LESSON 2:
And I Managed to Survive!

7th & 10th GRADE

Minnuette Rodríguez Harrison
María L. Ortiz Hernández

May 2019

Proyecto financiado por la Fundación Nacional de Ciencias #1736026

INTRODUCTION

The *Genomic Logic for Underlying Morphological Divergence (EPSCoR)* project aims to bring science-related learning experiences to schools. This lesson is the second of three designed to facilitate learning about the concepts of natural selection (module 1), adaptation (module 2), and evolution (module 3). These lessons will serve as a tool for the trainer or professional in charge of teaching (teacher, professor, among others). For participants, they can be teachers (as part of their professional development) or students.[1]

In this second lesson, the instructors or teachers of the Biological Sciences (7th grade) and Biology (10th grade) courses, and their students, will actively participate in some activities where they will understand the principles of adaptation. Emphasis will also be placed on how changes in the immediate environment affect the evolution of adaptations in species.

This lesson includes:

- ✓ Scientific background of the concepts
- ✓ Glossary
- ✓ Alignment of the content to the standards, expectations, and specificities of the Department of Education of Puerto Rico (DEPR)
- ✓ Educational Process
- ✓ Detailed activities to carry out in the classroom.

SUBJECT:	**Science** (Biological Sciences/ Biology)
LEVEL:	Intermediate – Advanced / 7th – 10th grade
PRIMARY CONCEPTS:	Adaptation, types of adaptations

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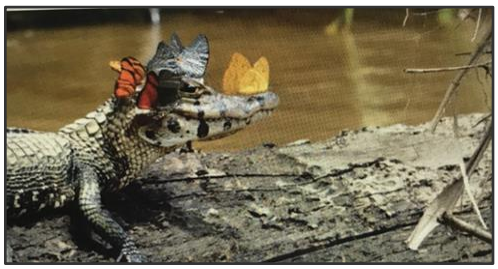
SECONDARY CONCEPTS: Genetic variations, environmental conditions

PRIOR KNOWLEDGE: Biodiversity, natural selection



LEARNING OBJECTIVES

Throughout the lesson, participants will:

1. Classify the types of adaptation in different organisms, given a group of organisms.
2. Distinguish between the concepts of adaptation, structural adaptation, behavioral adaptation, and physiological adaptation.

Continuous assessment

Throughout the activity, the instructors or teachers will be making observations as they move between the working groups, when participants discuss and when they present their answers to the questions. This allows them to assess the participants' learning.

STANDARDS, EXPECTATIONS AND SPECIFICITIES 7th GRADE – SCIENCE

Standard(s): Interactions and Energy, Conservation and Change
Area of expertise: Natural selection and adaptations
Expectation B.CB4: Biological evolution: unity and diversity

Adaptation: Adaptation through natural selection acts over generations and is an important process by which species change over time in response to changes in environmental conditions. Characteristics that contribute to survival and successful reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of characteristics in the population changes.

Indicators

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EI.B.CB4.CC.4 Explain how genetic variations in the characteristics of a population increase the probability of survival and reproduction of some individuals in a specific environment.

STANDARDS, EXPECTATIONS AND SPECIFICITIES 10th GRADE – SCIENCE

Standard(s): Interactions and Energy, Conservation and Change
Area of expertise: Natural selection and evolution

Expectation B.CB4: Biological evolution: unity and diversity
Adaptation: Evolution is the result of the interaction between four factors: (1) the potential of a species to increase in number, (2) the genetic variation of individuals within a species due to mutation or sexual reproduction, (3) competition for the limited supplies of resources that each individual needs to survive and reproduce in the environment, and (4) ensuring the proliferation of those organisms that are best equipped to survive and reproduce in the environment. Natural selection leads to adaptation; that is, in a population dominated by organisms that are anatomically, behaviorally, and physiologically equipped to survive in certain environments. In other words, the differentiation in survival and reproduction of organisms in a population that have advantageous hereditary characteristics leads to an increase in the proportion of individuals in future generations that have such characteristics and a decrease in the proportion of individuals that do not have those characteristics. Adaptation also means that the distribution of characteristics in a population can change when conditions change.
Indicators
ES.B.CB4.IE.4 Construct an evidence-based explanation of how natural selection leads to the adaptation of populations.

