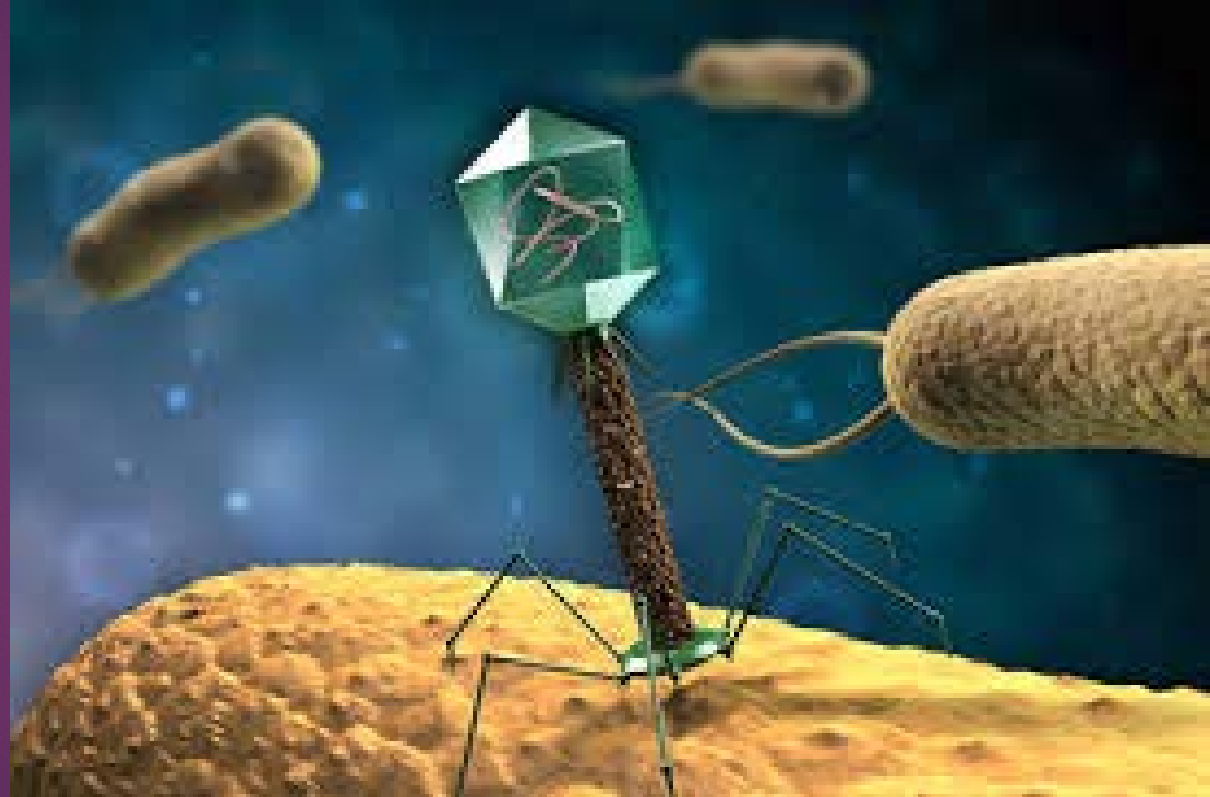


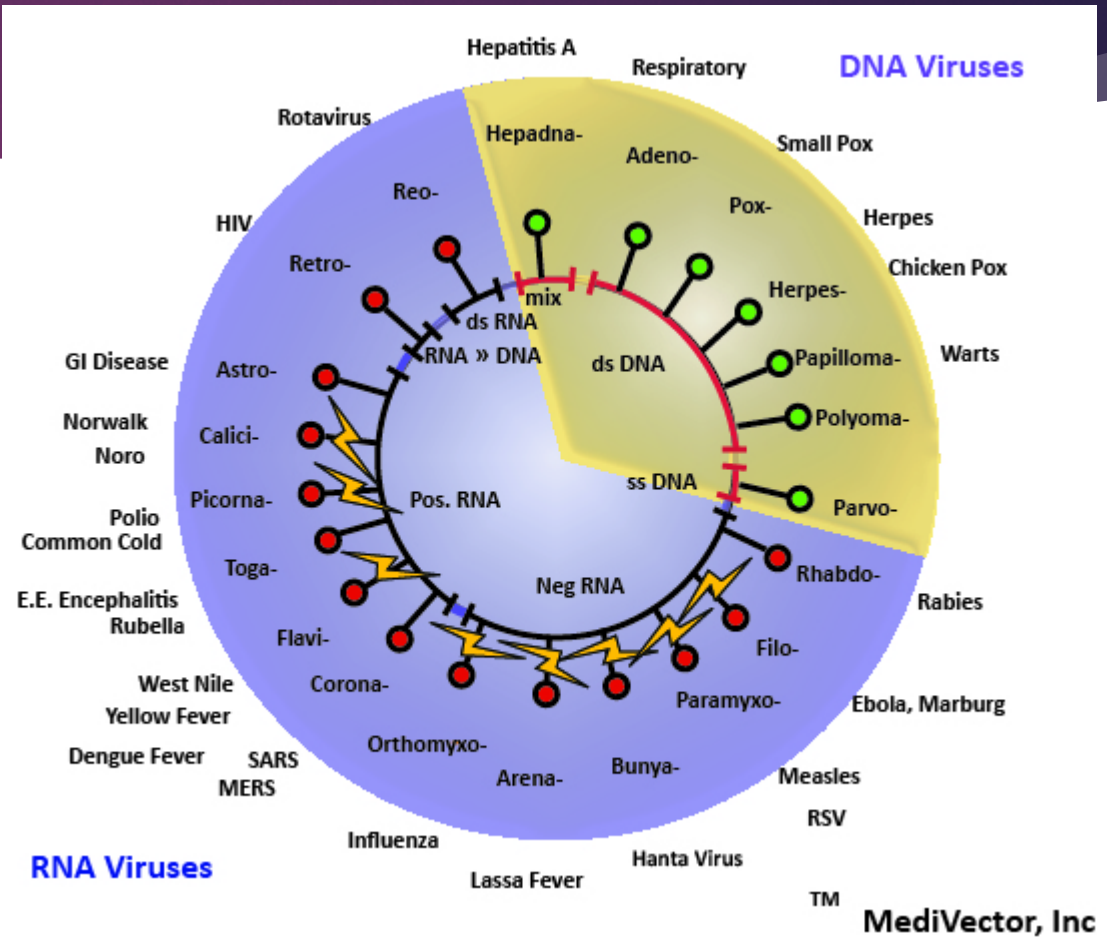
Viruses

WHERE DO THEY FIT IN?



Classification

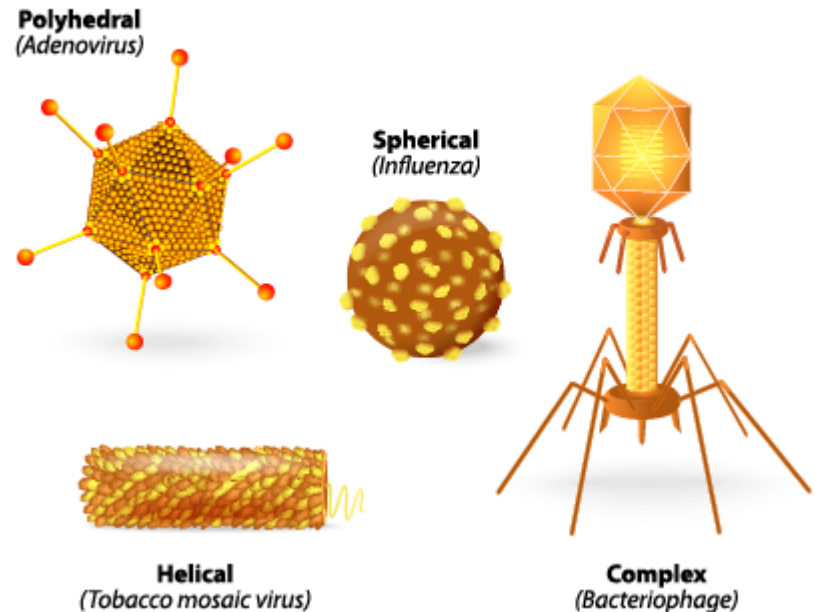
- ▶ Do not fit under the 5 kingdom, 3 domain system
- ▶ They are simpler than bacterial cells
 - ▶ No membranes, nucleus or organelles



What is a Virus?

- ▶ Particles of nucleic acid, protein and sometimes lipid (fat)
- ▶ They can only reproduce by infecting living cells
- ▶ Vary widely in size and structure
- ▶ All viruses have one thing in common
 - ▶ They enter living cells, and once inside use the machinery of the infected cell to produce more viruses

