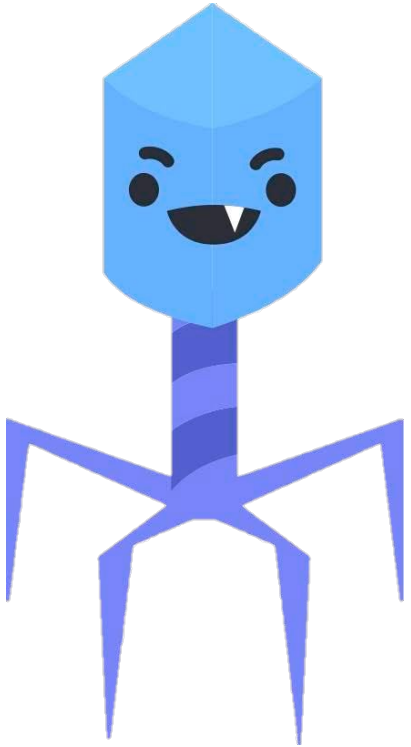
SBI3C
Viruses

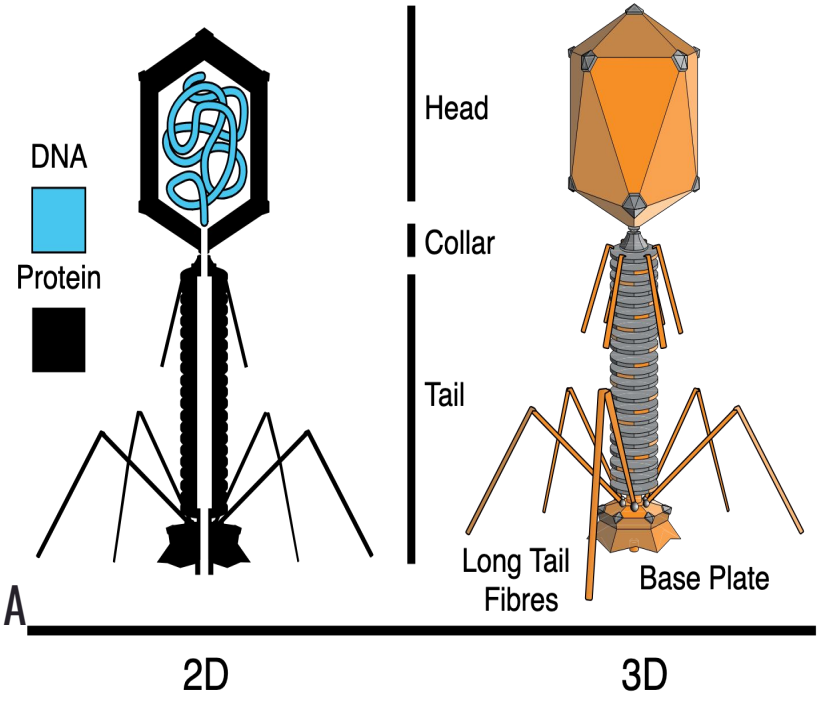
Impossible

That’s what we are.
We break all the rules.



Acellular

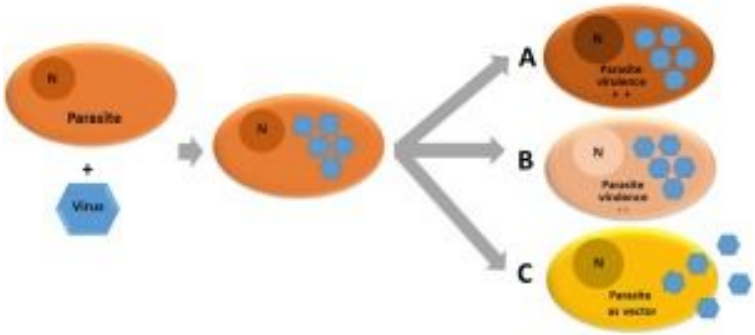
- No cells, but alive
- Basic components:
  - **Capsid**: a protein coat
  - **Nucleic Acid**: DNA or RNA
- Additional components:
  - **Envelope**: coating of host cell membrane
  - **Nucleocapsid**: protects DNA or RNA
  - **Spikes, fibres**.



Bacteriophage, a virus that infects bacteria.

