Introduction

- One-step growth curve, developed by **Max Delbriick** and **Emory Ellis (1939)** using Escherichia coli-T_4 bacteriophage system**,** marks the starting of modern bacteriophage research.
- An experiment by which molecular events during reproduction can be observed in a single replication cycle of a virus.
- It reveals the fundamental nature of virus replication.
- In this only single or one cycle of virus growth is observed hence it is called as One-step multiplication curve

Phases of one step growth curve

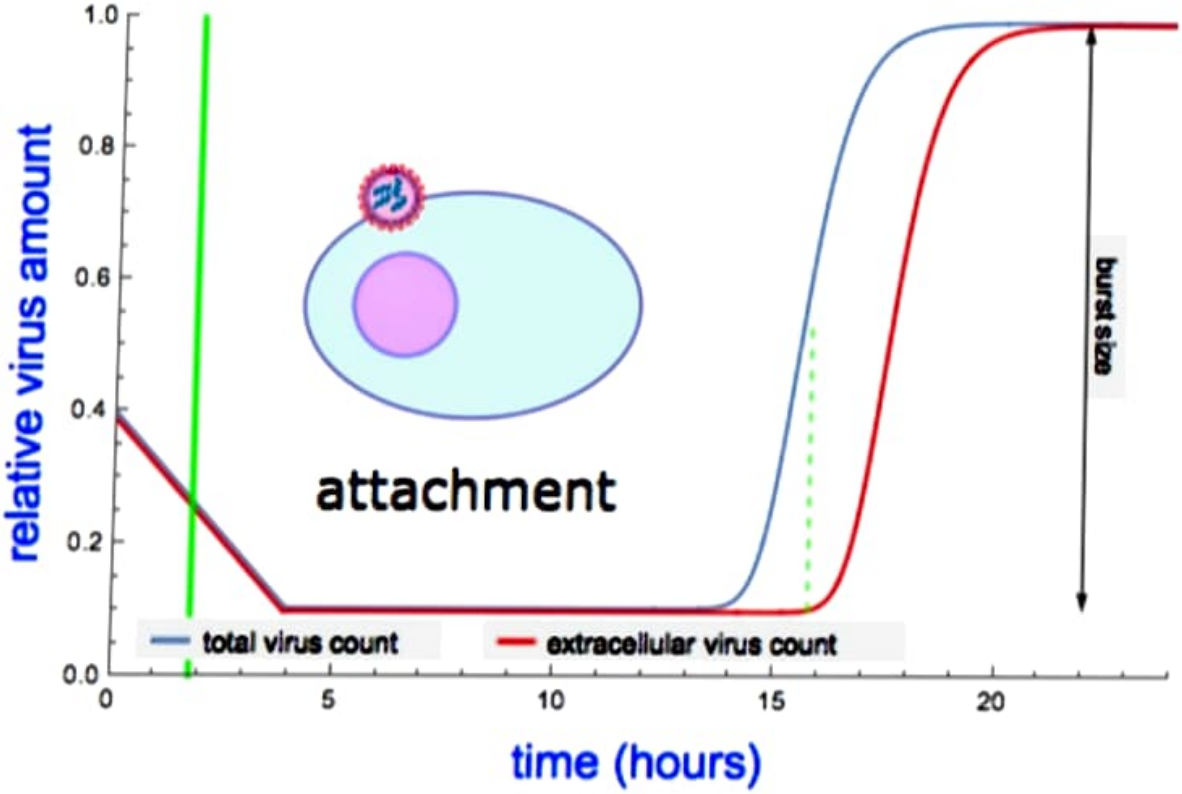
- log no. of plaque forming unit/ml plotted against time, a curve is obtained, termed as one step growth curve
- It has three distinct phases
  1. Latent period
  2. Burst or Rise period
  3. Plateau period

1. Latent Period

- The latent period is described as the time **period prior to the release of infection particles or appearance of extra cellular phages**.
- In the latent period, attachment, entry, replication, transcription, translation and assembly of progeny phages occur.
- During this period there is no release of new phage particle therefore plaque count remains constant
- Latent period can be divided into two phases

