Scope Phenomenon

Name: _____ Date: _____

Bees and Flowers

1. What actions did you observe from the bee?

2. How does the bee aid in the flower's reproduction?

3. This type of reproduction is known as sexual reproduction. This means that two cells are needed to create offspring. Based on the video, what types of traits do you think this flower's offspring will have?

4. Asexual reproduction results in identical genetic information, and two cells are not required for asexual reproduction. Can you think of something that reproduces asexually?

Explore

Name: _____ Date: _____

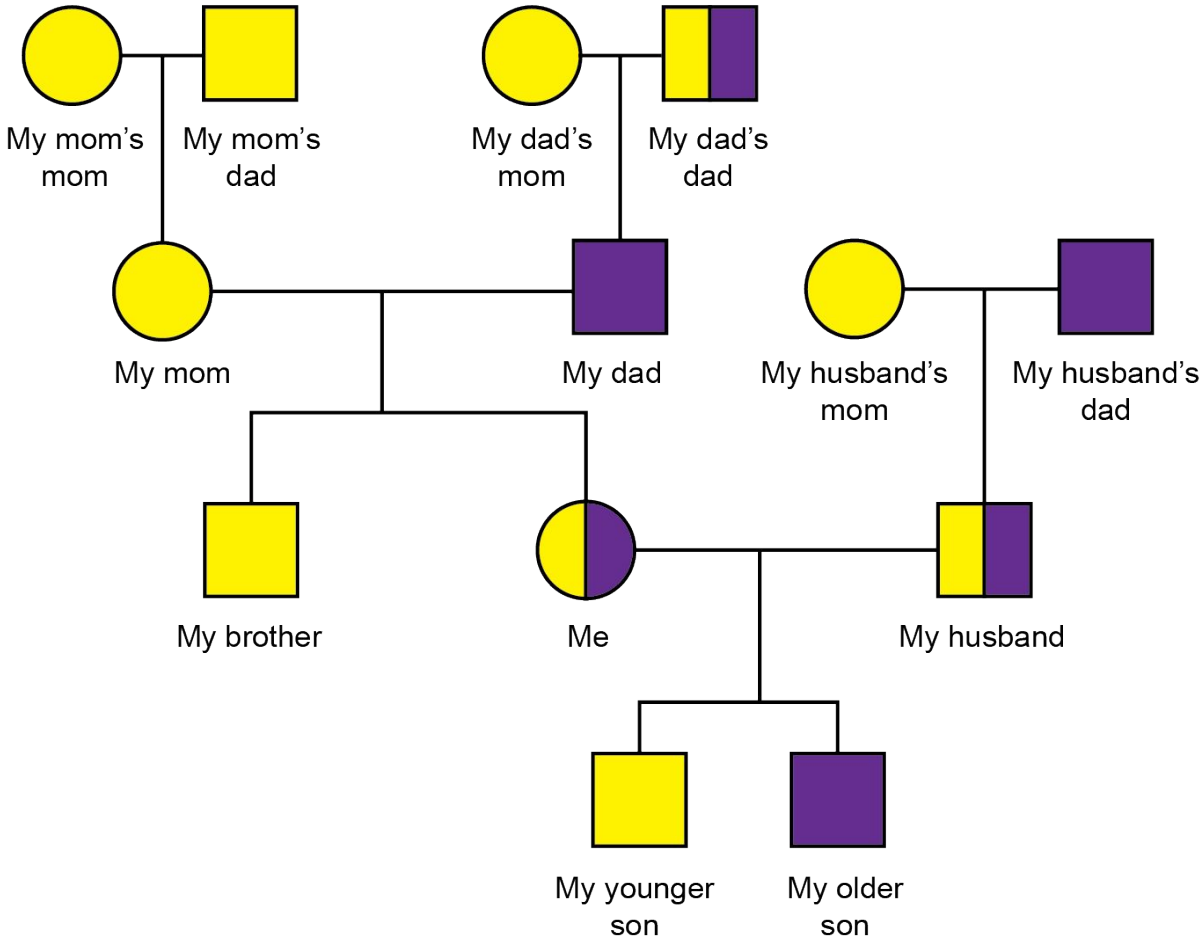
Delicious Genetics

A chromosome is a large DNA molecule. This large molecule is organized into sections known as genes. Genes contain the code for traits that show up in offspring. Traits are physical characteristics.