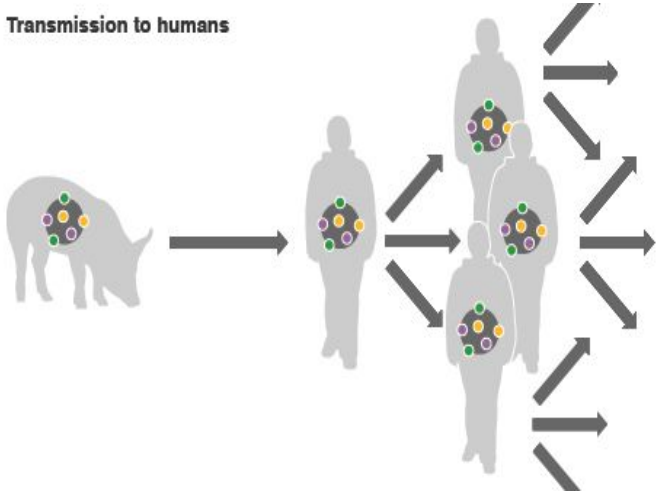
Obligate Parasites

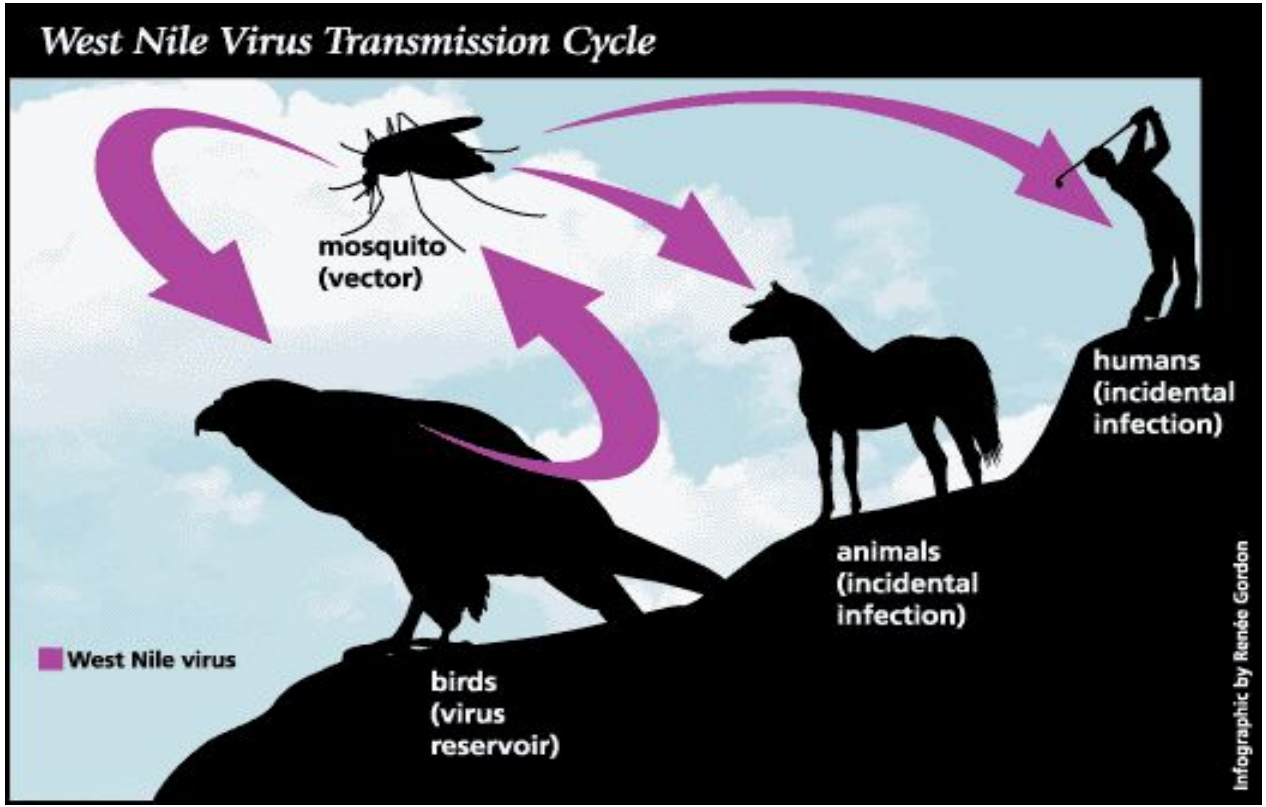
- Viruses have no way of getting or processing nutrients, or materials for reproduction
- They must infect cells in order to survive
- Every virus has a specific **Host Cell**



Vectors & Hosts

- Viruses sometimes spread when they're carried by another living thing
- **Vectors** spread viruses, but don't get sick from infection
- **Hosts** get infected and get sick, but can also spread viruses




West Nile Virus Transmission Cycle
mosquito
(vector)
humans
(incidental
infection)
animals
(incidental
infection)
birds
(virus
reservoir)
West Nile virus
Infographic by Renée Gordon

Types of Viruses

Classification by:

- Capsid shape - polyhedral, filamentous, helical, or complex
- Host type - infecting bacteria, plants, or animals
- Nucleic acid - DNA or RNA viruses, single or double stranded

Comparison:

Eukaryotes

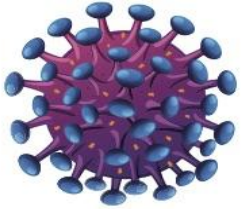
- Relatively large
- Cellular
- Organelles
- Nucleic acids code traits
- Diploid & Haploid

Prokaryotes

- Smaller
- Cellular
- No organelles
- Nucleic acids code traits
- Haploid

Viruses

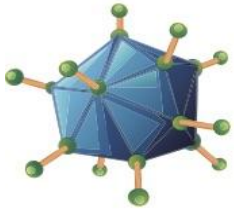
- Smallest
- Acellular
- No organelles
- Nucleic acids code traits
- Haploid



