

Green Genes: a DNA Curriculum

Massachusetts 4-H Program

Activity #5: WHAT WILL THEY LOOK LIKE?

Time: 30-60minutes (Allow longer time if designing animal or if doing multiply crosses.)

Introduction: Have you ever wonder why a litter of cats looks so different or how none are the same color of the mom or the opposite how maybe a litter of bunnies look so alike? Are you interested in breeding your own project animals? In this activity we are going to look at inheritance and why it is important to many professional breeders, farmers and even 4-H youth.

Information to share with youth:

Chromosomes are shaped differently from one another because they contain different amounts of DNA. Some are long and thin; others are short and fat, which helps to identify them and each chromosome pair carries a set of genes that no other pair carries. The instructions for eye and hair color might be carried on one pair of chromosomes, but the instructions for ear lobes are located on the genes in a different pair of chromosomes. Also a female has two equal-sized chromosomes named X's. A male has one x chromosome and one y chromosome which is smaller in size.

Genes are passed down from parents to their offspring. Much like your parents inherited their genes from their parents, your pet inherited it's genes from its parents and received one chromosome copy from each of its parents. For instance, you got two chromosome #3's, each one carrying the same genes as the other one, for doing exactly the same jobs in the body. So which genes are chosen for a particular job, the Dad's or the Mom's?

In fact, most of the matching genes on your two chromosome #3's will be exactly the same, and it won't matter which one the body uses. But some will have slightly different codes form each other, and one gene code could be dominant over the other. In that case, the body will use the dominant gene for the job and ignore the unused "recessive" gene. Even if the "recessive" genes is not turned on for the job it is still carried and could be passed on to its offspring.

Background Information for Educators:

All the living things in the world have chromosomes full of DNA in their cells. But the number of chromosomes varies from species to species. For instance, mosquitoes have only six chromosomes in each cell, but goldfish have 94. Though humans have 46 chromosomes they carry about 30,000 genes in all, the most genes of any species. Every species however has a certain number of chromosomes in its cells and they exist in pairs. The two chromosomes of a pair are not identical, but they are similar in size and shape and come from the parents. Most importantly, both chromosomes are responsible for producing the same characteristics in the



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cell. In people we are given 23 chromosomes from our mother and 23 from our father, so nearly all your cells contain 46 chromosomes or 23 pairs of chromosomes. Genetics have numbered the chromosome pairs to make studying them easier and in species with males and females there is a special pair of chromosomes that determine whether you are a boy or girl. The 23rd chromosome pair in a human cell is different from the others because it varies depending on whether you are a boy or a girl.

Goals:

- Review concepts of traits
- Discuss Heredity
- Review probability and alleles

Group Size: Whole group then crosses in pairs

Supplies:

- Pencils
- (1) Worksheet per student for each pairing Handout A
- Bags from “Call It Probability?” Activity
- Optional – materials to make/color animals and their offspring

Directions:

1. Have the group decide on a particular species such as rabbits, cats, dogs....(*You may want to review activity #1 on traits.*)
2. Have the youth recall what are physical traits and make a list.
3. Have the group select 5-8 traits other than gender such as coat color, pattern, ears, horns... and decide which genes are dominant and write alleles (RR,Rr,rr...) *Note: It is best for them to start with only two alleles and then allow more alleles to make more choices. . (They can be creative and come up with some new choices such as purple coat color.)*
4. Assign each person to create their own animal using the traits from the list.
5. Have the group pair up and cross their animal with their partners resulting in 4 or more offspring and list the traits of each using the system they learned in activity #4, “Call It Probability”. (Youth can do more crosses as time permits in between.) Option: Have youth draw or make models of each one. Youth will have to determine which genes are expressed and explain how they came up with their results. (Ex: Why only one offspring is the same color as the mother – gene is recessive.)
6. Pairing can be repeated.
7. Discuss with the group using pugent squares, dominant/recessive....



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Reflect:

- Why are we looking at physical traits
- Why do we not want to include gender
- How many variations do we have for each trait? Why?
- How did you determine which traits would be dominant and which ones recessive?

Apply:

- How does this apply to Dog Breeders?
- How might this apply to those in 4-H or FFA choosing an animal project?
- What would a dairy farmer look at for favorable traits in heifer calves?

Go Farther:

- Discuss how some genes/traits like hair and eye color are on the same chromosome with the group and have them redo the exercise by linking two of the traits and trying again.
- Repeat by adding gender and a sex-linked trait. How do these crosses and the resulting offspring differ from their earlier cross?
- Investigate Poultry genetics and the genes that control egg color.
- Check out the PowerPoint on Dairy Genetics looking at coat color.



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