

## Introduction to Medical Virology

What are viruses?

Virus = Nucleic acid + Protein coat

A virus is a microorganism consisting of genetic material (either DNA or RNA) enclosed within a protective protein coat known as a **capsid**.

The **virion** is the complete infectious unit of a virus. It includes the viral nucleic acid (genome) enclosed within the capsid. Virions are the structures able to attach to susceptible host cells to initiate the infection process.

The capsid is a protein shell that protects the viral nucleic acid. It plays an important role in the attachment to host cells and the release of the viral genome into the host cell during infection.

Viruses have the ability to infect a wide range of living cells, including those of humans, animals, plants, bacteria (phage/bacteriophage), and archaea. However, medical virology focuses on viruses that specifically infect humans and cause various infectious diseases (e.g., influenza, AIDS, hepatitis B, hepatitis C, common cold, viral gastroenteritis, aseptic meningitis, measles, mumps, rubella, poliomyelitis, Ebola fever, rabies, etc.)

### General features of viruses:

**A. Single type of nucleic acid:** Virions contain either DNA or RNA, but never both.

**B. Variability in size, host range, and structure:** Viruses exhibit high variability, including size (5 to 300 nanometers for most viruses), host specificity (human, animal, plant, bacteria), genome type (DNA or RNA), and structural diversity (shape, presence of envelope, spike proteins, etc.)

**C. Unknown origin:** The origin of viruses is still a subject of scientific debate and remains unknown.

**D. Uncertain living status:** Viruses exist as inactive particles outside host cells and exhibit characteristics of life only when inside host cells during viral replication. Thus, “presently viruses do not find a place on the universal tree of life”

Please read more on this subject (not for the exam): Brüssow H. The not so universal tree of life or the place of viruses in the living world. *Philos Trans R Soc Lond B Biol Sci*. 2009 Aug 12;364(1527):2263-74. doi: 10.1098/rstb.2009.0036. PMID: 19571246; PMCID: PMC2873004.

**Variability in virus genome:**

- A. DNA viruses: Some viruses have DNA genomes, which can be either single-stranded (one strand) or double-stranded (two strands).
- B. RNA viruses: Others possess RNA genomes, which can also be single-stranded or double-stranded.
- C. Positive-sense RNA: Single-stranded RNA viruses can be positive-sense, meaning their RNA can serve as a template for direct protein translation (acts like a messenger RNA).
- D. Negative-sense RNA: Some single-stranded RNA viruses are negative-sense, requiring conversion to positive-sense RNA before protein translation. This conversion occurs through the enzyme RNA-dependent RNA polymerase.
- E. Ambisense RNA: In certain cases, single-stranded RNA viruses have an ambisense genome, with both positive-sense and negative-sense regions within their RNA.

For further reading (not for the exam), please check: Kiening, M., Weber, F. & Frishman, D. Conserved RNA structures in the intergenic regions of ambisense viruses. *Sci Rep* 7, 16625 (2017). <https://doi.org/10.1038/s41598-017-16875-4>

**This is the only material required for the exam. No other source is needed**

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