BBS 2711
Virology

VIRUS STRUCTURE AND REPLICATION

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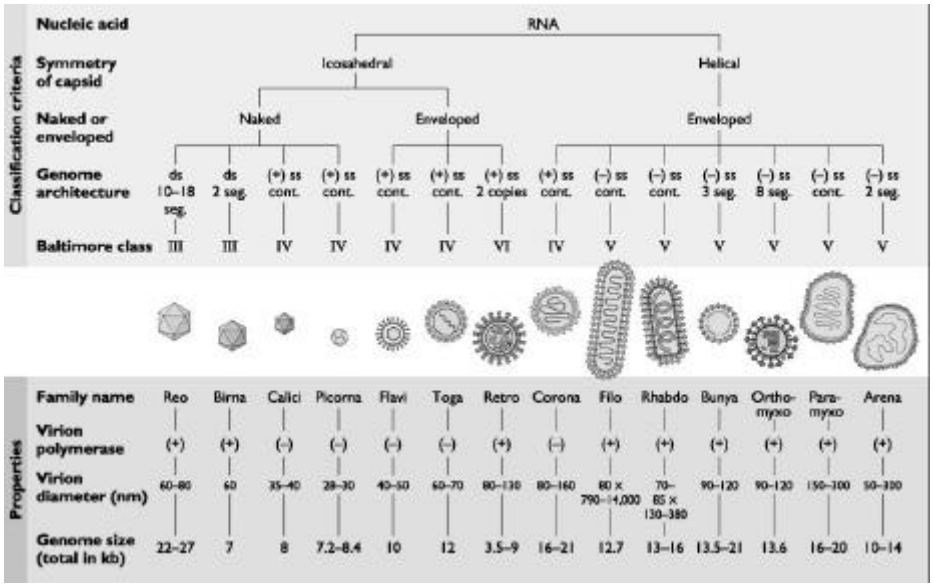
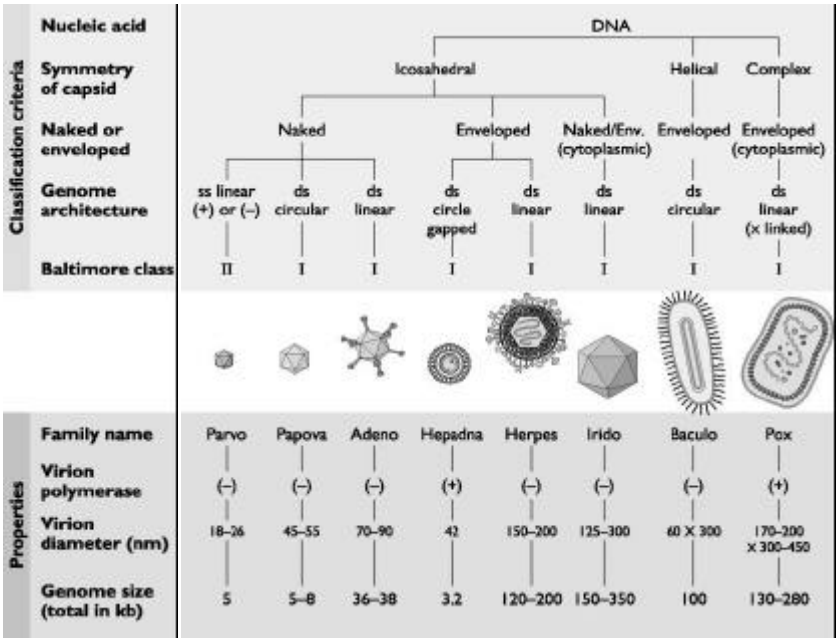
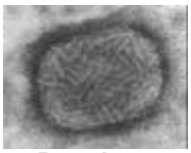
Viruses comprise a wide diversity of types I



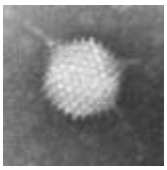
Viruses comprise a wide diversity of types II





Poxvirus

Are viruses living organisms?