BACKGROUND

When we talk about adaptation, we refer to those traits that a species possesses that offer it the ability to survive within the environment it inhabits. A species is a group of organisms that share the same traits and can interbreed to produce fertile offspring. Nevertheless, individuals from the same species can show some minimal variations. These variations can be favorable or not. This lets the species survive in a particular environment. According to environmental

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factors, after many generations, a population could look very different. These adaptations can be structural, physiological, or behavioral. Butterflies are a particularly strong example of structural adaptation. These adaptations in butterflies include things such as the way in which they use mimicry, camouflage, and even their ability to fly. Some examples of adaptations that butterflies possess include:

Camouflage
Butterflies' main structural adaptation is in their wings and how they use them to hide themselves. The wings of many species have evolved to mimic their surroundings, with green as a particularly good example of it. The butterflies' wing shape and color is exactly the same as the leaves in which they are found, which makes it difficult for predators to find them.

Disguise and subterfuge
Many butterflies have developed "eyespots" in their wings. When their wings are open, these spots grant the butterfly the look of a bigger creature, frightening possible predators. In that same way, the Viceroy butterfly deliberately mimics the appearance of the Monarch butterfly, which has evolved to the point of being toxic when eaten. As a result, predators avoid hunting both species.

Delight
Butterflies are cold-blooded creatures, which means they need to heat up their wings before taking off. That is when they are most vulnerable to predators but is a vital part in butterflies' progress. The butterfly can simply fold its wings if they heat too much.

Light sensibility
Every fourth generation, monarch butterflies migrate 2,000 miles (3,200 kilometers), voyaging from places as far north as Canada to places in Mexico, to hibernate. Monarch butterflies use their antennae to detect the basic light level around them. This lets them know what time of the day it is, depending on the amount of light that they can see, which at the same time lets them remain alert.

Examples of adaptation in living creatures

Species	Adaptation	How does the adaptation help it to survive in the environment?

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crocodiles	digestive tract	It has adapted to ingest a large variety of prey
fish	travel	it is favored by the undulating movements of their bodies
horses	size increase	to face predators from the prairie
wolves	Development of muscles for mastication	it eases chewing their prey
anteaters	tail	it serves as a coat
mollusks	long muscular foot	It lets them set themselves on the sand to travel
primates	Fingers	pick up tree branches
butterflies	camouflage	lets them mimic their surroundings, which makes it difficult for predators to find them

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GLOSSARY

Adaptation —a trait in an animal that lets it survive in a specific environment.

Behavioral adaptations —changes in animal behavior; for example, migratory trips that some birds make.

Biodiversity—Biodiversity, or biological diversity, is the variety of life. This recent concept includes various levels of biological organization. It encompasses the diversity of plants, animals, fungi and microorganism species that live in a determined space, their genetic variability, the ecosystems they are a part of, and the landscapes and regions in which these ecosystems are located. It also includes ecological and evolutionary processes that take place at different levels: genetics, species, ecosystem, and landscape.

Camouflage —structural adaptation that lets the individual blend into its surroundings. It involves the individual's change in color.

Mimicry—structural adaptation that provides protection to an individual, letting it copy the appearance of other species.

Physiological adaptation —changes in the metabolic processes of an organism.

Species —members in populations that reproduce or can interbreed in nature and are not of a similar appearance. Although appearance is useful to identify species, it does not define it.

Structural adaptations —adaptations that include changes in the structure of some parts of the species' body.

Natural selection —it forms part of the theories proposed by British naturalist Charles Darwin to explain the evolution of species. According to Darwin, different biological species share a common descendant that has been branching through evolution.

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LESSON PROCESS (BEGINNING, DEVELOPMENT, AND CLOSURE)

BEGINNING

During this part, participants' prior knowledge about the concepts to be developed is explored; in this case, the theory of natural selection, species and adaptation. This will let the instructor recognize misconceptions that participants may have and ensure that they can be corrected during the educational process.

1. The instructor, using a PowerPoint presentation, projects image #1 of a giraffe with a long neck and another one with a short neck.
2. The instructor will ask the participants to explain what they understand happened to the dead giraffe in image #1.
3. The instructor will hand each participant a sheet for them to reply using the *minute paper* assessment technique. The expected answer would be that the participants point out that the giraffe died because it did not phenotypically express a long neck like the rest, and, by not having a long neck, it would be difficult for it to obtain its food from trees, and, therefore, it would eventually die. It is recommended to paste the participants' answers around the room to make reference to them in further activities.
4. The instructor will ask, "What would you call a living creature's ability to change or modify itself through time to survive?
   It is expected that participants identify the concept: adaptation.

