

Genetic Inheritance

SKILLS

- **Understanding inheritance:** we inherit the genes of our parents, grandparents, etc. Attaining certain features is predisposed.
- **Understanding genetic variability:** there is a fair amount of chance that plays behind inheriting genes so that there's no given formula for what is inherited from Mom and what is inherited from Dad. This chance, however, can be predicted in terms of probabilities.
- *(Advanced)* **Understanding dominant and recessive traits:** we may have a recessive gene, but it may be overridden by a dominant trait. This is also why we may inherit a recessive trait that neither of our parents have.
- *(Advanced)* **Present the concept of incomplete and codominance:** sometimes, both or neither gene will be completely dominant. This introduced the idea of a combination of gene qualities (genotype) in the actual trait (phenotype).

MATERIALS

- Whole Potatoes (*Face*)
- Black, Dark Brown, Yellow, and Red Yarn (*Hair*)
- Black, Green, and Blue Googly Eyes (*Eyes*)
- Black, Dark Brown, Yellow, and Red Chenille Stems (*Eyebrows*)
- Red and Pink Construction Paper and Cardstock Cut-Outs (*Lips*)
- Triangular Eyelets and Circular Stickers (*Pointy/Round Nose*)
- Hole-Punched Paper (*Freckles*)
- Scissors
- Glue
- Colored Pencils, Crayons, and/or Markers
- Coins

NOTES

Adult assistance will be necessary for making a “potato baby.” If there is extra time, another one can be made and added to the family. This is preferred because they can see the role of dominant and recessive genes better in the creation of multiple children.

The idea of genetic inheritance may be difficult to get across in a lecture format, so it may be a good idea to give a very brief overview. Having an interactive discussion (explanations as well as application and questions for further exploration) in small groups during the “potato baby” activity is highly encouraged.

Activity 1	What are Your Features?
Materials	Handouts of Features (images included)

Introduction

- ❖ Give a review of what has been learned so far. Do you remember what DNA is? What does it look like? What is it made of? What does it do?
- ❖ DNA is like an *instruction manual* for how things appear and function; each set of instructions for how things look (like your hair or eye color) is called a *gene*.
- ❖ Not all genes are used! We actually have *two* genes (DNA instruction manuals) for every trait (appearance). Can anyone guess which gene is used?
- ❖ There are two types of genes: **dominant** genes and **recessive** genes. Can anyone guess what they do? **Dominant** genes overpower **recessive** genes, so if you get a dominant gene from either of your parents, you will have that trait! If you have a trait from a recessive gene, it means you didn't inherit any dominant genes from your parents!
- ❖ Let's take a look to see if you have dominant or recessive genes.

Note: This can be a small group activity, but it can also easily be a large group activity. Please determine what best works for your group.

- Play a game with the kids where you go through the list of features to see if they have it (see below). Each kid should circle which trait they have. See if they know if their parents have it too!
- After the game, wrap up by going through the traits as a large group, polling the number of people for each trait (have them write these numbers on their sheets), and see if there is more of one trait than the other. If so, see if they can figure out why!

Note: being a dominant trait does not necessarily mean that it is common. Often, dominant genes that cause diseases, for instance, are not common.

- **Widow's Peak:** A *dominant* gene where the hairline dips like a "V" in the middle of the forehead. The straight hairline is a recessive gene.
- **Bent Pinky:** A *dominant* gene where the distal segment of the pinky can bend – aka, the pinky finger can bend inwards towards the ring finger.
- **Thumb-Crossing:** Cross your hands in a relaxed manner, interlocking your fingers. If your left thumb crosses your right thumb, you have inherited a *dominant* gene for thumb-crossing.
- **Earlobe Attachment:** Detached earlobes are *dominant*; attached earlobes are *recessive*.
- **Tongue-Rolling:** A *dominant* trait where the lateral edges of the tongue can be rolled.
- **Cleft Chin:** A *dominant* gene where the chin has a Y-shaped dimple.
- **Dimples:** A *dominant* gene where there are visible indentations on the cheeks, especially when smiling.
- **Handedness:** The gene for right handedness is *dominant*; the gene for left handedness is *recessive*.
- **Natural Curly Hair:** The gene for natural curly hair is *dominant*; the gene for straight hair is *recessive*. (This is actually not a straightforward inherited gene – rather, it's a polygenic one – but we can ignore that for now.)
- **Allergies:** Commonly *dominant* genes.
- **Sight:** Nearsightedness is a *dominant* trait; normal vision is a *recessive* trait.

