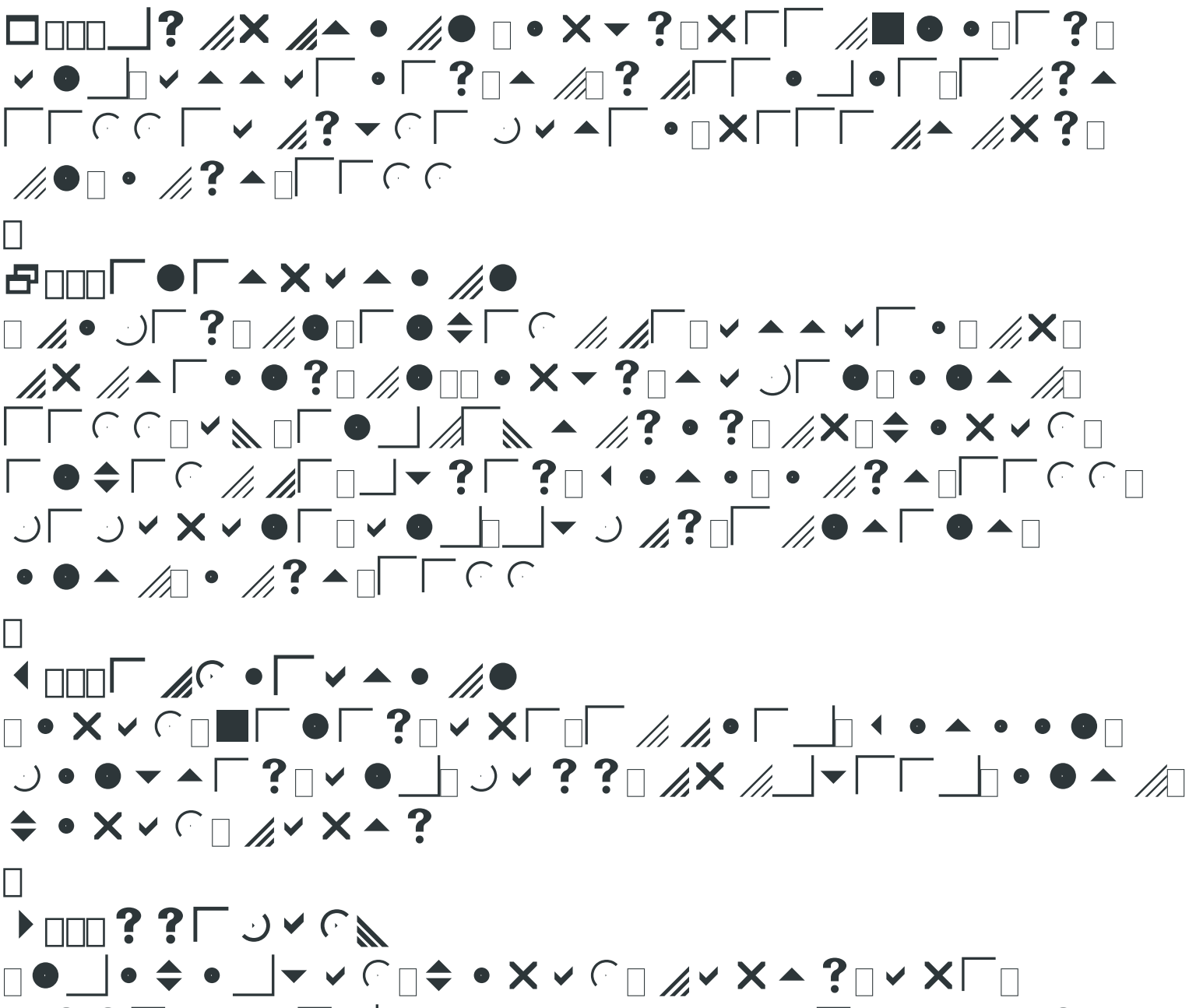
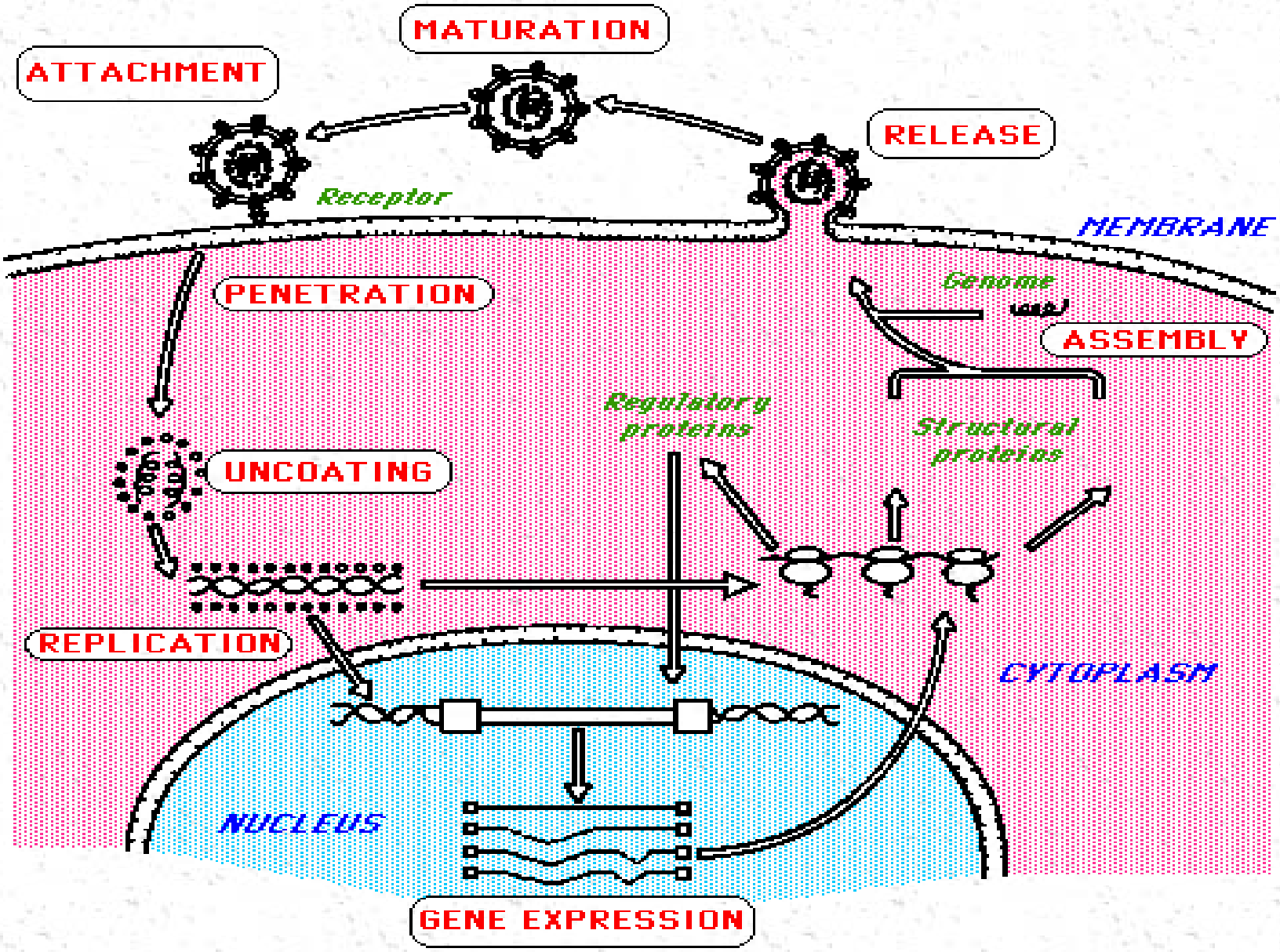
Animals were first used for experimental or diagnostic work, followed by chick embryos and finally cell cultures. Numerous types of animal cell culture have found application in virology. The choice of species, tissue of origin, and type of culture (primary, cell strain, or cell line) depends on the virus and experimental objectives.




