



Animal Breeding & Genetics

Pedigrees

Grade Level
9-12

Lesson Length
2 periods x 55 Minutes

STEM Careers

- Geneticist, Statistician, Analyst

Nebraska Science Standards

- SC 12.3.2 (Heredity)

Next Generation Science Standards

- LS3.A (Inheritance of traits)

Animal Biology

- 1. (Apply genetic principles in the selection and breeding of animals for food production and human welfare)

These lessons aim to bring the science, skills of inquiry, critical thinking, and problem solving to life through an agricultural context.



Learning Objectives

By the end of the unit, students should be able to:

- Describe what a pedigree is
- Explain how they are useful in the animal science community
- Utilize a pedigree to identify key traits or possible diseases in a family line
- Explain how pedigrees assist with selection of top animals for either breeding or production

Materials List – (per student team)

- Writing Utensil
- Worksheet

Materials List – (common working area)

- Powerpoint
- Photos/video of set of animals for judging or bring in real set of animals

Preparation

- Use in conjunction with your own livestock evaluation lesson to introduce pedigrees and how they can be beneficial if looking at a class that has them
- Bring in animals or use video/pictures of evaluation classes that you have for Activity 2



Introduction (Interest Approach)

Think about your immediate family and what traits you share with them. They can be physical traits such as red hair or green eyes. They can also be non-physical traits such as disliking the same foods or an affinity for a certain type of animal.

Have students begin to fill out a family tree in their notes that show some traits that they think have been passed down from their parents or what they think they got from them. Give students about 3 minutes before allowing them to branch out and add in your siblings, cousins, aunts, uncles and grandparents if you know some of their traits (such as eye color or hair color). Allow students to have access to electronic device to look at pictures of them if they have them.

Once everyone has completed their family trees, ask some of them to share a trait that is in their family to give them a little bit of time to talk about their families.

- Example: every girl on my mother's side is born with red hair and keep it until we reach high school (except me)
- Why might I be different than other women in my family? –because my dad carries the recessive red hair gene in his family as well.

Give them time to think about what might make them genetically different from their parents and their siblings if they have them.

Essential Questions

- *How can we use pedigrees in conjunction with other judging methods to select for the best breeding and production animals?*

Learning Activity 1: Understanding the Use of Pedigrees

Show video: <https://www.youtube.com/watch?v=QFy4uLHUdS8>

→introduces the parts and structure of a pedigree with some examples

Show video: https://www.youtube.com/watch?v=YhRxoA_49m8

→introduces the structure and explains autosomal pedigrees and sex-linked pedigrees

Go through the slides of notes one by one, addressing everything and answering any questions. This lesson should be after the other genetics lesson over blood typing, so some of the slides are review over terms that will aid them in figuring out pedigrees.

Hand out notes page worksheet that have room for students to take notes and has example pedigrees to work on it. Pause on slides with pedigrees to allow students time to figure out the genotype of each individual on the pedigrees or answer what the offspring child would look like.

Walk through how calculating breed breakdown of a crossbred would go using the example slide. This could then be investigated further if the students are interested in their own family history and what their family genealogy is and what the percent of a specific ethnicity they may be.

- Present what your own genealogy percentage breakdown is if you know some of it.
- Example: I am 1/8 Austrian, 1/4 Irish, 1/8 Scottish....etc.

Learning Activity 2: What's Wrong with This Picture?

After going through pedigrees, review or introduce to the class the concept of livestock evaluation (depending on where during the year you go over pedigrees as compared to what you look for in livestock evaluation and the knowledge level of the class). Every person has their own way of teaching livestock evaluation concepts, so feel free to use whatever you have done in the past.

- I stick to the basics of going over what to look for in muscling, finishing and structure of the animal.

Pull out the pictures/video or live animals you have to evaluate and give them to go through and evaluate the animals that are there based on the livestock evaluation principles you review with them at the beginning of class. After they are done, pose the questions:

- In what order did you rank the class?
- Why did you place one over two and two over three and three over four?
- What really stuck out to you about the four of them?

Depending on what type of animal you decide to bring in or you may have to evaluate, set up the scenario for your students with their worksheet (feel free to change the type of animal said in the scenario based on what you have access to).

“There is an unnamed genetic disorder in your family’s cattle herd that is starting to become a problem. The disease doesn’t have any physical symptoms that you or your family have noticed yet. Not only does it kill the cattle, but the meat of the animal isn’t as appetizing and causes those who eat it to become very sick.

