

Florida 4-H Environmental Education Activities

PROTECTIVE COLORATION

Grade Level 2-10 (* = Grades 8-10)

Sunshine State
Standards Science SC. G. 1. 2. 2.
SC. F. 2. 3. 2.
SC. F. 2. 4. 3.
SC. G. 2. 4. 3.

Major Instructional
Goal To help students understand how some organisms have evolved certain adaptations or color patterns which provide them protection from predators.

Associated Concepts

A. Individuals and Populations	E. Mutations
B. Camouflage	F. Natural Selection*
C. Morphological Adaptations*	G. Evolution*
D. Prey and Predator	

Educational/
Instructional
Objectives

Upon completion of this activity, students should be able to:

1. Identify two organisms whose color or color patterns blend with its environment and explain how this protects this organism from its predators.
- *2. Give an example of how the color of an organism can influence the natural selection process.
- *3. Explain how natural selection by predators could influence the evolution of a prey species by favoring an adaptation originating through mutations (e.g., peppered moths in England).
4. Explain how the environment (habitat) in which the organism lives could influence the survival of the organism; how seasonal changes could influence the survival of the species.



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Background Information

- *5. Predict what would happen to a toothpick worm population capable of reproducing if the students continue to prey on them over one week period, over a one year period, and over a hundred year period.
6. Explain how predator-prey relationships serve as an example of interaction in communities of plants and animals.

Through the process of evolution, organisms develop adaptations to increase their chances of survival. Natural selection is one of the mechanisms through which adaptation and evolution takes place. Natural selection is a process resulting in the survival and perpetuation of plant and animal life having certain characteristics that are best suited for the conditions under which they live.

Organisms that blend with their physical environment are less likely to be seen by a predator and, therefore, have a better chance for survival. The protective coloration activity will enable students to observe how animals might adapt and survive in their environment through camouflage. It can also demonstrate how some individuals may be eliminated because they lack the necessary coloration to blend with their physical environment.

Predator-prey relationships play a very important role in natural selection. The predator will usually select and feed upon prey species that are more visible or easier to find. The resulting effect on the prey population causes a higher survival rate for those individuals that are better adapted for concealment. Over several generations, a dominant genetic strain would result in a prey population that has the desirable survival characteristics. This genetic strain would persist as long as the habitat and the predators were selective in favor of this strain. The predator population might also evolve adaptations making them more efficient hunters (e.g., hawks have evolved excellent eyesight).

New traits appear in a population by a change occurring in an organism's genetic make-up. This is called a mutation. Mutations may be advantageous to the individual, allowing it a higher probability of survival and passing the new gene(s) and trait on to future generations. Or, a mutation may result in a reduced survival rate for the individual, thus being eliminated from the population. It is through mutations that homo sapiens have evolved many different morphological characteristics, such as eye/hair/skin color.



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The Activity

A. Information

4. Learning Site – Any lawn or short grassy area that is at least 15' x 15'.
2. Materials – 202 wooden toothpicks, green, red, blue, and yellow food coloring. Four wooden stakes, one small portable chalkboard, or a classroom with a board. Photos and mounts of animals may be used to illustrate examples of adaptations and protective coloring.
3. Preparation by Instructor – Separate toothpicks into four bundles of fifty each, and dye three of the bundles with a different color. (This should be done in advance so that the toothpicks have a chance to dry.) Stake off the game area before the students arrive, and randomly distribute the toothpicks within the area. Two or three blue toothpicks can also be added as an example of a mutation occurring. The leader may wish to wait until the students are taken to the site before distributing the toothpicks. This way they will see that 202 toothpicks are placed in the area. Care must be taken so that the toothpicks are scattered randomly and not clumped together.
- *4. Critical Vocabulary – Evolution, Adaptation, Protective Coloration, Predator, Prey, Natural Selection, Mutation.

B. Directions for the Actual Learning Activity

1. Focus – Introduce the concept of protective coloration. If you wish, you may use pictures of animals and the habitats they are found in, or a story which uses fictitious organisms and places, to illustrate the point of blending with the surroundings. Also discuss predator-prey relationships and how this affects the prey population in terms of survival of individuals with characteristics that are best suited for the environment.
2. The Activity – Show the students the boundaries of the game area, and the colored toothpicks for which they will be searching. Explain to participants that they are the predators (birds, i.e., toothpeckers) and



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that they toothpicks (worms) are their prey or good source. Explain how each color represents a separate non-interbreeding population or sub-species of worms. The game will involve two 2-minute hunts where they will gather as many toothpick-worms as possible. After the toothpick collection time is up, ask students to separate the toothpicks by color and then total the numbers of the individual colors and calculate percentages of each color collected. Have students compare percentages. Record this on the chalkboard for all groups and then ask students why fewer green and natural colored toothpicks were gathered. Give the students a second chance to hunt the toothpicks. This will help show the students how protective coloration increases chances of survival. Some green and natural colored toothpicks should remain, while red and yellow will probably all be collected. If two blue toothpicks were included, they should be found by the students and be used as a lead-in to mutations, which introduce new traits into a population.

Assign a reproductive rate to the unfound toothpicks (example, two offspring/mated pair). Assume only toothpick animals of the same color can reproduce. Have the students calculate numbers of each color for the next generation. Using the calculations, predict what the fate will be of each toothpick worm population.

3. Synthesizing Strategy – Using the data from the hunts, review the results of the first and second hunt. Introduce the concept of natural selection favoring a certain trait over another (in this case, color). Have the students predict the fate of each of the toothpick worm populations. Discuss how different environmental conditions may change the selection pressure felt by the population (e.g., if the snowshoe hare did not change colors to match the winter snow, it would fall easy prey to predators such as the lynx). Using the two blue toothpicks, introduce the concept of mutations and the way new traits appear in a population. This should help in clarifying the idea that natural selection is a process working at the level of the individual, but eventually, over many generations, may result in a new trait or characteristic



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to that population. The use of pictures showing other examples of adaptation/camouflage/mimicry, can be used to re-emphasize concepts and processes.

The following questions may aid in the syntheses:

- a. What types of patterns and colors produce the best camouflage?
 - b. How do these different colors or morphological adaptations appear in generations in the first place? (mutations) Are all mutations passed on to future generations?
 - c. Is it advantageous for predators, as well as prey, to be camouflaged? If it is, why?
 - d. Why aren't all animals camouflaged? (They have a better means of escape. Some provide mutual protection by flocking, poison, or sting adaptation).
 - e. What other types of adaptation for survival do animals have? (flight, remaining motionless, speed, burrows, scent)
 - f. Why are many female birds and young better camouflaged than adult males?
4. Suggestions to Teachers – Often, a search of the activity area and nearby environments will reveal a whole host of invertebrates that possess adaptations to help them survive. The book *Mimicry*, listed in the reference section, is an excellent source of colored pictures and examples which help illustrate the major concepts of the activity.

If more than one group is going to do this activity, but at different times, the same area can be used with the collected toothpicks re-scattered. After the second group some extra toothpicks may need to be added to replace the ones that have been trampled to the point of not being gathered.

