IMHOTEP'S LEGACY ACADEMY

CLASSIFICATION, NATURAL SELECTION AND ADAPTIONS

Grade 6 Activity Plan

Reviews and Updates

6.7 Classification, Natural Selection and Adaptions

Objectives:

1. To understand how living things can be subdivided into small groups of related organisms.
2. To learn how to classify organisms based on similar characteristics.
3. To understand how new organisms arise from previously existing ones through evolution.
4. To see how living things adapt to their surroundings/environment through evolution and natural selection.

Keywords/concepts: Classification, Hierarchy, Organism, Diversity, Survival, Adaptation, Evolution, Natural selection, Heterotroph, Autotroph, Eukaryote, Prokaryote, Replication, DNA, Mutation.

Curriculum Outcomes:
Grade 6:
Outcome 6 concepts: Bullets 1, 2, 3, 4.
Outcome 6 indicators: Bullets 1, 2, 3, 4.
Focus: Bullet 1.

Take-home product: Model of an imaginary ideal species.

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Segment	Details
African Proverb (5 min.)	Every cackling hen was an egg at first. **Rwanda**
Pre-test (10 min.)	Ask some questions to get the students to start thinking about how we classify living things, and how organisms adapt to their environment. • What are some things that set living things apart from each other? Give some examples, such as shape, colours, or sounds. • Give some examples of plants or animals and explain how you think their characteristics help them survive in their environment, such as fur, claws for defence, or camouflage. • Brainstorm on how you think animals develop the traits they have to help them thrive. **Mentors:** Help the students think about organisms that live in harsh environments, such as camels and cold-blooded lizards.
Background (10 min.)	Introduce how we classify living things by separating them into different groups. Describe what characteristics we use to distinguish living things. Explain how organisms adapt to their surroundings giving rise to knew organisms.
Activity 1 (15 min.)	Write down the characteristics of 16 different animals pictured on provided animal cards. Separate the animals into two groups based on written characteristics. Separate the animals a second time as vertebrates/invertebrates.
Activity 2 (15 min.)	Create a model environment of microorganisms using Styrofoam bowls and assorted beans. Sift the beans through holes in the Styrofoam bowls to model microorganisms surviving and adapting, or dying off.
Activity 3 (20 min.)	Design an ideal species meant to survive in a simulated environment. Build a model of the designed species using craft materials.
Post-test (15 min.)	"Evolution Telephone"

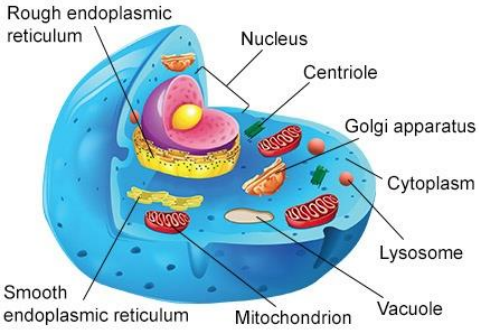
Suggested interpretation of the proverb:
Even the most powerful and impressive people had to start somewhere. Every teacher was once a student; every professional athlete was once a

novice. Given time, all beginners can be amazing at whatever they choose to pursue.

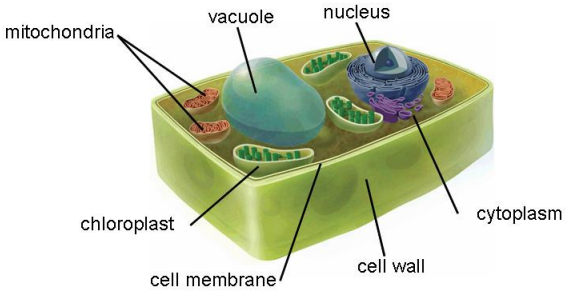
BACKGROUND INFORMATION

Classification schemes have changed since the study of living things in the environment began many, many years ago. New and more useful ways to separate organisms are developed as more information is gained on each type of organism encountered. The two groups of organisms most familiar are plants and animals. However, modern classification methods divide all organisms into five "kingdoms": **Plants**, **animals**, **fungi** (mushrooms, mold…), **protists** (algae, amoebas…) and **monerans** (bacteria). Protists and monerans are usually grouped together into the kingdom "**microorganisms**", due to their microscopic size.

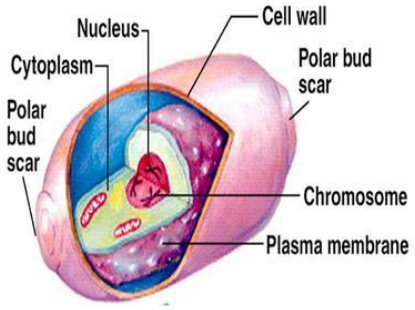
Animals: Organisms that are multicellular, consume other living things for nutrients, and are motile – meaning they can move independently for at least a portion of their lives – belong to the kingdom "**Animalia**". Almost all animals have bodies which are differentiated into separate tissues, such as muscles, nerve tissue, and others. As well, animals have some sort of internal digestive system, with one or two openings.



