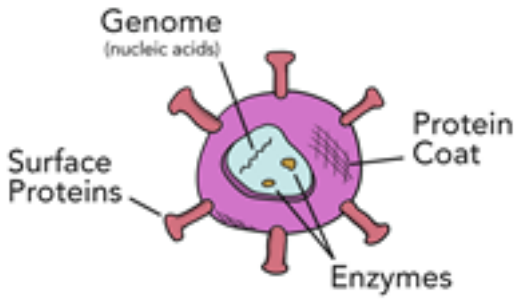
Chapter 11

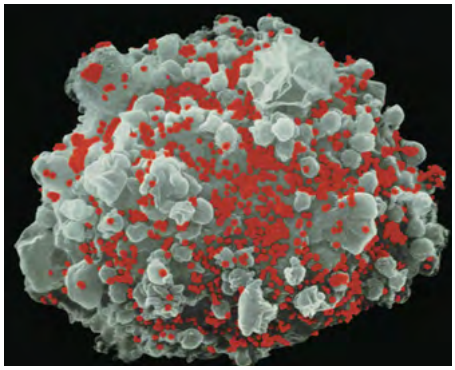
Diversity of Life 2

11.5 Viruses and Prions

A **virus** is a small piece of genetic material wrapped in a protein coat. Viruses exist on the border between living and nonliving. They are not made of cells, and they can reproduce only within a host cell. However, they have genes and they evolve. Where did viruses come from? Scientists believe viruses originate when little pieces of host DNA or RNA somehow evolve the ability to move from one cell to another. This means that viruses have probably originated many times. A typical virus is shown in Figure 11.23, along with a photo of Human immunodeficiency virus (HIV), the virus that causes acquired immunodeficiency syndrome (AIDS).



(a)



(b)

FIGURE 11.23

(a) Most viruses consist of a protein coat encapsulating an inner chamber containing genetic material and essential enzymes. The protein coat can also feature surface structures that play a role in the virus's ability to penetrate the host cell. (b) This human immune cell (gray) is infected with HIV (red), the virus that causes AIDS. The cell is covered with viral particles that will soon spread and infect other cells.

Many viruses have normal double-stranded DNA, but others have genes made of single-stranded DNA, single-stranded RNA, or double-stranded RNA. Viruses reproduce by infecting a host cell and then using the cell's resources to copy their genetic material and build viral proteins. These are then assembled to form new viruses. All forms of life—from bacteria to plants and animals—are infected by viruses.

On Earth, viruses can be found nearly everywhere from the soil, to the air, to the water we drink. The adult human body harbors viruses as well. Some of these viruses are of the sort that infect not human cells, but bacterial cells, which have evolved various defenses. Thus, in many ways, your body is but a battleground between these two biological agents.

When there is a balance between these opposing forces the result can be your good health. Any upset to this balance, however, can lead to your poor health.

Some of the more notorious viruses include those responsible for human diseases such as the common cold, influenza (the "flu"), AIDS, smallpox, and Covid. One feature of viruses is that their genes may mutate very quickly. This explains why there are always plenty of colds to catch and why the flu comes back, in a different form, year after year.

Prions are incorrectly folded proteins that cause disease. (Remember that proteins are folded strings of amino acids. In prions, the folding has somehow gone wrong.) Prions cause mad cow disease and the related Creutzfeldt–Jakob disease in humans. Both these diseases cause severe damage to the brain. Prions infect cells and then "reproduce" by converting normal proteins into the incorrectly folded form. Prions are spread when we eat infected meat. Cooking, which kills bacteria and viruses, has no effect on prions.

READING CHECK

How are prions different from the viruses and bacteria that cause many human diseases?

CHECK YOUR ANSWER

Unlike viruses and bacteria, prions are disease-causing agents that don't have any genetic material at all and are certainly not living things. Prions are incorrectly folded proteins that have the ability to convert the proteins near them to the misfolded variety. Large numbers of misfolded protein result in diseases such as Creutzfeldt–Jakob disease.

You can read more about **viruses** here:

https://www.news-medical.net/health/What-is-a-Virus.aspx

More on **prions** can be found here:

https://www.cdc.gov/prions/index.html