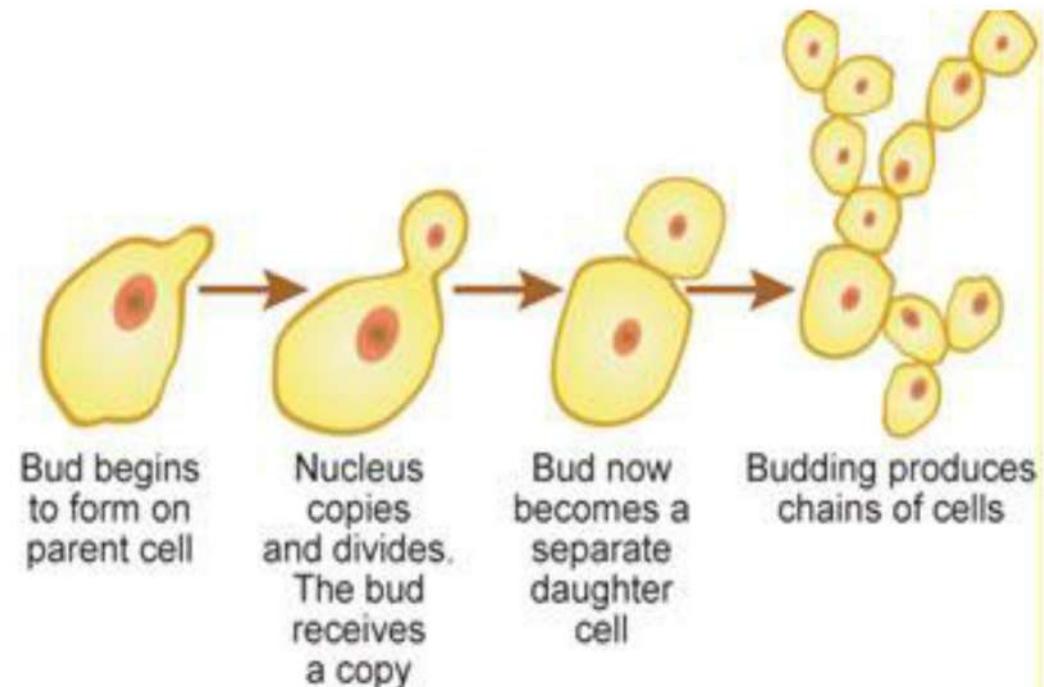
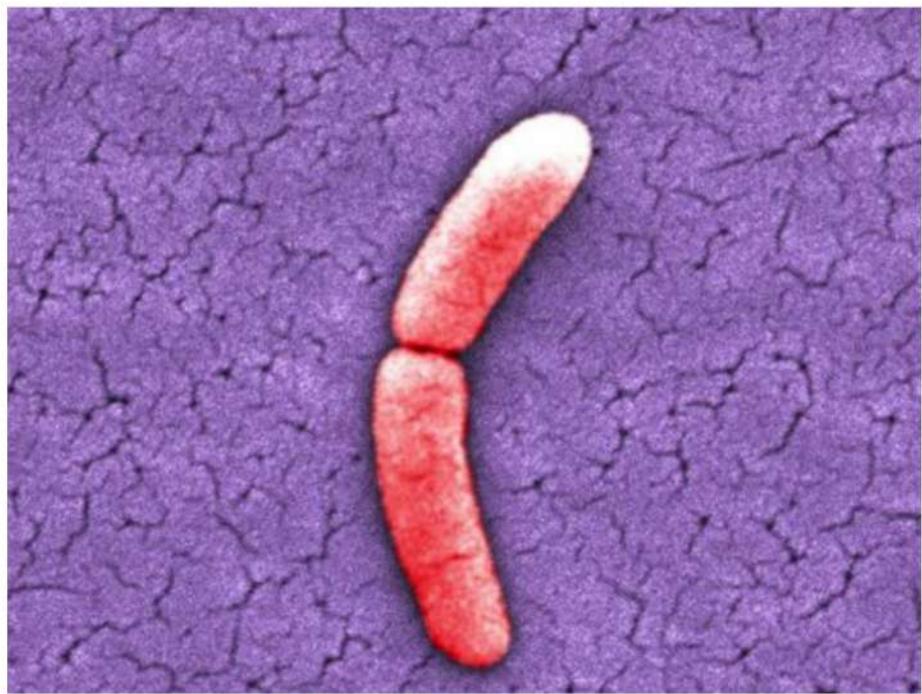
~~NEGLECTED~~

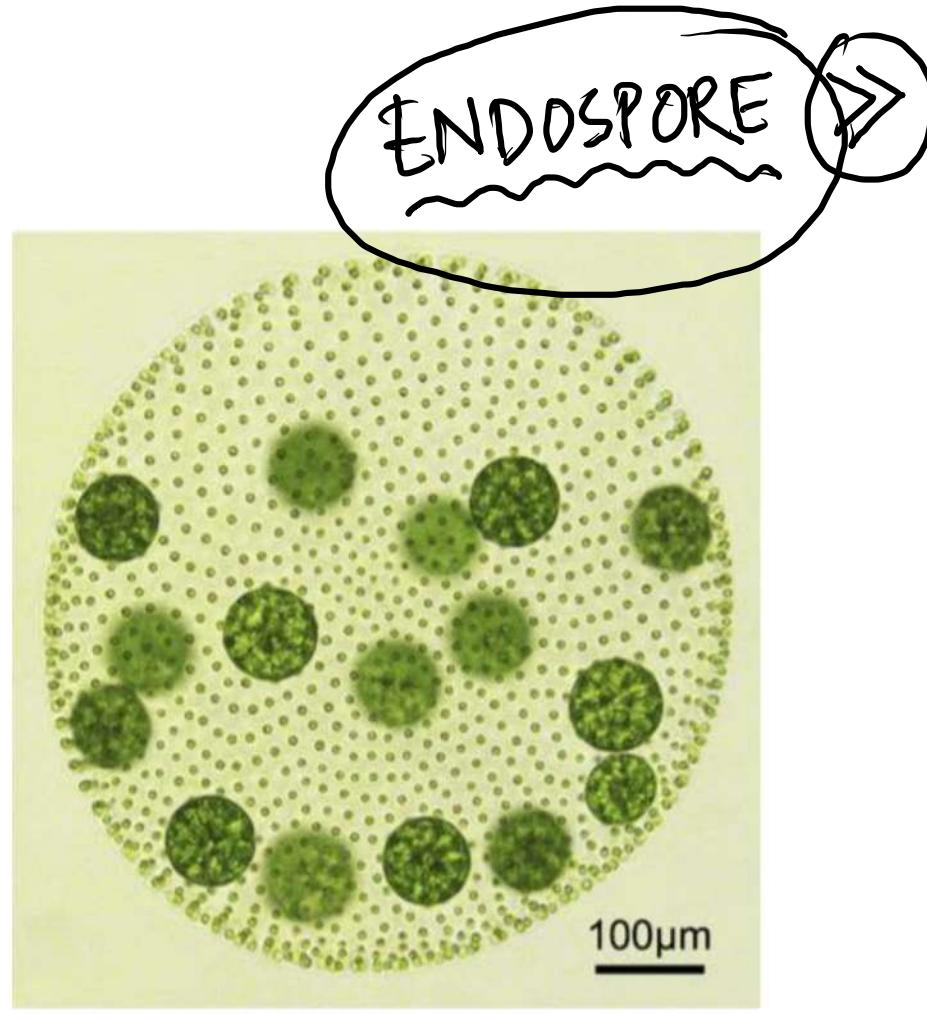
Replication of Bacteria:

