

Activity 5.1

Unit Word Search

Name _____ Date _____ Hour _____

Student Materials

Pencil

Activity

Fill in the blank with the correct term from the word bank. Find the answer within the word search.

- _____ 1. _____ is the study of how traits or characteristics are passed from parent to offspring.
- _____ 2. The passing of characteristics from one generation to another is known as _____.
- _____ 3. Sex cells are called _____.
- _____ 4. Self-_____ is one reason why the garden pea is the perfect plant to study.
- _____ 5. The crossing of purebred strains results in a _____.
- _____ 6. A _____ cross is one between parents that only differ by a single trait.
- _____ 7. _____ is the basic unit of heredity which contains the information to control traits.
- _____ 8. _____ is the alternative gene form.
- _____ 9. The trait that is shown is known as the _____ trait.
- _____ 10. A _____ trait is one that seems to disappear.
- _____ 11. The rule of _____ states the dominant trait will override the recessive trait.
- _____ 12. The law of _____ states that each parent provides one of the two alleles or genes for each trait.
- _____ 13. A _____ cross is a cross between plants that differ from each other in two traits of interest.

- _____ 14. The law of _____ assortment states that genes for certain traits are inherited independently of each other.
- _____ 15. The allele combination of an offspring is known as the _____.
- _____ 16. When the alleles are either both dominant or both recessive it is referred to as _____.
- _____ 17. If one dominant and one recessive allele are present, it is referred to as _____.
- _____ 18. _____ is the observable characteristics.
- _____ 19. _____ dominance occurs when neither gene is totally dominant over the other.
- _____ 20. Animal _____ is the practice of breeding and raising livestock.
- _____ 21. _____ breeding is the process of breeding plants and animals for particular traits.
- _____ 22. _____ is the crossing of two plants of different varieties.
- _____ 23. _____ is the probability that characteristics or traits will be passed from parent to offspring.
- _____ 24. Expected _____ Differences are an indication of the genetic value of one animal compares to another within the same breed.
- _____ 25. Genetic _____ is the process of transferring genes from one individual to another individual or organism.
- _____ 26. Gene _____ is the process of determining the location of the genes on a strand of DNA.
- _____ 27. _____ is a vehicle that will allow DNA to be introduced into the host organism's cell during genetic engineering.

Activity 5.1 Word Bank

alleles	heredity	mapping
dihybrid	heritability	monohybrid
dominance	heterozygous	phenotype
dominant	homozygous	pollination
engineering	husbandry	progeny
gametes	hybrid	recessive
gene	hybridization	segregation
genetics	incomplete	selective
genotype	independent	vector

I E C D B I G Q E H E E S P A P Y U S P S Y
 N L T E I A N C J G W E C H L N T H M O H U
 Z O Z E M R N D R G G W E E L N I S O L E O
 H P I E L A B E E R D S Z N E U L E X L K I
 I E T T N P C Y E P U D S O L Q I F L I D T
 Y E R I A E M G H O E C Z T E Y B Z A N I N
 S N M E S Z A O G I I N W Y S X A U Y A R A
 G O E S D T I Y C T D B D P I N T Z Q T B N
 D E I G I I Z D E N G I N E E R I N G I Y I
 B V N O O O T N I G I E H R N X R X X O H M
 E J N E R R E Y J R C A K M J T E Q N N O O
 Q X J E Q G P H U S B A N D R Y H L E T N D
 B Q T G T Q J S U O G Y Z O M O H A T E O P
 X E V I T C E L E S J K H G N I P P A M M V
 H W B W G E N O T Y P E V E C T O R Y H P E

Activity 5.2

Mendelian Genetics

Name _____ Date _____ Hour _____

Student Materials

Pencil

Directions

After reviewing the section in the unit about Mendel’s Laws of Genetics, answer the following questions.

- 1. What plant did Mendel choose to complete his experiment? Why did he choose this plant?

- 2. Why was self-pollination important to the first set of experiments?

