



# Viruses

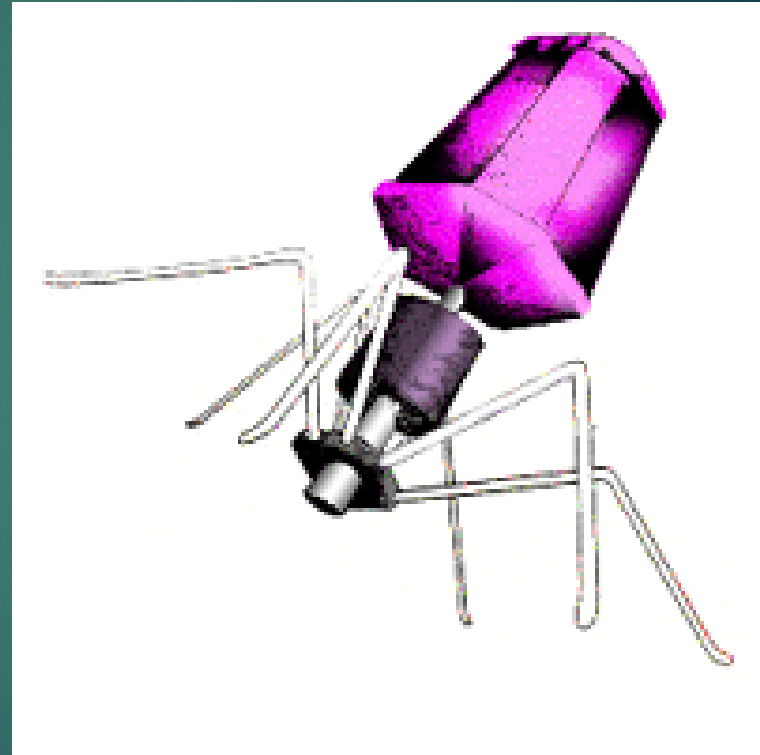
MICROBIOLOGY

# Microbiology

- ▶ The branch of science that deals with microorganisms
  - ▶ All living organisms that are too small to be seen with the naked eye
    - ▶ i.e. bacteria, archaea, viruses, fungi, prions, protozoa and algae
      - ▶ Collectively known as 'microbes'

# Boundary of Life

- ▶ Review: what are some of the characteristics of living things?
- ▶ Viruses lay between macromolecules like proteins and prokaryotes (i.e. bacteria)
- ▶ What characteristics of living things do viruses display?
- ▶ Viruses consist of nucleic acid (either DNA or RNA), and a protective coat of protein molecules and sometimes lipids



Pictured: bacteriophage

# Boundary of Life

- ▶ In isolation:
  - ▶ Viruses and bacteriophages show none of the expected signs of life
    - ▶ They do not respond to stimuli, they do not grow, they do not do any of the things we normally associate with life
- ▶ Debate:
  - ▶ Are viruses living or not?
    - ▶ Independently they do nothing
    - ▶ They do show one of the most important signs of life
      - ▶ The ability to reproduce at a fantastic rate but only in a host cell

# Virus Basics

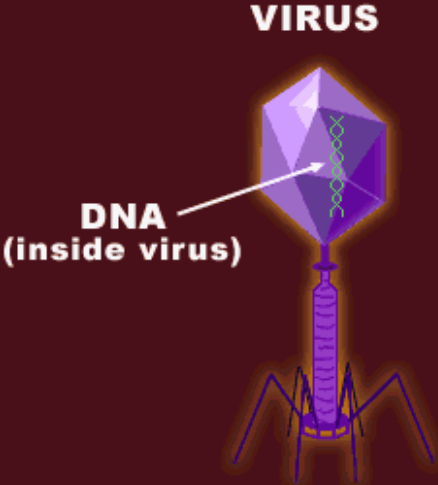
- ▶ Two types of viruses:
  - ▶ Bacteriophages attack bacteria (prokaryotes)
  - ▶ Viruses attack eukaryotic cells
- ▶ Mechanism for reproduction:
  - ▶ Once inside, viruses use the host cell's organelles to make more of their own macromolecules
- ▶ Viral 'life' cycles:
  - ▶ Lytic (virulent) cycle – once the virus enters the host, it immediately begins reproducing and creating new viruses until the host cell dies
  - ▶ Lysogenic (latent) cycle – once the virus enters the host, it 'joins' the host cell's DNA and the host continues the cell cycle normally



