SUCCESS ACADEMY EDUCATION INSTITUTE

Cell Division and Genetics

Name: _____

Teacher: _____

Class: _____

Life Science (Lower Middle)
Unit 2
Lab Notebook

Lesson 1:
Introduction to Heredity: Genetic Diversity

Directions: You will inventory your observable genetic traits as you play Traits Bingo!

B	I	N	G	O
Aunt	I have allergies	Straight hairline	Freckles	Mother
I cross my right thumb over my left when I clasp my hands	Can not taste PTC	Curly hair	Neighbor can not taste PTC	Straight hair
Father	Grandmother	Free	Attached earlobes	Dimples
I have a different trait than the person sitting next to me	Cleft chin	Can taste PTC	Uncle	Can not roll tongue
Detached earlobes	Shared trait - Left	Trait in common - Right	I cross my left thumb over my right when I clasp my hands	Least common trait

Image credit: Genetic Science Learning Center. (2018, August 7) Learn. Genetics. https://learn.genetics.utah.edu/

Lesson 2:
Mitosis and Meiosis, Day One

Directions: Record notes about the similarities and differences between mitosis and meiosis.

Analysis Questions:

Why are there two types of cell division?

Lesson 2, Day One

What does each part of your model represent? (You may write and/or draw below. Ensure drawings are labeled.)

Additional Notes:

Lesson 2:
Mitosis and Meiosis, Day Two

Directions: Record additional notes about mitosis and meiosis.

Lesson 2, Day Two

Discussion Questions:

1. How is meiosis different from mitosis?

2. What is similar about both processes?

3. Do both mitosis and meiosis occur in the same organism? Explain.

4. If a human has 46 chromosomes in a somatic cell, how many chromosomes does a gamete have?

In the space below, create a T-chart to compare and contrast mitosis and meiosis.

Lesson 3:
Sexual and Asexual Reproduction

Directions: Record notes about the different types of cell division in organisms.

Lesson 3

Record notes about the different types of reproduction in organisms.

Lesson 4:
Generations of Simple Traits

Hypothesis: Record your hypothesis to the question “Why do children often resemble their siblings and parents?” on the lines below.

_____

_____

_____

Directions: Complete the following procedure and answer the questions that follow.

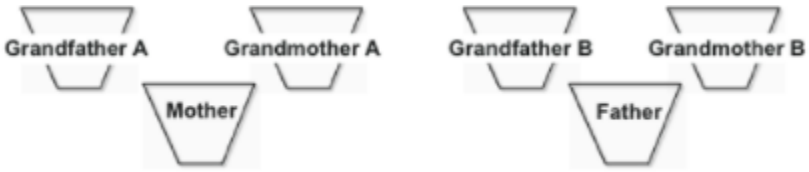


Image credit: Module: The Basics and Beyond: An Introduction to Heredity, Generation of Traits by Genetic Science Learning Center © 2006 University of Utah

1. Arrange the cups as shown above and place pom-poms into each cup as follows:

    - Grandfather A – six red
    - Grandfather B – six blue
    - Grandmother A – six yellow
    - Grandmother B – six green

2. The colored pom-poms represent traits that each of the grandparents have. Color the pom-pom pictures on the Generations of Traits page to show the traits for each grandparent.

3. Close your eyes and pick one trait from Grandfather A and one trait from Grandmother A and place them in the cup labeled “Mother.” These are the traits that Mother inherited from her parents. Color the pom-pom picture on the worksheet to show the traits Mother has (you should leave any extra circles blank).

4. Close your eyes again and pick one trait from Grandfather B and one trait from Grandmother B and place them in the cup labeled “Father.” These are the traits that Father inherited from his parents. Color the pom-pom picture on the worksheet to show the traits Father has (you should leave any extra circles blank).

5. Mother and Father have four children: Mary, George, Elizabeth, and Carl. To determine the traits that Mary will inherit from Mother and Father, close your eyes and take one pom-pom from Mother and one pom-pom from Father. Color the diagram to show the traits that Mary inherited.

6. Next, **return the pom-poms that you took from Mother and Father**. (Look at your diagram if you forget where each trait came from.) Now, close your eyes again and choose the traits that George will inherit (one from Mother, one from Father). Color the diagram to show George's traits.

7. Return the traits you took from Mother and Father and repeat the process to find the traits for Elizabeth and then Carl.