VIRAL SHAPES



Size

Microorganisms-size comparison

- ▶ Viruses are very small, much smaller than bacteria

Prokaryotic cell: 1-3 μm
Eukaryotic cell: 15-20 μm
Virus: 20-200 nm

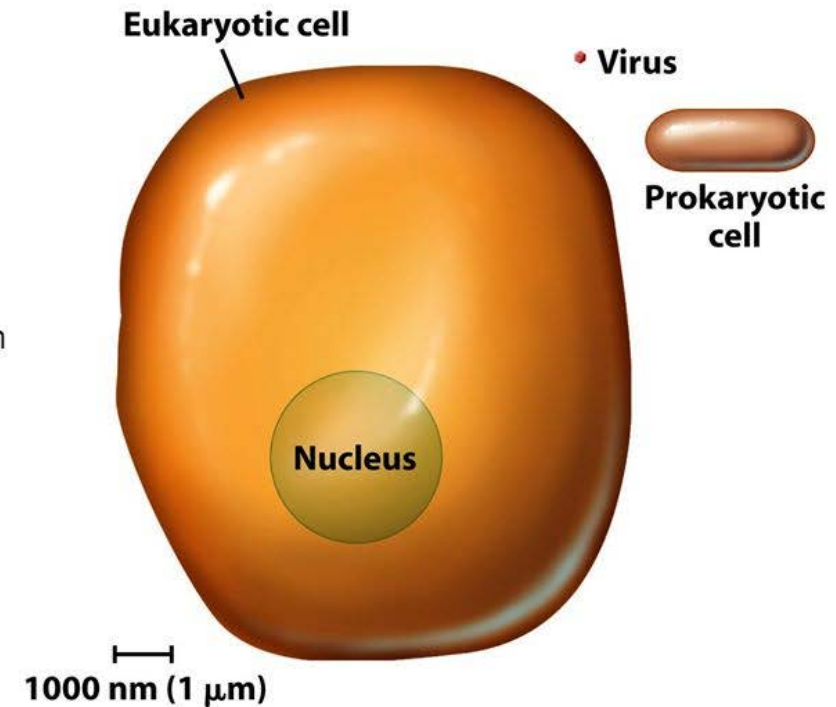
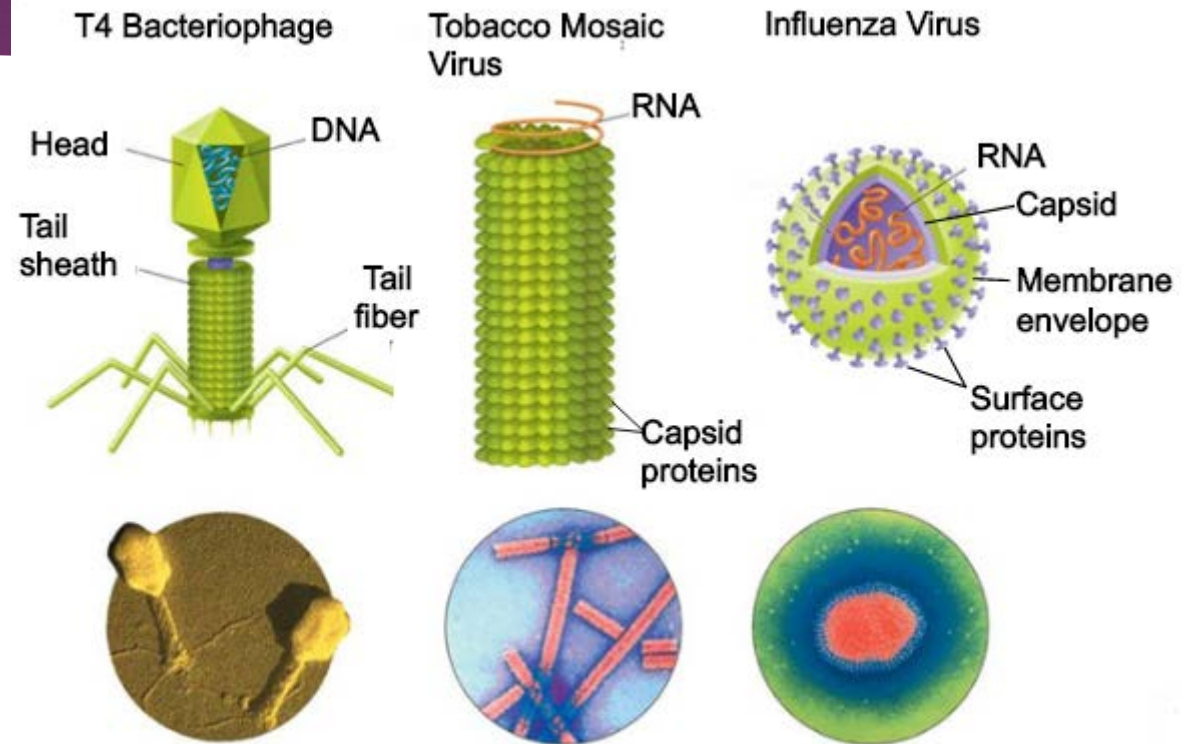


Figure 2-3c Brock Biology of Microorganisms 11/e
© 2006 Pearson Prentice Hall, Inc.