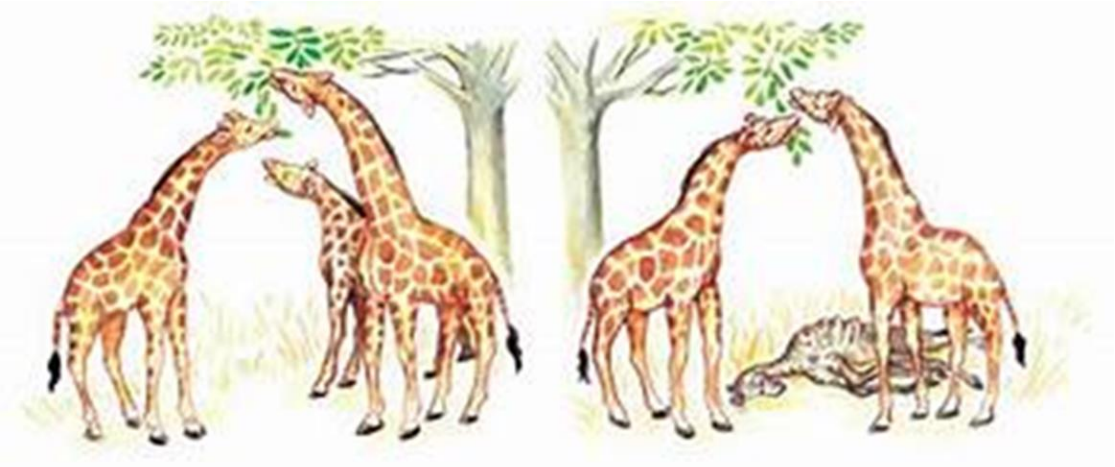

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Image # 1

1. Participants (seventh graders) will use an informational page (matching type) and will create a folder to explain some traits and adaptations to survive in the environment, using five different species examples (see Worksheet #1).
2. Worksheet #1 includes a chart that shows how the gathered information should be organized in the informational page.
3. The instructor will explain the instructions on how to create the folder to help participants in this activity.
4. Once the participants group the pictures with their descriptions, the topic will be reinforced in a socialized discussion using a PowerPoint presentation.

DEVELOPMENT

7TH GRADE **Worksheet #1**

Activity #1: And I manage to survive!

Folder: Adaptation to the environment

Materials:

informational page: adaptation to the environment

blank paper

pencils or crayons

scissors

glue

Procedure:

1. Follow the instructions to make your folder. See appendix #1.
2. Cut and paste species' pictures.
3. Complete the information in your folder using the informational page.
4. Use the example that appears in the chart to know how to complete your folder.

Animal's common name	Typical environment where it lives (habitat)	Adaptation that the animal has	How does the adaptation help it survive in this environment?
camel	desert	camel's hump	it provides water

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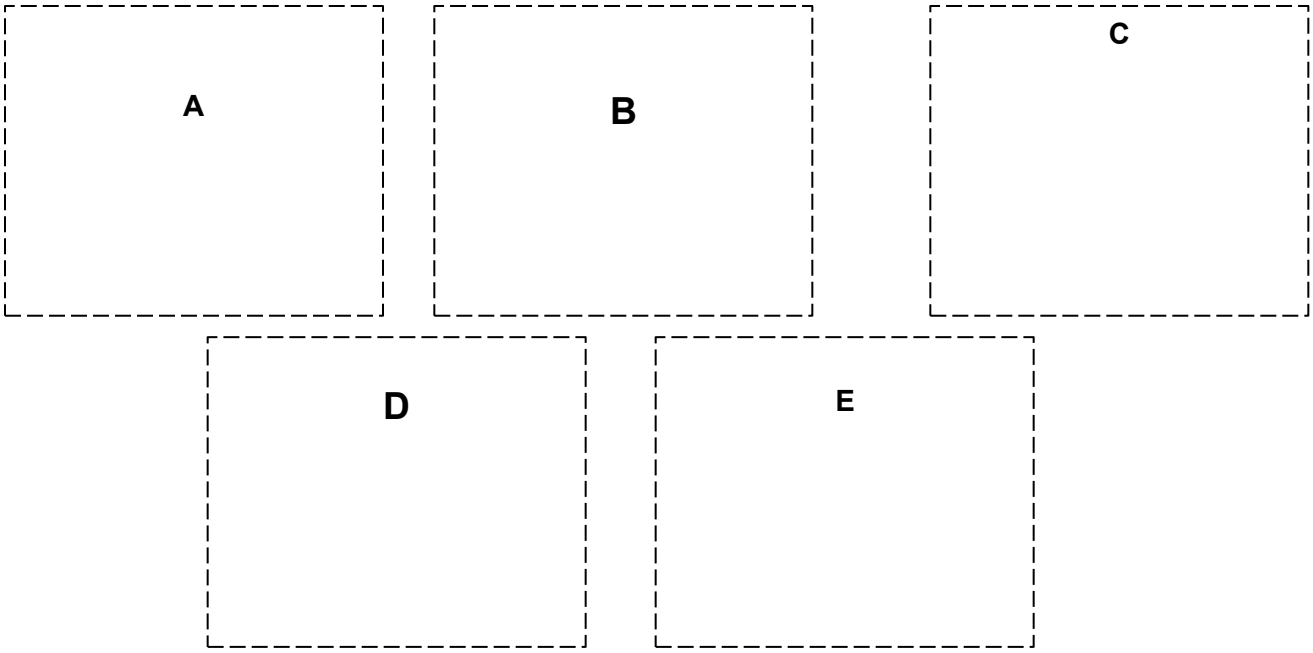
INFORMATIONAL PAGE: ADAPTATION TO THE ENVIRONMENT

A. Observe the 5 species' examples. Look for their traits and adaptations to survive in their environment. Use this information to complete your folder.



Look for the adaptations of each species and write them down on your folder
● Uses its front legs to propel itself through water using a dog-style swimming method. ● They live in cold environments, like the North Pole.
● The color lets it blend in with the green leaves in plants. ● This trait is called camouflage. ● Some can live in tropical places. Others live in temperate areas but migrate to warmer zones to reproduce.
● They have very distinctive big eyes, but once they close them, they remain immobile in the foliage. They are barely distinguishable. ● This is another example of camouflage. ● These species can inhabit Central America.
● It uses its ability to change color to hide from its predators. ● Besides changing color, it remains still, and it seems to be dead. ● They are found in deep waters (oceans).
● Its long neck helps it feed from tree leaves. ● This trait occurred through time. ● It was not a quick adaptation. ● They can live in the tropical savanna.

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Worksheet #1

INFORMATIONAL PAGE: ADAPTATION TO THE ENVIRONMENT (KEY)

A. The following chart shows 5 species' examples and their adaptations to survive in the environment. Use this information to complete your folder.

Species	Adaptations
polar bear 	● Polar bears use the adaptations in their front legs to propel themselves through water in a dog-style swimming method. ● They place their hind legs horizontally and use them as rudders. ● Polar bears live in cold environments, such as the North Pole.
 **Butterfly**	● The butterfly's color lets it blend in with the green leaf. ● This is an example of butterflies' main structural adaptation. ● This trait is called camouflage. ● These butterflies can live in tropical places. Some live in temperate places but migrate to warmer places to reproduce.
 **tree frog**	● Tree frogs have very distinctive, large, red eyes, but once they close them, they remain immobile in the foliage. They are barely distinguishable. ● This is another example of camouflage. ● This frog species can inhabit Central America.
 **flat fish**	● This flatfish uses its ability to change color to hide from its predators. ● Besides changing color, it remains still and seems to be dead. ● These fish can be found in deep waters (oceans).

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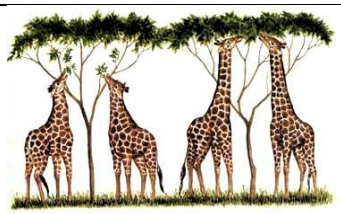 **giraffe**	● Giraffes' long necks are an adaptation that lets them eat. ● This trait in giraffes occurred through time. ● It was not a quick adaptation. ● Giraffes tend to live in tropical savannas.

10TH GRADE

Activity #1: Kinds of adaptations **Worksheet #2**

1. At the high school level, each participant will be given a worksheet with pictures and descriptions representing each kind of adaptation (Worksheet #2).
2. Participants will group the pictures by the three kinds of adaptations, but the names of the adaptations will not be pointed out.
3. Pictures and descriptions of the kinds of adaptations will be shown.
4. Once the participants group the pictures with their descriptions, the names of the kinds of adaptations will be established via socialized discussion.
5. Participants will write the name of the corresponding adaptation on each description in their folder.
6. The topic will be reinforced by using a PowerPoint presentation.

