

Animal viruses are diverse in their modes of infection and replication

- Many variations on the basic scheme of viral infection and reproductions are represented among animal viruses.
 - One key variable is the *type of nucleic acid* that serves as a virus' genetic material.
 - Another variable is the presence or absence of a membranous envelope.
- Viruses equipped with an outer envelope use the envelope to enter the host cell.
 - Glycoproteins on the envelope bind to specific receptors on the host's membrane.
 - The envelope fuses with the host's membrane, transporting the capsid and viral genome inside.
 - The viral genome duplicates and directs the host's protein synthesis machinery to synthesize capsomeres with free ribosomes and glycoproteins with bound ribosomes.
 - After the capsid and viral genome self-assemble, they bud from the host cell covered with an envelope derived from the host's plasma membrane, including viral glycoproteins.
- These enveloped viruses do not necessarily kill the host cell.
- Some viruses have envelopes that are not derived from plasma membrane.
 - The envelope of the herpesvirus is derived from the nuclear envelope of the host.
 - These double-stranded DNA viruses reproduce within the cell nucleus using viral and cellular enzymes to replicate and transcribe their DNA.
 - Herpesvirus DNA may become integrated into the cell's genome as a **provirus**.
 - The provirus remains latent within the nucleus until triggered by physical or emotional stress to leave the genome and initiate active viral production.
- The viruses that use RNA as the genetic material are quite diverse, especially those that infect animals.
 - In some with single-stranded RNA (class IV), the genome acts as mRNA and is translated directly.
 - In others (class V), the RNA genome serves as a *template* for mRNA and for a complementary RNA.
 - This complementary strand is the template for the synthesis of additional copies of genome RNA.
 - All viruses that require RNA → RNA synthesis to make mRNA use a viral enzyme that is packaged with the genome inside the capsid.

- **Retroviruses** (class VI) have the most complicated life cycles.
 - These carry an enzyme, **reverse transcriptase**, which transcribes DNA from an RNA template.
 - The newly made DNA is inserted as a provirus into a chromosome in the animal cell.
 - The host's RNA polymerase transcribes the viral DNA into more RNA molecules.
 - These can function both as mRNA for the synthesis of viral proteins and as genomes for new virus particles released from the cell.
- **Human immunodeficiency virus (HIV)**, the virus that causes **AIDS (acquired immunodeficiency syndrome)** is a retrovirus.
- The viral particle includes an envelope with glyco-proteins for binding to specific types of white blood cells, a capsid containing two identical RNA strands as its genome and two copies of reverse transcriptase.
- The reproductive cycle of **HIV** illustrates the pattern of infection and replication in a retrovirus.
- After HIV enters the host cell, reverse transcriptase synthesizes double stranded DNA from the viral RNA.
- Transcription produces more copies of the viral RNA that are translated into viral proteins, which self-assemble into a virus particle and leave the host.
- The link between viral infection and the symptoms it produces is often obscure.
 - Some viruses damage or kill cells by triggering the release of hydrolytic enzymes from lysosomes.
 - Some viruses cause the infected cell to produce toxins that lead to disease symptoms.
 - Other have molecular components, such as envelope proteins, that are toxic.
- In some cases, viral damage is easily repaired (respiratory epithelium after a cold), but in others, infection causes permanent damage (nerve cells after polio).
- Many of the temporary symptoms associated with a viral infection results from the body's own efforts at defending itself against infection.