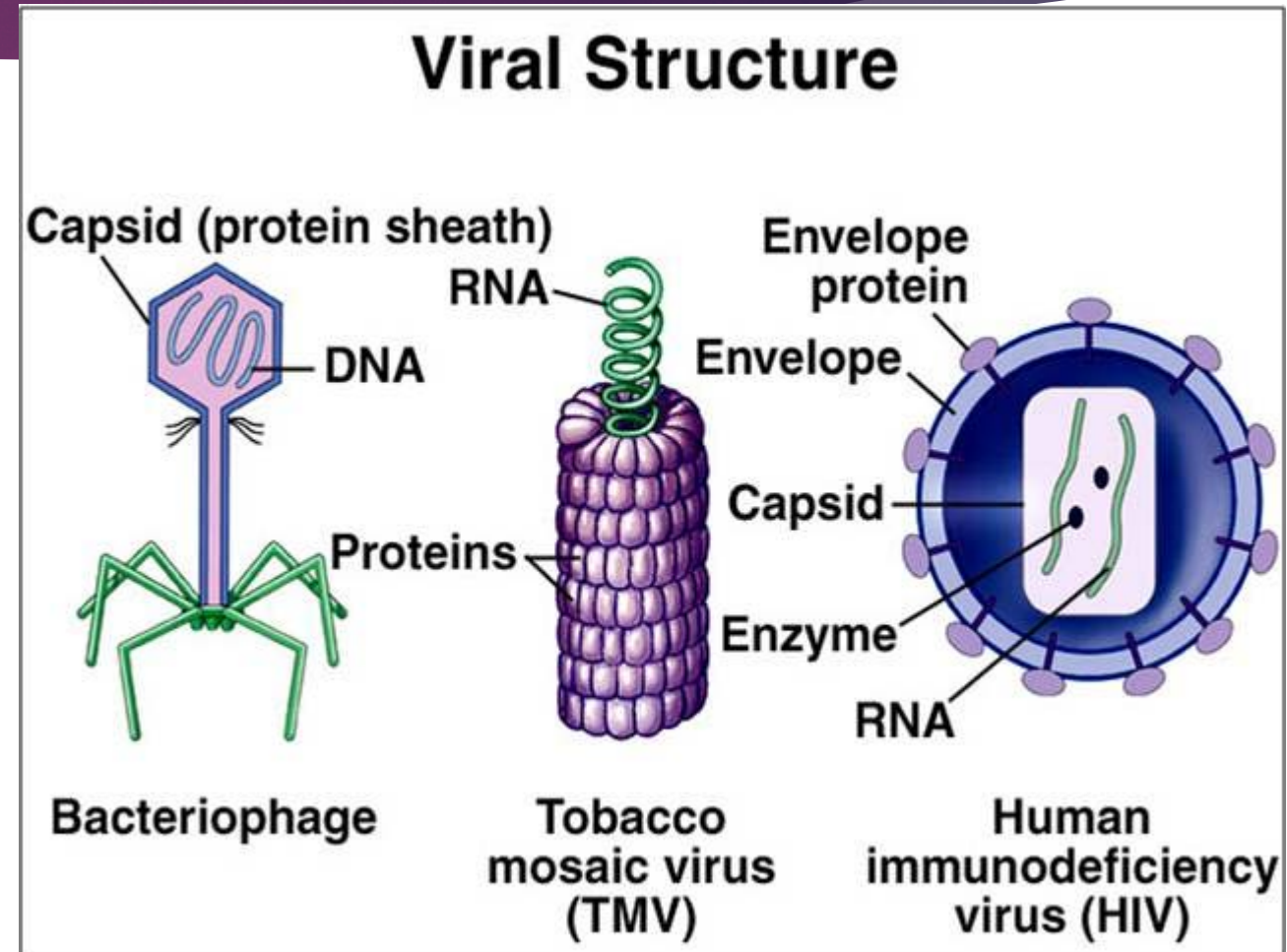
Viruses

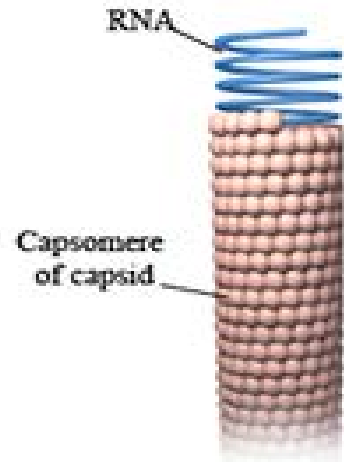
- ▶ A Typical virus is composed of a core of DNA or RNA surrounded by a protein coat
- ▶ The simplest viruses contain only a few genes
- ▶ The most complex may have more than 100 genes
 - ▶ Humans (20,000)



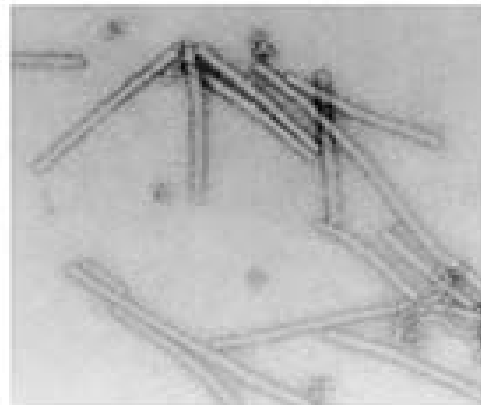
Structure

- ▶ Core: DNA/RNA
- ▶ A viruses protein coat is called a capsid
 - ▶ The capsid includes proteins that enable a virus to enter a host cell
 - ▶ The capsid proteins bind to receptors on the surface of the cell to “trick” the cell to allowing it inside
 - ▶ Once inside, the viral genes are expressed

