

Demonstration Slides: Viruses and Bacteria

The first eight slides are of viruses. Viruses are not cells, and though they may possess a few enzymes, they lack the metabolic machinery for energy generation and they never have the ribosomes required for protein synthesis.

Slide 1 shows a bacteriophage - a virus that attacks only bacterial cells. The virus is actually a rather complicated structure, consisting of a head, collar, tail, and tail fibers.

The next three slides show bacteriophage replication. Remember that viruses cannot reproduce themselves. Rather, the host cell manufactures new viruses using the genetic instructions provided by the virus.

Slide 2 shows bacteriophages attacking an *E. coli* bacterial cell.

Slide 3 - The bacteriophages attach to the host cell by their tail fibers and inject their nucleic acid into the host cell. Once inside the cell, the nucleic acid provides the genetic information for the synthesis of new phages.

Slide 4 shows new phages being synthesized within the host cell. Later the cell will rupture, releasing hundreds of new phages into the surrounding medium.

The next four slides show viruses that attack eukaryotic cells. Note that these viruses are not as structurally complex as the bacteriophages.

Slide 5 shows a typical rod-shaped virus. The virus consists of a nucleic acid core (either DNA or RNA, but not both) surrounded by a protein coat called a capsid.

Slide 6 shows an actual adenovirus (left) and a model of the virus. The adenovirus is an icosahedron (having twenty equal sides); it multiplies in the human upper respiratory system causing cold-like symptoms in the host.

Slide 7 shows an influenza virus and an interpretive drawing. Note that the protein coat is surrounded by a membranous envelope, probably derived from the host cell membrane.

Slide 8 is of the infamous herpes virus, here photographed within a host cell. This particular virus causes cold sores; a related virus is responsible for genital herpes.

The next eleven slides are of different types of bacteria.

Slide 9 is of different types of bacteria. You should be able to recognize staphylococci, streptococci, and bacilli. (The prefixes staphlo means clusters, strepto means chain, and diplo means pairs.)

Slide 10 is of a spirochete.

Slide 11 is of *Staphylococcus aureus* (10,000 X), a common inhabitant of the human skin and nose and a potential pathogen. The organism may bring about pimples, abscesses or boils, food poisoning, pneumonia, and many other serious infections.

Slide 12 is of *Bacillus cereus* (20,000 X). This bacterium is a saprophyte and is found most often in milk and cream. It is closely related to *Bacillus anthracis* and can cause food poisoning in humans.

Slide 13 shows *Clostridium thermosaccharolyticum* (10,000 X) with spore. This is a large bacillus that produces spores and prefers growth under anaerobic conditions. The straight arrow points to the vegetative portion of the organism while the curved arrow points to the terminal spore that has been produced as a response to unfavorable conditions.

Slide 14 is of *Pseudomonas aeruginosa* (10,000 X), a small bacillus with a single flagellum (arrow). Most strains produce a blue-green pigment that can be seen in the culture medium or in infected tissue. The species is a common human pathogen found in urine, wounds, and burn patients; it is often difficult to treat since it is resistant to most antibiotics.

Slide 15 is of the famous *E. coli*, an organism widely used in recombinant DNA technology. It is a common inhabitant of the human large intestine.

Slide 16 is of *Neisseria gonorrhoea* (20,000 X), a small diplococcus that is the causative agent of the sexually transmitted disease gonorrhea. Gonorrhea is increasing in incidence since many of the strains have become resistant to penicillin.

Slide 17 shows why you should not chew your fingernails! These are fingernail scrapings magnified 2,000 times.

Slide 18 - Bacteria are all over us, and within us; they constitute the "normal flora" of our bodies. Here are bacteria living in a pore on human skin.

Slide 19 shows streptobacilli on human skin.

The next seven slides are of cyanobacteria. The cyanobacteria are photoautotrophs, possessing chlorophyll *a*, which carry on water-based photosynthesis, yielding O₂ as a by-product.

Slide 20 shows a typical cyanobacterium. It is a photosynthetic bacterium in which groups of nearly spherical cells are enclosed in layers of gelatinous material.

Slide 21 is a gelatinous "butter-ball" of a *Nostoc* commune, each consisting of hundreds of filaments. Such "balls" occur frequently in freshwater habitats; these were collected from the walls of the gorge at Ithaca Falls.

Slide 22 shows what the edge of one of the *Nostoc* balls looks like.

Slide 23 shows another view of *Nostoc* filaments. The larger, slightly darker cells are **heterocysts**, which are capable of nitrogen fixation. The fact that these and other cyanobacteria can fix nitrogen is very important ecologically, because it enables them to survive in nitrogen-poor environments where eukaryotic algae cannot.

Slide 24 is of *Oscillatoria* that is normally found floating in quiet waters. The individual filaments are unbranched and cylindrical, and the gelatinous sheath, if present at all, is extremely thin. The filaments exhibit a gliding movement, the nature of which is still not understood.

Slide 25 - Ponds or lakes containing a rich supply of organic matter often develop huge populations ("blooms") of green algae or cyanobacteria, which is what we see here. The water may become so green with these organisms that objects even a few centimeters below the surface are invisible.

Slide 26 is of *Anabaena*, a cyanobacterium that is common in ponds and lakes and can become so abundant as to cause an algal bloom. The larger cells indicated by the arrows are heterocysts.