~~MORE THAN BLOOD~~

Reproduction	Hasan Sir	Azmal Sir
(i) Vegetative	(a) Binary fission (Main reproductive process) (b) Budding	(a) Binary fission: <i>Streptococcus, E. coli</i> (b) Budding: <i>Ancalomicromyobium adetum</i> (c) Fragmentation: <i>Streptomyces</i>
(ii) Asexual (Occurs via spores)	(a) Gonidia: <i>Leucothris</i> (b) Endospore: Bacteria of Bacillaceae family	(a) Conidia: Stranded <i>Streptomyces</i> (b) Zoospore: <i>Azotobacter, Rhizobium</i> (c) Endospore
(iii) Sexual	(i) Along the conjugation tube (ii) Transformation (iii) Transduction	-

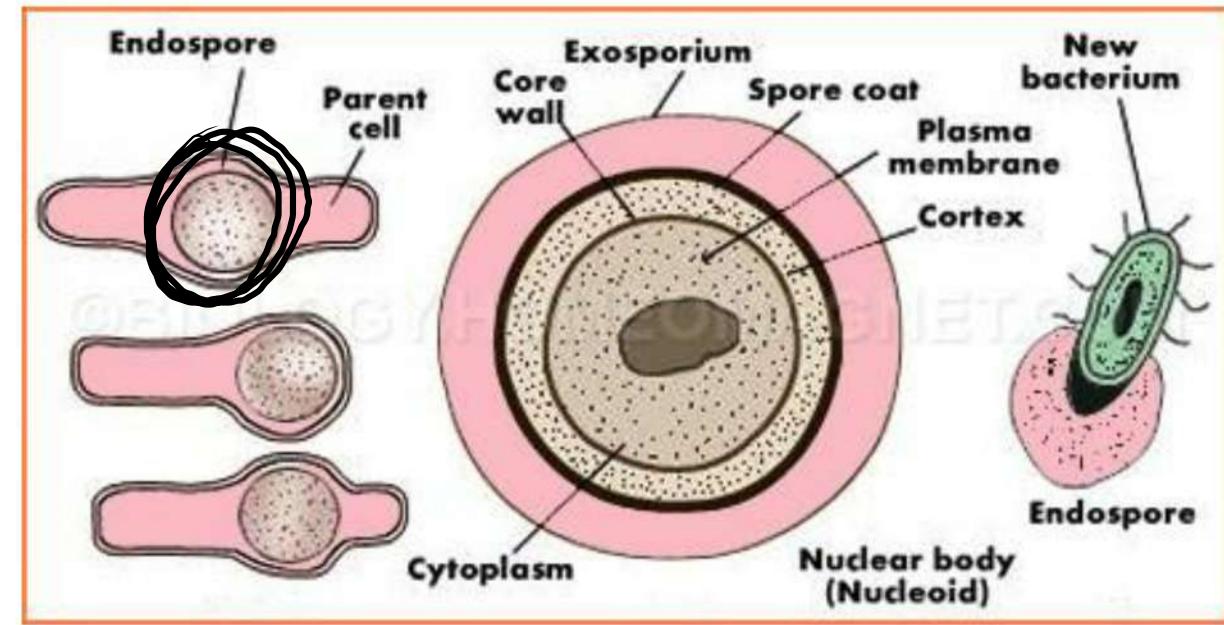
N.B.: Vegetative reproduction is a type of asexual reproductive process. Therefore, binary fission process can be called both vegetative/sexual.

