Chapter 6-7: Viruses

Viruses are tiny agents that can infect humans, animals, and plants. Scientists have not yet decided if they should be considered alive, for they do not grow, undergo metabolism, or evolve, and they can not reproduce themselves.

Viruses are very simple organisms. They consist of little more than nucleic acid enclosed in a coating of protein. In this plate, we will describe how viruses replicate.

This plate discusses some of the different types of viruses, as well as the viral replication process. Begin reading the text below.

Viruses fall below the range of vision of the light microscope, but they are visible under the electron microscope.

There are a few types of viruses; one is the icosahedral virus. It consists of a fragment of DNA or RNA (but never both), which is known as the **genome (A)**. A dark color should be used to trace over the genome in the diagram. The genome may consist of a closed loop of nucleic acid or a linear fragment, and is enclosed in a layer of protein called a **capsid (B)**. The capsid is made up of smaller identical units called **capsomeres (C)**. One face of the capsid in our diagram is shown as capsomeres, but all of the faces of the capsid are made up of these tiny units. In the icosahedral virus, the capsid is organized into a twenty-sided figure called an icosahedron, in which each side is an equilateral triangle, so that there are twelve points and twelve edges.

All viruses have a genome and capsid. Many, but not all types of viruses are enclosed in a **membranous envelope (D)**. This envelope is similar to the cell membrane of a eukaryotic cell, but it contains components specific to each virus. For instance, this envelope may have projections called spikes. The viruses that cause herpes simplex, infectious mononucleosis, chickenpox, and acquired immune deficiency syndrome (AIDS) are all icosahedral viruses.

The second major viral type is the helical virus. There are two types of helical viruses. In the first, the genome (A) is wound in a helix, and the shape of the capsid conforms to the shape of the genome. You can also see the capsomeres (C) and the envelope (D) of the helical virus. The rabies virus is an example of a helical virus.

In a second type of helical virus, the genome (A) is found in fragments that are mixed together; this virus has a more circular shape. The influenza virus is an example of the second helical virus.

A virus that attacks bacteria is the bacteriophage. Bacteriophage have icosahedral heads that contain the genome (A) and icosahedral capsids. They also have extended **tails (E)** that show series of rings, and sets of **fibers (F)** at the end of their tails. Bacteriophage are very complex in comparison to other types of viruses.

Notice that the only components of a virus are the fragment of nucleic acid and the coat of protein. An envelope is found in some, but not all viruses. We will now examine the method of viral replication. Look at the second part of the plate and continue reading.

Viruses need the machinery of living cells in order to replicate. In diagram 1, we show a simplified cell; you can see the **cytoplasm (G)** and **nucleus (H)**. At its membrane is a virus displaying the **viral genome (I)** and the **viral capsid (J)**.

In diagram 2, a hole has opened in the cell membrane and the viral genome (I) has entered the cytoplasm. In this case, the viral capsid (J) has remained outside the cell, but in other cases, the entire virus enters the cytoplasm by phagocytosis, and the viral envelope blends with the cell membrane. The key process here is that the viral genome is released into the cytoplasm of the cell.

In the third diagram, the viral genome has directed the synthesis of new viral parts, and you can see a group of **new genomes (K)** and a group of **new capsids (L)**. Note that the cell's nucleus has disappeared; during the process of viral replication, some of the cell structures are consumed and destroyed.

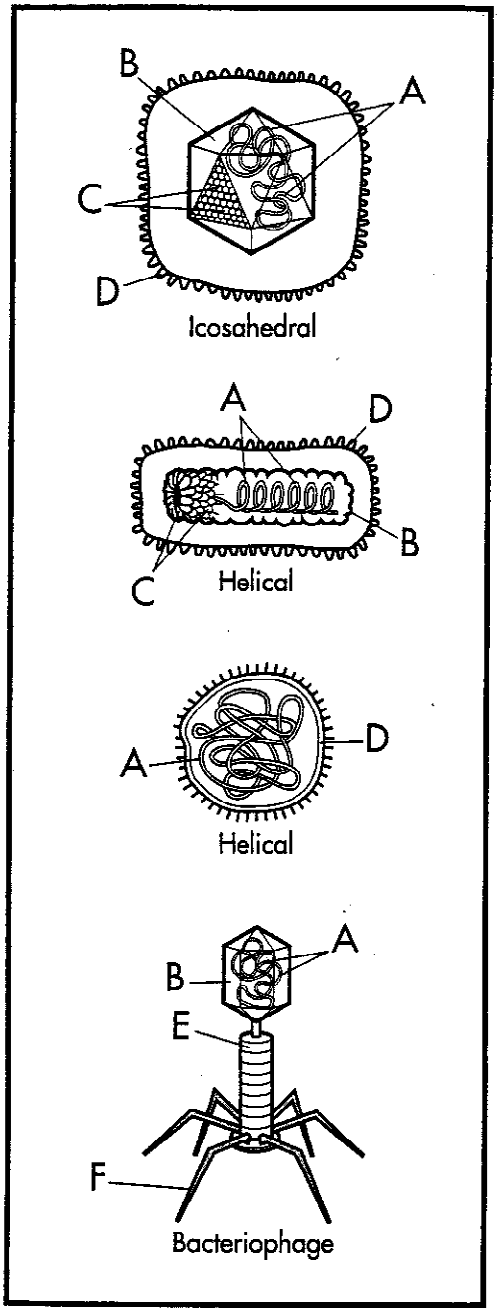
In diagram 4, **new viruses (M)** are constructed within the cell cytoplasm (G). About one hour has passed since the viral genome was released in the cell cytoplasm, and now the cytoplasm is filled with hundreds of thousands of new viruses.

In diagram 5, viral replication is complete, and new viruses (M) are leaving the cell cytoplasm (G). In some cases, the viruses force their way through the cell membrane to the exterior, while in other cases, the cell bursts in a process called lysis, releasing the new viruses.

Viruses

○ Genome .....A	○ Tail .....E	○ Viral Capsid .....J
○ Capsid .....B	○ Fibers .....F	○ New Genomes.....K
○ Capsomeres C	○ Cytoplasm.....G	○ New Capsids.....L
○ Membranous Envelope....D	○ Nucleus.....H	○ New Viruses.....M
	○ Viral Genome I	

Viral Types



Viral Replication