**Is it evolution?**

   

   

A teacher has asked some students to write down examples of evolution by natural selection.

How do you feel about each example in the table below – could it be an example of evolution by natural selection?

Tick **one** box for each example.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Examples** | | I am **sure** this is right | I **think** this is right | I **think** this is wrong | I am **sure** this is wrong |
| **1** | A kitten grows up to become an adult cat. |  |  |  |  |
| **2** | After chasing lots of prey, a predator’s leg muscles get bigger and it can run faster. |  |  |  |  |
| **3** | A baby inherits a useful characteristic from its parents. |  |  |  |  |
| **4** | The average beak length of a population of birds increases over many generations. |  |  |  |  |
| **5** | A girl learns to play the piano. |  |  |  |  |
| **6** | In each new generation of roses, the petals are bigger and redder. |  |  |  |  |
| **7** | A species dies out because of climate change. |  |  |  |  |
| **8** | Smartphone cameras get better with each new model of phone that is released. |  |  |  |  |

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

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

**Overview**

|  |  |
| --- | --- |
| 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: | Apply the idea that evolution by natural selection occurs within populations, over generations and without foresight. |
| Question type: | Confidence grid |
| Key words: | evolution, natural selection |

**What does the research say?**

Common misunderstandings about natural selection and evolution arise from naïve, everyday ways of thinking that – whilst intuitive and therefore difficult to overcome – do not align with the accepted scientific explanations (Gregory, 2009; Smith, 2010).

These naïve ways of thinking include **Lamarckism** (or ‘soft inheritance’). This is the incorrect belief in the inheritance of acquired characteristics, whereby evolution proceeds because organisms pass on characteristics they have acquired through use or disuse during their lifetime (Engel Clough and Wood-Robinson, 1985; Alters and Nelson, 2002). Research reported by a number of authors suggests that children up to age 11 have numerous misunderstandings about the inheritance of characteristics from one generation to the next, including that acquired characteristics (e.g. variation resulting from interaction with the environment) can be passed from parents to offspring (Cisterna, Williams and Merritt, 2013). In order to correctly explain evolution using ideas about natural selection, students must appreciate that only genetic variation can be inherited.

A similar and common misunderstanding is that changes within an individual’s lifetime constitute adaptation or evolution (Alters and Nelson, 2002) – they do not; adaptation and evolution refer to the process of accumulation of advantageous traits in a *population* over *generations* (Andersson and Wallin, 2006).

Evolution-related terminology can also be associated with misunderstandings. Terms such as “evolution”, “fitness” and “adaptation” are used in everyday life in ways that do not reflect the scientific usage, and can confuse students if they are used in teaching without careful explanation (Andersson and Wallin, 2006).

**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 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 kitten grows up to become an adult cat – **wrong** (changes within an individual’s lifetime are not evolution; in this case, it is growth and development)
2. After chasing lots of prey, a predator’s leg muscles get bigger and it can run faster – **wrong** (changes within an individual’s lifetime are not evolution, and acquired characteristics such as bigger muscles cannot be passed on to offspring – therefore do not affect the continued evolution of the species)
3. A baby inherits a useful characteristic from its parents – **wrong** (the inheritance of advantageous characteristics is a key part of evolution by natural selection, but one individual inheriting a characteristics from the previous generation is not evolution; evolution is a change in the proportion or frequency of a characteristic within a population over a number of generations)
4. The average beak length of a population of birds increases over many generations – **right** (this example is explored in more detail in the BEST response activity “Evolution in the garden”)
5. A girl learns to play the piano – **wrong** (changes within an individual’s lifetime are not evolution, and learned behaviours cannot be passed on to offspring – therefore do not affect the continued evolution of the species)
6. In each new generation of roses, the petals are bigger and redder – **right** (although this could be due to selective breeding, it could also occur due to natural selection)
7. A species dies out because of climate change – **wrong** (this is extinction, which occurs when a species does not adapt/evolve quickly enough to survive environmental change)
8. Smartphone cameras get better with each new model of phone that is released – **wrong** (this is obviously not a biological example, and refers to characteristics that have been designed rather than arose due to random variation and became more common due to natural selection)

**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 struggle to recognise what constitutes evolution, and to use the ideas of random variation, competition, fitness and natural selection to explain why it doesn’t plan in advance, the following BEST ‘response activity’ allows them to develop their understanding through small group discussion, and could be used in follow-up to this diagnostic question:

* Response activity: Evolution in the garden

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