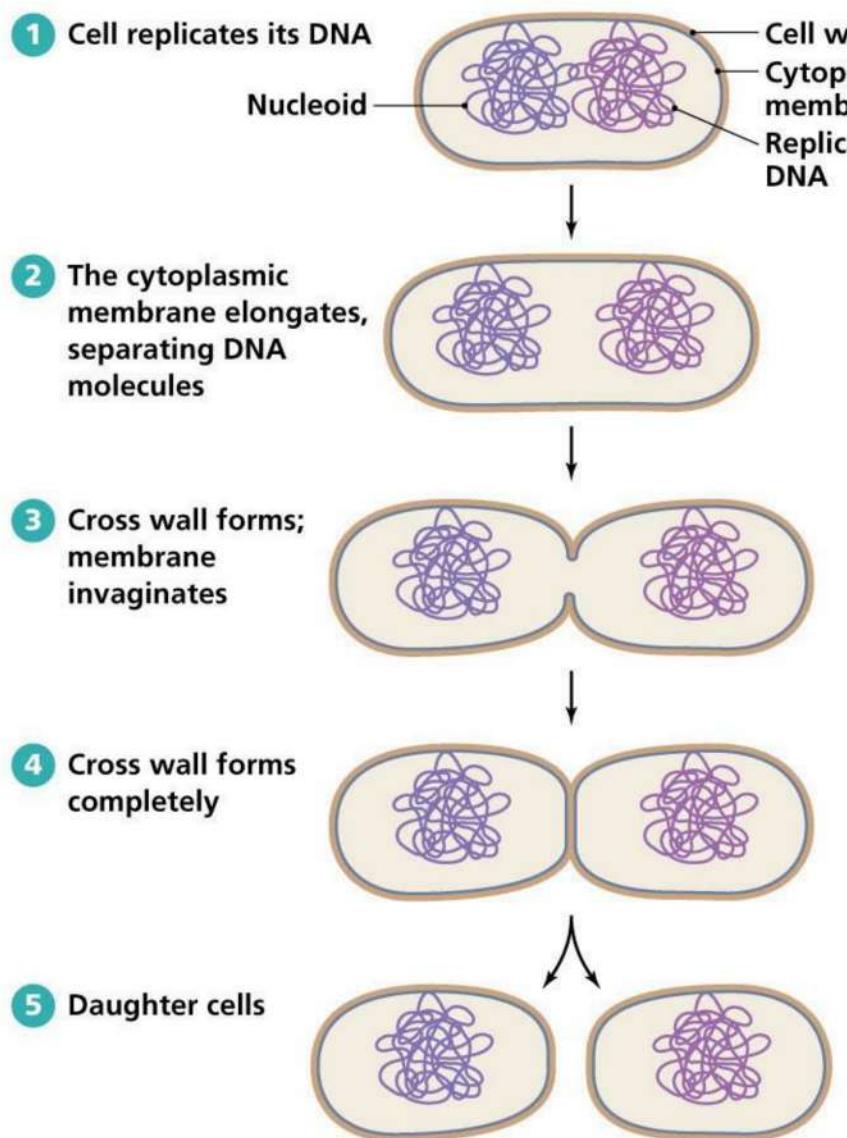




ENDOSPORE

SITUATION AGAINST
VIRULENT SITUATION





Copyright © 2006 Pearson Education, Inc., publishing as Benjamin Cummings.

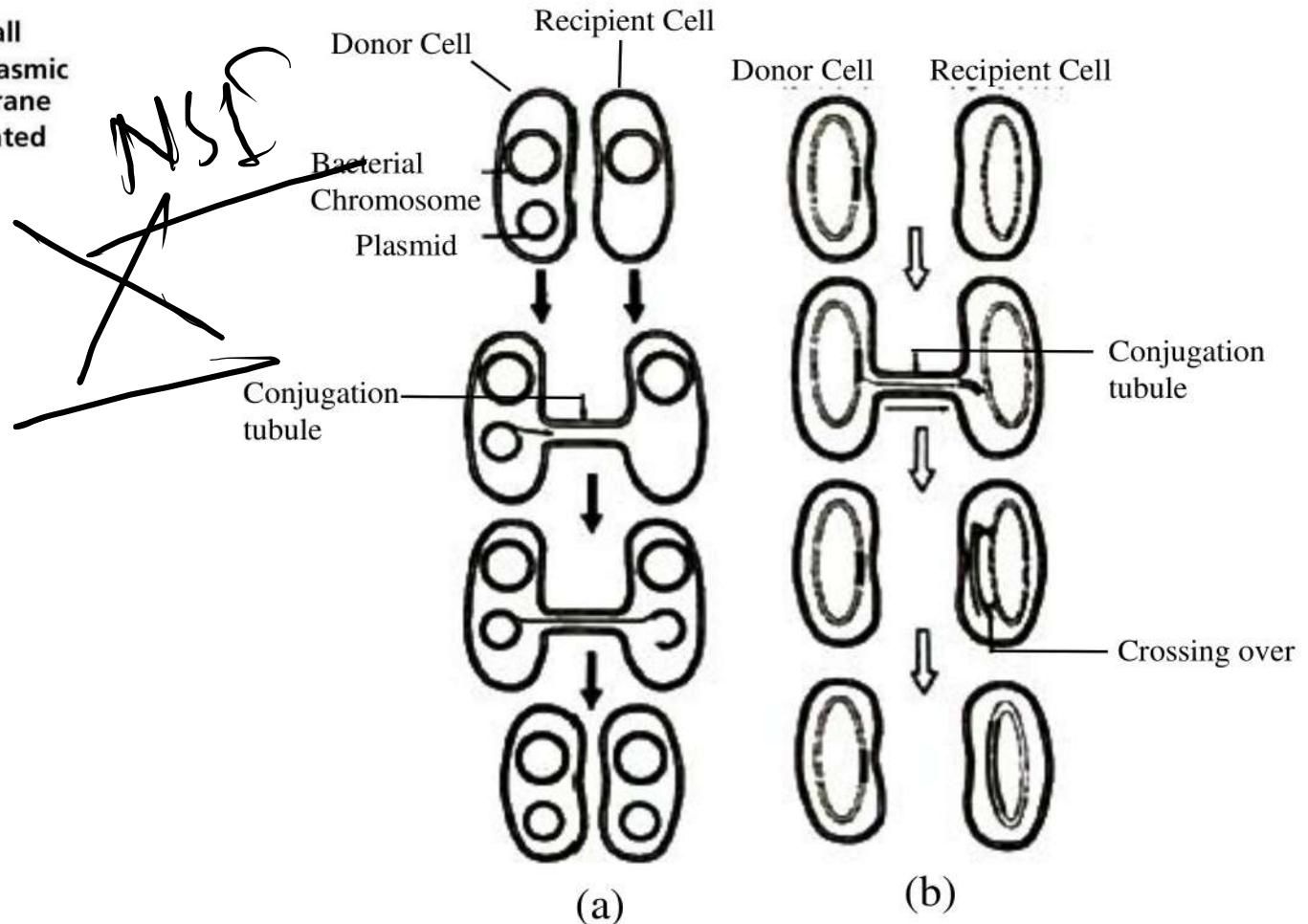


Fig: Genetic Recombination of Bacteria
 (a) Transformation of plasmid
 (b) Transformation and Recombination of Chromosome partly

Poll Question: 07

Which of the following bacteria can survive without free oxygen?

- (a) Azotobactor
- (b) Bacillus
- (c) Clostridium
- (d) Staphylococcus

Poll Question: 08

What is bacterial cell wall primarily made of?