- 3. Explain how Mendel cross-pollinated his garden peas in the second experiment.

- 4. What trait did Mendel observe in his first experiment? Explain the rule that was discovered from this experiment.

- 5. Explain what Mendel saw in his second generation of pea plants as well as the law that resulted.

6. What type of cross did Mendel conduct to establish the law of independent assortment?

7. Explain the law of independent assortment.

8. In your own words, briefly summarize Mendel's three principles.

Activity 5.3

Cross Pollination

Name _____ Date _____ Hour _____

Student Materials

2 lilies of different varieties

scissors

paintbrush

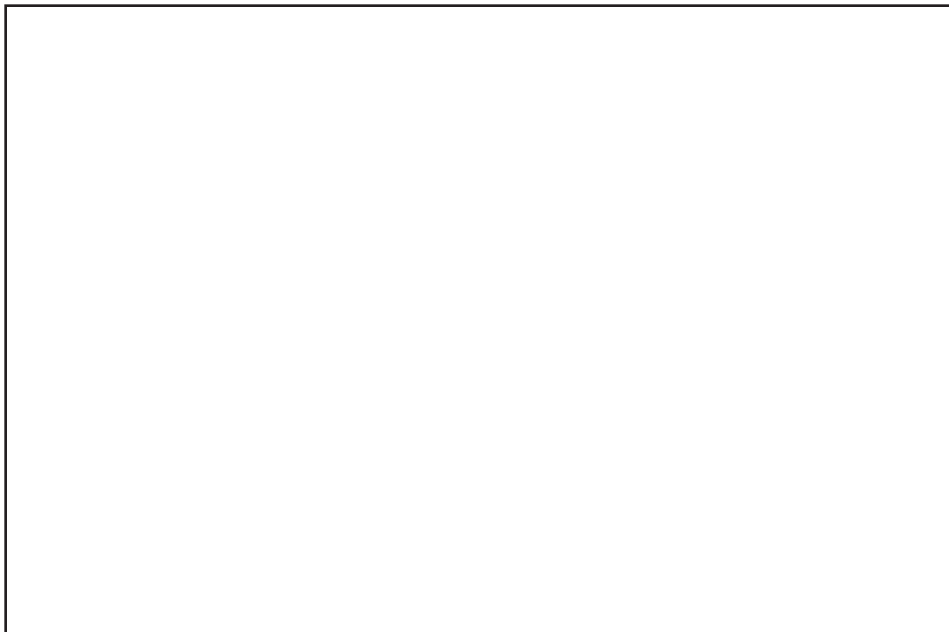
In the unit it was discussed that garden peas were the perfect plant to study because they were able to self-pollinate. When plants self-pollinate, the chances of pollen from another plant crossing over are reduced. Once Mendel had a purebred strain of the garden pea, it was necessary to cross them using cross-pollination. Mendel did this by removing the anthers from one flower and transferring pollen from another with a brush. In this activity, you will go through the process of cross-pollinating.

Procedure

1. Label the flowers A and B.
2. Remove the anthers from flower A.
3. Using the paintbrush, gently collect pollen from flower B.
4. Transfer the pollen from the paintbrush to the stigma of flower A.

Observation

1. Draw a picture of the lily and label the anther and stigma.



2. Hypothesize how cross-pollination would occur in nature.

3. Did you encounter any problems when cross-pollinating the flowers? Explain.

4. Explain the importance of Mendel completing the cross-pollination by hand.

Activity 5.4 Probability and Heredity

Name _____ Date _____ Hour _____

Student Materials

- 2 coins
- Pencil

Directions

In this activity, you will simulate Mendel’s experiments with coins. Flip the coins at the same time and record the outcome.

Hypothesize

Write a short hypothesis about the expected outcome of flipping the coins 100 times. Note your expected ration (HH:HT:TT).

Data

Possible outcomes are heads, heads (HH), heads, tails (HT), and tails, tails (TT). Make a tally mark in the correct row for the outcome. Flip the coins 100 times. After 4, 50 and 100 flips, record the ratio of combinations below the chart.

Result	Tally Count	Total
HH		
HT		
TT		

Ratio after 4 flips (HH:HT:TT)

Ratio after 50 flips (HH:HT:TT)

Ratio after 100 flips (HH:HT:TT)

Results

1. Which combination was seen most frequently?

2. Explain your ratio results at 4, 50 and 100 flips.

Conclusion

Write a brief conclusion for the experiment. Compare your results to Mendel's purebred crosses.

Activity 5.5

Punnett Square: Predicting the Genotype

Name _____ Date _____ Hour _____

Student Materials

Pencil

Directions

Complete the following monohybrid crosses using the Punnett Square. List the ratio for the genotype and describe the phenotype of each cross.

Example

A tall pea plant (TT) is crossed with a short pea plant (tt).

	t	t
T	Tt	Tt
T	Tt	Tt

Genotype Ratio: 0 TT : 4 Tt : 0 tt

Phenotype Description: 4 tall pea plants, 0 short pea plants

1. A green pea plant (GG) is crossed with a yellow pea plant (gg).

Genotype Ratio: _____

Phenotype Description: _____

2. A stress negative pig (SS) is crossed with a stress carrier (Ss).

Genotype Ratio: _____

Phenotype Description: _____

3. A Red Angus cow(nn) is crossed with a Black Angus bull (NN).

Genotype Ratio: _____

Phenotype Description: _____

4. A black chicken (BB) is crossed with a black rooster (BB).

Genotype Ratio: _____

Phenotype Description: _____

5. A stress carrier pig (Ss) is crossed with a stress carrier pig (Ss).

Genotype Ratio: _____

Phenotype Description: _____

Activity 5.6

Punnett Square: Independent Assortment

Name _____ Date _____ Hour _____

Student Materials

Pencil

Directions

Complete the following dihybrid crosses using the Punnett Square. List the ratio for the genotype and describe the phenotype of each cross.

- As we know from Mendel’s experiment, round seeds and yellow seeds are dominant traits and are inherited independently from each other. If you cross a plant that is heterozygous for round, yellow seeds with a plant that is heterozygous for wrinkled, green seeds, what are the genotypes of the parents?

Parent 1

Parent 2

- What are the possible genotype combinations from the cross in question 1?

Parent 1

Parent 2

- Complete a Punnett Square for the cross.

- What are the possible genotypes?

5. What is the genotype ratio?

6. What are the possible phenotypes?

7. Which phenotype is most likely to occur?

8. We also know from Mendel's experiments that tall plants are dominant and short plants are recessive. Use the Punnett Square to determine the possible offspring from a cross between a homozygous tall plant with yellow seeds and a homozygous short plant with green seeds. List the genotype for each parent.

Parent 1

Parent 2

9. Complete a Punnett Square for the cross.

10. What are the possible genotypes?

11. What is the genotype ratio?

12. What are the possible phenotypes?

13. Which phenotype is most likely to occur?

Activity 5.7

Punnett Square: Incomplete Dominance

Name _____ Date _____ Hour _____

Student Materials

Pencil

Directions

Incomplete dominance occurs when neither gene is totally dominant over the other. We know from the unit that an example of incomplete dominance is the snapdragon flower. Crossing a pink-flowered snapdragon and a white-colored snapdragon will result in a purple-flowered snapdragon. Answer the following questions based on this knowledge.

1. What are the genotypes for each flower color if P represents a pink gene and W represents a white gene?

Pink _____

White _____

Purple _____

2. Using a Punnett Square, determine the possible offspring from a cross of a pink-flowered snapdragon and a white-flowered snapdragon and then record the genotypes, phenotypes and percentage of each color.

