**Why we look like we do**

Some children talk about things that affect the features of an organism.

**Eleanor**

I’m pretty sure that all of an organism’s features are due to the genetic information in cells.

**Aaron**

All of an organism’s features are due to its lifestyle or its environment.

**Lauren**

You could use an organism’s genetic information to work out exactly what it will look like.

**Louis**

Most features depend on genetic information and they can then be affected by your lifestyle and your surroundings.

**John**

I think it all

comes down to

nature versus nurture.

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

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| --- |
| **Response activity** |
| **Why we look like we do** |

**Overview**

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| --- | --- |
| 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. |
| Activity type: | Talking heads, discussion |
| Key words: | heredity, reproduction |

This activity can help students to overcome misunderstandings about the difference between inherited and acquired characteristics, and the effects of lifestyle and the environment on characteristics, through discussion in small groups. It can be used in response to the following diagnostic questions:

* Diagnostic question: What affects an organism’s features?
* Diagnostic question: Is it genetic?

**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).

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).

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on discussion within the group. Students should work together to follow the instructions on either the worksheet or the PowerPoint presentation. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

If there is disagreement when you take feedback, a good way to progress might be 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.

*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.

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the 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.

**Expected answers**

Students should recognise that Louis gives the best explanation.

**Acknowledgments**

Developed by Alistair Moore (UYSEG).

**References**

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Cisterna, D., Williams, M. and Merritt, J. (2013). Students' understanding of cells & heredity: patterns of understanding in the context of a curriculum implementation in fifth & seventh grades. *American Biology Teacher,* 75(3)**,** 178-184.

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