(a) Muramic acid

P-Glycan + MA + TA

(b) Chitin

(c) Mucoprotein

(d) Cellulose

□ Economic Importance of Bacteria: Must to read part

Benefits	In medical sector In agricultural sector Point 10,11,15,17(Hasan sir)	→ Medicicks
Disadvantages	Human disease Other animal disease Point 4-9 (Hasan sir)	

□ Difference between Virus and Bacteria: 100%

□ Blight disease of paddy:

- *Xanthomonas oryzae*
- These are **gram negative bacteria** and do not produce spores.
- These **do not** have **capsule**, but have **one flagellum**.
- Generally occurs the disease process in **August**



□ Cholera

- *Vibrio cholerae*
- Detected by scientist **Robert Koch**.
- It is a **comma-shaped, gram negative bacteria**
- It produces a toxin named cholera toxin in the human intestine, which causes ulcers in the walls of intestine
- Main symptom is Diarrhoea(Bloody)



Poll Question: 09

Which of the following vitamin is not synthesized by *E. coli*?

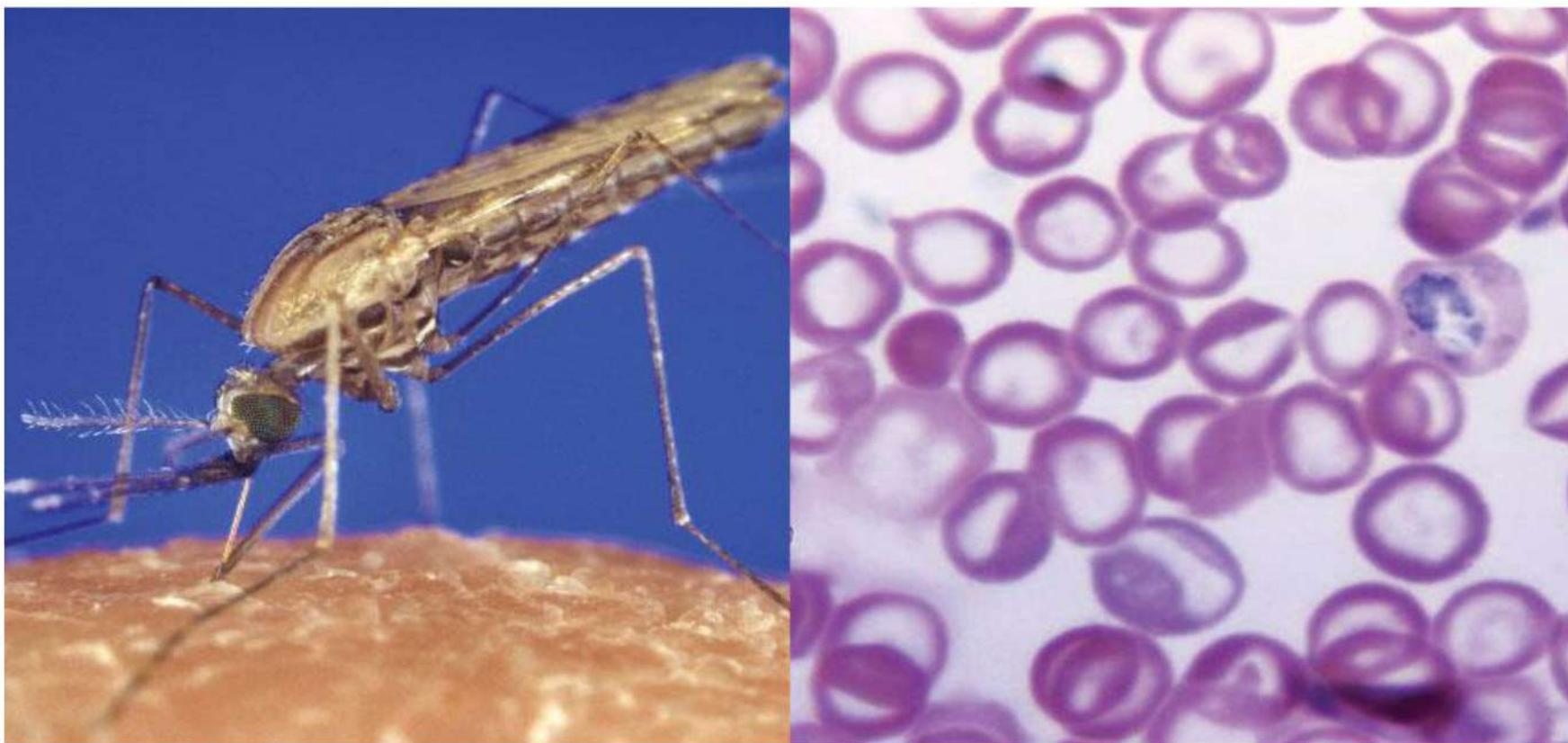
- (a) Vitamin - B_2
- (b) Vitamin - E
- (c) Vitamin - K
- (d) Vitamin - B_{12}

Poll Question: 10

Which of the following vitamin is not synthesized by *E. coli*?

- (a) Vitamin - B_2
- (b) Vitamin - E
- (c) Vitamin - K
- (d) Vitamin - B_{12}

Malarial Parasite



Different species of Malaria Parasite and names of fever

BRAIN
TOP
LTR

CHARLES LAVERON + ROSS

MALARIA

✓ NSI

Name of malarial parasite	Name of disease	Nature of fever	Latency period
<i>Plasmodium falciparum</i>	Malignant tertian malaria	Fever comes after 36-48 hours	8-15 days
<i>Plasmodium malariae</i>	Quartan malaria	Fever comes after 72 hours	18-40 days
<i>Plasmodium vivax</i> / <i>vibax</i>	Benign tertian malaria	Fever comes after 48 hours	12-20 days
<i>Plasmodium ovale</i> <i>uvale</i>	Mild tertian malaria	Fever comes after 48 hours	11-16 days