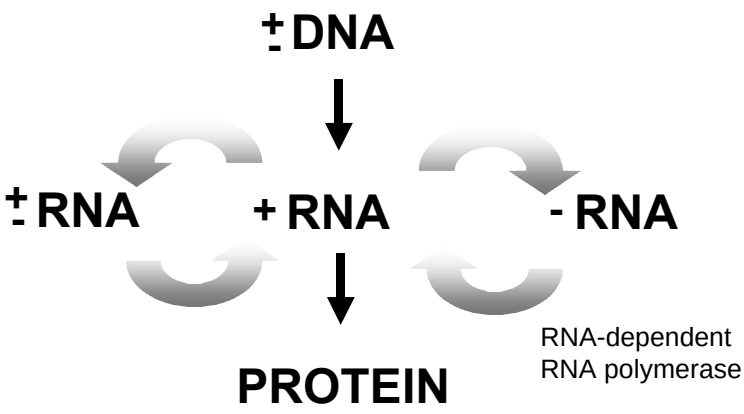


Adenovirus

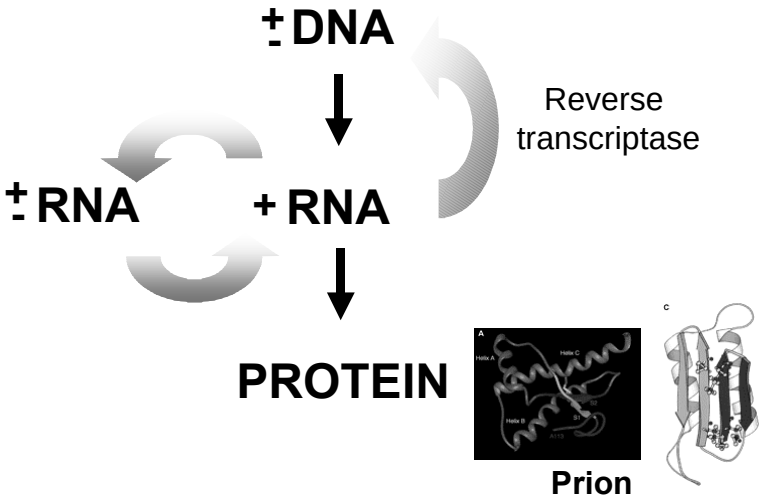
- viruses range in size from 20-400nm
- visualized in the electron microscope
  - see EM pictures above
- can only replicate in living cells
  - employ host cell's replicative and metabolic pathways
- outside cells they are essentially inert macromolecules

