



Virus

🕒 Created	@August 7, 2025 12:42 PM
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Explain why viral RNA enter host cell nucleus

- For transcription where viral genome RNA is used as a template to synthesise the mRNA strands catalysed by viral RNA dependent RNA polymerase
 - Which can be transported into cytosol as a template for translation of viral proteins which in turn acts as a template for replication of new viral RNA genome using host cells ribonucleotides and ATP which is abundant in nucleus
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How does new strains of virus arise

- Accumulation of mutation of the genome due to change in the ribonucleotide sequence known as antigenic drift caused by lack of proof reading ability of RNA-dependent RNA polymerase and high rate of replication of the virus giving rise to changes in the conformation of glycoproteins
 - Formed when two or more strains infect the same host cell causing reassortment of different RNA segments to occur resulting in recombination of genetic material in a virion, giving rise to antigenic shift
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Why is HIV a retrovirus

- A retrovirus is a RNA virus that duplicate via reverse transcription in the host cell
 - Using the RNA genome as a template, reverse transcriptase from the virus produce DNA from its RNA genome by complementary base pairing
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Why are viruses describe as obligate parasites

- An obligate parasite is an organism that cannot live independently of its host
 - They require the host cell to complete their life cycle and reproduce
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Advantages of the lysogenic cycle

- Prophage can be replicated each time host cell/bacteria divides, allowing large number of viral particles to be assembled upon prophage induction
 - Phage genome integrates itself into host cell/bacteria chromosome and becomes dormant as a prophage, allows prophage to survive for long periods when conditions for viral replication are unfavourable such as lack of nutrients
 - When conditions change, prophage can be switched back to the lyric cycle and start reproducing again
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How does influenza enter a virus

- Haemagglutinin binds to sialic acid receptors on host cell membrane that are complementary in shape
- Virus is taken into host cell via **receptor-mediated endocytosis**
- **Host cell membrane rearranges its cytoskeleton and extends inwards and invaginates** and **entire virus is enclosed** within an endosome
- This endosome will fuse with lysosome to form a phagolysosome,
- The resulting drop in pH causes **Viral envelope to fuse with the membrane** of the endosome To result in the **release of nucleocapsid into the cytoplasm** of the host cell and eventually viral RNA into cytosol

How does influenza exit host cell

- Capsid proteins associate with ribonucleoprotein (viral proteins that associated with the Viral RNA) near host plasma membrane
- Each new virus buds from host cell, Acquiring viral envelope from host plasma membrane which has neuraminidase and haemagglutinin embedded

- Neuraminidase cleaves sialic acid to release progeny virions from host cell surface

Describe how different strains of virus arose

Antigenic shift:

- **different strains of viruses** (give examples for question) **infected the same host** at the **same time**.
- **Results in Reassortment/recombination of (type of genome) of virus in one capsid** within host **cell** that results in a new strain with different antigens and glycoproteins then the original strains
- Give examples of the different strains if given in the question

Antigen drift:

- Gradual accumulations in mutations for the gene coding for glycoproteins and antigens due to lack of proofreading mechanism of RNA dependent RNA polymerase/reverse transcriptase
- Results in a change of 3D conformation that is more complementary or higher affinity for receptors on host cells

Explain how inhibition of HIV protease may limit the ability of HIV to reproduce

- If HIV protease activity is inhibited, viral poly proteins cannot be cleaved
- Proteins such as reverse transcriptase, integrase, protease and capsid proteins cannot be synthesised
- Fully functional virions cannot be produced and ability for HIV to reproduce will be limited

Explain advantage of a virus being able to rapidly accumulate gene mutations

- Rapid mutations results in antigens to have different conformation

- Unable to be recognised by memory T and B cells of the immune system immune cells
 - Takes longer time to remove virus from the body allowing them more time to replicate
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How does HIV enter a host cell

- The viral glycoprotein, gp120 recognises and binds to the CD4 receptor on host cell membrane that is complementary in shape and charge to the viral glycoprotein
 - Gp41 binds to co receptor and facilitates fusion of viral envelope with plasma membrane of the host cell to release capsid into the cell leaving the envelope behind
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How does a lambda phage enter cell

- Tail fibres of lambda phage attaches to specific receptors with complementary shape on bacterial host cell wall, it will release lysozyme, enzyme which digests bacterial cell wall resulting in release of molecules that changes base plate conformation
 - Causes tail sheath to contract and thrust hollow tube through bacterial cell wall
 - Viral DNA genomes will then be injected into bacterial host cell via hollow tube and original linear phage DNA will form a circle to form a Prophage
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Life cycle of T4 phage

- Inside cell, T4 phage DNA immediately transcribed to synthesise messenger RNA using host RNA polymerase
 - Phage enzymes coded by the phage genome takes over the bacterium's macromolecular synthesising machinery for its own use
 - The phage uses host cells nucleotide and DNA polymerase to synthesise many copies of phage DNA
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Describe result of lysogenic and lytic cycle

- Lytic
 - Enzyme lysozyme which is released by phage to digest bacterial cells wall to trigger lysis of host cell
 - Newly formed viruses are released to infect other host bacterial cells
- Lysogenic
 - Lambda phage DNA is integrated into bacterial DNA forming a prophage
 - Every time host cell machinery replicates bacterial chromosomes, it also replicates prophage DNA along with it
 - Host bacteria is not killed and prophage will be found in all progeny bacteria cells where it remains latent