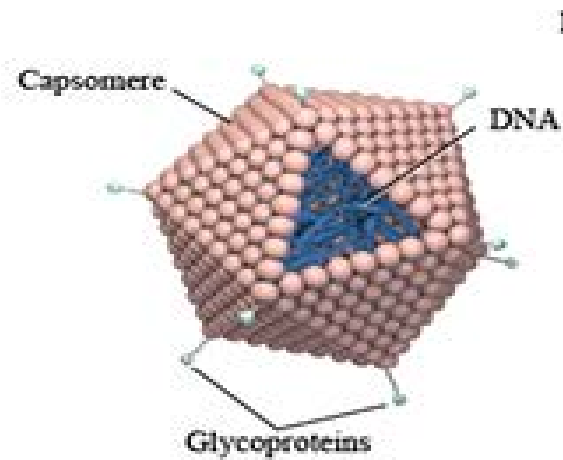




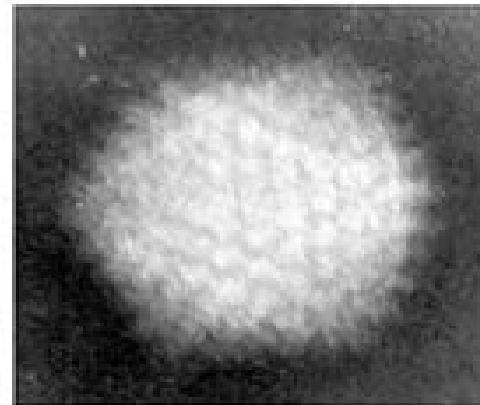
18 x 250 nm



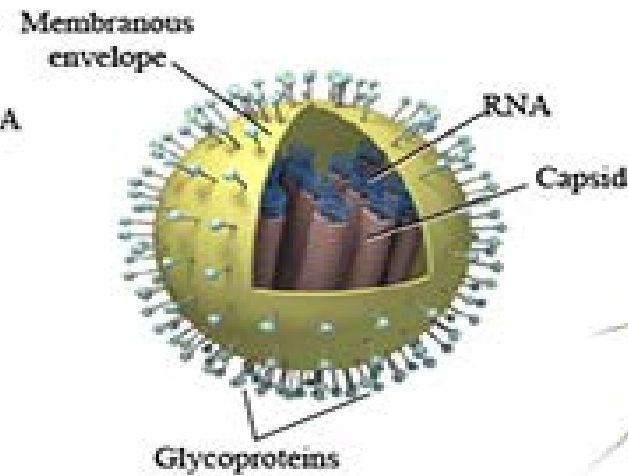
(a) Tobacco mosaic virus



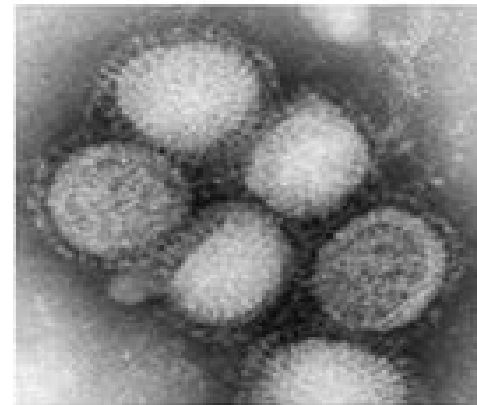
70-90 nm (diameter)



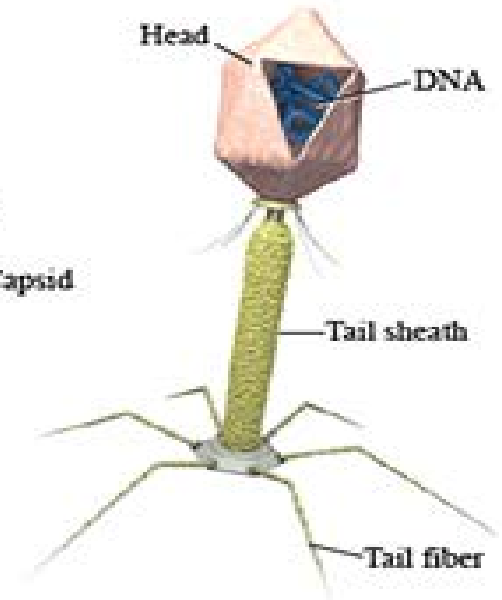
(b) Adenovirus



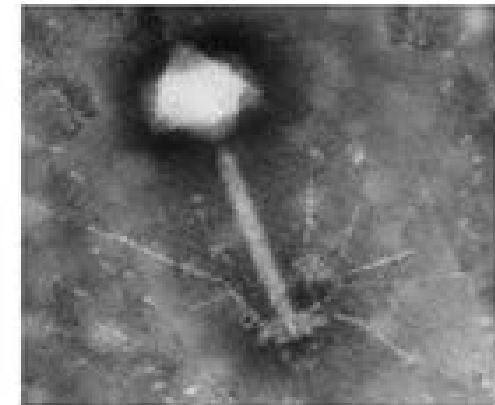
80-200 nm (diameter)



