Lysogenic Life cycle / Temperate phage.

Some phages don't replicate once inside the host cell but instead their DNA/RNA becomes incorporated in the DNA of the host cell just like a 'gene'; such inactive phages are called – Prophage/Provirus. In this way they are replicated for several generations as the host replicates its own DNA.

The λ phage DNA (dsDNA) is inserted into the E. coli DNA at a specific site between the "gal operon" and the "bio operon". Insertion requires special enzyme called — integrase.

spontaneous induction may occur in some cases, which activates bacteriophage genes and there is resumption of lytic life cycle.

* Multiplication of Phi X174 (ΦX174) :–

ΦX174 contains single stranded DNA in the form of a ring. During replication the Viral DNA (+ strand) synthesises a complementary '–' strand and becomes double stranded – "Replicative" form. The double strand helix duplicates in usual manner synthesising '+' and '–' strand. Virus coats are formed and their single strand form new virion.

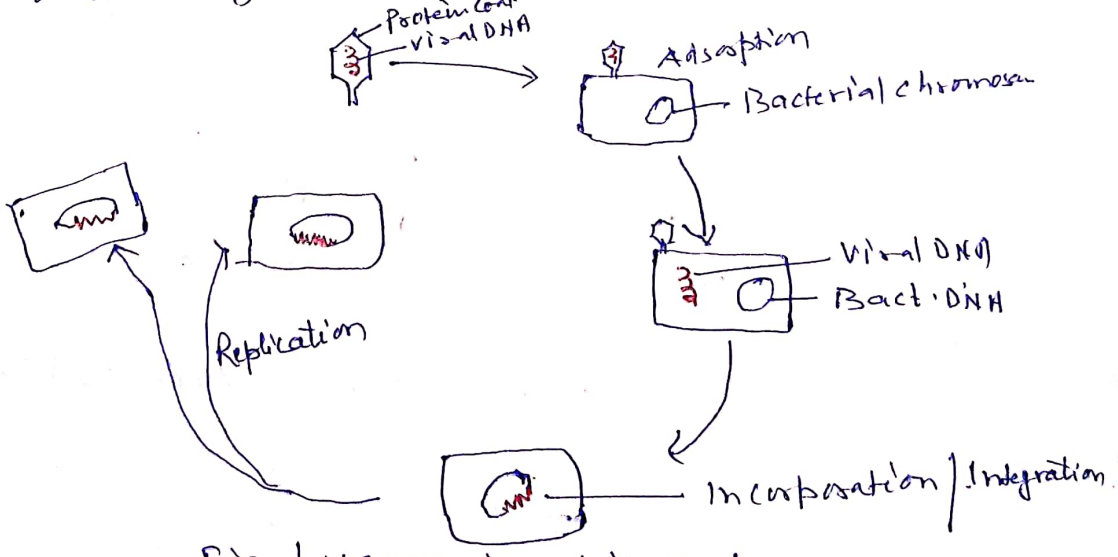

Fig- Lysogenic Life cycle.

depending upon the phage and the bacterium involved. Bursting is assisted by Lysozyme. About 200-1000 phages are released from one bacterium. The total time taken is called "Latent Period" which is nearly 30 min.

- Burst size — The numbers of mature virions released of Lysis is called "burst size".

vii) Re-Infection :- The mature virions after release infect new bacterial cell and complete the cycle.

