**Pathogens**

Some children are learning about pathogens.

They share their ideas about pathogens.

**Connor**

Bacteria and viruses are pathogens.

**Freya**

Pathogens are microorganisms.

**Amelia**

‘Pathogens’ is the scientific word for ‘germs’.

**Yasmin**

Different diseases are caused by different types of pathogens.

**Jayden**

All diseases are caused by pathogens.

**Lawrence**

All pathogens are the same.

**To talk about in your group**

1. Who do you **agree** with?
2. Who do you **disagree** with, and why?
3. How would you explain the right ideas to these children?

*Biology> Big idea BHD: Health and disease > Topic BHD3: Health and infectious disease > Key concept BHD3.1: Pathogens*

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| **Response activity** |
| **Pathogens** |

**Overview**

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| Learning focus: | The health of humans, other animals and plants can be affected by diseases caused by infection with pathogens, including viruses and some bacteria and fungi. |
| Observable learning outcome: | Recall that ‘germs’ are disease-causing microorganisms also known as pathogens, including bacteria, fungi and viruses. |
| Activity type: | Discussion, talking heads |
| Key words: | Health, disease, microorganisms, pathogens |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic questions:

* Diagnostic question: ‘Germs’
* Diagnostic question: Causes of disease

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| **P** | **PRIOR UNDERSTANDING**  This activity explores ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

In a study of students aged 12-13 in England, the terms ‘microorganism’ and ‘microbe’ were not used spontaneously to describe organisms such as bacteria that are too small to see with the unaided eye; the term ‘germ’ was most commonly used, followed by ‘bug’ (Maxted, 1984).

The term ‘germ’ is often used indiscriminately without understanding of the existence of (or differences between) separate types of disease-causing microorganisms such as bacteria and viruses. In a classic study of British and American children aged 5-11, all participants referred to a single type of ‘germ’ and were unaware that different diseases are caused by different pathogens (Nagy, 1953). Half of the English 12-13 year-olds in Maxted’s study (1984) suggested that different types of ‘germs’ caused different diseases, while only 9% of students aged 15 in a study in England by Prout (1985) knew that bacteria and viruses were different types of disease-causing agents.

When asked about “healthiness”, children up to age 12 primarily equated the term with eating a healthy diet and being physically active (Hesketh et al., 2005; Protudjer et al., 2010). When children aged 5-9 in Australia (Brindal et al., 2012), 9-11 in the US (Reeve and Bell, 2009) and 14-15 in Turkey (Çetin et al., 2013) were asked to draw and write about healthy and unhealthy things, most of the students’ answers related to food and drink (over 60% in the US study) and physical activity.

When asked to draw and write about “disease” (Isik, Çetin and Özarslan, 2017), children aged 14-15 in Turkey referenced the following as causes of disease: microbes [58% of answers in which a cause was mentioned], malnutrition [15%], cigarettes and alcohol [11%], and dirty environment [9%]. Similar results were observed when children aged 8-11 in Hungary were asked to draw and write about causes of disease (Piko and Bak, 2006).

**Ways to use this activity**

Students should complete this activity in small groups. The focus of the activity should be on group discussion to answer the questions.

It is through the discussions that students can check their understanding and develop their explanations. Listening in to the conversations of each group will often give you insights into how your students are thinking. The quality of the discussions can be improved with a careful selection of groups, or by allocating specific roles to students in each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers; they may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

After their discussions, each group should be prepared to report the key points of their discussion to another group, or to the class.

*Differentiation*

You may choose to read the speech bubbles and questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

Students should **agree** with Amelia (“‘Pathogens’ is the scientific word for ‘germs’”) and Yasmin (“Different diseases are caused by different types of pathogens”).

They should also **agree** with Connor (“Bacteria and viruses are pathogens”), though they may wish to explain to Connor that not all bacteria are pathogens, and also that some fungi are pathogens.

They should also **agree** with Freya (“Pathogens are microorganisms”), though older or more able students might find it interesting to explore the issue of whether viruses should be classified as (micro) organisms. Viruses display some but not all of the seven characteristic processes of living organisms; furthermore, a big idea in biology is the cellular basis of life, and viruses are not made of cells. Should they be considered organisms if they would not, by those definitions, be considered alive?

Students should **disagree** with Jayden (“All diseases are caused by pathogens”), and may wish to explain to Jayden that some diseases are not caused by pathogens/’germs’ but result from other environmental factors, lifestyle choices, or inherited information in the genome.

Students should **disagree** with Lawrence (“All pathogens are the same”), and may wish to explain to Lawrence that Yasmin has the right idea (“Different diseases are caused by different types of pathogens”) and that viruses, some bacteria and some fungi are all different types of pathogens. You may wish to follow this up by asking students to talk about whether they think antibiotics work for all pathogens, and therefore whether they can be used to treat all diseases (the answer is no in both cases; antibiotics do not work against viruses).

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Images: book – adapted by UYSEG from pixabay.com/Clker-Free-Vector-Images (312393); bacterium – adapted by UYSEG from pixabay.com/OpenClipart-Vectors (156869)

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