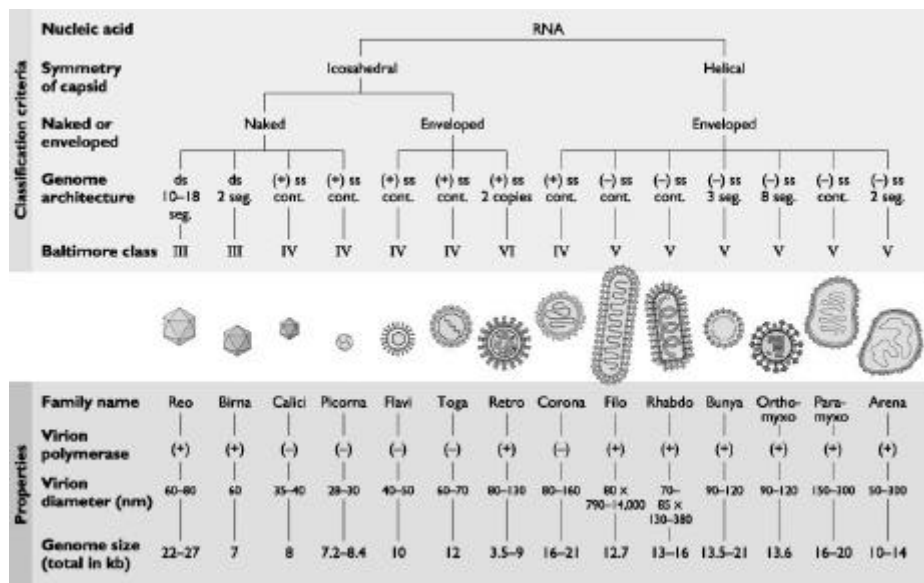


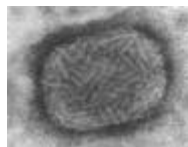
# VIRUS STRUCTURE AND REPLICATION

## Viruses comprise a wide diversity of types I



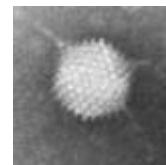
## Viruses comprise a wide diversity of types II

Classification criteria	Nucleic acid	DNA							
	Symmetry of capsid	Icosahedral				Helical		Complex	
	Naked or enveloped	Naked		Enveloped		Naked/Env. (cytoplasmic)	Enveloped	Enveloped (cytoplasmic)	
	Genome architecture	ss linear (+) or (-)	ds circular	ds linear	ds circle gapped	ds linear	ds linear	ds circular	ds linear (x linked)
	Baltimore class	II	I	I	I	I	I	I	I
Properties	Family name	Parvo	Papova	Adeno	Hepadna	Herpes	Irido	Baculo	Pox
	Virion polymerase	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)
	Virion diameter (nm)	18-26	45-55	70-90	42	150-200	125-300	60 X 300	170-200 x 300-450
	Genome size (total in kb)	5	5-8	36-38	3.2	120-200	150-350	100	130-280



