

# LIFE CYCLE OF BACTERIOPHAGE

The virus that infects and becomes parasite on the bacterium is called Bacteriophage. There are many strains of the phage but only one kind of phage will attack only one strain or one species of bacteria.

There are two types of life cycles of the phage namely:

1. Lytic cycle
2. Lysogenic cycle

## 1. LYTIC CYCLE

The phages undergoing lytic cycle are called lytic phages or virulent phages e.g. T-series bacteriophages.

In lytic cycle, a lytic phage infects and kills the host cells to release progeny virions.

In this cycle the phage is regarded as virulent or master and the bacterial cell (host) is regarded as slave.

The whole process involves the following steps:

1. Adsorption or infection
2. Penetration or Injection
3. Synthesis of Phage components

4. Virion assembly
5. Lysis or release.

## 1. ADSORPTION OR INFECTION

The lytic cycle begins with a collision between T-phage virion and a susceptible host cell i.e Escherichia coli. The process of attachment of a virion on the host cell surface is called adsorption. The phage attaches itself by tips of tail fibers to the cell wall of bacterium at a point called receptor site.

## 2. PENETRATION OR INJECTION

The phage contains an enzyme called lysozyme which digests the cell wall of bacterium. Thus an opening is formed in the bacterial cell wall.

The tail sheath contracts so that the hollow tail core (inner tube) penetrates the bacterial wall and injects the viral genome into the cytoplasm. ~~After~~ The protein coat and the tail remain outside. After penetration, the empty capsid that remains outside the bacterium is called the ghost or doughnut.

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## 3. SYNTHESIS OF PHAGE COMPONENTS

Immediately after penetration, the phage DNA (genome) synthesizes early

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proteins. Some early proteins break down the bacterial (host) DNA and take the control of the bacterial cell machinery.

The other early proteins are used as enzymes for replication of phage DNA.

The newly synthesized phage DNAs produces late proteins, which are the protein subunits of the phage capsid (~~head and tail~~)

#### 4. VIRION ASSEMBLY

The capsid protein assemble to form empty head and a condensed viral DNA is packed inside it. Finally the separately assembled tail joins to head to form a daughter or progeny virion.

#### 5. LYSIS OR RELEASE

During assembly of progeny virions, the bacterial cell becomes spherical. The daughter phages exert pressure on the cell wall of bacterium. The phage enzymes weaken the cell wall which ultimately burst or lyse to release about 100-200 progeny virions, which are now ready to attack new bacteria and start their life cycle.

P.S: This process takes 40 min

## 2. LYSOGENIC CYCLE

The phages that exhibit lysogenic cycle are called temperate phages or non-virulent phages. For example,  $\lambda$  (lambda)-phages attacking E. coli.

### HOST-GUEST RELATIONSHIP

In this cycle, ~~kill~~ the phage does not kill or destroy the bacterium (host). Both the phage and bacterium live and multiply in a peaceful coexistence. In this case the phage becomes a harmless guest and the bacterium acts as a host. Sometimes when the phage DNA enters the bacterial cell, instead of taking over the control of biosynthetic machinery of the host it becomes associated and mixed up with the bacterial chromosome in a friendly atmosphere. In this condition the bacterium continues to live and reproduces normally. The phage DNA which has integrated into the bacterial DNA is now called as prophage. The host bacterium containing prophage is called a lysogenic bacterium or lysogen. The prophage passively replicates along with the host DNA for many generations. Thus the number of phages increase without any harm or damage to the bacterium cell. Therefore this relation is called guest-host relationship. This type of cycle is called lysogenic cycle.

# INDUCTION UNFAVOURABLE CONDITION

When a lysogenic bacterium is exposed to UV-light or a chemical, the prophage withdraw from the host DNA and become re-activated to become virulent and hence destroy the bacterial cell and undergo lytic cycle. This conversion of a prophage into a lytic phage is called induction.