→ **OBLIGATE INTRACELLULAR PARASITES**

Genome composition

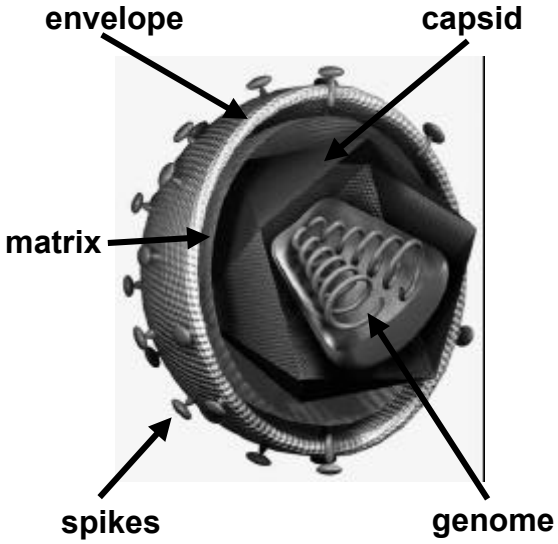


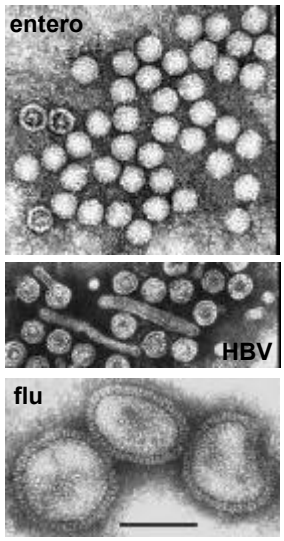
Genome composition



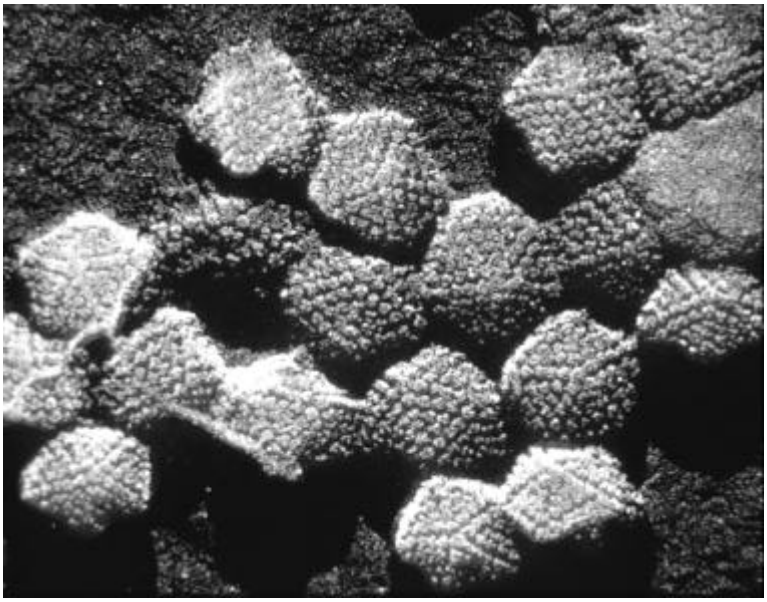
Prion

Virion structural composition

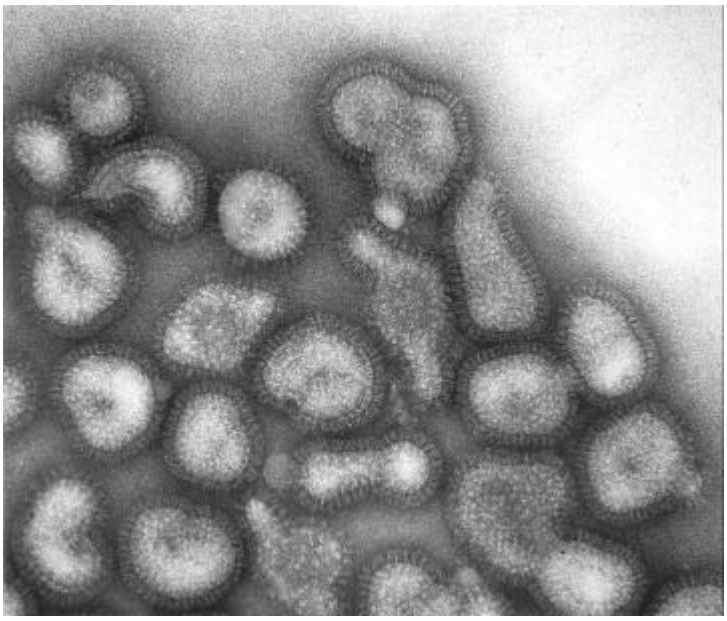




Adenovirus



Influenza

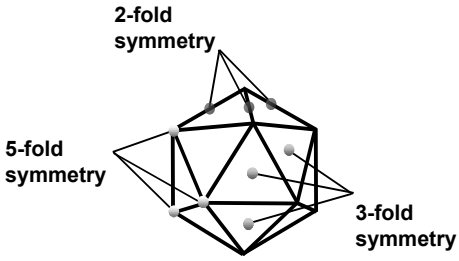


The function of the outer shell (**CAPSID**) of a virus particle is to protect the fragile nucleic acid genome from:

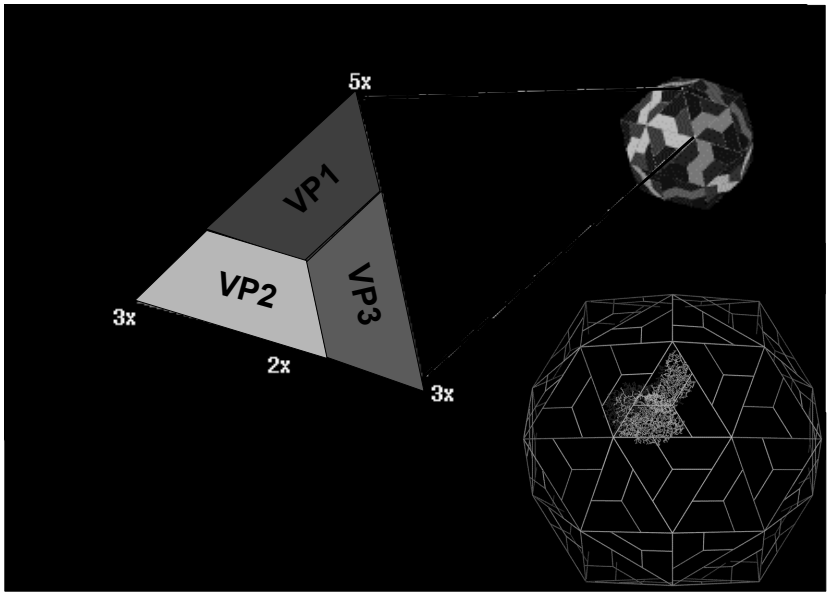
- **Physical damage** - Shearing by mechanical forces.
- **Chemical damage**- UV irradiation (from sunlight) leading to chemical modification.
- **Enzymatic damage** - Nucleases derived from dead or leaky cells or deliberately secreted by vertebrates as defence against infection.

