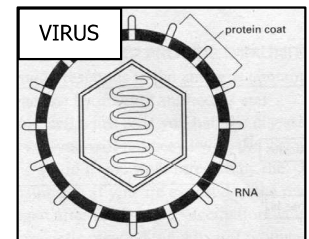
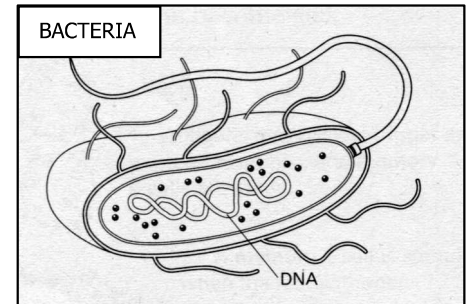


CA State Standard 10d: Students know there are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.

Bacteria and viruses can both cause infections in the body. However, their different structures and reproductive cycles allow them to infect the body in different ways. Bacteria are microorganisms, but viruses are small particles that contain only DNA and RNA. Bacteria and viruses that cause disease in humans are called **pathogens**. Although both types of pathogens cause disease, they have several different characteristics.

- Cell Wall vs. Protein Coat.** Bacteria have cell walls, but viruses are surrounded by a thick protein, called a protein coat.
- Self-Reproducing vs. Non-Self-Reproducing.** Bacteria replicate by mitosis, or cell division. Viruses can replicate only if they enter a host cell and cause the host cell to use the virus's DNA to synthesize new viruses.
- Toxins vs. Stopping Cell Activity.** Bacteria cause illness by releasing toxic chemicals that weaken or destroy body cells. Viruses cause illness by forcing cells to stop their normal activity and spend all of their energy making new viruses.
- Living vs. Not Living.** Bacteria are living cells that have organelles, use energy, and reproduce by themselves. Viruses are not living, even though they have a strand of DNA or RNA, because they do not have organelles, cannot reproduce on their own, do not use energy, and cannot make proteins on their own.



HOW DOES THE BODY RESPOND TO VIRUSES AND BACTERIA?

Most viruses are recognized by the body as **antigens**, to which the body responds by producing **antibodies**. The body recognizes harmful bacteria or the toxins they produce as antigens and produces antibodies in response.

HOW DO TREATMENTS FOR BACTERIAL AND VIRAL INFECTIONS DIFFER?

Diseases caused by bacteria can be treated with antibiotics. Antibiotics work by interfering with the synthesis of nucleic acids or proteins or by destroying the cell wall. Antibiotics do not work against viral infections because viruses cannot synthesize their own proteins. Nor can antibiotics disrupt viral reproduction because viruses do not synthesize their own DNA, nor do they have cell walls.

HOW DOES ANTIBIOTIC RESISTANCE ARISE?

Some species of bacteria have **evolved** antibiotic resistance due to overuse of antibiotics. Antibiotics tend to kill off non-resistant bacteria, leaving the resistant bacteria to reproduce. Offspring of resistant bacteria are also resistant.

Different chemicals and medicines can be used to control the spread of pathogens.

- **Antiseptics** are chemicals such as soap, vinegar, and rubbing alcohol that kill pathogens outside the body. Antiseptics weaken cell walls and membranes and poison the pathogens.
- **Antibiotics** are medicines that target specific types of bacteria or fungi and keep them from growing or reproducing once they enter the body. Although antibiotics are very useful in controlling disease, overuse can result in antibiotic-resistant bacteria. **Antibiotic resistance** occurs when bacteria mutate so that they are no longer affected by specific antibiotics.

Examples of Diseases

Pathogens	Diseases
Viruses	Rabies, colds, flu, AIDS
Bacteria	Blood poisoning, botulism, food poisoning, tuberculosis
Protists	Malaria, dysentery

ANSWER THE FOLLOWING QUESTIONS:

1. What distinguishes living bacteria and non-living viruses?

2. How does the body respond to viruses and bacteria?
3. How are treatments for bacterial and viral infections different?
4. What is one reason that antibiotics are not useful against viral infections?
5. How is natural selection related to the rise of antibiotic-resistant bacteria?
6. Which of the following is a difference between bacteria and viruses?
 - A) Bacteria have protein coats, but viruses have cell walls.
 - B) Bacteria have genetic information, but viruses do not.
 - C) Bacteria do not make people ill, but viruses cause disease.
 - D) Bacteria reproduce on their own, but viruses do not.
7. You are diagnosed with the flu, but your doctor does not give you any antibiotics. The doctor says that antibiotics are not effective against viral infections. Why not?
 - A) Viruses do not use glucose
 - B) Viruses do not need ATP
 - C) Viruses do not have DNA
 - D) Viruses do not have cell walls
8. Suppose you get infected with a virus. Which of the following statements best describes what the virus will do that will cause you to feel ill?
 - A) The virus will release toxins that will poison otherwise healthy body cells.
 - B) The virus will mutate so that antibiotics will not be able to destroy it.
 - C) The virus will cause body cells to stop their activity and produce viruses.
 - D) The virus will use ATP to grow large enough so that it can infect and consume body cells.
9. A person cuts her finger and puts an antiseptic on it to kill pathogens. How are antiseptics different from antibiotics?
 - A) Antiseptics weaken cell membranes.
 - B) Antiseptics stop the formation of cell walls.
 - C) Antiseptics are used once the pathogen is inside the body.
 - D) Antiseptics only target certain types of bacteria.
10. A scientist tests the effectiveness of an antibiotic against different strains of a bacterium. The scientist placed four strains of the bacterium in separate test tubes along with the antibiotic. The control test tube contained bacteria but no antibiotic. The table shows how the results of the experiment after 48 hours. Which strain is resistant to the antibiotic?

- A) Strain A
- B) Strain B
- C) Strain C
- D) Strain D

Test Tube	Number of Bacteria Living after 48 hours
Control	4,000,000
A	0
B	4,500,000
C	200
D	0