

An Ask A Biologist Activity for at Home or in the Classroom

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About the Author

When this activity was first designed, **Emma Gerrard** was a Barrett Honors undergraduate student at Arizona State University, where they were studying genetics. They designed the activity as part of their student thesis.

Monster Inheritance

askbiologist.asu.edu/experiments/monster-inheritance

Lesson Overview

Have you ever wondered why kids often look like their parents? Why puppies and kittens from the same parents look similar, but not the same? Or maybe you are just wondering why some apples are sour and some are sweet. These are all due to inheritance, which is how info is passed from parents to kids.

Inheritance is how you get certain traits from certain parents. But what does that look like, and how can we see something like that? With the help of some monsters, of course!

You will learn about inheritance by playing with monsters. Using this lesson, you'll learn:

- What inheritance is
- Why children might look different from their parents and their siblings
- How information is passed from parent to kid

What You Need

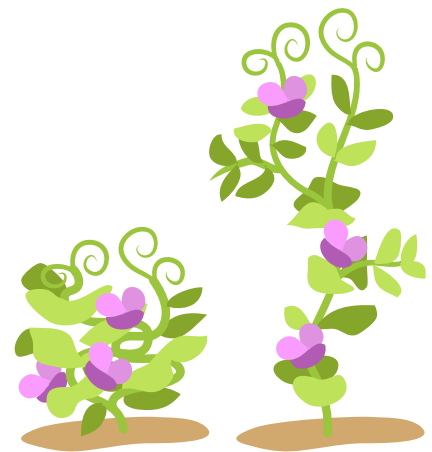
- One copy of the Monster Mixer Activity per pair of students
- PowerPoint presentation (your teacher has this)
- One coin of any kind, or one 6 sided die
- Whiteboard (or a piece of paper and a pen/pencil)

If you are playing Monster Maker online, you will also need:

- Access to a computer

If you are doing a paper version of Monster Maker, you will also need:

- Monster Maker worksheet
- Colored pencils, crayons, or markers



Procedure

Explain

- Step 1** Your teacher will be guiding the class through a presentation. Follow along with the slides and think about the questions. Talk about them with your table.
- Step 2** Consider the scenario with Farmer Joe and his peas. If the short and tall peas are crossed (bred) together, how tall will the peas he makes be? Why? Discuss this with your table.
- Step 3** Discuss your thoughts with the class. Did everyone agree with you?

Explore

- Step 4** Your teacher will pass out the Monster Mixer worksheet (page 7). Complete the worksheet with a partner unless your teacher tells you otherwise.
- Step 5** What is similar between Tombly and Tangely? What is different?
- Step 6** Think about what their baby will look like. What will their baby look like if it is a blend of Tombly and Tangely? Are there other options? Does it look like Baby Tangerine was a blend? Does Baby Tangerine have any unique traits?
- Step 7** Talk with your partner about why you think Baby Gesundheit has two horns when neither of its parents do. Do you think it might be related to the story Galoo told about its horns?

Explain

- Step 8** As a class, discuss the activity. What did you learn about how traits are inherited?
- Step 9** Explain your theory as to why Baby Gesundheit was born with two horns. Did people have different theories than you and your partner did?
- Step 10** Discuss what Inherited and what Acquired mean. Work together as a class to predict whether traits are inherited or acquired. Your teacher will show you example traits on the slideshow.
- Step 11** Your teacher may have other steps to make sure you understand the lesson. Follow their instructions! If you have any questions, now is a great time to ask your teacher.

This might be a good spot to end for the day... check with your teacher!

Elaborate

- Step 12** Watch the video your teacher shows you.
- Step 13** With the help of your teacher, think about how traits are able to be inherited. How is the information passed down from parent to child? How are DNA and proteins involved?
- Step 14** Your teacher will either pass out worksheets or you can play Monster Maker online at askbiologist.asu.edu/games-sims/monster-maker-game.
- Step 15** Decode the codons. Use the key at the bottom to reveal the instructions on how to build your monster! If you are working on paper, try to draw your monster! It's okay if they look silly.