Animation by: L.Z. Medaris

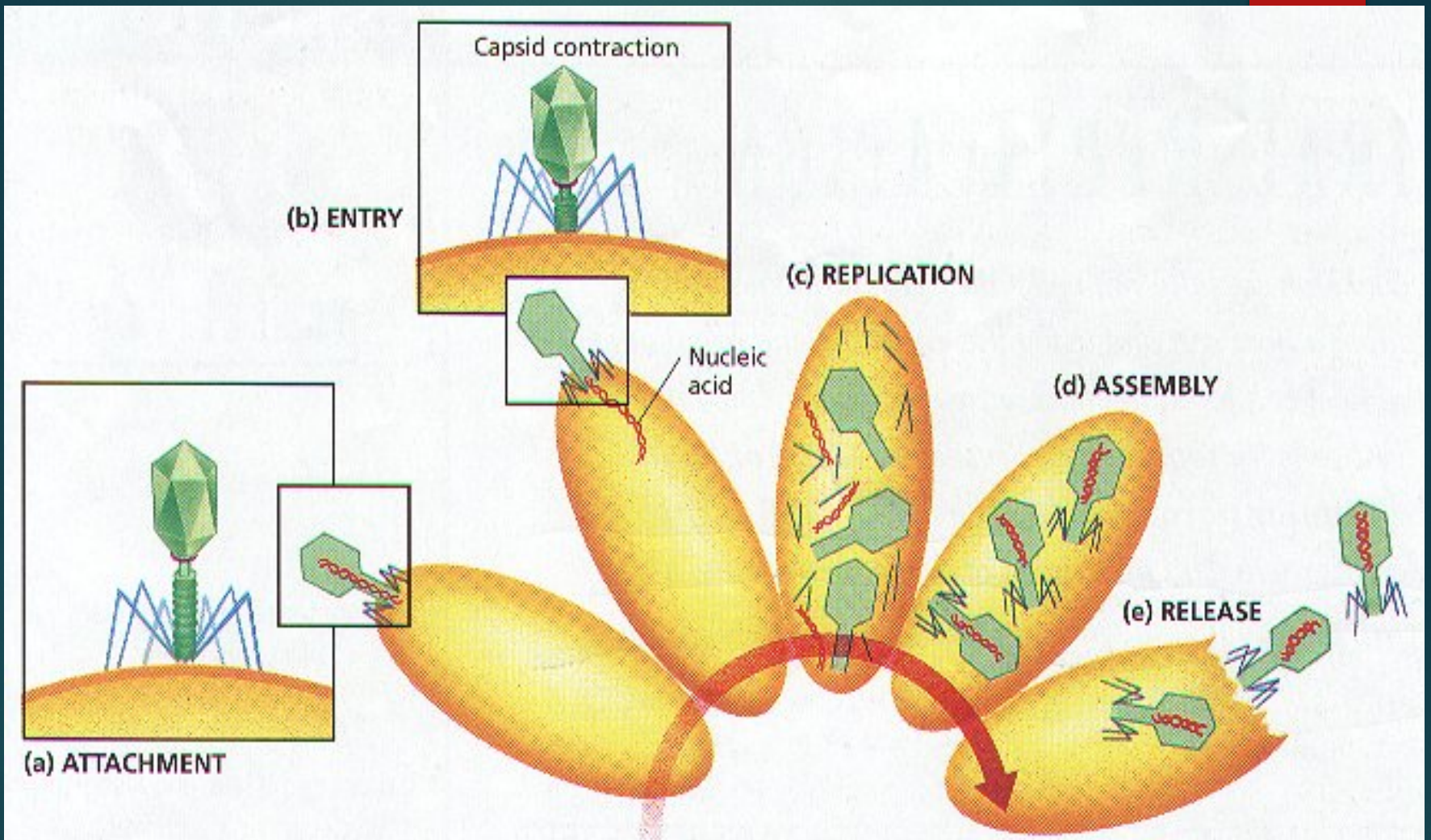


**CELL**

