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Virus

Reproduction in Viruses

In absence of biosynthetic enzymes, virus take over the biochemical machinery of the host cell biosynthesis the macromolecules required for the production of virus progeny. In general the replication cycle is similar in most viruses but details vary from group to group. Animal virus reproduction may be divided into many stages. like

(I) ~~Adsor~~ Adsorption of the virion.
(II) Penetration and uncoating.
(III) Biosynthesis and assembly of virus capsids.
(IV) Maturation &
(V) Release.

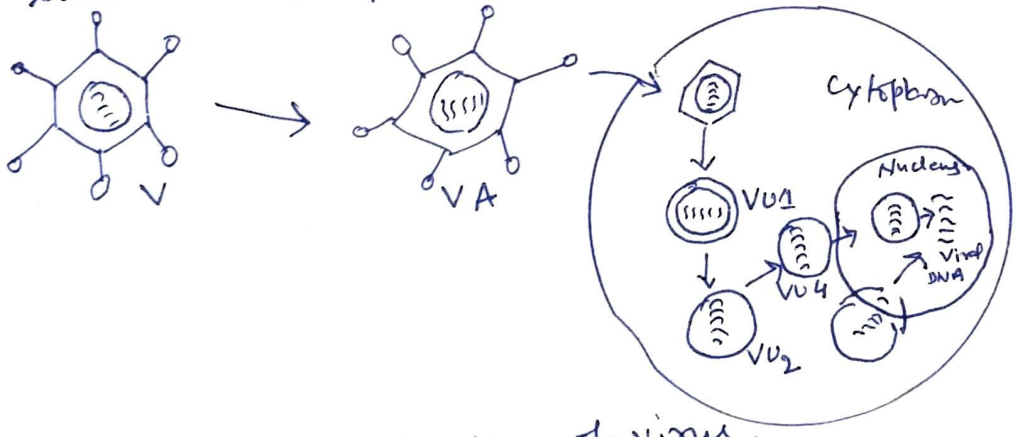
Adsorption of virion → Viruses come in contact with the host cell by random collision. The adsorption of a virion to the host cell depends upon the presence of specific receptors on the cell surface. The viruses often enter cell by endocytosis. Viruses trick the host cell by attaching to surface molecules that normally enter the cell by endocytosis. Thus viruses enter the host cell passively. These host cell surface proteins are usually the receptors which bind hormones & other important molecules essential for the cell's function. The orthomyxo and Paramyxovirus head specific glycoproteins containing neuraminic acid for attachment to cell walls.

Penetration and Uncoating → After adsorption, virus penetrate the plasma membrane and enter into a host cell. Removal of the capsid & release of viral genome

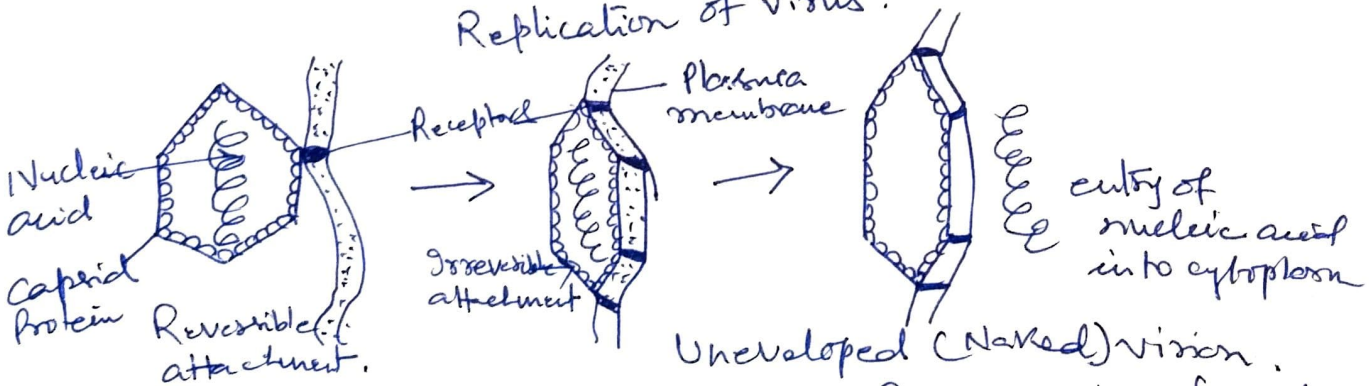
Viruses differ greatly in structure & mode of reproduction their mechanism of penetration & uncoating are also different. Some viruses only inject their genome into the cell, while others ensure that a virus associated DNA or RNA Polymerase must also enter the host cell along with viral genome. The entire process from adsorption to final uncoating may last from a few minutes to several hours.

The exact mechanism of penetration and uncoating is still not clear. It is assumed that three different mode of entry may be employed.

Some naked virus like Poliovirus undergo a major change in their capsid structure after its adsorption to plasma membrane, releasing only viral nucleic acid into the cytoplasm.