Materials:
blank paper (for the folder)
scissors, glue, and pencils or markers

Procedure:
1) Cut the pictures from each box.
2) Then, paste them in the folder according to the kind of adaptation it represents (follow the instructor's instructions to create the folder). See appendix #2.

 **camouflage**	 **feathers**	 **creeping movements**

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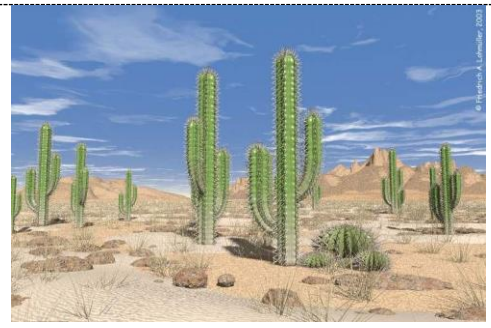
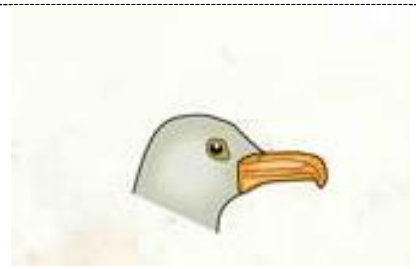
 **locomotion**	 **spines**	 **mimicry**
 **Mimicry**	 **locomotion**	 **bird courtship**
 **layer of fat beneath the skin**	 **thorns are reduced leaves**	 **bird beaks**

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Activity #1: Kinds of adaptations **Worksheet # 2**

KEY

camouflage
Structural adaptation

feathers
Physiological adaptation

creeping movement
Structural adaptation

locomotion
Structural adaptation

spines
Physiological adaptations

mimicry
Behavioral adaptation

mimicry
Behavioral adaptation

locomotion
Structural adaptation

bird courtship
Behavioral adaptation

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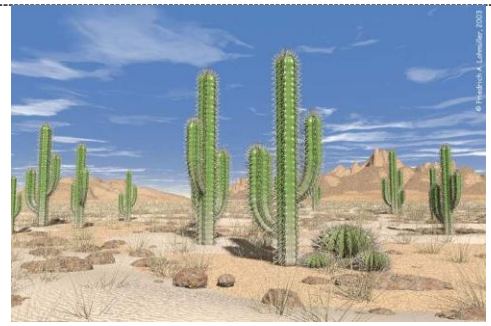
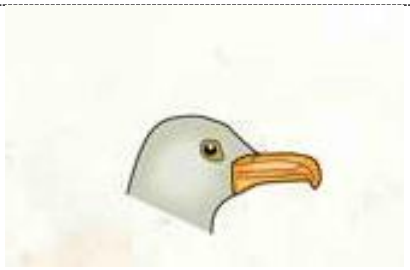
layer of fat beneath the skin
Physiological adaptation



thorns are reduced leaves
Structural adaptation

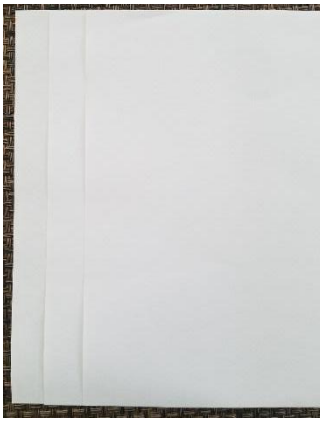


bird beaks

Structural adaptation

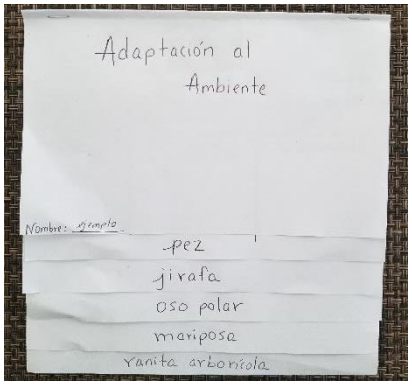
APPENDIX #1
HOW TO CREATE THE FOLDER
(SEVENTH GRADE)

Step #1: Use 3 blank sheets of paper and overlap them, leaving about ½" space between each sheet.



Step #2: Fold papers, so as to create six ½" tabs.