Possible Genotypes: _____

Possible Phenotypes: _____

Pink-flowered snapdragons _____%

White-flowered snapdragons _____%

Purple-flowered snapdragons _____%

3. Using a Punnett Square, determine the possible offspring from a cross of two white-flowered snapdragon.

Possible Genotypes: _____

Possible Phenotypes: _____

Pink-flowered snapdragons _____%

White-flowered snapdragons _____%

Purple-flowered snapdragons _____%

4. Using a Punnett Square, determine the possible offspring from a cross of a pink-flowered snapdragon and a white-flowered snapdragon.

Possible Genotypes: _____

Possible Phenotypes: _____

Pink-flowered snapdragons _____%

White-flowered snapdragons _____%

Purple-flowered snapdragons _____%

5. Using a Punnett Square, determine the possible offspring from a cross of two purple-flowered snapdragons.

Possible Genotypes: _____

Possible Phenotypes: _____

Pink-flowered snapdragons _____%

White-flowered snapdragons _____%

Purple-flowered snapdragons _____%

Activity 5.8 Utilizing EPDs

Name _____ Date _____ Hour _____

Student Materials

Pencil

Directions

Expected Progeny Differences or EPDs are a measurement of genetic potential. EPDs use the performance of relatives to predict the performance of a particular animal. EPDs are numbers relative to the average within a particular breed. For example, a bull with a +10 birth weight suggests that he is 10 pounds heavier at birth than the average for that breed. You cannot use EPDs to compare outside of their breed. EPDs allow us to compare differences among animals within a breed in relation to the breed average. This allows us to choose an animal based on our specific desired characteristics for our operation. Over time, this has proven beneficial for dairy cows to produce more milk and meat animals to grow faster on less feed.

Here's how it works. If you desire calving ease, you want the sire to pass along lower birth weights. Which bull possesses a trait for lower birth weight?

	BW
Bull A	-0.1
Bull B	+0.5

Bull A is 0.1 below the breed average for birth weight, and Bull B is 0.5 higher than the breed average; therefore Bull A would be your choice based on this scenario.

Practice

	BW	WW	Milk	YW	MARB	REA	FAT
Bull A	-10	-30	+5	-60	-0.50	-0.12	-0.15
Bull B	+30	+40	+7	+75	+0.20	+0.29	-0.12
Bull C	+12	-10	-3	+30	+0.10	+0.33	+0.09

- Which bull is the best choice for low birth weights resulting in calving ease?

- Which bull is the best choice for selling his offspring when they turn one year old?

3. Which bull is the best choice for producing heifers that will have high milking ability?

4. Which bull is the best choice for producing offspring with large rib eyes?

5. Which bull is the best choice for producing offspring with less fat?

	BW	WW	Milk	YW	MARB	REA	FAT
Bull A	+9	+20	+2	+44	-0.20	+0.30	-0.12
Bull B	+5	-5	-4	-10	+0.10	+0.05	-0.01
Bull C	-3	+5	-9	+10	+0.12	+0.22	-0.15

1. Which bull is the best choice for low birth weights resulting in calving ease?

2. Which bull is the best choice for selling his offspring when they turn one year old?

3. Which bull is the best choice for producing heifers that will have high milking ability?

4. Which bull is the best choice for producing offspring with large rib eyes?

5. Which bull is the best choice for producing offspring with less fat?

Activity 5.9

DNA Extraction

Name _____ Date _____ Hour _____

Student Materials

1 teaspoon raw wheat germ
1 teaspoon non-iodized table salt
1 ml liquid dish soap
10 ml ice-cold alcohol in a test tube
20 ml hot tap water
2 small plastic cups
1 large plastic cup filled with ice
eyedropper or pipette
large paperclip

Procedure

1. Place the test tube containing alcohol in the cup of ice and set aside for later use.
2. Place 1 teaspoon of raw wheat germ in one of the small plastic cups.
3. In another small plastic cup, mix the 50 ml of hot tap water, 1 ml of dish soap, and 1 teaspoon of salt. Be careful not to cause bubbles to form.
4. Pour the soap and salt mixture into the first cup that contains the wheat germ. Fill is about 1/2 full. The wheat germ will absorb the liquid. Enough liquid needs to be poured in to cover the wheat germ after it has swelled.
5. Stir the solution for 5 minutes with the eyedropper or pipette. Be careful to not cause bubbles to form.
6. After stirring, let the solution settle for 2-3 minutes.
7. Use the pipette to withdraw 1 ml of liquid off the top. Be careful not to withdraw the wheat germ that has settled to the bottom of the cup.
8. Slowly add the liquid to the test tube that contains alcohol. After a few minutes, DNA will appear. The DNA will look stringy.
9. Using the large paperclip, create a hook to spool the DNA.

Activity 5.10

Genetic Engineering

Name _____ Date _____ Hour _____

Student Materials

- Pencil
- Internet access
- Microsoft® PowerPoint

Directions

Your task is to search Google for genetically engineering pros and cons. You will browse the Internet and research the good and the bad related to genetic engineered food. Once your research is conducted and recorded, you will prepare a slide show presentation presenting both sides of the issue.

Presentation Requirements

- Minimum of 10 slides
- Minimum 5 pros, 5 cons
- Include images and graphs that support or enhance your presentation

What you should include:

- Definition of genetic engineering
- 5 pros
- 5 cons
- 10 examples of genetically modified foods at the grocery store
- A summary of your opinion based on your research

Notes

Activity 5.11

Genetics Crossword

Name _____ Date _____ Hour _____

Student Materials

Pencil

The crossword puzzle grid consists of 25 numbered starting points for words:

- 1: 15-letter horizontal word at the top left.
- 2: 10-letter horizontal word starting from the second cell of 1.
- 3: 3-letter vertical word at the top right.
- 4: 10-letter horizontal word starting from the second cell of 3.
- 5: 5-letter horizontal word on the second row.
- 6: 12-letter horizontal word on the third row.
- 7: 10-letter horizontal word on the fourth row.
- 8: 7-letter horizontal word on the fifth row.
- 9: 10-letter horizontal word starting from the eighth cell of 8.
- 10: 10-letter horizontal word starting from the second cell of 9.
- 11: 5-letter vertical word on the right side.
- 12: 3-letter vertical word on the left side.
- 13: 10-letter horizontal word on the sixth row.
- 14: 3-letter vertical word on the right side.
- 15: 7-letter horizontal word on the seventh row.
- 16: 3-letter horizontal word on the eighth row.
- 17: 7-letter horizontal word on the eighth row.
- 18: 5-letter horizontal word on the ninth row.
- 19: 5-letter vertical word on the right side.
- 20: 10-letter horizontal word on the tenth row.
- 21: 8-letter horizontal word on the eleventh row.
- 22: 10-letter horizontal word on the twelfth row.
- 23: 4-letter horizontal word on the thirteenth row.
- 24: 12-letter horizontal word on the thirteenth row.
- 25: 10-letter horizontal word on the fourteenth row.

EclipseCrossword.com

Across

1. Probability that characteristics or traits will be passed from parent to offspring
4. Trait which is hidden
5. Virus or plasmid used in genetic engineering
6. Observable characteristic
7. Alleles are either both dominant or both recessive
8. Different gene forms
10. Practice of breeding and raising animals
13. One dominant and one recessive trait is present
15. Cross between plants that differ from each other in two traits of interest
17. Sex cells
18. Type of pollination that allows for pollen transfer within the same flower
20. Cross between two parents that only differ by a single trait
21. Study of how traits are passed from parent to offspring
22. Law of _____ states that each parent provides one of the two alleles for each trait.
23. Basic unit of heredity
24. Determining the location of genes
25. Rule of _____ states that the dominant trait will override the recessive trait.

Down

2. Dominance that occurs when neither gene is totally dominant over the other
3. Passing of characteristics from one generation to another
9. Law of independent _____ states that certain traits are inherited independently of each other.
11. Offspring of a cross between two purebred parents
12. Process of breeding for particular traits; _____ breeding
14. Crossing of two plants of different varieties
16. Allele combination
19. Trait which is exhibited