



Nimbus Genetics

Created by the NC Aquarium at Fort Fisher Education Section

Essential Question:

How is albinism in reptiles regulated (genetically) and how does it affect the animal?

Lesson Overview:

Students will learn about albinism in sea turtles and other reptiles, and discuss how albinism impacts an animal's life. Students will then use Punnett squares to lay out the genetics of albinism (a recessive trait) and determine how often albinism should occur among the offspring of non-albino parents with recessive albinism genes.

Learning Objectives:

By the end of this lesson, students will be able to:

- Identify characteristics of albinism.
- Understand and explain genetic variation using a Punnett square.

North Carolina Standards:

Third Grade:

Math:

- **CCSS.Math.Content.3.NF.A.3d** Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols $>$, $=$, or $<$, and justify the conclusions, e.g., by using a visual fraction model.

Fourth Grade:

Math:

- **CCSS.Math.Content.4.MD.B.4** Make a line plot to display a data set of measurements in fractions of a unit ($1/2$, $1/4$, $1/8$). Solve problems involving addition and subtraction of fractions by using information presented in line plots.

Science:

- **4.L.1** Understand the effects of environmental changes, adaptations and behaviors that enable animals (including humans) to survive in changing habitats.
 - **4.L.1.4** Explain how differences among animals of the same population sometimes give individuals an advantage in surviving and reproducing in changing habitats.



Fifth Grade:

Math:

- **CCSS.Math.Content.5.MD.B.2** Make a line plot to display a data set of measurements in fractions of a unit ($1/2$, $1/4$, $1/8$). Use operations on fractions for this grade to solve problems involving information presented in line plots.

Science:

- **5.L.3** Understand why organisms differ from or are similar to their parents based on the characteristics of the organism.
 - **5.L.3.1** Explain why organisms differ from or are similar to their parents based on the characteristics of the organism.
 - **5.L.3.2** Give examples of likenesses that are inherited and some that are not.

Time Frame:

Preparation: 5 minutes

Explanation: 10 minutes

Activity: 15 minutes

Materials:

- Punnett square sheets, 1 per group
- 8 plastic slide mounts (used for photo negatives) per student group OR 8 photo mats for a classroom set
- Clear cellophane
- Brown cellophane
- Glue (if making classroom set)
- Photos of white animals at the North Carolina Aquariums

Supplemental Background Information for Teachers:

Sometimes when a sea turtle nest hatches, white turtles can be found in the nest. These turtles are often albino. Albinism is a condition that is passed down from parents to young that affects the animal's color and vision. When an animal has albinism, it has received, or inherited, a trait from its parents that stops the body from making any pigments. Pigments are what give nature color. One important pigment that is missing in albino animals is called melanin, which is the main pigment that provides most color in animals.

Melanin has two jobs. The first is to protect animals from harmful sunlight. As humans, our skin is a part of our Integumentary System, and protects the inside of our body from the outside environment. Melanin is located in our skin to protect us from the sun's harmful ultraviolet rays. This is the same with sea turtles. Yet, unlike sea turtles, if the sunlight is strong, we are able to put on sunscreen and clothing to take care of our skin. Humans can adapt quickly to their changing environments. Sea turtles are not able to change as rapidly. The second job of melanin is to help develop parts of the eyes.



How does a lack of melanin affect animals? Without the protective pigment, sunlight is harmful to albino animals. They are more likely to be sunburned or get skin cancer than non-albinos. They can also have problems blending in with their environment and are more easily targeted by predators. Animals with albinism often have issues with their eyesight as well.

The North Carolina Aquariums have several white animals that have different genetic abnormalities.

- [Luna](#) is an albino alligator that lives at the North Carolina Aquarium at Fort Fisher (NCAFF).
- Also at NCAFF is an albino snapping turtle and an amelanistic yellow-bellied slider (turtle). Amelanistic animals are missing just melanin but can have other pigments in their skin.
- [Nimbus](#) is a Loggerhead sea turtle that lives at the NC Aquarium at Pine Knoll Shores. Nimbus is special because he is white, while most loggerheads are brown in color. This is because Nimbus is leucistic. Leucism is a reduction in pigments rather than a complete lack of pigments. Leucism can cause the whole body to be white, like Nimbus, or just to have patches of white skin.
- [Bleu](#), an alligator at the NC Aquarium at Roanoke Island, is also leucistic. He has patches of color on his skin instead of being all white like Nimbus.

Preparation:

If preparing a classroom set, cut four pieces of each color cellophane to fit the photo mats. Use glue to attach the cellophane to the back of the mat.

If creating student group sets, cut four pieces of each color cellophane to fit the slide mounts. Slide the cellophane into the mounts. Then print one Punnett square sheet per group.

