



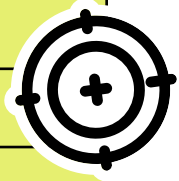
Monstrous Selection

**Adaptation and
Natural Selection**



Teacher Booklet

Grade:	Secondary I
Subject:	Science and Technology
Activity Duration:	Three 75-minute periods
Objective:	Students experiment with natural selection by creating a species of monster and analyzing the consequences of a disruptive event on its survival.
Materials:	One Teacher Booklet, one Student Booklet per student



Activity Summary

Key Concepts

- Name the characteristics that define a **species** (similar physical traits, viable and fertile natural reproduction).
- Name the characteristics that define a **habitat** (geographic location, climate, flora, fauna, proximity to humans, etc.).
- Name the characteristics that define an **ecological niche** (occupied space within the habitat, diet, daily/seasonal rhythm, etc.).

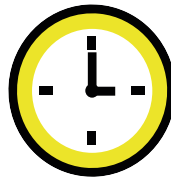
Learning Objectives

- Describe the **physical adaptations** that enable an animal or plant to increase its chances of survival (e.g., a coat colour or leaf shape that blends into its surroundings).
- Describe the **behavioural adaptations** that enable an animal or plant to increase its chances of survival (e.g., travelling in packs, phototropism).
- Explain the process of **natural selection**.



Step	Duration
Scenario	5 min.
Form Teams	5 min.
Part 1 - Describe the Habitat and Ecological Niche	30 min.
Part 2 - Create the Monster	45 min.
Part 3 - Physical/Behavioural Adaptations and Natural Selection	45 min.
Part 4 - Disruptive Event	45 min.

Procedure



Scenario

Approx. 5 minutes

The students read through the scenario individually. During Parts 1 to 3, the teacher must not mention the disruptive event that will occur in Part 4. This will ensure that the characteristics the students give their monsters remain random.

Form Teams

Approx. 5 minutes

The students will need to pair up for this activity.

Part 1 - Describe the Habitat and Ecological Niche

Approx. 30 minutes

Habitat and ecological niche are key concepts for this activity.

Part 1 of the student booklet corresponds to the **activation of prior knowledge**.

The teams work through Part 1 of the student workbook while the teacher walks around the classroom to provide guidance as needed. The teacher may clarify the concepts of habitat and ecological niche. The teacher may remind the teams that their description of the habitat and ecological niche will have a big influence on their monster's characteristics. The teacher may explore the following questions with teams who need guidance.

Description of the Habitat: Questions to Guide Students

► Questions about the **climate**:

- Is your habitat warm or cold?
- Does it get a lot of precipitation? If so, does it mainly rain or snow?
- How sunny is it?

► Questions about the **body of water**

(mainly for students who have chosen an aquatic habitat):

- Does it contain fresh water or salt water?
- Is the water warm or cold?
- Is there any current? If so, is the current strong or weak?

► Questions about the **fauna**:

- Are there predators in the habitat?
- Is there any prey for your monster to feed on?

► Questions about the **flora**:

- Is there any plant life that could provide shelter for your monster?
- Is there any plant life that could provide food for your monster?



Description of the Ecological Niche: Questions to Guide Students

► Questions and clarifications about **diet**:

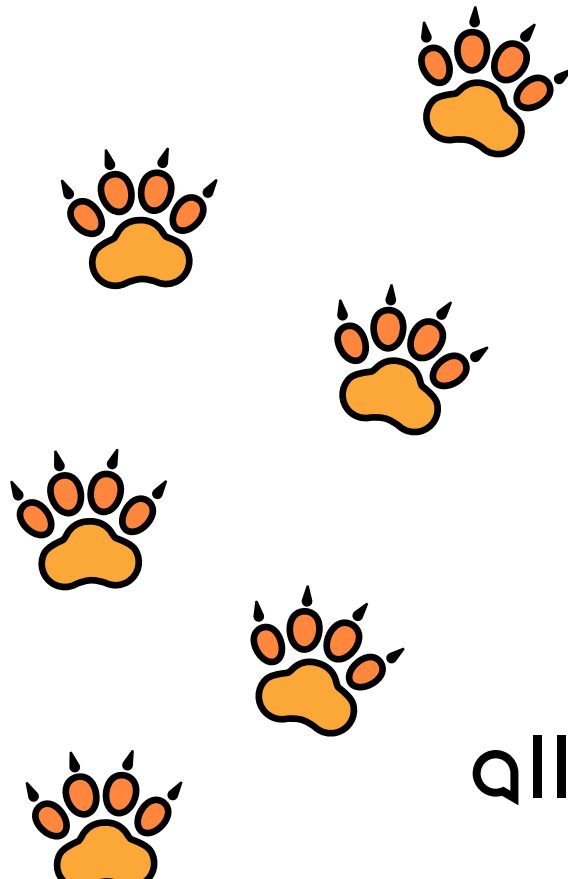
- Make sure the student understands the meaning of the words *carnivore*, *herbivore*, and *omnivore*.
- Are the foods you have chosen consistent with your monster's diet? (Does a carnivore eat grass, for example?)