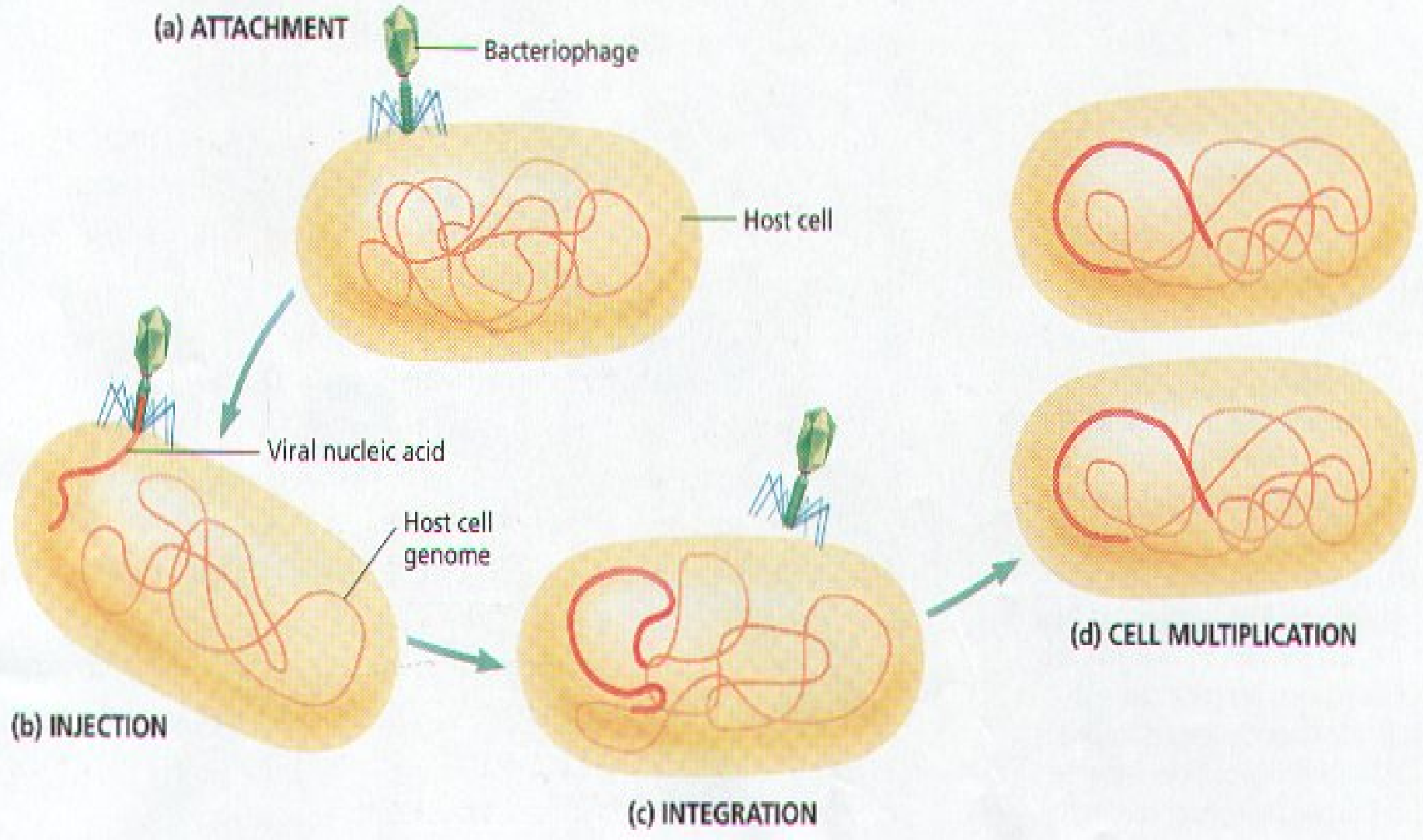


**VIRUS**

**DNA**  
**(inside virus)**

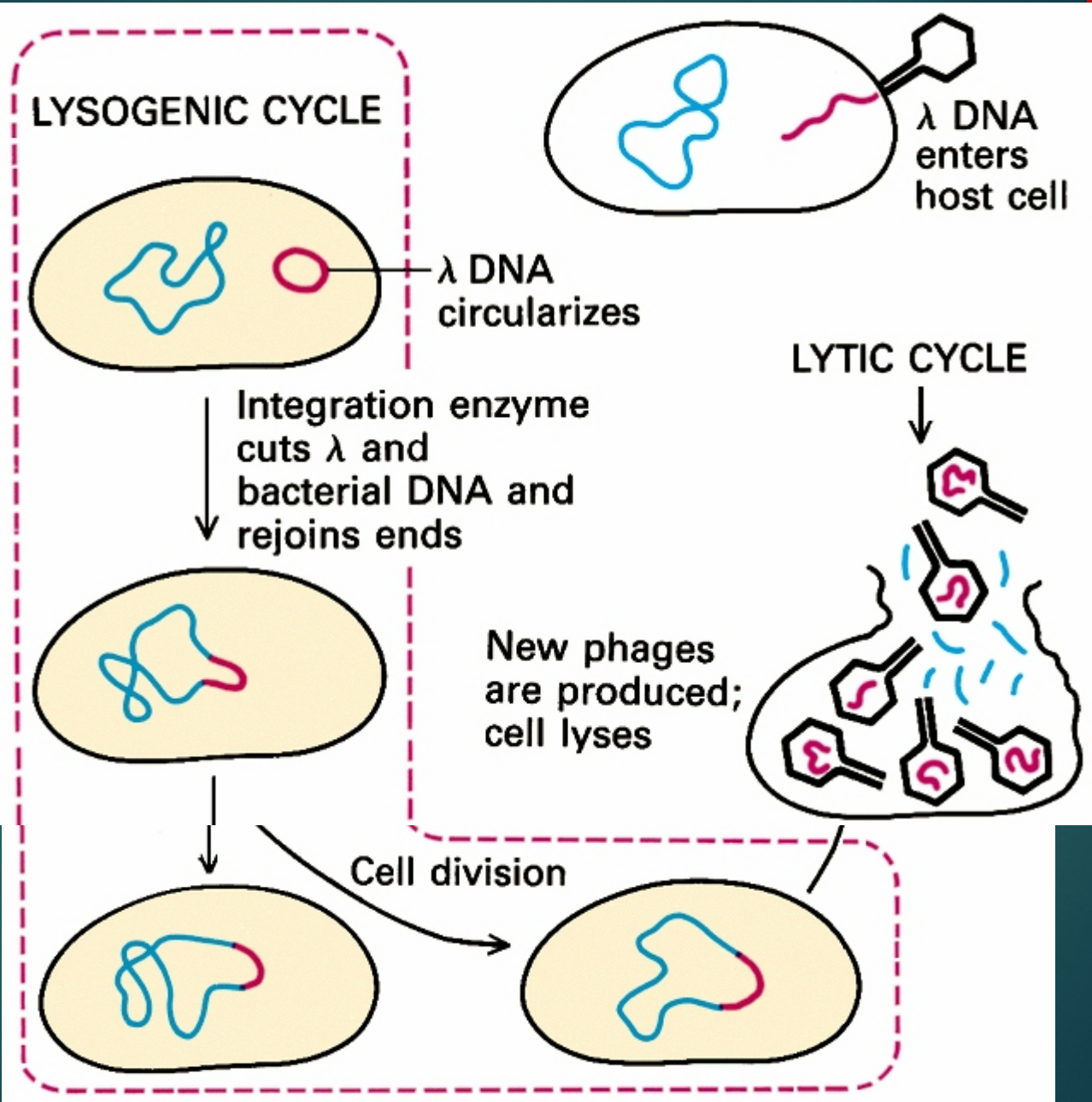


# The Lytic Cycle

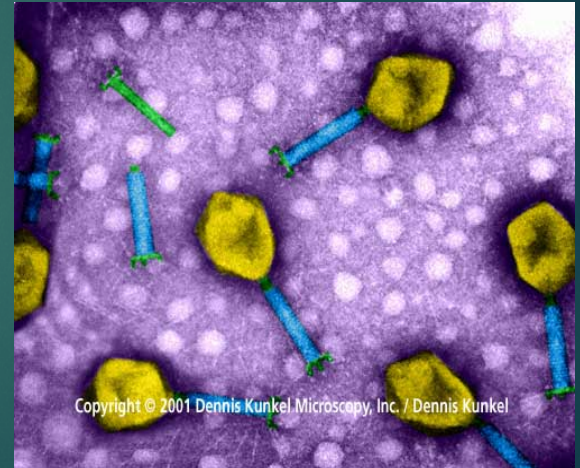
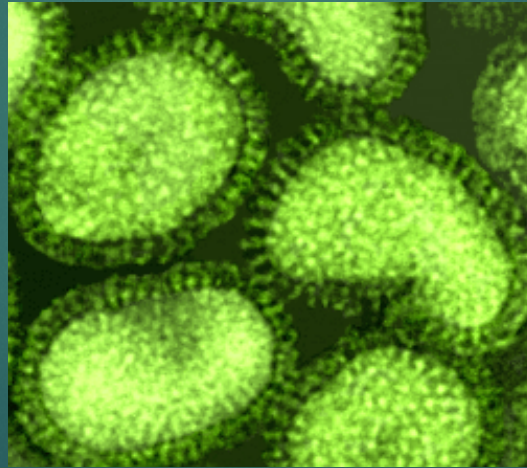