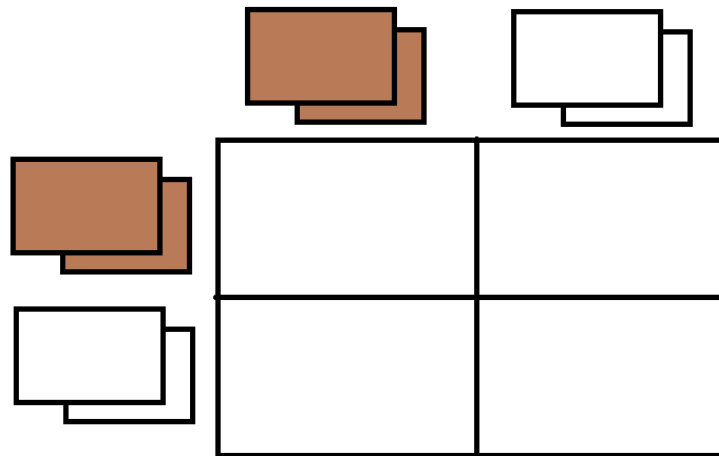
Activity:

1. Introduce the idea of physical character traits. Brainstorm character traits. Write a list of physical traits on the board.
2. Next, list the physical traits of sea turtles. Students should remember this from other lessons.
3. Explain that sometimes animals have different physical traits than normal. Ask the students if they can think of a physical trait that might change. Why might this happen? Review that organisms differ from or are similar to their parents, based on the characteristics of the organism.
4. Explain that the color of an animal can be different from their parents if they have the right combination of genes.
5. Show pictures of the different white reptiles at the NC Aquariums. Explain that their parents looked like normal reptiles, but these animals had a combination of genes that made them different.

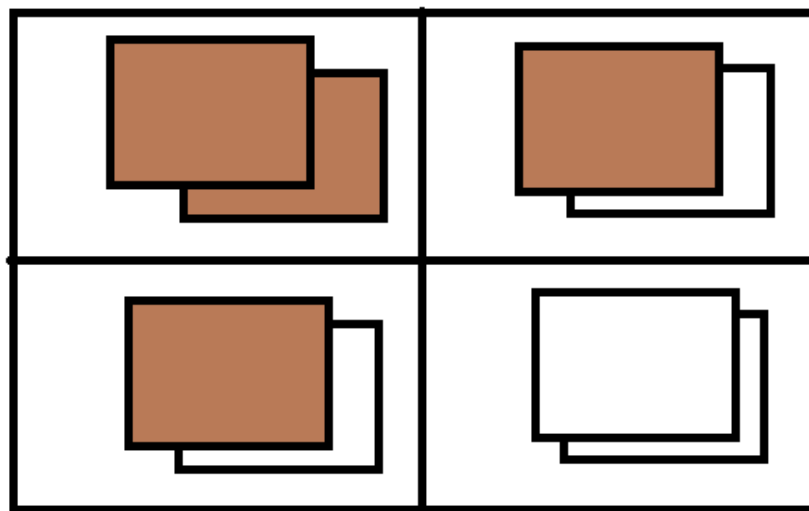


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6. Ask the students to consider: If two normal adult sea turtles had a baby that was albino, how might we figure out what the possibility of more albino babies would be?
7. Explain that the normal color for sea turtles, brown, is dominant to albino, so if a turtle has a brown gene, it will look brown. The turtle must get two albino genes to be white.
8. Distribute the Punnett square sheets to each group.
9. Explain to the students that for two normal sea turtles to have an albino baby, they must each have one brown gene and one albino gene. Explain that the genes of a mom and a dad each have dominant and a recessive gene. A dominant gene is one that is shown, while a recessive gene is hidden.
10. On the Punnett square sheet, have each group place two brown slides on the dominant space for each parent to represent the brown gene. Then have them place two clear slides on each recessive space for each parent to represent the albino gene. It should look like this:



11. Have the students place the slides into each of the four boxes. The slides will go down the columns and across the rows to look like this:





12. Students should answer the following questions:
 - a. What is the difference between a dominant gene and a recessive gene? Is albinism considered dominant or recessive?
 - b. Using fractions on a number line, what fraction of the offspring will be brown? What fraction will be albino?
13. Lead a discussion on why it is difficult to be a reptile that is albino (hard to hide from predators, hard to sneak up on prey, and a high chance of sun poisoning).

Summary:

Genes regulate everything about an organism. Sometimes offspring have genes that make them look very different from their parents. An example of this is albinism. This will cause the offspring to be white even if the parent is normal-colored. You can use a Punnett square to determine the percentage of offspring that will be albino.

Extensions:

1. Discuss other animals that can be albino. Do certain groups, such as reptiles, face more challenges as albinos than others, such as mammals?
2. Visit the North Carolina Aquariums to see the white animals. While Luna, Nimbus, and Bleu are on exhibit, the albino snapping turtle and amelanistic turtle are behind the scenes at NCAFF. Learn more about behind the scenes tours here:
<https://reservations.ncaquariums.com/fortfisher/Info.aspx?EventID=3>