Every gene in an organism has two variations (called alleles). One allele for each gene is inherited from one parent, and the other is inherited from the other parent, but only one shows up in an individual.

In this Explore, you'll investigate the basics of how traits are passed from parent to offspring through a pedigree diagram (an example of a pedigree is shown here).

Pedigree of Left-Handed Trait



Explore

Procedure

1. Write “Grandpa 1,” “Grandma 1,” “Grandpa 2,” and “Grandma 2” on four of the cups.
2. Group the Grandpa 1 and Grandma 1 cups together and the Grandpa 2 and Grandma 2 cups together with a space between the two groups.
3. Write “Mom” and “Dad” on two other cups. Put the Mom cup below Grandpa 1 and Grandma 1. Grandpa 1 and Grandma 1 are her parents. Place the Dad cup below Grandpa 2 and Grandma 2.
4. Write “Brother” and “Sister” on the last two cups, and place them below the Mom and Dad cups.

Part I

1. Place 12 brown hard-shell candies in the Grandpa 1 cup.
2. Place 12 blue hard-shell candies in the Grandma 1 cup.
3. Place 12 green hard-shell candies in the Grandpa 2 cup.
4. Place 12 red hard-shell candies in the Grandma 2 cup.
5. In the Data section, use the colored pencils to draw the following on the pedigree cup diagram:
    - 12 brown hard-shell candies on the Grandpa 1 cup
    - 12 blue hard-shell candies on the Grandma 1 cup
    - 12 green hard-shell candies on the Grandpa 2 cup
    - 12 red hard-shell candies on the Grandma 2 cup

Part II

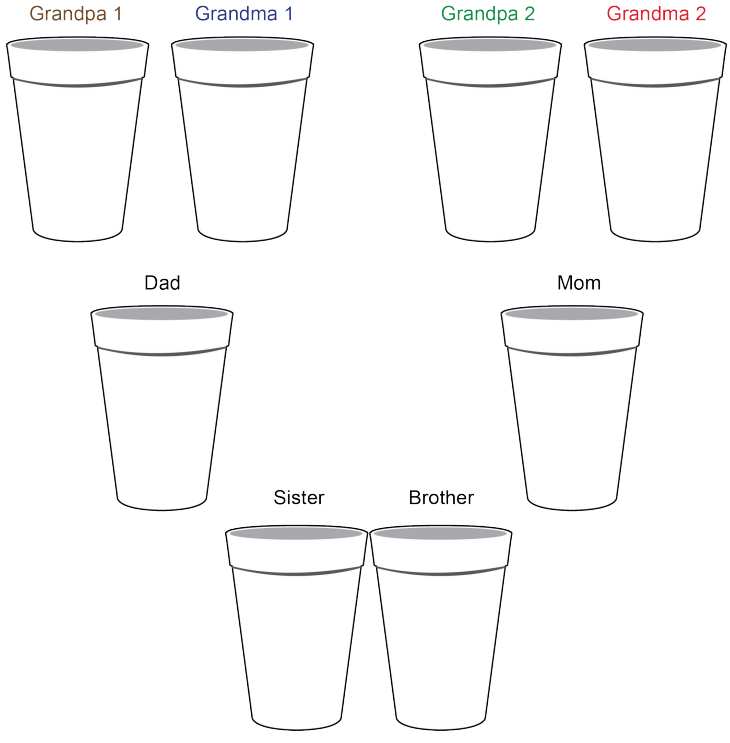
1. Take 6 brown hard-shell candies from the Grandpa 1 cup, and place them in the Mom cup; then, take 6 blue hard-shell candies from the Grandma 1 cup, and place them in the Mom cup. This shows that Mom got half of her DNA from each of her parents (Grandpa 1 and Grandma 1).
2. In the Data section, use the colored pencils to draw the hard-shell candies that are in your Mom cup on the Mom cup of the pedigree cup diagram.
3. Take 6 green hard-shell candies from the Grandpa 2 cup, and place them in the Dad cup; then, take 6 red hard-shell candies from the Grandma 2 cup, and place them in the Dad cup. This shows that Dad got half of his DNA from each of his parents (Grandpa 2 and Grandma 2).
4. In the Data section, use the colored pencils to draw the hard-shell candies that are in your Dad cup on the Dad cup of the pedigree cup diagram.