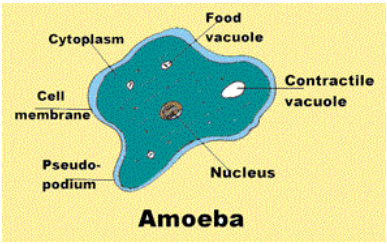
Plants: Organisms that generally do not move independently and obtain most of their energy from the sun and the air belong to the kingdom "**Plantae**". Most plants use energy from sunlight to convert water and carbon dioxide in the air into oxygen and simple sugars through a process called **photosynthesis**. These sugars are used as the building blocks to form the structural components of the plant. However, carnivorous plants, such as the Venus flytrap, get additional nutrients from the insects they capture. Plants also have somewhat unpredictable growth patterns; genetics as well as environmental factors will determine when and how much a plant will grow. Some environmental factors affecting plant growth are temperature, water, sunlight, carbon dioxide, and nutrients in the soil. Plants are multicellular organisms like animals, but their cellular structure greatly differs from those of animals. For example, plant cells have "cell walls" outside of their membrane which gives plants their rigid structure, and chlorophyll which gives plants their usually green colour.



Fungi: Organisms that usually grow in colonies and often produce fruit bodies, such as mushrooms and mosses, belong to the kingdom "**Fungi**". Like plants, fungi are immobile, have cells with cell walls, produce spores for reproduction, and grow mainly according to the conditions of their environment. On the other hand, like animals, fungi lack chlorophyll in their cells and are **heterotrophic**, meaning they consume other organisms for nutrients (such as the animal or plant on which they are growing). There are also many features which are unique to fungi: they may be unicellular, such as yeasts or molds, or multicellular, such as mushrooms. Fungi also have cell walls that contain both the molecules glucan and chitin, but lacking the cellulose contained in plant cell walls. Fungi are also the principle decomposers in ecological systems; breaking down organic matter often to allow new life to emerge.

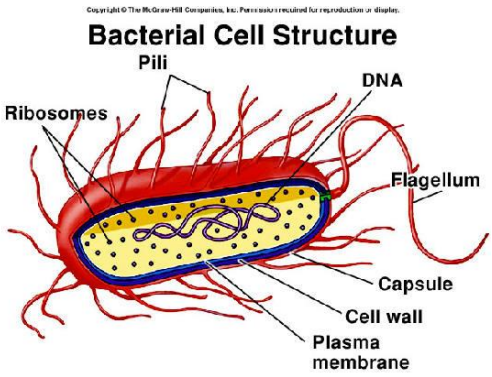


Microorganisms – Protists and Monerans: Organisms that cannot be seen with the naked eye are grouped into the kingdom "**microorganisms**". They are almost all unicellular and can be prokaryotic (without a nucleus) or eukaryotic (with a nucleus).



Protists are the unicellular eukaryotic organisms that do not fit into the kingdom of plants, animals, or fungi. Protists include amoebas, paramecia, and some species of algae. Many protists have cell structures that allow them to move independently, like flagella or cilia.

Monerans are all unicellular organisms which lack nuclei and other cell structures surrounded by a nucleus, called **prokaryotes**. Bacteria and archaea are the two types of monera. Organisms in this kingdom make up the majority of "pathogens" – infectious lifeforms that cause illness and death in other organisms. However, there are many species of monera which actually help other organisms and are essential to their survival. For example, many different species of bacteria live in the intestines of humans to aid in digestion.



Every single living thing in the world is included in one of these kingdoms. Organisms are organized into these groups based on characteristics they share. However, all organisms are related in some ways, much more than one may

expect. In fact, all living things in the world can be traced back to a single ancestor – the first organism to develop on Earth.

The number one priority of every species of organism is to prolong their existence indefinitely. Organisms thus must adapt to their environment and develop characteristics that help them to find food and combat predators in order to survive as long as possible. **Evolution** is the process by which organisms grow and change over time**.** This is a very slow process; it will often take many generations before a noticeable change becomes apparent. For example, modern humans first emerged approximately 200,000 years ago and haven't noticeably changed since.

