



GROUP II: SSDNA VIRUSES

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- ❖ Single-stranded (ss)DNA viruses are extremely widespread, infect diverse hosts from all three domains of life and include important pathogens.
- ❖ The ssDNA viruses include some of the smallest and simplest viruses, with genomes only approximately 2–6 kb in length.
- ❖ These small viruses rely on the host cell (and, for some ssDNA viruses, coinfecting larger viruses) for much of their replication machinery.
- ❖ The DNA in these viruses can be either circular or linear.
- ❖ The DNAs of ssDNA viruses are replicated by a mechanism similar to ‘rolling circle’ replication, involving synthesis of dsDNA intermediates containing multiple tandem copies of the viral genome.
- ❖ It should be noted that the template for the mRNAs of ssDNA viruses is not the ssDNA that the infecting virion brings into the cell, but rather the dsDNA produced intracellularly in infected cells.

TAXONOMY

- ❖ Currently **thirteen** families have been established (ICTV, <http://ictv.global/report>) of which **eleven** families contain circular genome, **two** families, *Parvoviridae* and *Bidnaviridae* have a linear single stranded DNA genome. (2019)
- ❖ **Seven** of these eleven families infect eukaryotes.
- ❖ family *Genomoviridae* comprises only a single fungal infecting virus; but more than 120 viral members detected in the insect tissue have also been included in it.
- ❖ The single stranded DNA viruses infecting bacteria belong to families *Microviridae*, *Inoviridae* .
- ❖ Two families, *Pleolipoviridae* and *Spiraviridae* infect archaea.

PARVOVIRIDAE

- ❖ Parvoviridae contain linear ssDNA genomes that are replicated via [rolling hairpin replication](#) (RHR)
- ❖ Parvovirus genomes have hairpin loops at each end of the genome that repeatedly unfold and refold during replication to change the direction of DNA synthesis to move back and forth along the genome, producing numerous copies of the genome in a continuous process. Individual genomes are then excised from this molecule by the viral endonuclease. For parvoviruses, either the [positive or negative sense](#) strand may be packaged into capsids, varying from virus to virus

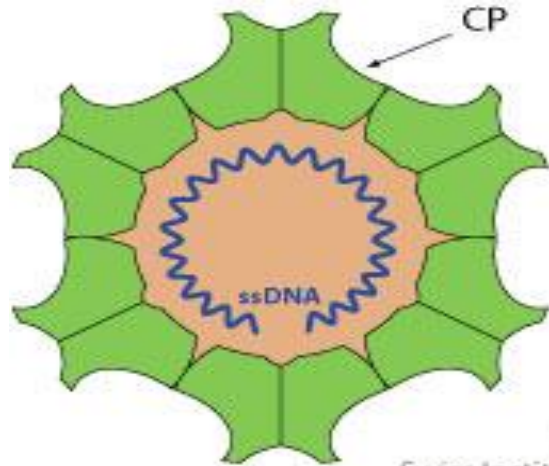
Parvovirus B19

Parvovirus B19 infects only humans. It most commonly causes fifth disease, a mild rash illness that usually affects children. But it can cause different signs and symptoms, depending on your age and overall health. Many people infected with parvovirus B19 do not have any symptoms, or they have only mild, nonspecific rash illness, not unlike the common cold.

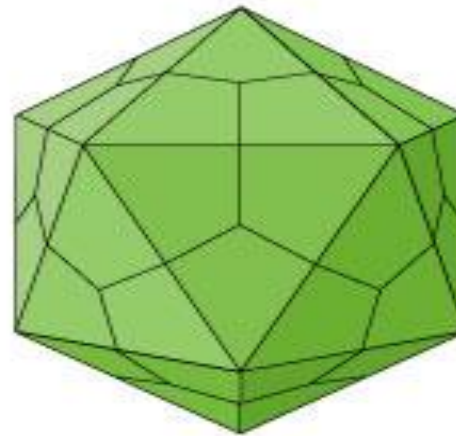


PARVOVIRUS

Non-enveloped, round, [T=1 icosahedral symmetry](#), 18-26 nm in diameter. The capsid consists of 60 copies of CP protein.



