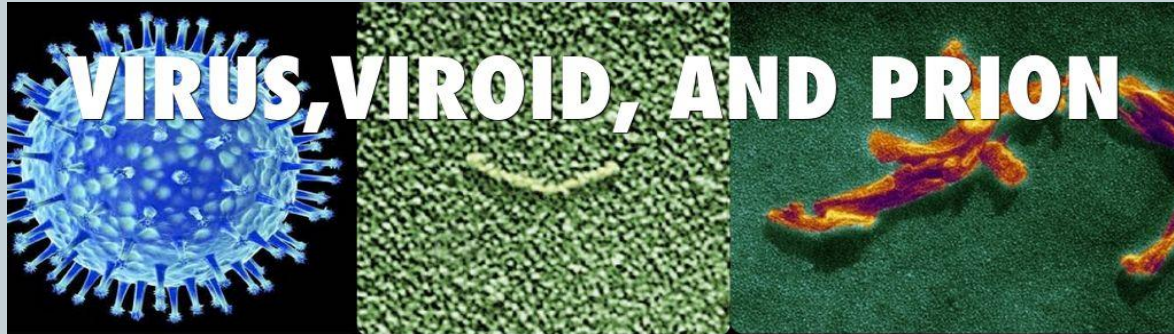
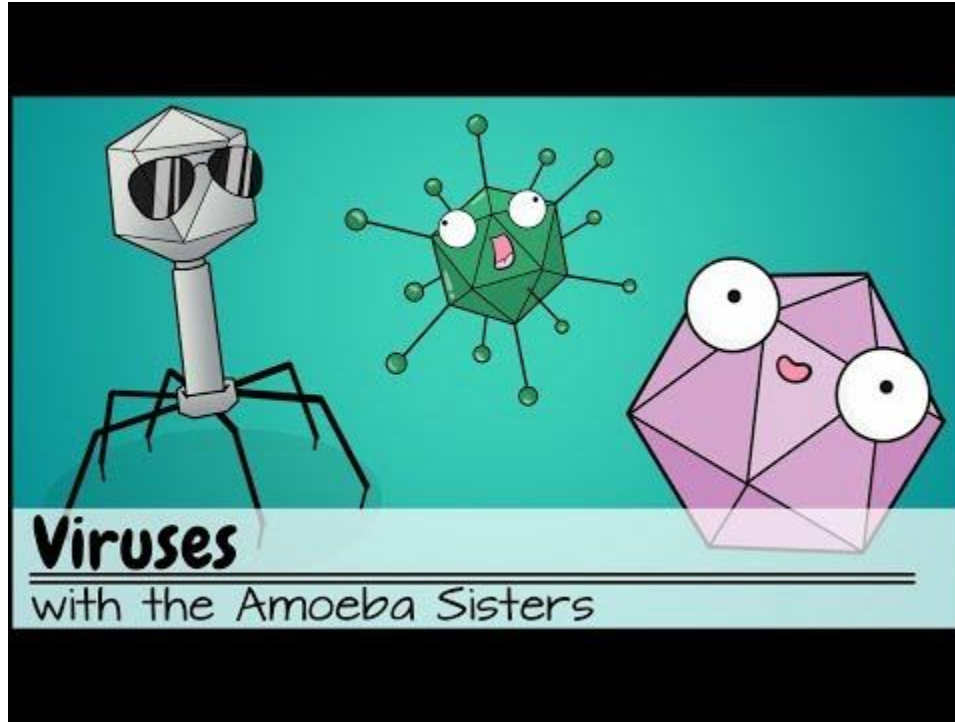


2.2 VIRUSES, VIROIDS, AND PRIONS

1



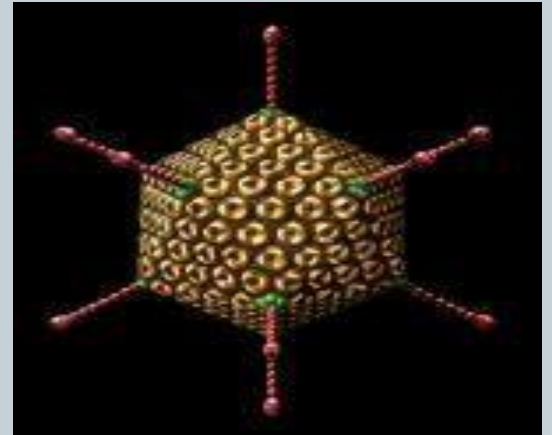
VIRUSES: INTRO



What are Viruses?