Lesson 4

Generations of Traits

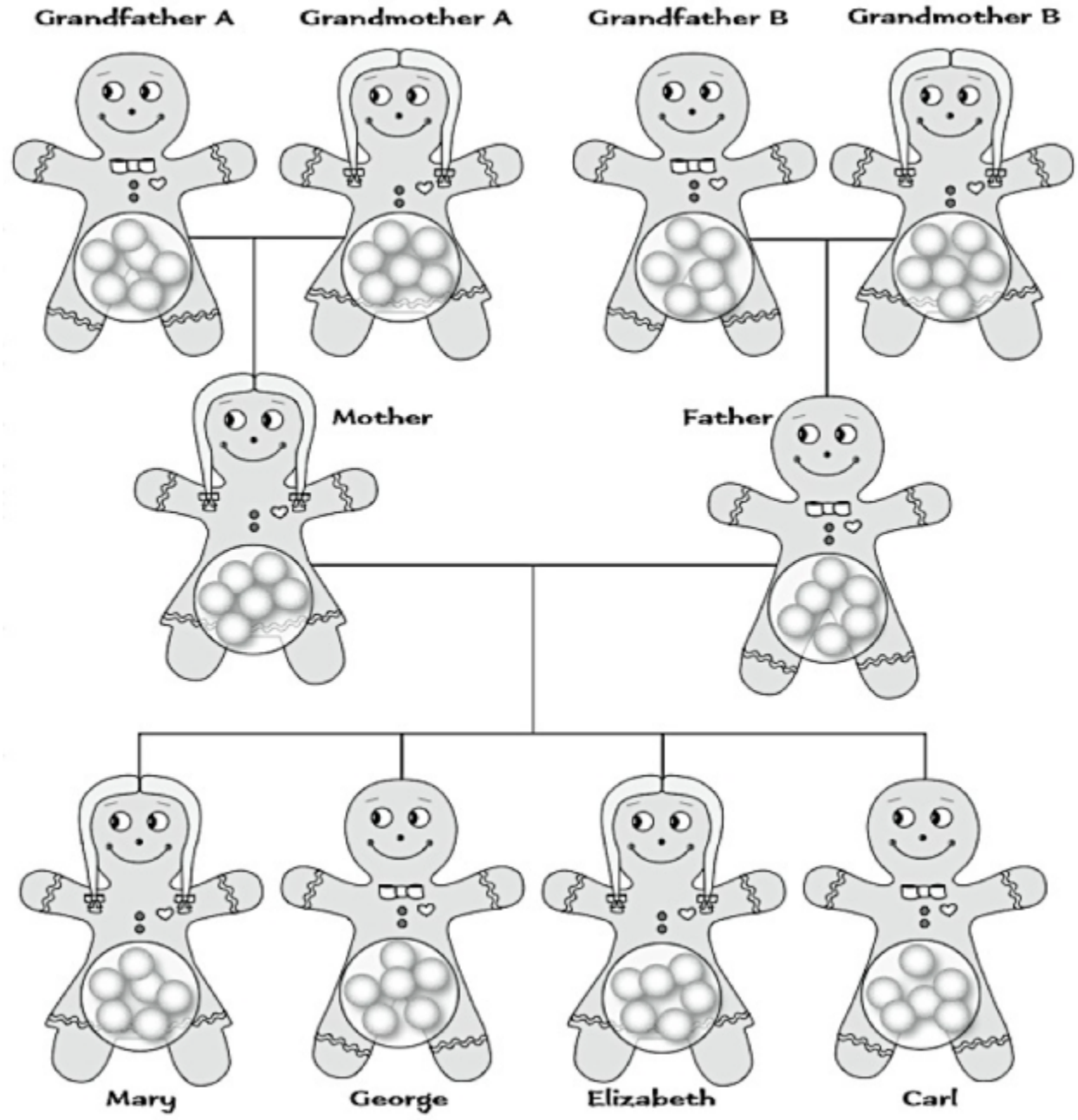


Image credit: Module: The Basics and Beyond: An Introduction to Heredity, Generation of Traits by Genetic Science Learning Center © 2006 University of Utah

Lesson 4

Analysis Questions:

What does each pom-pom represent? Why are they different colors?

What does this model tell you about heredity in organisms that reproduce sexually?

Did each sibling end up with the same traits? Why?

Lesson 4

Why did we put the pom-poms back into the parents' cups before picking the traits for each new sibling?

How do your findings from today help you answer the unit's Essential Question?

Lesson 5:
Mendelian Genetics and Plant Breeding

Hypothesis: Record your hypothesis about the F1 (first filial) generation on the lines below.

