Reebop breeding simulation

Adapted by Kirstin Milks from the lesson described in Soderberg, P. (1992). Marshmallow meiosis. *The Science Teacher*, *59*(8), 28-31.

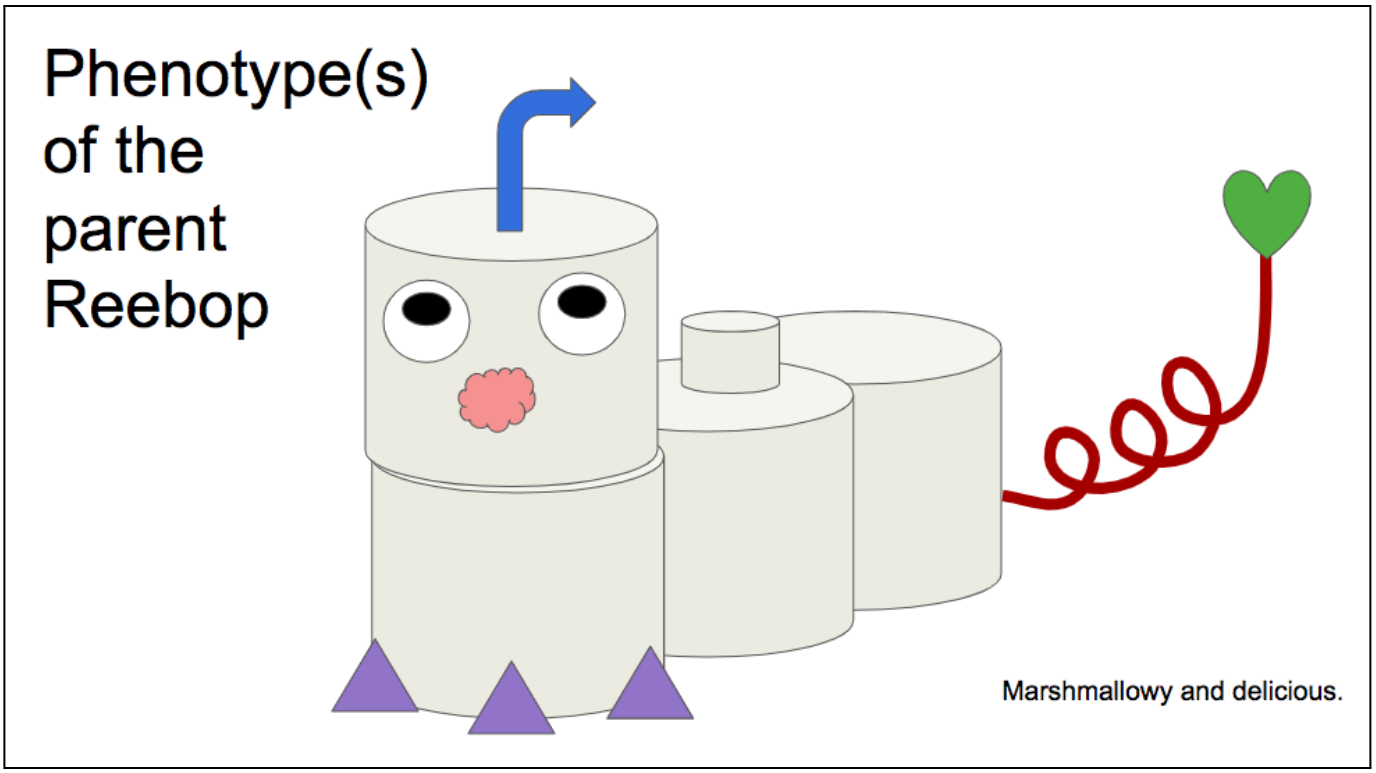
LESSON OBJECTIVE: After completing this assignment, you'll be able to explain how this simulation models real-life processes AND describe how these processes generate genetic diversity from generation to generation.

Part 1

Today, we are going to carry out a breeding program (using the same procedure as in the real thing for crops, dogs, and more) by applying the same rules that are found in genetics.