Step 16 Everyone made different monsters. Show your monster off to the people at your table and talk about how you made them. What is this game similar to?

Step 17 Participate in the discussion of traits and genetic information:

- What part of the game is similar to codons?
- What part of the game is similar to the bases?
- Do you think this game is similar to real life, or do you think it is different?
- How are traits passed from parents to kids?

Evaluate

Step 18 With your partner, use your white board/paper to write down the definitions of the following terms:

- Trait
- Inherited
- Acquired
- DNA
- Codon

Step 19 After a few minutes, you and your partner will work with the other people at your table. Try to make your definitions even better.

Don't forget to turn in any worksheets you might have completed.

Teaching Tips

Teaching students about inheritance can be tricky, as it requires many examples, and many examples need to be simplified. In real life, inheritance is typically much more complicated than single genes influencing single traits. Our activity, Monster Inheritance, brings a simplified system to explain a simplified version of inheritance, designed for the age group.

For just a quick refresher on the basics of DNA, visit DNA ABCs (askbiologist.asu.edu/explore/dna-abcs).

This activity is designed for 5th grade and uses the 5E model.

It also meets some standards for 3rd grade. For use in 3rd grade, we suggest focusing mainly on the Engage, Explore sections, with a brief version of the Explain section.

Time Required

This activity is designed to take about 90-120 minutes to complete, though it can be done in as little as about 75, if you are willing to shorten discussion time and eliminate optional slides.

Classroom set-up

Make sure you have the PowerPoint presentation. It is recommended you look through it and familiarize yourself with it - there is a slide in the presentation that is meant to be deleted! Notes for you are included in the speaker notes of the slides. There are also optional slides that you can feel free to use or skip as time and understanding dictate.

For day one, each pair of students will need a copy of the Monster Mixer Worksheet to work through. Students will also need some way of determining a 50/50 probability, such as a coin or a die (even/odd), it is ideal to pass that out with the worksheet. If you don't have either method, students can get creative (e.g., an online coin flip tool) or just skip it altogether and pick one or the other.

Both digital and paper version of the Monster Maker Elaborate activity are available. You'll need to visit Monster Maker (askabiologist.asu.edu/games-sims/monster-maker-game) online for either version.

- **Digital version:** If using the digital version, your students will visit Monster Maker and play the game directly online.
- **Paper version:** If using the paper person, you'll need to generate and print worksheets ahead of time. To do that, visit Monster Maker online then click on the Worksheet Generator link.
- If students are completing the activity on paper, it is recommended to give students extra time and supplies like colored pencils to be able to draw their monsters. This isn't required for the digital version, as the game creates the monster during game play.



Though there is no defined summative assessment for this activity, while partner or table groups are trying to define: "Trait", "Inherited", "Acquired", "DNA," and "Codon," it is recommended you check in on their progress. You can also have students write out their definitions on paper to collect it if you would prefer.

Tips

- Make sure to review the PowerPoint and familiarize yourself with the key ideas before leading your class through the lesson.
- You may also want to require each group to return their die/coin to you before they are allowed to leave class.

Objectives

After completing the lesson, students should be able to:

- Explain that inheritance does not occur by blending traits but by inheritance of discrete traits from each parent.
- Define traits, inherited and acquired, in relation to genetics.
- Predict if traits are inherited or acquired.
- Describe how DNA can pass genetic information from generation to generation.

Standards

Arizona Science Standards

Grade 5

- 5.L3U1.9 Obtain, evaluate, and communicate information about patterns between the offspring of plants and animals; construct an explanation of how genetic information is passed from one generation to the next.
- Many characteristics of organisms are inherited from their parents.
 - Different organisms vary in how they look and function because they have different inherited information.
- 5.L3U1.10 Construct an explanation based on evidence that the changes in an environment can affect the development of traits in a population of organisms
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
 - The environment also affects the traits that an organism develops. Differences in where they grow or in the food they consume may cause organisms that are related to end up looking or behaving differently.