Directions: Open the F1 pea pods, record your results, and share possible explanations for the data.

Total number of peas in pods:
Round Peas: % Round Peas:
Wrinkled Peas: % Wrinkled Peas:

Possible explanation for results:

Lesson 5

Hypothesis: Record your hypothesis about the F2 (second filial) generation on the lines below.

Directions: Open the F1 pea pods, record your results, and share possible explanations for the data.

Total number of peas in pods:
Round Peas: % Round Peas:
Wrinkled Peas: % Wrinkled Peas:

Possible explanation for results:

Lesson 5

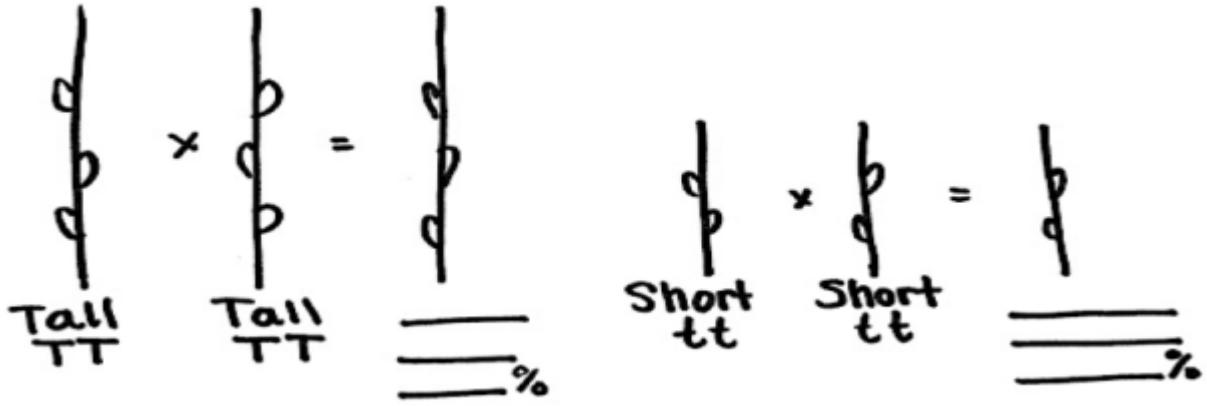
Conclusion: Develop a conclusion based on the from F1 and F2 results.

Plan a presentation of your findings using the lines and/or space below.

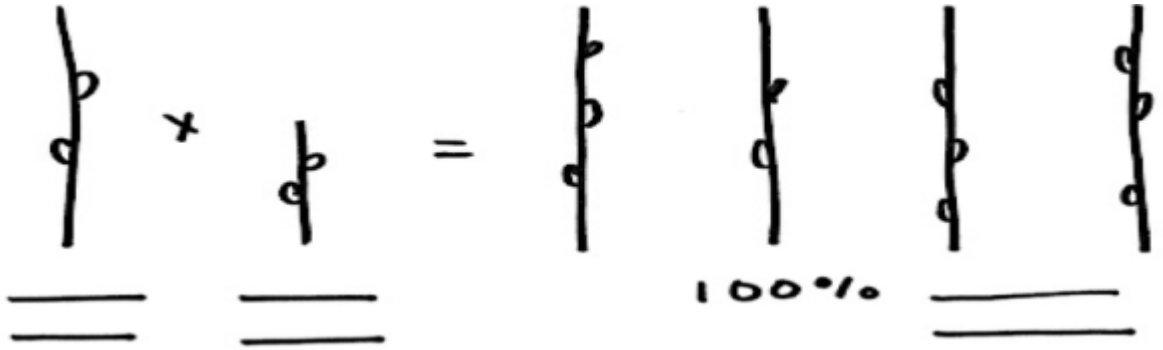
Lesson 5

Mendelian Genetics Guided Practice: Follow along as your teacher models using the images below, and record information on the blank lines.

