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Infectious Diseases: Viruses and Antivirals

- This lecture is oriented around the HIV protease

Anatomy of Viruses

- **Envelope** = outermost plasma membrane which protects virus
  - Has glycoproteins that cover the membrane
- **Protein capsid** = protein region inside envelope
  - Is typically digested once envelope is fused with the host cell
- **Viral nucleic acid** = some kind of genetic material
  - *e.g.* ssDNA, ssRNA, dsDNA, etc

Baltimore Classification

- **Baltimore classification** = a system of categorizing different viruses based on the way their viral nucleic acid is modified and expressed through infection
- Split into 6 "classes"

Retroviruses

- Classified as Group 6 under the baltimore classification system
- Contains **reverse transcriptase** which can create genomic DNA from RNA
- This created DNA can then be injected into the genome through an enzyme

Why Are Retroviruses So Dangerous?

- They can actually effect the genome of cells
- Reverse transcriptase is doesn't have strong proof-reading activity, so it mutates much faster than bacteria or other viruses

HIV

- **HIV** = the virus that is responsible for **AIDS**
  - **AIDS** = Acquired Immune Deficiency Syndrome
- Process
  1. Surface glycoproteins on envelope connect to CD4 receptors on T-Helper cells

2. Once connected, the plasma membrane of the T Cell and the envelope of the virus fuse and eject the protein capsid and viral RNA into the cell
3. The capsid is digested, leaving viral RNA
4. Reverse transcriptase creates dsDNA from ssRNA
5. DNA is fused into genome with **integrase**
6. Viral proteins for capsid and glycoproteins are created in cytoplasm and ER, respectively
7. The newly genorated parts assemble and the capsid and viral RNA are pinched off by plasma membrane to form a new virus
8. Once immature viruon is formed, a protease does some final protein modification to generate the final capsid structure

Vaccines

- Four classes of vaccines
    1. **Heterologous virus** = using similar but distinct antigens so that immune can be built up through a less dangerous antigen
    2. **Killed/inactivated virus** = using antigens that have been modified so they are no longer active to allow specific immune response to develop
    3. **Live attenuated vaccine** = using very small amounts of fully functioning antigen so that a response can develop
    4. **Recombinant vaccine** = using antigens or parts of antigens that come from genetically modified antigens