Question pattern

25

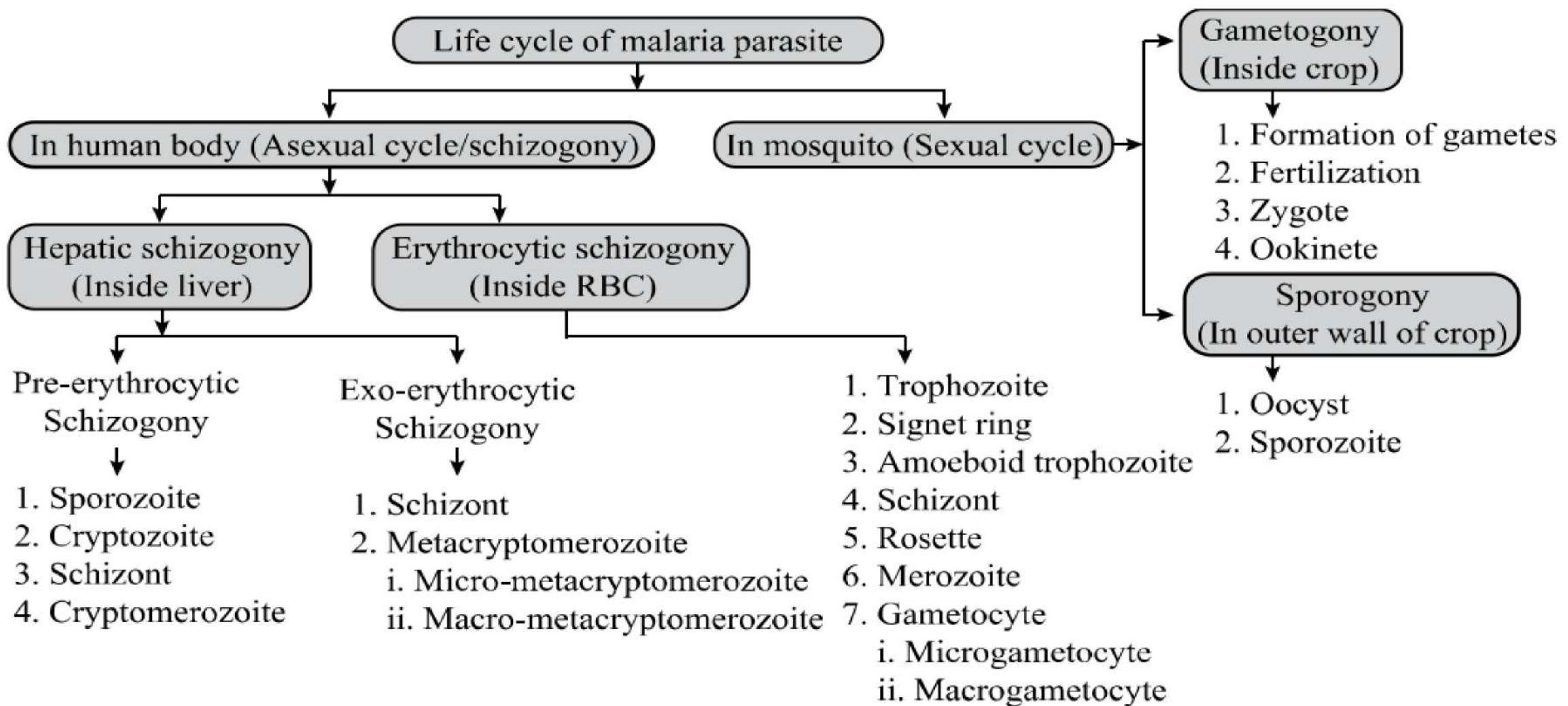
LIVER + RBC

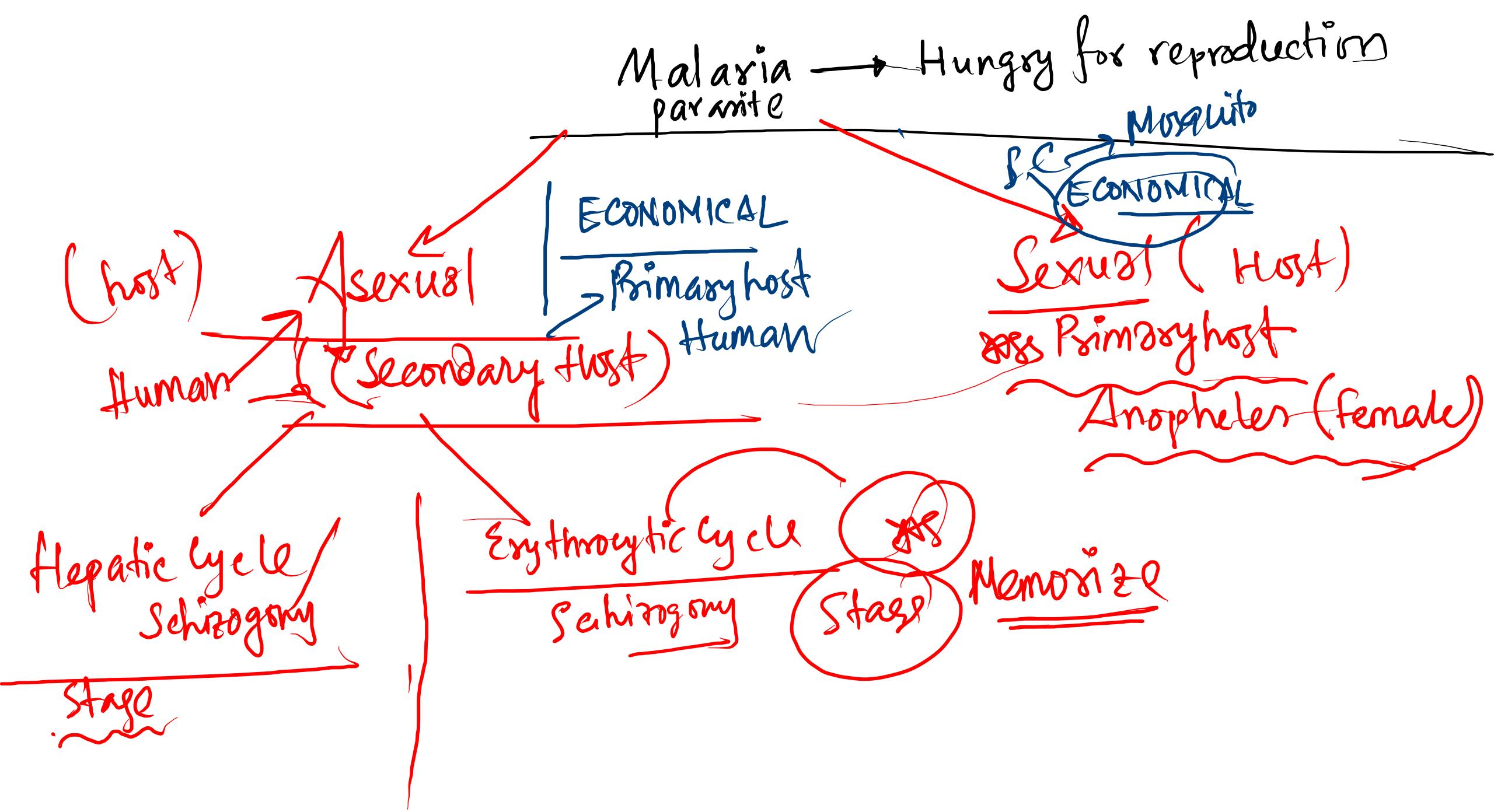


উন্মত্ত

মাধ্যমিক এবং উচ্চমাধ্যমিক বেসরকার

Life Cycle of Malarial Parasite





(Hepatic or liver schizogony)

- ❖ 8,000-20,000 merozoites are formed from each schizont in pre-erythrocytic schizogony
- ❖ Takes about 7-10 days.