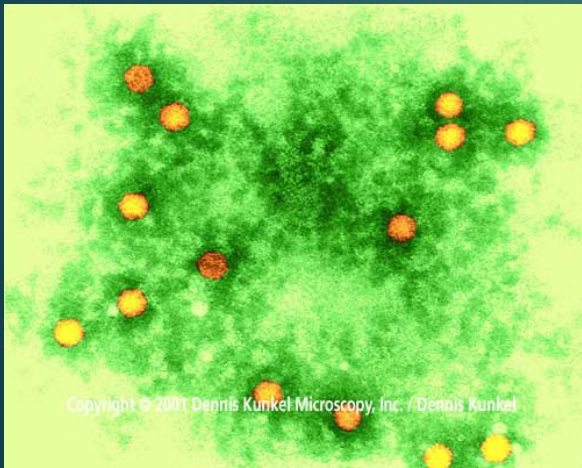
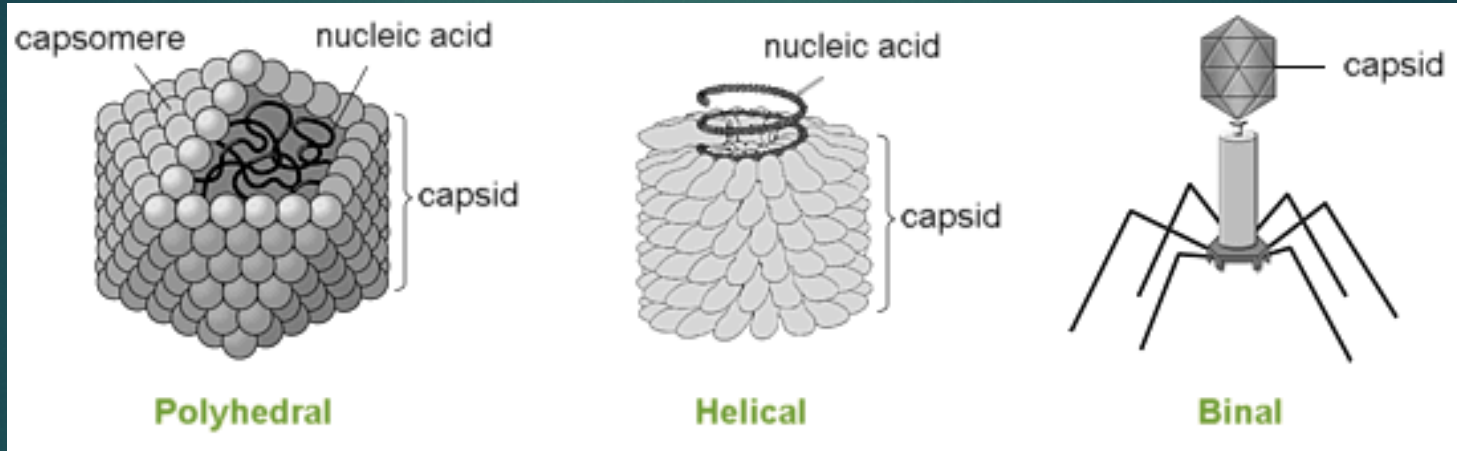