(c) Influenza virus



80 x 2225 nm



(d) Bacteriophage T4

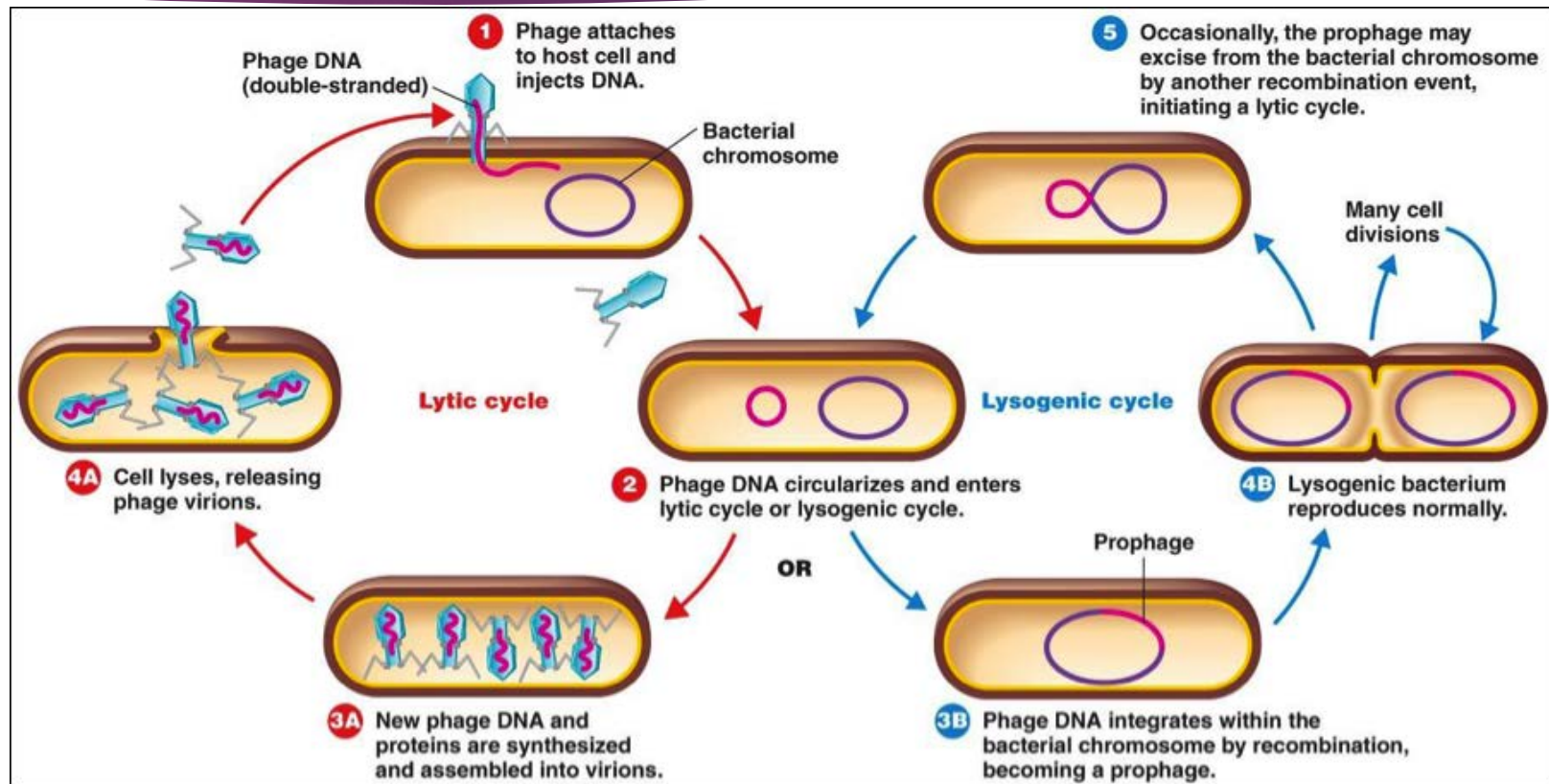
Specificity

- ▶ Viruses must bind precisely to proteins on the cell surface and then use that cells genetic system
 - ▶ Due to this, most viruses are HIGHLY specific to the cells that they infect
 - ▶ IE- Plant viruses infect plants, animal viruses infect only certain species, and bacterial viruses only infect certain types of bacteria
- ▶ Most viruses only infect one host (eg. Measles = humans)
- ▶ Some viruses infect more than one host (eg. Rabies)
- ▶ Viruses that infect bacteria are called BACTERIOPHAGES

