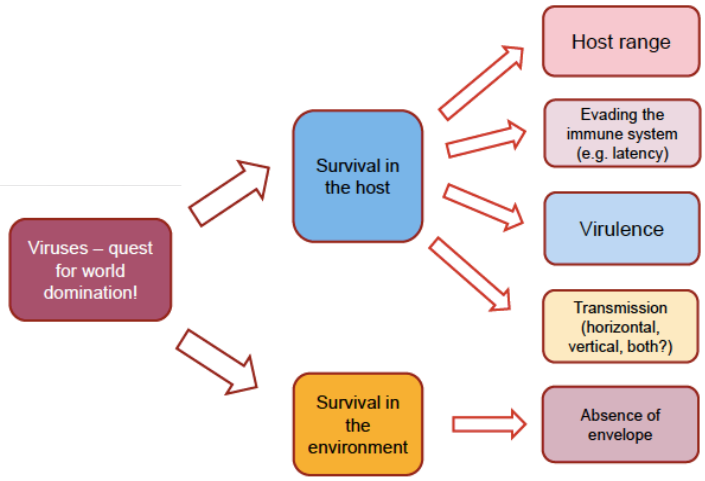
INTRODUCTORY VETERINARY PATHOGENESIS (IVP)

VIRAL STRUCTURE AND MORPHOLOGY:

	Viruses	Bacteria
Size	Small (<300nm diameter)	Large (>300nm diameter)
Cultivable on non-living media	No	Yes
Structure	Not cells, nucleic acid core with protein coat	Cells, usually surrounded by cell wall
Replication	Parasitic, must have a host cell to reproduce	Binary fission, most can survive and reproduce outside a host
DNA and RNA	No	Yes
Functional ribosomes	No	Yes
Metabolism	No	Yes
Antibiotics	No	Yes (most)

STRATEGIES FOR SURVIVAL:

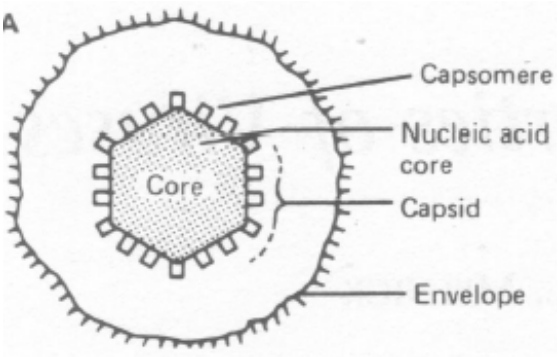


VIRUS: an obligate intracellular parasite that requires host cell metabolic processes to carry out replication and they only enter specific types of cell (tropism)

RETROVIRUS: ssRNA → enter host cell through reverse transcriptase → cDNA → integrase inserts cDNA into host genome → stays in cell

VIRION: Infectious viral particle

STRUCTURE OF VIRUS:



VIRAL GENOME VARIATION:

- Can be RNA or DNA
- Can be single stranded or double stranded
- Can be positive or negative sense (if single stranded)
- Can be segmented or non-segmented
- Can be linear or circular

DNA virus	RNA virus
Stable	Labile/transient (unstable)
Most replicate in nucleus	Most replicate in cytoplasm
Viral DNA replication resembles host DNA replication	Cells cannot copy RNA from RNA, RNA viruses must provide own RNA dependent RNA polymerase
Less prone to mutation	More prone to mutation

CAPSID:

- Protects genome and delivers it into cell (capsid proteins bind to cell receptors which triggers uncoating and ensures that the genome ends up in correct place within cell)
- Consists of capsomeres (made up of protomers)
- RNA/DNA + capsid = **nucleocapsid** = **virion** in non-enveloped viruses
- The nucleocapsid may contain nucleocapsid proteins with the viral genome (e.g. **FIV**)
- Shape can be icosahedral/cubical (**parvovirus**), helical (**influenza**) or complex symmetry (**poxviruses**)

LIPID ENVELOPE:

- Envelopes are derived from the **host** cell (cell membrane, nuclear membrane, golgi, endoplasmic reticulum, ribosomal membrane)
- Using host structures → less chance of evoking an immune response
- Enveloped viruses:
    - More **fragile** in environment
    - Harder to develop vaccines against as they require both **cell-mediated** and **humoral** immunity
    - Usually **easily inactivated** by disinfectants
    - Can be released from cells by cell **lysis** or viral **budding**
- Non-enveloped viruses:
    - More **resistant** to environmental desiccation and action of detergents
    - Released from host cell via cell **lysis**
    - **Humoral** immunity usually sufficient → easier to make a vaccine

CLASSIFICATION:

- Nucleic acid (DNA vs. RNA) and genome type
- Enveloped vs. non-enveloped
- Naming → family (e.g. viridae), sub-family (e.g. virinae), scientist name, location etc.

	DNA	RNA
Envelope	Poxvirus Herpesvirus	Coronavirus
No Envelope	Parvovirus Papillomavirus	Canine parvovirus Foot and mouth disease Calicivirus

VIRAL TROPISM:

- Viruses recognise host cell through specific interactions between viral proteins and specific receptors on a cell surface → a **susceptible cell**
- Not all susceptible cells can support viral replication → they must also be **permissive**
- For infection to occur, the virus must also be able to reach those susceptible and permissive cells → anatomical **barriers** are important

MUTATION:

- A structural alteration in the nucleic acid (genotype) that may or may not result in phenotypic changes
- Can have a negative, neutral or positive effect on the fitness of the virus
- Point mutations (single nucleotide substitutions)
- Insertions/deletions (less common)
- Mutations can have important effects on:
    - Host range of virus (e.g. **canine parvovirus** came from feline parvovirus → wider host range)
    - Virulence of virus
        - **Canine distemper** virus replication → lowers virulence and this can be used for vaccines
        - Point mutation in **FCoV** creates deadly virus **FIP**
- Viral recombination → exchange or transfer of genetic material between different but closely related viruses infecting the same cell

ANTIGENIC DRIFT VS. ANTIGENIC SHIFT:

- Antigenic drift = **gradual accumulation** of point mutations → responsible for yearly influenza epidemics (human to human strain)
- Antigenic shift (rare) = acquisition of a **new gene** from another virus due to recombination or reassortment → responsible for influenza pandemics every 10-50 years (pig = mixing bowl for avian and human viruses)
- **Influenza** → 2 receptors = hemagglutinin (H) and neuraminidase (N)

POXVIRUS = EXCEPTION:

- DNA virus that replicates in the **cytoplasm**
- Enveloped but lasts for long time and **vaccines** can be produced (e.g. smallpox)