**Passing it on**



Zara

Anna



Zoe

gave birth to

**Read the information about Zara, Zoe and Anna:**

* Zara gave birth to Zoe.
* As soon as she was born, Zoe went to live with Anna.
* Zoe is now a teenager.
* Zoe has lived with Anna all her life.
* Zara has not seen Zoe since she was born.

gave birth to



Zara

Anna



Zoe

* Zara gave birth to Zoe.
* As soon as she was born, Zoe went to live with Anna.
* Zoe is now a teenager.
* Zoe has lived with Anna all her life.
* Zara has not seen Zoe since she was born.

Zoe inherited a disease that affects her muscles. She has had it all her life.

**Part 1**

1. Who did Zoe inherit the disease from?

|  |  |
| --- | --- |
| **A** | Anna |
| **B** | Zara |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | Zoe got the disease from her mother. |
| **B** | The disease was passed on when Zoe was born. |
| **C** | You only catch diseases from people who are nearby. |
| **D** | “Inherited” means the same as “infected”. |

gave birth to



Zara

Anna



Zoe

* Zara gave birth to Zoe.
* As soon as she was born, Zoe went to live with Anna.
* Zoe is now a teenager.
* Zoe has lived with Anna all her life.
* Zara has not seen Zoe since she was born.

Zoe inherited a disease that affects her muscles. She has had it all her life.

**Part 2**

1. Which statement do you agree with?

|  |  |
| --- | --- |
| **A** | Zoe’s disease is caused by germs. |
| **B** | Zoe’s disease is caused by genetic information in her genome. |
| **C** | Zoe’s disease was caused by her behaviour and lifestyle. |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | All diseases are caused by germs. |
| **B** | Zoe got the disease because she did not take care of her health. |
| **C** | You cannot inherit germs. |
| **D** | The genetic information you inherit affects your features. |

gave birth to



Zara

Anna



Zoe

* Zara gave birth to Zoe.
* As soon as she was born, Zoe went to live with Anna.
* Zoe is now a teenager.
* Zoe has lived with Anna all her life.
* Zara has not seen Zoe since she was born.

Zoe inherited a disease that affects her muscles. She has had it all her life.

**Part 3**

1. Which statement do you agree with?

|  |  |
| --- | --- |
| **A** | Zoe could **not** pass this disease to Anna. |
| **B** | Zoe could pass this disease to Anna. |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | Zoe could pass the germs to Anna. |
| **B** | They are not related. |
| **C** | Zoe could only pass the genetic information to her children. |
| **D** | They live close together and touch the same surfaces in the house. |

*Biology > Big idea BHD: Health and disease > Topic BHD1: What are health and disease? > Key concept BHD1.2: Disease*

|  |
| --- |
| **Diagnostic question** |
| **Passing it on** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The good health of organisms can be compromised by infectious and non-infectious diseases, which can be caused by germs, lifestyle, environment, or information in the genome. |
| Observable learning outcome: | Recall that diseases can be caused by germs, lifestyle, environment or information in the genome. |
| Question type: | Two-tier multiple choice |
| Key words: | Health, disease |

**What does the research say?**

When children aged 14-15 in Turkey were asked to draw and write about disease, many answers depicted causes of disease; of these, the most common themes were microbes (58% of answers in which a cause of disease was included), bad diet and malnutrition (15%), cigarettes and alcohol (11%), and a dirty environment (9%) (Isik, Çetin and Özarslan, 2017). Similar results were observed with children aged 8-11 in Hungary (Piko and Bak, 2006). It was not reported that any children in either study included inheritance, genes, DNA or the genome as causes of disease in their answers.

Raman and Gelman (2005) used fictional ‘switched at birth’ scenarios to investigate whether children aged 5-11 could attribute different modes of transmission to genetic disorders and infectious diseases. They found that children’s ability to link genetic disorders to birth parents (rather than to adoptive parents) increases with age, and that even the youngest children were capable of deducing the correct mode of transmission of a disease (i.e. contagion or inheritance) with a better success rate than chance when given appropriate cues. Fictional diseases were used to rule out the effects of prior knowledge of modes of transmission of particular diseases. Results suggested that the key cue used by children to decide whether a disease was more likely to have been acquired by inheritance or contagion was whether the disease was said to be permanent or temporary.

**Ways to use this question**

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

*Differentiation*

You may choose to read the questions and answers 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. **B** – Zara
2. **A** – Zoe got the disease from her mother.

Answer 2B (“The disease was passed on when Zoe was born.”) is true, but it is not the best explanation in this case because it does not distinguish between inheritance and infection/contagion, and could apply to either Anna or Zara.

Students who pick answers 1A (“Anna”), 2C (“You only catch diseases from people who are nearby”) or 2D (“’Inherited’ means the same as ‘infected’”) may not understand the difference between inheritance and infection/contagion.

*Part 2*

1. **B** – Zoe’s disease is caused by genetic information in her genome.
2. **D** – The genetic information you inherit affects your features.

Students who pick answers 1A (“Zoe’s disease is caused by germs”) and 2A (“All diseases are caused by germs”) may not understand the difference between inheritance and infection/contagion.

Students who pick answers 1C (“Zoe’s disease was caused by her behaviour and lifestyle”) and 2B (“Zoe got the disease because she did not take care of her health”) may have the ‘imminent justice’ idea that disease arises as punishment for misbehaviour.

Answer 2C (“You cannot inherit germs”) is true, but is not the best explanation in this case, as it could also apply to diseases that arise from lifestyle or behaviour.

*Part 3*

1. **A** – Zoe could not pass this disease to Anna.
2. **C** – Zoe could only pass the genetic information to her children. (Or, less ideally, **B** – They are not related.)

Students who pick answers 1B (“Zoe could pass this disease to Anna”), 2A (“Zoe could pass the germs to Anna”) and 2D (“They live close together and touch the same surfaces in the house”) may not understand the difference between inheritance and infection/contagion.

**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 inheritance and the idea that the genetic information in your genome affects your features, topic BHL1 *Inheritance and the genome* provides diagnostic questions and response activities to further probe and develop students’ understanding.

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from diagnostic instruments described by Raman and Gelman (2005).

Images: adapted by UYSEG from pixabay.com/heblo (1091148, 2077339, 1087037)

**References**

Isik, E., Çetin, G. and Özarslan, M. (2017). Students' views about disease concept: drawing and writing technique. *Asia-Pacific Forum on Science Learning and Teaching,* 18(2).

Piko, B. F. and Bak, J. (2006). Children’s perceptions of health and illness: images and lay concepts in preadolescence. *Health Education Research, Theory and Practice,* 21(5)**,** 643-653.

Raman, L. and Gelman, S. A. (2005). Children's understanding of the transmission of genetic disorders and contagious illnesses. *Developmental Psychology,* 41(1)**,** 171-182.