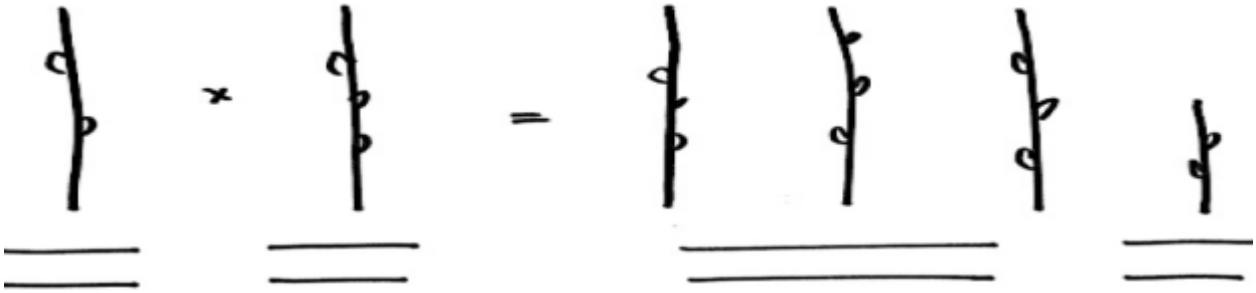
Parent Generations – Pure Line of Tall or Short Plants



F1 Generation – Tall and Short Cross from Parent Generation



F2 Generation – 2 Tall Crosses from F2 Generation



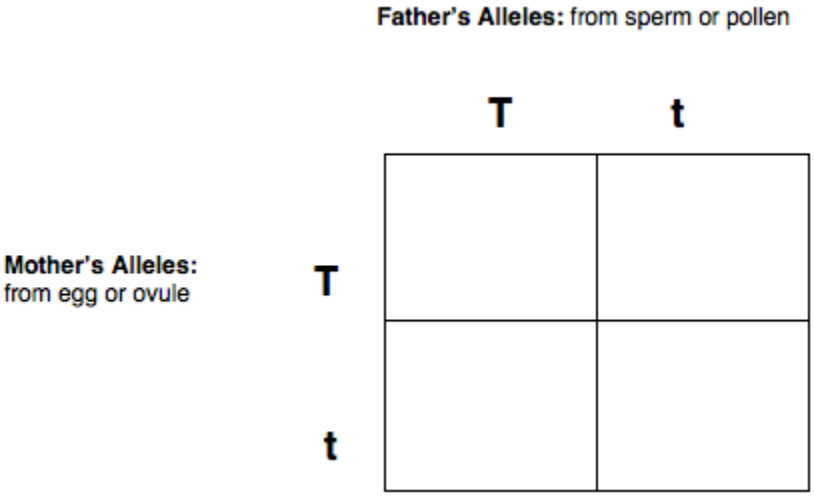
Lesson 5

After watching the video, record Hank's conclusion on the lines below.

Lesson 6:
Modeling Genetic Frequency

Guided Practice

Below is a Punnett square, which is a visual representation of possible fertilization outcomes. The gene being predicted is *plant height*, with T representing tall plants and t representing short plants.



Genotype Possibilities

% Homozygous recessive (What is the genotype you are looking for?)

% Homozygous dominant (What is the genotype you are looking for?)

% Heterozygous (What is the genotype you are looking for?)

Phenotype Possibilities

% Tall plants (What are the genotypes you are looking for? and)

% Short plants (What is the genotype you are looking for?)

Lesson 6

My Dog Spot

Spot's mother and father both had spotted coats but were both heterozygous for that trait (Tt, with T being the allele for a spotted coat and t being the allele for a solid coat).

Create a Punnett square in the space below to calculate the probability of my dog Spot inheriting each type of coat.

Probability of spotted coat:

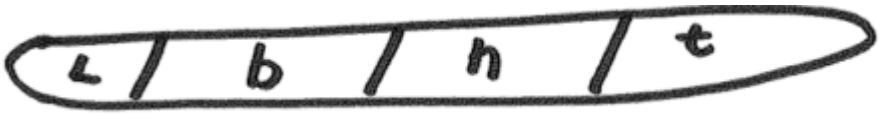
Probability of solid coat:

Lesson 6

The two rod-shaped structures below represent two chromosomes in my dog Spot. One chromosome came from my dog's father and the other came from her mother.

From the mother:

From the father:



Each of the chromosomes contains genes for the same traits. Use the information from the chromosomes to fill in the following chart.

