

# It's the small things in life: The perils and power of microbiomes

## Teacher notes

### Introduction

This investigation ties in with curriculum requirements on **the spread and prevention of communicable diseases, the development of antibiotic resistance in bacteria and ecosystems and competition.**

The presentation *The perils and power of microbes* supports the questions and activities on the student activity sheet.

Students are introduced to the idea of **microbiomes** – the ecosystems of microorganisms that live inside the body of humans, chickens and other living things, as well as in the soil, water and air. The focus of the material can be:

- how the mixing of microbiomes from different organisms can cause disease
- the problems of antibiotic resistance in bacteria and the search for new antibiotics
- microbiomes as examples of ecosystems, and the production of antibiotic substances by some of the microorganisms in a microbiome as an example of competition between species.

### Assumed prior learning

- Knowledge of gut microorganisms is helpful, as is knowledge of the transmission of disease and methods of preventing spread, but equally these activities could be used to introduce many of these ideas to students.
- Knowledge of antibiotic resistance in bacteria is useful.
- Concepts of ecosystems and competition are useful, although this could also be used to introduce ideas of competition and natural selection.

### Learning objectives

Explain what a microbiome is.

Explain how some communicable diseases are spread between animals and humans.

Describe the importance of interdependence and competition in a community.

Explain how antibiotic resistance can arise through natural selection of bacteria best able to survive, and recognise that the development of such resistance is direct evidence for evolution.

Describe ways of minimising the development of antibiotic-resistant bacteria.

### Answers to questions

1. All the microorganisms in a particular ecosystem and/or the total genetic material of the microorganisms in a particular ecosystem.  
(**Note:** explain to students that **microbiota** is the correct word for the microbes in a habitat – microbiome is all their genes – but we often use 'microbiome' to refer to the combined microbiota.)
2. **a)** The human microbiome is largely in the gut, so the food we eat could provide good material for the growth of useful microbes or else encourage growth of microbes that are less healthy.



**b) Probiotics:** yoghurts, desserts that contain high numbers of ‘good’ microorganisms that help to populate the gut. (Especially useful after the gut microbiome is destroyed in any way, for example by a course of antibiotics. Probiotics need to be used for a long time to have an effect.)

**Prebiotics:** leeks, onions, asparagus, Jerusalem artichokes – foods that supply inulin and other substances that encourage the growth of healthy bacteria in the gut microbiome.

3. An obvious answer for students to work out is antibiotics – they destroy pathogenic bacteria and can also destroy useful gut bacteria.

Some students may have experience of other drugs that also affect the microbiome, especially of the mouth. These include inhaled steroids for asthma treatment, wearing false teeth, having a dry mouth as a result of medication, having chemotherapy or radiotherapy for cancer treatment.

4. **a)** Microorganisms that are harmless in one species can cause disease/act as pathogens in another **or** pathogens can affect more than one species so if the microbiomes of two species meet in some way pathogens may be passed from one to the other.

**b)** Any sensible examples, such as *Campylobacter* from chickens and other poultry to humans, tuberculosis from cattle to people or badgers to cattle, bird flu from chickens/ducks to people.

### Activity

Look for evidence of good research, understanding of the science and effective communication. Suggestions for helpful websites are given in the teacher’s notes in the presentation (*The perils and power of microbes*).