Next Generation Science Standards

Grade 3

- 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

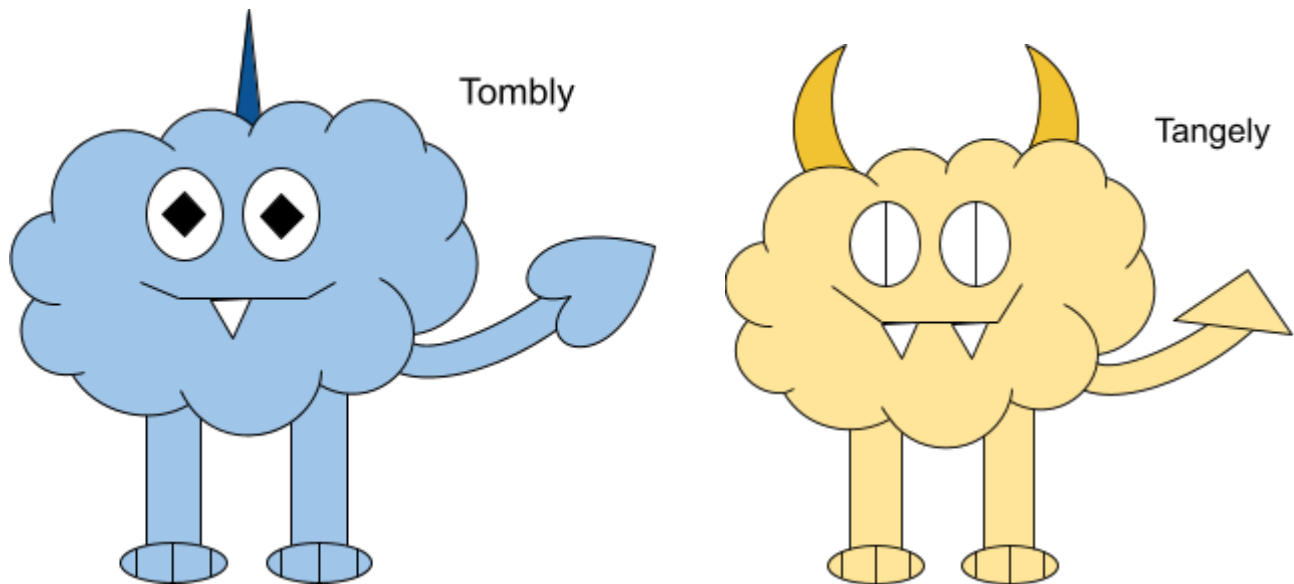
Monster Mixer Worksheet

Names: _____

Background:

In Monster Town, monsters have many unique features. They may have different fur colors, number of horns, or even different tail shapes. It's often said that when a baby monster is born, they usually look like a mix of its parents, but how does that work?

Tombly and Tangely are expecting a baby soon. They are wondering how their little one might look and have come to you for help!



1. What is similar between Tombly and Tangely? What is different?

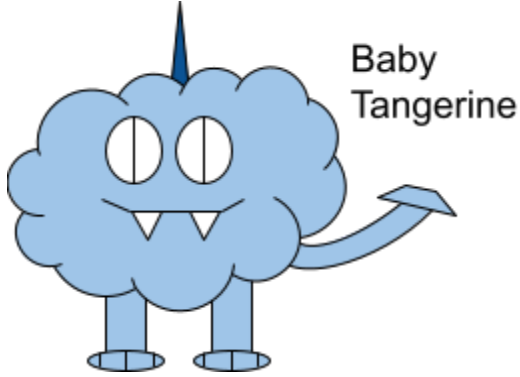
2. Their baby will look like both Tombly and Tangely, but how will the different **traits** from the parents come together? Will they blend together, like how black and white mix together to form grey or will their baby get some from each parent?