Explore

Part III

1. Place the index cards on top of the Mom and Dad cups, and gently shake them to mix up the colors.
2. Cover your eyes, take 6 hard-shell candies from the Mom cup, and place them in the Sister cup. Then, cover your eyes again, take 6 hard-shell candies from the Dad cup, and place them in the Sister cup. This shows that Sister got half of her DNA from each of her parents (Mom and Dad).
3. In the Data section, use the colored pencils to draw the hard-shell candies in your Sister cup on the Sister cup of the pedigree cup diagram.
4. Return the brown and blue hard-shell candies to the Mom cup and the red and green hard-shell candies to the Dad cup.
5. Place the index cards back on top of the Mom and Dad cups, and gently shake them again.
6. Cover your eyes, take 6 hard-shell candies from the Mom cup, and place them in the Brother cup. Then, cover your eyes again, take 6 hard-shell candies from the Dad cup, and place them in the Brother cup. This shows that Brother got half of his DNA from each of his parents (Mom and Dad).
7. In the Data section, use the colored pencils to draw the hard-shell candies in your Brother cup on the Brother cup of the pedigree cup diagram.
8. Notice that the Brother and Sister have different combinations of hard-shell candies, which shows that while they have similar DNA, theirs are not the same.

Data



Explore

Questions

Part I

1. Who are Mom's parents?

2. Who are Dad's parents?

3. What do each of the 12 hard-shell candies in the grandparents' cups represent?

Part II

1. Why did you take 6 hard-shell candies from both Grandpa 1 and Grandma 1 and put them in the Mom cup?

2. What do Mom's hard-shell candy genes look like compared to those of her parents?

3. What do Dad's hard-shell candy genes look like compared to those of his parents?

Part III

1. Why did you shake the Mom and Dad cups?

2. Why did the directions say to cover your eyes when selecting hard-shell candy genes from Mom and Dad?

3. If identical twins have the same genes, how would that be represented in the Brother and Sister cups in this activity?