Traditionally, Reebops are marshmallow dragons. In our digital setting, they are cartoon marshmallow dragons!

Look at the male parent Reebop in the figure below. Note its characteristics, such as number of eyes, antennae, etc. Both parents are actually genetically identical, except that genetic Dad has a green tail heart (assigned male at birth) and genetic Mom would have a yellow tail heart (assigned female at birth).



Please note that sex determination is FAR MORE COMPLICATED than this. Stay tuned ...

Oh, and one more thing before we dig in -- in this class, **we always say "genetic Dad" and "genetic Mom"** as a shorthand for who's contributing genetic information to a baby. This helps

us celebrate that families come in all different shapes and sizes -- and parents come in all genders!

IN YOUR NOTEBOOK:
- Set up a new entry in your Table of Contents.
- On the next available blank page, write the title of this lab and draw a box around it at the top of the page.
- Copy and complete Table 1 in black or dark blue pen.
    - No need to copy the *italicized* text.

TABLE 1. Characteristics of male parent Reebop

# of antennae on head	
# of body segments *(big marshmallows; don't count the head)*	
Tail: curly or straight?	
Nose color	
Leg type *(purple or orange)*	
# of eyes	
# of humps *(mini-marshmallows)*	
Tail heart color	

PROCEDURES: Instructions for breeding your Reebop.
→ **Make a copy of the Reebop template/workspaces slide show provided by your teacher.**

- No need to set the sharing so others can view; you'll be pasting a slide into another spot later.
- If you're working with a partner, only one of you needs to do this - just share your screen as you work.

1. Find genetic mom's and genetic dad's body cells on slide 4.
On each side, sort the chromosomes into 8 pairs by putting two of the same length side by side.
- Keep the pink and the blue separate!
- The two smallest ones in the same color are a pair, even though they may or may not be the same size.

2. See slide 5. Go back to Slide 4 and sort the chromosomes into two piles, as shown.

3. **What biological process did you model in Step 2? How do you know?**

Hint: the original pile had the same number of chromosomes as a Reebop somatic, or body, cell. But each of these piles -- hmm, let's call them "cells" -- has half the number of chromosomes, and we are making babies today.

That should be enough to help you search the internet if you are quite stuck.

IN YOUR NOTEBOOK: Copy and complete the following sentence to answer the questions. (It may take you several sentences to answer.)

In Step 2, we modeled the process of _____ because ...

4. You are going to take one of the pink piles and one of the blue piles and put their information together! Now we need to figure out which **ALLELE**, or flavor of gene, is on each of the pink chromosomes in your selected pink pile and each of the blue chromosomes in your selected blue pile.

Use slide 6 and slide 7 -- and a real-life coin or the digital coin flipper -- to figure out which alleles you've got! Fill out the tables on those slides. No need to take notes in your notebook yet.

5. Check out slide 8 to see what will happen next!

6. **What biological process did you model in Step 5? How do you know?**

Hint: pretty sure you just combined an egg cell from Genetic Mom and a sperm cell from Genetic Dad ...

IN YOUR NOTEBOOK: Copy and complete the following sentence to answer the questions. (It may take you several sentences to answer.)

In Step 5, we modeled the process of _____ because ...

• The one-celled **ZYGOTE** *(embryo)* now makes many, many more cells just like itself and as the number of cells increases, over time, a baby Reebop is built from the instructions in the genes it got from its genetic Mom and genetic Dad.

7. So what's the **GENOTYPE**, or genetic information, for your new baby? Remember, each of those letters in slides 6 and 7 represent the genes that your Reebop baby-to-be has inherited from its parents. Each letter is called an **ALLELE**.

IN YOUR NOTEBOOK:

- Copy Table 2 in black pen (there are 8 features total). Fill in the **GENOTYPE** column: the letters on the paired chromosomes for your "baby genes."
    - For example, if you have a letter "A" in the pink table and the blue table has "a", put Aa in the box for antennae.
    - We always write the capital letters first, no matter whether those alleles came from genetic mom or genetic dad: Aa, not aA.