HIV

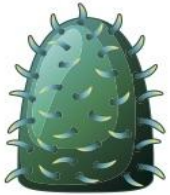
Hepatitis B

Ebola Virus

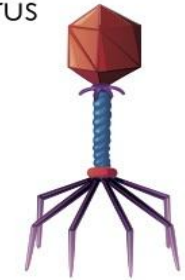


Adenovirus

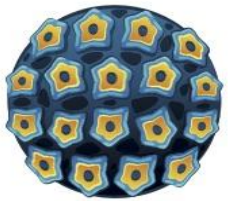
Influenza



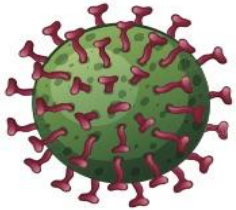
Rabies Virus



Bacteriophage



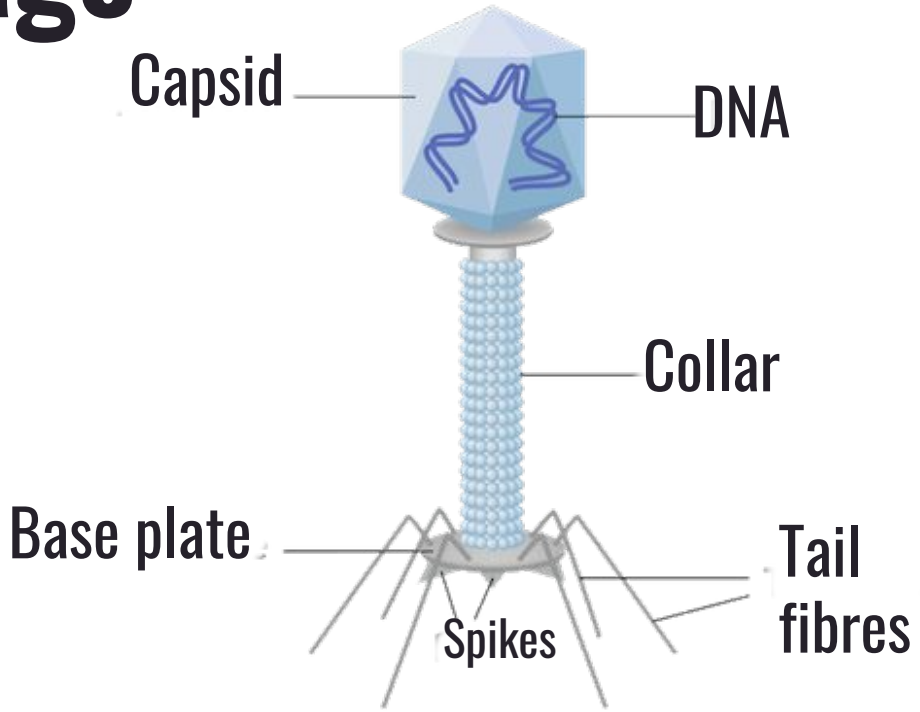
PaPillomavirus



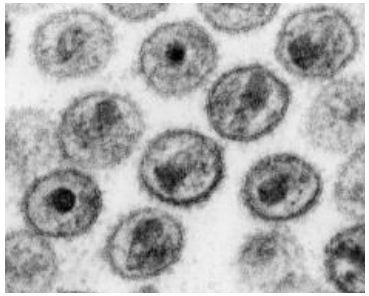
Rotavirus

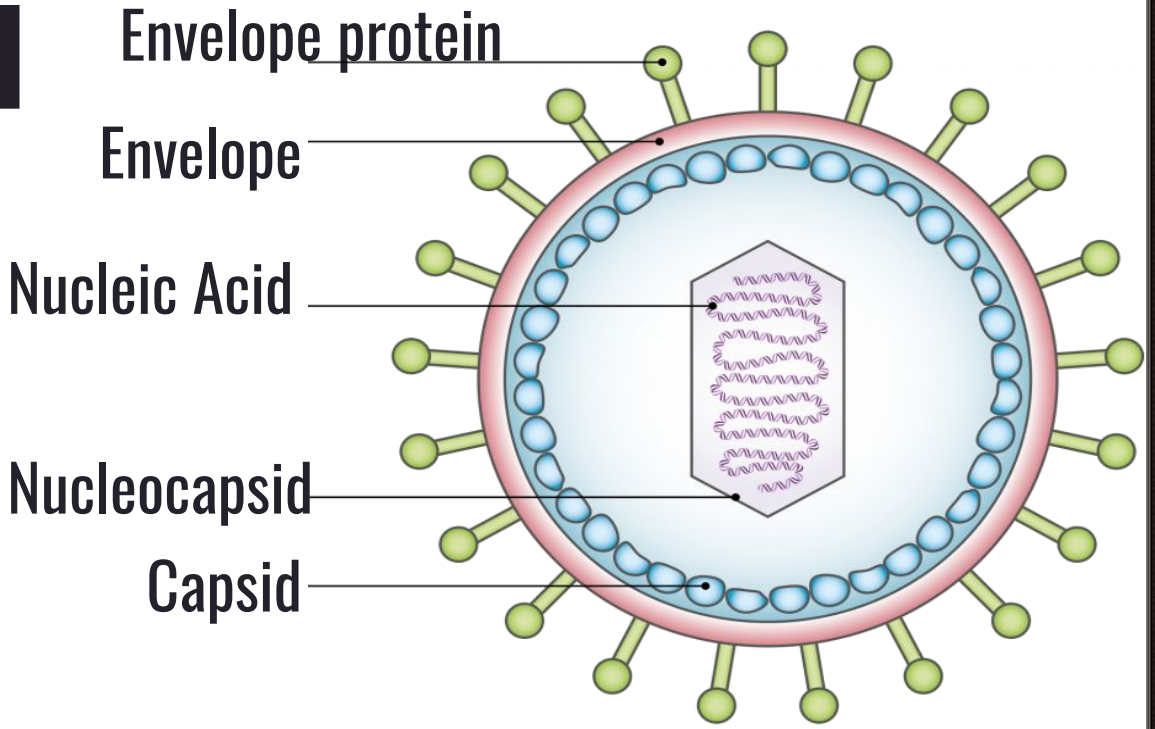
Herpes Virus

Bacteriophage

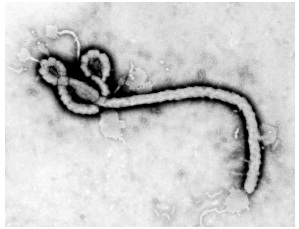


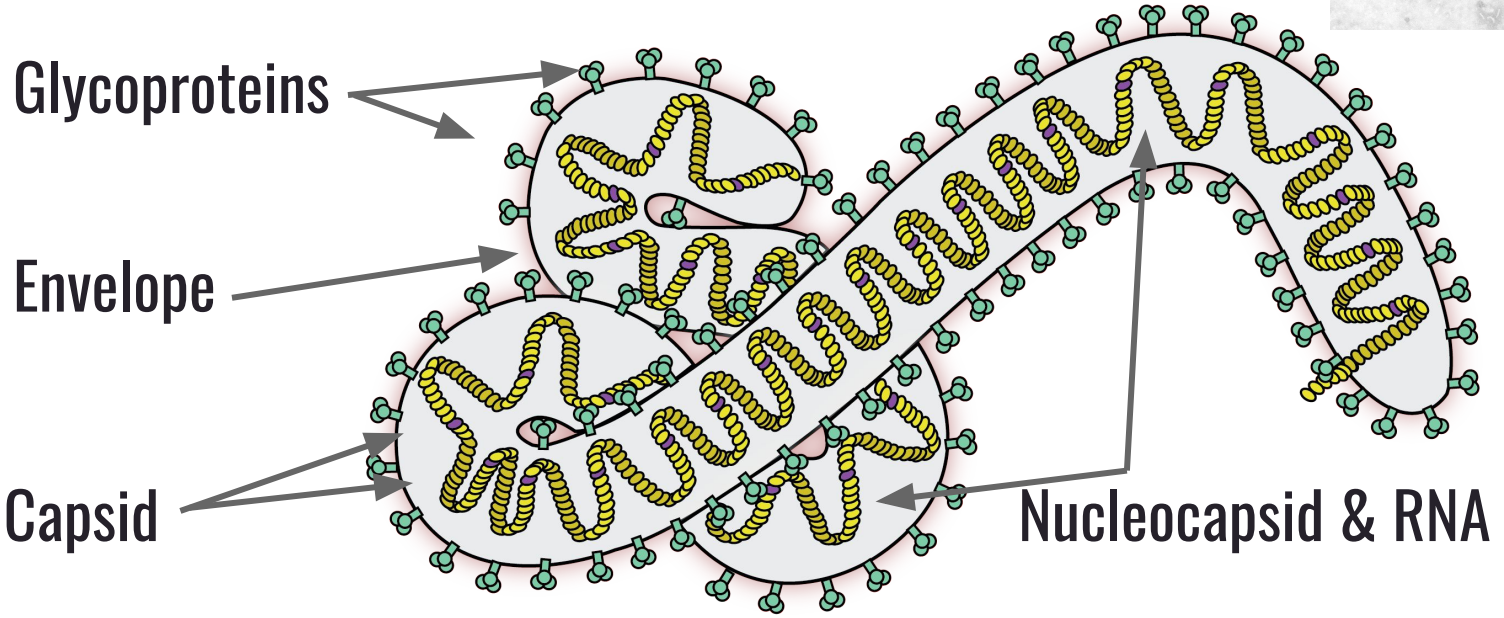
Enveloped Virus





Filamentous Virus





Subviral particles

Prions

are strands of protein that can infect & replicate

