

Name: _____

Date: _____

Life Science

Period: _____

Change Over Time – *Natural Selection*



Monstrous Mutations

Lab on the Effect of Random Mutations on Animals' Survival Skills

Introduction

The process of evolution involves changes in the genetic makeup of a population over a period of time. The production of the new genetic material results from alterations in the DNA of a developing organism. This random alteration of DNA from parent to offspring (called **mutations**) produces variable characteristics in offspring. These mutations are not related to the present needs of an organism but are merely the result of chance.

As a result of mutations, some organisms in a population will have a set of genes that are better suited to the current environmental conditions. ***These organisms will have a better chance of surviving and reproducing offspring.***

Unfortunately, not all mutations are helpful. Some alterations of DNA result in characteristics that harm the organism or do not affect it at all. Lizards' ability to change color is an example of a beneficial mutation that was retained and passed on to future generations. A fawn born with instead of brown as the result of a mutation would probably not survive long enough to reproduce because of its inability to conceal itself from predators. Such harmful mutations do not remain in the population long enough to be passed on to future offspring.

The characteristics caused by mutations that are retained and passed on to future offspring are called **adaptations**. These adaptations can be structural, physiological or behavioral. Antlers on deer, quills on a porcupine and venomous glands on a rattlesnake are examples of structural adaptations. A cat arching its back and an owl ruffling its feathers are examples of behavioral adaptations. A physiological adaptation in an organism is characterized by the reduction of the flow of warm blood to the skin in response to cold weather.

Why do organisms adapt? They do this in response to the need to obtain energy, nutrients and water from the environment. Adaptations are necessary to protect animals from predators and ward off disease-causing organisms. These adaptations allow them to compete with other organisms for limited resources.

Pre-lab Questions

1. What is a mutation? _____
2. An opossum's ability to play dead when approached by a predator is an example of a _____ adaptation.
3. A bird's ability to fly south when winter weather approaches is an example of a _____ adaptation.
4. The growth of a heavy coat of hair by an organism in response to cold temperatures is an example of a _____ adaptation.
5. List five adaptations not mentioned in the Introduction section.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

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Background

Students will form equal groups. Each student will simulate an animal with a mutation that can only digest pistachio nuts as its food source.

The goals of the group are to:

1. Gather the food (3 pistachios per group member).
2. Store the food for later use (place the group's pistachios in your letter-designated container).
3. Retrieve the food at a later time (remove the nine pistachios from the container and return with the pistachios to the home location).
4. Process and consume the food (remove the pistachios from the shells or candy from the wrapper, and consume them [or open them to appear as eaten]).

Materials

Pistachio nuts
Blanket
Table/desk
One container with lid per group
~50 plastic knives
Duct tape/5 cravats
Three pairs of socks
5-10 pairs of goggles
Stop watch

Procedure

1. Each group finds out which mutation has occurred to their group by selecting a letter from the paper bag. The letter drawn will correspond to the characteristic listed on Chart 1. The letter also corresponds to the letter of each group's home location.
2. Each group prepares itself to represent the characteristic produced by their mutation.

Chart 1

Letter drawn by groups	Characteristic produced by mutation
A	Long fingernails (produced by plastic knives taped to fingers)
B	No fingers (produced by placing a sock over each hand and taping hand closed)
C	Lack of peripheral vision (produced by putting on goggles and stuffing cotton on the sides to prevent viewing from the side)
D	Hands fused together in front of body (produced by placing hands together in front of body and taping/tying them together)
E	Feet and ankles fused together (produced by taping the ankles tightly together with duct tape/cravats)
F	No arms (produced by securing arms down to the side of the body)
G	Arms fused together behind the back at the wrists (produced by placing arms behind the back and securing tightly at the wrists)
H	Blind (produced by using goggles taped over securely with duct tape/blind folding)

3. The teacher spreads the pistachio nuts on the blanket in the center of the room. Containers marked with letters for each group are set in another part of the room.

4. Each group positions itself at its specified home location, away from the lettered containers.

5. At the start of the stopwatch:

- Group members will proceed to the blanket and gather three pistachios each (ex: if there are 4 group members, 12 pistachios are to be collected).
- These nuts are then put in the container marked with the letter of the group.
- The group members should return to their home base and sit for 5 seconds.
- The group members return to their plastic container to retrieve their food and return to their home base. *Each group member must retrieve his/her own nuts.*
- At the home location, each group member will consume the contents of the nuts.
- When all members have eaten their nuts, the group will shout the letter of their group.
- The amount of time required to achieve this will be recorded by the time keeper on the board, and then transferred onto chart 2.

Data

Chart 2

Mutation Group	Time (Minutes)
A Long fingernails	
B No fingers	
C Lack of peripheral vision	
D Hands fused together in front of body	
E Feet and ankles fused together	
F No arms	
G Arms fused together behind the back at the wrists	
H Blind	

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Answer the post-lab questions in complete sentences:

1. Which characteristic caused by mutation appeared to be the most detrimental to the survival of a species? Explain your answer.

2. Which characteristic caused by mutation appeared to have the least detrimental effect on an organism's ability to survive? Explain your answer.

3. What activity in nature is represented by placing peanuts in the plastic bowl?

4. Select an animal in nature and describe how it gathers, stores, retrieves and processes its food.

5. Create an adaptation that might result from a mutation that would **enable** the organism to achieve these goals.

6. Make up an adaptation that might result from a mutation that would **prevent** the organism from achieving these goals.
