**Food poisoning**



Timmy has symptoms of food poisoning.

His food poisoning was caused by bacteria in some food he ate. The bacteria are pathogens.

1. When do you think Timmy ate the food with the bacteria in it?

|  |  |
| --- | --- |
| **A** | One or two minutes ago. |
| **B** | One or two days ago. |
| **C** | One or two months ago. |

1. Which is the best explanation for your answer to question 1?

|  |  |
| --- | --- |
| **A** | Pathogens cause symptoms as soon as they get inside your body. |
| **B** | It’s never because of the last meal you ate. |
| **C** | Pathogens reproduce inside your body and when there are enough of them you get symptoms. |
| **D** | Pathogens have to walk around inside your body until they find a place where they can cause symptoms. |

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

|  |
| --- |
| **Diagnostic question** |
| **Food poisoning** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The health of humans, other animals and plants can be affected by infection with pathogens, including viruses and some bacteria and fungi. |
| Observable learning outcome: | Apply the idea that pathogens do not cause symptoms of ill health until they are present in sufficient numbers. |
| Question type: | Two-tier multiple choice |
| Key words: | Health, disease, pathogens, bacteria, symptoms |

|  |  |
| --- | --- |
| **B** | **BRIDGING**  This diagnostic question probes understanding of ideas that are usually taught at age 14-16, to build a bridge to later stages of learning. |

**What does the research say?**

Research suggests that young children’s primary source of health information is their family, television, public health campaigns, and also teachers and friends at school (Maxted, 1984; Brindal et al., 2012). What students learn about microorganisms (often specifically pathogens) from their family, their peers and the media predates and often contrasts with what they learn in school (Bandiera, 2007).

Symptoms of disease appear when the body’s cells or systems have been damaged or are not working normally. An organism may not always show symptoms after infection with a pathogen; pathogens only cause symptoms when they are present in sufficient numbers. Barenholz and Tamir (1987) found that students aged 15-17 could not adequately explain how microorganisms cause symptoms of disease; although they held some correct rudimentary notions such as that microorganisms inside the human body would breed and ‘poison us’, they also held animistic and anthropomorphic views such as that they would ‘walk about’ and ‘eat us’.

**Ways to use this question**

Students should complete the questions individually. This could be a pencil and paper exercise, or you could use the presentation with an electronic voting system or mini white boards.

*Differentiation*

You may choose to read the 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**

**1B** – One or two days ago.

**2C** – Pathogens have to reproduce inside your body until there are enough of them to cause symptoms.

If students choose **1A** (“One or two minutes ago”) or **2A** (“Pathogens cause symptoms as soon as they get inside your body”) they may have misunderstandings about the need for pathogens to be present in sufficient numbers before they cause noticeable symptoms. Alternatively, if they choose **1A** (“One or two minutes ago”) or **1C** (“One or two months ago”) they may have misunderstandings about the rate at which bacteria reproduce.

If students choose **2B** (“It’s never because of the last meal you ate”) they may be relying upon things they have been told in everyday life, rather than scientific understanding. Similarly, **2D** (“Pathogens have to walk around inside your body until they find a place where they can cause symptoms”) could indicate animistic and anthropomorphic thinking, such as that pathogens have limbs or act with intent.

**How to respond - what next?**

If there is a range of answers, you may choose to respond through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas (meaning making) through dialogue.

If students have misunderstandings about the rate at which bacteria reproduce, the following BEST ‘response activity’ provides practice in applying the idea that bacteria multiply by dividing, and could be used in follow-up to this diagnostic question:

* Response activity: Divide and conquer

The idea that pathogens do not cause symptoms of ill health until they are present in sufficient numbers will be helpful in later study when students encounter the idea that asymptomatic individuals can sometimes pass on diseases. The idea that bacteria multiply by dividing in two, and that growth of a bacterial population can be exponential in ideal conditions, will be helpful in later study when students explore the importance of hygiene and proper storage of food in reducing the risk of infection.

**Acknowledgments**

Developed by Alistair Moore (UYSEG).

Images: pixabay.com/PaliGraficas (3176411)

**References**

Bandiera, M. (2007). Micro-organisms: everyday knowledge predates and contrasts with school knowledge. In Pintó, R. & Couso, D. (eds.) *Contributions from Science Education Research.* Berlin: Springer.

Barenholz, H. and Tamir, P. (1987). The design, implementation and evaluation of a microbiology course with special reference to misconceptions and concept maps. In Novak, J. D. (ed.) *Proceedings of the 2nd International Seminar: Misconceptions and Educational Strategies in Science and Mathematics, 26-29 July.* Ithaca, N.Y.: Cornell University.

Brindal, E., et al. (2012). How do Australian junior primary school children perceive the concepts of "healthy" and "unhealthy"? *Health Education,* 112(5)**,** 406-420.

Maxted, M. A. (1984). *Pupils' prior beliefs about bacteria and science processes: their interplay in school science laboratory work.* MA, University of British Columbia, Canada.