eg. BSE, “Mad Cow Disease” or Creutzfeld Jakob

Viroids

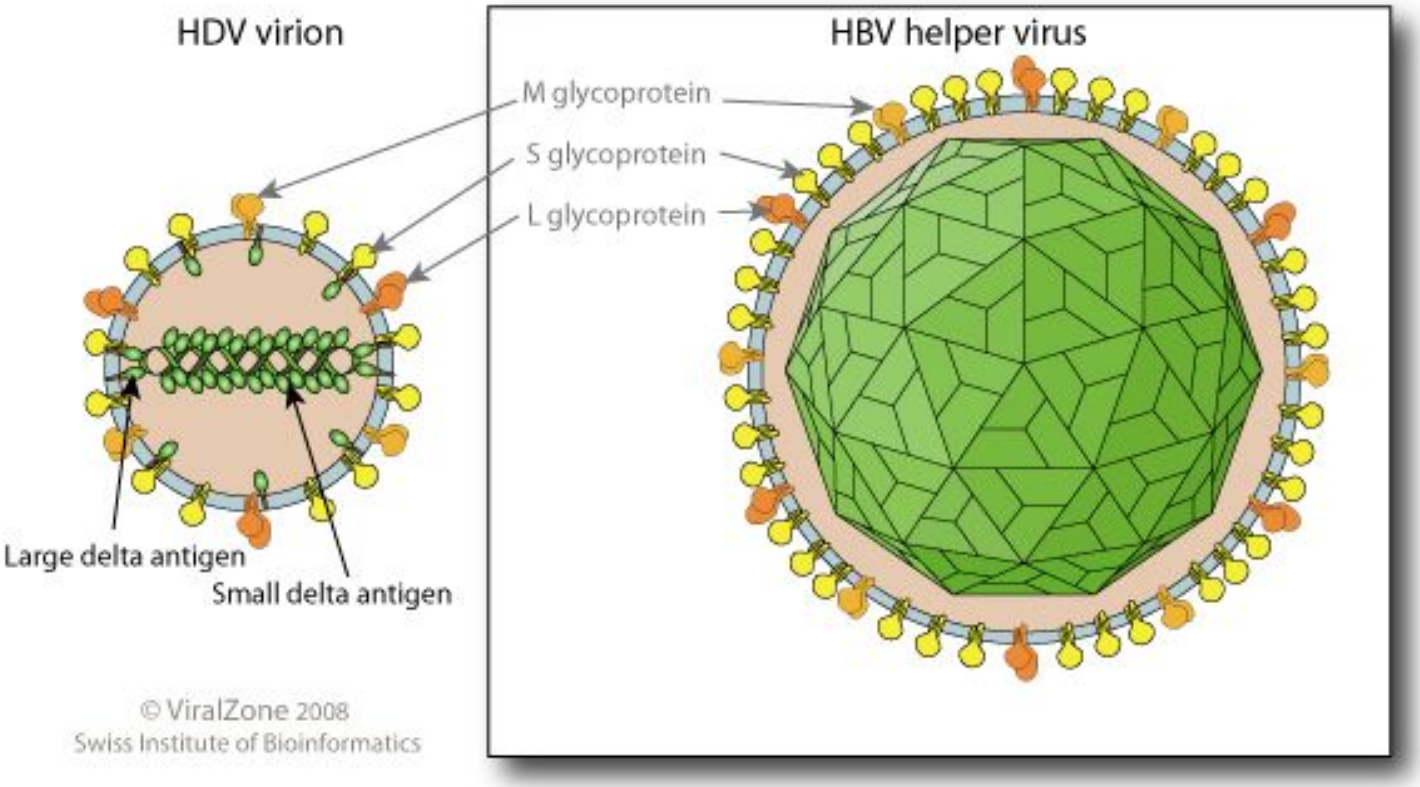
are small loops of RNA that can replicate in plant cells

eg. Potato viroid, Citrus Exocort v.

Satellites

need a helper virus to get into cells, and may have a capsid.

eg. HDV Hepatitis Delta Virus


HDV virion
HBV helper virus
M glycoprotein
S glycoprotein
L glycoprotein
Large delta antigen
Small delta antigen
© ViralZone 2008
Swiss Institute of Bioinformatics

How Creutzfeldt-Jakob disease works

CAUSE

Creutzfeldt-Jakob disease is caused by abnormal proteins called prions that are not killed by standard methods for sterilizing surgical equipment.

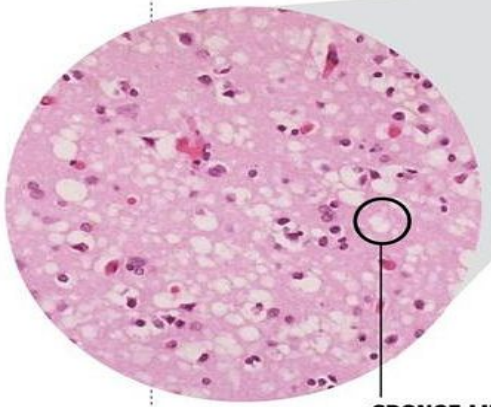
NORMAL HUMAN PROTEIN

DISEASE-CAUSING PRION

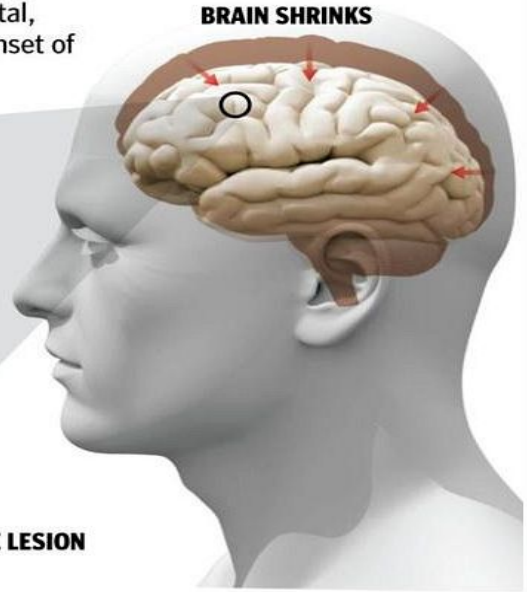
As prions build up in cells, the brain slowly shrinks and the tissue fills with holes until it resembles a sponge.

CONSEQUENCES

Those affected lose the ability to think and to move properly and suffer from memory loss. It is always fatal, usually within one year of onset of illness.



