**Silence on the island**

This article is taken from a news website:



*A cricket*

**Crickets fall silent**

Crickets are insects that make a ‘singing’ noise by rubbing their wings together. The noise can often be heard on warm summer nights.

However, in 2003 scientists on a Hawaiian island found a few crickets that were no longer able to ‘sing’. This was due to a change in the crickets’ genome, which changed the shape of their wings.

The scientists think that not ‘singing’ helped these few crickets to avoid predators. Perhaps they lived to die of old age – which for a cricket happens after only a few months!

Ten years later most of the crickets on the island were unable to ‘sing’. Silence had fallen!

Four students talk about why the silent crickets first appeared, and why they are now the most common type of cricket on the island.

**Millie**

It was random chance that the change in the crickets’ genome first appeared. It’s just coincidence that it was helpful.

**Nahum**

When ‘singing’ crickets saw that silent crickets had an advantage, they also stopped ‘singing’.

**Curtis**

The crickets evolved so that they could avoid getting eaten by predators.

**Aidan**

It was clever of the crickets to stop ‘singing’. It helped them to survive!

1. Who do you **agree** with?
2. Who do you **disagree** with?
3. How would you explain the right ideas to each person you **disagree** with?

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

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| **Diagnostic question** |
| **Silence on the island** |

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

**What does the research say?**

Biologists explain evolution by combining ideas about heritable variation, competition, fitness and natural selection to explain why advantageous traits become more common in populations over generations. To help students to become secure in doing this, it is helpful to allow them to practice with plentiful examples from the real world.

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 **teleology**, **anthropomorphism** and **Lamarckism**.

Teleology is incorrectly ascribing a goal, intention or purpose to a natural process. In the case of evolution by natural selection, it is common and intuitive – but incorrect – for students to think and use language that implies that adaptations arise by design or in order to fulfil a need (Alters and Nelson, 2002; Kelemen, 2012).

Anthropomorphism is when human emotions and motivations are incorrectly evoked to explain a phenomenon (Tamir and Zohar, 1991), for example in assuming that organisms want or choose to adapt and evolve (Legare, Lane and Evans, 2013).

Lamarckism (or ‘soft inheritance’) 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).

**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 article, 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.

**Expected answers**

Students should **agree** with **Millie**.

They should **disagree** with **Aidan**. His statement is evidence of anthropomorphic thinking, because it implies that the crickets cleverly chose to stop ‘singing’, and is incorrect – the loss of the ability to ‘sing’ was a random occurrence due to a change (mutation) in the genome that changed the shape of the crickets’ wings.

They should **disagree** with **Curtis**. His statement is evidence of teleological thinking, because it implies that the crickets deliberately or intentionally evolved in order to satisfy the need to avoid predators, and is incorrect – the loss of the ability to ‘sing’ was a random occurrence that did **not** happen with any foresight that it would be advantageous.

They should **disagree** with **Nahum**. His statement could be evidence of belief in the inheritance of acquired characteristics (Lamarckism), because it implies that some ‘singing’ crickets learned to be silent (and then must have passed this acquired characteristic on to their offspring, to explain why most crickets on the island were silent several years later).

*Extension activity 1*

More able or older students could be challenged through group discussion of a piece of text in which incorrect teleological and anthropomorphic explanations appear. Teleological explanations are common in popular media reports. This activity is based upon a piece of scientific research (Pascoal et al., 2014) that was reported on the BBC News website (Webb, 2014); the BBC News article contains some statements that could be read as teleological and anthropomorphic – for example the title: “Crickets in two places fall silent to survive”, which implies that evolution or the crickets themselves acted with foresight.

Students could be challenged to re-write these statements to avoid teleology and anthropomorphism, e.g.: “silent wing shape became more common during cricket evolution as it helped crickets to avoid predators” or “predators caused the natural selection of crickets with silent wing shape”.

*Extension activity 2*

Students could be challenged to use ideas about heritable variation, competition, advantage/fitness and natural selection to explain why the advantageous trait (the wing shape that does not make a ‘singing’ noise) became more common in the cricket population on the island over a number of generations[[1]](#footnote-1). The gist of such an explanation would be that there was (genetic) variation in the cricket population (which arose at random) – most had the wing shape that made a ‘singing’ noise but a few did not; the silent individuals had an advantage in the competition to survive, as they were less likely to be found and eaten by predators; so they were more likely to survive to reproduce (this is natural selection), and therefore to pass on (the gene/mutation for) the silent wing shape; over a number of generations (the gene/mutation for) the silent wing shape became more common in the population.

**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 use the ideas of random variation, competition, fitness and natural selection to explain evolution and 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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Images: pixabay.com/gdakaska (1407203)

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1. The article on the student sheet says that crickets die of old age after a few months, so students can assume that quite a few generations had passed by the time most of the population was silent ten years later; the original research upon which this activity is based states that in less than 20 generations the mutation that caused the silent wing shape had spread to 90% of the population. [↑](#footnote-ref-1)