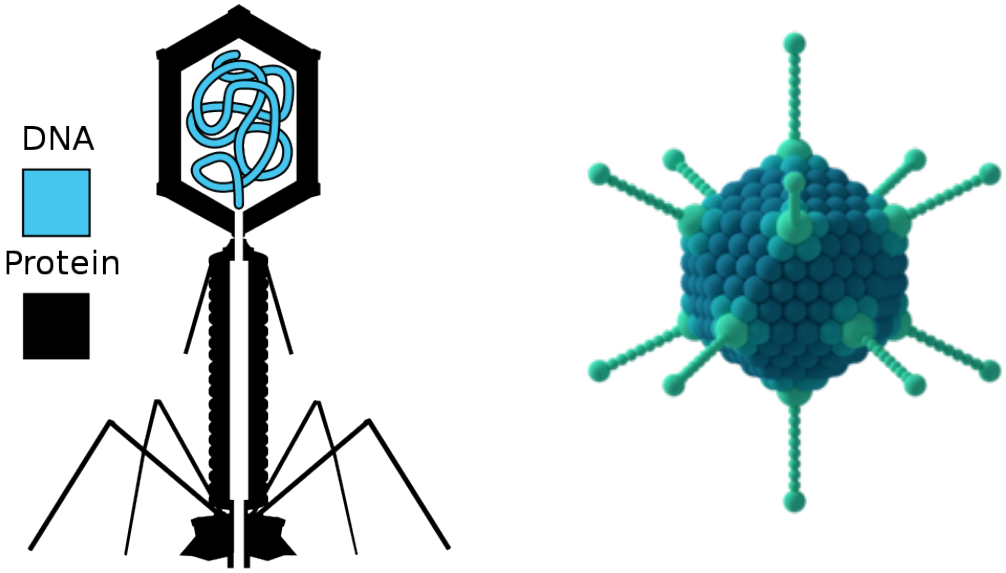
CONCEPT: VIRUS STRUCTURE

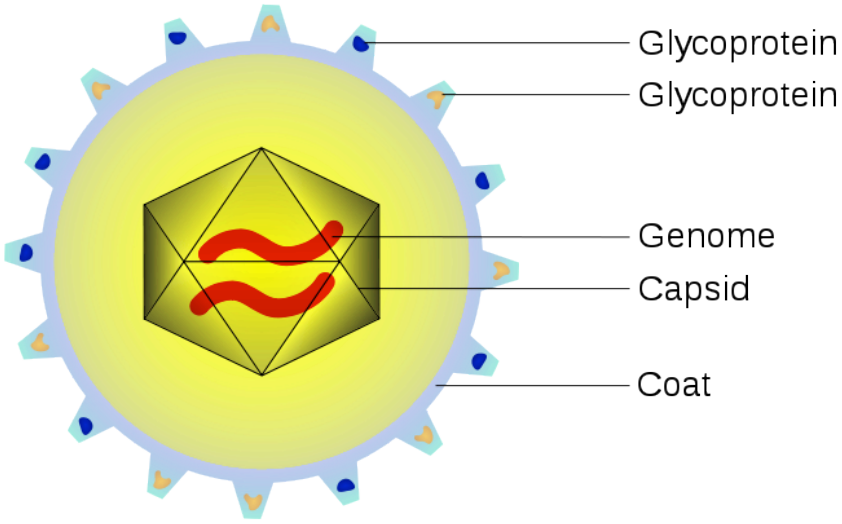
- Viruses are significantly smaller than cells, which act as their host, and are like vessels for genetic material
    - □ ***Capsid*** – the protein coat covering the viral genome that may take many different forms
        - ***Capsomere*** – a subunit of the capsid
- Viruses may contain double-stranded DNA, single-stranded DNA, double-stranded RNA, or single-stranded RNA.
- ***Bacteriophages*** – viruses that infect bacteria, and contain complex capsids

EXAMPLE:



- ***Viral envelope*** – accessory structure common in animal viruses, often derived from the membrane of host cells
- Host range – the collection of hosts that the virus can enter and infect
    - □ Viruses identify host cells with surface proteins that attach to specific receptors on the host