Activity 2	Congratulations – It’s a Baby!
Materials (amounts dependent on the number of children participating; use personal judgment)	Whole Potatoes (<i>Face</i>) Black, Dark Brown, Yellow, and Red Yarn (<i>Hair</i>) Black, Green, and Blue Googly Eyes (<i>Eyes</i>) Black, Dark Brown, Yellow, and Red Chenille Stems (<i>Eyebrows</i>) Red and Pink Construction Paper and Cardstock Cut-Outs (<i>Lips</i>) Triangular Eyelets and Circular Stickers (<i>Pointy/Round Nose</i>) Hole-Punched Paper (<i>Freckles</i>) Scissors Glue Colored Pencils, Crayons, and/or Markers “D”/“R” Coins

Introduction

- ❖ Remember how we have two genes for each trait? Where do you think they come from? That’s right – our parents! Like everyone else, mom and dad have two genes each. As their kids, we get one gene from mom and one gene from dad to make what we look like!
- ❖ Let’s think for a moment. Do your parents look like you? What about your grandparents, relatives? Does everyone in your family look alike? Why do you think that is or isn’t?
- ❖ No one gets to choose the genes they get from mom and dad, though. The selection is completely random! Let’s do an activity to see how all of this works.

Creating a Genetic Profile: Let’s Meet The Kid!

- Take the coin labeled “D” for Dominant and “R” for Recessive. For each trait on the Genetics Table, flip the coin twice. The first flip is for the gene given by parent 1. Record this result on the chart. The second flip is for the gene given by parent 2. Record this result on the chart.
- Put the two gene choices together in the “Child” column, yielding of a gene combination of “DD,” “DR,” “RD,” or “RR.”

Making a Mr. Potato Head Child

- Look at the code for each trait. If it reads “DD,” “DR,” or “RD,” a dominant trait is exhibited. If the code reads “RR,” a recessive trait is exhibited. Create the potato head accordingly.
- Yarn hair, googly eyes, chenille stem eyebrows, cut-out mouths, eyelet/sticker noses, and paper hole-punched freckles will be provided. Follow the Genetics Table to create the baby of the family! **PLEASE READ THE NOTES BELOW!**
 - The googly eyes are actually stickers. Just peel the back and stick!
 - For **thin** eyebrows, keep the pipe cleaners as they are; for **bushy** eyebrows, fold the pipe cleaners into a zig zag pattern. Then, cut them to the appropriate size and stick the metal ends into the potato to hold them in place. (Glue is also okay to keep them to the potato.)
 - The “freckles” are hole-punched pieces of paper of varying colors, mostly white. If the children want a different color, let them color it in with the corresponding color of interest.

Wrap It Up

- ❖ Review the general ideas of the lesson. Where do you get your traits? Can you know for sure which trait you'll get? What's a recessive trait? What's a dominant trait? Can you give any examples? What does DNA have to do with all of this again?
- ❖ Give a glimpse of the complexity of genetics with the concepts of incomplete dominance, codominance, and if you're feeling really ambitious, polygenic inheritance.
 - **Incomplete dominance** occurs when *neither* gene is completely dominant, leading to a blending of two genes. Breeding white and red snapdragons, for instance, will yield pink snapdragons. This can also be seen in hair: a person who inherits one gene for straight hair and one gene for curly hair may have wavy hair!
 - **Codominance** occurs when *both genes* are dominant, which means both features will appear. Many flowers exhibit codominance: when the red and white flowers breed, their petals will be some combination of red and white (red petals with white dots or vice versa). This can also be seen in blood – A blood and B blood are both dominant. Thus, a person who has both genes will have AB blood!
 - **Polygenic Inheritance** is when one trait is controlled by the inheritance of several genes. Thus, there are a variety of outcomes – more than you can count! Height is an example. Are you as tall as the other people in the room? No? That's because of polygenic inheritance!