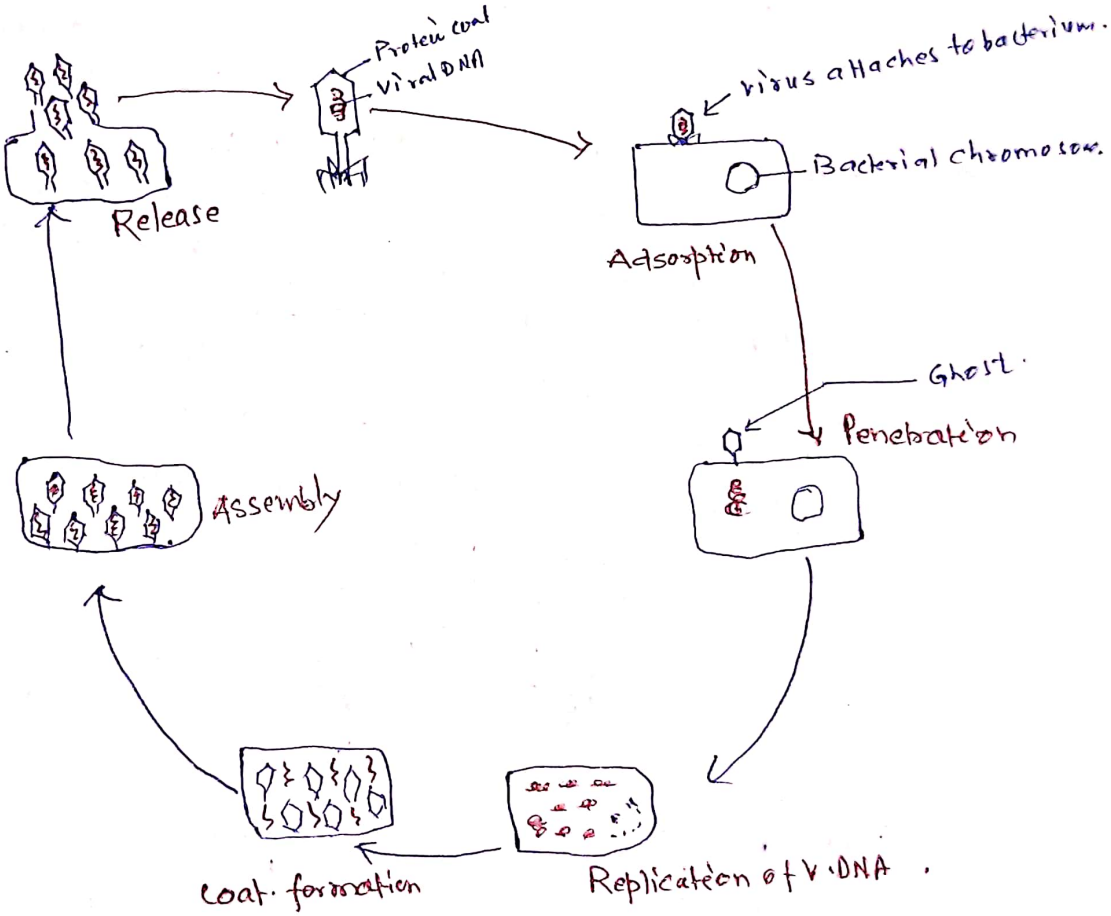

Fig. Lytic Life cycle of Phages.

3. Describe the Life Cycle of Bacteriophages.

Life cycle of a typical bacteriophage is completed with the help of E. coli. Generally two types of life cycle are reported in bacteriophage.

1) Virulent / Lytic life cycle, &

2) Temperate / Lysogenic life cycle.

1. Virulent / Lytic life cycle:—

The different stages are as follows :—

(i) Adsorption :- When phages attack bacteria, tail fibres adsorb to the specific receptor sites on bacterial cell surface.

(ii) Penetration and injection of DNA :-

The mucopeptide wall of Bacteria is penetrated either by digestion with lysozyme found in base plate or by physical force. This is provided by the tail sheath. Finally, the hollow spine is penetrated in to the cell.

After penetration, DNA is injected in the cell. The head remains on the outside of the bacterium and is termed as "ghost". The tail) Sheath contains ATP, ATPase enzyme and contractile protein. Phage DNA carries genetic information.

The period inside the bacterial cell before the formation of new phages is called "Vegetative phage"

(iii) The Eclipse Period :—

The period of time between infection by the phage and the appearance of the mature phage virus within the cell is called eclipse period. During this period following steps occur —

(a) Synthesis of early Proteins — Phage DNA takes control of cell metabolism for the synthesis of phage specified mRNA & Proteins. In T-even phages 2 sets of mRNA — early mRNA & late mRNA are synthesized corresponding to early and late proteins. The early proteins are made before phage DNA replication and includes —

- enzymes for synthesis of phage DNA
- enzymes for breaking any bacterial mRNA
- enzyme that break bacterial DNA
- the internal head protein.

(b) Replication of Phage DNA —

The early enzyme (DNAase & RNAase) breaks DNA and RNA of bacteria. It serves two functions —

- stops bacterial protein synthesis and makes bacterial protein synthesis apparatus available to phage. secondly.
- bacterial DNA fragments are required in phage DNA synthesis.
- DNA replication takes place rapidly in to 100 – 200 phage DNA.

(c) Synthesis of late protein :–

After replication of phage DNA late mRNA is used for the synthesis of late proteins. These are structural proteins i'e coat protein and Lysozyme.

iv) **Maturation / Assembly** :–

The process of assembly of the phage from it's components is called — maturation. The head, tail and tail fibres are completed independently, and only do they combine.

v) **Release:** Release occurs by sudden bursting which takes place within 20 minutes to an hour.