

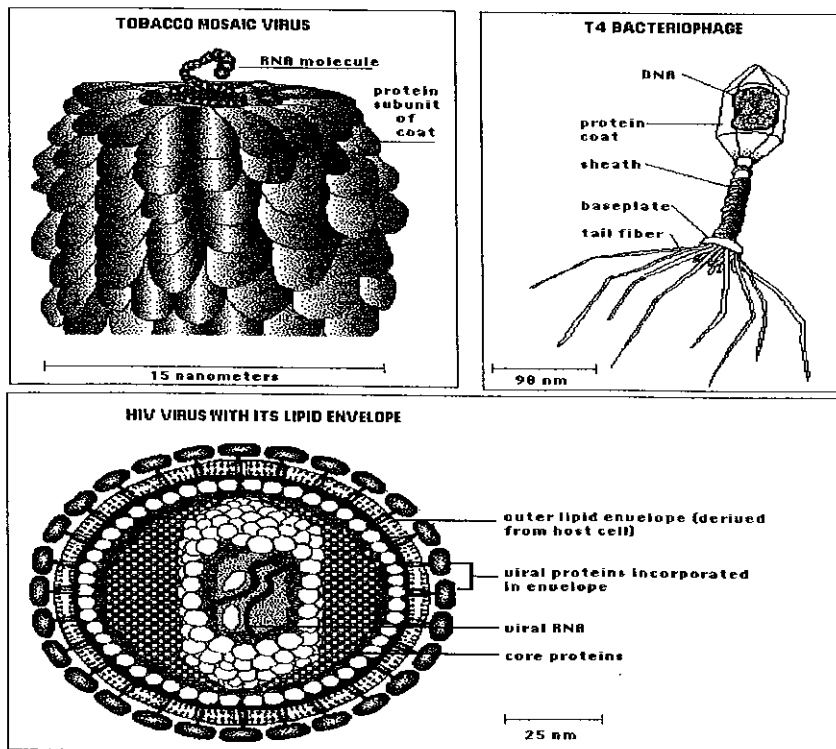
BIOLOGICAL DIVERSITY: VIRUSES

Viruses: a Group of Intracellular Parasites

In the 19th century, many rabies cases plagued Europe. In London, for example, 29 deaths by "hydrophobia" were enumerated in the first weeks of 1877, and the Rabies Order gave local authorities the right to muzzle, control, seize, lock up, and dispose of stray dogs to combat the "rabies of the streets". Louis Pasteur began to work on rabies in 1880. His initial objective was to find ways to prevent the diseases, following the route opened by his work on fowl cholera. He suspected something smaller than bacteria caused rabies. For this small infectious substance he used the word virus, the Latin term for poison. In 1892, Russian biologist Dimitri Ivanowsky confirmed Pasteur's hypothesis of an infectious agent smaller than bacteria. The invention of the electron microscope in the twentieth century allowed visualization of these infectious agents that we know as viruses.

A virus is a submicroscopic infectious particle composed of a protein coat and a nucleic acid core (DNA or RNA), as shown in Figures 1 and 2. Viruses are similar in size to a large protein macromolecule. Viruses, like cells, carry genetic information encoded in their nucleic acid, and can undergo mutations and reproduce; however, they cannot carry out metabolism, and thus are not considered alive. Viruses are classified by the type of nucleic acid they contain, and the shape of their protein capsule.

EXAMPLES OF VIRUSES



Structure of a variety of viruses..

Examples of several viruses are shown in Figures 1-3.

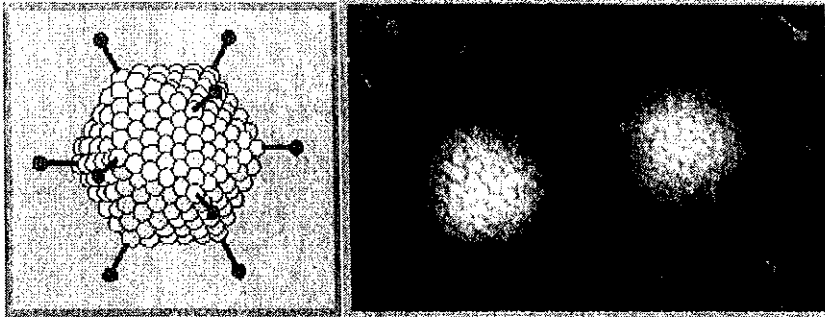


Figure 2

The Adenovirus is a DNA virus that causes colds and "pink eye". Structure of the adenovirus (left), and transmission electron micrograph of the virus.

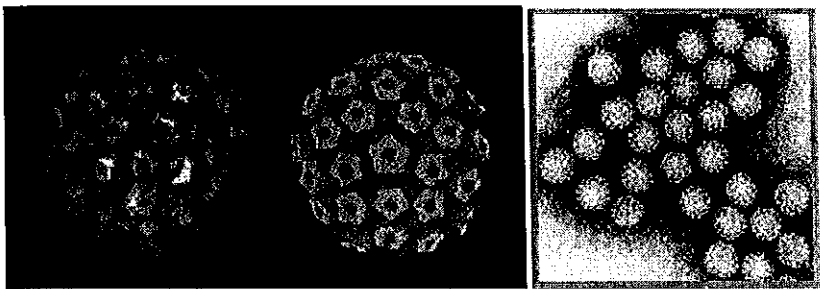


Figure 2

The Papillomavirus is a DNA virus that causes warts. These infectious particles are small, about 15 nm in diameter. Structure (left) and electron micrograph (color added) of the paillomavirus.

