

Chapter 15 - Viruses: Morphology, Classification, Replication

Ways Viruses Differ from Bacteria, Fungi, and Protozoans

1. **Obligate intracellular parasites** - only live inside of other things
2. **Single type of Nucleic Acid** - Can only be one of the below four combinations:
 - ssDNA
 - dsDNA
 - ssRNA
 - dsRNA

May be either
Linear or Circular
3. **Protein Coat** - around nucleic acid
4. **May have Envelope** - made of lipids, proteins, carbohydrates which make it sensitive to disinfectants
5. **Use Host Cell** - machinery to multiply
6. **Synthesis of Specialized Structures** - to program host
7. **Host Specific** - certain viruses can only bind to certain receptors only found in certain species

Host-Specific Viruses

1. Animals - cell membrane, special receptor proteins
2. Plants
3. Bacteria - plasma membrane, flagella, pili
4. Insects

Virus Characteristics

1. Involvement of receptor site in attachment to host
2. Size - 20 - 30 nm
 - Largest = pox
 - Smallest = parvo
3. Virion - intact infectious particle composed of nucleic acid + protein coat

Classification of Viruses

1. **Nucleic Acid** - linear, circular, segmented (ssDNA, dsDNA, ssRNA, dsRNA)
2. **Capsid** - protein coat (nucleocapsid = nucleic acid + capsid)
 - Capsomeres = subunits of capsids (classified by their arrangement)
 - a. Helical
 - b. Polyhedral (icosahedral)
3. **Envelope** - lipid covering or non-enveloped which is called naked
4. **Morphological Types**
 - a. Enveloped Helical = TBV
 - b. Enveloped Polyhedral
 - c. Naked Helical
 - d. Naked Polyhedral = herpes
 - e. Complex = extra structures off of the proteins

Replication

Lytic Cycle

Bacteriophage (viruses that infect bacteria) T-even phage

1. Adsorption - attachment to receptor site
2. Penetration - DNA injection
3. Biosynthesis - of viral components (DNA & Protein parts) production of early & late mRNA proteins
4. Maturation - assembly of parts
5. Release - Lysis

Lysogenic Cycle

Prophage

1. Integration - into bacterial chromosome
2. Temperate Phage - goes through integration to become prophage

Animal Virus Cycle

1. Attachment - binding to specific complimentary receptor (protein or glycoprotein) site
 - receptor dependent
 - pH dependent
 - temperature independent
 - antiviral therapy = targets by blocking site
2. Penetration (entry) temperature dependent
 - Nonenvelope viruses = Endocytosis - infolding of virus (engulfment)
 - Envelope viruses = Fusion of envelope of virus to the cell membrane of host
3. Uncoating - release of nucleic acids by host enzymes (digestion of protein coat reveals the genetic material)
4. Biosynthesis - differs in process & location in RNA/DNA viruses
 - Most DNA replicate in the nucleus and use the host enzymes for replication (Ex. Herpes Simplex I)
 - Most RNA replicate in the cytoplasm and use their own enzymes for replication (Ex. Influenza)
 - dsRNA
 - ssRNA
 - (+) strand RNA (sense RNA) = acts like mRNA \therefore can immediately produce proteins
 - (-) strand RNA (antisense RNA) = viral RNA dependent RNA polymerase must make mRNA first
 - Retroviruses = RNA converted to DNA
5. Maturation & Release
 - Nonenvelope viruses = Lysis for release
 - Envelope viruses = Budding for release