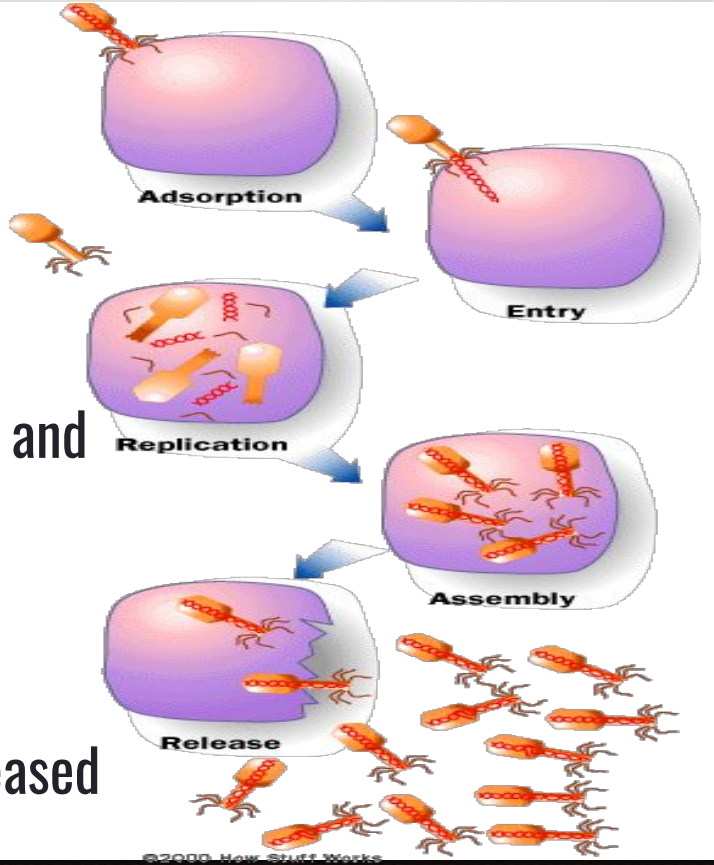
SPONGE-LIKE LESION



BRAIN SHRINKS

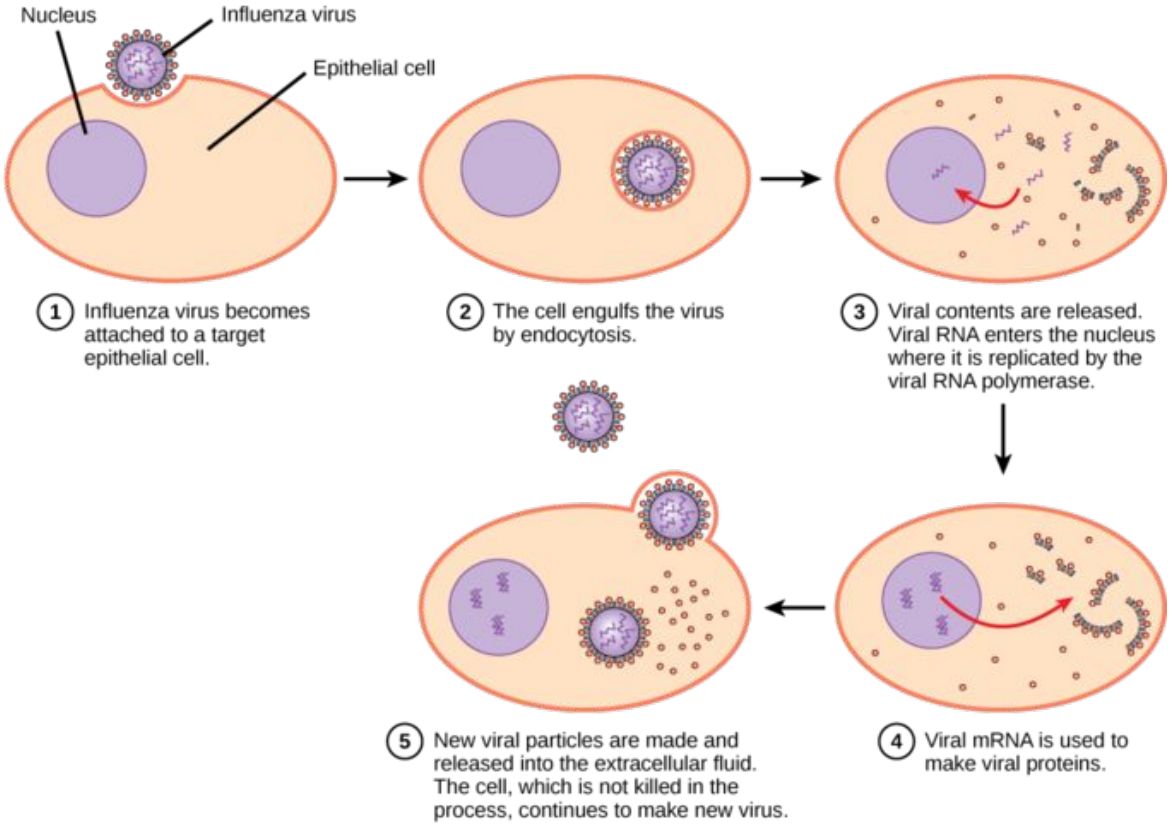
Lytic Cycle

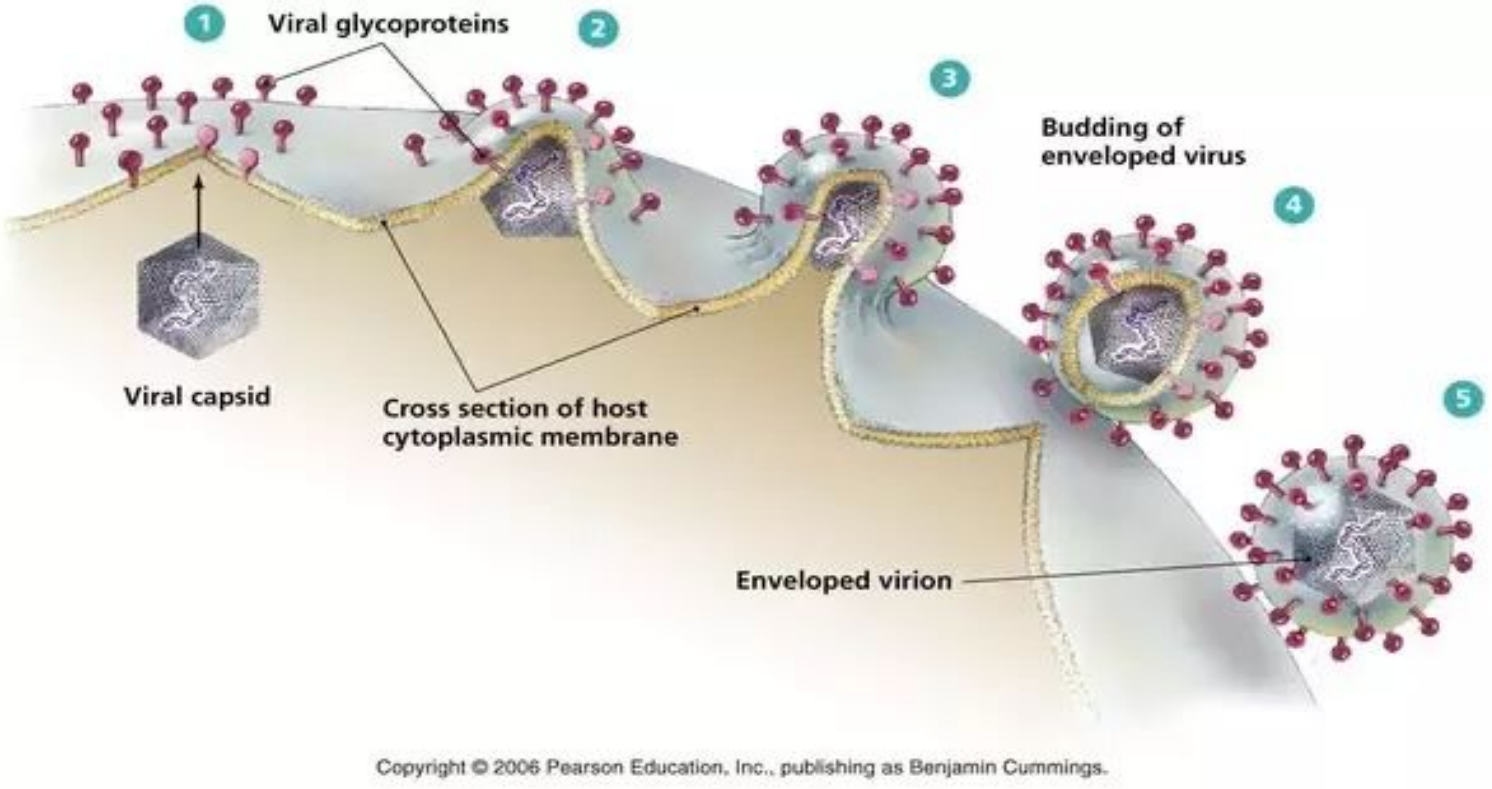
- Adsorption: attach to cell
- Entry: inject DNA, discard capsid
- Replication: Cell's nucleus takes in DNA and makes many copies of viral DNA
- Assembly: Viral capsids are made from instructions in viral DNA
- Lysis: Host cell bursts & dies, virus released