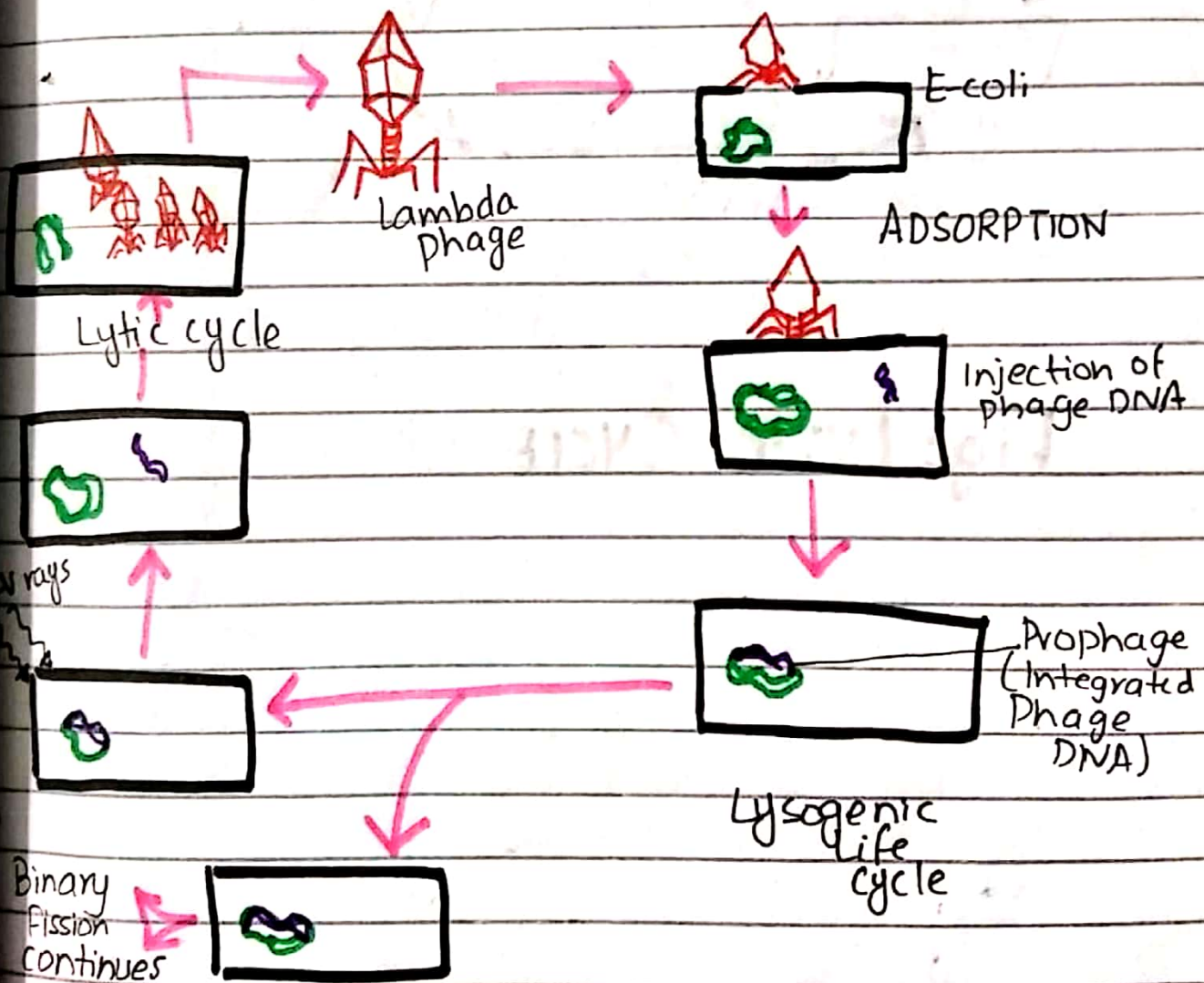


Fig: Lysogenic Cycle

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