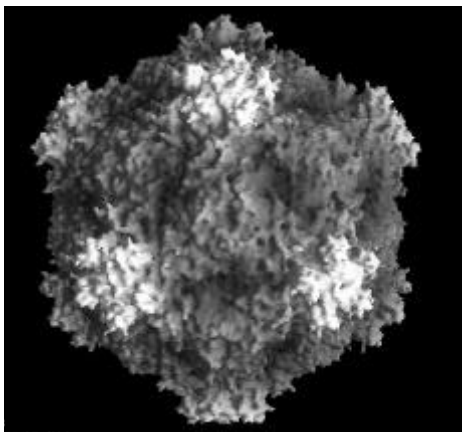
Electron microscopy suggests many viruses are roughly spherical

• detailed study shows that they are ICOSAHEDRAL

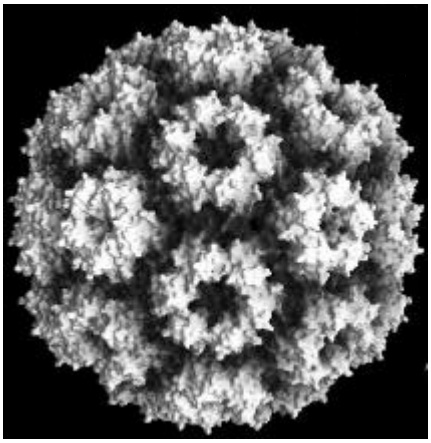


Polio virus structure



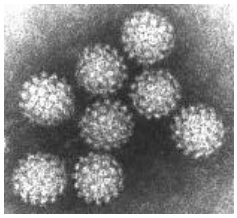


BeanPod

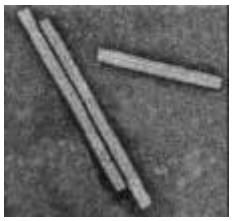


Cowpea Chlorotic Mottle

Simplest virion forms



1. Naked icosahedral



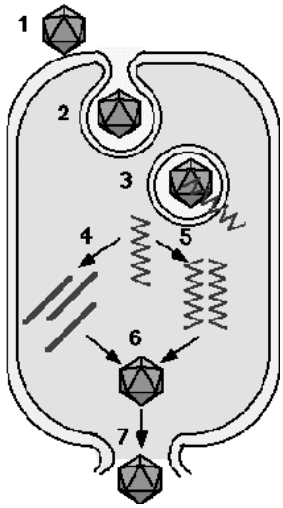
2. Naked helical

3. Enveloped icosahedral

4. Enveloped helical

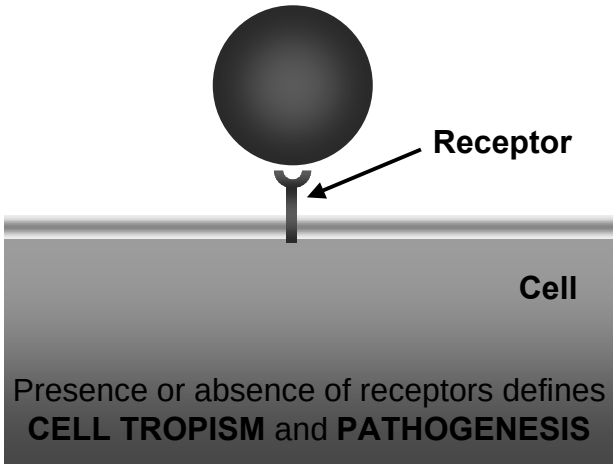
VIRUS LIFE CYCLE

1. Attachment
2. Penetration
3. Uncoating
4. Transcritpion and/or Translation
5. Genome Replication
6. Assembly
7. Release



