

## Penicillin

Penicillin is a group of antibiotics derived from the *Penicillium* mold, and used to treat a large range of bacterial infections. In 1928 a Scottish bacteriologist named Alexander Fleming first observed that colonies of the bacterium *Staphylococcus aureus* failed to grow in those areas of a culture that had been accidentally contaminated by the green mold *Penicillium notatum*. He isolated the mold, grew it in a fluid medium, and found that it produced a substance capable of killing many of the common bacteria that infect humans. By 1941 an injectable form of the drug was available for therapeutic use after Howard Florey and Ernst Boris isolated and purified penicillin in the late 1930s.

There are several kinds of penicillin synthesized by various species of the mold, and they are divided into two classes:

- the naturally occurring penicillins which are formed during the process of mold fermentation
- the semi-synthetic penicillins in which the structure of a chemical substance called 6-aminopenicillanic acid and found in all penicillins is modified in various ways.

It is possible to change the characteristics of the antibiotic therefore different types of

penicillin are produced for different therapeutic purposes.

The naturally occurring penicillins, penicillin G (benzylpenicillin) and penicillin V (phenoxymethylpenicillin), are still used clinically. Because of its poor stability in acid, much of penicillin G is broken down as it passes through the stomach. For this reason, it must be given by intramuscular injection, which limits its usefulness. Penicillin V, on the other hand, typically is given orally as it is more resistant to digestive acids than penicillin G.

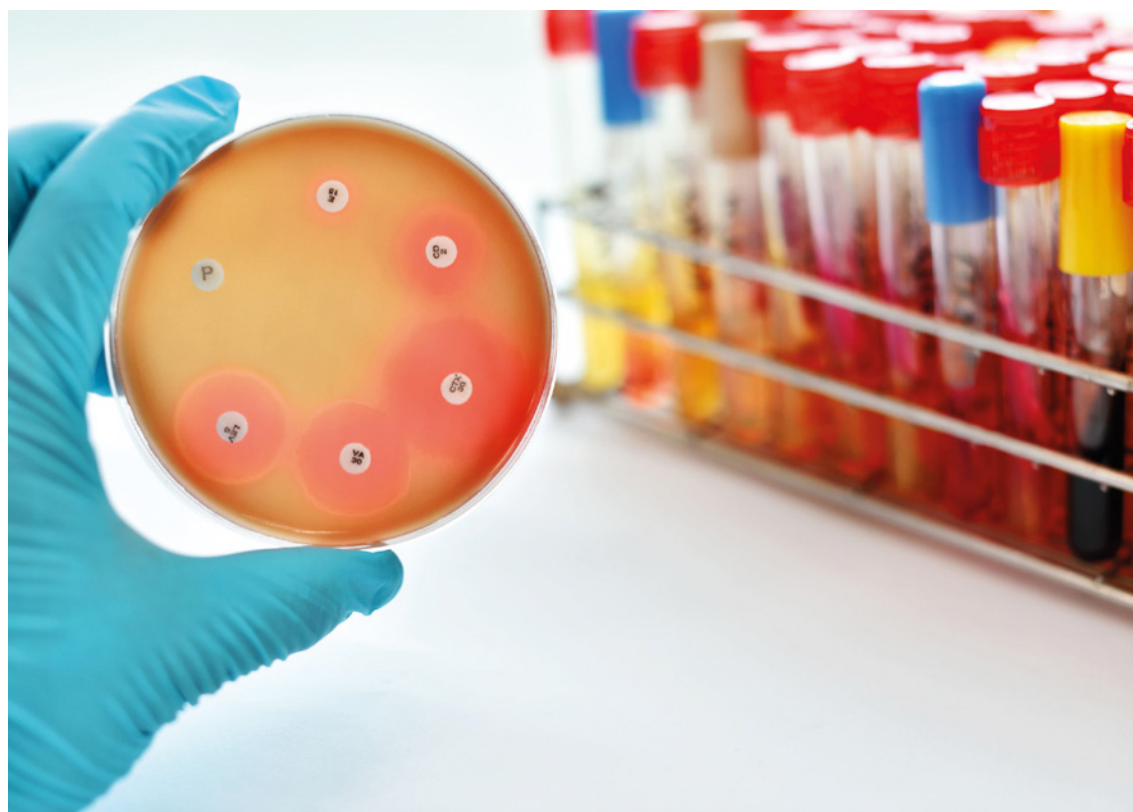
Some of the semi-synthetic penicillins are also more acid-stable and thus may be given as oral medication.

