Health and microbes

Teacher review edition. Ask your teacher if anything is unclear.

How can we distinguish useful microbes from pathogens and judge health claims?

What you will learn

- Describe useful and harmful roles of microbes.
- Distinguish bacteria from viruses.
- Describe some of the body's defences.
- Explain why one person's experience is not enough to prove a health claim.

What is health?

> **Health**
> Physical, mental and social wellbeing.

Health includes physical, mental and social wellbeing. It is influenced by many things, including inherited characteristics, diet, activity, living conditions, infection and access to healthcare.

A single habit does not explain every illness. People with similar habits or inherited risks can have different health outcomes.

Microorganisms are not all harmful

> **Pathogen**
> An organism or infectious agent that causes disease.
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> **Microorganism**
> A living organism too small to see clearly without a microscope.

Microorganisms, such as bacteria and microscopic fungi, are too small to see clearly without a microscope. Many are harmless or useful. Viruses are also studied as microbes, but they must use living cells to reproduce.

- Some bacteria help with digestion.
- Microbes are used in food production.
- Decomposers break down dead material and return nutrients to the environment.
- A pathogen causes disease. Some bacteria, fungi and viruses are pathogens, but not all microbes cause disease.

Bacteria and viruses

Bacteria and viruses have different structures and reproduce in different ways.

- Bacteria are single-celled organisms.

- Viruses are much smaller and use living cells to make more viruses.
- Antibiotics act against certain bacteria. They do not kill viruses, so they do not treat the virus itself in a viral infection.

The body's defences

> **Immune response**
> The body's defence against pathogens and other harmful material.

The body has barriers that help keep pathogens out. If pathogens enter, the immune system responds.

- Skin forms a physical barrier.
- Mucus traps microbes.
- Stomach acid kills many swallowed microbes.
- Some white blood cells engulf pathogens.
- Other white blood cells help make antibodies, which recognise particular targets on pathogens.

What does a risk factor mean?

> **Risk factor**
> Something that changes the chance of a health outcome.

A risk factor changes the chance of an outcome. It does not tell us for certain what will happen to one person. For example, a factor linked to a greater chance of disease does not mean that everyone with that factor will develop the disease.

Scientists compare groups to investigate risks. They also consider other differences between the groups, such as age, that could affect the result.

Checking a health claim

> **Reliable health evidence**
> Health information supported by trustworthy sources and well-conducted investigations.

Suppose someone says, "I took this product and felt better, so it cured me." That is one person's experience. The person might have recovered naturally or changed something else at the same time.

A fair comparison provides stronger evidence. Ask what was measured, how many people were included and whether the groups were similar before the comparison. A headline or advertisement is not the same as the full evidence.

- Who made the claim, and are they selling something?
- What evidence supports it?
- Was there a fair comparison?

- Could another factor explain the result?
- Does a reliable health organisation support the information?

Worked examples

An advertisement says that a drink improved people's energy. However, the group drinking it was much younger than the comparison group. Age could explain some of the difference.

Work through it

1. Identify the claim: the drink caused the improvement.
2. Check whether the groups were similar before the test.
3. Notice the age difference, which could affect the result.
4. Conclude that this comparison alone cannot show that the drink caused the improvement.

Common mistakes

Common mistake: All microbes cause disease.

Remember: Many are harmless or useful, including microbes involved in digestion, food production and decomposition.

Common mistake: Antibiotics kill viruses.

Remember: Antibiotics act against certain bacteria. Viruses have different structures and use living cells to reproduce.

Answering questions

- When evaluating a claim, identify the comparison and consider another possible explanation for the result.
- Use "increases the chance" when discussing a risk factor. Explain why it does not predict what must happen to one person.

Try an investigation

Compare two fictional health advertisements with a supplied evidence summary. Identify the claim, the evidence and any missing information. Use approved school procedures for any microbiology work.

Plan, record and review

- Question and prediction: What are you testing, and what do you think will happen? Give a reason.
- Change, measure, keep the same: What will you deliberately change? What will you measure, and in what units? What stays the same to make it a fair test? For an observation, say what you will record consistently instead.
- Record and look for a pattern: Use a table with headings and units. Look for a pattern or a result that does not fit.
- Conclude from evidence: Answer your question using a result or observation. Say if the evidence is unclear.
- Improve the investigation: What would you repeat or change, and how would that make the evidence better?

Do practical work with your teacher and follow the laboratory safety instructions.