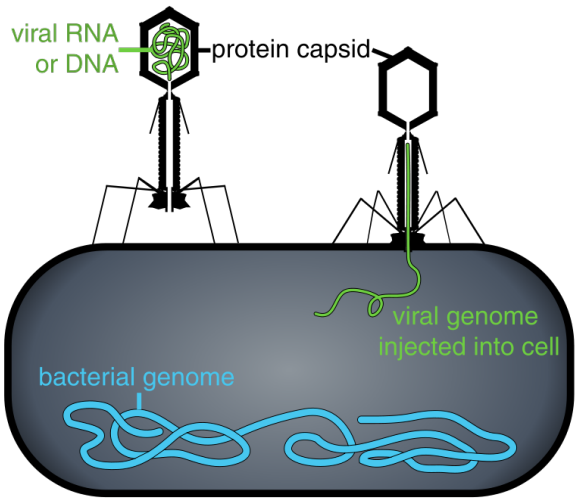
EXAMPLE:



CONCEPT: VIRUS REPLICATION

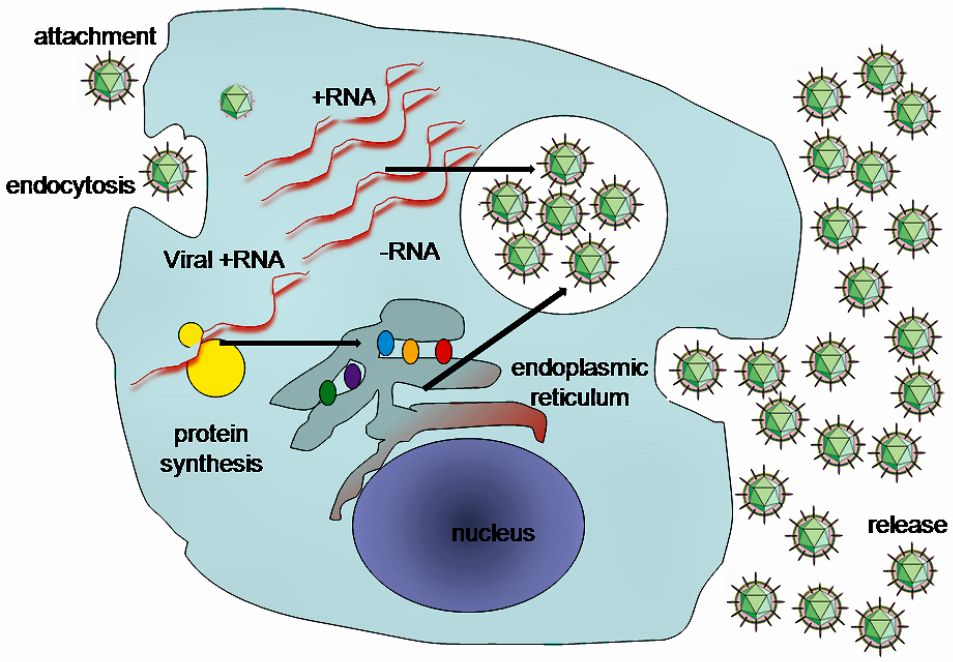
- Viral infection begins when the virus bind to the host cell, then the viral genome enters the cell
    - □ Some viruses, like bacteriophages, inject their genome into the host
    - □ Some viruses are absorbed into the host by endocytosis
    - □ Some viruses fuse their membranes with the host's membrane

EXAMPLE:



- Viral replication – the virus hijacks the replicative machinery of the host to produce products from it's own genes
    - □ The host unwittingly provides nucleotides, enzymes, ribosomes, tRNA, animo acids, and ATP to the virus
    - □ Nucleic acids, and capsomeres are produced, and spontaneously assemble into new viruses