As organisms age individually, their bodies grow from a process called cell reproduction, where one cell splits into two cells which are almost always identical. During this process, the genetic material in the cell called **deoxyribonucleic acid** (**DNA**) is copied and then divided evenly between the two new cells – this is called DNA **replication**. The DNA in a cell is occasionally copied imperfectly, resulting in one cell containing slightly different genetic material than the other. This is called a **mutation**, and it can happen as a response to a change in the organism's environment, a change in the organism's internal body, or simply by accident. When these mutations result in a positive change in the organism, such as a change that helps them survive better in harsh weather, the mutation is passed on to the next generation of the species. The other organisms of the same species will either eventually develop the same mutation, or they will die off because they are unable to survive in their environment. The species is then said to have *evolved*, and the process of the environment killing off the unevolved members of the species is called **natural selection**.

Activity 1: How to Classify Animals

Purpose: To learn how we can use physical characteristics to group different animal species together, and observe that there are many factors used when grouping organisms together or separating them.

Item	**Quantity (10 students)**
Animal picture cards (sheet)	10

TO BE DONE BY MENTOR (prior to activity): Print off several sheets of animal picture cards, one sheet per student. The animal sheet can be **found at the link on the references page, on page 4 of the .pdf file.**

Procedure:

1. Give each student a sheet of animal picture cards.
2. Cut out the cards.
3. Write down unique characteristics of each animal on the sheet.
4. Separate the animals into two different groups based on their characteristics.
5. Pair up to compare and discuss their reasoning for creating their respective groups.
   Mentors: Call on a few pairs to tell the class their findings.
6. Establish that animals can be divided into two large groups: vertebrates (with backbone) and invertebrates (without backbone), and then rearrange your cards using these criteria.
   Mentors: Check if each pair has the distinctions correct.

Activity 2: Natural Selection

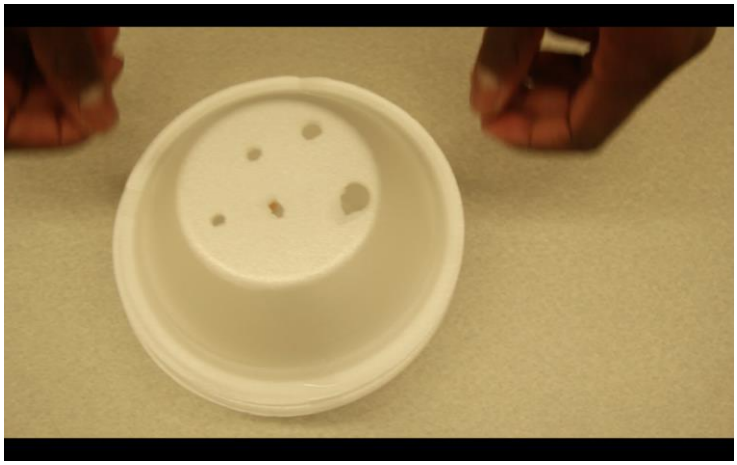
Purpose: To learn how natural selection results in populations of organisms different from the original, and discover how natural selection occurs.

Item	**Quantity (10 students)**
Cup of various sizes of beans (5 different beans recommended; dry soup mixes work well).	5
4 wooden dowels with assorted diameters	5
Pencil	5
Styrofoam bowls	10
Tape	5

Procedure:

Mentors: Ask students to pair up. Each pair gets one cup of beans, four dowels, one pencil, and two Styrofoam bowls.

1. Poke five different sized holes into <u>one</u> of the Styrofoam bowls using the pencil and dowels.
2. One student places five of each type of bean into the Styrofoam bowl <u>without the holes.</u> Put the bowl with holes on top of the filled bowl, tape the bowls together, and turn the bowls over with the beans inside.



3. One student shakes the bowl from side to side 10 times while the other student watches closely and records the number of each type of bean that falls through the holes.

Note: The beans that fall out represent microorganisms that have died off, and the beans that stay in the bowls represent microorganisms that have survived.

4. For each bean remaining, add another bean of the same type to represent cell reproduction; then repeat step 4. Do this two or three times, then observe which type of bean (species of microorganism) has survived best and which have died off quickest.

Activity 3: Building the Ideal Species

Purpose: To study the processes of adaptation and natural selection by designing an ideal species for a simulated environment.

Item	**Quantity (10 students)**
Writing paper	10
Construction paper, assorted colours	20
Cotton balls	20
Pipe cleaners	20
Tooth picks	20
Sheet of aluminum foil, 1 foot in length	10
Glue, white or stick	10
Scissors	10

Procedure:

Mentors: Before starting the activity, write down the conditions in step 3 for only the mentor to see.