Poxvirus

### Are viruses living organisms?

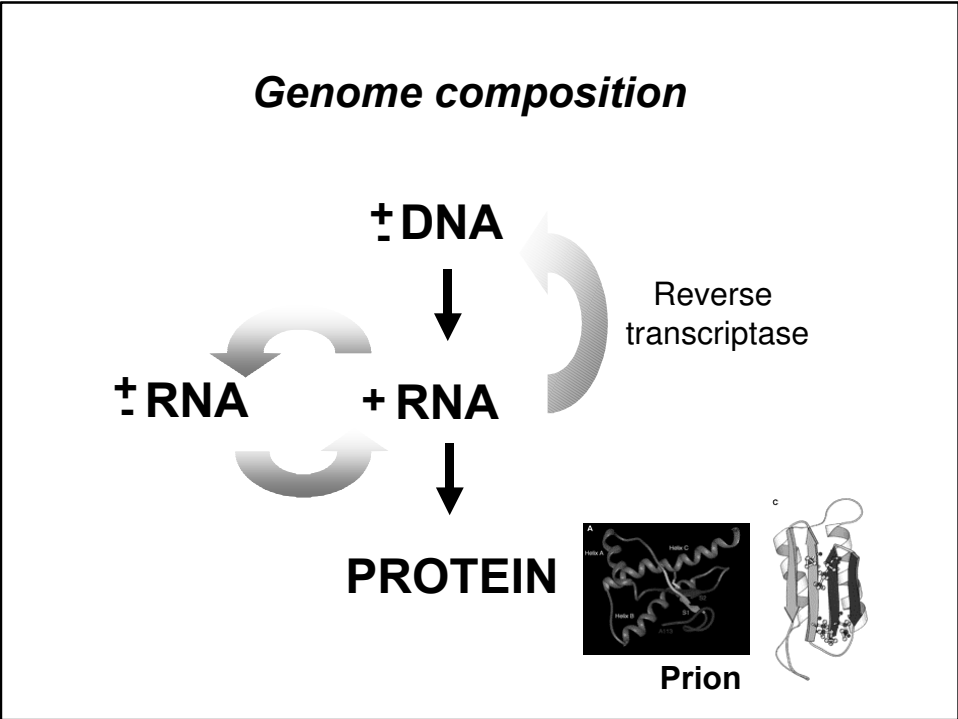
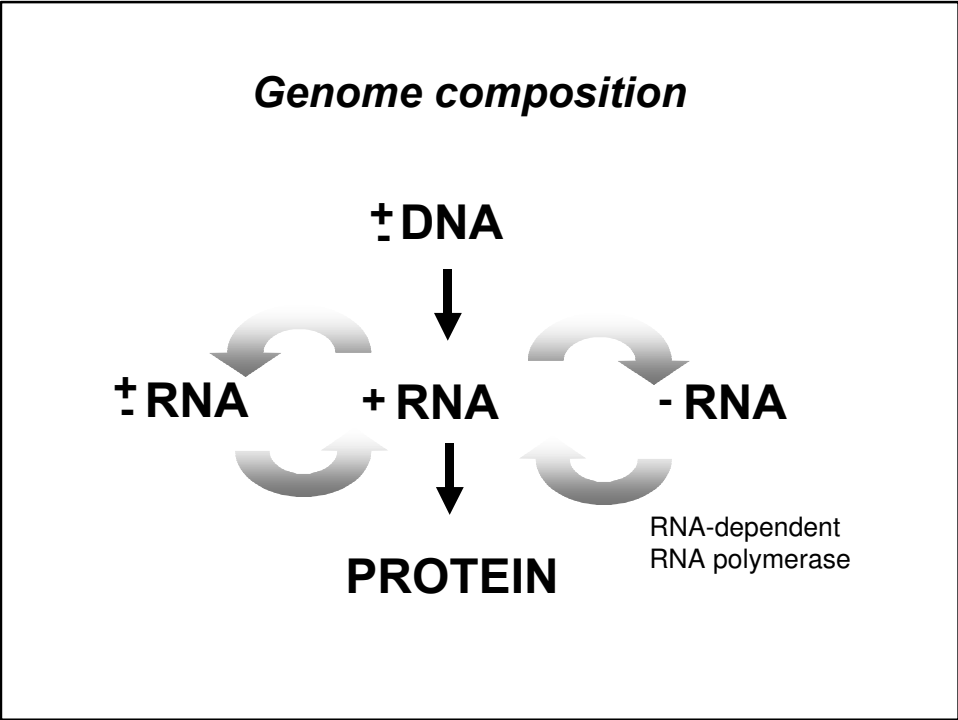