► Questions about **occupied space**:

- Where exactly does the monster live within its habitat?
 - For example: A bat's habitat could be a cave, and the space it occupies could be the ceiling where it hangs to sleep.

► Questions about **daily and seasonal rhythms**:

- What works best for your monster: foraging during the day, when other animals are active, or foraging at night, when they are less visible? This will depend on the type of food your monster is looking for, and whether that food is available during the day or at night.
- Is your monster comfortable in hot weather? How about in cold weather?
- How easy is it for your monster to find food, whatever the weather?



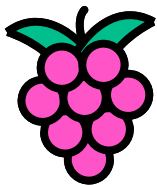
Part 2 - Create the Monster

Approx. 45 minutes

The teams work through Part 2 of the student workbook while the teacher walks around the classroom to provide guidance as needed.

Description of Diet-Related Adaptations: Clarifications to Guide Students

- ▶ In general, students must be consistent with the diet they have chosen for their monster. Students are encouraged to make connections between feeding habits, beaks versus teeth, and the selected diet.
- ▶ Make sure students understand the meaning of words indicating how the monster might obtain food, including the following terms:
 - *Harvesting*: The act of gathering seeds for food. For example, many bird species harvest seeds.
 - *Filter feeding*: The act of feeding on organic matter, microorganisms, and/or small animals by filtering them from the water in which they are found. For example, flamingos and several species of fish are filter feeders.
 - *Grazing*: The act of grazing, pulling up vegetation for food. For example, cows and hippos graze on grass.
 - *Insect predation*: The act of feeding on insects. For example, many birds are insect predators.



Description of Adaptations Related to Occupied Space:

Clarifications to guide students

- For students who need extra support, the teacher can show photos of mimicry or camouflage. These examples will help students better understand how living things are able to adapt their coat, plumage, or other physical traits to their surroundings.

Figure 1. The camouflage of the leaf insect (*Phyllium philippinicum*)



Figure 2. The camouflage of the pine hawk-moth (*Sphinx pinastri*)



Figure 3. The mimicry of the owl butterfly (*Caligo memnon*)



Figure 4. The camouflage of the polar bear (*Ursus maritimus*)



[illegible]

- ▶ Does the monster have a way of protecting itself from the cold (fur, appropriate shelter, etc.)?
- ▶ Does snow affect the monster's movements?
- ▶ Does the cold prevent the monster from feeding?

Suggestion (Optional)

To make the activity even more fun, have students name their monster using binomial nomenclature. You can also ask students to draw their monster. They could even use an artificial intelligence (AI) image generator to produce an image of the monster based on its characteristics.

Part 3 - Physical/Behavioural Adaptations and Natural Selection

Approx. 45 minutes

Part 3 includes a teacher-led instruction carried out as a class, and a familiarization phase carried out individually by the students.

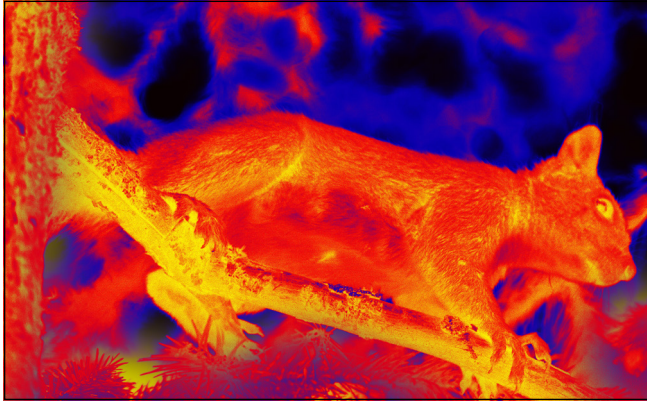
Teacher-Led Instruction

Approx. 20 minutes

The teacher explains the concepts of physical and behavioural adaptation, as well as natural selection.