Your parents have the pedigree of some of the cattle in the herd, but they don’t know what it means. They don’t know what cattle might be carrying the disease or which ones are okay to eat. They want to get to work on clearing out the cattle that have the disease, but don’t want to get rid of the wrong cattle or save the cattle with the disorder.

You have had the experience to understand their pedigree and think you can help them out in determining which cattle have the disease and which don’t, so you offer up your services.”

Have the students complete the worksheet pedigree and answer the few questions that the parents have. Also be sure to explain that those are some of the sample cattle from your pasture and that a few of them may have the disease, but we don’t know which ones.

Reflection

Using the prompts below to facilitate reflection, allow each student to respond in writing to the prompts and then facilitate a whole class discussion.

- 1) In Learning Activity 2, you used a pedigree to figure out which animals had a genetic disorder that was not only killing them, but also would cause people to get sick if they ate the meat. What if you hadn't had the pedigree? How do you think farmers work with this problem daily?
- 2) After learning that some of the animals that we had evaluated were diseased, would this change your rankings? Why and how?

Apply

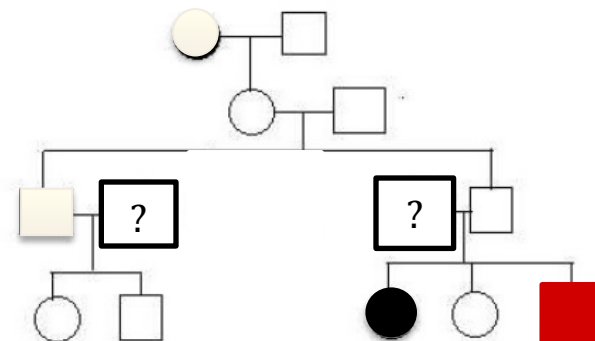
You are looking at a buying a purebred male doberman dog that you would like to breed with your purebred female doberman dog. You only want to purchase a purebred, to ensure purebred offspring, allowing you to continue with the lineage.

You have met with two potential sellers that both claim that their dogs are purebred. Just to be sure, you ask the sellers for their dog's pedigrees. The first owner hands his over without any fuss, however the second owner doesn't seem too keen about handing her's to you.

When looking at the first doberman's pedigree, you see that each generation of dog is easily depicted, leading up to the stud doberman the owner now owns. When you look at the second owner's pedigree, you notice that there are some blank spaces on the pedigree. Thanks to your high school ag class, you can look at the pedigree and determine what is missing.

The red square is his doberman and you need to figure out what the black circle on the pedigree chart could represent in regard to the purebred pedigree. What is the likelihood that one of the missing dog's was not a purebred?

Which seller would you choose to breed your female doberman with? Why?



Name:

Lab Report

Please complete the following report during the design and implementation of your experiment.

Research Problem

- Describe what you are investigating and justify why you are investigating the problem.

Hypothesis

- Formulate one or more hypotheses for your experiment.

Procedures

- Create the steps you will follow for your experiment.

Data Collection

- Describe the data that you will collect during your experiment.
- Provide graphs, tables, charts, and raw data as necessary.

Results

- Explain your results.