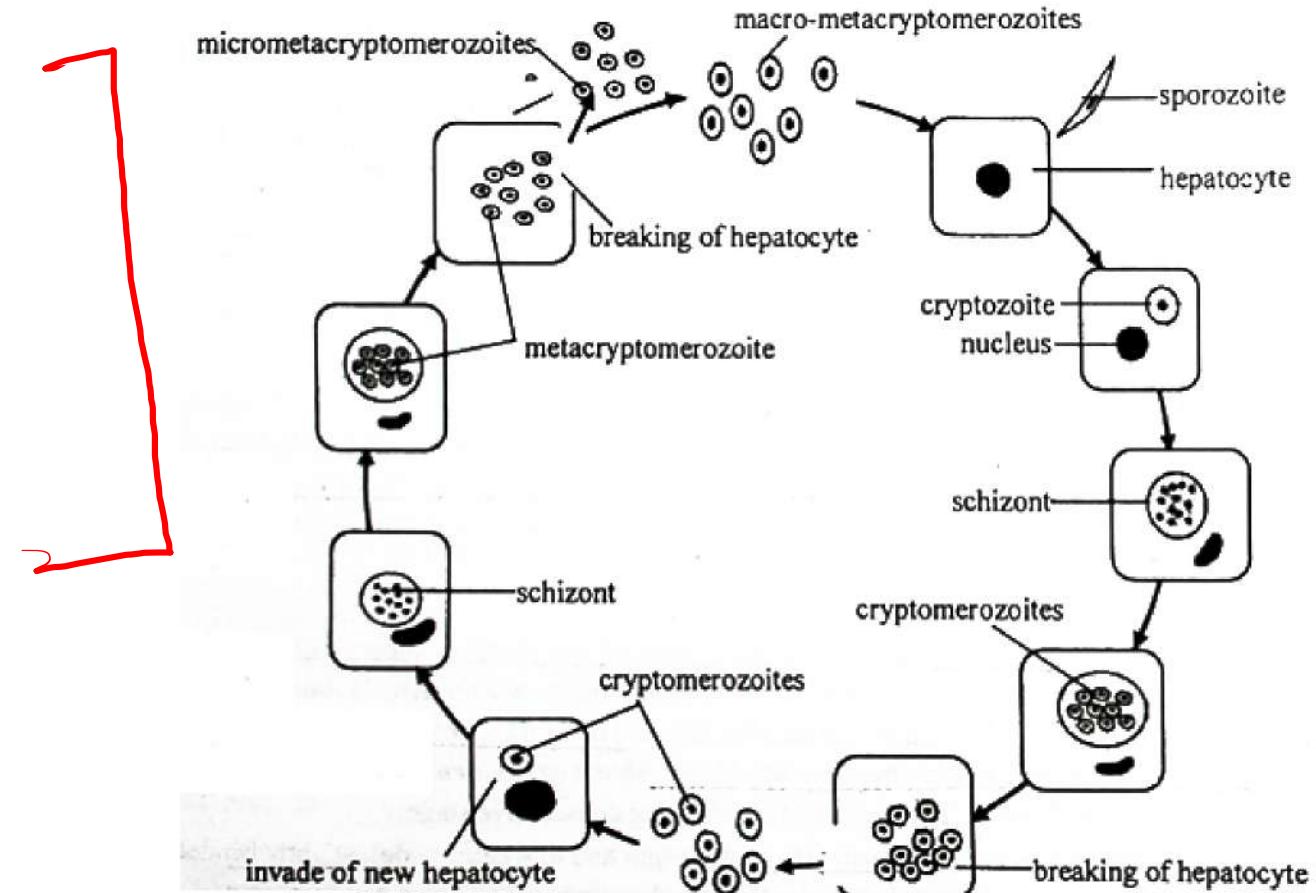


Fig 4.15 Hepatic schizogony of *P. vivax*

Erythrocytic Schizogony

Stage Headline

- ❖ Trophozoite
- ❖ Signet ring
- ❖ Amoeboid trophozoite: Malaria is diagnosed by the presence of Schuffners dots in RBC.

- ❖ Schizont (hemozoin) **Headline**
- ❖ Merozoite: Rosette phase can be seen.
- ❖ Gametocyte: 2 types: a) Micor/male; b) Macro/female