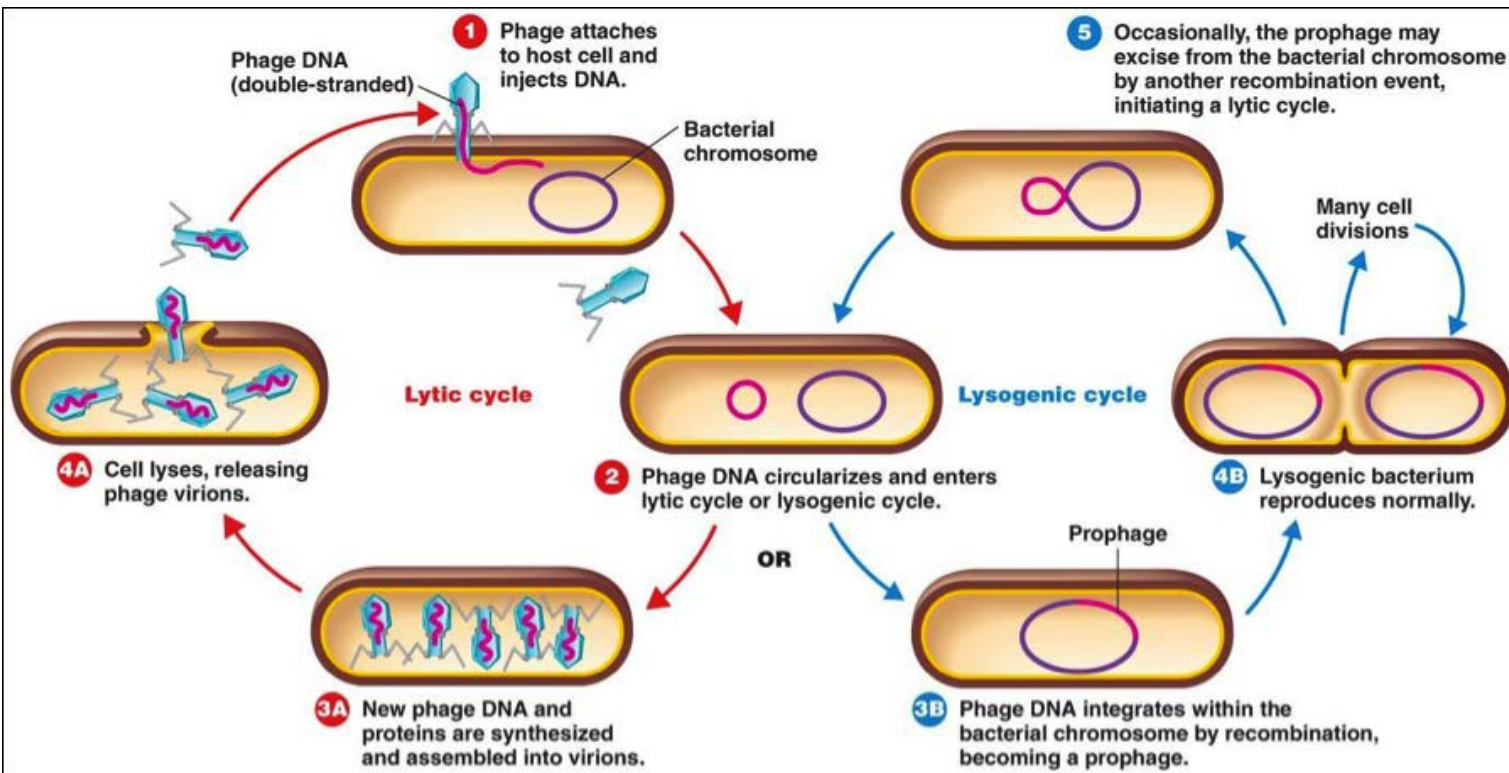


Viral Infection

- ▶ Once a virus enters a host cell two different processes may occur
 - ▶ Some viruses replicate immediately killing the host cell
 - ▶ Some viruses replicate but do not kill the host cell immediately



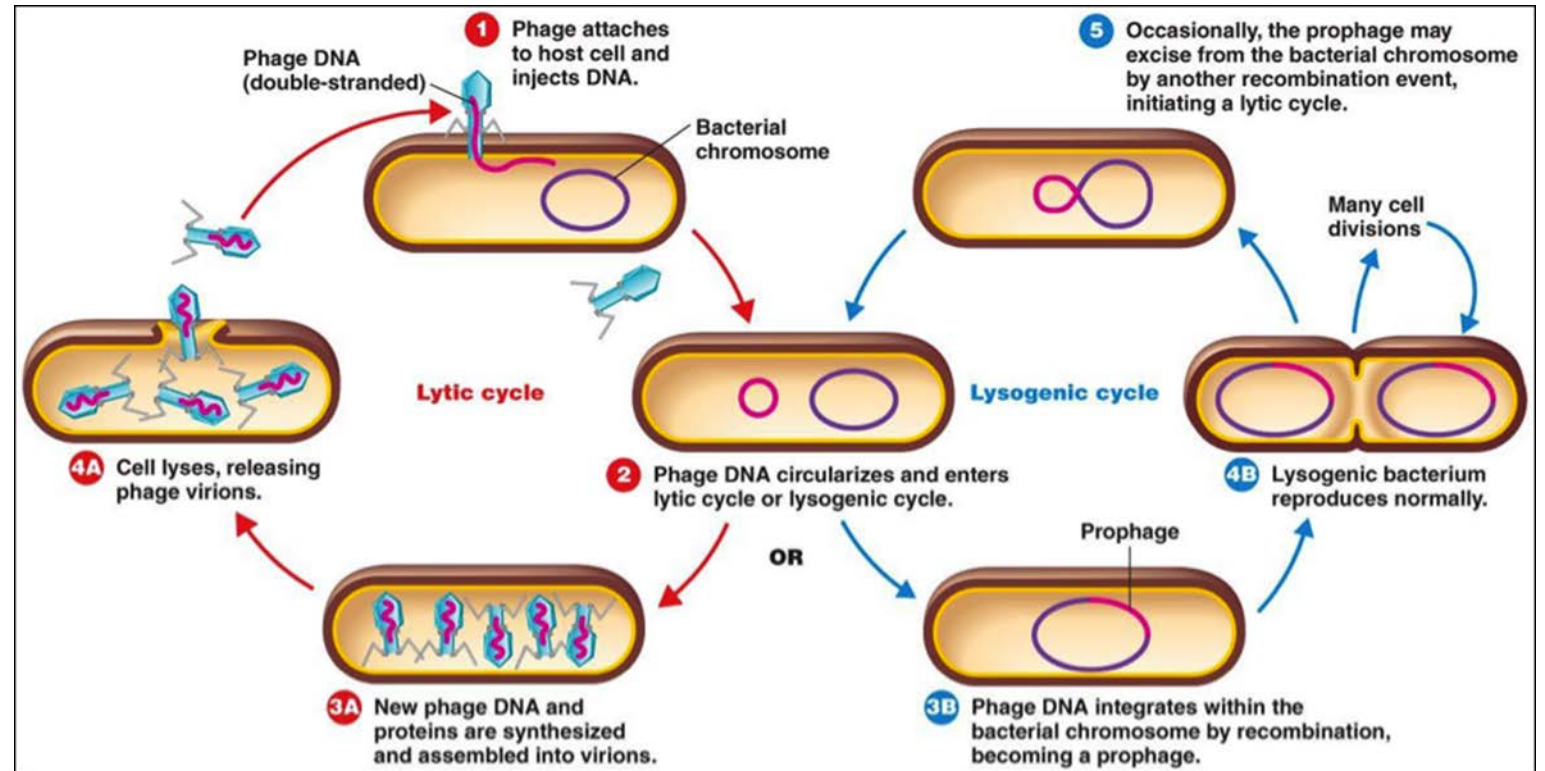
Lytic Cycle



- ▶ Virus enters cell and uses host cell to reproduce its genetic information forming duplicate copies of the virus
- ▶ The host cell bursts (i.e lysis) releasing many copies of the identical virus
- ▶ typical lytic cycle takes 30 minutes & produces ~ 200 new viruses

