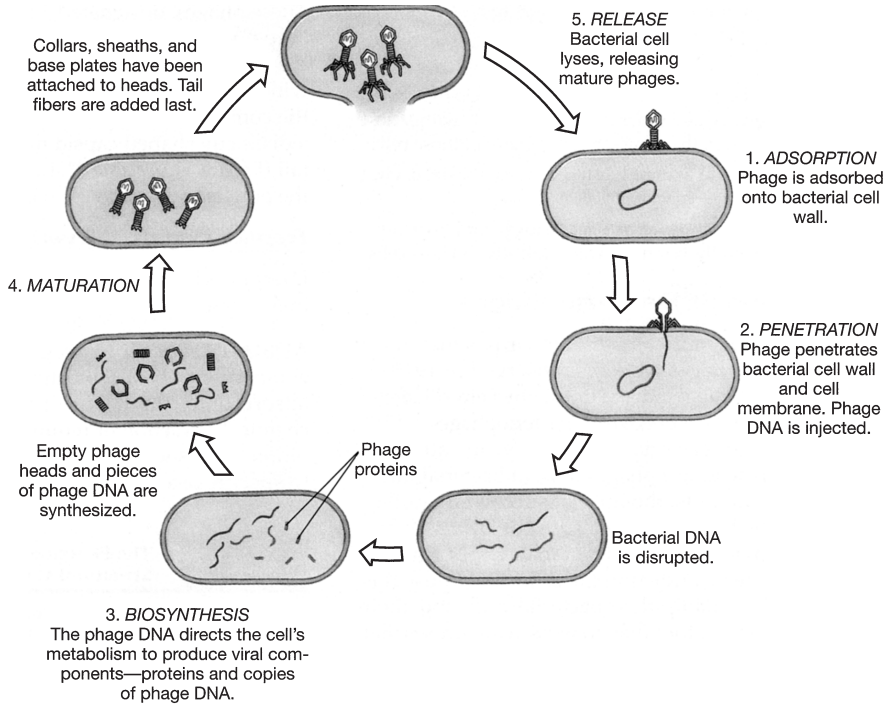

Figure 2.1. Replication of a virulent bacteriophage. A virulent phage undergoes a lytic cycle to produce new phage particles within a bacterial cell. *Cell lysis* releases new phage particles that can infect more bacteria. (With permission, from J. G. Black, *Microbiology: Principles and Applications,* 3d ed., p. 282. This material is used by permission of John Wiley & Sons, Inc.)

is to use a virus where viral genetic material has been replaced with the desired gene to be inserted into the patient. The viral capsid can act as a Trojan Horse to protect the desired gene in a hostile environment and then to deliver it selectively to a particle cell type. Thus, viruses can do great harm but also are important biotechnological tools.

2.1.4. Procaryotes

The sizes of most procaryotes vary from 0.5 to 3 micrometers (μm) in equivalent radius. Different species have different shapes, such as spherical or coccus (e.g., *Staphylococci*), cylindrical or bacillus (*E. coli*), or spiral or spirillum (*Rhodospirillum*). Procaryotic cells grow rapidly, with typical doubling times of one-half hour to several hours. Also, procaryotes can utilize a variety of nutrients as carbon source, including carbohydrates, hydrocarbons, proteins, and CO_2.

2.1.4.1. Eubacteria. The Eubacteria can be divided into several different groups. One distinction is based on the gram stain (developed by Hans Christian Gram in 1884). The staining procedure first requires fixing the cells by heating. The basic dye, crystal violet, is added; all bacteria will stain purple. Next, iodine is added, followed by