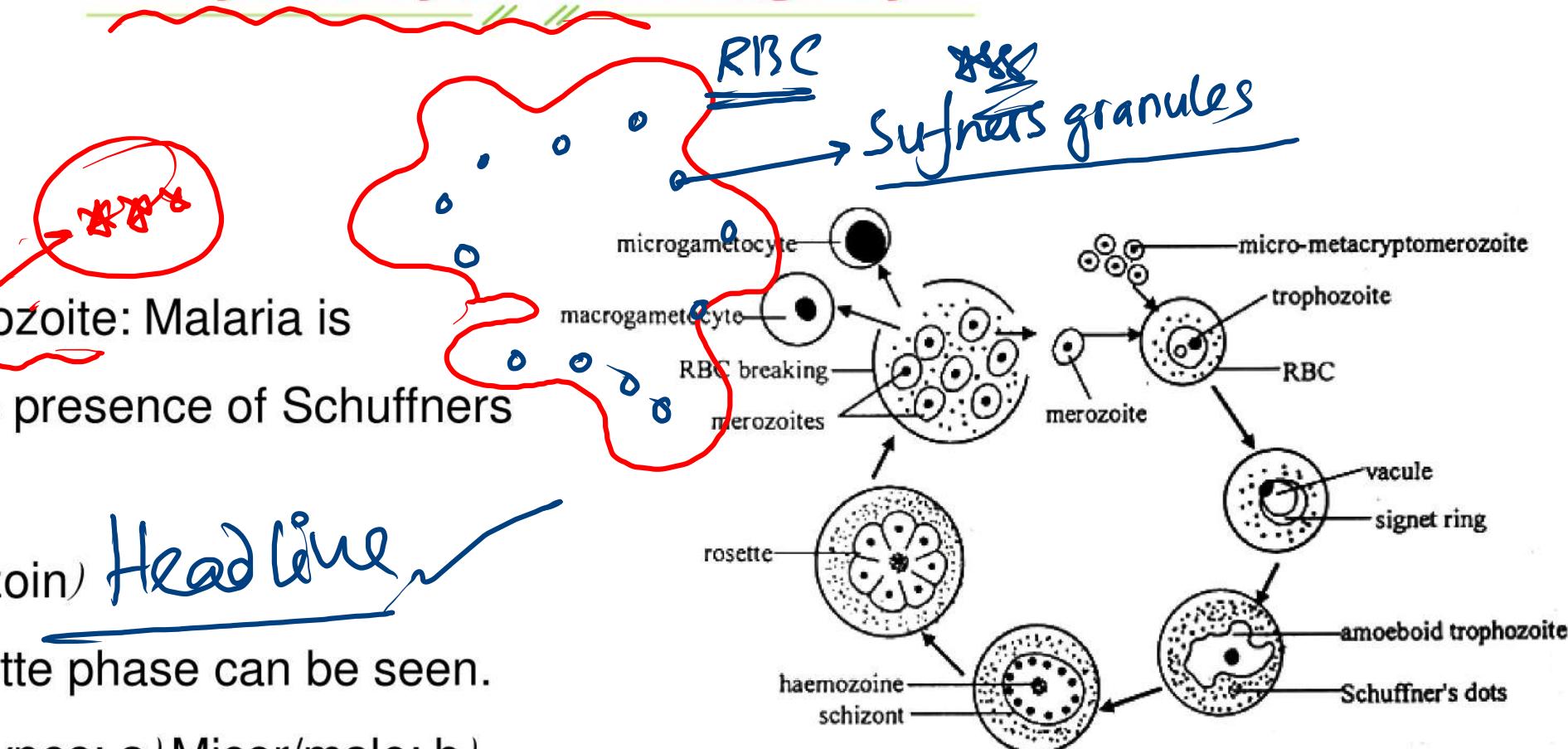


Fig 4.16 Erythrocytic schizogony of *P. vivax*

Sexual Life cycle in female Anopheles mosquito

- ❖ Gametogony
- ❖ Sporogony

NS

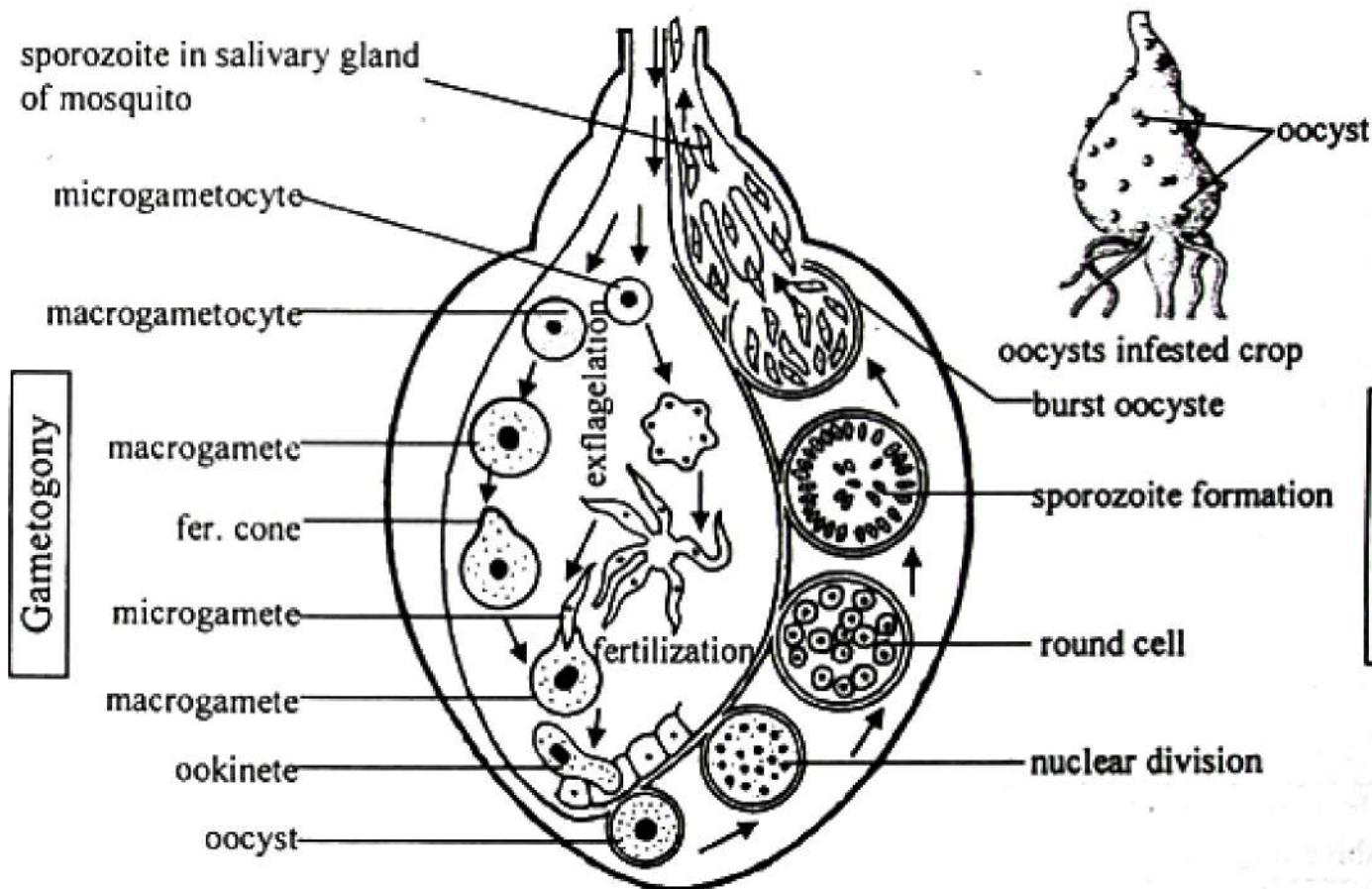


Fig 4.17 Sexual cycle of *P. vivax* in mosquito body

Alteration of Generation:

