Drugs

➤ Drugs

A **drug** is any substance that is taken into the body that changes or affects chemical reactions in the body. There are different kinds of drugs for example, antibiotics and painkillers.

➤ Antibiotics

- **Antibiotics reduce bacterial growth and can stop its spread.** Therefore they actually reduce the number of pathogens and treat the underlying problem, rather than just treating the symptoms like painkillers.
- **Antibiotics kill bacteria.** Antibiotics work by killing infective bacteria in the body. They do not damage the host cells, but instead specifically target bacteria. An example of an antibiotic is penicillin.
- **Each bacteria requires a specific antibiotic.** Different bacteria have different properties, so must be targeted by certain antibiotics. Antibiotics target specific aspects of a bacterium's structure in order to harness these weaknesses, for example certain antibiotics attack the cell walls of bacteria. Therefore, different antibiotics are required for different types of bacteria.

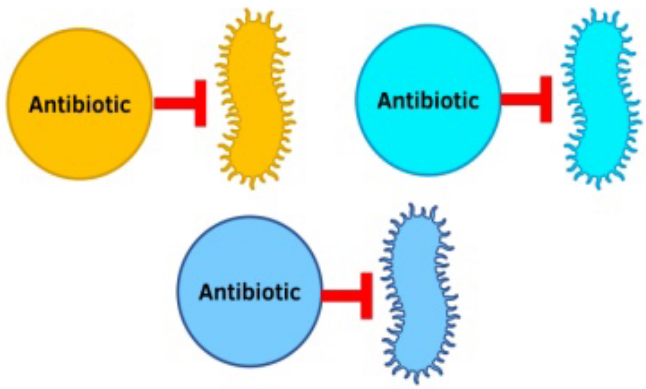


Fig 1. Antibiotics are specific. Each bacteria requires a specific antibiotic.

- **Antibiotics are a key part of medicine.** Antibiotics have saved many lives over the years, and antibiotics allow us to do many things that were previously

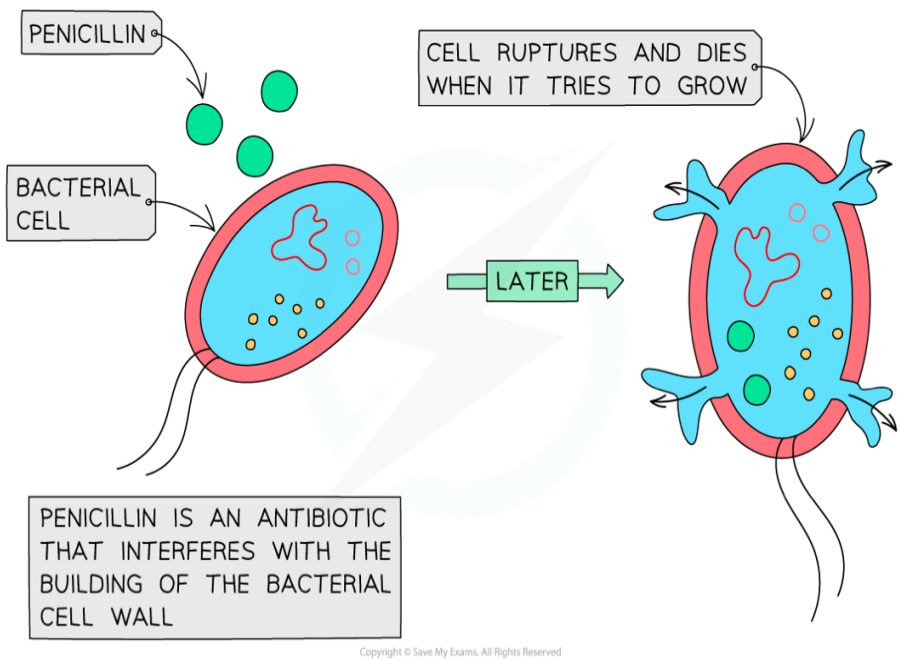
impossible. Everyday medical treatments, such as surgery, would be impossible without antibiotics.

- **Resistant strains cause serious infection:** resistant strain could cause serious infection and can't be treated by antibiotics. For example **MRSA (Methicillin - resistant staphylococcus aureus)** causes serious wound Infection and it is resistant to powerful antibiotic Methicillin
- **Complete course of antibiotics:** It is necessary to complete course of antibiotic to feel fully healthy. These course may be 3 days, 5 Days or 7 days course.

➤ How antibiotics work

Antibiotics work by stopping bacteria cellular processes such as the production of the cell wall – they affect processes usually only in bacteria so are not harmful to animal cells

- For example : **Penicillin** was the first antibiotic to be discovered and is widely used, although resistance is a problem



➢ Painkillers

- **Painkillers are used to relieve symptoms.** They do not get rid of infection. Examples include ibuprofen and paracetamol.
- **Painkillers help relieve pain or other symptoms but don't treat the cause.** For example, if you have a bacterial infection, the painkillers don't kill the bacteria but help soothe the symptoms.

Drugs— Came from plants

- Traditionally drugs were extracted from plants and microorganisms
- New drugs are being developed all the time by scientists at universities and drug companies around the world
- Lots of the medications that we use today are based on **chemicals extracted** from plants
    - The heart drug **digitalis** originates from **foxgloves**
    - The painkiller **aspirin** originates from **willow**
    - **Penicillin** was discovered by Alexander Fleming from the Penicillium mould
- Most new drugs are synthesized by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant

➢ Discovery of Penicillin

- Penicillin was first discovered by Alexander Flemming in 1928. He left some Petri dishes that had been **contaminated** with mould and found the bacteria would not grow near the mould
- He discovered that the mould (Penicillium notatum) was releasing a chemical (penicillin) that killed the bacteria surrounding it
- New drugs are now developed by the pharmaceutical industry. Many of these still have plants as their source

Testing and Developing New Drugs

➢ Testing the Drugs

All new drugs need to be tested and trialled before they can be used in patients. They are tested for:

- **Toxicity** – does it have harmful side effects?
- **Efficacy** – does the drug work?
- **Dose** – what dose is the lowest that can be used and still have an effect

➢ Developing New drugs

The 3 main stages of drug development

1- Preclinical Testing

- The drug is tested on cells in the lab
- Computer models may also be used to simulate the metabolic pathways that may be taken by the drug
- **Efficacy** and **toxicity** are tested at this stage

2- Whole organism testing

- The drug is tested on animals to see the effect in a whole organism – all new medicines in the UK have to have tests on 2 different animals by law
- **Efficacy**, **toxicity** and **dosage** are tested at this stage

3- Clinical trials

- The drug is tested on human volunteers first, generally with a very low dose then increased. This is to make sure it is safe in a body that is working normally
- The next stage is to test on patients with the condition.
- The patients are often split into two groups; one given the drug the other given a **placebo**. This is called a **double-blind study** – neither the doctor nor the patient knows if the patient is getting the placebo or the active drug
- Once the drug is found to be safe then the lowest effective dose is tested at this stage