MATURATION
ATTACHMENT
RELEASE
Receptor
MEMBRANE
PENETRATION
Genome
ASSEMBLY
Regulatory proteins
Structural proteins
UNCOATING
REPLICATION
CYTOPLASM
NUCLEUS
GENE EXPRESSION

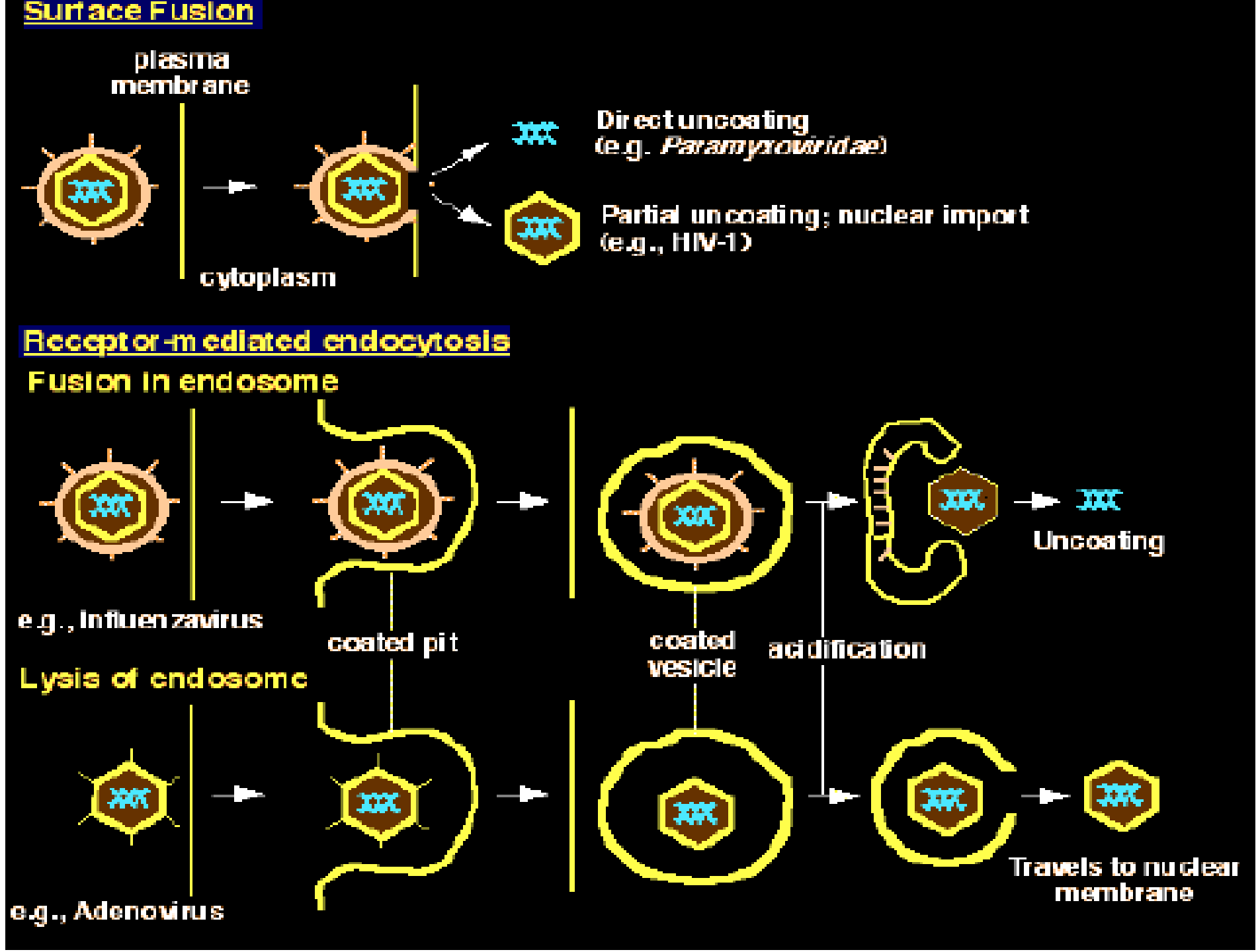
Adsorption

The virus becomes attached to the cells, and at this stage, it can be recovered in the infectious form without cell lysis by procedures that either destroy the receptors or weaken their bonds to the virions. Animal viruses have specialized attachment sites distributed over the surface of the virion e.g. orthomyxoviruses and paramyxoviruses attach through glycoprotein spikes, and adenoviruses attach through the penton fibers. Adsorption occurs to specific cellular receptors. Some receptors are glycoproteins, others are phospholipids or glycolipids.