~~Inside Human
Anophelis (Female)~~

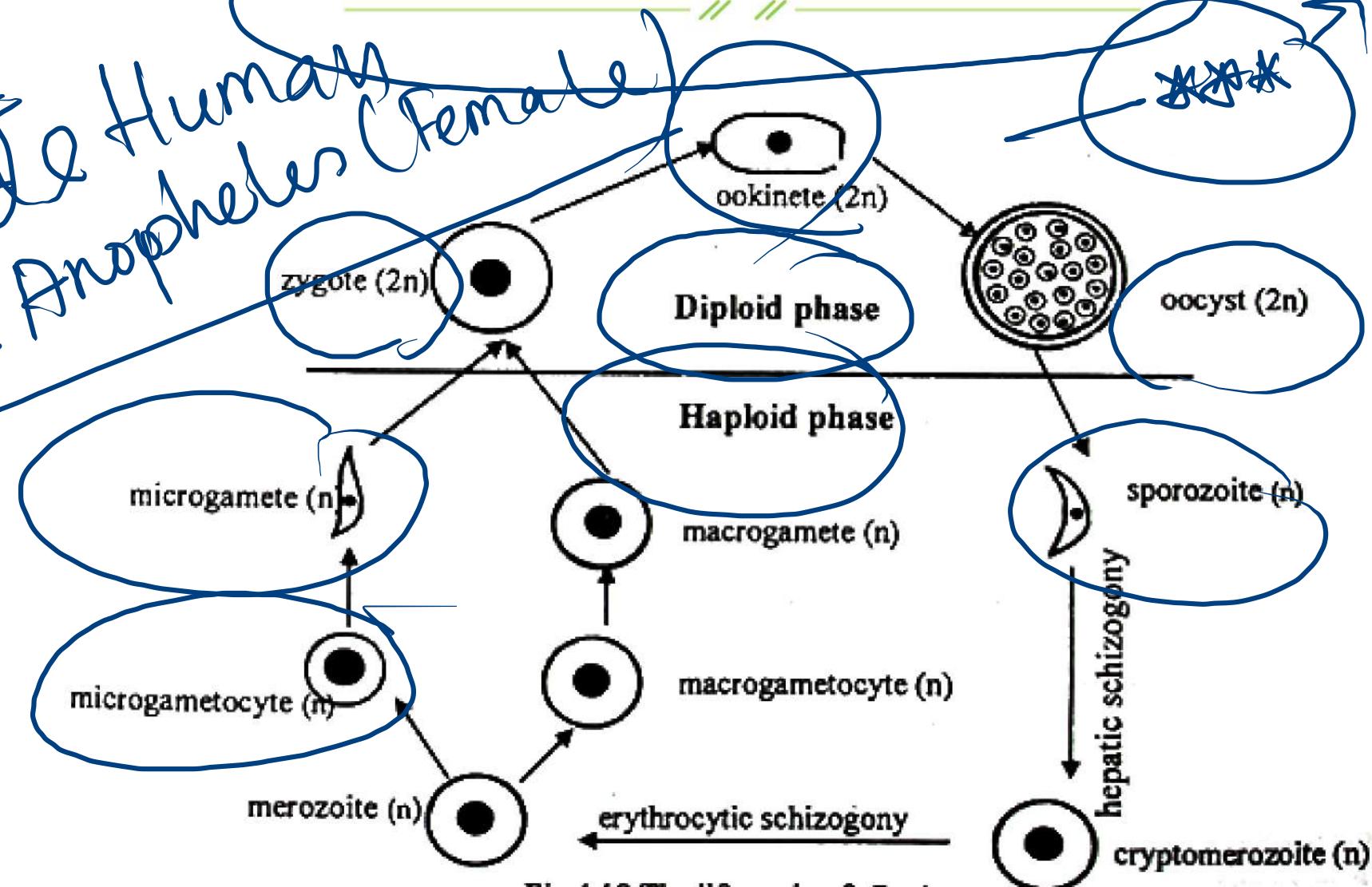


Fig 4.18 The life cycle of *P. vivax*

~~DAPPX~~

~~Meditrix~~

Difference between Exo-erythrocytic (hepatic) and Erythrocytic Schizogony: VVI

Difference between asexual and sexual cycle in malaria parasite: 100%

□ Malaria Vaccine:

- ❖ First vaccine of malaria in the world is called Mosquirix, which is also known as RTS,S.
- ❖ Doses- 4 which is able to produce active antibody against P. falciparum.



Malaria fever:

Symptoms	<ul style="list-style-type: none">The symptoms are manifested within 2-3 weeks of transmission.Fever appears with chills and rigor at regular intervals.Lack of appetite, lower abdominal pain, nausea, thirst and deep respiration occur.Spleen and liver enlarge and the affected spleen releases a substance called lysolecithin, which causes the destruction of normal RBC, resulting in anemia.<ul style="list-style-type: none">Temperature rises to <u>105-106°F</u>. <i>Temperature 98</i>
Diagnosis	<ul style="list-style-type: none">Malaria is detected by the presence of Schuffner's dots in RBC.<u>Immunochromatography (ICT)</u> can detect malaria parasites.

Treatment

❖ **Quinine** is the main drug of malaria which is prepared from *Cinconia officinales* plant.

❖ **Other drugs** : Nivaquine, chloroquine, chemoquine, palludrine, avlochlor, doxycycline, malarone etc



Poll Question: 11

During which schizogony is malarial fever seen-

- (a) Pre-erythrocytic
- (b) Exo-erythrocytic
- (c) Hepatic
- (d) Erythrocytic

Poll Question: 12

Malignant tertian malarial fever occurs after every-

- (a) 48 – 56 hours
- (b) 72 – 100 hours
- (c) 36 – 48 hours
- (d) 24 – 48 hours