Stages in the virus life cycle

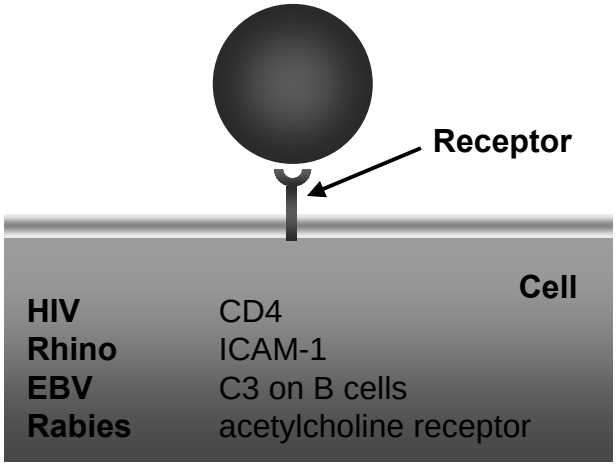
1. Adsorption



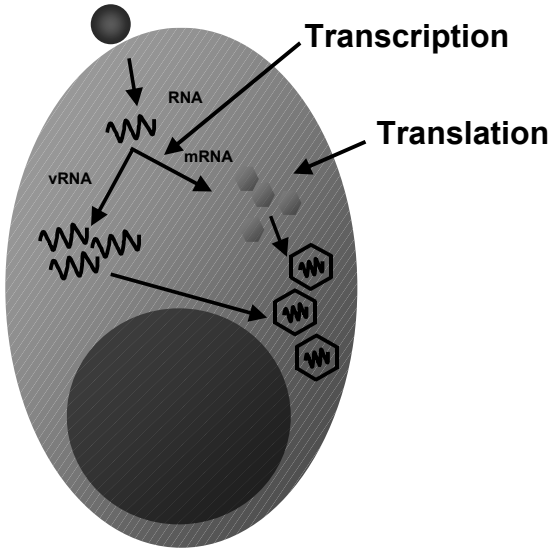
Presence or absence of receptors defines **CELL TROPISM** and **PATHOGENESIS**