Penetration is the passage of the virion from the surface of the cell, across the cell membrane and into the cytoplasm. There are two principal mechanisms by which viruses enter animal cells: receptor-mediated endocytosis and direct membrane fusion

-Receptor-mediated endocytosis:

2-Membrane fusion:


Surface Fusion
plasma membrane
cytoplasm
Direct uncoating
(e.g. Paramyxoviridae)
Partial uncoating; nuclear import
(e.g., HIV-1)
Receptor-mediated endocytosis
Fusion in endosome
e.g., Influenzavirus
coated pit
coated vesicle
acidification
Uncoating
Lysis of endosome
e.g., Adenovirus
Travels to nuclear membrane

Uncoating refers to the stepwise process of disassembly of the virion that enables the expression of the viral genes that carry out replication. For enveloped viruses, the penetration process itself is the first step in uncoating. In general, most steps of the uncoating process occur within the cell and depend on cellular enzymes; however in some of the more complex viruses, newly synthesized viral proteins are required to complete the process.

The loss of one or more structural components of the virion during uncoating predictably leads to a loss of the ability of that particle to infect other cells, which is the basis for the eclipse period of the growth curve. It is during this phase in the replication cycle that viral gene expression begins

Mechanisms of viral genome replication

1- DNA viruses: The replication of viral DNA takes place in the cell nucleus exception: (poxviruses in cell cytoplasm). This type of virus usually must enter the host nucleus before it is able to replicate. Some of these viruses require host cell polymerases to replicate their genome, while others, such as adenoviruses or herpes viruses, encode their own replication factors. However, in either cases, replication of
the viral genome is highly dependent on a cellular state permissive to DNA replication and, thus, on the cell cycle. The virus may induce the cell to forcefully undergo cell division, which may lead to transformation of the cell and, ultimately, cancer. An example of a family within this classification is the Adenoviridae.

DNA VIRUS REPLICATION STRATEGIES

 The virus needs to make mRNAs that can be translated into protein by the host cell translation machinery.

 The virus needs to replicate its genome.

 Host enzymes for mRNA synthesis and DNA replication are nuclear (except for that in mitochondrion) and so, if a virus is to avail itself of these enzymes, it needs to enter the nucleus.

RNA viruses

The replication of each RNA virus family has unique features; the mechanisms evolved to surmount these restrictions can be grouped into four broad patterns of replication.

1-Type I: RNA viruses with a single-stranded genome (ssRNA) of (+) polarity that replicates via a complementary strand intermediate: In Type I viral replication, the infecting parental RNA molecule serves both as mRNA and later as a template for synthesis of the complementary strand.

2-Type II: Viruses with an ssRNA genome of (-) polarity that replicate via a complementary (+) strand intermediate: Viral genomes with polarity, such as the (+) strand genomes, also have two functions:

1) To provide information for protein synthesis

2) To serve as templates for replication. Unlike (+) strand genomes, however, the strand genomes cannot accomplish these goals without prior construction of a complementary (+) strand intermediate .

3-Type III: Viruses with a dsRNA genome. The dsRNA genome is segmented, with each segment coding for one polypeptide .Type III viral mRNA transcripts are, therefore, produced by virus-coded, RNA-dependent RNA polymerase (transcriptase) located in a sub- viral core particle. This particle consists of the dsRNA genome and associated virion proteins, including the transcriptase. The mechanism of replication of the dsRNA is unique, in that the (+) RNA transcripts are not only used for translation, but also as templates for complementary strands synthesis, resulting in the formation of dsRNA progeny.

Assembly and release of progeny viruses

Assembly of nucleocapsids generally takes place in the host cell compartment where the viral nucleic acid replication occurs (that is, in the cytoplasm for most RNA viruses and in the nucleus for most DNA viruses). For DNA viruses, this requires that capsid proteins be transported from their site of synthesis (cytoplasm) to the nucleus. The various capsid components begin to self-assemble, eventually associating with the nucleic acid to complete the nucleocapsid.

1 Virus-specific glycoproteins are synthesized and transported to the host cell membrane.

2 The cytoplasmic domains of membrane proteins bind nucleocapsids.

3 A nucleocapsid is enveloped by the host cell membrane.

4 The host cell membrane provides the viral envelope by a process of "budding".

5 The enveloped virion is released from the host cell.