Adenovirus

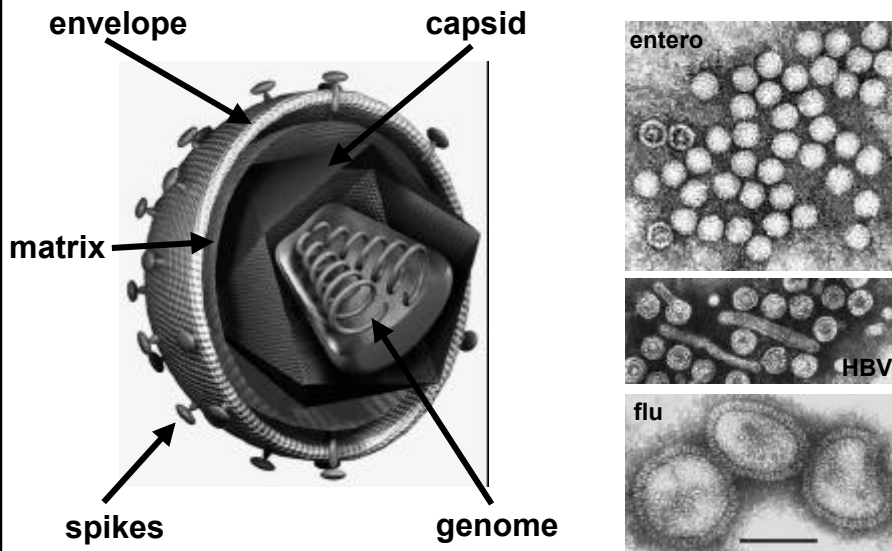
- viruses range in size from 20-400nm
- visualized in the electron microscope
  - see EM pictures above
- can only replicate in living cells
  - employ host cell's replicative and metabolic pathways
- outside cells they are essentially inert macromolecules