Lysogenic Cycle

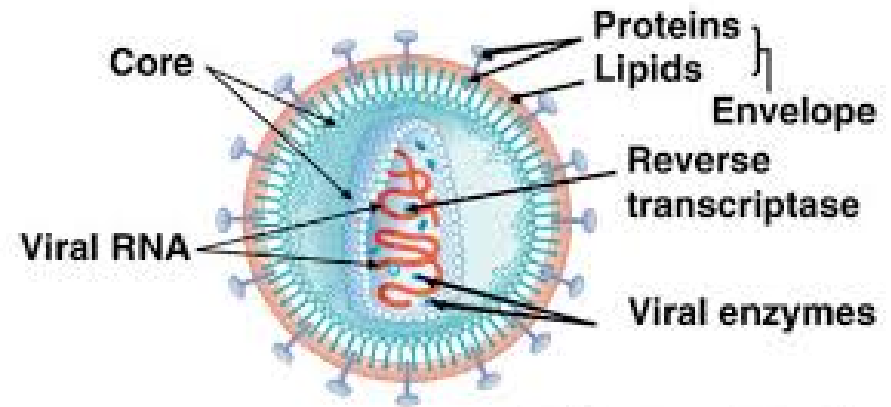
- ▶ Genetic information from virus is integrated into the host cell's chromosomes (DNA)
 - ▶ Viral DNA=prophage
- ▶ The viral genetic information replicates along with the host cell's DNA
- ▶ Virus stays dormant (i.e. asleep) and doesn't affect the function of the host cell
- ▶ Can lead to the lytic cycle



Retroviruses

- ▶ Viruses that contain RNA as their genetic information
- ▶ When they infect a cell
 - ▶ Produce a DNA copy of their RNA
 - ▶ This DNA is inserted into the DNA of the host cell
 - ▶ Genetic information is copied backward
 - ▶ HIV Virus

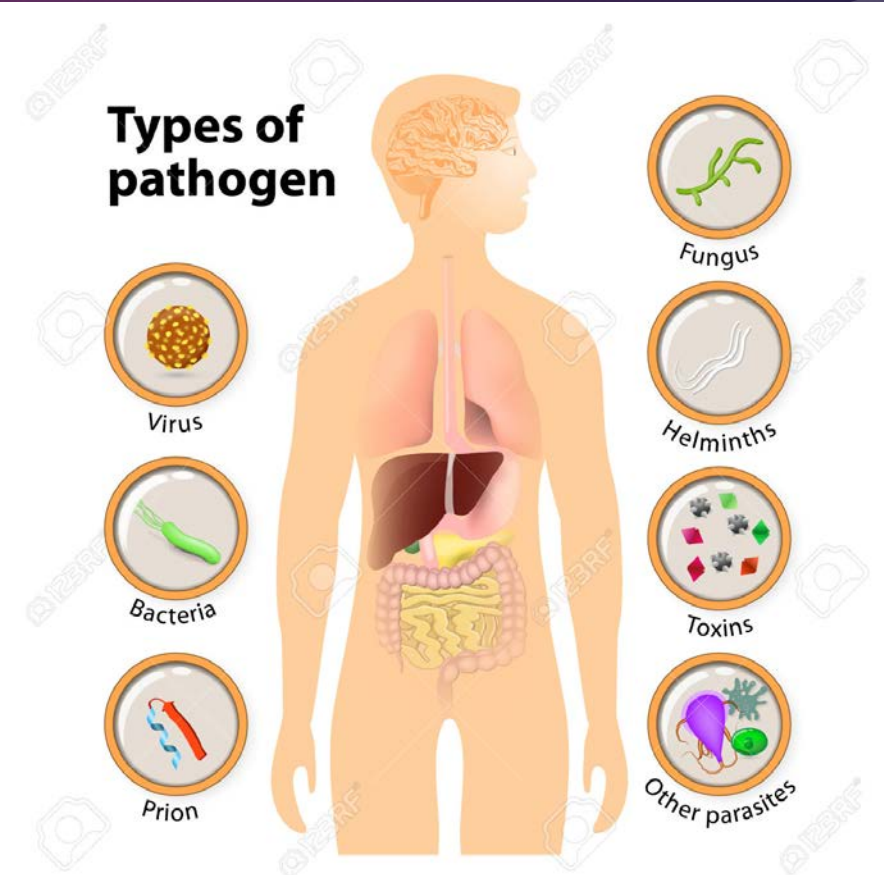
Structure of a retrovirus



courtesy www.andrew.cmu.edu

Viruses as Parasites

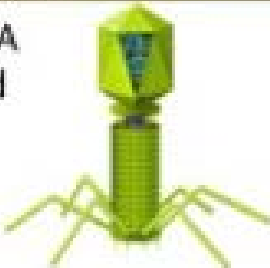

- ▶ Viruses depend entirely upon another living organism for its existence, harming that organism in the process



Are Viruses Living?

- ▶ Characteristics of living things
 - ▶ Made up of cells
 - ▶ Reproduce
 - ▶ Have a universal genetic code
 - ▶ Grow and develop
 - ▶ Obtain and use materials and energy
 - ▶ Respond to environment
 - ▶ Maintain a stable internal environment
 - ▶ Change over time

Non Living

Viruses and Cells		
Characteristic	Virus	Cell
Structure	DNA or RNA core, capsid 	Cell membrane, cytoplasm; eukaryotes also contain nucleus and organelles 
Reproduction	only within a host cell	independent cell division either asexually or sexually
Genetic Code	DNA or RNA	DNA
Growth and Development	no	yes; in multicellular organisms, cells increase in number and differentiate
Obtain and Use Energy	no	yes
Response to Environment	no	yes
Change Over Time	yes	yes