

LIVING WITH BACTERIA: THE GOOD, THE BAD, AND THE RESISTANT

Bacteria are single-celled organisms that live everywhere on Earth. They have a simple advantage that allows them to adapt to new environments: they make copies of themselves quickly. An average bacterium can replicate¹ or copy itself once an hour, becoming two bacteria. At this rate, one bacterium could become 16 million bacteria within 24 hours!

Bacteria can be helpful. Some provide nutrients by breaking down dead plants and animals. Others create food such as cheese, yogurt, and sourdough bread.

Bacteria can be harmful, too. These organisms cause ear, throat, heart, and lung infections such as pneumonia. Bacteria can lead to food poisoning when food is not prepared or stored properly. They can also cause blood poisoning if wounds become infected.

Resistance to Antibacterial Products

Many antibacterial hand sanitizers and popular household cleaners claim to eliminate 99.9 percent of bacteria. But what happens to the 0.1 percent?

These bacteria resist the product and survive - no matter how much product is used. While this may seem inconsequential, bacteria's ability to reproduce so quickly means that 0.1 percent can become a much larger number in little time. When resistant bacteria flourish, the antibacterial product becomes useless.

The Significance of 0.1 Percent

When bacteria reproduce, the genetic material (RNA and DNA) usually replicate¹ accurately and the offspring are normal. Sometimes, however, errors during replication occur and cause mutations or changes. Most organisms with mutated genetic material die.

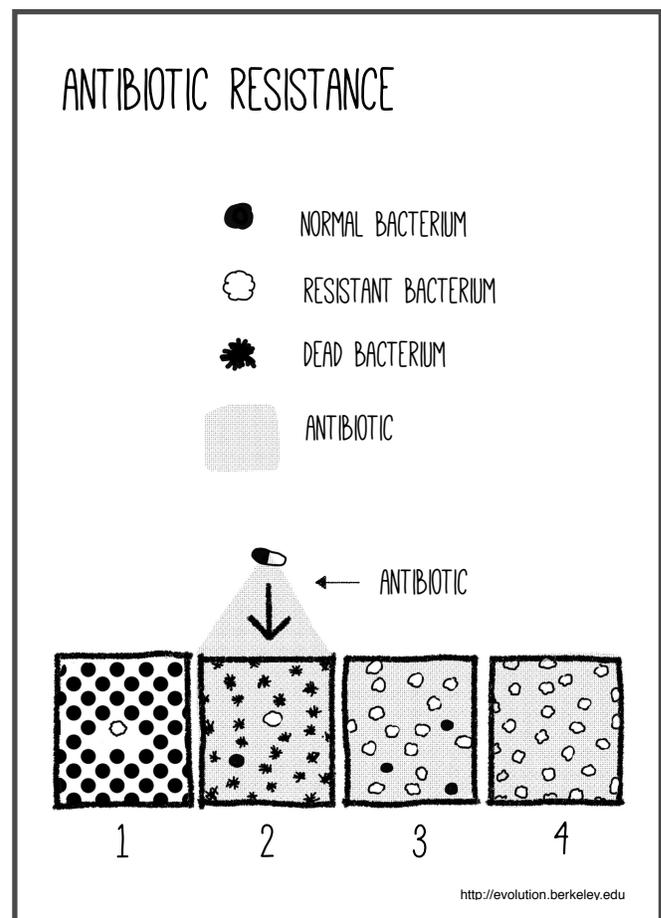
Occasionally mutations enable bacteria to resist various substances that should kill it – like the 0.1 percent of bacteria not eliminated by antibacterial products. These new resistance genes can then be passed to offspring, possibly forming a completely resistant species.

The Discovery of Antibiotics

Antibiotics are compounds produced by fungi and bacteria colonies. They are used to fight bacterial infections by killing bacteria.

The most common antibiotic, penicillin, was discovered by Alexander Fleming. As a battlefield doctor during World War I, he amputated infected limbs to stop the spread of infection. This experience inspired Fleming to research other treatment methods for bacterial infections. In 1928 he observed a fungus kill a Staphylococcus bacterium. This prompted him to isolate the compound that killed the bacteria. As a result, penicillin was developed and, in 1942, approved as a drug to treat a variety of infections.