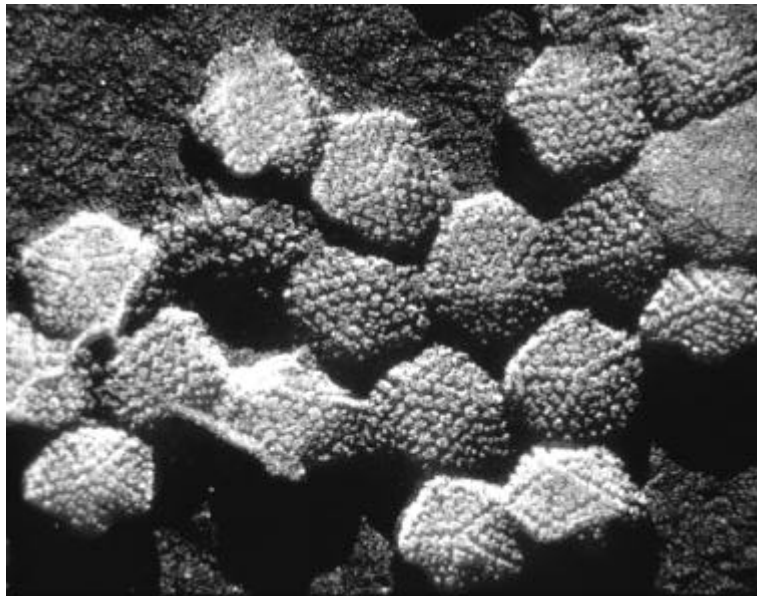
**OBLIGATE INTRACELLULAR PARASITES**



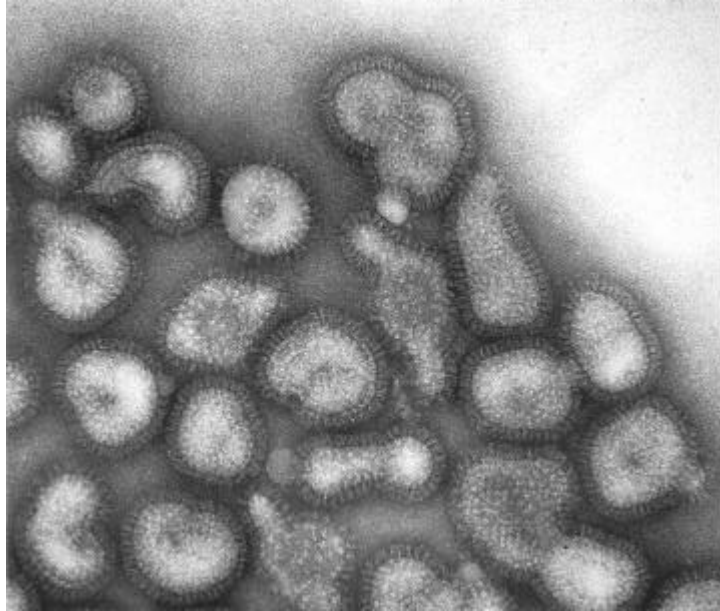
## *Virion structural composition*



## *Adenovirus*



## *Influenza*

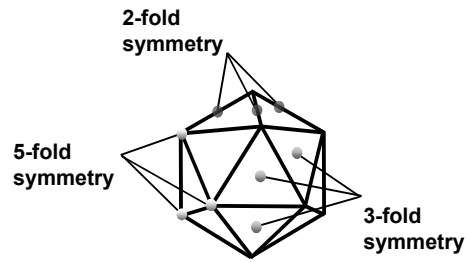


The function of the outer shell (**CAPSID**) of a virus particle is to protect the fragile nucleic acid genome from:

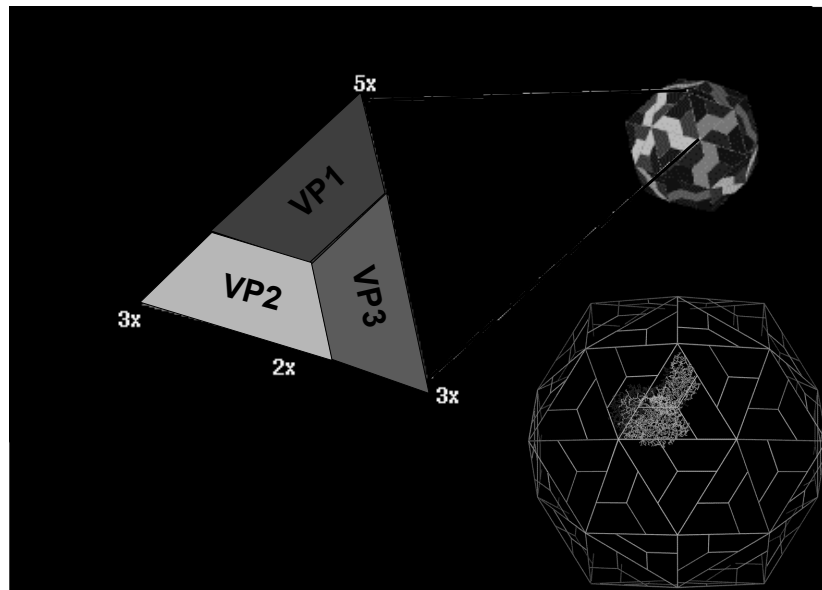
- **Physical damage** - Shearing by mechanical forces.
- **Chemical damage**- UV irradiation (from sunlight) leading to chemical modification.
- **Enzymatic damage** - Nucleases derived from dead or leaky cells or deliberately secreted by vertebrates as defence against infection.

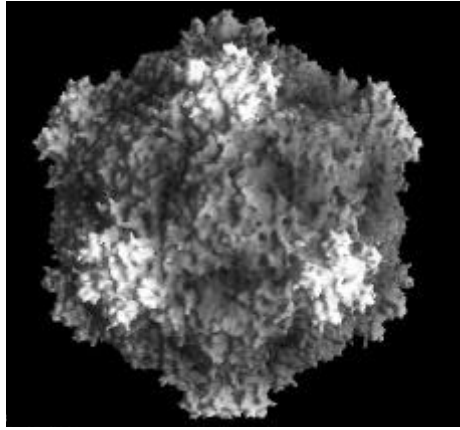
***Electron microscopy suggests many viruses are roughly spherical***