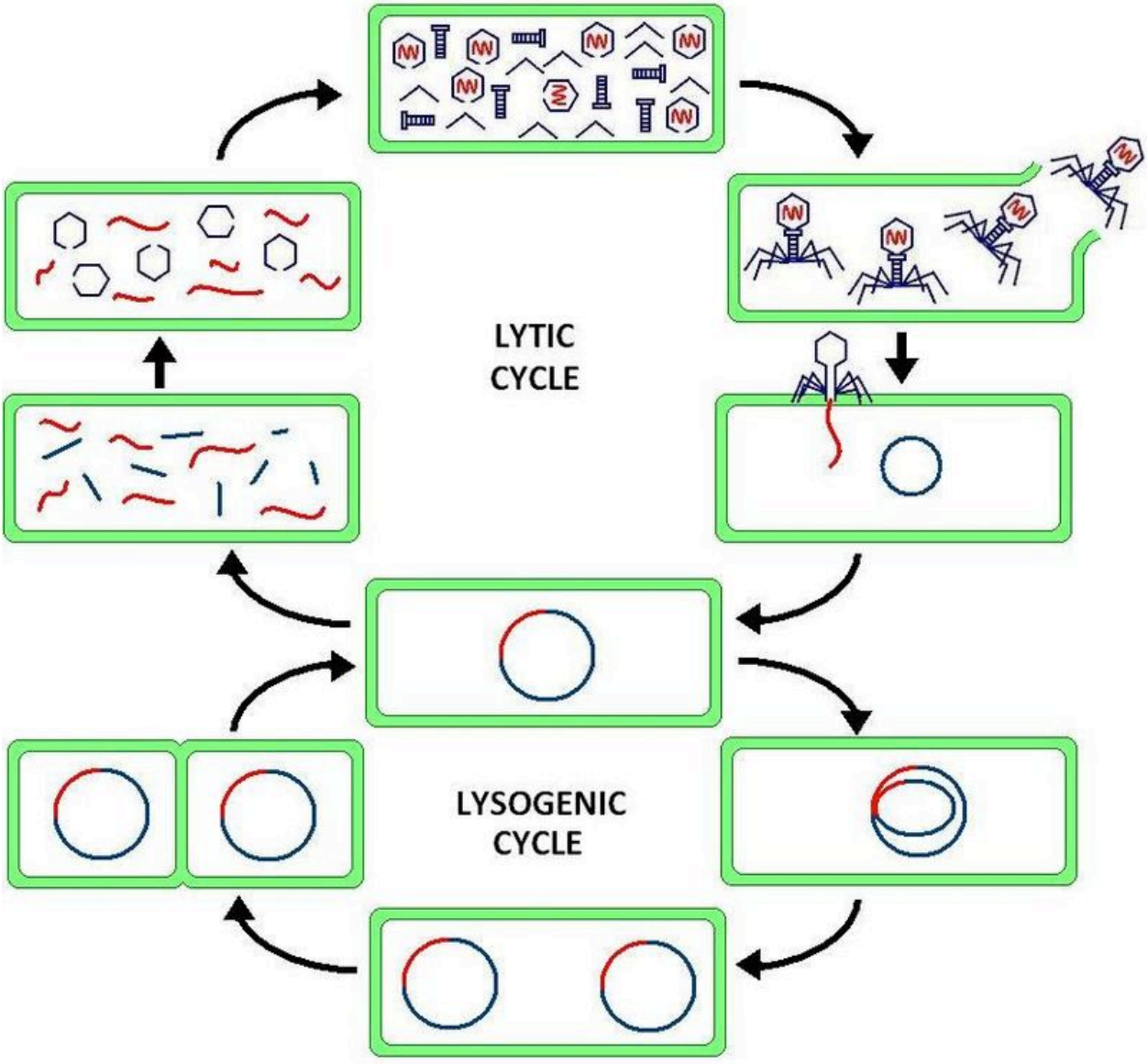
EXAMPLE:



CONCEPT: LYTIC AND LYSOGENIC CYCLES

- ***Lytic cycle*** – phage replication that culminates in the death of the host
  - □ The phage inserts it's DNA, the host DNA is degraded, then viral components are synthesized
  - □ ***Virulent phage*** – a phage that replicates only by the lytic cycle
  - □ Many bacteria have defensive restriction enzymes that degrade viral DNA
- ***Lysogenic cycle*** – replicates the viral genome without killing the host
  - □ The phage inserts it's DNA into the host, and it is integrated into the bacterial chromosome
  - □ ***Temperate phage*** – a phage capable of replicating through both the lytic and lysogenic cycles
  - □ ***Prophage*** – viral DNA integrated into the bacterial chromosome

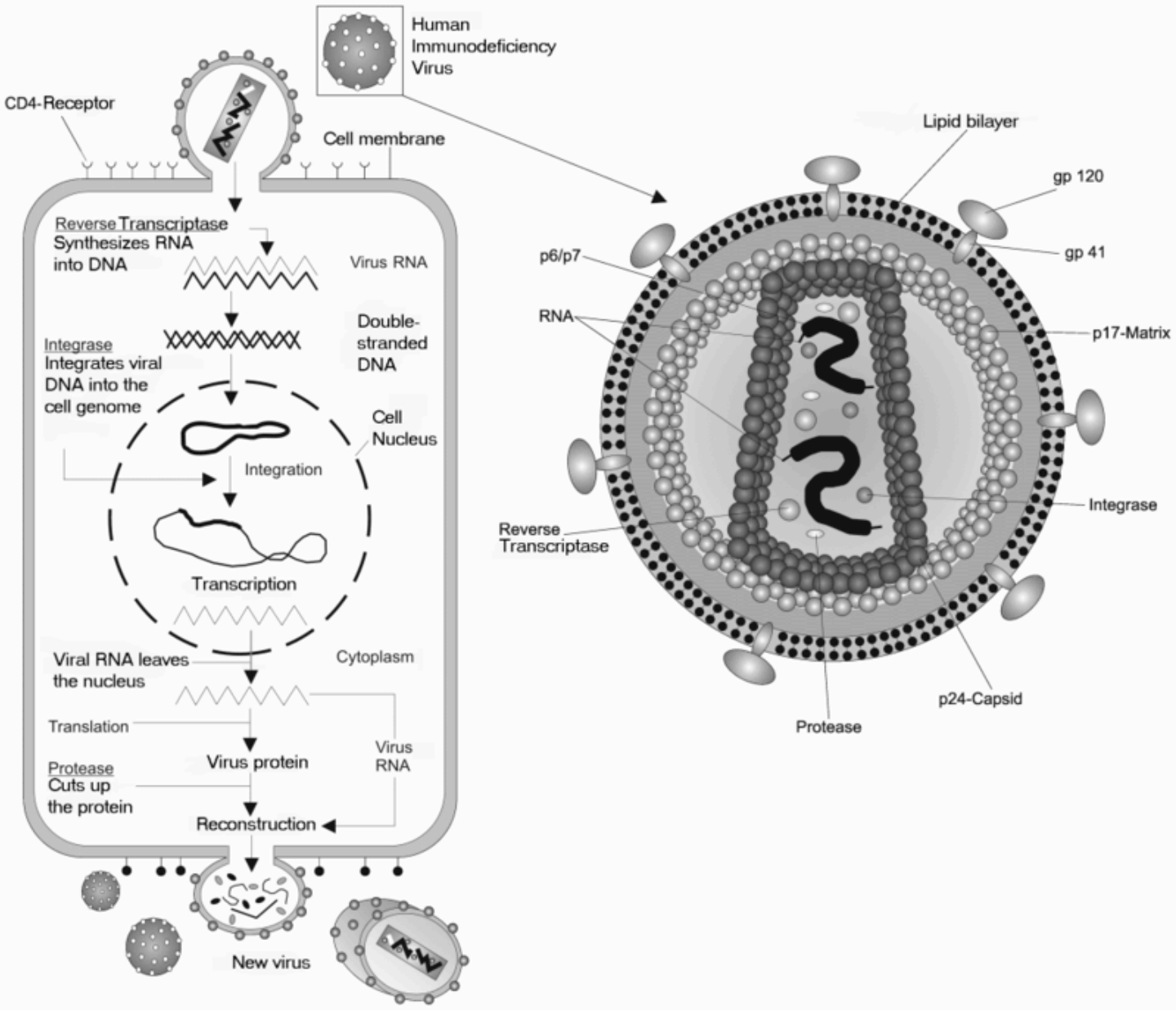
EXAMPLE:



CONCEPT: ANIMAL VIRUS REPLICATION

- Animal viruses tend to have viral envelopes and RNA genomes
- Animal virus replication involves the entry into the cell via cell surface protein-receptor recognition
    - □ Viral RNA serves as template for synthesis, and replication by viral RNA polymerase
- ***Retrovirus*** – virus with RNA genome that reverse transcribes its genes into the hosts DNA chromosome
    - □ ***Reverse transcriptase*** – the enzyme which catalyzes the RNA → DNA transcription
    - □ ***Provirus*** – the viral DNA integrated into the hosts genome

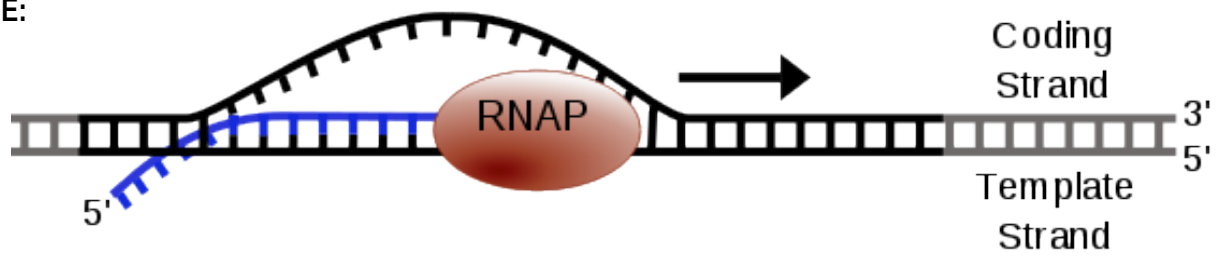
EXAMPLE:



CONCEPT: VIRUS

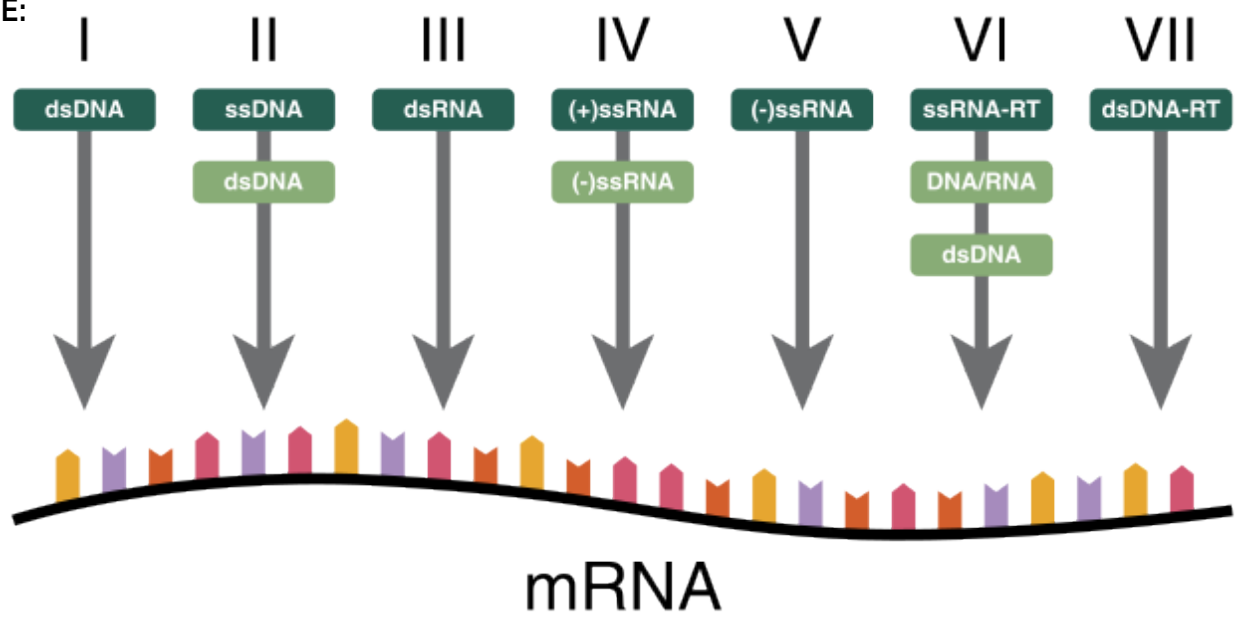
- Double stranded DNA virus – enter nucleus to be replicated, often replicate genomes during S phase of the cell cycle
    - □ Infect wide array of organisms, except land plants, include bacteriophage and human viruses like smallpox
- Double stranded RNA virus – enters cytosol and serves as template for synthesis, viral enzyme replicates genome
    - □ Infect a wide variety of organisms, including fungi, plants, vertebrates, bacteria, and insects

EXAMPLE:



- Positive sense RNA virus – genome contains the same sequences need to produce the viral proteins
    - □ Genome enters cell and is immediately transcribe into proteins
- Negative sense RNA virus – genome contains the complementary sequences to those coding for the viral proteins
    - □ Viral RNA polymerase must accompany genome to transcribe RNA
- Retrovirus (+ssRNA) – viral reverse transcriptase enters cell with the genome, transcribes the dsDNA version of genome

EXAMPLE:



CONCEPT: OTHER INFECTIOUS AGENTS

- ***Viroids*** – the smallest known pathogens consisting of short, circular, single-stranded RNA
    - □ Viroids are mostly plant pathogens and tend to disrupt growth
    - □ Viroids do not encode proteins, but replicate in the host using host enzymes

EXAMPLE:

- ***Prions*** – infectious self-propagating proteins that cause brain diseases in animals
    - □ Prions can fold in multiple ways, some of which a transmittable to other proteins

EXAMPLE: