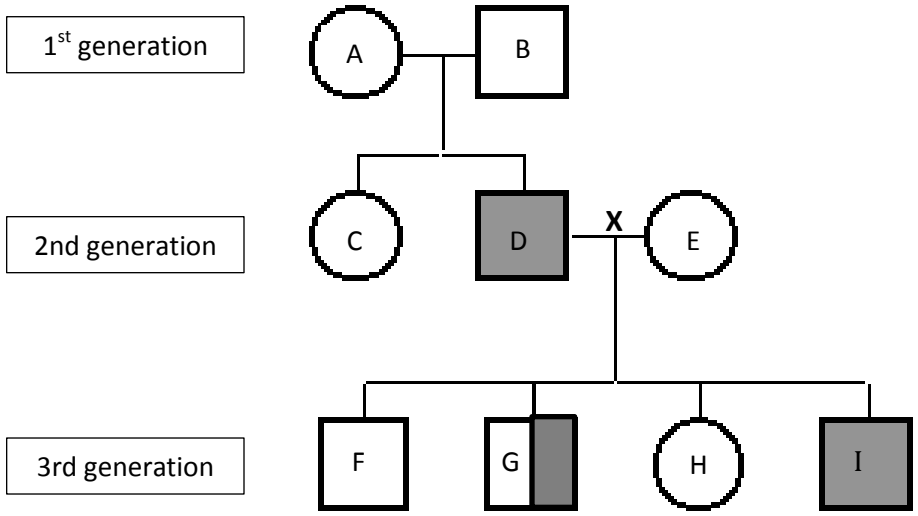
Name: _____ Date: _____ Per: ____

Pedigree Analysis

Name: _____ Class: _____

Pedigrees: Introduction

A pedigree is a diagram of family relationships that uses symbols to represent people and lines to represent genetic relationships. These diagrams make it easier to visualize relationships within families, particularly large extended families. Pedigrees are often used to determine the mode of inheritance (dominant, recessive, etc.) of genetic diseases. A sample pedigree is below.



In a pedigree, squares represent males and circles represent females. Horizontal lines connecting a male and female represent mating. Vertical lines extending downward from a couple represent their children. Subsequent generations are therefore written underneath the parental generations and the oldest individuals are found at the top of the pedigree.

If the purpose of a pedigree is to analyze the pattern of inheritance of a particular trait, it is customary to shade in the symbol of all individuals that possess this trait.

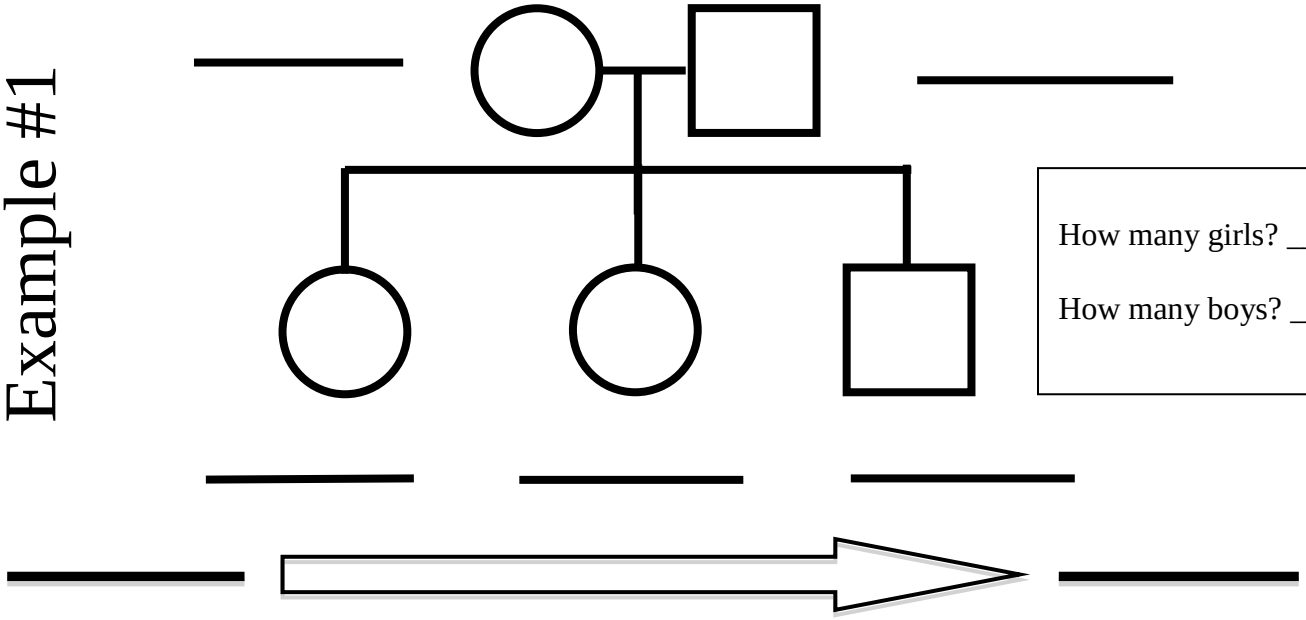
In the pedigree above, the grandparents had two children, a son and a daughter. The son had the trait in question. One of his four children also had the trait.

1. How many females are shown in this family? _____
2. What does a shaded symbol represent? _____
3. What does the line at X tell you? _____
4. How many offspring did the second generation have? _____
5. Describe three characteristics of individual G.
    a. _____
    b. _____
    c. _____
    d. _____

Pedigree Notes **Name: _____**

1. **Pedigree:** a diagram that traces _____ _____ through several generations of a family.

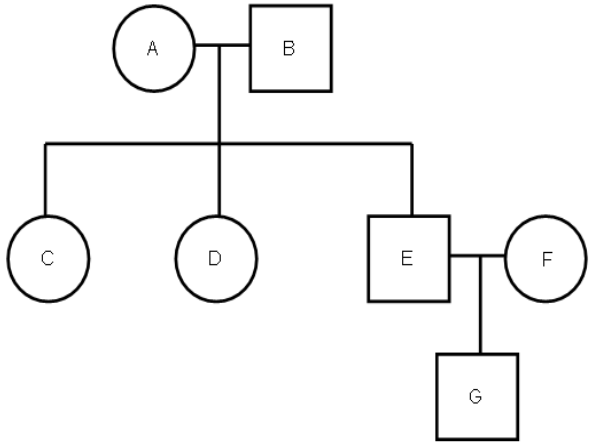
Example #1



How many girls? _____

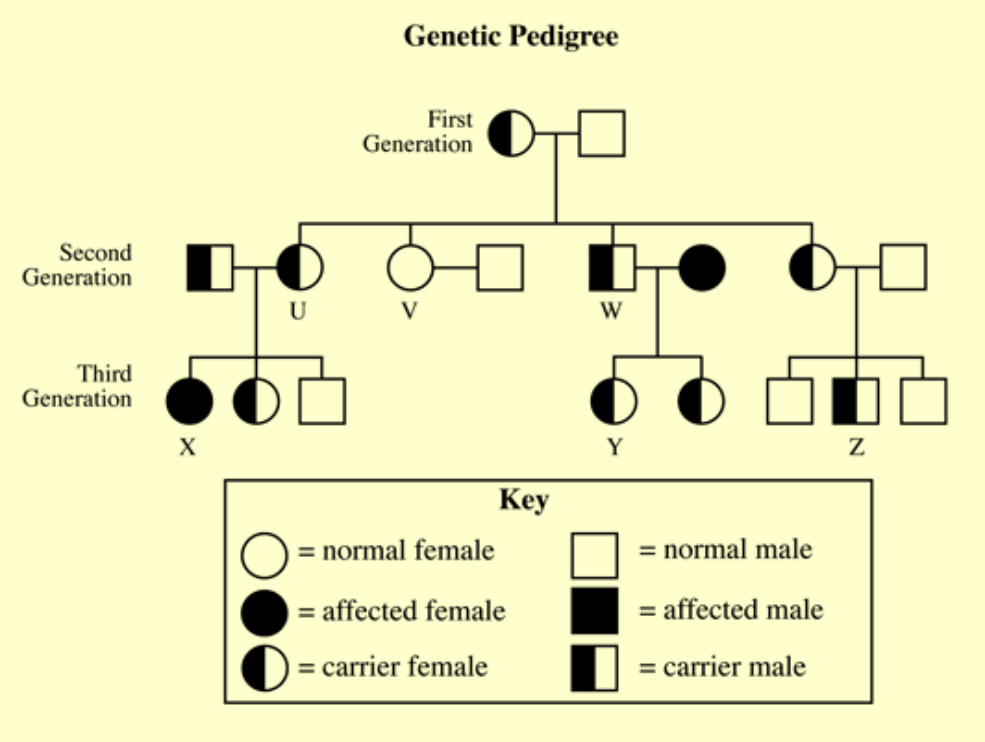
How many boys? _____

2. A horizontal line connecting two shapes represents a _____/_____.
3. How many crosses/marriages in the pedigree below? _____
4. A _____ line extending down from a marriage/cross represents that the couple _____ _____.
5. **A** and **B** are _____.
6. **E** and **F** are _____.
7. **A** and **B** have ____ kids, while **E** and **F** have ____ kid(s).
8. What is **F** to **D**? _____.
9. What is **B** to **G**? _____.



Example #2

Name: _____ Class: _____



Questions:

1. How many children did the first generation have? _____
2. How many girls did the first generation have? _____
3. Describe individual Y. _____
4. Describe individual Z. _____
5. How many children and grandchildren have the disease? _____
6. What is the genotype of X? Use the letter R/r. _____
7. What is the genotype of Y? Use the letter R/r. _____
8. How many children and grandchildren are carriers for the disease? _____
9. What is a carrier?

   _____

   _____
10. How many kids did W and his wife have? _____
11. Who is older, U or V? _____ How do you know?

    _____

    _____

Meet the Charltons

The Charltons are a family of five. In addition to mom and dad, there is a son named Tyler, and two daughters named Terry and Anna. Terry is the oldest of the children and Anna is the youngest. Mr. and Mrs. Charlton have black hair. Terry and Tyler have red hair and Anna has black hair like her parents. Mrs. Charlton's mother has black hair and knows that her genotype is pure dominant. Both of Mr. Charlton's parents are hybrids.

Make a pedigree below to represent all of the members of the Charlton family. Add a name label for each person

Questions:

1. How many generations are in your pedigree?

2. What is the genotype and phenotype of Mrs. Charlton's father? How do you know?

3. If Mr. and Mrs. Charlton had a forth child, what are the possible genotypes and phenotypes for that child?

4. If Anna marries a red-head, what is the probability that her first born will have red hair? How do you know this?

Name _____

Inheritance Questions

Draw a pedigree to represent the following family. Include the name and genotype of each person in the family. Use the letter R. Curly hair is dominant.

Joe and Sarah are married. They have three children. David is the oldest and Ben is the youngest. Their daughter is named Cayla. Cayla's husband is Mike. They have one son named Jon. Joe has curly hair, but Sarah is pure recessive. David and Mike have curly hair. Ben and Cayla have straight hair.

1. How many generations are present?

2. What is Joe's genotype? How do you know?

3. What is/are Jon's possible genotype? How do you know?

4. ***Could*** two parents with curly hair have four straight haired sons? Prove your answer by completing a punnett square followed by a written explanation.

Objectives for Unit 1 - Part 4: <u>Cloning, Genetic Engineering, & Selective Breeding</u>

You will <u>UNDERSTAND</u> the following concepts…

- Most cells have genetic information that determines traits.
- Organisms inherit genetic information in a variety of ways that result in variations/similarities in organisms.
- Models of genetic inheritance can be used to show the probability of traits being expressed.
- Genes can be modified through mutation or human intervention.
- Genetic traits are passed from parents to offspring.

<u>Underlined</u> terms are required vocabulary words.

You will <u>KNOW</u> the following ideas and concepts…

- Each human cell contains a copy of all the genes needed to produce a human being.
- **<u>Cloning</u>** is the production of cells/organisms with identical genes.
- **<u>Identical twins</u>** are natural **<u>clones</u>**.
- A **<u>clone</u>** made from a living organism will be genetically identical to that organism, but will be younger.
- The environment may affect the expression of genes. In other words, two organisms may be genetically identical, but no t look exactly the same.
- **<u>Selective breeding</u>** is the mating of two organisms in an attempt to combine the best traits of each in the offspring.
- Selective breeding has been practiced for thousands of years and requires no special equipment.
- **<u>Genetic engineering</u>** is when humans modify/replace/exchange genes to change the DNA of an organism.
- Genetic engineering can combine genes from two different species.

You will <u>BE ABLE TO DO</u> the following activities…

- Identify the advantages and disadvantages of GE and SB.
- Create a virtual clone (Mimi).

Twins! What do you know about twins?

Watch the brainpop on twins and complete the quiz. Pick **one** question to answer. Use COMPLETE sentences! Circle your choice!

1. Are twins clones? Why or why not? (Hint: think about the types of twins.)
2. How are fraternal and identical twins made?

TWINS

Date:_____

Name:_____

Class:_____

1  **Identical twins share the exact same:**

A Genes

B Personalities

C Interests

D Identities

2  **What can you infer about the following set of twins?**

A They are identical twins

B They are fraternal twins

C They are conjoined twins

D They are mixed twins

3 **What is the key difference between fraternal twins and identical twins?**

A Fraternal twins are born several hours apart; identical twins are usually born at the same time

B Identical twins are born at the same time; fraternal twins are usually born several hours apart

C Identical twins develop from two separate eggs; fraternal twins develop from one fertilized egg

D Identical twins develop from one fertilized egg; fraternal twins develop from two separate eggs

4 **Place the following events in sequence: A) A fertilized egg splits; B) Identical twins develop; C) A sperm and egg cell unite**

A A, C, B

B B, A, C

C C, A, B

D C, B, A

5 **In the phrase, "Twins develop during the prenatal stage of life," what does "prenatal" mean?**

A After birth

B Before birth

C Before conception

D During birth

6 **What must happen for fraternal twins to develop?**

A A fertilized egg must divide twice as rapidly as it ordinarily does

B A sperm cell must split in half

C An egg cell must split within the uterus

D A woman must release two egg cells at the same time

7 **Which term best describes the genetic makeup of fraternal twins?**

A Indistinguishable

B Similar

C Opposite

D Generic

8  **How are conjoined twins formed?**

A When two sperm fertilize one egg

B When two separate eggs fuse together

C When one fraternal twin begins to consume the other in the womb

D When identical twins start to form but don't split completely

9 **What can you conclude from the fact that doctors usually try to surgically separate conjoined twins?**

A Conjoined twins often face dangerous health risks

B Conjoined twins can never lead fulfilling lives

C Conjoined twins will die immediately if they're not separated

D Conjoined twins are not legally allowed to live

10 **Which term best describes the occurrence of conjoined twins?**

A Frequent

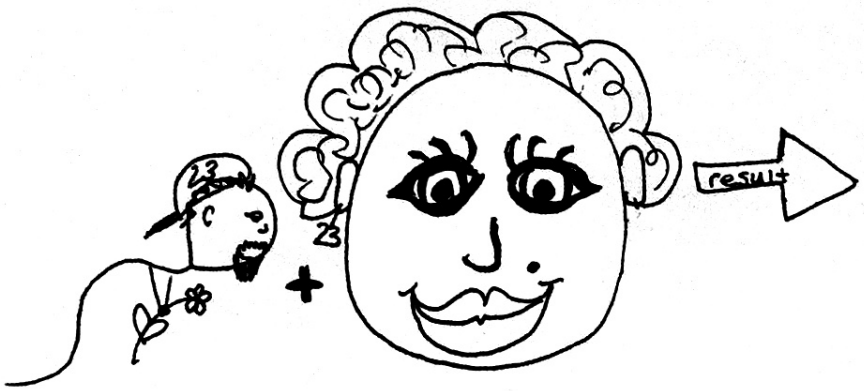
B Uncommon

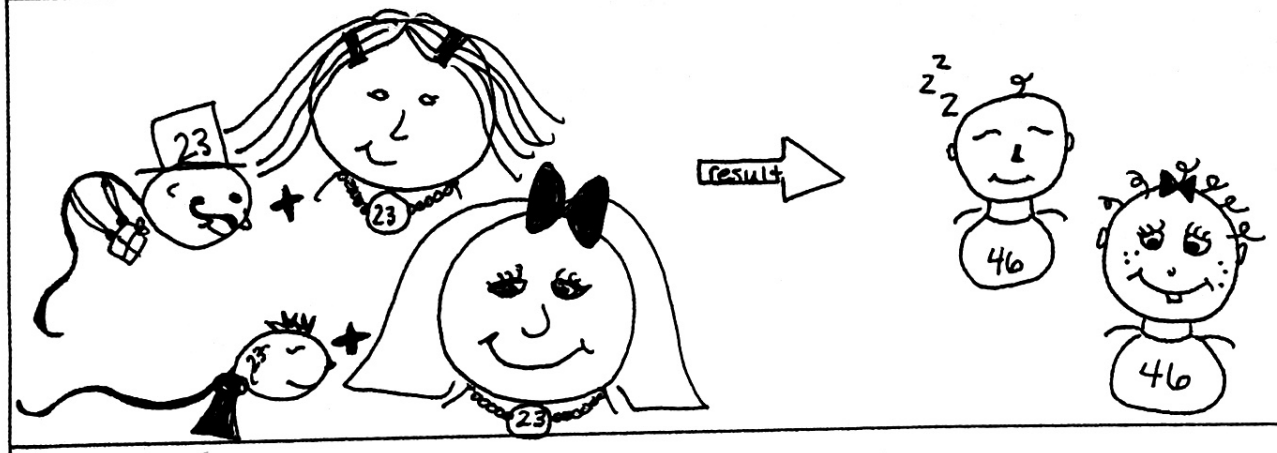
C Typical

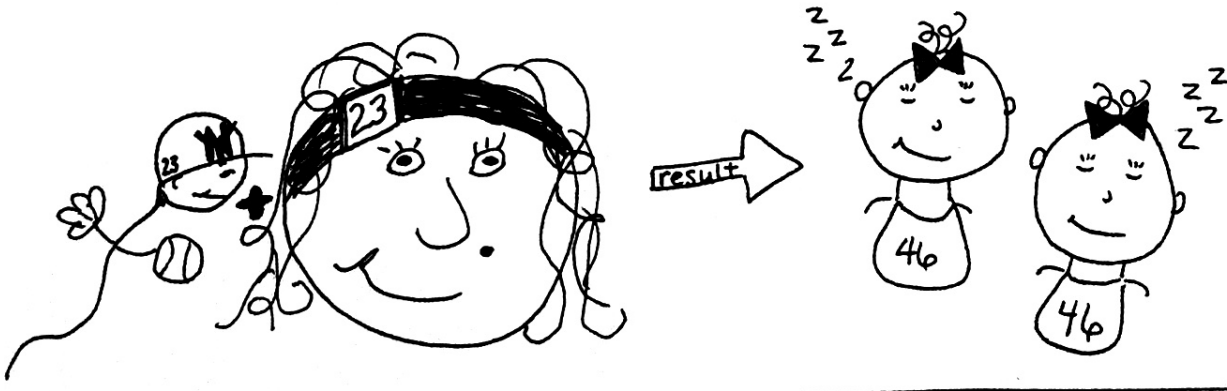
D Impossible

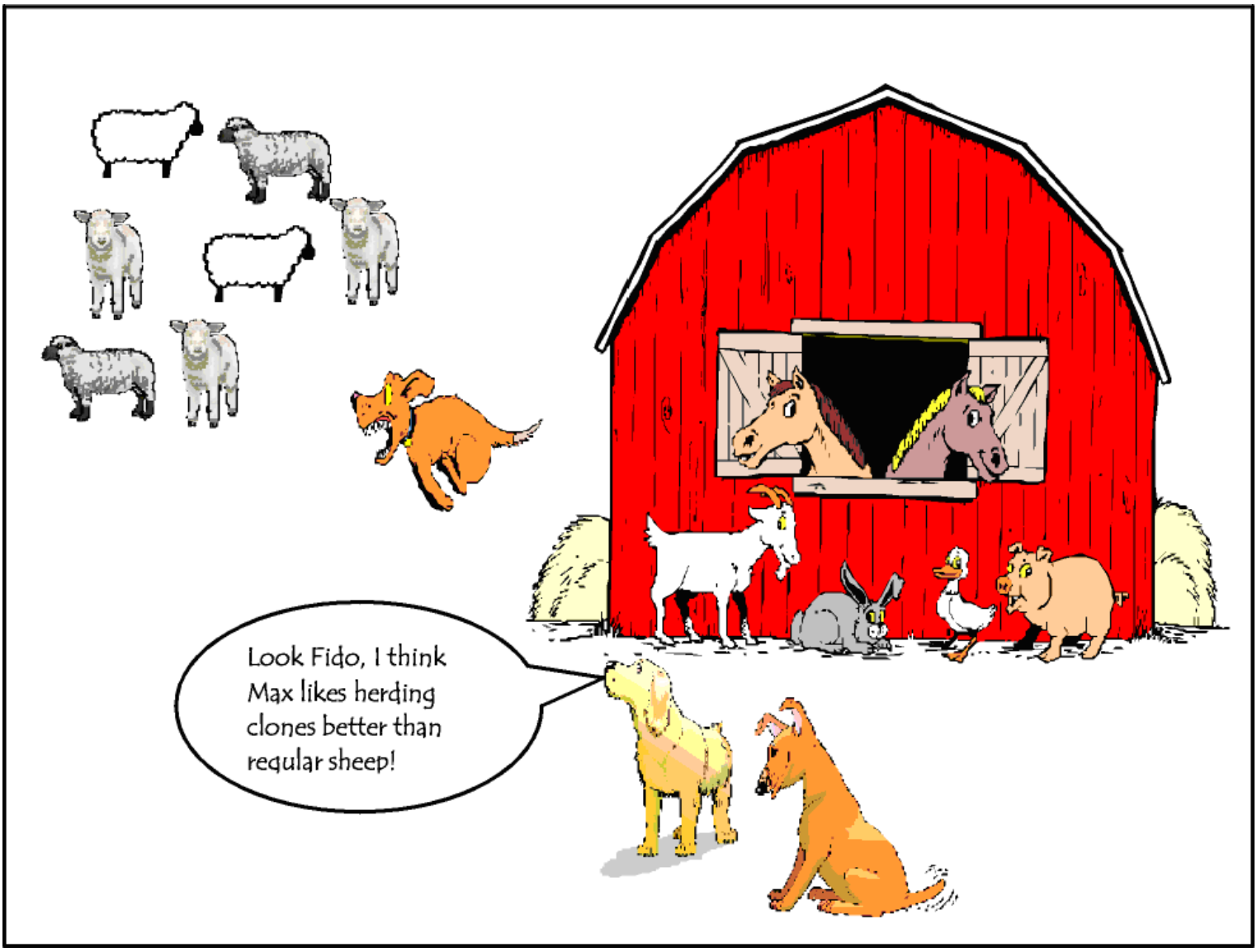
TWINS!

Notes









1. What is cloning?

2. What type of reproduction is cloning? Why?

3. What are some ethical issues regarding cloning?

Let's Clone a Mouse, Mouse, Mouse…..

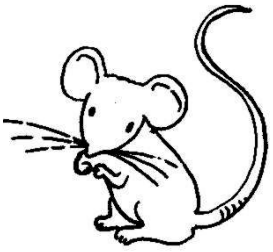
Name _____

BACKGROUND INFORMATION

In 1996, Dolly the sheep became the first mammal to be cloned by transferring the nucleus from an adult body cell into an **enucleated** egg cell.

To confirm that Dolly was truly a clone, researchers at the University of Hawaii used a similar process in 1998 and ultimately cloned 50 mice.

In this activity you will simulate their steps of **somatic cell nuclear transfer** to produce an exact clone, or genetic copy, of a mouse.



enucleated means _____

Your task: check off each step in the activity as you complete it. You must wait to get your **teacher's initials** at certain spots in the activity before you can move forward.

☐ **1.** Go to the 7th grade science website, to the Cloning page under the Inheritance section. Follow the link entitled **"The Cloning Activity".** Then click on **"What is Cloning?"** on that new page.

☐ **2.** Read the first few paragraphs of the **"What is Cloning?"** article and answer the following questions…

a. What is cloning? _____

_____

b. Do human clones exist? _____ **Defend your answer:** _____

_____

☐ **STOP!** You must get your teacher's initials in the box before you can continue.

☐ **3.** Further down in the **"What is Cloning?"** article read about **artificial embryo twinning** and **somatic cell transfer**.

☐ **4.** Watch both **"Compare and Contrast"** animations *(one looks like a 2 cartoon pictures of a cell, the other has drawings of sheep).* **Each has 2 play buttons – be sure to watch all the parts!!**

☐ **5.** Watch both **"See the Real Thing"** videos *(bottom right of the page – they look like microscope pics)*.

☐ **6.** Use what you learned in steps 3-5 to answer the following:

somatic cell = body cell
nuclear = nucleus
transfer = moving an object from one place to another

Using these definitions, what does ***somatic cell nuclear transfer*** mean? _____

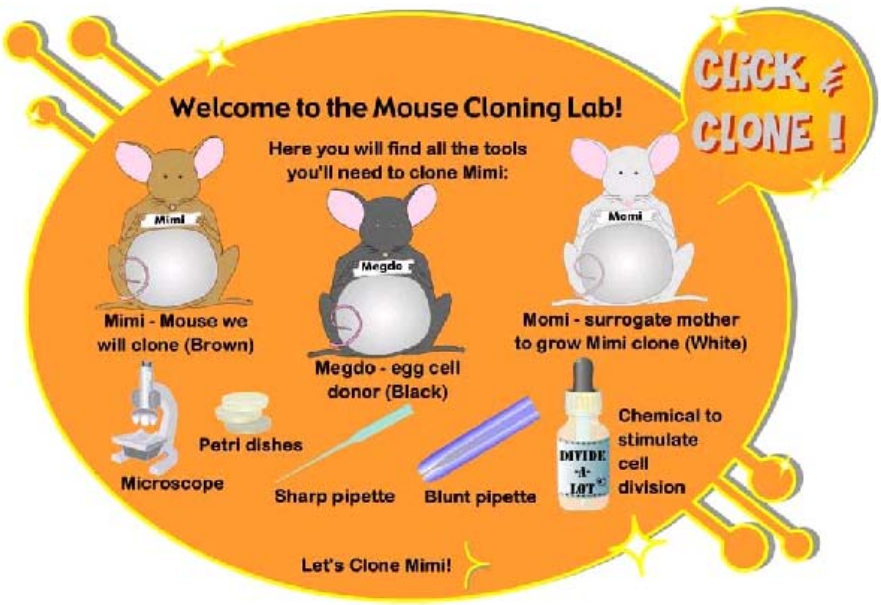
_____

_____

☐ **STOP!** You must get your teacher's initials in the box before you can continue.

☐ **7.** Click the back button, and go to the **"Click and Clone"** activity on the website. *(Find the orange bar with the cartoon mice on it.)*

☐ **8.** Go through all the steps to clone Mimi the mouse. (click on ***"Let's Clone Mimi!"*** to start)



☐ **9.** Answer the following questions…

a. Why isn't the baby white like Momi the surrogate mother? _____

_____

b. What do you think about cloning? Could it be useful to humans? Do you see any possible problems that could be caused by making clones?

_____

_____

_____

c. If you could clone any one person; who would you clone? _____

Why would you clone that person? _____

_____

STOP! You must get your teacher's initials in the box before you can continue.

☐ **10.** Choose one of the following: *(circle your choice)*

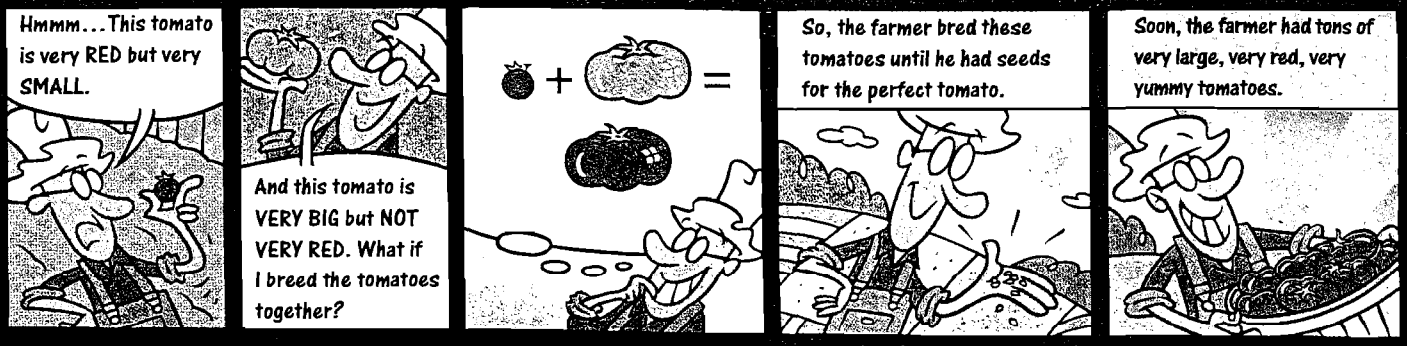
(A) **Cloning Card Sort** to start getting ready for your upcoming quiz

(B) **"Going Further…" writing activity** from the other side of this page (for EXTRA CREDIT)

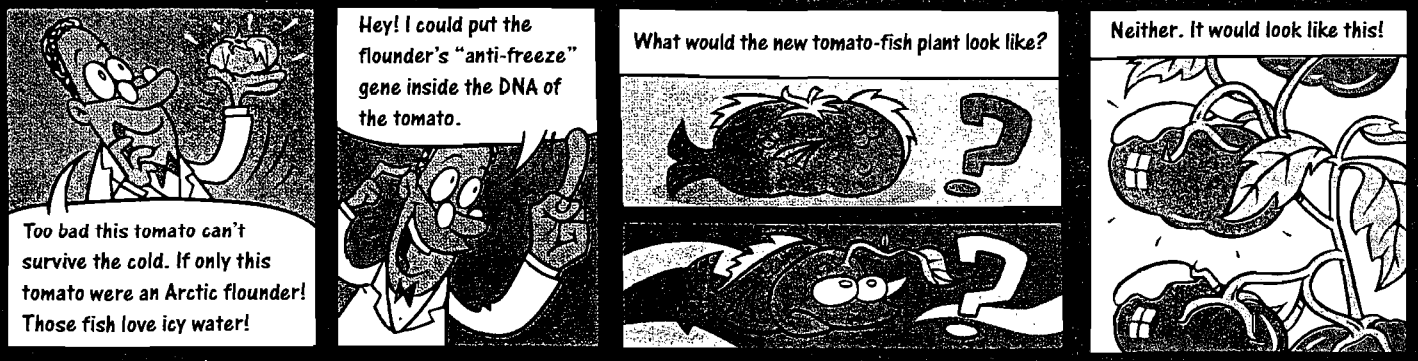
☐ **11.** Be ready for an **Exit Ticket** about cloning!

The Quest for the PERFECT TOMATO

For centuries, farmers have used a method called breeding to grow the most desirable crops. With tomatoes, they have combined different kinds to produce larger, redder, and tastier varieties.



You can make bigger and better tomatoes, but no tomato can withstand chilly weather. What can? Fish in the Arctic! But you can't breed a fish and a tomato. Guess what? Scientists have figured out a way to take genes from one species and put them into another. This is called genetic modification.



Looks aren't everything! If we could genetically modify a tomato using the fish "anti-freeze" gene, it would look like a normal one. But it would surely act differently. It would be able to grow in the cold.

FOOD FOR THOUGHT

Do you think these genetically modified foods are a good idea?

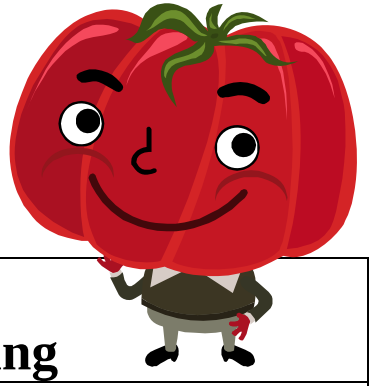
Corn Farmers Are All Ears

Pests can ruin farmers' corn crops. So scientists developed genetically modified corn that resists these bugs. The good news is that the farmers can now produce more corn. The bad news is that some scientists think that the pollen from the corn could be killing harmless insects.

An A-Peeling Vaccine

Each year, thousands of people in poorer countries die of cholera. There is a vaccine to prevent this disease, but the injections are expensive. Scientists are working on a way to put genes that produce vaccines into genetically modified bananas. Opponents worry that altering fruit may have dangerous side effects.

The Quest for the Perfect Tomato

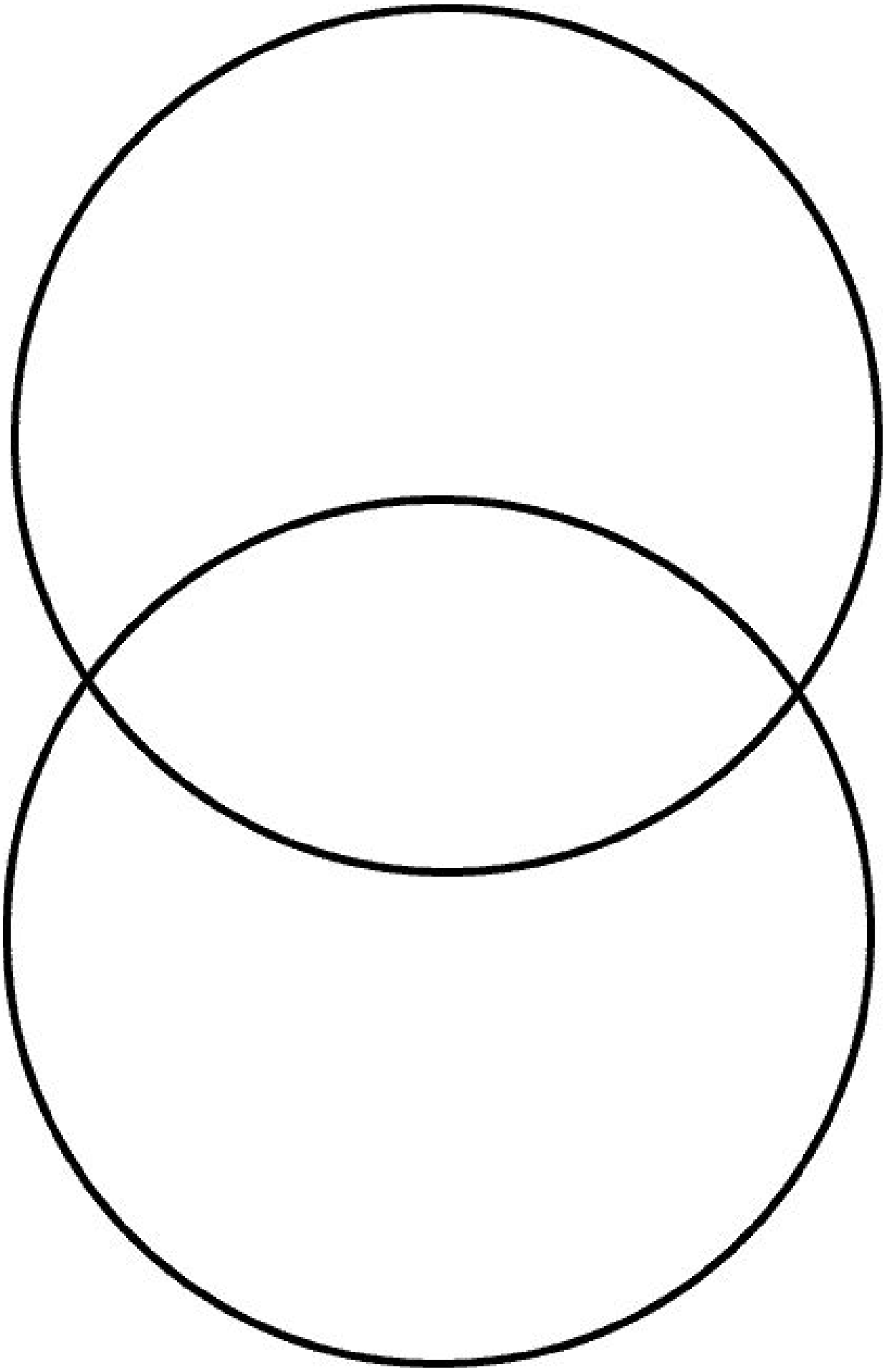


	Selective Breeding	Genetic Engineering
Definition		
Advantages		
Disadvantages		
Example		

2 Ways to Change the Traits in a Species

Use the T-Chart below to compare and contrast these two processes.

Name of the process (Pile A)	*Name of the Process (Pile B)*
Description (Pile A) - DO THIS FIRST ● *this can be a paragraph or bullet points* ● *use lots of details from the cards!*	*Description (Pile B) - DO THIS FIRST* ● *this can be a paragraph or bullet points* ● *use lots of details from the cards!*



Genetic Engineering and Selective Breeding Practice

Directions: Read the examples or facts below. Determine whether the examples are describing **genetic engineering (GE)** or **selective breeding (SB)**. *(Note: some examples might describe both GE and SB.)*

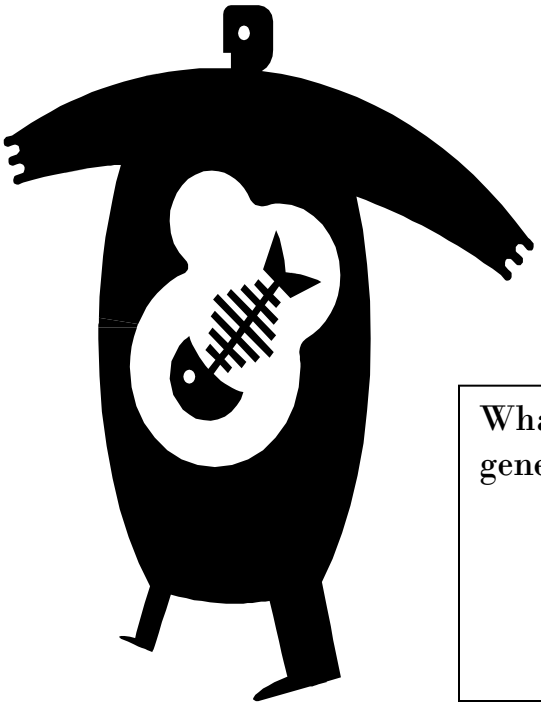
Scientific Example or Fact	GE or SB?
Farmers removed the gene in chicken DNA to make them grow featherless.	
This process combines the best traits of organisms through sexual reproduction.	
Dog breeders wanted to breed a dog that would run fast but also be born with long, shiny fur, by looking for the best characteristics from the parents.	
Scientists take out a gene for bioluminescence from a jellyfish and put that gene into a mouse's DNA to see if it will have a glowing effect.	
This process is relatively new and done in science labs.	
This process removes, adds or changes genes.	
This results in organisms with new traits.	
English Shorthorn cattle, which produced good beef were bred with Brahman cattle from India to make the offspring both tasty and resistant to heat.	
This process has been around for thousands of years.	
Scientists removed a gene for fat in bison to make them leaner.	
This results in organisms with desirable traits from both parents.	
This is a costly way to change traits.	
Humans choose the mates for organisms.	
Humans decide on a particular trait that they want to see in a new organism.	
This process can only occur with organisms of the same species.	

~~Bill Nye:~~ Genetically Modified Foods

What are genetically modified foods?

How do genetically modified foods differ from traditional foods?

Give three examples of genetically modified foods.

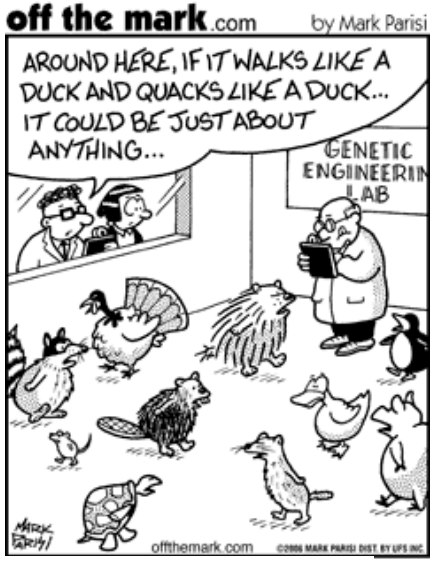


What can happen, for the good, due to growing and eating genetically modified foods?

What can happen, for the bad, due to growing and eating genetically modified foods?

Genetic Engineering: Freaky Science?

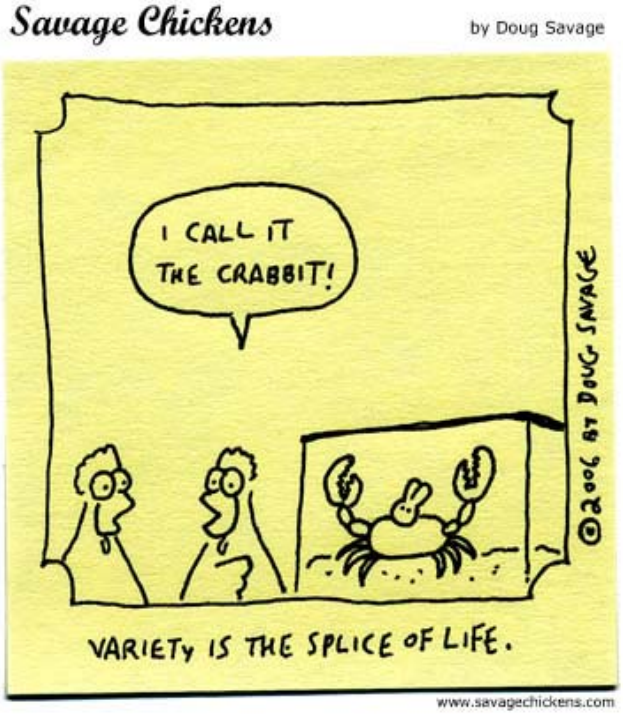
In the space below, using **one** of the cartoons as reference as well as information gained from Bill Nye: Genetically Modified Foods, complete the following (on the back of this sheet), using FULL SENTENCES.

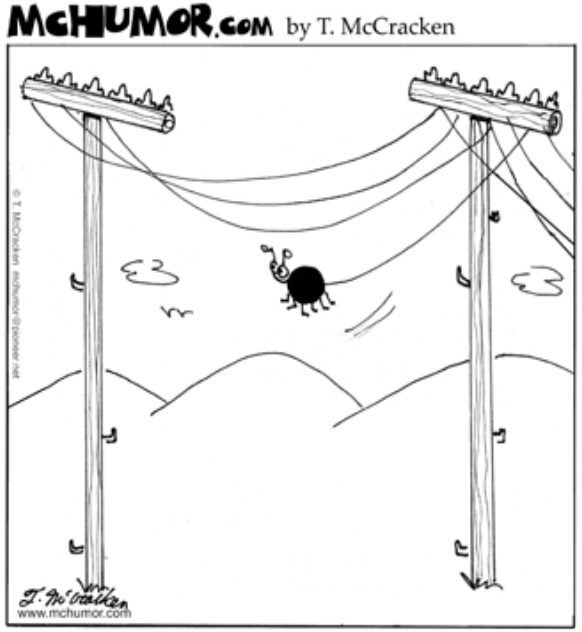


1. Identify and explain something in the cartoon that has been **changed or modified** through genetic engineering.

2. Identify one thing in the cartoon that is **true (or realistic)** based on what you know about genetic engineering.

3. Identify one thing in the cartoon that has been **exaggerated** or is **inaccurate**, based on what you know about genetic engineering.





A genetically bred super spider that spins utility lines.

1. Identify and explain something in the cartoon that has been **changed or modified** through genetic engineering.

2. Identify one thing in the cartoon that is **true (or realistic)** based on what you know about genetic engineering.

3. Identify one thing in the cartoon that has been **exaggerated** or is **inaccurate**, based on what you know about genetic engineering.

Class Notes