**Variation**

Use your understanding of variation to answer the questions.

1. Which statement do you think is true?

|  |  |
| --- | --- |
| **A** | There can be variation between individuals of the same species. |
| **B** | There **cannot** be any variation between individuals of the same species. |

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

|  |  |
| --- | --- |
| **A** | All members of the same species are exactly the same. |
| **B** | There is only variation between members of different species. |
| **C** | There are usually differences between members of the same species. |
| **D** | Any variation between members of the same species is an error. |

*Biology > Big idea BVE: Variation, adaptation and evolution > Topic BVE3: Evolution > Key concept BVE3.1: Explaining evolution*

|  |
| --- |
| **Diagnostic question** |
| **Variation** |

**Overview**

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| --- | --- |
| Learning focus: | The characteristics of a species can change over generations as advantageous adaptations become more common; this is evolution, and can be explained by a process of natural selection. |
| Observable learning outcome: | Recognise that there is variation between individuals within a species, and that only genetic variation can be inherited. |
| Question type: | Two-tier multiple choice |
| Key words: | variation, species |

**What does the research say?**

The term ‘variation’ has different meanings and usage in everyday language and in biology. In the everyday sense, the term ‘variation’ refers to differences between things; it is common for students up to age 11 to use the term ‘variation’ in its everyday sense to refer to differences *between species* (Allen, 2014). However, strictly speaking, in biology the term ‘variation’ refers specifically to differences between individuals *within* a species.

Researchers (e.g. Shtulman, 2006; Gregory, 2009) have described common misunderstandings about variation, which can persist in students up to undergraduate level, including that:

* while there are differences between species, there is no variation between individuals of the *same* species;
* a species has a uniform ‘type’ or a common ‘essence’ (this kind of thinking is called **essentialism**), and variation among individual members of the species is an anomalous or unimportant deviation from this norm.

Gregory (2009) summarises numerous studies in which it was found that when students of various ages were asked to explain evolution by natural selection, very few explicitly included ideas about variation within species (a fundamental requirement for evolution by natural selection, in which the natural variation within populations of a species can cause some individuals to have a survival and therefore reproductive advantage).

**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**

1. A - There can be variation between individuals of the same species.
2. C - There are usually differences between members of the same species.

**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 meaning of the term ‘variation’ or that it occurs within species, the following BEST ‘response activity’ could be used to build understanding by using real-life examples to challenge students’ thinking in follow-up to this diagnostic question:

* Response activity: Observing and explaining variation

**Acknowledgments**

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**References**

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Gregory, T. R. (2009). Understanding natural selection: essential concepts and common misconceptions. *Evolution: Education and Outreach,* 2**,** 156-175.

Shtulman, A. (2006). Qualitative differences between naïve and scientific theories of evolution. *Cognitive Psychology,* 52(2)**,** 170-194.