Virology

Viruses are small obligate intracellular parasites, which by definition contain either a RNA or DNA genome surrounded by a protective, virus-coded protein coat .

*Viruses are the smallest infectious agents (ranging from about 20 nm to 300 nm in diameter) , being parasites at the genetic level.

* viruses depend on specialized host cells supplying the complex metabolic and biosynthetic machinery of eukaryotic or prokaryotic cells.

*The genome of a virus may consist of DNA or RNA, which may be single stranded (ss) or double stranded (ds), linear or circular.

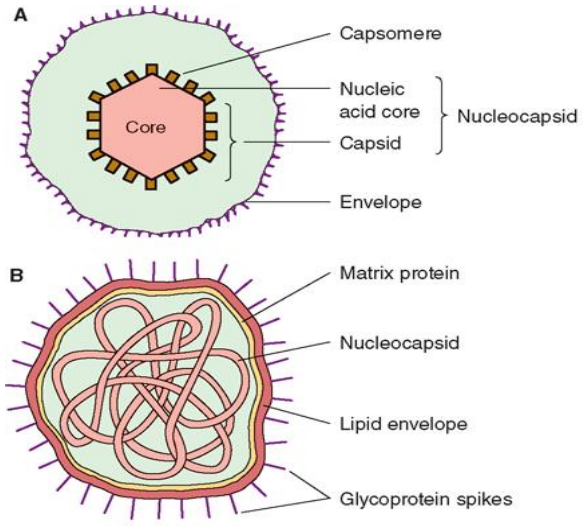
*The nucleic acid is encased in a protein shell, which may be surrounded by a lipid-containing membrane.

* The entire infectious unit is termed a *virion*.

Capsid: The protein shell, or coat, that encloses the nucleic acid genome.

Capsomeres: Morphologic units seen in the electron microscope on the surface of icosahedral virus particles. Capsomeres represent clusters of polypeptides, but the morphologic units do not necessarily correspond to the chemically defined structural units.

Nucleocapsid: The protein–nucleic acid complex representing the packaged form of the viral genome. The term is commonly used in cases in which the nucleocapsid is a substructure of a more .



viruse structure

Structure of Viruses

All viruses contain the following two components: 1) a **nucleic acid genome** and 2) a **protein capsid** that covers the genome. Together this is called the **nucleocapsid**. In addition, many animal viruses contain a 3) **lipid envelope**. The entire intact virus is called the **virion**. The structure and composition of these components can vary widely.

A: Viral Genomes: While the genomes of all known cells are comprised of double stranded DNA, the genomes of viruses can be comprised of single or double stranded DNA or RNA. They can vary greatly in size, The known structures of viral genomes are summarized below.