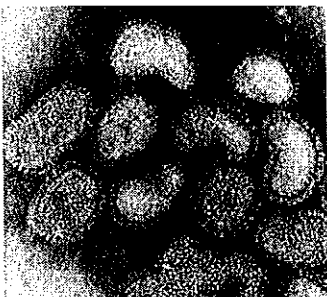
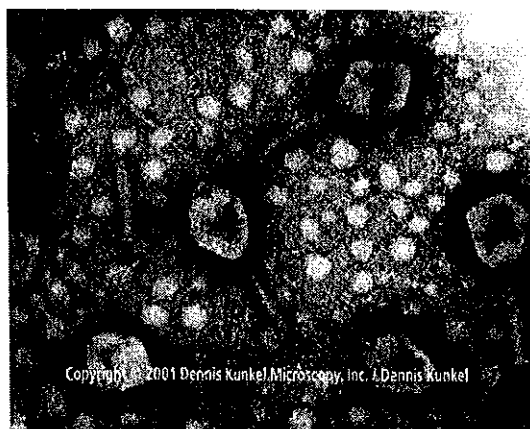


Figure 3

Transmission electron micrograph of the influenza virus. The Influenza virus causes the flu. It has RNA as its genetic material instead of DNA.

Viruses cannot multiply outside a living cell, they can only replicate inside of a specific host. Animal viruses in laboratories are raised in live chick embryos or in cell tissue culture. Viruses infect all sorts of cells, from bacteria to human cells, but for the most part tend to be host specific. For example, the tobacco mosaic virus infects certain plants; the rabies virus infects only mammals; and the AIDS virus, HIV, infects only certain human blood cells. The various viruses that cause hepatitis invade only liver tissues, while the polio virus only reproduces in spinal nerve cells.

Figure 5 shows a bacterial virus, as well as an HIV human virus.



T4 bacteriophage (DNA virus).

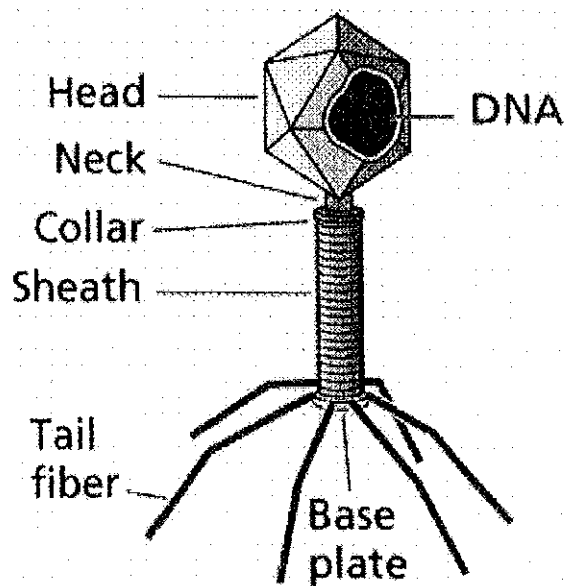


Figure 6

Structure of a T bacteriophage virus..

Viruses and Diseases |

Viruses cause a variety of diseases among all groups of living things. Virally caused human diseases include the flu, common cold, herpes, measles, chicken pox, small pox, and encephalitis. Viral diseases in humans are controlled by preventing transmission, administering vaccines, and by the administration of antiviral drugs. Frequent hand washing and condom use may help prevent transmission of certain viral diseases. Vaccination offers protection for uninfected individuals. Vaccines are substances that stimulate an immune response **without** causing the illness. Commonly used virus vaccines include polio, measles, and mumps. Antivirals include acyclovir for herpes and AZT for AIDS. Antibiotics **are not** effective against viruses.

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The URL of this page is:

www2.estrellamountain.edu/faculty/farabee/biobk/BioBookDiversity_1.html

Figure 1 from http://www.gene.com/AE/AB/GG/examples_of_viruses.html

Figure 2 images are from <http://www.uct.ac.za/depts/mmi/stannard/adenovirus.html> and <http://www.uct.ac.za/depts/mmi/stannard/papillomavirus.html>

Figure 3 is from <http://www.uct.ac.za/depts/mmi/stannard/fluovirus.html>

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Figure 6 from Purves et al., Life: The Science of Biology, 4th Edition, by Sinauer Associates (www.sinauer.com) and WH Freeman (www.whfreeman.com), used with permission

VIRUS ACTIVITY QUESTIONS

1) Are viruses living or non-living? Write your prediction and reasoning below:

2) What is some evidence from the reading that viruses are living?

3) What is some evidence from the reading that viruses are NOT living?

4) Based on the criteria we developed in class, would you classify viruses as living or non-living? Write a CER paragraph defending your answer.