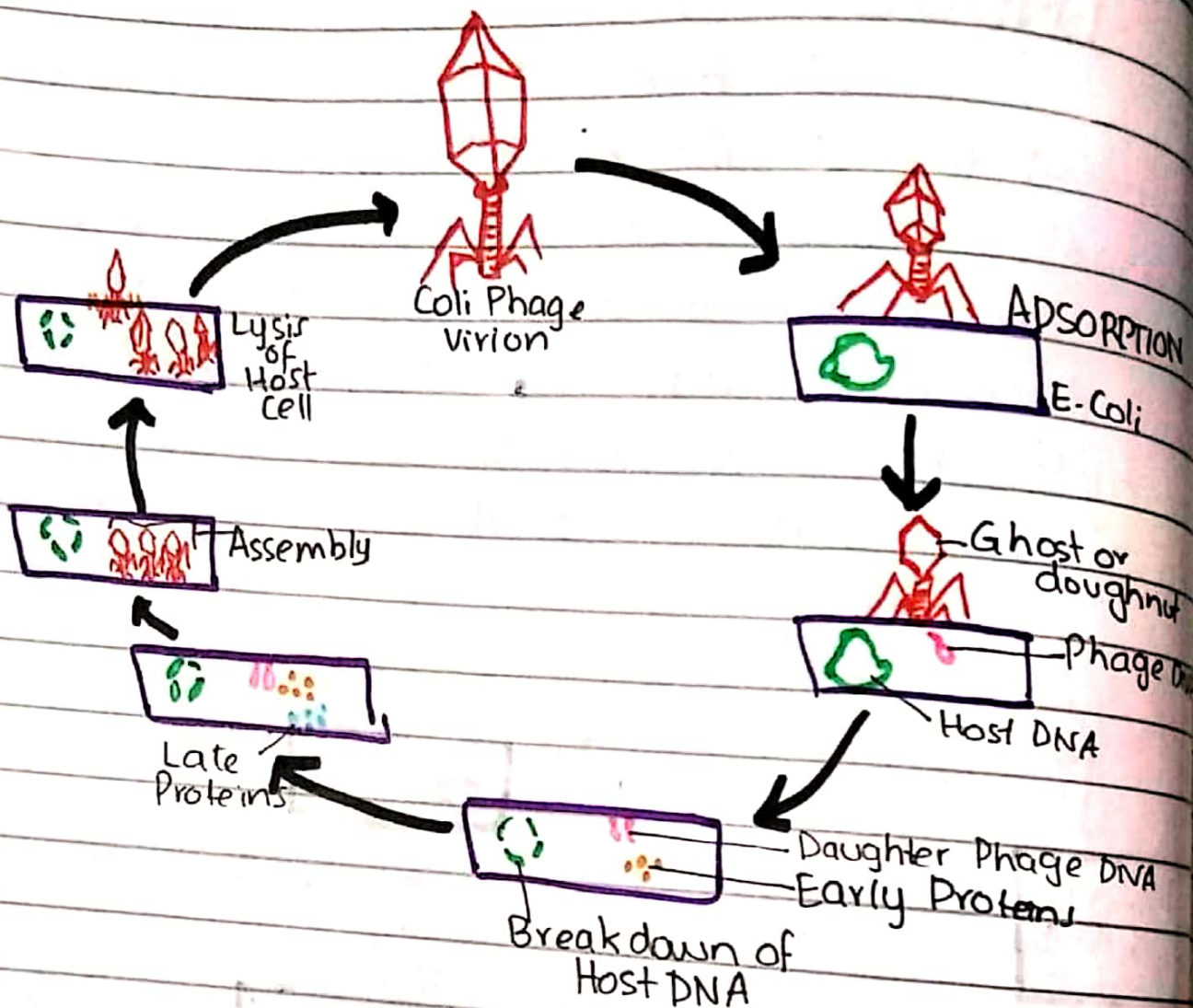


Fig: LYTIC CYCLE

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