# Lesson Element

# Natural Selection

## Instructions and answers for teachers

These instructions cover the learner activity section which can be found on [page 7](#_Learner_Activity). This Lesson Element supports OCR GCSE (9–1) Gateway Science Biology A and the Twenty First Century Science Biology B qualifications.

**When distributing the activity section to the learners either as a printed copy or as a Word file you will need to remove the teacher instructions section.**

### Mapping to specification level (Learning outcomes)

**GCSE (9–1) Gateway Science Biology A/Combined Science A**

B5.2c explain how evolution occurs through the natural selection of variants that have given rise to phenotypes best suited to their environment.

B5.2d describe evolution as a change in the inherited characteristics of a population over time, through a process of natural selection, which may result in the formation of new species.

**GCSE (9–1) Twenty First Century Science Biology B/Combined Science B**

B6.1 How was the theory of natural selection developed?

B6.1.1 State that there is usually extensive genetic variation within a population of a species.

B6.1.2 Recall that genetic variants arise from mutations, and that most have no effect on the phenotype, some influence phenotype and a very few determine phenotype.

B6.1.3 Explain how evolution occurs through natural selection of variants that give rise to phenotypes better suited to their environment.

B6.1.4 Explain the importance of competition in a community, with regard to natural selection.

B6.1.5 Describe evolution as a change in the inherited characteristics of a population over a number of generations through a process of natural selection which may result in the formation of a new species.

B6.1.6 Explain the impact of the selective breeding of food plants and domesticated animals.

B6.1.7 Describe how fossils provide evidence for evolution.

B6.1.8 Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection.

B6.1.9 Describe modern examples of evidence for evolution including antibiotic resistance in bacteria.

B6.1.10 Explain the impact of these ideas on modern biology and society.

### Introduction

Learning outcome Task 1

* Explain how a change in the selection pressure can give rise to phenotypes that better suit a population to their environment as a result of natural selection.

Learning outcome Task 2

* Describe how a change in the inherited characteristics of a population may result in the formation of a new species.

Learners are likely to have some knowledge of this topic and as a result will find this topic interesting.

Topics such as natural selection bring with them a variety of problems and misconceptions that can be addressed in this lesson element.

Learners often talk of ‘adaptations’ as a result of the individual ‘needing’ or ‘wanting’ a particular characteristic. In this activity, comments around the geckos ‘not needing’ sticky feet should be addressed as incorrect. Learners may also talk about how an individual gecko can adapt to its environment when clearly they are referring to the population of geckos as a whole.

The most likely misconception that will arise during the activity is the use of the term ‘survival of the fittest’. Learners often believe that having a special trait like ‘sticky feet’ is always an advantage, a little like having a ‘super power’. It is important to emphasise that the term ‘fittest’ actually means ‘best adapted’ to the environment.

### Equipment

Learners should be provided with counters/coins that can slide on the desk.

For making the ‘sticky feet’, blue-tack can be used.

The following resources can be used by learners either prior to the lesson or as consolidation. They may help learners to visualise what is a very difficult and abstract concept to understand.

<http://evolution.berkeley.edu/evolibrary/article/evo_25>

<http://www.ck12.org/life-science/Natural-Selection-in-Life-Science/lesson/Natural-Selection-MS-LS/>

### Supporting information

Task 1 – Learners could use the task as it is or the learners could be asked to cut out and assemble the cards as a card sort. If a card sort is used teachers may prefer to save time during the activity and the teacher could pre-cut (and maybe laminate) the cards. To save paper learners could draw out the table in their books.

Task 2 - It may be of benefit to demonstrate how to make ‘sticky feet’ on the counters. Only a very small amount of blue-tack is required. This should be spread very thinly on one side of the counter. The aim is to have a counter that can still slide but will move around less when the forceps are used making them easier to pick up.

### Prior knowledge

Learners should already be aware from Key Stage 3 that there is variation between species and between individuals of the same species. This means that some organisms compete more successfully, which can drive natural selection. Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce.

### Summary of the activity

This activity can be used for the delivery of the topic for the first time or as a consolidation tool. Learners should be aware of key terms such as selection pressure, selective advantage and adaptation.

### Running the activity

Learners could work individually or in pairs.

### Task 1 – True or False?

Learners should decide whether each of these statements is true or false and write the statement in the correct column.

Depending on how the activity is delivered (either a revision task or a learning aid) learners could either use their notes to help or use guided discussion with their partner or teacher to help place the cards.

| **True** | **False** |
| --- | --- |
| Darwin’s Theory of Evolution proposed that species evolve by natural selection | The strongest individuals are most likely to survive |
| Genes are passed to offspring | Individuals that are poorly adapted will become extinct |
| If an organism can survive in an environment when others cannot it has a selective advantage | Organisms change to suit their environment |
| A feature that helps an organism to survive is called an adaptation | To reach food high in tree tops, giraffes have been stretching their necks making their necks grow longer |
| A mutation in the DNA causes genetic variation | When two different species have offspring, a new species is made |

### Task 2

Learners should work in teams for this task.