Step #3: Write a title and the name of the species in each of the tabs.



Step #4: Use activity #1's sheet:And I manage to survive! to complete the information for each species.

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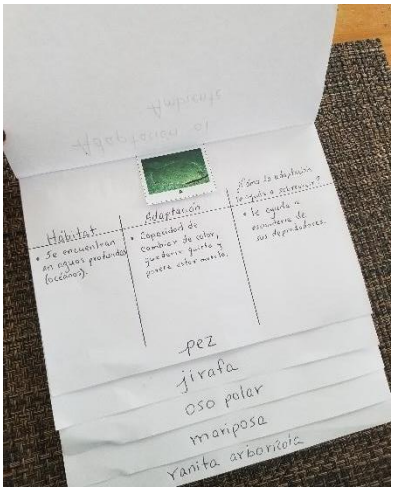

APPENDIX #2
How to create the folder (tenth grade)

Step #1: Use 2 blank sheets of paper and overlap them, leaving approximately ½" space between each other.

Step #2: Fold papers so as to form three ½" tabs.

Step #3: Write a title and the names of the three kinds of adaptations.

Step #4: Use activity #2 sheet: Kinds of adaptations, and paste the illustrations for each kind of adaptation.

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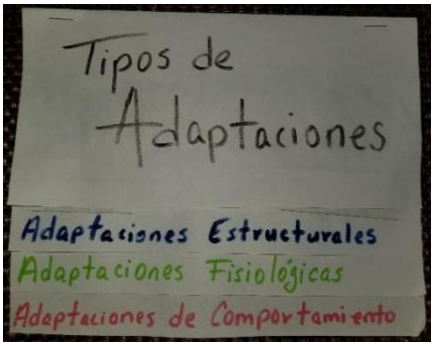

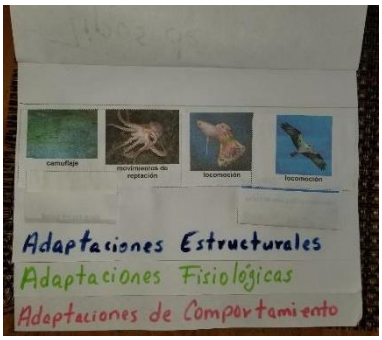

CLOSURE

1. The instructor will ask participants to complete Worksheet #3 (Memory Game) using images in a PowerPoint presentation.
2. Having finished the worksheet, participants will answer the question: how do adaptations help animals and plants survive in their environment?

Activity # 2: Memory Game **WORKSHEET #3**

Materials:

Table and images of organisms

Procedure:

1. Use the images of organisms shown in the PowerPoint presentation to complete the information in the following table:

Organism	Trait	Adaptation (structural, behavioral or physiological)	Benefit of the adaptation

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Activity # 2: Memory Game (Key) **Worksheet # 3**

Use the images of organisms shown in the PowerPoint presentation to complete the information in the following table

Organism	Trait	Adaptation (structural, behavioral or physiological)	Benefit of the adaptation
Viceroy butterfly	Orange, black and white colors Mimics monarch butterfly	Müllerian mimicry Behavioral adaptation	Possesses colorful coloration as a warning. Reduces impact that would exist on a sole species.
Penguin	Black and white feathers Layer of fat beneath the skin Pico largo	Structural adaptation Physiological adaptation Structural adaptation	Form a rigid exterior and a soft coat on their bodies. To obtain energy and heat To catch prey
Cactus	Superficial root system with hairs	Structural adaptations	To catch and absorb surface water.

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	Thorns are reduced leaves Bulky stem.		Avoids water loss Most of the photosynthesis takes place there
Frog	Vibrant colors (yellow, black and white)	Behavioral adaptation	Warning coloration for predators
Hummingbird	Small Long, thin beak	Structural adaptations	Eases flight when eating To extract nectar
Two-headed snake	Part of its body mimics the other part	Self-mimicry Behavioral adaptation	To increase its survival chances
Tree	Deep root system Larger leaves	Structural adaptations	Absorb deep waters Most of the photosynthesis takes place there
Geese	Fly in groups Migrate	Behavioral adaptation Physiological adaptation	Protection To look for food
Chameleon	Mimics coloration of the vegetation in which it's located	Behavioral adaptation	Trick other animals' senses, inducing a determined behavior upon them.

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https://www.faunatura.com/tag/adaptacion

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