# The Lysogenic Cycle

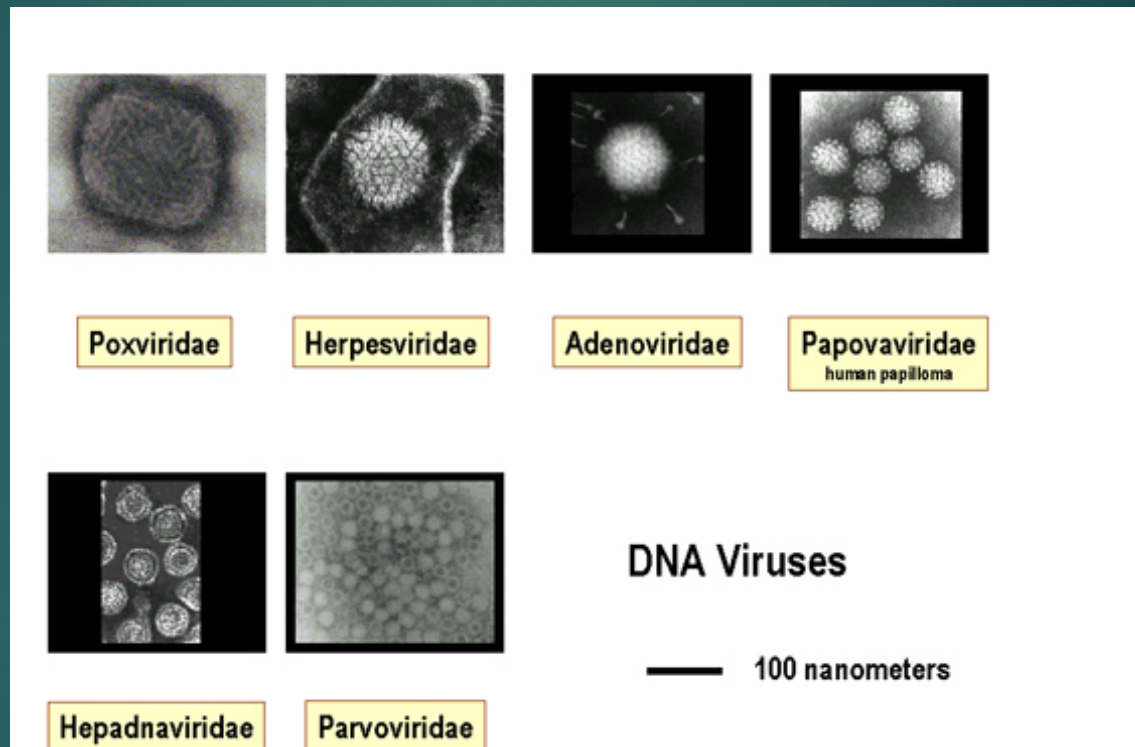




# Viral Structures

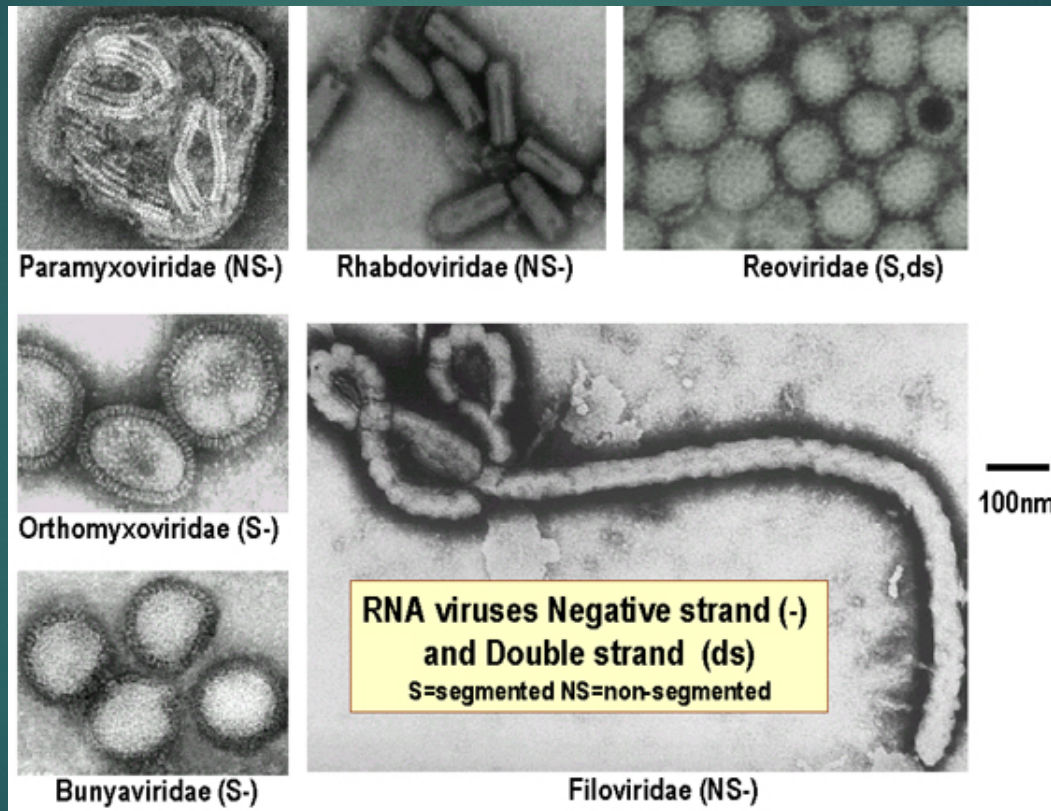


# Viral Examples



A provirus is a DNA virus that has been inserted into a host cell chromosome

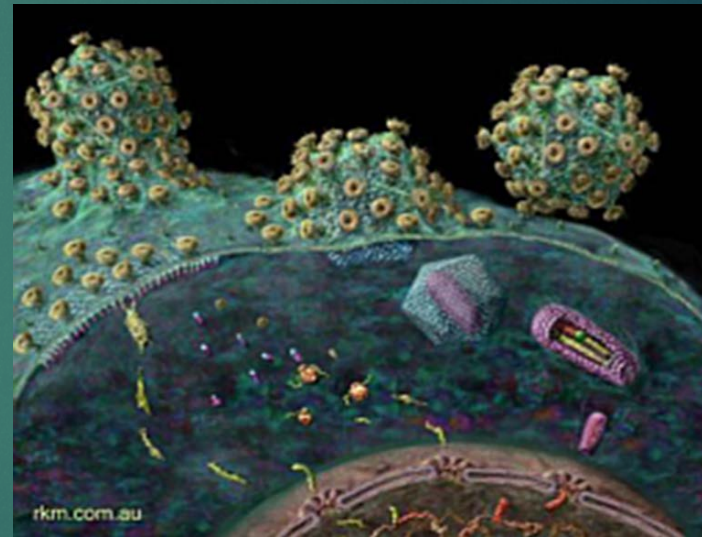
# Viral Examples



A retrovirus injects the enzyme reverse transcriptase into the cell to copy viral RNA into DNA

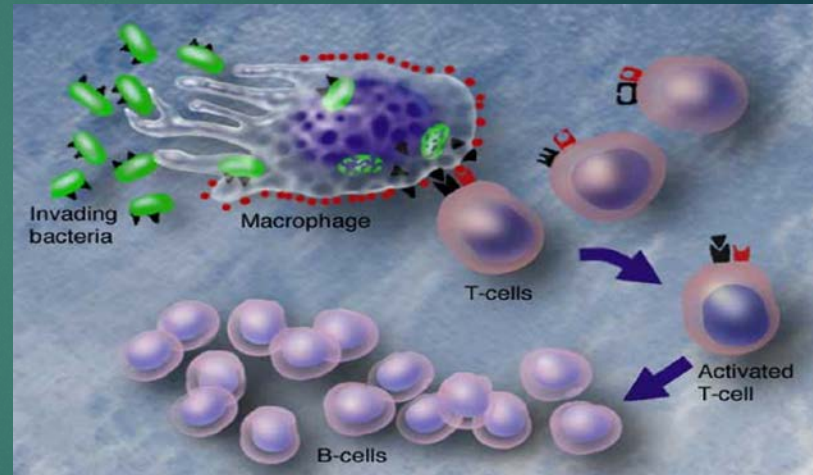
# Host Specificity – Lock and Key

- ▶ Viruses are host specific
  - ▶ Surface proteins are used to signal host cells
  - ▶ Plasma membrane transport proteins are lock and key
- ▶ Surface antigens allow viruses to lock onto the host cell



# Lock and Key

- ▶ HIV doesn't target random cells
  - ▶ HIV has evolved to attack the cells that want to kill it
    - ▶ "Helper T" cells
      - ▶ Direct the immune response
    - ▶ HIV infects 10 billion cells per day
      - ▶ 1.8 billion can be replaced daily naturally



# HIV → AIDS

3/4/2019

- ▶ Eventually T-Cells are depleted
  - ▶ The immune system can't mount an immune response
  - ▶ When body is unable to fight off common infections → AIDS (acquired immune deficiency syndrome)
- ▶ HIV is not the direct cause of death
  - ▶ It is the inability to fight off something as minor as the common cold