The History of Antibiotics and Antibiotic Resistance

A

The discovery of antibiotics ranks among the most significant breakthroughs in the history of medicine. Before their advent, even minor infections such as strep throat or a small wound could prove fatal. The term “antibiotic” refers to a substance that kills or inhibits the growth of bacteria, and the modern era of antibiotics began in 1928 with Alexander Fleming’s discovery of penicillin. While working at St. Mary’s Hospital in London, Fleming noticed that a mold called *Penicillium notatum* had destroyed bacterial colonies on a culture plate. Though he published his findings in 1929, it was not until over a decade later that penicillin was mass-produced and widely used to treat infections, particularly during World War II.

B

Even before the formal discovery of penicillin, people had used molds and plant extracts to treat infections, although without an understanding of the microbial world. The 20th century saw a revolution in antimicrobial therapies, beginning with sulfa drugs in the 1930s and expanding rapidly after World War II. The postwar years ushered in what is often called the “golden age” of antibiotics, roughly spanning the 1940s to the 1970s. During this time, numerous antibiotic classes were discovered and developed, including streptomycin, tetracycline, erythromycin, and cephalosporins. These drugs saved countless lives and contributed to a dramatic decline in mortality from bacterial diseases.

C

However, as early as the 1940s, scientists began noticing a troubling phenomenon: bacteria that had once been vulnerable to antibiotics were

beginning to survive treatment. This resistance occurs when bacteria evolve mechanisms to evade the effects of a drug. For example, they might develop enzymes that deactivate the antibiotic, change their cell structure to prevent drug entry, or pump the antibiotic out of their cells. In many cases, these resistance traits are passed between bacteria via genetic elements known as plasmids, allowing resistance to spread rapidly.

D

The development of antibiotic resistance has been accelerated by human activity. Overuse and misuse of antibiotics are key factors, including the prescription of antibiotics for viral infections, which they cannot treat, and patients failing to complete the full course of treatment. Moreover, the widespread use of antibiotics in livestock to promote growth and prevent disease has exposed bacteria in animals to low levels of these drugs, creating an ideal environment for resistant strains to emerge. These strains can then be transmitted to humans through the food supply, direct contact, or environmental pathways.

E

In recent years, the rise of so-called "superbugs"—bacteria resistant to multiple or even all available antibiotics—has raised alarm across the medical and public health communities. Organisms such as *Methicillin-resistant Staphylococcus aureus* (MRSA) and *Carbapenem-resistant Enterobacteriaceae* (CRE) are associated with high mortality rates and are difficult to treat. Hospitals, in particular, have become hotbeds for resistant infections due to the high use of antibiotics and the presence of vulnerable patients. The World Health Organization has declared

antibiotic resistance one of the top ten global public health threats facing humanity.

F

Combating antibiotic resistance requires a multi-pronged approach. Surveillance systems that track the spread of resistance, stewardship programs that promote responsible use of antibiotics, and efforts to improve infection prevention in healthcare settings are all critical. In addition, researchers are exploring alternative treatments, such as bacteriophage therapy, which uses viruses that infect and kill bacteria. Yet perhaps the most urgent need is the development of new antibiotics. Unfortunately, pharmaceutical companies have little financial incentive to invest in this area, as antibiotics are less profitable than drugs for chronic conditions and are typically used for only a short duration.

G

The story of antibiotics is one of remarkable triumph followed by mounting challenge. These drugs have transformed modern medicine, enabling surgeries, cancer treatments, and the management of previously deadly diseases. But their effectiveness is not guaranteed. Antibiotic resistance is not just a future threat—it is a present reality. Addressing it will require global cooperation, sustained investment in research, and a renewed commitment to using these powerful tools wisely. As history has shown, the battle between humans and bacteria is ongoing, and the outcome may depend as much on behavior and policy as on scientific discovery.

Questions

Questions 1–4

Match the statement with the correct paragraph (A–G).
Write the correct letter in boxes 1–4 on your answer sheet. You may use any letter more than once.

1. An explanation of how resistant bacteria can transfer their abilities to others
2. Reference to a specific type of therapy being investigated as a future alternative
3. A description of the initial large-scale production and use of antibiotics
4. The financial disincentive for companies to develop new antibiotics

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Questions 5–8

Do the following statements agree with the views of the writer in the passage?
In boxes 5–8 on your answer sheet, write:
YES – if the statement agrees with the claims of the writer
NO – if the statement contradicts the claims of the writer
NOT GIVEN – if it is impossible to say what the writer thinks about this

5. Penicillin was discovered accidentally.
6. All bacterial infections can be treated effectively with modern antibiotics.
7. Antibiotic-resistant bacteria are primarily found in tropical regions.

8. Antibiotic resistance can spread through multiple pathways.

Questions 9–13

Complete the summary below. Choose ONE WORD ONLY from the passage for each answer.
Write your answers in boxes 9–13 on your answer sheet.

The development of antibiotics has played a vital role in modern medicine, drastically reducing death rates from bacterial infections. The period following World War II is sometimes called the “golden age” of antibiotics due to the wide range of drugs discovered. However, the emergence of 9 soon posed a major challenge. This occurs when bacteria adapt in ways that allow them to survive treatment. One mechanism by which this occurs is the sharing of 10, which can spread resistance traits.

Human actions have worsened the issue, including using antibiotics for 11 illnesses and giving them to farm animals. Hospitals have become centers for the emergence of 12, which are particularly hard to treat. Solutions include research into new drugs and better 13 practices.

Answer Key

1. C
2. F
3. A
4. F
5. YES
6. NO
7. NOT GIVEN
8. YES
9. resistance
10. plasmids
11. viral
12. superbugs
13. stewardship