Prediction: If their baby is a blend of Tombly and Tangely, what will their baby's **traits** be? The first one has been filled in for you.

Traits	Tangely	Tombly	Baby
Teeth	2 teeth	1 tooth	3 teeth
Horns			
Tail Shape			
Color			
Pupil Shape			

Prediction: What if each child gets a trait from either parent and they don't mix? Flip a coin for each trait to determine if the baby will **inherit** the genes for a trait from Tombly or Tangely (and look like them). The first one has been done for you.

Traits	Tangely (Heads on coin or even on die)	Tombly (Tails on coin or odd on die)	Baby
Teeth	2 teeth	1 tooth	2 teeth
Horns			
Tail Shape			
Color			
Pupil Shape			



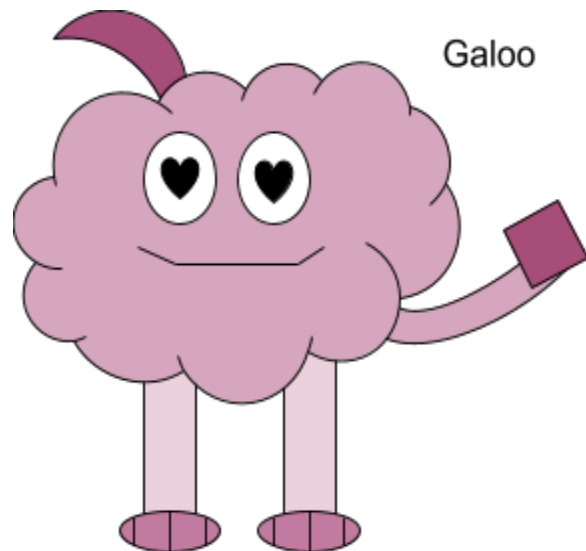
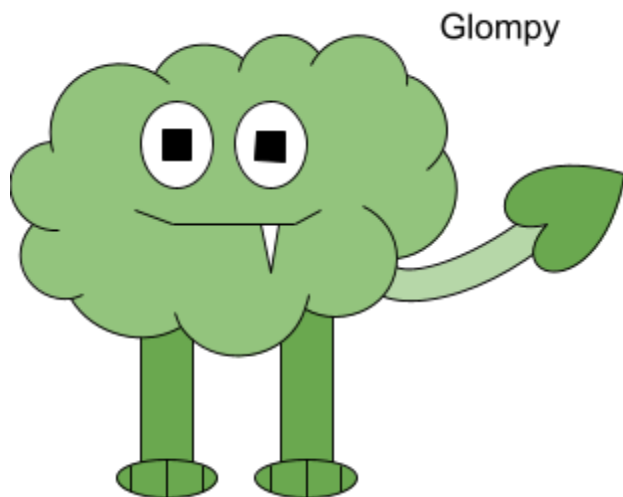
Hooray! Baby Tangerine is born. Tombly and Tangely are so excited to have a little baby. It's also exciting for you, because you can look at your predictions and figure out which one looks the most correct.

3. Do you think the traits blended or did Baby Tangerine inherit some from Tombly and some from Tangely? Why?

4. What is unique about Baby Tangerine that neither of its parents had?

5. Propose an explanation as to how Baby Tangerine can have unique characteristics that neither of its parents had:

To answer your new question, you go and ask Glompy and Galoo, who also recently had a baby.



Galoo lost one of its horns when it was little and fell off its bicycle. This means that having one horn wasn't a trait it got from its parents, but one it **acquired** when it was little. So when Baby Gesundheit was born, Glompy and Galoo weren't very surprised it had two horns, just like how Galoo had when it was a kid.

6. Why do you think Baby Gesundheit doesn't have only one horn like Galoo?