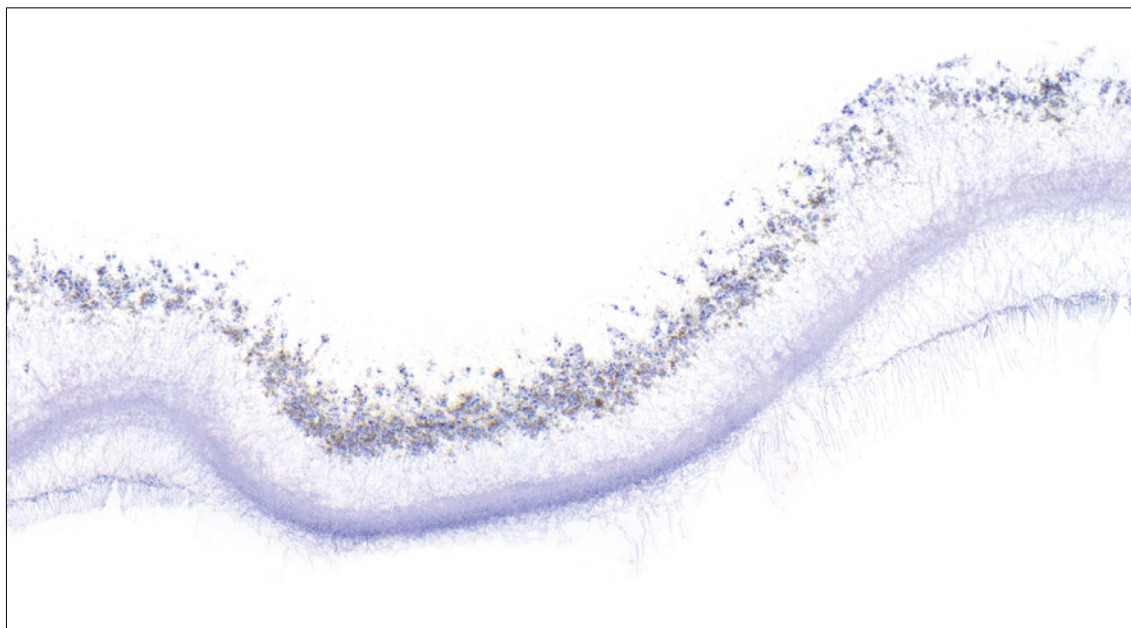
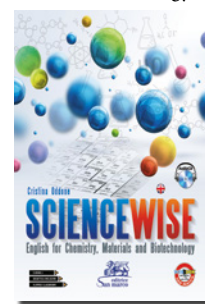
All penicillins work in the same way, by inhibiting the bacterial enzymes responsible for cell wall synthesis in replicating microorganisms and by activating other enzymes to break down the protective wall of the microorganism. As a result, they are effective only against microorganisms that are actively replicating and producing cell walls. They do not harm human cells, which fundamentally lack cell walls.

Penicillins are used in the treatment of throat infections, meningitis, syphilis and various other infections. Penicillins have side effects such as hypersensitivity reactions (including

### GLOSSARY

- 1 a guide that may be used for example





*Penicillin under the microscope*

skin rash, hives, and swelling) and anaphylaxis or allergic shock. Nonetheless the more serious reactions are uncommon and milder symptoms may be treated with corticosteroids or can be prevented by switching to alternative antibiotics.

Some bacteria, such as *Staphylococcus*, have developed a specific resistance to the naturally occurring penicillins; these bacteria either produce an enzyme that disrupts the

internal structure of penicillin and thus destroys the antimicrobial action of the drug, or they lack cell wall receptors for penicillin, greatly reducing the ability of the drug to enter bacterial cells. This has led to the production of the penicillinase-resistant penicillins, which is considered the second generation of penicillins.

(adapted from *Encyclopaedia Britannica*)

## ACTIVITIES

### 1 Answer the following questions.

- |   |   |
|---|---|
| 1 What is penicillin?   | 7 How do penicillins work?                              |
| 2 What is it derived from?                                      | 8 Why do they not harm human cells?                     |
| 3 What did Fleming discover?                                    | 9 What are penicillins used for?                        |
| 4 When was it made available for therapeutic use?               | 10 What are their side effects?                         |
| 5 What types of penicillin are there?                           | 11 What has happened because of the use of antibiotics? |
| 6 What is the difference between penicillin G and penicillin V? | 12 What have scientists produced in response?           |

### 2 Match each word with its definition.

- |                  |  |
|------------------|--|
| 1 Mold           | A To change action or direction, to substitute                               |
| 2 Colony         | B A superficial growth produced on damp or on living organisms by a fungus   |
| 3 Culture (here) | C An enzymatically controlled anaerobic breakdown of an energy-rich compound |
| 4 Fermentation   | D To interrupt, to destroy the normal continuance of something               |
| 5 To break down  | E To prohibit from doing something   |
| 6 To inhibit     | F To decompose   |
| 7 Rash           | G A disease that causes large, itchy patches to appear on the skin           |
| 8 Hives          | H An end organ, specialized to be sensitive to stimulating agents            |
| 9 Swelling       | I An area of spots or redness on the skin                                    |
| 10 To switch to  | J The cultivation of bacteria, cells, etc.                                   |
| 11 To disrupt    | K An abnormal enlargement or protuberance                                    |
| 12 Receptor      | L A circumscribed mass of microorganisms                                     |

### 3 Summarize the main features of penicillin using your own words.