Budding

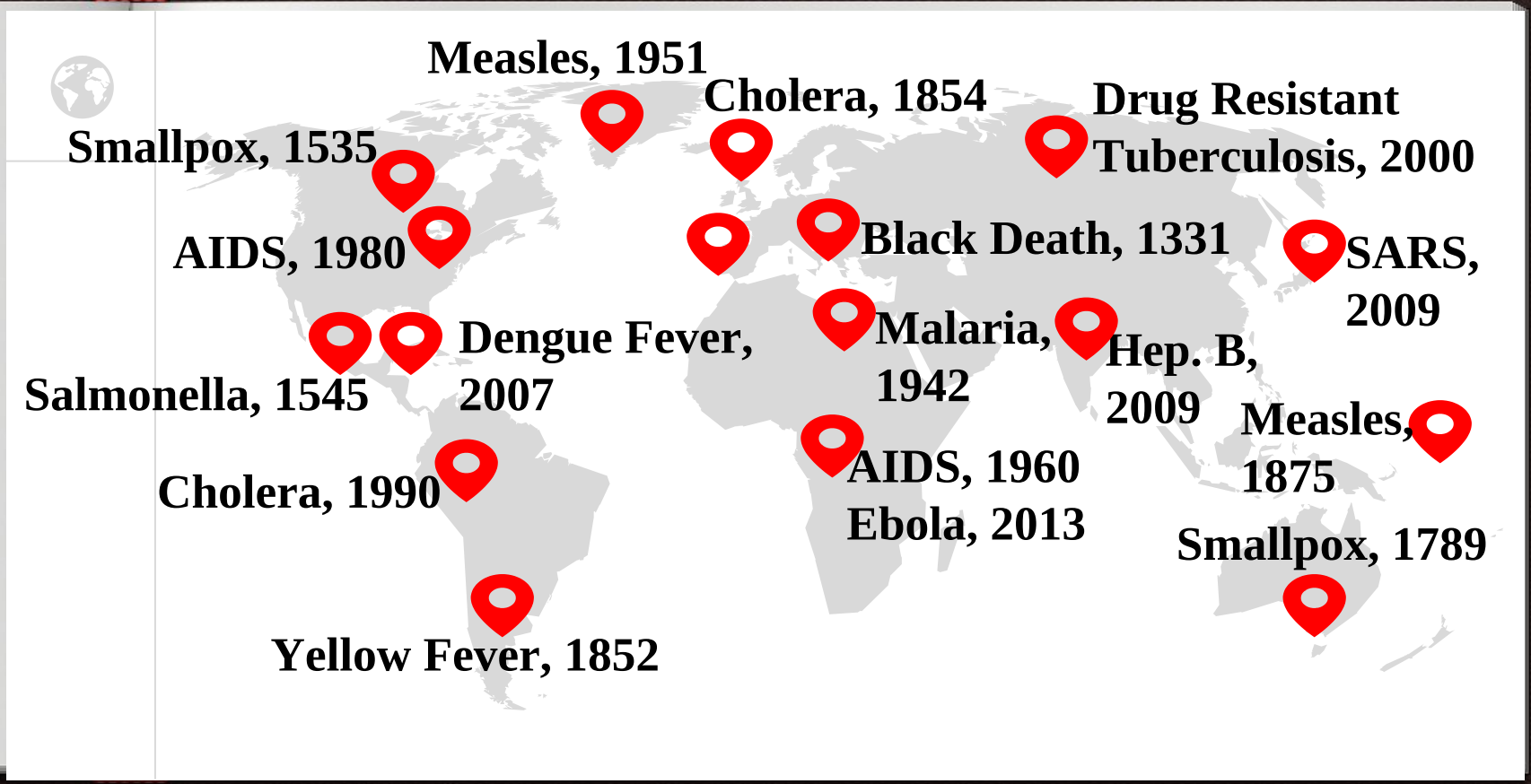
- Host cell survives
- Viruses keep being released
- Envelope allows them to ‘sneak by’ our immune system





Epidemics & Pandemics

- Viruses sometimes spread when they're carried by another living thing
- Vectors spread viruses, but don't get sick from infection
- Hosts get infected and get sick, but can also spread viruses


Measles, 1951
Cholera, 1854
Drug Resistant Tuberculosis, 2000
Smallpox, 1535
AIDS, 1980
Black Death, 1331
SARS, 2009
Dengue Fever, 2007
Malaria, 1942
Hep. B, 2009
Salmonella, 1545
Measles, 1875
AIDS, 1960
Ebola, 2013
Cholera, 1990
Smallpox, 1789
Yellow Fever, 1852