

Anbar University

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Viral replication

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Virology, Stephen N.J. Korsman, Gert U. van Zyl, ... Wolfgang Preiser
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Jawetz Melnick & Adelbergs Medical Microbiology, Stefan Riedel
(Author), Stephen Morse (Author), Timothy Mietzner (Author), Steve
Miller.

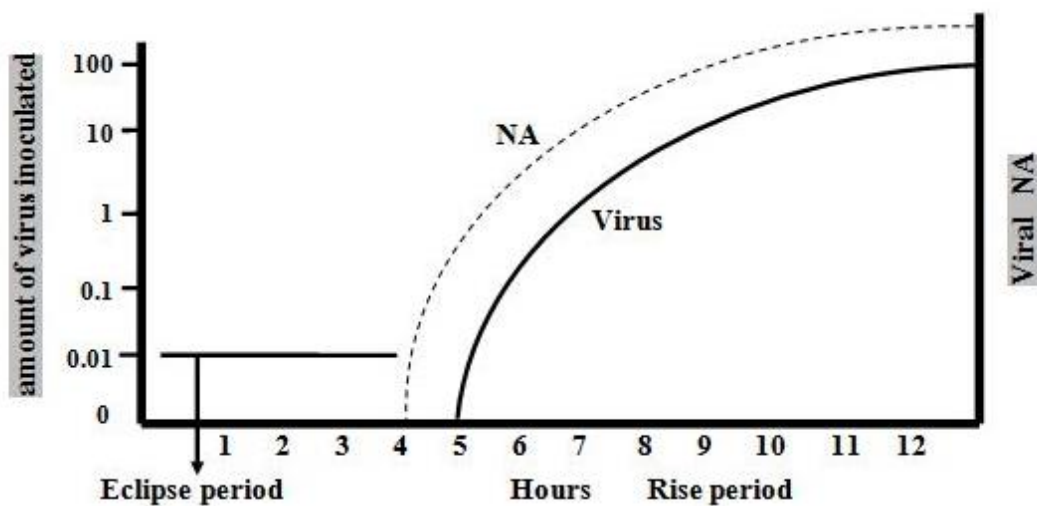
**Viruses, Pandemics, and Immunity, By Arup K. Chakraborty
and Andrey S. Shaw**

Viral replication

Each family of viruses has its own characteristic of replication

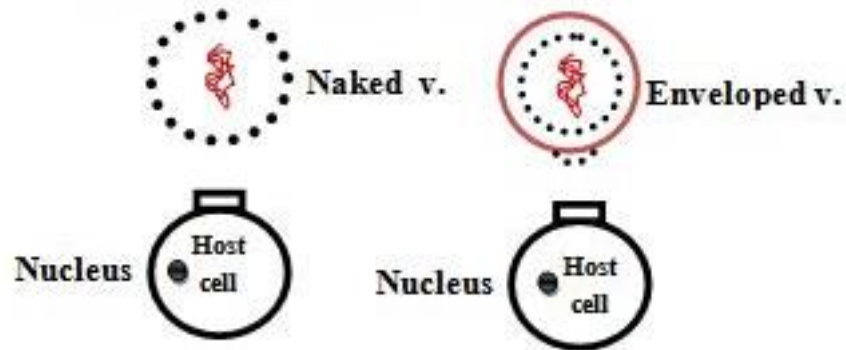
Eclipse period

When the virus enters the cell, they disappear inside host cell 2-3h. This time from the entrance to the appearance again called eclipse period.



Steps of the viral replication:

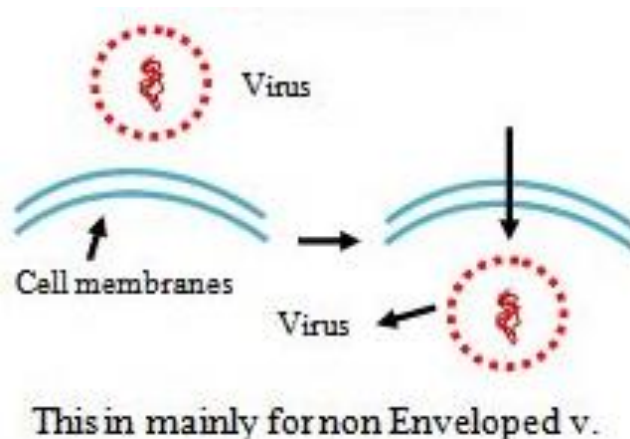
- 1- **Attachment:** recognition of a target host cell, when the virus recognizes the cell receptors and binds out.



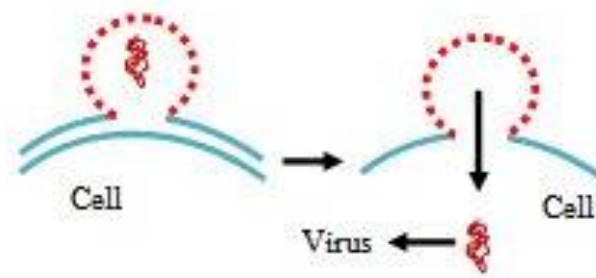
2- Penetration:

To enter cells, viruses penetrate the plasma membrane, endolysosome membrane, or ER membrane to reach the cytosol. Many viruses including influenza virus, HIV, and PV breach the plasma or endolysosome membranes to enter the cell.

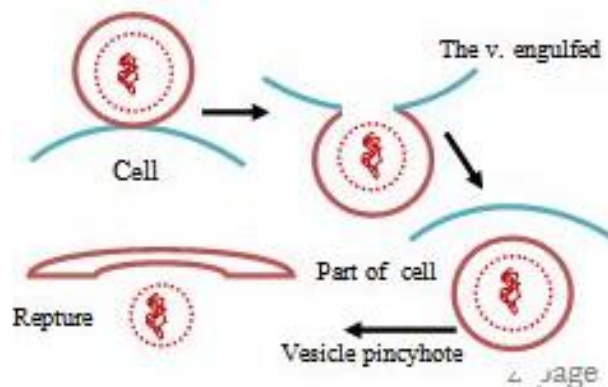
a- Direct translocation across cell membrane



b- Fusion of the viral and cell membrane



c- Viropexis is the process by which different classes of viruses—particularly picornaviruses and papovaviruses—enter the host cell in which they will be able to replicate.



3- **Uncoating:** the virus capsid will be destroyed by enzymatic action mainly leading to release the nucleic acid inside host cell. It is regulated by cues from receptors, enzymes and chemicals.

4- **Genome expression and genome replication:**

Transcription / mRNA production

For some RNA viruses, the infecting RNA produces mRNA. This is translation of the genome into protein products. For others with negative stranded RNA and DNA, viruses are produced by transcription then translation.

- DNA viruses replicate in the nucleus use host cell DNA depend RNA polymerase to synthesis mRNA. Pox virus

replicate in the cytoplasm because it carry's own polymerase within virus particles.

Synthesis of virus components

The components are manufactured by the virus using the host cell.

Viral proteins:

Viral mRNA is translated on cellular ribosomes into two types.

Viral protein:

- 1- Structural: proteins which make up the virus particle
- 2- Nonstructural: proteins not found in the virus particle, mainly enzymes for virus genome replication

Viral nucleic acid

New viral genomes are synthesized; templates are either the parental genome or newly formed complementary strands, in the case of single-stranded genomes. These genomes are made by either a viral polymerase or (in some DNA viruses) a cellular enzyme.

Replication

-Single positive strand RNA (+ve sense): directly acts as mRNA
ex. Polio virus

-Single negative strand RNA (-ve sense): dependent RNA polymerase ex. influenza virus

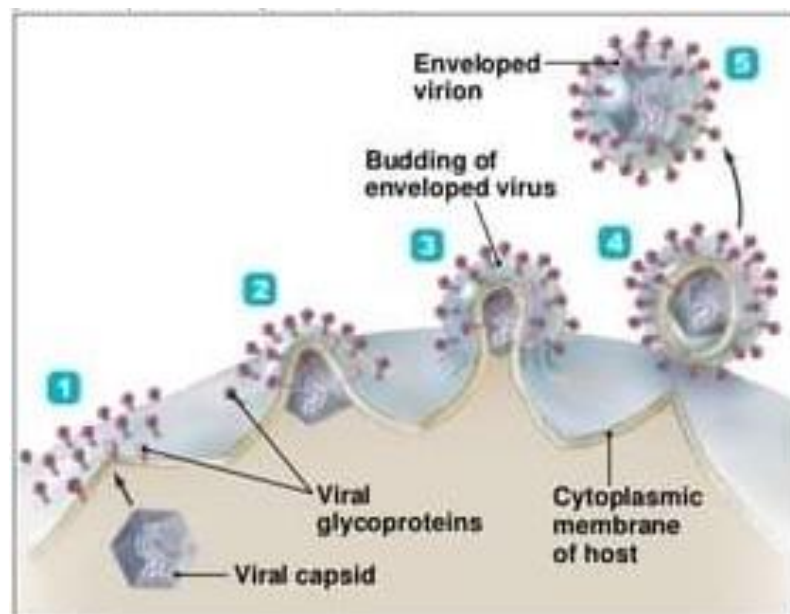
RNA virus's replication occurs in cytoplasm except HIV (the late stage of this virus is ADIS) and influenza, they occur in nucleus of the host cell.

After formation of viral mRNA for DNA or RNA the following step is translation of mRNA

Release of viruses

Releasing viruses are achieved by two methods:

- 1- Rupture of the cell membrane and release of mature particles (undeveloped viruses).
- 2- Budding: budding enables viruses to exit the host cell and is mostly used by enveloped viruses which must acquire a host-derived membrane enriched in viral proteins to form their external envelope.



Typical viruses

- 1- **Defective viruses:** consist of viral nucleic acid and protein; usually have mutation or deletion in their genetic material.
- 2- **Pseudovirions:** contains host cell nucleic acid instead of viral nucleic acid within the capsid.
- 3- **Viriods:** consist of a single molecule of circular RNA without protein coat (capsid).
- 4- **Prions:** infectious particles consist of only protein without detectible nucleic acid. They cause many of diseases (slow disease) ex. Creutzfeld Jacob dis. (CJD) and bovine transmissible spongiform encephalitis (cow madness) which is chronic degeneration disease of CNS caused by prion.

Histological examination of brain biopsy shows that the brain tissue looks like chees (hole in brain). The infection can occur by eating unwell cooked beef of infected cattle.