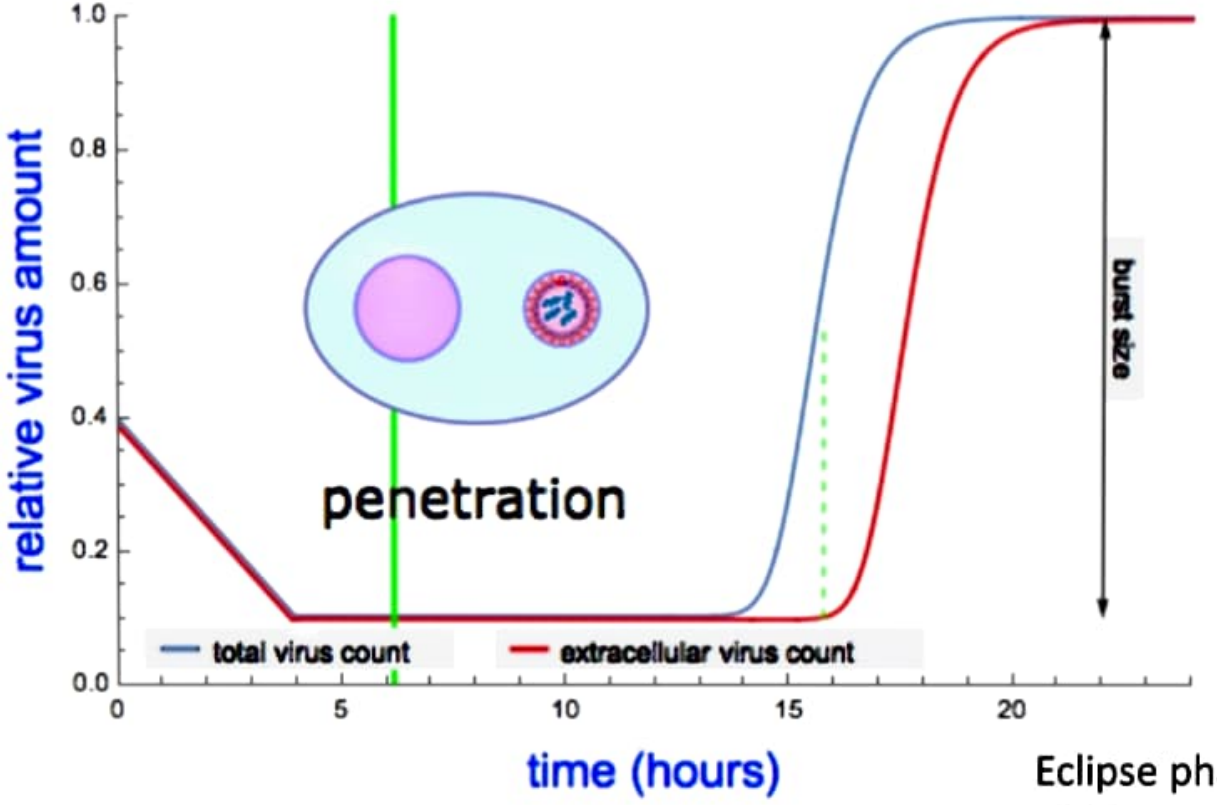
a. **Eclipse:** This period immediately follows the penetration of viral particles into the host cell. Eclipse is characterized by the incapacity to detect free virions since viruses are actively transcribing and replicating inside the host. The eclipse usually lasts from minutes (bacteriophages) to hours or days (animal or plant viruses).

b. **Intracellular accumulation**: During the eclipse period all structural proteins and viral genomes have been produced and massively accumulated in the cytoplasm of the host cell. Both components self assembly to form new viral particles that accumulate intra cytoplasmatically