**Equipment**

Learners should be provided with counters/coins that can slide on the desk.

For making the ‘sticky feet’ blue-tack can be used.

**Instructions**

It may be of benefit to demonstrate how to make ‘sticky feet’ on the counters. Only a very small amount of blue-tack is required. This should be spread very thinly on one side of the counter. The aim is to have a counter that can still slide but will move around less when the forceps are used making them easier to pick up.

**Sample results**

| **Attempt** | **Number of geckos surviving** |
| --- | --- |
| **‘Mutant’ geckos** | **‘Sticky feet’ geckos** |
| **1** | 3 | 2 |
| **2** | 5 | 2 |
| **3** | 8 | 1 |
| **4** | 14 | 0 |

An extension to this task can be to ask learners to plot a suitable bar chart of their results.

**Questions**

1. What are the two variants of gecko?

Mutant gecko

Sticky feet gecko

1. Look at the results. If this same pattern continued what would you expect to happen in this area?

Learners should see that the number of sticky feet gecko would decrease and the number of mutant geckos should increase.

1. Do you think that your findings suggest that the ‘stick feet’ gecko will become extinct?

Potentially they could become extinct. However this is only in a small area so they may survive well in other local environments that do have vertical surfaces.

1. What do you think could happen to the species of gecko Pachydactylus rangei?

It could potentially lose its sticky feet trait and mutant geckos would become normal in that area.

1. Some people may think that the ability to climb walls would give the gecko with ‘sticky feet’ an advantage. Using your knowledge of ‘survival of the fittest’ explain why this isn’t always true.

Having sticky feet doesn’t give the gecko a selective advantage in this environment and actually makes the geckos chance of survival lower.

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# Natural Selection

## Learner Activity

### Task 1 – True or false?

| Darwin’s Theory of Evolution proposed that species evolve by natural selection | A feature that helps an organism to survive is called an adaptation |
| --- | --- |
| To reach food high in tree tops, giraffes have been stretching their necks making their necks grow longer | The strongest individuals are most likely to survive |
| If an organism can survive in an environment when others cannot it has a selective advantage | Organisms change to suit their environment |
| Individuals that are poorly adapted will become extinct | When two different species have offspring, a new species is made |
| A mutation in the DNA causes genetic variation | Genes are passed to offspring |

Decide whether each of these statements is true or false and write the statement in the correct column.

| True | False |
| --- | --- |
|  |  |

### Task 2 – Sticky feet



The gecko (Pachydactylus rangei) iswell known for having sticky feet that allows them to climb vertical surfaces like walls or trees. This unusual trait also allows them to climb walls in order to hide and avoid predators but is having sticky feet always a good thing?

Research has been conducted that has discovered that some ‘mutant’ geckos are losing their ‘sticky feet’. It is known that ‘mutant’ geckos can run faster on the ground and get away from predators more easily.

So if the gecko does not live in an environment with lots of vertical surfaces, having sticky feet isn’t really an advantage. This is a theory your team is going to investigate.

**Equipment**

* Pair of forceps (tweezers)
* 30 plastic counters
* Small ball of blue-tack
* Plastic cup
* Timer

**Instructions**

* One of the team will use the forceps as they are going to be the ‘predator’. They need to look away for the next bit.
* Take 8 plastic counters, these are going to be the geckos.
* On 4 of them add a **small** amount of blue-tack; this should be a small amount and they should still be able to slide across the desk.
* Leave the other 4 as they are. These are the ‘mutant’ geckos without sticky feet.
* Spread the 8 counters on the desk. Check that all the counters can slide cross the desk. Sticky feet geckos will slide slower than mutant geckos.
* The ‘predator’ now has 10 seconds to pick up as many counters as they can, using their forceps.
* Count how many of each type of gecko are remaining and record them in the table.
* The predator needs to look away again.
* At this point the population will reproduce. For every ‘mutant’ gecko left put another counter down and for every gecko with ‘sticky feet’ put a counter with blue-tack down.
* Again the predator has 10 seconds to pick up as many geckos as they can and the process continues.
* This is repeated 4 times and record your findings in the results table.

**Results**

| **Attempt** | **Number of geckos surviving** |
| --- | --- |
| **‘Mutant geckos’** | **‘Sticky feet’ geckos** |
| **1** |  |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |

**Questions**

1. What are the two variants of gecko?
2. Look at the results. If this same pattern continued what would you expect to happen in this area?
3. Do you think that your findings suggest that the ‘stick feet’ gecko will become extinct?
4. What do think could happen to the species of gecko Pachydactylus rangei?
5. Some people may think that the ability to climb walls would give the gecko with ‘sticky feet’ an advantage. Using your knowledge of ‘survival of the fittest’ explain why this isn’t always true.