Stages in the virus life cycle

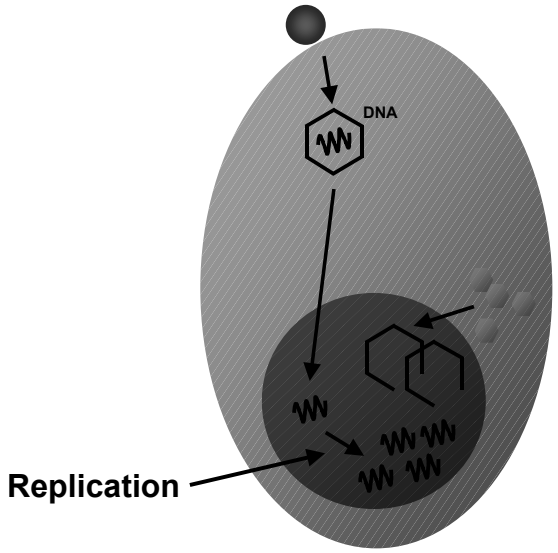
1. Adsorption



RNA virus replication

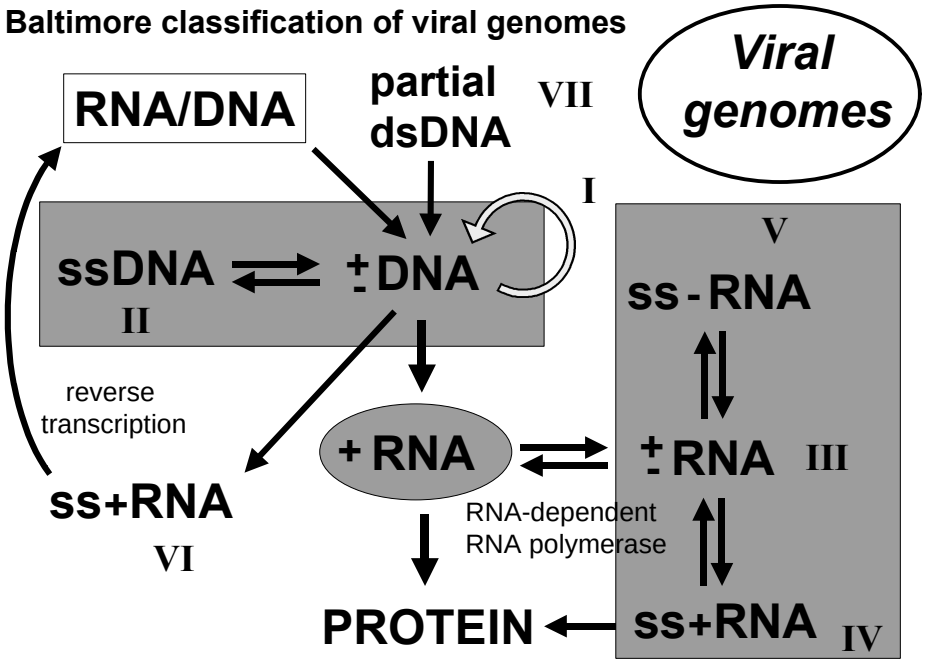


DNA virus replication

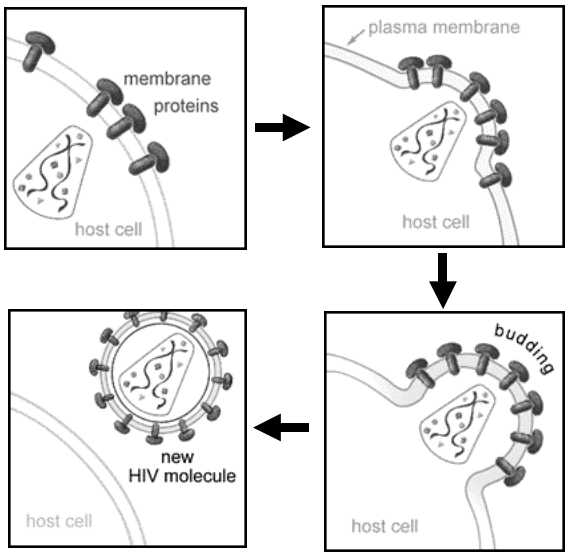


- RNA genomes are generally smaller.
  - up to a max. of 30Kb (Coronaviruses)
    Why?
  Viral RNA polymerases are more error prone than DNA polymerases
    - size limited by replication fidelity?
  Fragility of long RNA strands
- DNA genomes can be up to 250kb.
  - packaging/assembly problems beyond this size?
- genome type and size dictates replication
  - RNA viruses in cytoplasm
  - DNA viruses in nucleus
- viral genomes heavily condensed
  - maximize gene coding capacity
    - overlapping genes
    - employing different reading frames
    - using both strands

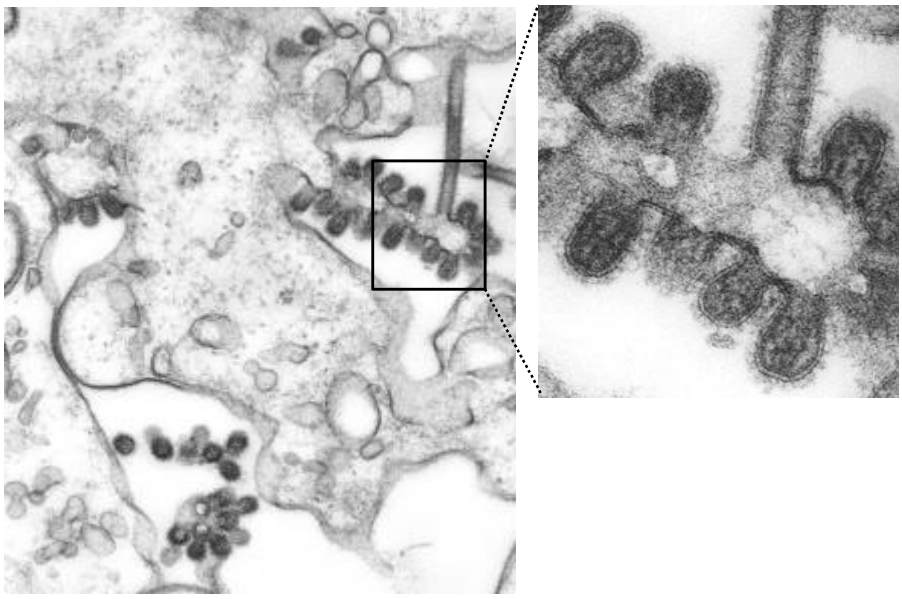
Baltimore classification of viral genomes



Schematic of HIV budding from an infected cell



Influenza – thin section through an infected cell



Scanning electron micrograph of
HIV budding from the surface of an infected cell