**Is it genetic?**

Look at the drawings of the two men.

Some of their features have been labelled.



hair

eye colour



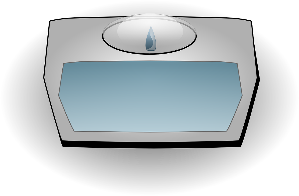
muscley arms



tattoo

height

scar



body mass

Answer the questions for **each** feature.

1. Which statement is true for the feature?

|  |  |
| --- | --- |
| **A** | It is caused by genetic information in cells and **cannot** be changed by lifestyle or the environment. |
| **B** | It is affected by genetic information in cells and by lifestyle or the environment. |
| **C** | It is caused by lifestyle or the environment. |

1. How did you decide?

*Biology> Big idea BHL: Heredity and life cycles > Topic BHL1: Inheritance and the genome > Key concept BHL1.1: Heredity and genetic information*

|  |
| --- |
| **Diagnostic question** |
| **Is it genetic?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Similarities and differences between family members can be explained by the passing of genetic information from one generation to the next and the effects of the interaction of organisms with their environment. |
| Observable learning outcome: | Recognise that an organism’s characteristics are affected by genetic information in cells and by the environment. |
| Question type: | Two-tier multiple choice |
| Key words: | heredity |

**What does the research say?**

An organism’s characteristics are affected by genetic information in cells and by the organism’s lifestyle and environment, but research indicates that most students at secondary school level think of genes as the only determinants of an organism’s characteristics – a conception dubbed ‘genetic determinism’ (e.g. Jamieson and Radick, 2017; Stern and Kampourakis, 2017). Genetic determinism can underlie (or be used to justify) dangerous assumptions and prejudices, such as that individuals are limited by their genes, and that all traits and behaviours are innate and cannot be changed.

Teaching from an early stage about the difference between inherited and acquired characteristics, and the role of environmental factors in shaping an organism’s characteristics, can help to reduce the likelihood that notions of genetic determinism will be introduced or reinforced.

Studies have found that 11 and 12-year-old students can usually distinguish between, and provide examples of, characteristics that are inherited from parents and characteristics that are caused by the environment (e.g. Cisterna, Williams and Merritt, 2013). However, it is much less common for students of this age to be able to link “characteristics that you get from your parents” to inherited genetic information. Discussions of “nature versus nurture” are not always helpful as students can conflate the two terms, or rote learn the words without understanding (Allen, 2014).

**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.

The answers to the questions will show you whether students understand that organisms have both inherited and acquired characteristics, that inherited characteristics arise from genetic information stored in cells, and that some inherited characteristics can be modified by the environment.

*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**

*Caused by genetic information in cells and* ***cannot*** *be changed by lifestyle or the environment:* eye colour (coloured contact lenses do not change underlying colour of the iris)

*Affected by genetic information in cells and by lifestyle or the environment:* hair (presence, colour), height, body mass

*Caused by lifestyle or the environment:* muscly arms, tattoo, scar

**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 through dialogue.

Researchers have used formative assessments coupled with constructivist approaches that enable students to build their own explanations of heredity, which may help to develop students’ understanding and overcome misconceptions, including the use of group discussions (e.g. Chin and Teou, 2010). If students have misunderstandings about the difference between inherited and acquired characteristics, and the effects of lifestyle and the environment on characteristics, the following BEST ‘response activity’ describes a group discussion activity that could be used in follow-up to this diagnostic question:

* Response activity: Why we look like we do

**Acknowledgments**

Developed by Alistair Moore (UYSEG).

Images: men – pixabay.com/GraphicMama-team (1456569, 1456168); scales – pixabay.com/Clker-Free-Vector-Images (35901)

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