1. Number your paper 1 to 5.
2. Assign a letter from A to E to each number
   Note: You may assign the same letter to multiple numbers, or not use certain letters. For example, you may choose to write the letter "B" next to all give numbers, if you wish.
3. **Mentors:** Read the conditions that correspond to the letters and numbers as follows:
   1) Climate: A=Hot and dry (example: desert), B=Hot and rainy (example: tropical rain forest), C=Moderate temperatures and high rainfall (example: deciduous forest) D=Moderate temperatures and low rainfall (example: grasslands), E=Below zero temperatures (example: tundra).
   2) Type of Terrain: A=Volcanic islands, B=Swampy, C=Mountains, D=Flatlands, E=Underground.
   3) Predators: A=Large birds of prey, B=Humans, C=Cheetahs, D=Wolves, E=Bears.
   4) Food: A=Fish, B=Leaves of tall plants or trees, C=Roots of plants, D=Fast running animals, E=Insects.
   5) Biggest threat to survival: A=Pollution, B=Deforestation, C=Disease, D=Not producing enough offspring, E=Lack of food or water.

4. Now that you have your environment, decide which adaptations would be suitable for an animal living under these conditions (for example, wings, gills, camouflage). Write down these adaptations and explain in one sentence how they aid in the animal's survival.
5. Create a model of your species using drawings and the materials provided.

Mentors: If students are unfamiliar with the given conditions, have a brief discussion about these conditions and how real organisms survive in them.

References and additional resources:

Background information:
http://micro.magnet.fsu.edu/cells/animalcell.html
http://www.biologipedia.com/wp-content/uploads/2015/07/structure-of-an-animal-cell.jpg
https://www.britannica.com/topic/plant
http://www.livebinders.com/play/play?id=232663
http://www.microbiologyonline.org.uk/about-microbiology/introducing-microbes/fungi
https://colonialnuggets.wikispaces.com/2014_KingdomsFungi
http://www.microbeworld.org/types-of-microbes/protista
http://www.zephyrus.co.uk/protistkingdom.html
http://biology.tutorvista.com/organism/kingdom-monera.html
http://faculty.southwest.tn.edu/rburkett/Cell%20structure%20and%20function.htm
http://www.kidsbiology.com/biology_basics/five_kingdoms_life/moneran2.php

Activity 1:
http://www.onestopenglish.com/clil/young-learners/animals/pdf-content/amazing-world-of-animals-lesson-1-how-to-classify-animals-lesson-plan/550144.article

Activity 2:
http://www.microbeworld.org/images/stories/resources/PDFs/Experiments/naturalselection.pdf

Activity 3 and post-test:
http://evolution.about.com/od/teaching/a/5-Quick-Evolution-Activities.htm

Post Test

"Evolution telephone":

This game can be played with groups of no less than five individuals. Mentors should join in the activity if necessary to reach the required number.
Create a short, informative phrase about evolution – for example, "animals adapt over generations for their environment". Have players sit in a circle, with one player designated the start of the circle. Whisper the phrase to the first player and ask them to continue by whispering the phrase to the next player, and so on. Tell the player at the end of the circle to say aloud the phrase that they hear whispered to them. The phrase will most likely be different than the original.

Explain to the students that this is how evolution works; the phrase said represents DNA, and each player along the line can represent a single generation. At the end of the line, the phrase that is said aloud by the last player is the "evolved" version of the original phrase.

*If the phrase at the end is identical to the original, explain how this could represent the DNA of an organism that didn't change over time because it wasn't required to change to adapt to its environment.

Materials List

Item	Store	Cost
Round dowel: 3/16 by 48 inches	Rona/Pierceys	$0.67
Round dowel: 1/4 by 48 inches	Rona/Pierceys	$1.12
Round dowel: 7/16 by 48 inches	Rona/Pierceys	$1.99
Round dowel: 5/16 by 48 inches	Rona/Pierceys	$1.23
Hilroy heavyweight construction paper pad, assorted colours; 48 sheets	Staples	$5.19
Red lentils	Superstore	$.79/100g
Green lentils	Superstore	$.35/100g
Split peas	Superstore	$.39/100g
White pea beans	Superstore	$.59/100g
Red kidney beans	Superstore	$.89/100g
equate regular size cotton balls; 600 pack	Wal-Mart	$2.57
Elmer's chenille stems, assorted; 100 pack	Staples	$1.97
Great Value round toothpicks; 2 pack, 500 total	Wal-Mart	$1.93
Great Value aluminum foil, 25 feet	Wal-Mart	$1.97
Elmer's washable school glue, 120ml	Wal-Mart	$.97
Elmer's all-purpose glue sticks; 30 pack	Staples	$19.69
Westcott Kleen Earth 8" Scissors; 3 pack	Wal-Mart	$9.97
Great Value 12oz foam bowl; 50 pack	Wal-Mart	$2.98