Trait	Dominant Gene	Recessive Gene	Spot's Genotype	Spot's Phenotype
Hair length	Long (L)	Short (l)		
Hair texture	Bristly (B)	Silky (b)		
Hair curliness	Curly (H)	Straight (h)		
Coat pattern	Spotted (T)	Solid (t)		

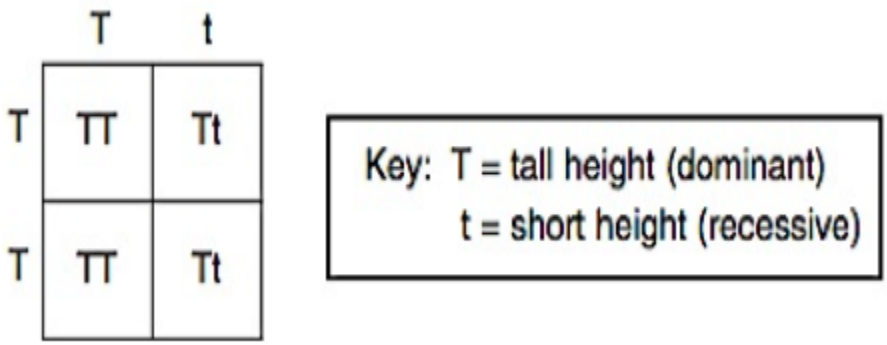
Should my dog be named Spot? Why or why not?

Lesson 6

Independent Practice

The Punnett square below represents the result of the cross between two tall pea plants. All of the resulting offspring were tall.

1. Identify two offspring from the Punnett square that could produce short pea plants if crossed.

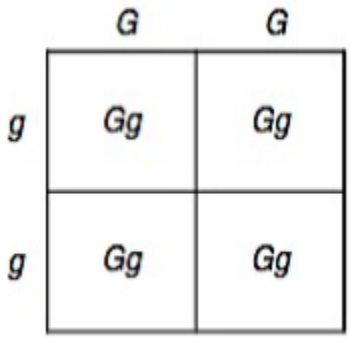


Offspring: x

2. Explain your answer using specific evidence.

Lesson 6

The Punnett square below shows a cross between a pea plant with green pods (GG) and a pea plant with yellow pods (gg).



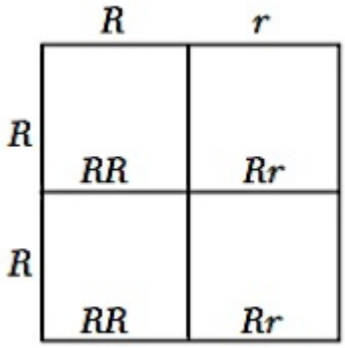
3. Explain why the offspring with Gg genes for pod color look the same as a pea plant with GG genes for pod color. [3]

4. Evaluate the following statement based on the cross in question #3.

25 percent of offspring will have yellow pods.

Lesson 6

The Punnett square below shows an RR pea plant crossed with an Rr pea plant.



Key

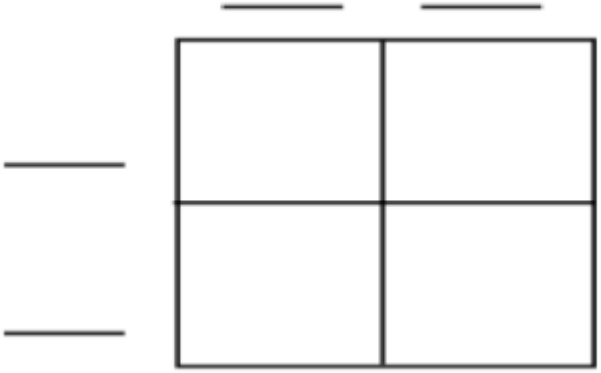
R = full, round pod shape (dominant)

r = wrinkled pod shape (recessive)

5. What percentage of the offspring will have a full, round pod shape? %

6. Will any of the offspring show the recessive trait? Explain.

7. Complete the Punnett square below to show the cross between two Rr parents.



Lesson 9:
Cell Specialization, Gene Expression, and Mutations

Directions: Record notes from the video on the lines below.

Lesson 9

Draw and label the cell model you made from clay. Use the space below.

Discussion Questions:

1. What did you do to change your cell into a specialized cell?

2. How do you think cells really complete these transformations?

Create a diagram showing how stem cells turn into specialized cells. Use the space below.

Lesson 9

Discussion Questions:

1. Reflect on the processes of transcription and translation.

2. What might happen when the “copy/paste” process goes wrong?

Additional Notes:

Lesson 10:
Selective Breeding

Directions: Use the Chicken Farmer's Reference Sheet and scrap paper to help you complete this activity.

Generation 1:

Genotypes of breeding pairs:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Genotypes of their offspring:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Select the ten offspring above that will be kept to breed next round. Circle the ten that will be sold for profit (these chickens cannot breed in the next round, as they will be gone). Transfer their genotypes into the "Generation 2" breeding pairs table on the next page.

Calculate your profit from selling the remaining ten chickens in the space below.

