

Antibiotic Resistance

Antibiotics are compounds that can kill or interfere with the growth of microorganisms such as bacteria or viruses. Because antibiotics are often used unnecessarily or incorrectly, microorganisms have been able to adapt and survive. This is called **antibiotic resistance**. One way this happens is **genetic mutations**, which are random changes in genetic material that can be passed on from one virus or bacterium to successive generations. For example, penicillin is one of the oldest and most commonly used antibiotics. Some bacteria have developed an **enzyme** or protein that changes the structure of penicillin and prevents it from killing bacteria.

CONSEQUENCES OF INCREASING ANTIBIOTIC RESISTANCE

As more microorganisms become resistant, commonly used antimicrobials become ineffective against the diseases these microorganisms cause. In turn, the microorganisms become more **virulent** (more capable of producing serious illness). Patients may need to be hospitalized to treat infections once considered simple to treat because stronger antibiotics are required or because these diseases are now associated with severe complications. Some examples include

- **Methicillin-resistant *Staphylococcus aureus* (MRSA)**, a strain of bacteria no longer sensitive to different forms of penicillin. It can cause complicated skin infections and pneumonia and requires stronger antibiotics such as vancomycin for treatment.
- **Multidrug-resistant tuberculosis**, which is very difficult to treat because it is caused by microorganisms that are resistant to 2 of the first-choice drugs used to treat tuberculosis.
- **Extended-spectrum β -lactamase bacteria**, a group of bacteria that have evolved to produce an enzyme that can interfere with the mechanisms of several newer antibiotics, making these bacteria resistant and difficult to treat.



PREVENTION

Several different types of microorganisms live everywhere in our bodies—on our skin and in our intestinal tracts, for example. They help our bodies remain healthy. Unless they are actively causing an infection, there is no need to take antibiotics to eliminate these bacteria. Using antimicrobials unnecessarily increases resistance by eliminating sensitive bacteria and giving resistant and perhaps more virulent bacteria a chance to increase in number.

- Antibiotics should not be used without a proven bacterial infection.
- Some antibiotics are designed to treat very specific infections while others can treat infections caused by several different microorganisms. Thus, antibiotics need to be used with medical guidance.
- Once a course of antibiotics is started for an infection, the entire course should be finished unless there are significant side effects.

WAYS HEALTH SCIENTISTS DEAL WITH ANTIBIOTIC RESISTANCE

- Outmaneuvering the microorganisms; for example, penicillin can be paired with other proteins that **inhibit** (prevent) the bacterial enzyme from changing penicillin's structure and inactivating it
- Developing newer and more powerful antibiotics with mechanisms of action to which various bacteria have not yet developed resistance
- Designing treatment combinations that include different antibiotics, each with a different mechanism of action against the same microorganism

FOR MORE INFORMATION

- American College of Physicians
www.acponline.org
- Centers for Disease Control and Prevention
www.cdc.gov
- American Academy of Pediatrics
Healthy Children
www.healthychildren.org

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