phase: inoculation

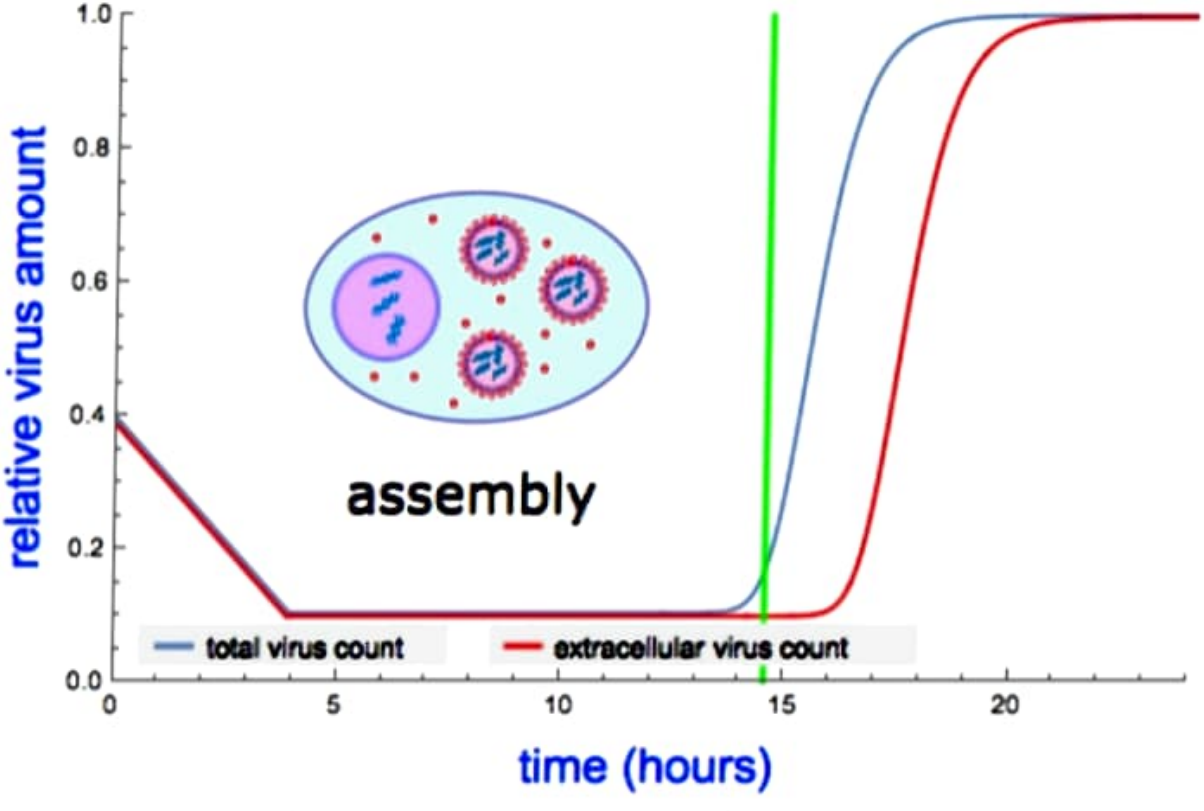
Inoculation phase: A host (cells, bacteria, etc.) is inoculated with a virus. During this phase, the virus undergoes the first step of the *viral life cycle*: **attachment** (to host cells). Sometimes, the amount of virus decreases because the virions attached to host cells are not yet considered viruses. After some time, the culture medium is diluted or antibody is added to prevent new virion attachment to host cells, thereby freezing the number of virions for the rest of the experiment.



Eclipse phase for T_4 is 11.5 min

phase: eclipse

Eclipse phase: Viruses are now being manufactured within host cells. During this phase, viral contents enter the cell during the **penetration** step of the viral life cycle. After genetic material is **uncoated** (the capsids removed), genetic material is copied and viral components are manufactured during the **biosynthesis** step. Typically, a combination of viral enzymes packaged in the original virus and machinery and materials already present in the cell is used during biosynthesis.



phase: maturation

Maturation phase: After synthesis of capsids, enzymes and other materials, new virus particles (virions) are formed during the **assembly** step. Total virus count increases before extracellular virus count increases: there is a lag while virions are being created, but not enough have been created for **release** to occur. Non-enveloped viruses accumulate in cells until cell lysis. Enveloped viruses assemble near cell membranes and "bud" off cell membranes via exocytosis.

2. Rise Period

- In this period lysis occurs and librated a crop of new virus particle hence extracellular phages appear
- During this phase, phage particle increase in their concentration rapidly.

T_4 rise period = 10 min

---

3. Plateau Period

This period represents the end of all infected host cell lysis.
The newly liberated phage particles fail to meet uninfected host cells due to high dilution.
Therefore during this phase, the plaque count remains constant.
Burst Size: Average yield of infectious virus per cell is called burst size.
Burst Size = pfu/ml at plateau/ pfu/ml at latent period

There is much variation in bursts size between different kind of cells. (range between 20-3000 pfu/ml)
Burst size for T_4 = 100