Explore

Reflections and Conclusions

1. How is shuffling cards similar to the inheritance of traits?

2. What are some limitations of this model for genetics?

Explore

Name: _____ Date: _____

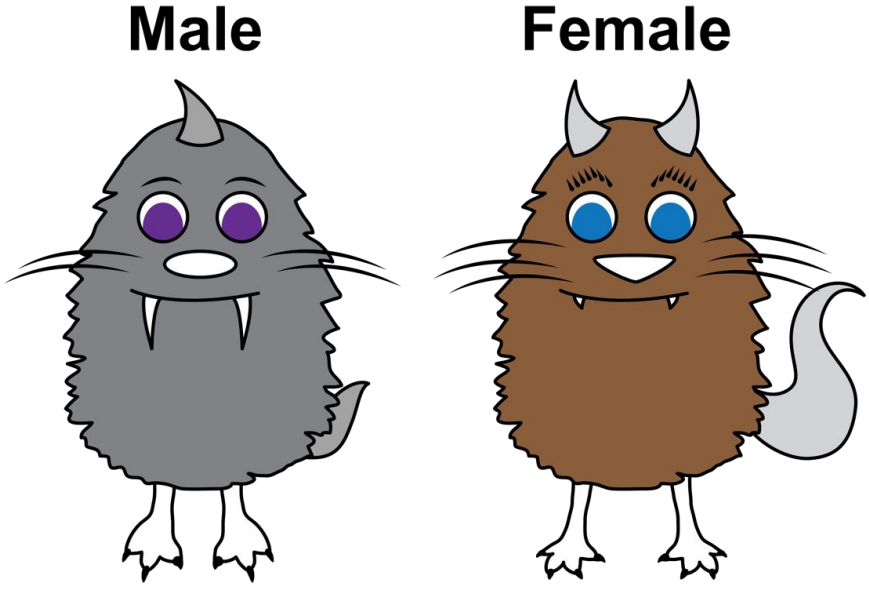
Monster Genetics

These cute little buds are called Mus monsters. You will use the Mus monsters to investigate inherited genetics and how traits are expressed. One monster has gray fur, and the other has brown fur. Brown fur is dominant over gray fur.

A genotype is the exact genetic information that is carried by an individual. A phenotype is the physical expression of the genotype, or the appearance of an organism. Notice that the male Mus monster has purple eyes, and the female Mus monster has blue eyes. If purple eyes are dominant, the allele is represented with a capital letter, such as P. Because blue eyes are recessive, they are represented by the lowercase letter p.

The male Mus monster must have a purple allele, but it could have two purple alleles or a purple and a blue allele because purple is dominant. This genotype is written as PP or Pp. The phenotype is what is expressed, so the male phenotype is purple.

The female Mus monster cannot have a purple allele, or her eyes would be purple. So, her genotype is pp. Her phenotype is blue.

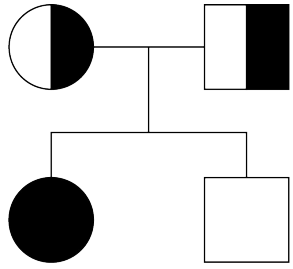


Procedure

1. Obtain three circular tokens from your teacher. The green token represents the female Mus monster's alleles for fur color, and the orange token represents the male Mus monster's alleles for fur color. The third token, the brown one, is used to determine the sex of the offspring.

Explore

2. Examine the tokens. The letters B and b are the possible alleles for fur color. The brown-furred female parent has a genotype of Bb, and the gray-furred male parent has a genotype of bb. Based on this information, you can determine that brown is dominant because the brown-furred parent has the B allele in their genotype.
3. Now, you will determine the genotypes and phenotypes of eight offspring for these two Mus monsters.
4. Flip the token for the female Mus monster. Record the letter (B or b) for the allele for fur color the offspring will inherit from the female parent in the data table.
5. Flip the token for the male Mus monster. Record the letter for the allele for fur color the offspring will inherit from the male parent in the data table.
6. Flip the token for the offspring's sex, and record the sex of the offspring in the data table.
7. Based on the two alleles that you recorded, write the genotype for the offspring in the data table.
8. Based on the offspring's genotype, write the offspring's phenotype to the data table.
9. Repeat steps 4–8 for the other seven offspring.
10. A pedigree chart is used to show how traits are passed down through generations. A pedigree chart for the Mus monsters has been started for you in the Data section. The male and female parents are provided. Add the eight offspring that you recorded in the data table to the pedigree chart using the following key. Notice that the male and female parents in this example have shaded and unshaded areas. This is because they each have both a dominant and recessive allele.