TABLE 2. Characteristics of MY new baby Reebop

FEATURE/TRAIT	GENOTYPE	PHENOTYPE
Antennae (letter A)		
Body Segments (letter B)		
Tail (letter T)		
Nose (letter N)		
Legs (letter L)		
Eyes (letter E)		
Humps (letter H)		
Sex (letters X and Y)		

8. Now study the Reebop Gene Decoding Table at the end of this document to find out what physical features (characteristics) your baby will have that are determined by its genes. In your notebook, write those features for each body part into the **PHENOTYPE** column in TABLE 2.

9. When you have completed all the features in the grid (as shown on slide 10, along with incomplete but correct answers for the previous questions!), you are ready to make your baby Reebop on slide 12.

- The parent Reebop is on slide 11 to remind you of what each parent looked like. Feel free to use parts of the parent as a template on slide 12.
- You will also need the "parts" on slide 13.
- **Please do NOT draw your own parts!** This will help us more directly compare babies.
- For example, for a BB you will need three white marshmallow body parts in addition to a head (so four big marshmallows total).

10. Assemble all the features that your baby will possess; check that you have not made a mistake (mutated a part!).

11. Name your baby -- something school-appropriate, if you would be so kind.

12. Copy the slide with your baby on it and put it into the REEBOP NURSERY (linked on the last page of the template/workspace slide show you've been using).

13. Take a screenshot of your baby (use Snipping Tool if on a PC) and upload it to the Canvas assignment for Part 1.

PLEASE WAIT TO COMPLETE PART 2 OF THIS ASSIGNMENT UNTIL YOUR TEACHER ASSIGNS IT.

Reebop breeding simulation, Part 2

Time to look at all the babies in the Reebop nursery slide show! Your teacher will provide the link.

14. Scroll through all of those marshmallowy babies! Aren't they adorable?!

IN YOUR NOTEBOOK, copy Table 3 below. Take some quick notes (no need for complete sentences). You'll use these notes in Step 15 below.

TABLE 3. Analysis of baby Reebops

Are the babies all the same? If so, in what ways?	**In what ways are they different?**	**Anything else you've noticed? Try…** ● **counting a specific trait for 20 Reebops** ● **seeing if any traits are more likely to show up together than apart**

15. PUTTING IT TOGETHER: Take another look at the objective for this lesson.

LESSON OBJECTIVE: After completing this assignment, you'll be able to explain how this simulation models real-life processes AND describe how these processes generate genetic diversity from generation to generation.

In your lab notebook, write a paragraph that

- **explains** how this simulation models real-life processes
- **describes** how these processes generate genetic and phenotypic/physical diversity from generation to generation.

Use your experience and the class data set to provide analogies, descriptions of data or processes, draw sketches to explain your thinking (make sure to explain them in writing as well), and/or even ask questions in your paragraph as you write your paragraph.

You won't know all of the story yet from our time in class so far, and that's okay! Just use ideas and data from this assignment.

16. Write END at the conclusion of your notes for this simulation.

→ Submit PART 2 of this assignment on Canvas!

Please take pictures of ALL your notes for Part 1 *and* Part 2 -- the whole assignment. Place them in a Google Doc so the notes are in order, then submit the GDoc link.

REEBOP GENE DECODING TABLE

Antennae	AA = 2 antennae	Aa = 1 antennae	aa = no antennae
Body segments	BB = 3 segments	Bb = 3 segments	bb = 2 segments
Tail	TT = curled	Tt = curled	tt = straight
Nose	NN = red	Nn = pink	nn = white
3 front Legs	LL = purple	Ll = purple	ll = orange
Eyes	EE = 3 eyes	Ee = 2 eyes	ee = 1 eye
Humps	HH = 1 hump	Hh = 1 hump	hh = 2 humps
Sex	XX = female yellow tail	XY = male green tail	