

Biology 331
Introduction to Virology, Class I Viruses
Mostly Chapters 9, 16

Virology
Obligate Intracellular Parasites, Non-Cellular

Early History

- 1889 - Beijerinck, Tobacco Mosaic Virus, "filterable"
- 1911 - Rous, first cancer virus (Rous Sarcoma)
- 1915 - Twort, first bacteriophage

Electron microscopy and X-ray crystallography (mid-1900's) required to actually see viruses.

All Viruses Contain Genetic Material

- DNA, RNA, or both - single or double stranded
- Form determines replication strategy
- Some are linear, circular, or segmented

Single stranded can be coding (+) or non-coding (-); (+) means ribosome recognizes and translates it.

Baltimore Classification System - Table 9.2

- Class I - ds DNA genomes
- Class II - ss DNA genome (not covered)
- Class III - ds RNA genome (not covered)
- Class IV - ss (+) RNA genome
- Class V - ss (-) RNA genome
- Class VI - ss (+) RNA with DNA intermediate
- Class VII - ds DNA with RNA intermediate

Baltimore was given this recognition for discovering Class VI retroviruses in 1969.

All Viruses Contain Protein Capsids

- Capsid shells hold genetic material
- Confer specific shapes - helical, icosahedron
- Nucleocapsid directly wraps nucleic acid

Some viruses a mix of both icosahedral capsid and helical nucleocapsid - e.g. HIV

Some Viruses Contain Envelopes

- Host-derived membrane, studded with viral proteins
- Make less hardy outside host - TRANSMISSION

Some viruses also have other accessories - tails, enzymes... BUT - NONE has ribosomes.

Virus Replication - Common Features

- Attachment - surface protein + specific host receptor
- Penetration - receptor-mediated entry of capsid
- Synthesis - new proteins and genetic material
- Assembly - packaging of viruses
- Release - exit of mature viruses from cell

Which cells a virus can infect = host range; some viruses establish long-term latency... chronic/cancer

Class I Viruses

Virulent T4 Phage

- Replication always lyses host (E. coli, Proteobacteria)
- Unenveloped icosahedron + tail attaches to LPS
- Induces contraction - DNA injected

- Transcription and translation by host machinery
- Genome replication by viral DNA Pol

Temperate Lambda Phage

- Temperate - choose lysis or lysogeny of E. coli
- Lysogeny - replication without lysis
- Structure, attachment, penetration like T4
- Early genes: ASSESS HOST HEALTH...
- If BAD: late gene expressed, inducing lysis
- If GOOD: DNA integrates, passively copied by host

Transduction (10.8)

- Transfer of bacterial DNA between hosts via phage
- Generalized: accidental packaging during lysis
- Specialized: recombinant viruses following lysogeny

Papillomavirus

- Small enveloped icosahedron, 65+ strains
- DNA + stolen histones, less than 10 genes
- Transcription, translation AND replication by host

For this course, Polyomavirus = Papillomavirus

Transformation

- Permissive/dividing cells copy virus - transient warts
- Nonpermissive don't - so cervical cancer via...
- Integration and T-Ag which induce division
- CIS = DNA effect, integration position induces
- TRANS = protein effect, distant from integration

Cervical cancer associated with 2-4 strains, effective vaccine nearly approved.

Variola/Smallpox

- TWO envelopes, nucleocapsid/genome (200 genes)
- DNA and RNA Pol enzymes in virus - MANY others
- Virus DNA Pol replicates and RNA Pol transcribes
- Host ribosomes translate - ALL occurs in cytoplasm
- Exit via Golgi AND cell membrane - so?

Why is this virus not associated with cancer?