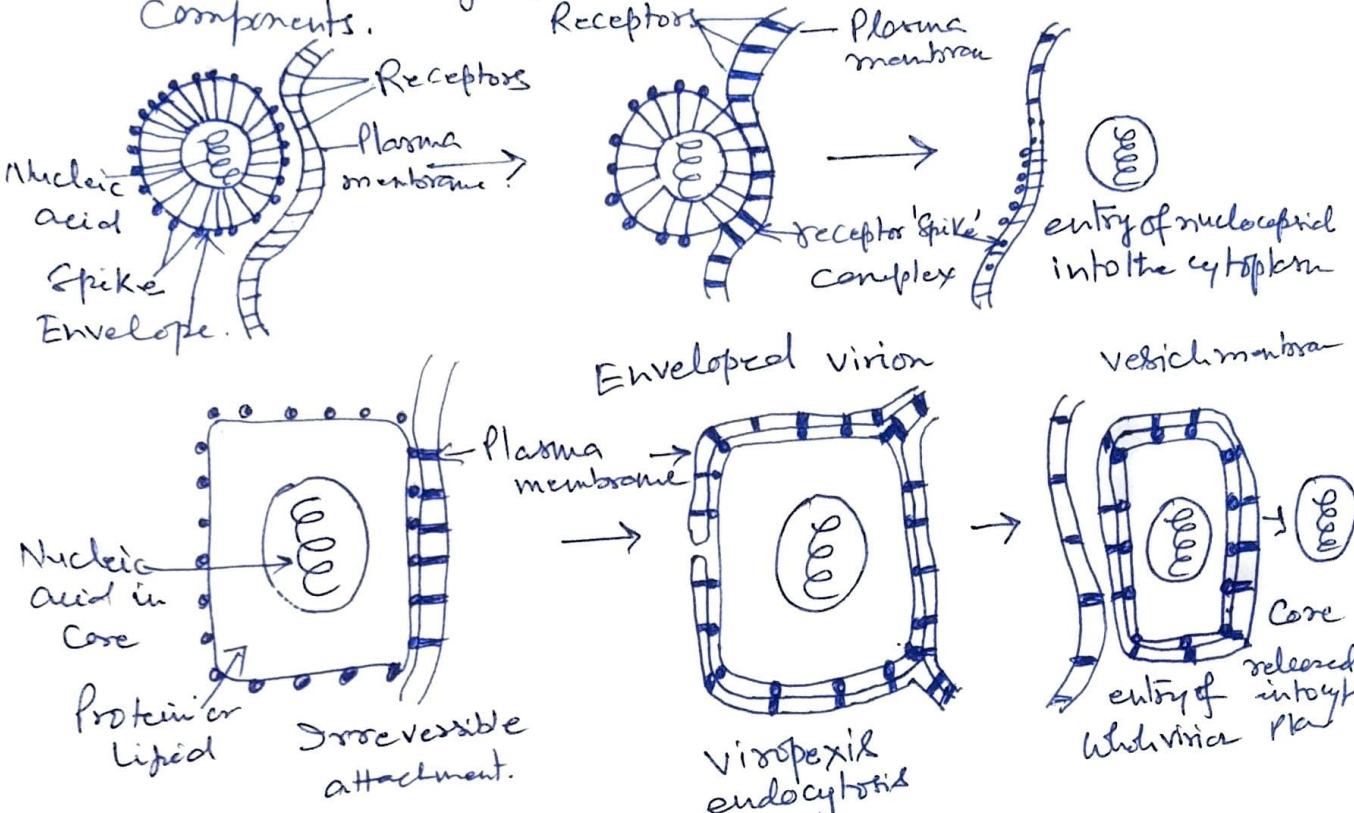
Replication of virus.



Uncveloped (Naked) virion.

Envelopes of some viruses like Paramyxovirus fuse directly with the host cell plasma membrane, depositing the nucleo-capsid into the host cytoplasm. The virus RNA Polymerase begins transcription of viral RNA, which still enclosed in capsule

Most of the other enveloped viruses enter the host cell through engulfment by receptor mediated endocytosis to form coated vesicles (Pits). These vesicles are pinched off into the cytoplasm where they fuse with the lysosomes. The lysosomal enzymes dissolve the coating of the viruses. once in the cytoplasm, viral genome may be released from its capsid or may function while still attached to capsid components.



Biosynthesis and Assembly of virus capsid → once the viral genome is released into the host cytoplasm, it overtakes the biosynthesis machinery of the host cell. It shuts down the normal host cell metabolism & produces new virus particles. It transcribes specific mRNAs from the viral nucleic acid. Synthesis of viral nucleic acid takes place at different intracellular sites in different viral groups. Viral protein is synthesized on the polysiboomes in the cytoplasm. Genome of most of the DNA viruses is synthesized in the host nucleus. But the genome of the

Pox virus is synthesized in the host cytoplasm. But the genome of orthomyxo, Paramyxo, & retroviruses are synthesized partly in the nucleus. The viral mRNA of DNA viruses are synthesized by the host RNA Polymerases on the viral DNA templates. Messengers from nucleus enter the cytoplasm to initiate the synthesis of viral proteins & glycoproteins. Viral proteins enter the nucleus together with viral DNA Polymerase to start DNA replication. In Myxorabdo virus, the viral RNA Polymerase synthesize mRNA. In this case the single stranded RNA genome itself acts like mRNA, for the production of a complimentary strand. The negative strand acts as the templet for the synthesis of viral RNA progeny

(iv) Maturation → Viral genome & capsid assemble together to form daughter virions either in the host nucleus or in the cytoplasm. Envelop is derived from the nuclear mem if nucleocapsid is assembled in the nucleus, which usually of nucleocapsid occurs in the host cell cytoplasm, the viral envelop is derived from the plasma membrane during the process of budding.

(v) Release → Bacteriophages are released by lysis of host cells. While animal viruses are usually released by the process of budding from the cell membrane over a period of time. The host cell is usually unaffected but the Polio virus damage the host cell.

Eclipse Phase → Interval between the Penetration of virus into the host cell & the formation of first infective virus progeny is called Eclipse Phase, because of the inability to detect the virus in the infected cell during this period. The duration of Eclipse phase is about 15-30 minutes for bacteriophages & 3-12 hours for animal viruses