Physical Adaptation

A **physical adaptation** is a physical characteristic that increases a species' chances of survival.

Example of Physical Adaptation in Plants	Example of Physical Adaptation in Animals
<i>Monstera deliciosa</i> has very large leaves to soak up the sun's rays. Figure 6. Leaves of a <i>Monstera deliciosa</i> 	The snake species <i>Vipera ammodytes</i> can see infrared light (heat), which enables it to spot prey in the dark. Figure 7. A thermal image of a squirrel similar to what <i>Vipera ammodytes</i> might observe in the dark 

Behavioural Adaptation

A **behavioural adaptation** is a way of behaving that increases a species' chances of survival.

Example of Behavioural Adaptation in Plants	Example of Behavioural Adaptation in Animals
The sunflower (<i>Helianthus annuus</i>) moves to follow the path of the Sun in the sky. Figure 8. Sunflower buds turned to face the Sun 	The North American beaver (<i>Castor canadensis</i>) builds a dam to flood a small area, creating its own habitat. Figure 9. A beaver and its dam 

Example of a Preconception to Avoid

The chameleon's ability to change colour according to its environment is a behavioural adaptation. (False)

The chameleon has special skin cells that enable it to change colour. The change of colour allows the chameleon to regulate its temperature or better blend into its environment. However, the chameleon cannot control the colour change; it is a nervous system reaction. Therefore, this adaptation is not a behaviour, but rather a physical trait.

Natural Selection

Natural selection is the process by which individuals best adapted to their environment are more likely to survive and reproduce. In this way, these individuals pass on their favourable traits to their descendants.

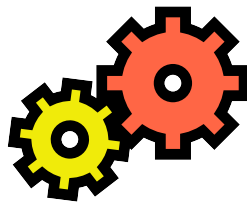
Here are the main steps of the natural selection process:

1. Individuals within a species population have different physical or behavioural traits.
2. A disruptive event occurs.
3. Certain traits favour the survival of some individuals, and the least well adapted gradually die off.
4. The survivors reproduce, and their favourable traits are passed on to their descendants.
5. In time, most of the descendants have these favourable traits.

Example of a Preconception to Avoid

Giraffes evolved to have long necks so that they could reach food in the high canopy of trees. (False)

In the past, the length of a giraffe's neck varied, with some being short and others long. A change in the environment meant that giraffes with long necks had a better chance of survival. Long-necked giraffes survived and reproduced. Their descendants were also born with long necks. Short-necked giraffes were less likely to survive and gradually died off. Eventually, after many years, most giraffes had long necks.



Familiarization

Approx. 25 minutes

The student answers the questions in Part 3 of the student booklet.

The teacher walks around the room to ensure that the students understand the difference between physical and behavioural adaptation.

The teacher ensures that students understand that natural selection is a process triggered by a change in the environment and that it occurs over a long period of time.

Answers to Questions 1 and 2

Varies according to the student's monster

Answers to Question 3

B - E - C - A - D



Part 4 - Disruptive Event

Approx. 45 minutes

This section is completed individually by the students. This is the evaluation part of the activity. It enables the teacher to evaluate the following three points:

- Understanding of the concept of **physical adaptation**
- Understanding of the concept of **behavioural adaptation**
- Understanding of the concept of **natural selection**

To begin, the student answers question 1 by choosing one of the three possible disruptive events. The teacher ensures that the event chosen by the student has an impact on their monster's habitat.

For example, if the habitat is a coral reef, frequent torrential rains will have little impact on the habitat. This would make it difficult for the student to complete Part 4 correctly.

A Few Definitions to Help Students

Soil erosion is a mechanism whereby rocks and soil are worn away and transformed by erosive agents such as water, wind, glacier movement, or temperature.

A **landslide** is the detachment and downward displacement of part of the soil on sloping ground. Landslides are generally caused by soil erosion at the bottom of slopes.

Students then answer questions 2 to 8 to help them analyze the impact of the disruptive event on their monster's habitat and ecological niche. Taking into account the answers to these questions, the student must determine whether their monster survives. They must justify their analysis by referencing their monster's ecological niche, physical adaptations, and behavioural adaptations.

The student's answers enable the teacher to assess their understanding of physical and behavioural adaptations. The named adaptations must be traits that help the monster survive in its new environment.

Finally, the student must demonstrate an understanding of the natural selection process by explaining the impact of the disruptive event on the monster community, that is, the survival of adapted species and the elimination of species not adapted to their new environment.

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