INVESTIGATION 2
BREEDING HAPPY FACES
These faces belong to an imaginary species of Happy Face Monsters.

In this activity, we will pretend that each part of the face is controlled by only one gene pair.
Different alleles, or versions, of each gene are what give variation in the traits.

For Happy Face Monsters each trait has two versions. For example, a face shape can be circle or square; The eye shape could be triangle or heart.
For this investigation, you will use *Handout B: Happy Face Monster Traits*, to make faces, and to predict how traits are inherited.

With your partner, examine the traits. Then choose one of each and use them to draw a face in your notebook.

The individual you’ve drawn will serve as a parent in this activity in order to demonstrate how alleles are inherited by offspring.
For each trait, two alleles lead to two possible versions of the trait.

How can you know which allele is dominant and which is recessive?

The uppercase letter is the dominant version of the gene, and the lowercase letter is the recessive version.
You will also draw the offspring of the parent individual you created on the previous slide. But to do this you need to know whether this species of Happy Face Monster reproduces sexually or asexually.

First, assume they use asexual reproduction. This table tracks how the alleles for Eye Shape are passed from parent to offspring. The parent's alleles are in one row, and the offspring's alleles are in another.

In asexual reproduction, what alleles will the offspring have? 
Now consider a sexually reproducing Happy Face Monster. How many parents are needed in this species of Monster?

2 parents

Parent A  Parent B
You've already drawn one parent in this investigation. We'll call that drawing Parent A. Now draw Parent B, using Handout B to draw a face based on the following alleles:

- ffNneeHHMmgg
In sexual reproduction, each parent has two alleles for each gene, and each parent passes along one allele for each gene. This makes the table complex.

By representing one parent’s alleles on the top, and one parent’s alleles on the left, we can show all the alleles that could be inherited by offspring.

By mixing alleles from each parent, we can plot all possible inherited allele combinations. This lets us predict which combinations are most likely for offspring to inherit.
These models of how alleles are passed to offspring are called Punnett Squares.

With your partner, fill out a series of Punnett Squares showing how alleles would be passed on from the parents you drew to their offspring. Fill out one Punnett Square for each trait.

Probability of Dominant trait: 3-in-4
Each allele combination has a 1-in-4 or 25 percent chance of occurring. But there are only two possible traits: the dominant one and the recessive one.

Based on the allele combinations, predict which trait is most likely to occur for the offspring. Then draw a face with the most likely offspring traits.
Use a coin toss to determine which alleles are actually passed on to the offspring of Parent A and B. For each gene, do a toss to see which of Parent A’s alleles is passed on, and another toss to see which of Parent B’s alleles is passed on. Heads is the first allele listed, tails is the second allele listed.

Write down each allele in the table in your notebook. Then draw the offspring’s face based on its alleles.

How does the actual offspring compare to the one you predicted as most likely?
Now do a second set of coin tosses to determine what traits are passed to a second offspring. Again, fill in the table and then draw the offspring based on its alleles. Then answer the questions.

- Does this offspring look exactly like its sibling?
- Does this offspring have the most likely traits you predicted?
- Do real life human siblings look exactly alike? Explain.
Wrap Up

- What is an allele? a version of a gene
- How many alleles of each gene does an individual have? two
- Why do sexually reproducing organisms have more trait variation? New allele combinations occur for each offspring.
- Is a coin toss a good way to represent what determines which alleles are inherited by each offspring? Explain. Yes; each offspring has a random collection of alleles from each parent.