Since then researchers have discovered hundreds of antibiotics. Unfortunately, the overuse and misuse of these antibiotics has contributed to a crisis in Western health care: antibiotic resistance.



¹ replicate - to make an exact copy

Antibiotic Resistance

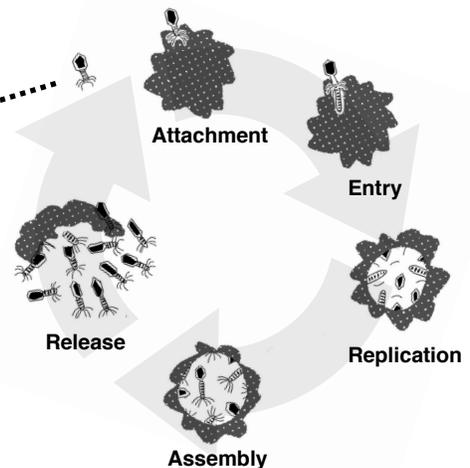
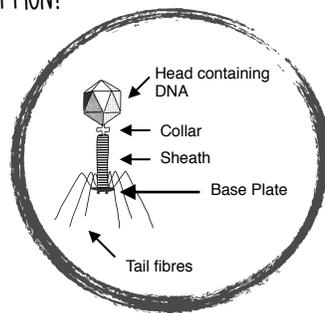
By treating everything from a common cold to kidney damage, humans have overused antibiotics and created new problems. Frequent and unnecessary use of antibiotics has allowed resistant bacterial numbers to grow. Now antibiotics are useless against some serious illnesses.

Another factor that contributes to antibiotic resistance is the misuse of antibiotics. This happens when patients do not take all of their pills because they feel better. An incomplete dose means that harmful bacteria may still be present in the person's body, just in a lower amount. When this happens, bacteria have time to adapt to their environment and mutate, potentially developing antibiotic resistance. Before long, that little bit of bacteria could become a thriving, untreatable "superbug."

How serious is it? To date, there are hundreds of resistant superbug strains that have led to thousands of deaths. The most serious are multidrug-resistant tuberculosis, gonorrhoea, and malaria.

BACTERIOPHAGE THERAPY: AN OPTION?

Bacteriophages are viruses that recognize specific bacteria. These viruses work by inserting their DNA into each bacterium. They then replicate until they explode out of the cell, killing the bacterium. In theory, bacteriophage therapy targets only infectious bacteria, so it should not harm beneficial bacteria in a person's body.



Bacteriophage therapy has been used successfully in the former Soviet Union countries since World War II. Perhaps this treatment method will complement or replace antibiotics in the future.

The Future of Antibiotics

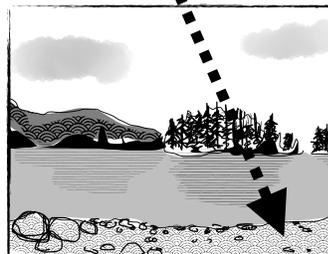
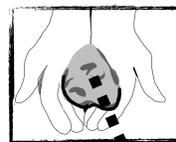
To preserve the strength of antibiotics currently used, scientists recommend that antibiotic use be decreased and that patients follow the exact prescription given by their doctors.

Sometimes "decoy" molecules are added to the antibiotic, so the bacteria attacks the decoy molecule instead of the antibiotic. This method is used with drugs in the penicillin family.

Meanwhile researchers search for new bacteria in extreme habitats, such as caves and the Arctic. Many of these new bacteria produce antibiotics that are similar to common antibiotics, so resistance, over time, may be unavoidable.

One thing is clear: bacteria - good, bad, or resistant - are part of who we are. While they may only be single-celled organisms, their impact on us is surprisingly complex.

INDIGENOUS
KNOWLEDGE



HEILTSUK
FIRST NATION

Researchers think clay used by B.C. First Nations for its healing properties could fight against antibiotic-resistant bacteria. The 400 million kilogram clay deposit is on Heiltsuk First Nation near Bella Bella.



NONFICTION READING ASSESSMENT GRADES 4-9

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