- ***detailed study shows that they are ICOSAHEDRAL***

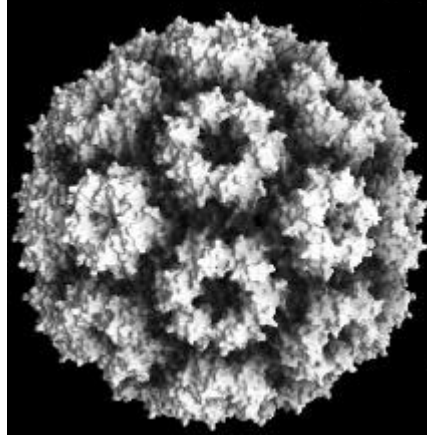


***Polio virus structure***



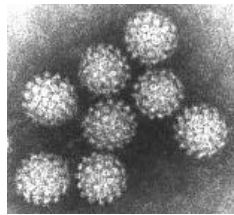


**BeanPod**

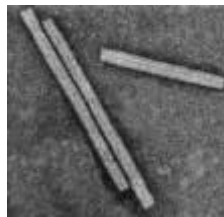


**Cowpea Chlorotic Mottle**

### ***Simplest virion forms***



1. Naked icosahedral



2. Naked helical

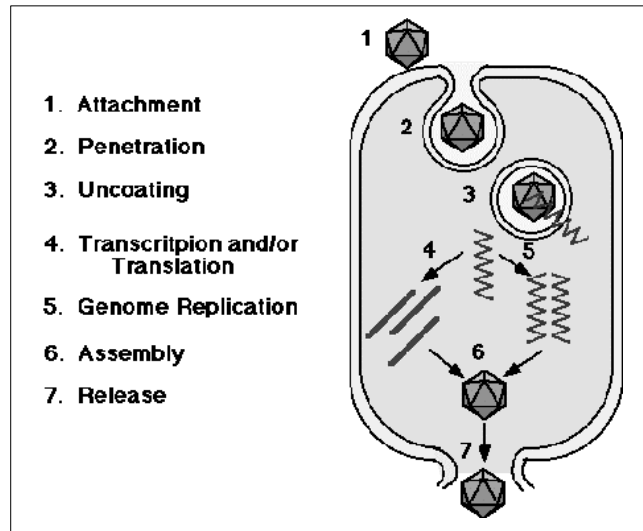