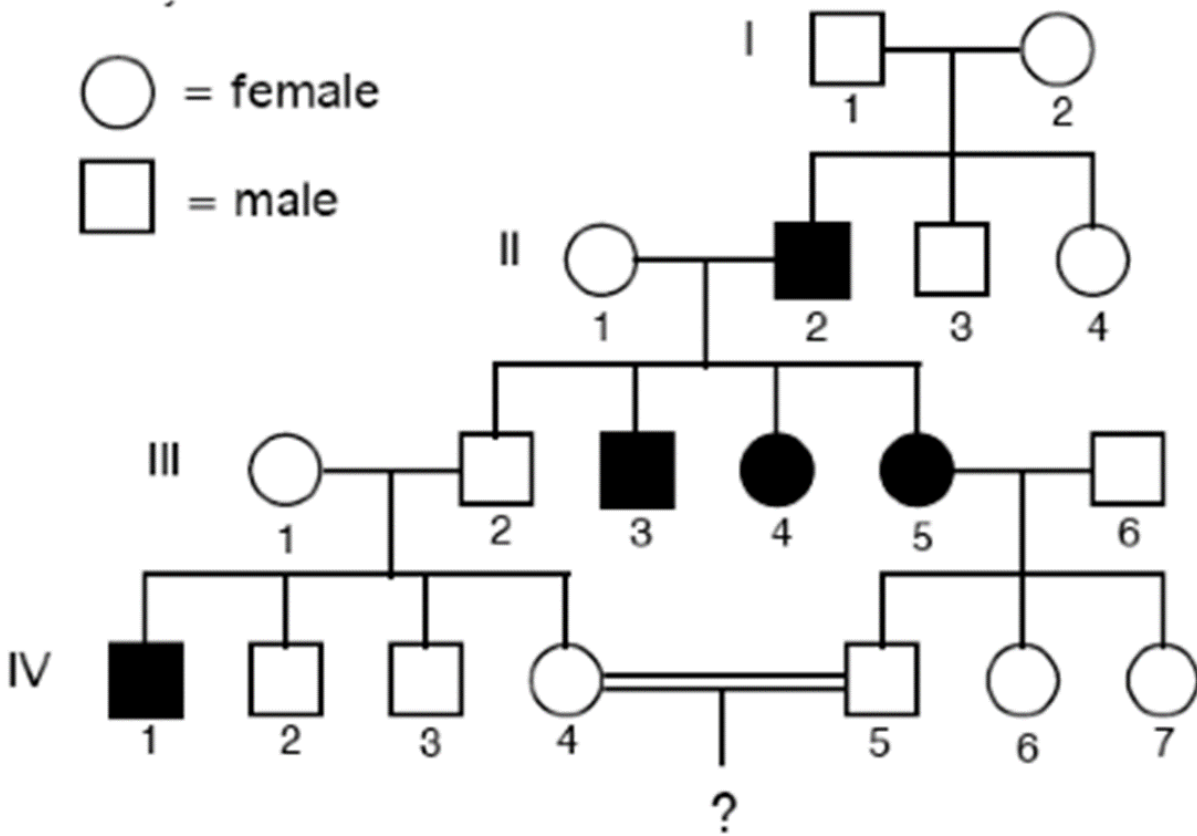
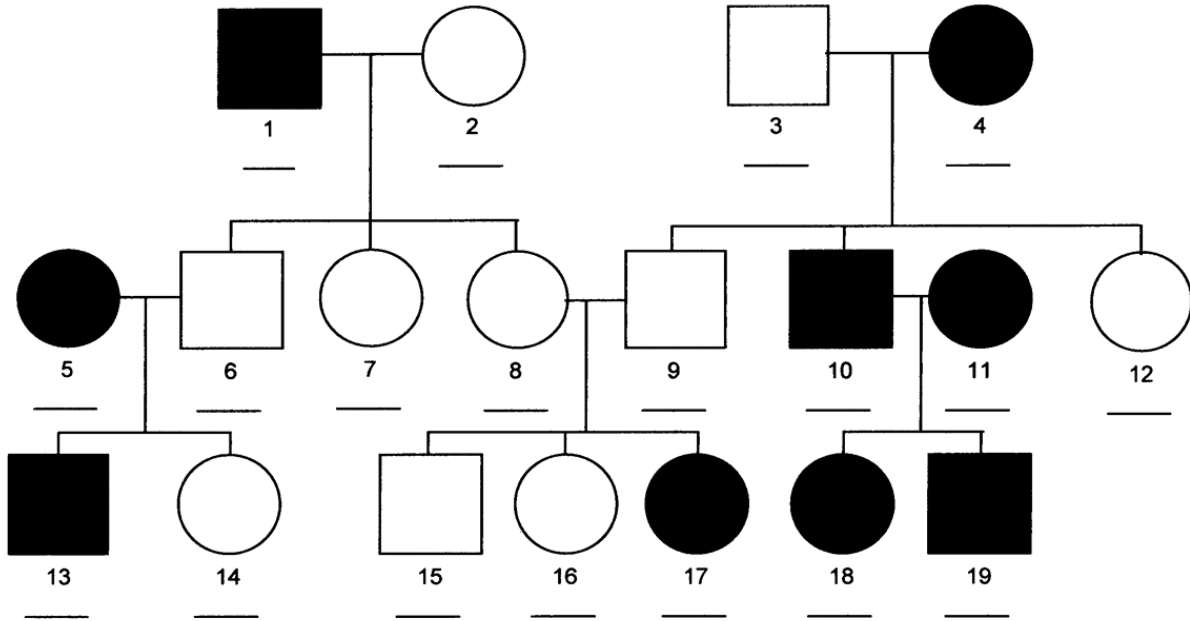
Conclusion

- Based on your data:
 - What can you conclude?
 - Were your hypotheses supported?
 - Were there limitations to your experiment?
 - What are new research questions that derived from this study?