Profit this round: $

Lesson 10

Generation 2:

Genotypes of breeding pairs:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Genotypes of their offspring:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Select the ten offspring above that will be kept to breed next round. Circle the ten that will be sold for profit (these chickens cannot breed in the next round, as they will be gone). Transfer their genotypes into the “Generation 3” breeding pairs table on the next page.

Calculate your profit from selling the remaining ten chickens in the space below.

Profit this round: $

Lesson 10

Generation 3:

Genotypes of breeding pairs:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Genotypes of their offspring:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Select the ten offspring above that will be kept to breed next round. Circle the ten that will be sold for profit (these chickens cannot breed in the next round, as they will be gone). Transfer their genotypes into the “Generation 4” breeding pairs table on the next page.

Calculate your profit from selling the remaining ten chickens in the space below.

Profit this round: $

Lesson 10

Generation 4:

Genotypes of breeding pairs:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Genotypes of their offspring:

Pair 1	Pair 1	Pair 2	Pair 2	Pair 3	Pair 3	Pair 4	Pair 4	Pair 5	Pair 5

Select the ten offspring above that will be kept to breed next round. Circle the ten that will be sold for profit (these chickens cannot breed in the next round, as they will be gone).

Calculate your profit from selling the remaining ten chickens in the space below.

Total profit in this round: $

Total profit from all four rounds put together: $

Lesson 11:
Genetic Engineering

Directions: Record notes on your research in the lines below. Make sure you include information on both selective breeding and genetic engineering.

Lesson 11

Lesson 11

Discussion Questions:

1. Do you feel there are ethical concerns with selective breeding? What about genetic engineering? Why?

2. Should the government “draw a line” somewhere, limiting certain practices or making them illegal? If so, where should the line be drawn?

Write a position statement (argument) addressing Discussion Question #1. [4]

Lesson 12:
Gummy Bear Genetics, Day One

Directions: Today you will apply your knowledge of the unit by testing hypotheses to explain Mendelian and non-Mendelian genetic patterns. Work in groups to complete the procedure listed below.

Procedure:

Adapted from William P. Baker and Cynthia L. Thomas's "Gummy Bear Genetics."

1. Record the total number of bears in your bag. These bears represent the F1 generation of a breeding experiment.

2. Empty the bag onto the table and sort the gummy bears into groups based on phenotypic differences that can be easily observed and quantified.

    - Identify the phenotypic characteristic you used to sort the bears.

    _____

3. Count the number of individual bears for each of the alternate forms of this characteristic and fill in the table below. Fill in the correct row for **your bag number only**.

Cross number (bag #)	Trait you sorted by	Number of each phenotype present	% of each phenotype present
1			
2			
3			
4			
5			
6			
7			

4. Share your data with the class. Compare your data to the results of other groups and record their data in the correct row above for each bag.

Discussion Questions:

1. Which trait(s) appear to be dominant? How do you know?

2. Which type of inheritance is exhibited by your sample of bears?

Lesson 12:
Gummy Bear Genetics, Day Two

Directions: Today you will apply your knowledge of the unit by testing hypotheses to explain Mendelian and non-Mendelian genetic patterns. Work in groups to complete the procedure listed below.

Procedure: Continue the procedure from Day One below.

Adapted from William P. Baker and Cynthia L. Thomas's "Gummy Bear Genetics."

5. As a class, agree on letters to represent the alleles for the characteristics your bears have in common. Then, discuss the questions below for your group's bag and record your answers in the space below each question.

    - Based on the evidence, what are the probable genotypes for each phenotype you observed?

    - What were the probable genotypes of the original parental cross that created the bears in your bag?

    - What were the phenotypes of these parent individuals?

6. Create one or more Punnett squares that will test your hypotheses using the space below.

Discussion Questions:

1. How closely does your actual data approximate the ratio predicted by your Punnett square?

2. Is your hypothesis confirmed by the evidence? If not, repeat steps 5–7. You must show all work to receive full credit.

Lesson 12, Day Two

Data: Work with your group to fill in each column and determine the probable modes of inheritance for each bear phenotype observed in the class.

Activity Data					
Cross #	**Phenotypic Frequency**	**Ratio**	**Possible Genotypes**	**Mode of Inheritance**	**Most Likely Parental Cross**
sample	*15 blue, 15 colorless*	*1:1*	*BB, Bb, bb*	*Mendelian*	*Bbxbb*
1					
2					
3					
4					
5					
6					
7					

Image credit: Adapted from William P. Baker and Cynthia L. Thomas's "Gummy Bear Genetics"