Key

Circle = Female

Square = Male

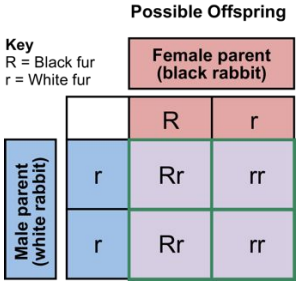
Unshaded = No recessive allele present

Shaded = Recessive allele is expressed

Half-shaded = Carrier for the recessive allele

Explore

11. A Punnett square is a tool that is used to analyze possible combinations of offspring between two parents. For example, the alleles for a male rabbit (blue) and a female rabbit (red) are shown in the following chart. Each purple square shows a possible outcome for their offspring.



12. Fill in the Punnett square in the Data section with all the possible offspring genotype combinations for the male and female Mus monsters that you've been working with. Remember that each offspring has one allele from each parent.

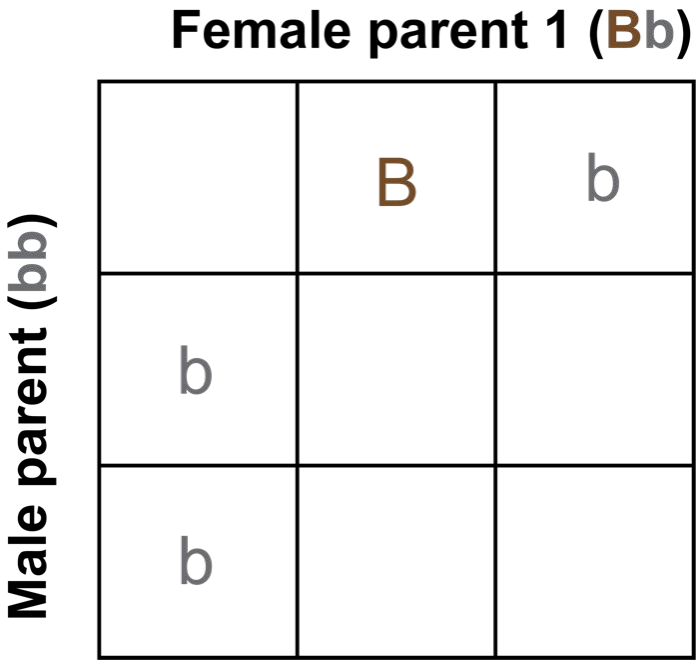
Data

Data Table

	Allele from Female Parent	Allele from Male Parent	Sex	Genotype	Phenotype
Offspring 1					
Offspring 2					
Offspring 3					
Offspring 4					
Offspring 5					
Offspring 6					
Offspring 7					
Offspring 8					

Explore

Pedigree Chart



Questions

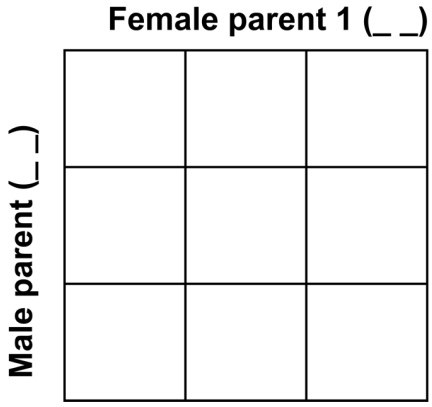
1. How did the genotype Bb compare to the genotype bb in the data table?

2. What percentage of Mus monster offspring from the data table had brown fur versus gray fur? How does this compare to the percentage of each phenotype that was predicted in the Punnett square? Show your work.

3. What was the ratio (the number of genotype 1 to the number of genotype 2) for genotypes in the data table? How does this compare to the ratio for genotypes in the pedigree chart?

Explore

4. A male Mus monster with the genotype Bb mates with a female Mus monster with the genotype Bb. Use a Punnett square to predict their possible offspring.



5. What is the ratio for the phenotypes of the offspring in your Punnett square in question 4?

Reflections and Conclusions

1. How could a Punnett square be used to predict the outcome of any possible combination of parents? Are there any limitations for Punnett squares?

2. Refer to the two Mus monsters, and find other characteristics that could be analyzed for dominant and recessive alleles.

