Thanks to antibiotics we are able to fight off potentially deadly bacterial infections. Antibiotics, save lives, on average adding 20 years to life expectancy.

But the more antibiotics we take the less effective they get - why?

**Antibiotic resistance**

Using antibiotics is causing bacteria to become resistant to them - meaning that they are no longer killed.

Only two new types of antibiotic have been developed in the last 40 years so we don’t have new drugs to fight antibiotic resistant bacteria. This means that getting infected by an antibiotic resistant strain is life-threatening as we do not have antibiotics that will fight them, and relying on our own immune system to do the job is often not enough.

The incentive to develop new antibiotics is low because whenever a new antibiotic is introduced, it is not long before bacteria become resistant to it.

**What is the solution?**

Microbiologists, like the ones at The University of Oxford, are researching into possible other strategies to kill harmful bacteria.

---

**Your task:**

1. Complete storyboard A to show how using antibiotics increases the number of resistant bacteria.
   a) Describe what happened to the population of resistant bacteria when the person took antibiotics.
   b) Predict what would have happened if they had not taken antibiotics.
   c) Explain why taking antibiotics increases the population of resistant bacteria.

2. Bacteria exist in large groups called colonies. Many species release products into the environment that improve overall growth.
   These products include enzymes that break down food sources and scavenging molecules that help collect scarce resources, such as iron.

   Making these products will slow the reproduction of the bacteria that makes the product, because production uses energy. However, because the products are released into the environment, they help the growth of the bacteria around them.

   Complete storyboard B.
   a) If the bacteria become resistant to the drug it will increase how effective it is. Explain why.
   b) Should scientists pool their efforts into discovering new antibiotics or researching into alternatives such as this drug? Explain your choice.
# Alternative antibiotics

## A

<table>
<thead>
<tr>
<th>A population of bacteria live inside a human body. A few have a random mutation, which means they are resistant to an antibiotic. Colour in two bacteria – these are resistant.</th>
<th>The person takes the antibiotic. It kills the non-resistant bacteria. Draw how the population will look now.</th>
<th>The remaining bacteria reproduce. Draw how the population will look now.</th>
</tr>
</thead>
</table>

## B

<table>
<thead>
<tr>
<th>A population of bacteria live inside a human body. They release products that increase growth. A few have a random mutation. The arrows show the release of the product. The dark bacteria is the mutant.</th>
<th>The person takes a drug that stops the release of the product. The mutant bacteria are not affected. Draw how the population will look now. Include arrows to show cells that are releasing the product.</th>
<th>Only the bacteria that are not making the product have enough energy to reproduce. Draw how the population will look now.</th>
</tr>
</thead>
</table>