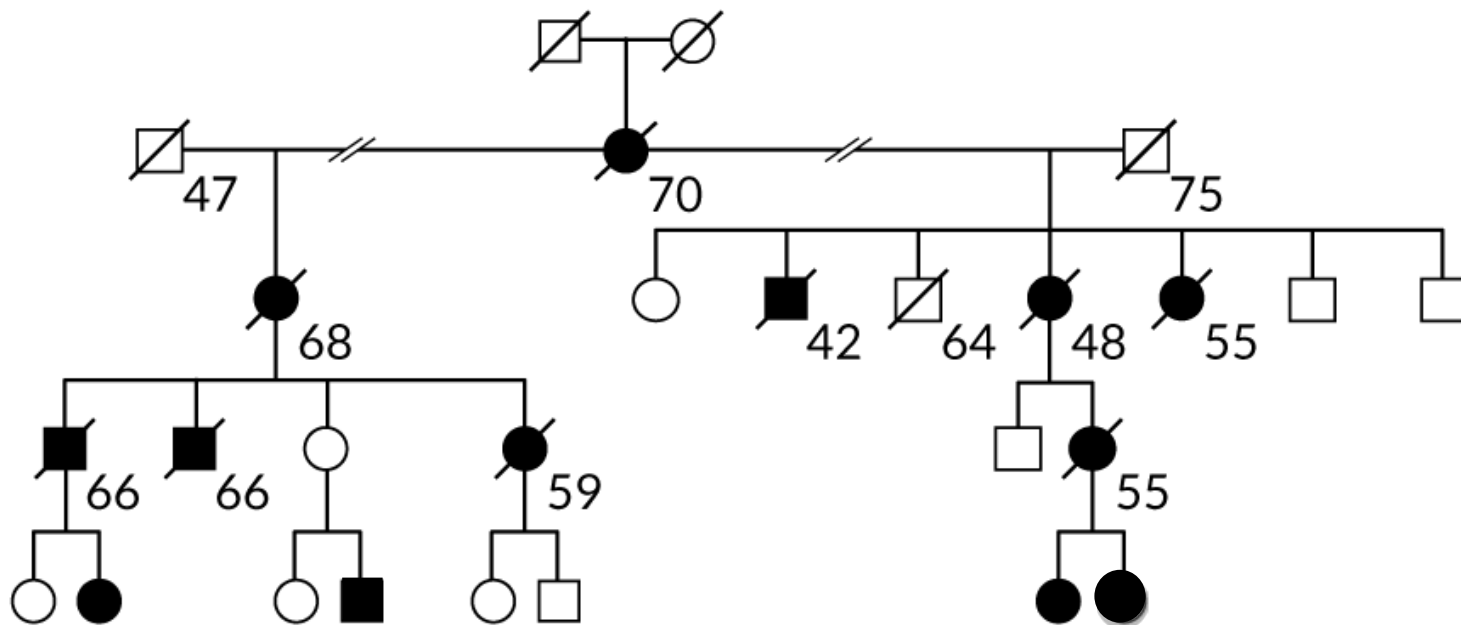
Pedigree Notes Page:

Name _____

Create your own family tree tracing back a physical trait that you share with family members.



Unnamed Genetic Animal Disorder Pedigree



Black = individual shows signs of disease

White = individual does not show signs of disease

Crossed Out Individual = deceased

Break in line = there are other offspring, but they aren't needed for this pedigree

Scenario 1:

“There is an unnamed genetic disorder in your family’s cattle herd that is starting to become a problem. The disease doesn’t have any physical symptoms that you or your family have noticed yet. Not only does it kill the cattle, but the meat of the animal isn’t as appetizing and causes those who eat it to become very sick.

Your parents have the pedigree of some of the cattle in the herd, but they don’t know what it means. They don’t know what cattle might be carrying the disease or which ones are okay to eat. They want to get to work on clearing out the cattle that have the disease, but don’t want to get rid of the wrong cattle or save the cattle with the disorder.

You have had an Ag class where you worked on pedigrees and think you can help them out in determining which cattle have the disease and which don’t, so you offer up your services.”

Directions: Go through the pedigree above and figure out which genotype (using G and g) the animals have. Then answer the following questions that your parents have asked you about the herd.

1. Is the disease a dominant or recessive trait?

2. How do you know?

3. Which cattle that are still alive are safe to eat and which are not?

NOT SAFE:

SAFE:

4. How might we correct for this in the future?