3. Enveloped icosahedral



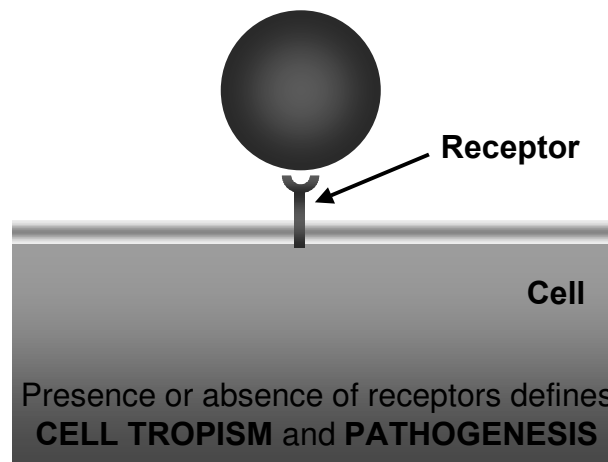
4. Enveloped helical

# VIRUS LIFE CYCLE



## Stages in the virus life cycle

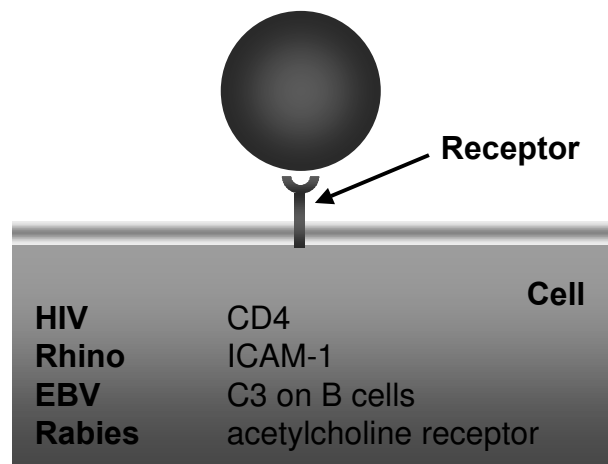
1. Adsorption



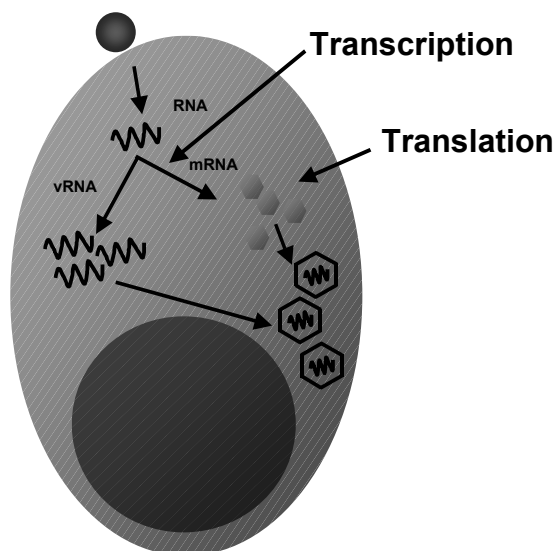


## Stages in the virus life cycle

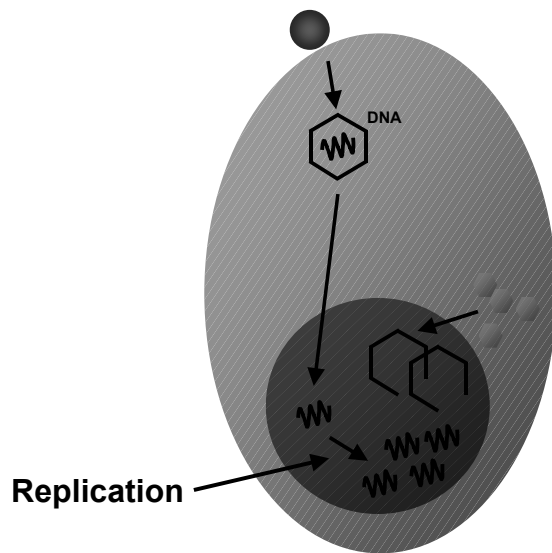
### 1. Adsorption



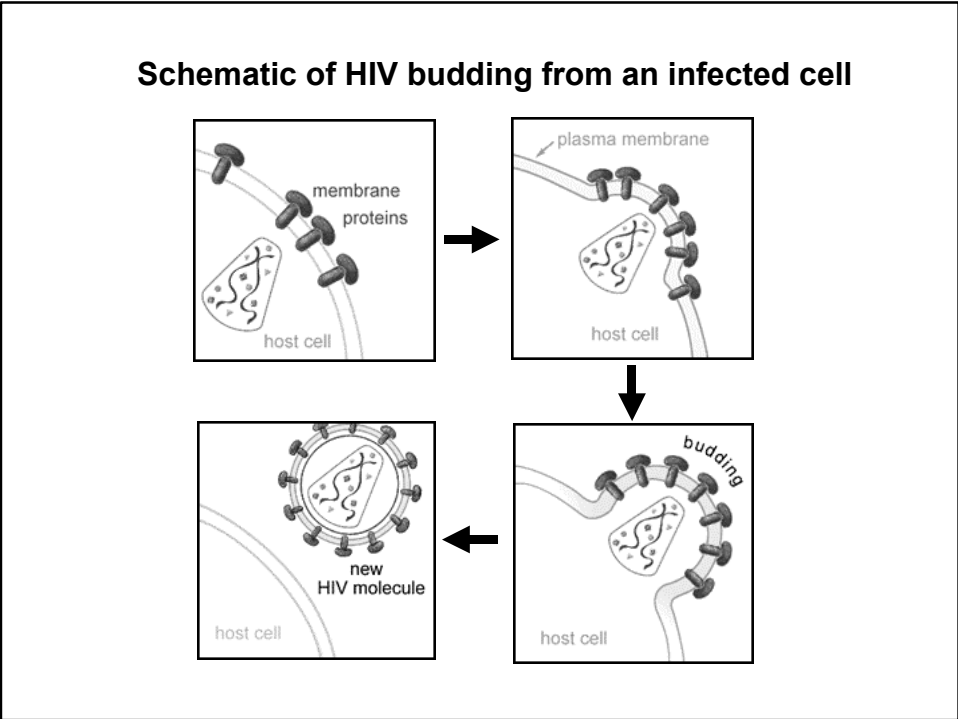
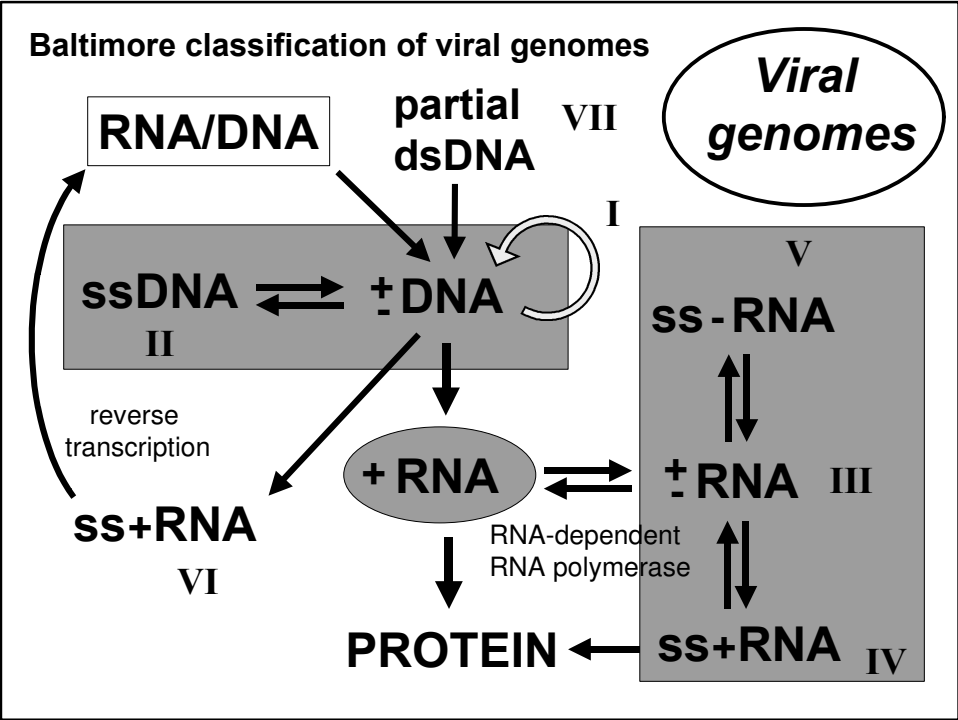
## RNA virus replication



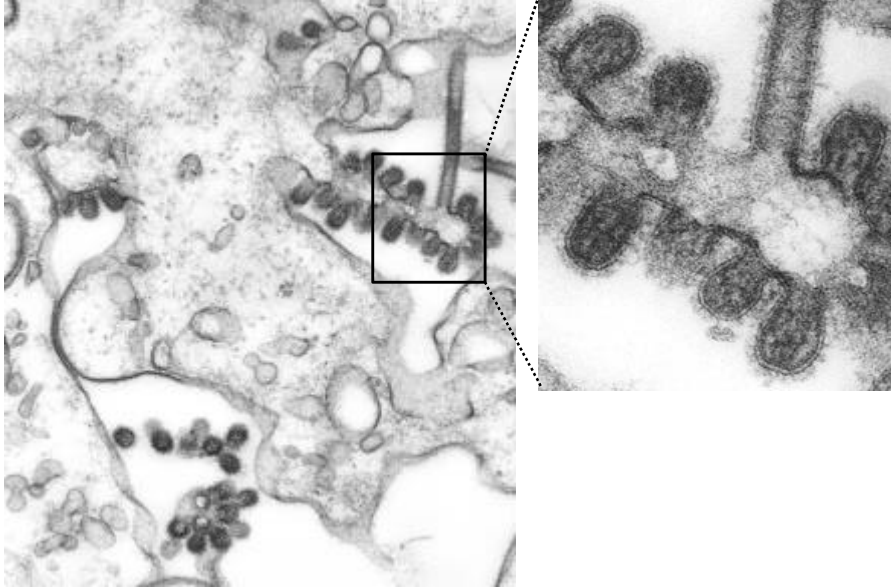
## ***DNA virus replication***



- 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



***Influenza – thin section through an infected cell***



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