3. Choose one characteristic of the male and female Mus monsters. Assign a letter to the dominant and recessive characteristic. Explain the possible genotypes for each Mus monster.

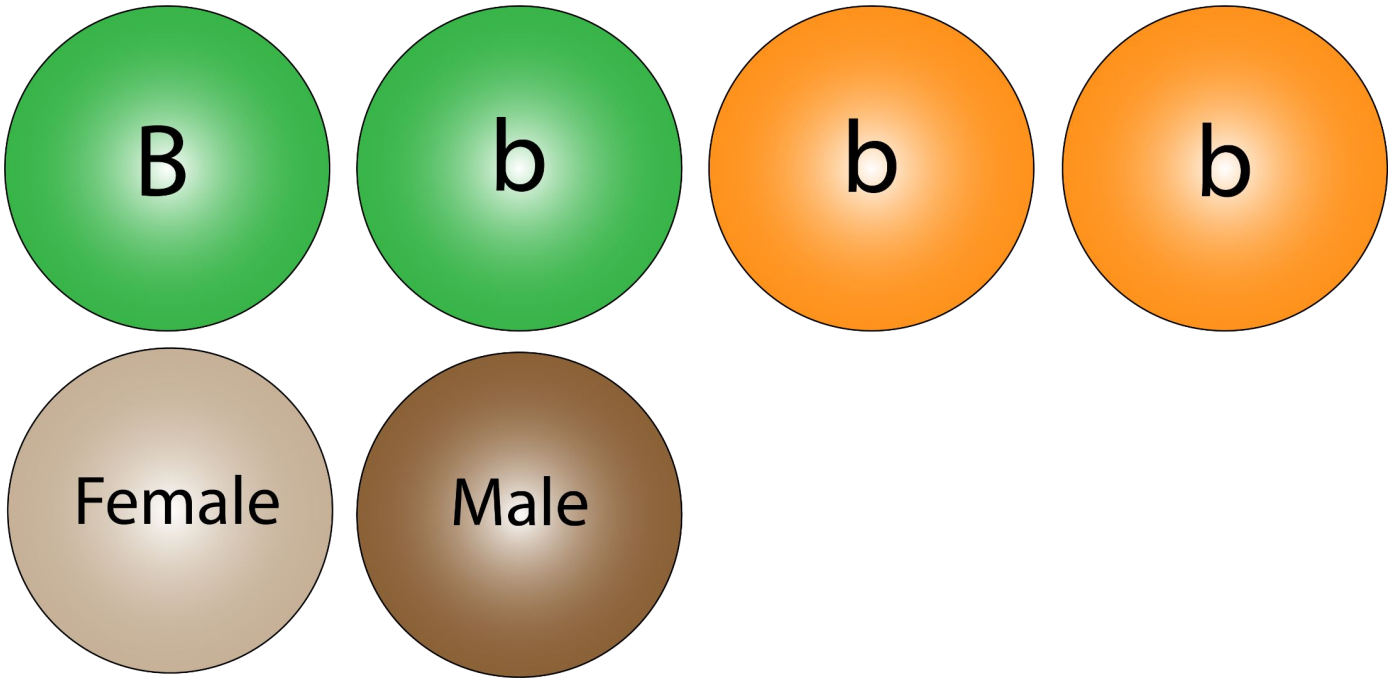
Explore

4. If the monster reproduced asexually, how would the monster's offspring appear? Why?

5. Should a Punnett square be used to predict the resulting offspring if the monster reproduced asexually? Why or why not?

6. Why do you think it is an advantage to the monster to reproduce sexually?

Token Sheet



Linking Literacy

Name: _____ Date: _____

BDA Reader's Questions

Use the table below to record your thoughts and questions before, during, and after reading the text.

Before-Reading Questions	
Based on my preview…	My questions include the following:
During-Reading Questions	
While I am reading, I notice that…	My questions include the following:
After-Reading Questions	
I still wonder about…	My questions include the following: