

Viruses (Chapter 13)

Contains a single type of nucleic acid: RNA or DNA

Contains a protein coat that surrounds the nucleic acid

Capsid: most of mass of cell; composed of protein subunits (capsomers)

Coat may be enclosed in envelope (lipids, proteins, carbohydrates)

When extruded, part of host's plasma membrane becomes envelope

Envelope may be covered with spikes (used to attach, to HIV virus, clump RBCs)

Obligate intracellular parasites: (Are these the only ones?)

Inert outside living tissue

In host: nucleic acids active and multiply

Have no or very few enzymes: must use host metabolic ability

Medical significance of characteristics: Most agents that would interfere with viral multiplication would also harm the host cells → Very toxic

Host: Most viruses are able to infect specific types of cells in only one host species

Bacterial viruses: Bacteriophage or phage

To infect, must interact with chemical receptor sites on host
(on cell wall, fimbriae, flagella)

Phage therapy: use bacteriophage to kill bacteria; oncolytic viruses for cancer
Disadvantage?

History: 1886 Adolf Meyer (TMV=tobacco mosaic virus)

1892 Iwanowski

Life cycles of bacteriophages:

Lytic cycle: results in lysis of cell

Attachment

Penetration (phage lysozyme)

Biosynthesis (eclipse period)

Maturation

Release

Burst time: time from phage attachment to release (about 20-40 min)

Burst size: number of new phages released from single cell (50-200)

Lysogenic cycle: (lysogenic or temperate phage) may result in lysis of cell or the virus may integrate into host chromosome and become permanent part of cell

Phage remains inactive within lysogenic host cells

Lysogenic cells immune to reinfection by same virus

Phage conversion: host cell may have new characteristics due to phage

Morphology:

Helical (Rabies and Ebola; Influenzae is helical with envelope)

Polyhedral (Polio)

Complex (Bacteriophage, Pox)

Cultivation:

Must be cultured in living cells

Bacteriophage: Plaque assay (pour agar with bacteria and phage on top of agar plate; "plaque" develops where virus infected bacteria cell. Each plaque is counted as one Virus)

Animal viruses:

Cultured in living animal:

Use of animal (some human viruses have no animal host: AIDS)

Embryonated Eggs: still used to grow for some vaccines

Cell Cultures:

Cytopathic effect (CPE): count like plaques

Primary cell line/Continuous cell line (Immortal cell line)

Multiplication of Animal Viruses:

1. Attachment: attach to receptor sites on plasma membrane (these receptors are inherited Characteristic of host and vary with individuals---significance?)

2. Penetration: endocytosis ([plasma membrane folds inwards to form vesicles and virus ingested into cell)

3. Uncoating

4. Biosynthesis

RNA viruses differ in how mRNA produced

+ single stranded RNA can serve as mRNA to code for proteins

= single stranded RNA does not code for proteins

5. Maturation: assemble protein capsid

6. Release

Enveloped: pushes through host plasma membrane and portion (envelope adheres to capsid; extruded from cell (host cell may survive)

Non-enveloped: released through rupture of plasma membrane which usually results in host cell death

Specific viruses on handout in class