2

- Small, non-cellular particles (no cell organelles)
- Non-living
- Cause diseases: flus, AIDS, Chicken pox, herpes, mono., rabies, polio, hepatitis (all are pathogenic)

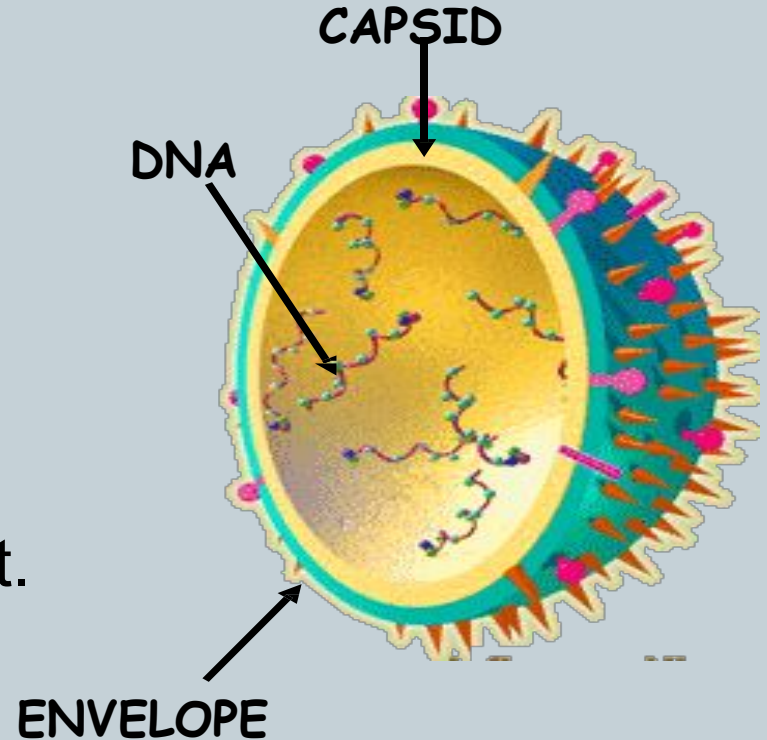


Structure

3

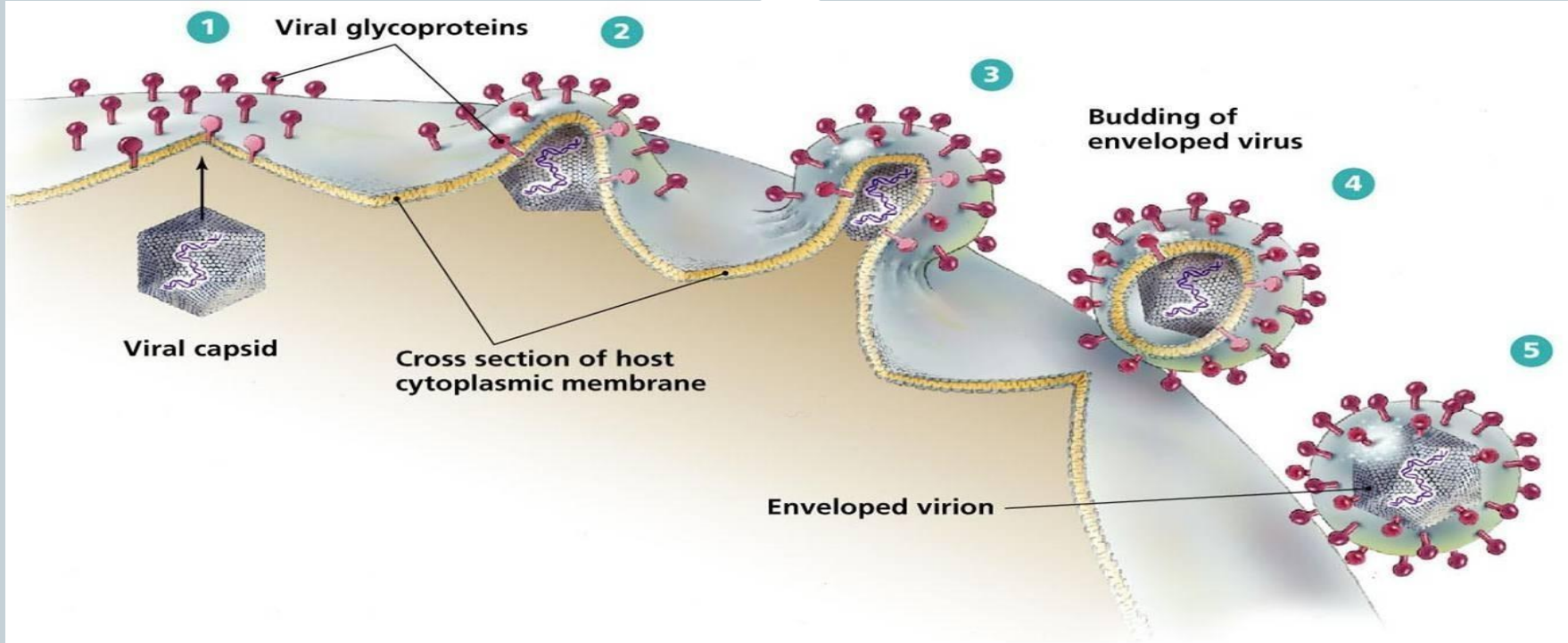
Two main parts:

- Capsid (protein coat)
- Nucleic acid - DNA **or** RNA
- **Some** have envelopes
- Their envelopes are part of the cell's membrane that they infect.



Formation of Envelope

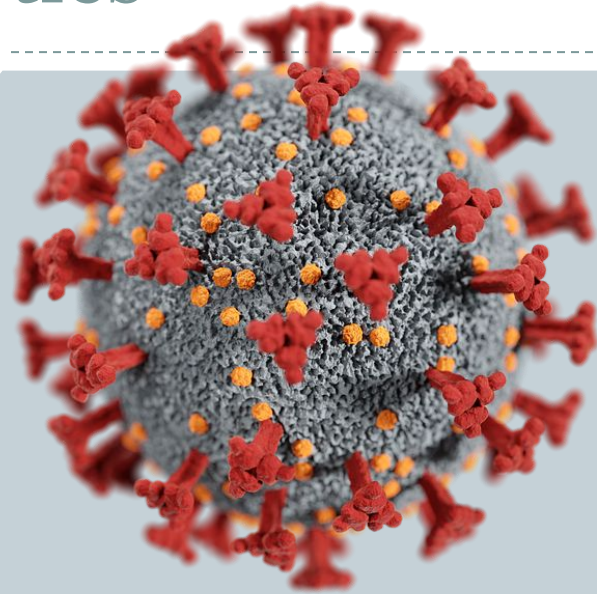
4



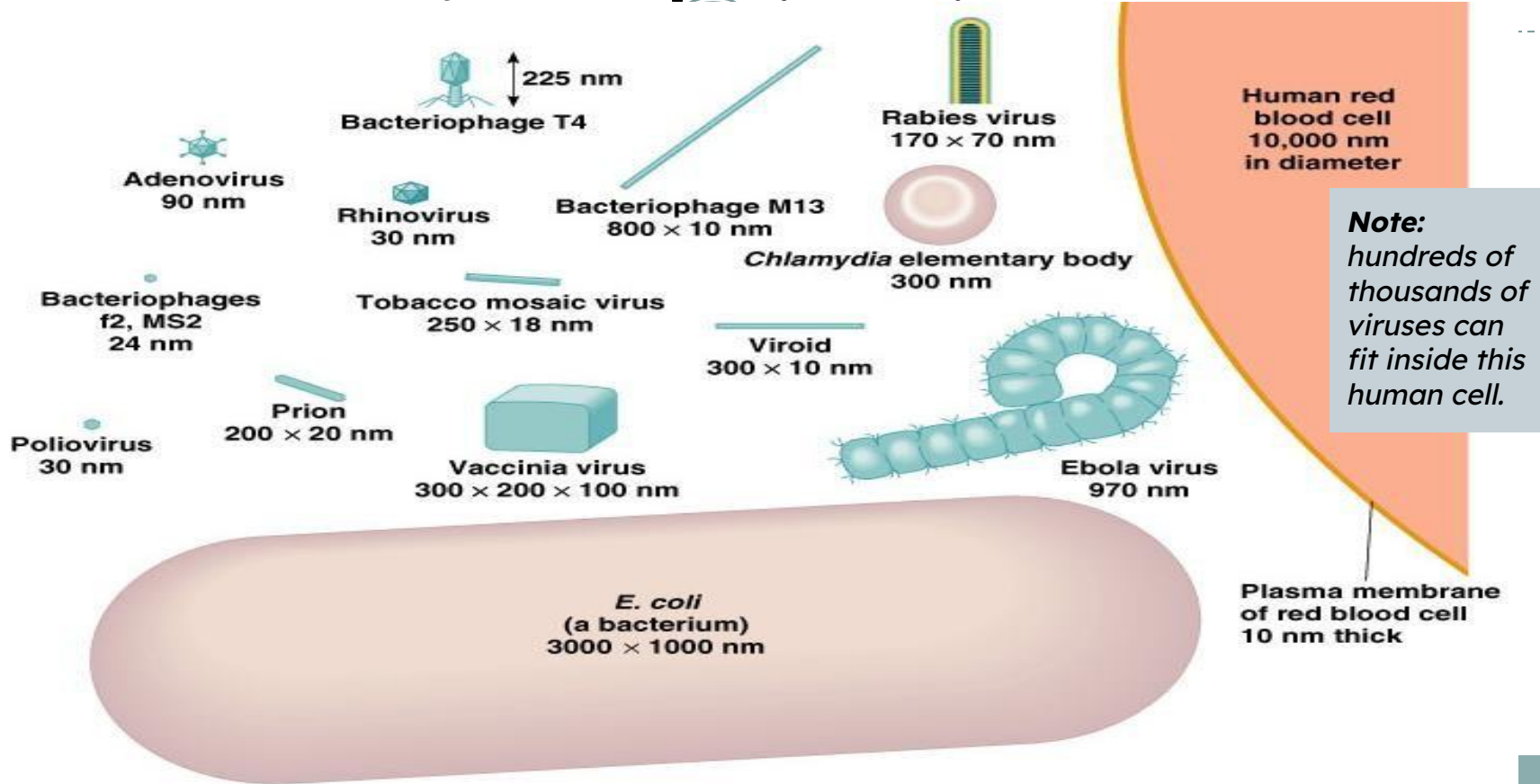
Properties

5

- Do not make or use energy
- Do not move independently
- Do not grow
- Only reproduce inside a host
- Do not produce waste
- Extremely small
 - ◆ 0.1 micrometre
 - ◆ Only visible with an electron microscope



Size of Viruses



Characteristics

7

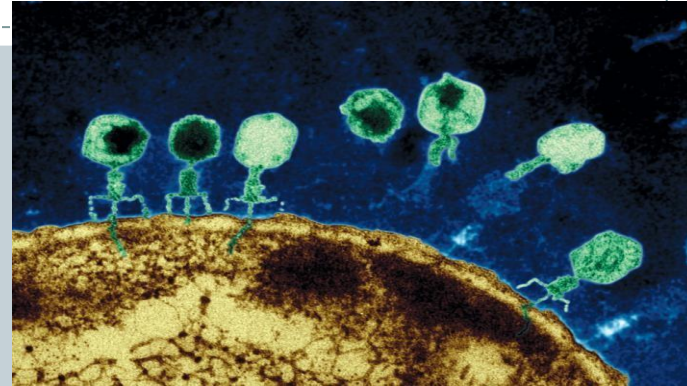
- Most viruses infect only **SPECIFIC** host species or a few closely related hosts

e.g. HIV

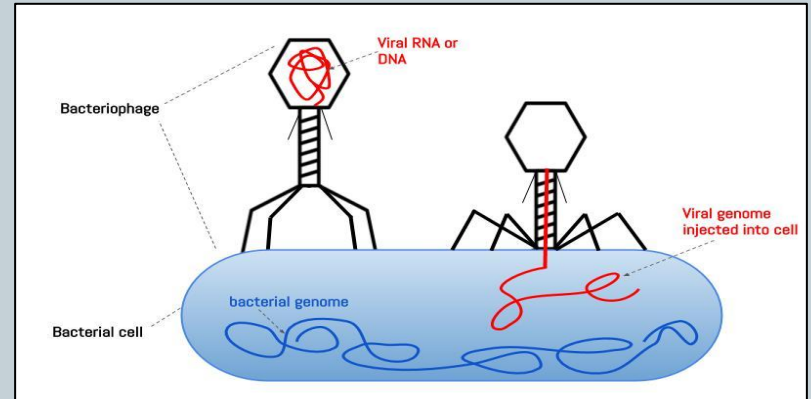
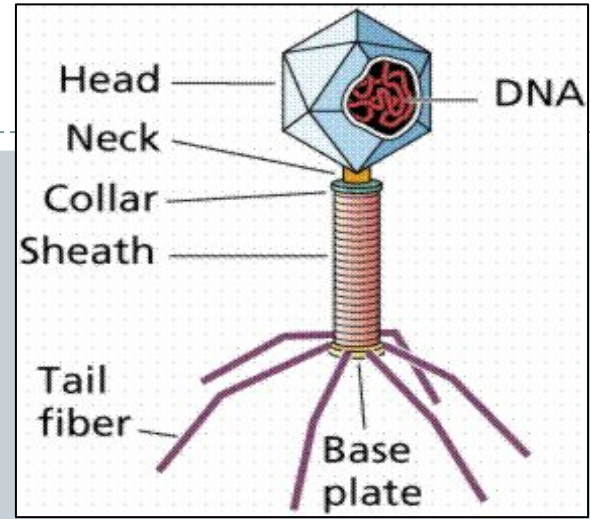
- Some can infect many species

e.g. rabies

- Species that infect bacteria are called **bacteriophages**



- While most other viruses enter the host cell whole, bacteriophages (phages) do not.
- The protein capsule remains outside the cell and the DNA is injected into the bacterium

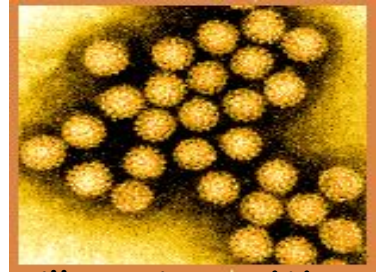


Why Viruses are Important?

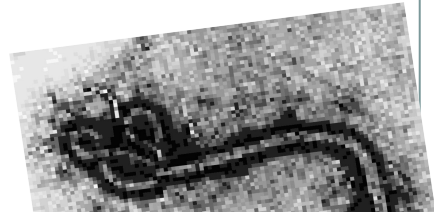
9

Viruses affect humans, animals, plants and bacteria etc.

- Some cause disease
 - They may be spread by bites, fluids, airborne particles or direct contact
 - Some produce mild symptoms - colds, chicken pox, warts
 - Others can be fatal - HIV, Ebola
- Oncoviruses are linked to cancer
 - Hepatitis C virus is linked to liver cancer
- They are important in ecosystems to help control the populations of other organisms.



Papillomavirus - Warts!



EBOLA VIRUS



Herpes
virus

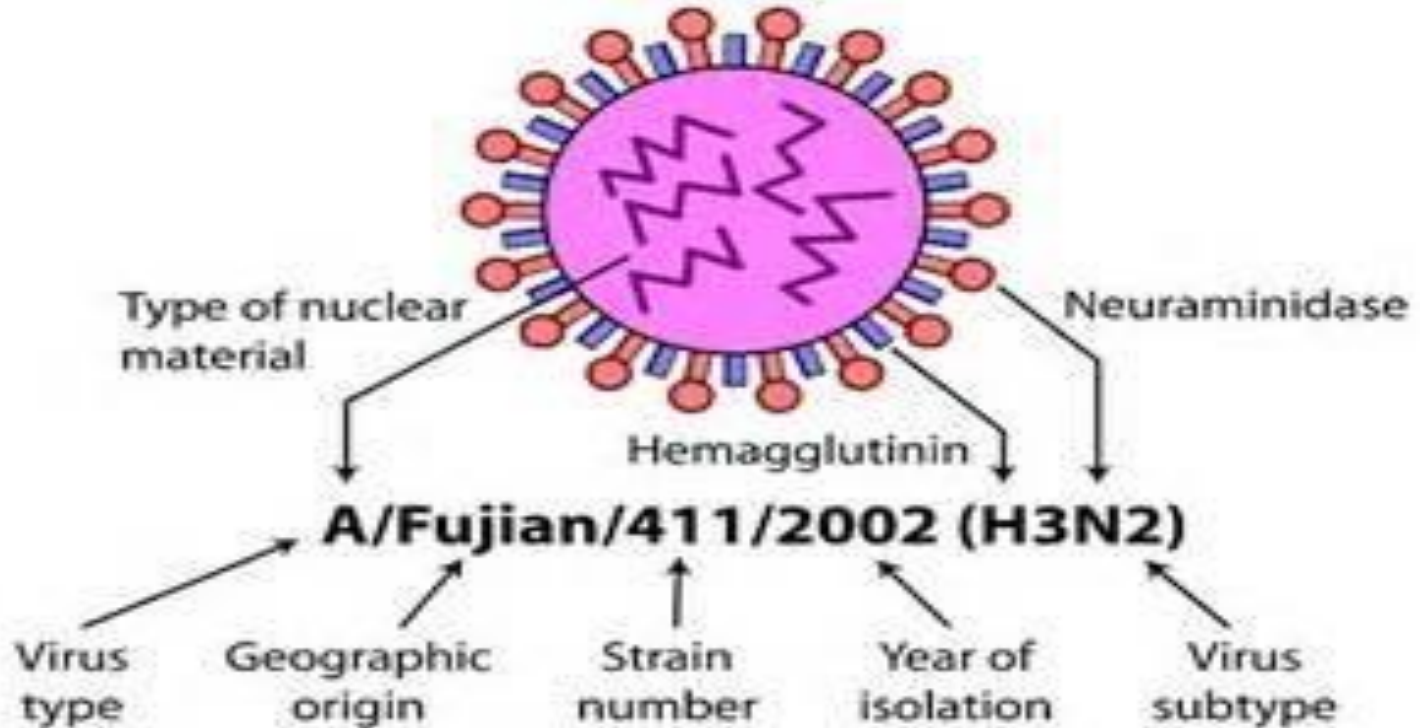
Classification and Phylogeny

10

- Viruses are classified based on:
 - RNA or DNA Virus
 - Presence of an envelope
 - Capsid shape (helical, polyhedral etc.)
 - HOST they infect
- Approximately 4000 species have been classified but scientists believe there may be millions
- Of the 80 known virus families, **21** include viruses that cause **disease to humans**.

Newer naming methods

11



Viral Shapes

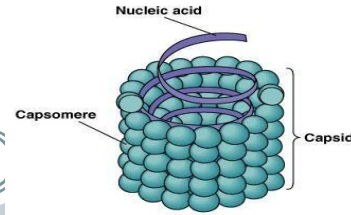
12

Viruses come in variety of shapes

Some may be helical shape like the Ebola virus

Some may be polyhedral shapes like the influenza virus

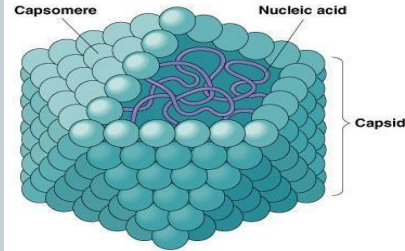
Others have more complex shapes like bacteriophages



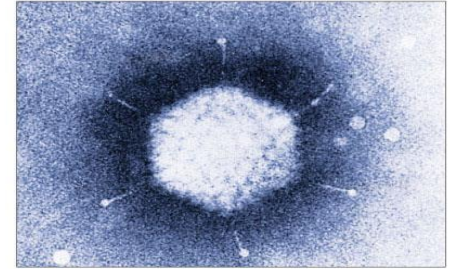
(a) A helical virus



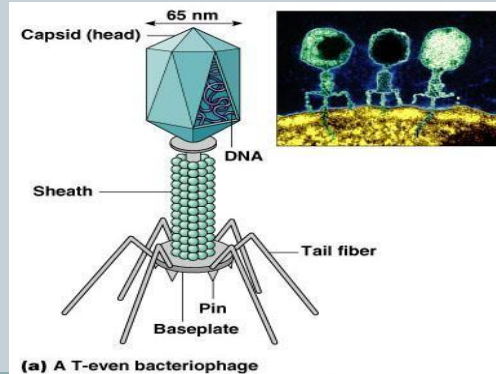
(b) Ebola virus



(a) A polyhedral virus



(b) A Mastadenovirus



(a) A T-even bacteriophage

Hypothesized Origin of Viruses:

13

1. Originated as small infectious cells that lost their cytoplasm and ability to reproduce outside a living cell
2. Originated as “escaped” fragments of DNA
3. Virus-like particles existed before the first cells

Viral Replication

14

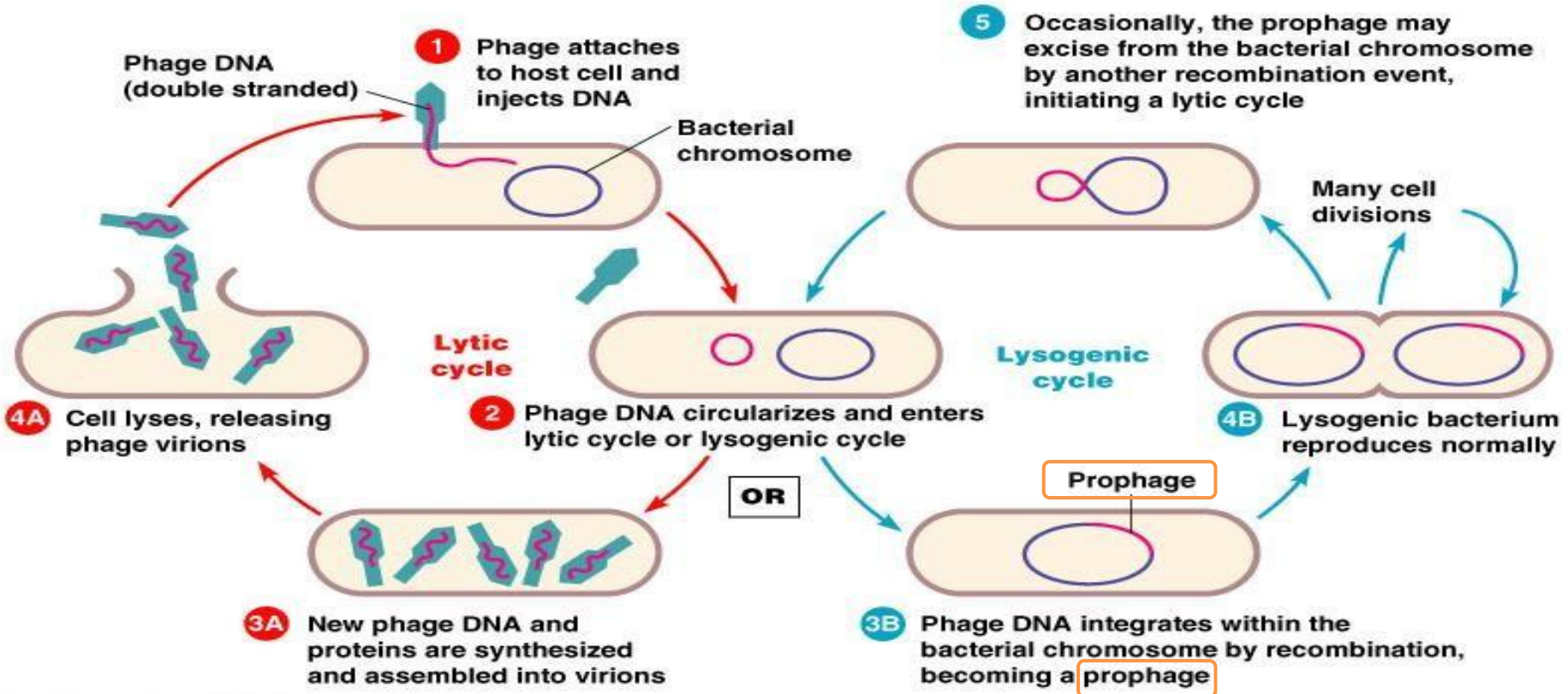
- Viruses can only reproduce by hijacking a host cell

They go into one of the following cycles once inside the host cell:

- **Lytic cycle** = virus is active, symptoms occur
 - Viral reproduction occurs, cells burst
- **Lysogenic cycle** = virus is dormant, no symptoms occur
 - reproduction does not immediately occur as viral DNA is integrated with the host genome (**prophage**)
 - These **latent** viruses may remain inactive for multiple years
 - e.g. herpes (cold sores), HIV, *varicella zoster* (chicken pox virus that can lay dormant and come out as shingles years after initial disease)