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T=1

GENOME

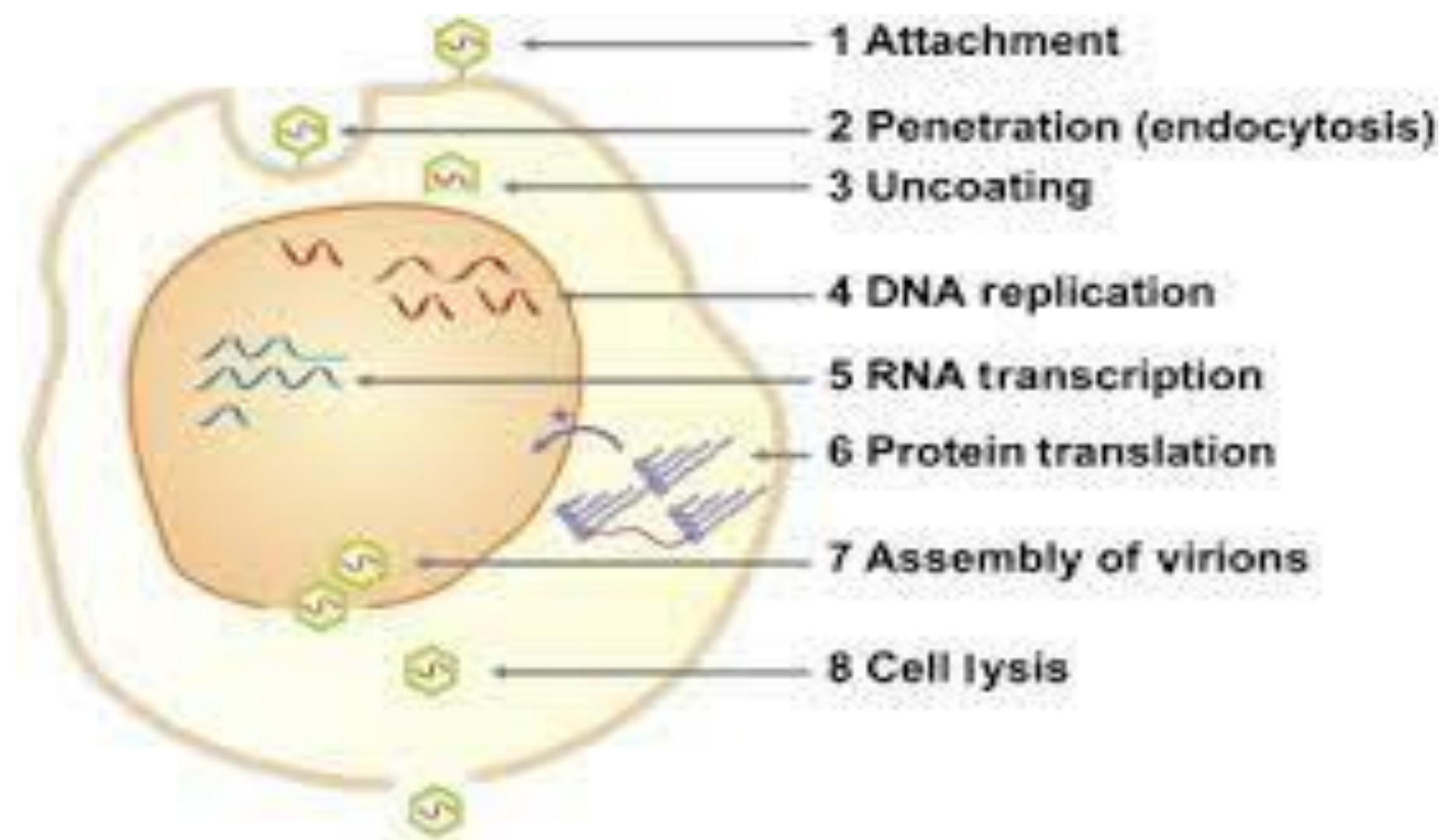
Linear, [ssDNA genome](#) of about 4 to 6 kb in size. The genome is replicated through rolling-hairpin mechanism.



Figure 1 Information pathways in viral mRNA synthesis. The nature of the nucleic acid in the virus particle is indicated in groups I – VII (green boxes). Dark blue and light blue wavy arrows represent positive and negative sense DNA strands, respectively, whereas red and orange wavy arrows represent positive and negative sense RNA strands, respectively. The direction of the wavy arrows indicates polarity (5' to 3'). Straight, black arrows represent a copying step. The two parallel gray lines represent equivalency.

Replication

- Attachment to host receptors initiates clathrin-mediated endocytosis of the virion into the host cell.
- The virion penetrates into the cytoplasm via permeabilization of host endosomal membrane.
- Microtubular transport of the virion toward the nucleus.
- The viral ssDNA genome penetrates into the nucleus.
- The ssDNA is converted into dsDNA by cellular proteins.
- dsDNA transcription gives rise to viral mRNAs when host cell enters S phase and translated to produce viral proteins.
- Replication occurs through rolling-hairpin mechanism, with NS1 endonuclease binding covalently to the 5' genomic end.
- Individual ssDNA genomes are excised from replication concatemers by a process called junction resolution.
- These newly synthesized ssDNA can either
 - a) be converted to dsDNA and serve as a template for transcription/replication
 - b) be encapsidated to form new virions that are released by cell lysis.





Thank you for listening