**Yogurt drink**

**Part 1**



The picture shows a yogurt drink.

The yogurt drink contains living bacteria.

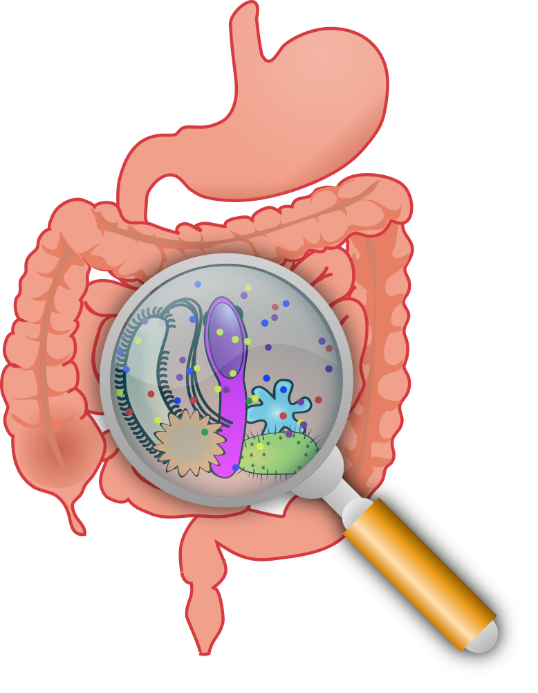
Why does the yogurt drink contain living bacteria?

Tick **one** box for each statement.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statements** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | It must be a mistake! Bacteria only cause disease. |  |  |  |  |
| **2** | They are just contamination. |  |  |  |  |
| **3** | They are helpful bacteria. |  |  |  |  |
| **4** | The bacteria could have been used to make the yogurt. |  |  |  |  |
| **5** | It tops up bacteria that live in our digestive system. |  |  |  |  |

**Yogurt drink**

**Part 2**

The yogurt drink contains living bacteria.

Drinking it tops up bacteria that live in our digestive system.

What do the bacteria that live in our digestive system do?

Tick **one** box for each statement.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statements** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | They only cause disease. |  |  |  |  |
| **2** | They help to defend against pathogens. |  |  |  |  |
| **3** | They help us to digest food. |  |  |  |  |
| **4** | They make some vitamins. |  |  |  |  |

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

|  |
| --- |
| **Diagnostic question** |
| **Yogurt drink** |

**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: | Recognise that not all microorganisms cause ill health. |
| Question type: | Confidence grid |
| Key words: | Health, disease, pathogens, microorganisms, bacteria |

**What does the research say?**

The common and incorrect practice of referring to *all* microorganisms as ‘germs’ or ‘bugs’ (or even as ‘pathogens’) indicates the misunderstanding that all microorganisms cause disease (Byrne and Sharp, 2006). Most bacteria and fungi are not pathogenic; many have beneficial and important roles (e.g. the breakdown and cycling of substances by decomposers, and the roles of the gut microbiota in supporting digestion and nutrition), and some are used by humans to perform useful functions (e.g. in fermentation to produce foodstuffs or to synthesise medicines).

Bacteria and other microorganisms are often portrayed in everyday life and even in lessons in a negative light, particularly in disease contexts; this likely contributes to widespread negative perceptions of microorganisms, and to concerns that many students (and teachers) have about working with living microorganisms in lessons (Lock, 1996); it also underscores the need for positive approaches to reassure students that most microorganisms are not harmful (Lock, 2011).

In a study of concept maps drawn by 169 students, Byrne & Grace (2010) found that 11-year-olds much more readily associate microorganisms with disease and the spoilage of food than with any useful roles. In a subsequent study of concept mapping, drawing and interviews with 458 students, Byrne (2011) found that negative perceptions of microorganisms were present in students of all ages from 7-14. In a study of 836 primary school students, over half described microorganisms as being harmful, dirty or a form of pollution (Karadon and Şahin, 2010).

**Ways to use this question**

Students should complete the confidence grids 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 and statements 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**

*Part 1*

1. It must be a mistake! Bacteria only cause disease – **wrong**
2. They are just contamination – **wrong**
3. They are helpful bacteria – **right**
4. The bacteria could have been used to make the yogurt – **right**
5. It tops up bacteria that live in our digestive system – **right**

*Part 2*

1. They only cause disease – **wrong**
2. They help to defend against pathogens – **right**
3. They help us to digest food – **right**
4. They make some vitamins – **right**

**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.

When teaching about pathogens, care should be taken to avoid creating or reinforcing the common misunderstanding that *all* microorganisms cause disease. It will be helpful to positively reinforce the messages that most bacteria and fungi are not pathogenic, that many have beneficial and important roles (e.g. the breakdown and cycling of substances by decomposers, and the roles of the gut microbiota in supporting digestion and nutrition), and that some are used by humans to perform useful functions (e.g. in fermentation to produce foodstuffs or to synthesise medicines).

If students struggle to accept that microorganisms can be useful, or that helpful bacteria live in our digestive systems and can be eaten, giving students the chance to explore and also taste foods and drinks made using microorganisms has been shown to increase engagement and foster positive attitudes ("Menus Made By Microbes", Verran et al., 2019). Examples could include yogurt, cheese, butter, sourdough bread, sauerkraut, kefir, yeast extract spread (e.g. Marmite) and even alcohol-free versions of wine and beer.

The following BEST ‘response activity’ facilitates a role-play activity in which students debate the positive and negative roles played by microorganisms, and could be used in follow-up to this diagnostic question:

* Response activity: Microorganisms on trial!

**Acknowledgments**

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Images: yogurt bottle – UYSEG; strawberry – pixabay.com/OpenClipart-Vectors (576772); gut with magnified microorganisms – adapted by UYSEG from pixabay.com/OpenClipart-Vectors (160524)

**References**

Byrne, J. (2011). Models of micro-organisms: children's knowledge and understanding of micro-organisms from 7 to 14 years old. *International Journal of Science Education,* 33**,** 1927-1961.

Byrne, J., Grace, M. and Jenny Byrne and Marcus, G. (2010). Using a concept mapping tool with a photograph association technique (CoMPAT) to elicit children's ideas about microbial activity. United Kingdom.

Byrne, J. and Sharp, J. (2006). Children's ideas about micro-organisms. *School Science Review,* 88(322)**,** 71-80.

Karadon, H. D. and Şahin, N. (2010). Primary school students’ basic knowledge, opinions and risk perceptions about microorganisms. *Procedia Social and Behavioral Sciences,* 2(2)**,** 4398-4401.

Lock, R. (1996). Educating the "New Pasteur". *School Science Review,* 78**,** 63-72.

Lock, R. (2011). Microbiology and biotechnology. In Reiss, M. (ed.) *Teaching Secondary Biology.* 2nd ed. London, UK: Hodder Education.

Verran, J., et al. (2019). Refreshing the public appetite for 'good bacteria': menus made by microbes. *Journal of Biological Education,* 53(1)**,** 34-46.