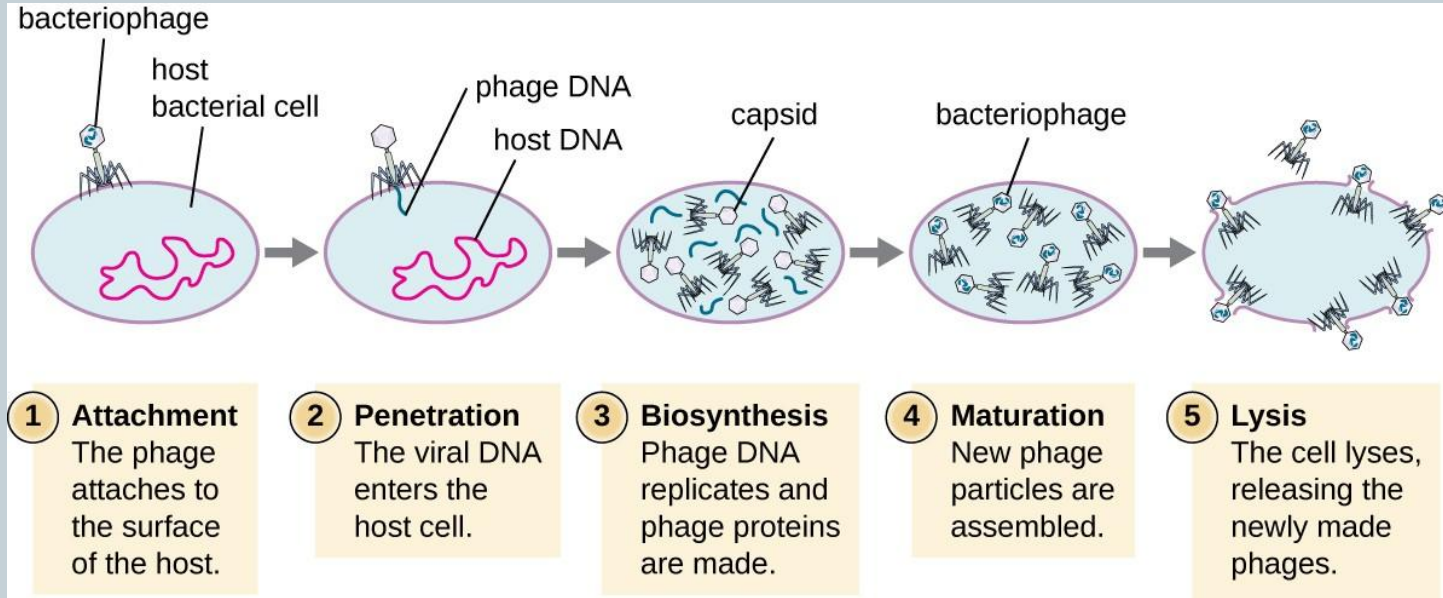


Infectious Cycles



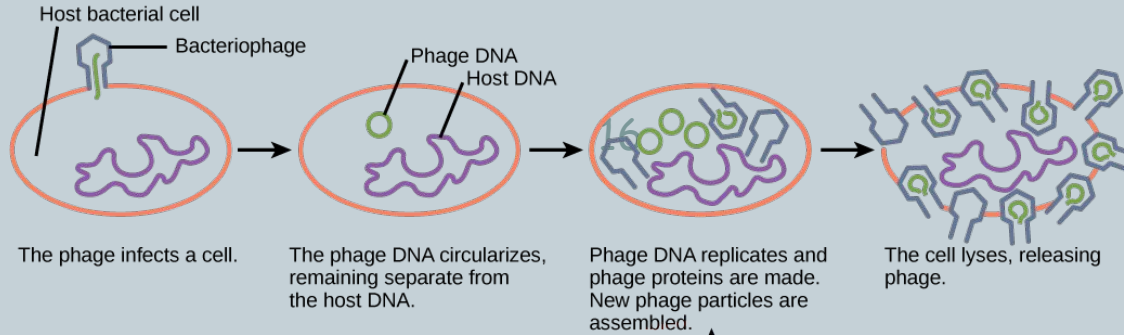
The Lytic Cycle

16

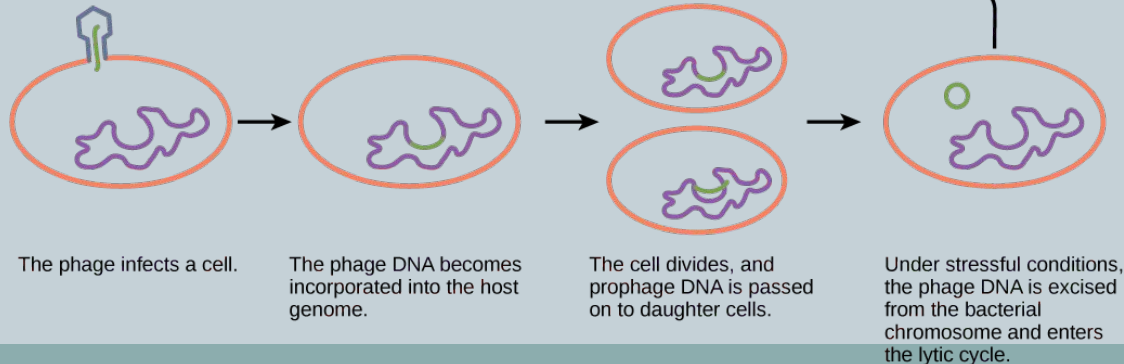


The Lysogenic Cycle

Lytic cycle



Lysogenic cycle



Vaccines

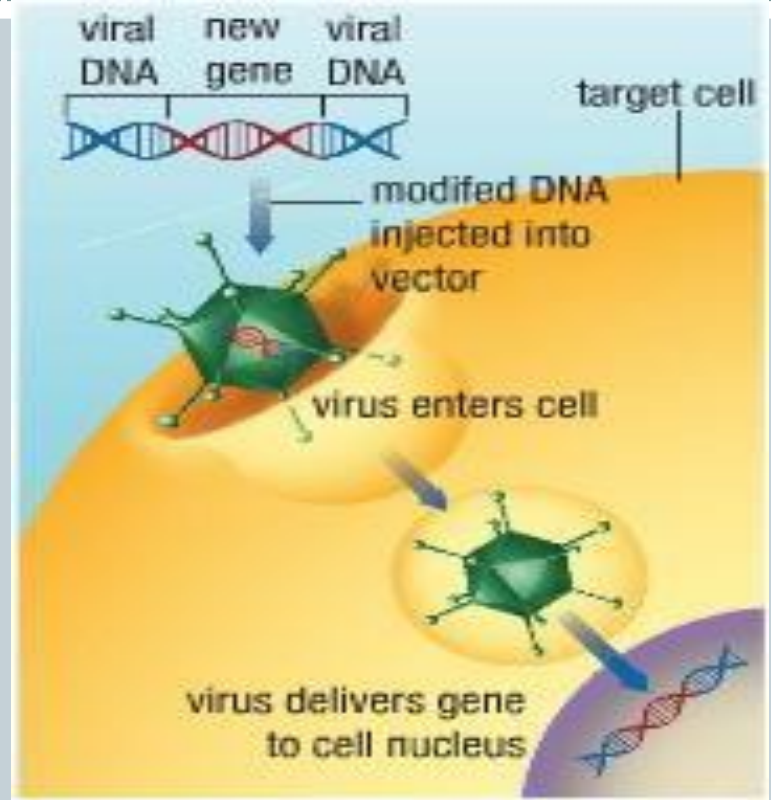
17

- A **weakened form** of a virus is injected
- This **triggers an immune response** but not illness
- The **‘antibodies’ are stored** in memory in case of contact with the true form of the virus
 - e.g. 2006 a vaccine was created for human papillomavirus (HPV)
(HPV was a leading cause of cervical cancer)
- It is not always possible to develop effective vaccines for some diseases (e.g. HIV)
- Some viruses are constantly changing so vaccinations are needed often e.g. influenza

Putting Viruses to Work

18

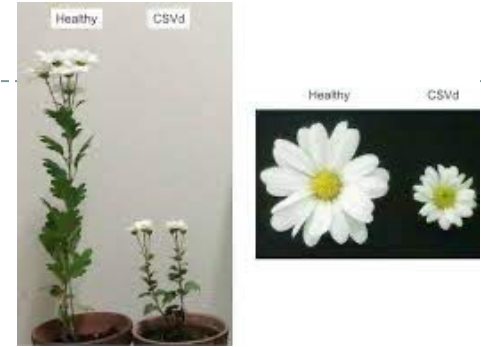
- Viruses lower the numbers of harmful bacteria
- Since viruses can enter target cell they can be used for:
gene therapy
 - Drugs or genes can be delivered to target cells (using virus as vectors)
 - Gene can be replaced with correct version
