**Adaptation and Change over time**

**Learning Objectives:**

* Recognise that living things can change over many generations.
* Identify how animals and plants are adapted to suit their environment in different ways, and how the pressure to adapt may lead to evolution.
* Understand the importance of variation within a population of animals.

**Prep Required**

* Print out the **Circles Worksheet** for each pair of students. Cut out the circles.
* **A3 white paper** for each pair of students.
* **Tweezers** for each pair of students
* Print out the **Moth Outline Worksheet** for each pair of students.
* Different **coloured/patterned A3 pieces of paper/**backgrounds (can use wrapping paper) for each table of students.

**Starter (15 minutes)**

*Aim: to set up the experiments for the main task. No key learning points are introduced in either of these starters but they are necessary to create a back drop for the main task to be completed.*

*Important note: if the option one starter is chosen then option one main task should be used and if the option two starter is chosen then option two main task should be used.*

1. Hand out the **[A3 paper]** and **[Circles Worksheet]** for each pair of students.
2. One child in the pair turns around and closes their eyes, whilst the other person in the pair places 20 white and 20 black circles on the piece of white paper. The child that closed their eyes opens them and uses the tweezers to pick up as many of the circles as possible in 20 seconds.
3. The circles that have not been picked up should be kept, and their number doubled for the next round. The circles that were picked up should be discarded.
4. Repeat this with the children exchanging tasks. The child with their eyes open should shuffle the remaining circles and place them randomly on the paper, before the second round of picking starts.
5. After the second round, the children should count up how many white circles in comparison to black circles remain on the piece of paper. Which value is higher?
6. Discuss that this is imitating a predator prey situation (e.g. a bird and insects) and that more white circles should have remained because they are better camouflaged.

**Class Activity (30 minutes)**

*Aim: to introduce the idea of adaptation, natural selection and evolution. To make sure students have an understanding that variation is important to prevent animals becoming extinct.*

**Habitat**

The natural home or environment of an animal or plant

1. Split the class into pairs and explain that each pair must design 10 moths using the **[Moth Outline Worksheet]**. Explain that you are focusing on camouflage, so they should think about the colour of their moths. Their moths are going to be placed into a ***habitat*** and a predator is going to try to eat as many moths as possible. Their moths can be all the same, all different, some the same, some different. Give them 10 minutes to discuss their plan and to draw their moths.

**Misconception!**

Organisms ado not *try* to adapt. There is no personal choice involved. Natural selection causes some members to survive and reproduce better depending on their characteristics.

1. Present each table with a **[background]**. Ask the children to predict as a table which moths will be eaten and which will survive?
2. Choose a person from each table who is going to be the predator. This person should then go to another table and act as the predator picking up as many moths, using a pair of tweezers, as possible in 10 seconds. Repeat 3 times, changing the ‘predator’. At the end of each round the moths that are picked up are discarded whilst the moths that are left double in number (the children will have to make new moths if their moth’s survive, they should be identical to the moths that have survived).

**Adaptation**

The process of change by which an organism/species becomes better suited to its environment.

1. Look at how certain moths are better ***camouflaged*** in their habitat and therefore are better able to survive: they are ***adapted***. If you start with a population of animals with a variety of characteristics, over time that population will change so that the animals that are adapted to the habitat become more common than those that are not. Hence we get ***natural selection*** of those animals most suited to their habitat causing the population to change over time i.e. ***evolve***.

**Natural Selection**

The differential survival of different forms of the same organism due to environmental pressures.

1. Now complete exactly the same experiment but swap the backgrounds around. Explain how this can happen in the natural world as often environments can change for example due to climate warming.

**Misconception!**

Organisms are not always optimally adapted; they do not achieve perfection. They just need to be fit enough to survive and reproduce.

1. When they have repeated the game three times discuss the findings. Also discuss which pairs tactics worked best throughout the game? Was it better to have all the same moths or a variety? The class should find that different moths survived in comparison to the last time, since the environment changed. The moths that survived would have been those best camouflaged and thus best adapted to the new background. The class should find it is better to have a variety of moths as with a variety of moths it is more likely that some of them will survive a change in environment. In contrast if all of them are the same then a certain change in the environment could kill the whole population of moths.

**Plenary (10 minutes)**

Big thought question: why do we need variation in a population? Answer: in case the environment changes. A giant meteor killed the dinosaurs, we’ve had several Ice Ages which affects the animals and plants on Earth and global warming is already having an effect on the populations of different animals.

**Extra materials:**

–          This is a fantastic practical experiment that could be undertaken if time is available <http://www.nuffieldfoundation.org/print/3218>

–          This is a good video showing a great practical lesson on natural selection. Good for helping teacher understanding and to give ideas for interactive lessons: <http://www.theguardian.com/science/teacher-blog/2013/feb/01/masterclass-teaching-evolution>