DNA: Double Stranded - linear or circular

Single Stranded - linear or circular

Other Structures - gapped circles

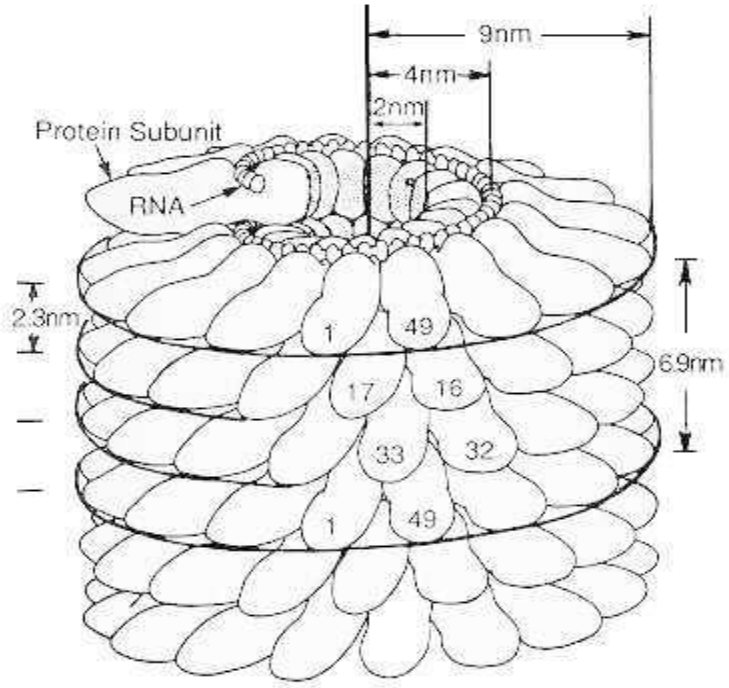
RNA: Double Stranded - linear

B:ProteinCapsid

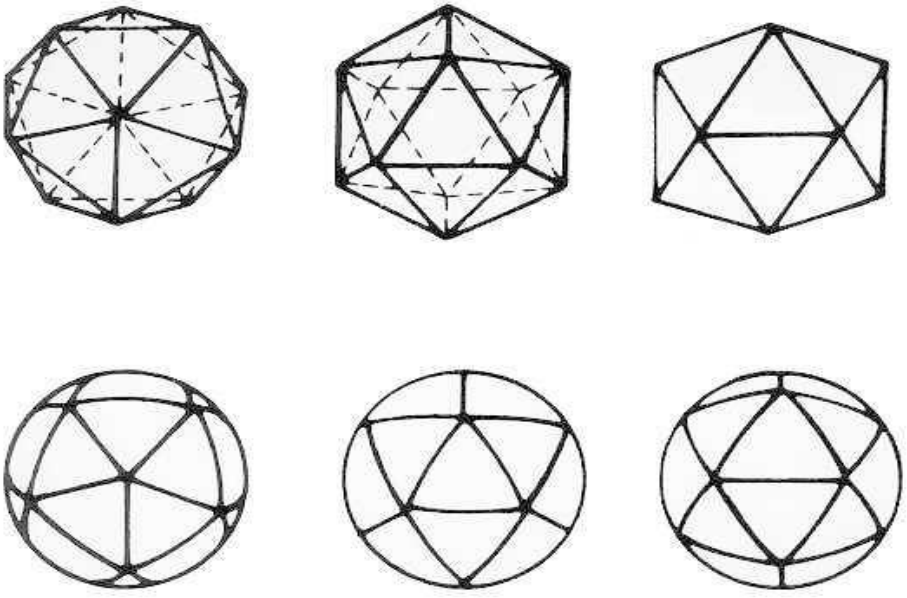
Viral genomes are surrounded by protein shells known as capsids. One interesting question is how capsid proteins recognize viral, but not cellular RNA or DNA. The answer is that there is often some type of "packaging" signal (sequence) on the viral genome that is recognized by the capsid proteins. A capsid is almost always made up of repeating structural subunits that are arranged in one of two symmetrical structures, a **helix** or an **icosahedron**. In the simplest case, these "subunits" consist of a single polypeptide. In many cases, however, these **structural subunits (also called protomers)** are made up of several polypeptides. Both helical and icosahedral structures are described in more detail below.

1) **Helical Capsids**: This structure is very stable, and can be dissociated and re-associated readily by changing ionic strength, pH, temperature, etc. The interactions that hold these molecules together are non-covalent, and involve H-bonds, salt bridges, hydrophobic interactions, and vander Waals forces.

EX: *Orthomyxoviridae* (influenza) , *Rhabdoviridae* (rabies)



2) **<u>Icosahedral Capsids</u>**: In these structures, the subunits are arranged in the form of a hollow, quasi spherical structure, with the genome within. An icosahedron is defined as being made up of **20 equilateral triangular faces** arranged around the surface of a sphere .



Classification and Nomenclature of Viruses :

On the basis of shared properties viruses are grouped at different levels(order, family, subfamily, genus and species). More than 30,000 different virus isolates are known today and grouped in more than 3,600 species, in 164 genera and 71 families. Viral morphology provides the basis for grouping viruses into families. A virus family may consist of members that replicate only in vertebrates, only in invertebrates, only in plants, or only in bacteria. Certain families contain viruses that replicate in more than one of these hosts.

Besides physical properties, several factors pertaining to the mode of replication play a role in classification: the configuration of the nucleic acid (ss or ds, linear or circular), whether the genome consists of one molecule of nucleic acid or is segmented, and whether the strand of ss RNA is sense or antisense. Also considered in classification is the site of viral capsid assembly and, in enveloped viruses, the site of nucleocapsid envelopment .

The use of Latinized names ending in -viridae for virus families and ending in -virus for viral genera has gained wide acceptance. The names of subfamilies end in -virinae. Vernacular names continue to be used to describe the viruses within a genus. In this text, Latinized endings for families and subfamilies usually are not used.

TABL ent Classification of Major Groups of Viruses of Medical Significance

Family	Genera (or Subfamilies)	Vernacular Name of Type Species or Typical Member	Viruses Shown to Produce Infection in Humans
DNA Viruses			
Parvoviridae	*Erythrovirus*	B19 virus	B19 virus associated with erythema infectiosum and aplastic crisis of sickle cell anemia
	Dependovirus	Adeno-associated virus (AAV) 2	Defective viruses (infect humans in presence of a helper adenovirus)
Papovaviridae	*Papillomavirus*	Human papilloma virus (HPV) 1	More than 60 HPV types
	Polyomavirus	Polyomavirus (simian, human, mouse)	JC and BK viruses, simian virus 40 (SV40)
Adenoviridae	*Mastadenovirus*	Human adenovirus 2	Human adenovirus serotypes 1-47
Herpesviridae	Alphaherpesvirinae	Human herpesvirus 1 Human herpesvirus 2	Herpes simplex virus 1 Herpes simplex virus 2
	Varicellovirus	Human herpesvirus 3	Varicella-zoster virus
	Gammaherpesvirinae	Human herpesvirus 4	Epstein-Barr virus
	Betaherpesvirinae	Human herpesvirus 5	Human cytomegalovirus
	Roseolovirus	Human herpesvirus 6	HHV-6; Roseola infantum
	Unclassified	Human herpesvirus 7	?
Poxviridae	Orthopoxvirus	Vaccinia virus	Vaccinia, Variola (eradicated), cowpox, monkeypox viruses
	Parapoxvirus	Orf virus	Orf, bovine pustular stomatitis, milker's node viruses
	Molluscipoxvirus	Molluscum contagiosum virus	Molluscum contagiosum
Hepadnaviridae	*Orthohepadna viruses*	Hepatitis B virus	Hepatitis B virus

In the early days of virology, viruses were named according to common pathogenic properties, and/or modes of transmission, and often also after their discoverers .

https://www.ncbi.nlm.nih.gov/books/NBK8174/#_A2258_