 - Genes from one species can be inserted into the genome of another species (GMOs)



Viroids

19

- Small, circular RNA molecules without a protein coat (or capsid)
- Pathogens of higher plants e.g. *Potato spindle tuber viroid* causes stunting of plants and elongated tubers



Chrysanthemum stunt viroid in chrysanthemum



Prions

20

Abnormally folded “infectious proteins” in the brain and nervous system

They convert normal prion proteins into abnormal ones

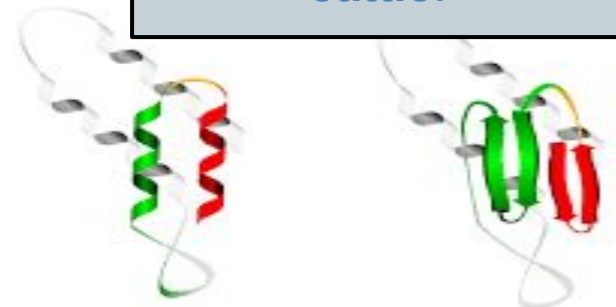
How it spreads: when an animal eats an infected organism, these proteins travel through the bloodstream to the brain and affect other proteins

e.g. Mad cow disease (bovine spongiform encephalitis: BSE) (results in spongy holes in brain of cows)

Humans who eat infected meat develop Creutzfeldt-Jakob disease (CJD)



Mad cow disease is a fatal disease that slowly destroys the brain and spinal cord (central nervous system) in cattle.



What's for homework?

- ❑ Virus lab (due Thursday)
- ❑ Complete note (using textbook)
- ❑ Textbook Questions (P. 59: 6, 7)
- ❑ Edpuzzle viruses
(due before next class)