SCIENCE E-LEARNING BIOLOGY

MRS. BOWEN'S CLASS - CHOICE BOARD

Instructions: Choose THREE (3) of the five assignments.

	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
Week 5: **4/27 – 5/1**	1. Read Darwin's Journey 2. Complete the **READING TOOL** on the page labeled 206 Lesson 1 A Voyage of Discovery	1. Read Ideas that Influenced Darwin 2. Complete the **READING TOOL** on the page labeled 209 Lesson 2 Ideas That Influenced Darwin	1. Read The Process of Speciation 2. Complete the **READING TOOL** on the page labeled 228 Lesson 3 The Process of Speciation	1. Follow the links in Option 4: Human Evolution Part 1 and answer the questions	1. Follow the links in Option 5: Human Evolution Part 2 and answer the questions

NEED HELP? MY OFFICE HOURS ARE THE TIME TO ASK ANYTHING

I AM ABLE TO BE REACHED AT THESE HOURS MONDAY THROUGH FRIDAY EACH WEEK: **8:00 AM – 9:00AM** **8:00PM – 9:00PM**	**IF YOU NEED ME OUTSIDE OF THESE HOURS, I AM STILL AVAILABLE. I WILL RESPOND AS SOON AS I AM ABLE.**

SCIENCE E-LEARNING BIOLOGY

KEY:
T = Needs technology (access to a device)
N = Does NOT need technology to complete (physical copies are available)
T/N = Can be done either with or without technology

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OPTION 1

LESSON 1

A Voyage of Discovery

READING TOOL **Main Ideas and Details** As you read the lesson, complete the main ideas and details table. One row is completed for you.

Heading	Main Idea	Details
Darwin's Epic Journey	What did Darwin contribute to science?	Darwin developed the theory of evolution.
Observations from the Voyage		
• Species Vary Globally		
• Species Vary Locally		
• Species Vary Over Time		
• Putting the Puzzle Together		

Lesson Summary

Darwin's Epic Journey

KEY QUESTION *What did Charles Darwin contribute to science?*

Charles Darwin was born in England in 1809. In 1831, he started a five-year voyage on the ship HMS *Beagle*. The voyage of the *Beagle* took place at a time of new scientific ideas. Geologists suggested that Earth was ancient and had changed over time. Biologists suggested that life had also changed, through a process they called **evolution**. However, no scientist before Darwin had offered a scientific explanation of how evolution could occur.

Darwin developed a theory of biological evolution that offered a scientific explanation for the unity and diversity of life, by proposing how modern organisms evolved through descent from common ancestors.

Observations from the Voyage

KEY QUESTION *What three patterns of biodiversity did Darwin observe?*

Darwin saw much diversity of life during the voyage. He saw how well suited plants and animals were to their environment. Darwin wanted to explain the diversity of life in a scientific way, so he kept observing, asking questions, and formulating hypothesis. Darwin focused on three patterns of diversity: (1) species vary globally, (2) species vary locally, and (3) species vary over time.

Species Vary Globally In South America, Darwin saw flightless, ground-dwelling birds called rheas. Rheas look and act a lot like ostriches. Yet rheas only live in South America, and ostriches only live in Africa. Then, in Australia, Darwin saw another large flightless bird, the emu. Darwin also noticed that rabbits and other grassland species in Europe did not live in the grasslands of South America and Australia. In Australia, Darwin saw kangaroos and other grassland species that are found nowhere else. Darwin noticed that different, yet ecologically similar, species inhabited separate, but ecologically similar, habitats around the globe.

Species Vary Locally Darwin noticed that different, yet related, species often occupied different habitats within a local area. Darwin saw two species of rheas in South America. One lived in the grasslands while a smaller species lived in a colder scrubland. Darwin also observed local variation in the Galápagos Islands off the Pacific coast of South America. The islands are relatively close to each other but are ecologically different. People who lived there could tell which island a tortoise came from just by looking at the shape of its shell.

As you read, circle the answers to each Key Question. Underline any words you do not understand.

BUILD Vocabulary

evolution change over time; the process by which modern organisms have descended from ancient organisms

fossil preserved remains or traces of ancient organisms

Word Origins *Evolution* comes from the Latin *volvere*: "turn, roll, revolve." With the prefix *e-*, meaning "away" or "out of," *evolution* means unfolding or unrolling. ☑ **What was Darwin's key contribution to science?**

_____

_____

_____

Visual Reading Tool: Darwin's Journey

1. List the three species of flightless birds Darwin observed and draw a line to where he saw them.

2. List three different animals Darwin observed in the Galápagos.

READING TOOL

Make Connections Darwin observed many species of small finches in the Galápagos that had beaks of different shapes and sizes.

☑ **What do birds use their beaks for, and why would there be differences between species?**

Species Vary Over Time

In addition to collecting specimens of living species, Darwin also collected fossils. **Fossils** are preserved remains or traces of ancient organisms. In Darwin's time, scientists knew that fossils formed a record of extinct organisms, but did not know how to interpret that record. Darwin observed that the fossil record included many extinct animals that were similar to, yet different from, living species. One fossil he collected was from an extinct animal called a glyptodont. Why had glyptodonts disappeared, and why did modern armadillos resemble them? Could glyptodonts and armadillos have had a common ancestor?

Putting the Puzzle Together

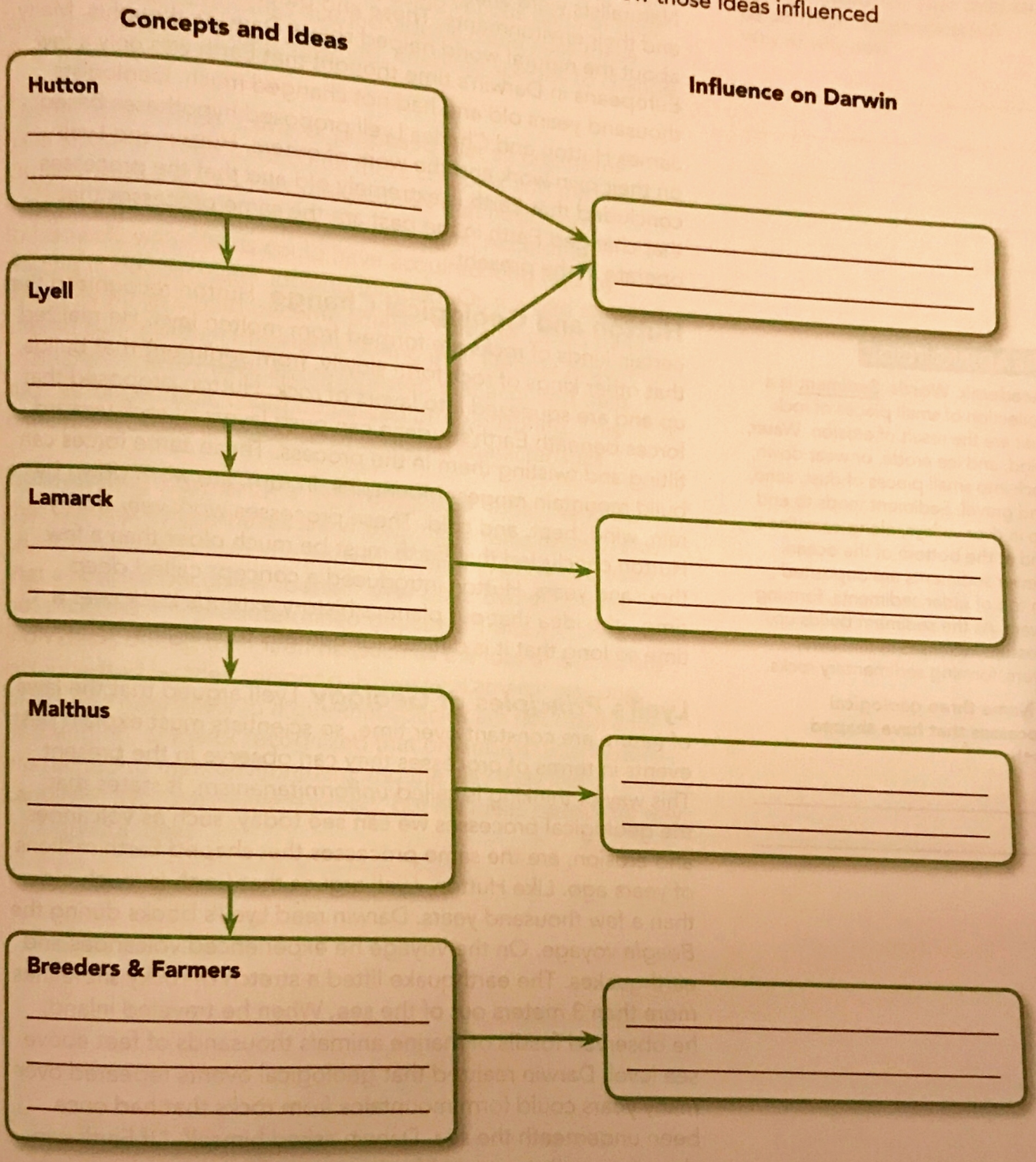
When Darwin returned home, experts identified his samples. The Galápagos mockingbirds were three separate species found nowhere else. The small brown birds were species of finches that lived nowhere else, but resembled South American species. This was true of Galápagos tortoises, iguanas, and many plants. Darwin wondered if species were really fixed and unchanging as many thought. Could organisms change over time through natural processes? Could Galápagos species have evolved from South American ancestors?

OPTION 2

LESSON 2

Ideas That Influenced Darwin

READING TOOL **Use Structure** As you read, use the structure of the lesson to identify the science concepts and ideas that influenced Darwin. Complete the graphic organizer by writing the concepts and ideas in the box on the left side with the scientist's name, and in the boxes on the right, fill in how those ideas influenced Darwin.



An Ancient, Changing Earth

KEY QUESTION *What did Hutton and Lyell conclude about Earth's history?*

As you read, circle the answers to each Key Question. Underline any words you do not understand.

Darwin was influenced by the work of other scientists. At the time of the *Beagle's* voyage, geologists were making new observations about forces that have shaped our planet. Naturalists were analyzing connections between organisms and their environments. These and other new ways of thinking about the natural world helped shape Darwin's thoughts. Many Europeans in Darwin's time thought that Earth was only a few thousand years old and had not changed much. Geologists James Hutton and Charles Lyell proposed hypotheses based on their own work and the work of others. Hutton and Lyell concluded that Earth is extremely old and that the processes that changed Earth in the past are the same processes that operate in the present.

READING TOOL

Academic Words Sediment is a collection of small pieces of rock that are the result of erosion. Water, wind, and ice erode, or wear down, rock into small pieces of dust, sand, and gravel. Sediment tends to end up in river valleys, along coastlines, and at the bottom of the ocean. Newer sediments are deposited on top of older sediments, forming layers. As the sediment builds up, pressure increases in the lower layers, forming sedimentary rocks.

Name three geological processes that have shaped Earth.

_____

_____

Hutton and Geological Change Hutton recognized that certain kinds of rocks are formed from molten lava. He realized that other kinds of rock form slowly, from **sediment** that builds up and are squeezed into layers of rock. Hutton proposed that forces beneath Earth's surface can push layers of rock upward, tilting and twisting them in the process. These same forces can build mountain ranges. Mountains, in turn, are worn down by rain, wind, heat, and cold. These processes work very slowly. Hutton concluded that Earth must be much older than a few thousand years. Hutton introduced a concept called *deep time*—the idea that our planet's history extends back over a time so long that it is difficult for humans to imagine.

Lyell's *Principles of Geology* Lyell argued that the laws of nature are constant over time, so scientists must explain past events in terms of processes they can observe in the present. This way of thinking is called *uniformitarianism*. It states that the geological processes we can see today, such as volcanoes and erosion, are the same processes that shaped Earth millions of years ago. Like Hutton, Lyell argues that Earth is much older than a few thousand years. Darwin read Lyell's books during the *Beagle* voyage. On the voyage he experienced volcanoes and earthquakes. The earthquake lifted a stretch of rocky shorelines more than 3 meters out of the sea. When he traveled inland, he observed fossils of marine animals thousands of feet above sea level. Darwin realized that geological events repeated over many years could form mountains from rocks that had once been underneath the sea. Darwin asked himself, "If Earth can change over time, could life change too?"

Lamarck's Evolutionary Hypothesis

KEY QUESTION *How did Lamarck propose that species evolve?*

Darwin wasn't the first to suggest that species could evolve. The fossil record provided strong evidence that life had changed over time. Jean-Baptiste Lamarck proposed two of the first hypotheses about how species could change. Lamarck suggested that individual organisms could change during their lifetimes by selectively using or not using various parts of their bodies. He also suggested that individuals could pass these acquired traits on to their offspring, enabling species to change over time.

Lamarck's Ideas Lamarck proposed that all organisms have an inborn urge to become more complex and perfect. Organisms change and acquire features that help them live more successfully in their environments. According to Lamarck, water birds could have acquired long legs by wading in deeper water looking for food. Or, if a bird stopped flying, its wings would become smaller. Lamarck called traits altered by individual organisms during their lifetime *acquired characteristics*. Lamarck also suggested that acquired traits, such as longer legs, could be passed on to offspring. This principle is called *inheritance of acquired characteristics*.

Evaluating Lamarck's Hypotheses Today we know that Lamarck's hypotheses are wrong. Organisms do not have an inborn drive to become perfect. Evolution does not mean that a species becomes "better" over time. Evolution does not progress in a predetermined direction. Traits acquired by individuals during their lifetime (such as the loss of a limb) are not inherited by their offspring. However, Lamarck was one of the first naturalists to argue that species are not fixed and unchanging. Lamarck recognized that organisms' adaptations are related to their environment and the way they live. Lamarck's hypotheses were wrong, but his ideas paved the way for Darwin's ideas.

READING TOOL

Apply Prior Knowledge

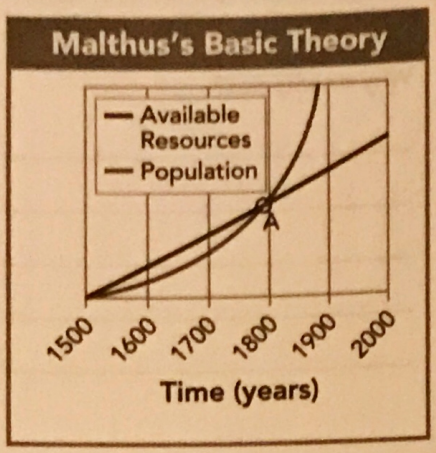
Lamarck did not know what we know today about how parents pass traits or characteristics on to their offspring. Now we know that characteristics are passed on by DNA in the germ cells: sperm in the male, and eggs in the female.

☑ **If you exercise a lot and build up big muscles, will your children be born with bigger muscles? Why or why not?**

READING TOOL

Connect to Visuals

Thomas Malthus recognized that our planet can only support a certain amount of people before it gets overcrowded, and there are not enough resources for everyone. The graph below represents the population of Earth and the available resources over time.



☑ **What happens after point A in regard to the population and resources available at that point in time?**

_____

_____

_____

BUILD Vocabulary

artificial selection selective breeding of plants and animals to promote the occurrence of desirable traits in offspring

Root Word *Artificial* has the root *artifice*, from *art*, meaning "skillful, creative," and *facere*, meaning "doing, making." *Artificial* means "made or done by humans."

☑ **Why is animal and plant breeding by farmers artificial?**

_____

_____

_____

Population Growth

KEY QUESTION *How did Malthus explain population growth?*

Before Darwin's time, the economist Thomas Malthus recognized that people were being born faster than people were dying, causing overcrowding. Malthus reasoned that if the human population grew unchecked, there wouldn't be enough living space and food for everyone. The forces that work against population growth, he suggested, include war, famine, and disease. Darwin realized that if Malthus's reasoning applied to people, it applied even more to other organisms. Many organisms can produce many more offspring than humans. Darwin realized that if all descendants of just one pair of oysters, which produce millions of eggs, were to survive, oysters would overrun Earth. However, many die and only a few survive to reproduce. This is known as differential reproductive success. This idea was important to Darwin in determining the mechanism, or natural process, that could produce evolutionary change. Darwin wanted to know which individuals survive, and why.

Artificial Selection

KEY QUESTION *How is inherited variation used in artificial selection?*

Some plants have larger or smaller fruit than average for their species. Some cows produce more or less milk than others in their herd. Farmers told Darwin that some of these differences were inherited variation—meaning they were traits that were passed from parents to offspring. Farmers would select for breeding only the plants that produced the largest fruit or cows that produced the most milk. Darwin called this selective breeding **artificial selection**. In artificial selection, nature provides the inherited variations, and humans select those variants they find useful. Darwin did not know how heredity worked, but he knew that inherited variation occurred in wild species as well as in domesticated plants and animals. Unlike earlier scientists, Darwin recognized that inherited variation was important, because it could provide the material for a natural process that could drive evolution.

OPTION 3

LESSON 3

The Process of Speciation

READING TOOL **Cause and Effect** As you read, think about the three types of reproductive isolation and what causes them. Fill in the flow chart below.

Effect: Behavioral Isolation

Cause:

Effect: Geographic Isolation

Cause:

Effect: Temporal Isolation

Cause:

Lesson Summary

As you read, circle the answers to each Key Question. Underline any words you do not understand.

BUILD Vocabulary

speciation formation of a new species

reproductive isolation separation of a species or population so that they no longer interbreed

Isolating Mechanisms

KEY QUESTION *What types of isolation lead to the formation of new species?*

Speciation is the process by which new species evolve. Sexual reproduction allows for genes to be passed along in a population. If some individuals stop breeding with other individuals, eventually this can lead to a split in the population. As evolution continues, if two groups stop reproducing together, the gene pool will not be shared, resulting in **reproductive isolation**. Reproductive isolation can develop in several ways, including behavioral isolation, geographic isolation, and temporal isolation.

Behavioral Isolation If an important behavior, such as a mating ritual, evolves differently in two groups, then this type of reproductive isolation is termed **behavioral isolation**.

Geographic Isolation Geography can be a barrier that leads to reproductive isolation. If individuals cannot physically reach each other, this is known as **geographic isolation**. Any type of isolated habitat can result in this, whether they be mountaintops or actual islands. Natural disasters can also play a part as barriers or connectors.

Temporal Isolation When two or more species experience mating seasons that do not match up, then time is the divisive factor here, and it is known as **temporal isolation**.

Speciation in Darwin's Finches

KEY QUESTION *What is a current hypothesis about Galápagos finch speciation?*

Using research-based understanding of the finch populations on the Galápagos Islands, we can begin to piece together the historical events that led to Darwin's finches as the species they are today. Speciation in Galápagos finches occurred by founding a new population, geographic isolation, changes in the new population's gene pool, behavioral isolation, and ecological competition.

Founders Arrive A founding population of finches migrated to one of the Galápagos Islands from the South American mainland. A founder effect occurred, because these individuals would have only had certain alleles compared to the larger gene pool of the overall species back on the mainland.

Geographic Isolation Finding themselves on an island, the finches would have been geographically isolated from other populations, which would minimize the opportunity for interbreeding. If members of this founding population migrated to other islands, these new populations would become isolated.

Changes in Gene Pools Over time, each population of finch would evolve to adapt to the environment of each island. Food type and availability would be important in determining the most fit beak shape and size. Evolution continues.

Behavioral Isolation After more time, if any individuals manage to return to the original founding colony on the first island, behavioral isolation would have occurred. It is likely that courtship rituals and sexual selection would prevent birds with different-sized beaks from choosing to mate with one other.

BUILD Vocabulary

behavioral isolation form of reproductive isolation in which two populations develop differences in courtship rituals or other behaviors that prevent them from breeding

geographic isolation form of reproductive isolation in which two populations are separated by geographic barriers such as rivers, mountains, or bodies of water, leading to the formation of two separate subspecies

temporal isolation form of reproductive isolation in which two or more species reproduce at different times

Root Words The word temporal is based on the Latin word *tempus* which means "time." ☑ **Do you know any other word that has a similar root that relates to time?**

Competition and Continued Evolution Competition between birds with different phenotypes (beak size and shape) would result in further evolution and speciation. This process would repeat until modern times, when 13 distinct species are found among the island system.

Visual Reading Tool: Darwin's Finches Speciate

1. Fill in the diagram below with the five events that caused speciation of the finches of the Galápagos Islands.

A. _____

B. _____

C. _____

D. _____

E. _____

_____

2. Behavioral isolation occurs when one population stops breeding with another population, perhaps because of physiological differences and behaviors. In which event has behavioral isolation occurred? How can you tell?

_____

_____

_____

3. At what stage did the founder effect take place?

_____

_____

_____

OPTION 4

Name: _____ Date: _____ Period: _____

Worksheet : Human Evolution

Web site name : BBC News

Web URL : http://news.bbc.co.uk/hi/english/sci/tech/newsid_1333000/1333730.stm

Read "Gene data underline primate link"

1) Which three species of ape did researchers compare to humans?

2) How long ago does this study suggest that the chimp and human lines diverged?

3) Which type of person did the team use for the human DNA?

4) How much did chimp and human DNA differ? _____ %

5) Was human DNA more **similar** to gorilla DNA or orang-utan DNA?

6) How do these genetic differences arise?

7) How long ago did orang-utans separate from other apes?

Web site name: Palomar College, California

Web site URL: https://www2.palomar.edu/anthro/hominid/australo_1.htm

Read "Discovery of early Hominids"

8) What feature distinguishes hominids from chimps and gorillas?

9) What change was taking place in the vegetation as australopithecines evolved?

10) What did hominids eat to supplement their protein and fat?

11) How old was the "Taung baby"?

12) Why did Dart conclude that this fossil was intermediate between apes and humans?

13) What had eaten some of the hominids from Swartkraus cave?

14) What is the scientific name of "Lucy"?

15) How old was Australopithecus anamensis ?

Web site name: National museum of natural history

Web URL: http://humanorigins.si.edu/evidence

Read "Evidence of evolution"

16) What evidence gives clues about human behavior?

17) "Early human fossils have been found from more than _____ individuals".

Click on "Human Fossils", then "Open the Family Tree"

18) Which fossil species is the oldest on the chart?

19) Which **two** species lived at the same time as early *Homo sapiens* ?

Click on "*Homo erectus*"

20) When did they live?

21) In which country was the first fossil found?

22) How much did they weigh?

23) What did they eat?

Go back to the family tree and click on one of the "*Australopithecus*"

24) Which species did you click on?

25) Give a summary of a few sentences about this species:

26) What is one “unknown”?

OPTION 5

Web site name: Palomar College, California
Web URL: https://www2.palomar.edu/anthro/homo2/mod_homo_2.htm

Read "Neandertal"

Numbers will begin at 27 as this is a continuation of Option 4

27) How long ago, and where, did Neandertals live?

28) Why did the fossil Boule examined walk hunched over?

29) What climate were Neandertals adapted for?

30) Why did adult Neandertals have multiple healed fractures?

31) How tall were adult Neandertals?

32) Why do new-born humans have such a small brain?

33) What does the DNA evidence suggest about the Neandertals?

34) Roughly how long ago did the Neandertals diverge from the line leading to modern humans?

35) What was unusual about the child's skeleton found in Portugal in 1999?

36) What is the last secure date for a Neandertal site?

37) What is one hypothesis for the disappearance of the Neandertals?

Web site name: BBC News
Web URL: http://news.bbc.co.uk/2/hi/science/nature/5343266.stm

38) When did Neanderthals first appear in the fossil record?

39) What material in Gorham's cave was tested for radiocarbon dates?

40) What characteristics made this cave a "favored spot" for Neanderthals?

41) What animals were Neanderthals in this area eating?

42) What is the new explanation for why Neanderthals became extinct?

43) Look at the map at the bottom of the article. Why do you think that all the sites less than 30,000 years ago are concentrated in southern Europe, not in northern Europe?

WEEK 6 E-LEARNING SCIENCE

MRS. BOWEN'S CLASS - CHOICE BOARD

Instructions: For this week, you **MUST do REQUIRED NOTES**. Then choose TWO (2) of the other five assignments.

	REQUIRED	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
WEEK 6: **5/4 - 5/8**	1. Complete the notes **Intro to Genetics and Heredity** 2. Answer the questions and submit pictures/PDF to Mrs. Bowen when complete.	1. Read the article **"What is a gene?"**and complete the questions.	1. Use the **Observable Genetic Traits** worksheet and record your data.	1. Watch the Amoeba Sister's video **"Monohybrids and the Punnett Square Guinea Pigs"** 2. Answer the questions on the worksheet	1. Using the **Punnett Square Review** activity, answer the questions associated with the Punnett Squares.	1. Using the **Smiley Genetics** activity, flip a coin and create a wacky smiley face! Draw and (if you can) color your photo when you are done.

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REQUIRED NOTES AND QUESTIONS

WEEK 6
INTRODUCTION TO GENETICS AND HEREDITY

1

INTRODUCTION

- This mother and daughter share many characteristics, including hair type and eye color.
- A parent's son or daughter is known as that person's **offspring**.
- A specific characteristic that an organism can pass to its offspring is a **trait**.
- The passing of traits from parents to offspring is called **heredity**.

This dog and her puppies share similar traits such as the color of their fur and their floppy ears.

2

GENETICS

- The scientific study of heredity and variation in organisms is called **genetics**.
- Many people have studied how traits are passed down from parents to offspring, but much of what scientists know today about heredity comes from the experiments of Gregor Mendel.
- His experiments form the basis of modern-day genetics.

A family tree shows the relationship between people in several generations of a family. Many traits are passed down over several generations of offspring.

Genes → Genetics

When people talk about your "genes", they don't mean your jeans. They mean the stuff that makes you, you.

3

GREGOR MENDEL

- Who was Gregor Mendel?
  - European Monk who worked in the garden, primarily
  - He did most of his work in the mid-1800s.
- What did Mendel do?
  - He worked with pea plants and studied:
    - Stem height, seed color, seed shape and flower color.
    - Sometimes the offspring matched their parents, sometimes they didn't
      - This made him curious so he began to study them more closely

4

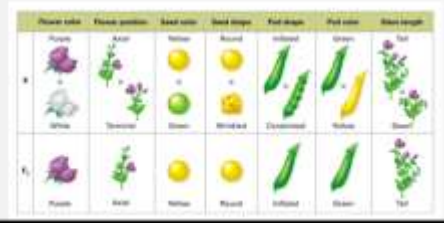
MENDEL'S EXPERIMENTS

- How did he study peas?
  - Mendel developed a method called cross-pollination.
  - Mendel took the pollen of one purebred plant and used it to fertilize another purebred plant with a contrasting form of a trait.
    - For example, he paired a plant that produced yellow pea pods with a plant that produced green pea pods

5

MORE MENDEL

- Other tests:
  - Mendel also looked at a lot of other traits of the pea plants
  - Each time, he saw that only **one** trait showed up in the first generation.

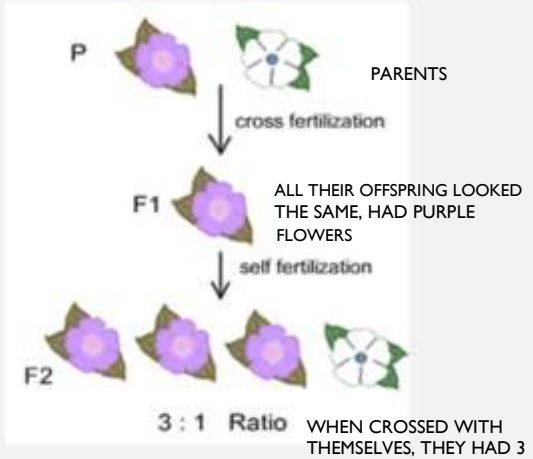


6

MENDEL ON THE MOVE

- What happened next?
  - Mendel then let the first generation reproduce through self-pollination
  - When they had offspring, the missing trait came back in 1 of every 4 offspring.
  - Example:
    - Purple flower is crossed with a white flower
    - All of their offspring are purple
    - That purple flower crosses with another purple flower offspring
    - Those flowers now make 3 purple for every 1 white flower.

7



8

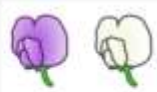
MENDEL CONCLUSIONS

- So what does this mean?
  - Mendel realized there are "factors" that influence our traits and that we get one from each parent
    - Humans get one from mom, one from dad
  - These "factors" are called **alleles**.
  - We have **two** alleles for each trait that we have
    - Hair color, eye color, etc.

9

ALLELES

- Alleles can be **dominant** or **recessive**
- If it's **dominant**, it will always show
  - If someone dominates a competition, they take over.
    - Any time there's a dominant allele, it takes over.
  - Dominant alleles are represented by a CAPITAL letter
- If it's **recessive**, it can be overshadowed
  - A recessive allele won't show unless there are two of them
- Recessive alleles are represented by LOWERCASE letters



A capital B symbolizes the purple flower allele, which is dominant in pea plants. A lowercase b symbolizes the white flower allele, which is recessive in pea plants.

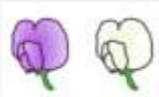
10

GENOTYPE VS PHENOTYPE

- **Genotype** is the combination of alleles that you have.
  - Genotype is ALWAYS represented by two letters
- **Phenotype** is the physical representation of a genotype.
  - Think about a characteristic you can describe
    - Brown hair, purple flower, green eyes, etc.

Thinking about the flower example:

GENOTYPE	PHENOTYPE
BB	Purple flower
Bb	Purple flower
bb	White flower



A BB genotype means a plant has two dominant alleles, so its phenotype is purple flowers. A bb genotype means a plant has two recessive alleles, so its phenotype is white flowers.

11

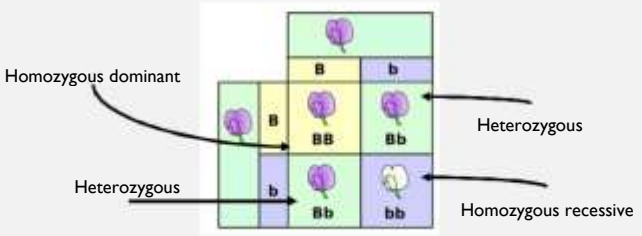
GENOTYPES

- There are some specific words we use with genotypes:
  - **Heterozygous**
    - Hetero means different
    - Therefore, the alleles are different. Example: Bb
  - _____ **dominant**
    - Homo means same
    - Therefore, the alleles are the same and DOMINANT. Example: BB
  - _____
    - Homo means same
    - Therefore, the alleles are the same and RECESSIVE. Example: bb

12

PUNNETT SQUARES

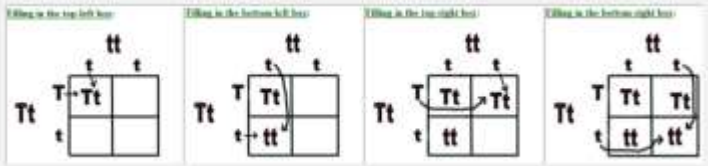
- **Punnett Squares** are tools that show the likelihood of all of the possible allele combinations that result from a genetic cross
  - In simple words, it shows all the possible combination of traits two parents could give to their offspring



13

PUNNETT SQUARE

- So how do I fill it out?
  - One parent's genes go on the top of the Punnett Square
  - The other's go along the side
  - Bring one of each allele into the boxes, which represent our possible offspring



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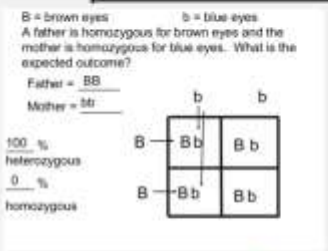
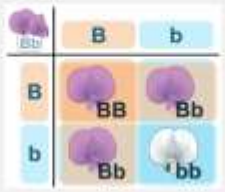
EXAMPLES

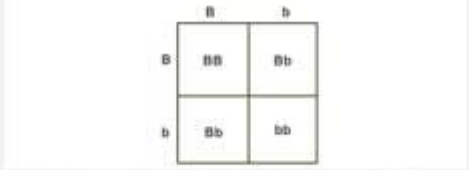




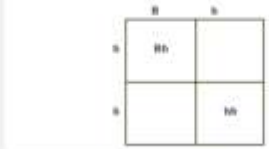
15

QUESTIONS

Two heterozygous parents with brown eyes are paired. This Punnett square shows possible genetic outcomes for brown or blue eye color. Which of these possible outcomes are homozygous?



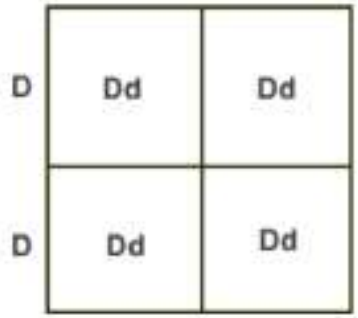
Jack's genotype for eye color is Bb, meaning that he has brown eyes. Jill's genotype for eye color is bb, meaning she has blue eyes. Fill in the Punnett square below to see the potential allele combinations for their offspring's eye color.



16

QUESTIONS

The Punnett square below shows the probability that an offspring will have dimples. What is most likely the father's genotype?



A phenotype is _____.

- [ ] an organism's observable traits
- [ ] an organism's allele combinations for one or more genes
- [ ] having two different alleles for a particular gene
- [ ] having two identical alleles for a particular gene

A genotype is _____.

- [ ] having two different alleles for a particular gene
- [ ] an organism's allele combinations for one or more genes
- [ ] having two identical alleles for a particular gene
- [ ] an organism's stored energy that is used to make alleles

QUESTIONS

Short hair is dominant in cats. A female cat has a homozygous dominant genotype. A male cat has a heterozygous genotype. Fill in the Punnett square below to see the potential allele combinations for their offspring.

	R	r
R	RR	Rr
r	Rr	rr

Having wrinkled seeds is a recessive trait in pea plants. The Punnett square below shows a cross between two pea plants and the potential allele combinations of their offspring. What is the phenotype for the allele combination in the top right corner?

- heterozygous seed
- rounded seed
- wrinkled seed
- both wrinkled seed and rounded seed

QUESTIONS

What is heredity?

- [ ] a specific characteristic that an organism can pass to its offspring
- [ ] different forms of a gene that produce the variations in a genetically inherited trait
- [ ] the passing of traits from parents to offspring
- [ ] segments of DNA that determine traits and are passed down from parent to offspring

What is a dominant allele?

- [ ] an allele that is only expressed when no dominant allele is present
- [ ] an allele that is acquired after birth
- [ ] an allele that is always expressed when the allele is present
- [ ] an allele that can never be expressed

What is a recessive allele?

- [ ] an allele that is only expressed when no dominant allele is present
- [ ] an allele that can never be expressed
- [ ] an allele that is only expressed when there are four present
- [ ] an allele that is acquired after birth

Gregor Mendel's experiments with pea plants shaped much of what is known about _____, the scientific study of heredity and variations in organisms.

- chemistry
- biology
- physics
- genetics

OPTION 1

What Is a Gene?

Genes play an important role in determining physical traits — how we look —and lots of other stuff about us. They carry information that makes you who you are and what you look like: curly or straight hair, long or short legs, even how you might smile or laugh. Many of these things are passed from one generation to the next in a family by genes.

What Is a Gene?

Genes carry the information that determines your traits, which are features or characteristics that are passed on to you — or inherited — from your parents. Each cell in the human body contains about 25,000 to 35,000 genes.

For example, if both of your parents have green eyes, you might inherit the trait for green eyes from them. Or if your mom has freckles, you might have freckles too because you inherited the trait for freckles. Genes aren't just found in humans — all animals and plants have genes, too.

Where are these important genes? Well, they are so small you can't see them. Genes are found on tiny spaghetti-like structures called chromosomes (say: KRO-moh-somes). And chromosomes are found inside cells. Your body is made of billions of cells. Cells are the very small units that make up all living things. A cell is so tiny that you can only see it using a strong microscope.

Chromosomes come in matching sets of two (or pairs) and there are hundreds — sometimes thousands — of genes in just one chromosome. The chromosomes and genes are made of DNA, which is short for deoxyribonucleic (say: dee-ox-see-ri-bo-new-CLAY-ik) acid.

Most cells have one nucleus, The nucleus is a small egg-shaped structure inside the cell which acts like the brain of the cell. It tells every part of the cell what to do. But, how does the nucleus know so much? It contains our chromosomes and genes. As tiny as it is, the nucleus has more information in it than the biggest dictionary you've ever seen.

In humans, a cell nucleus contains 46 individual chromosomes or 23 pairs of chromosomes (chromosomes come in pairs, remember? 23 x 2 = 46). Half of these chromosomes come from one parent and half come from the other parent.

Under the microscope, we can see that chromosomes come in different lengths and striping patterns. When they are lined up by size and similar striping pattern, the first twenty two of the pairs these are called autosomes; the final pair of chromosomes are called sex chromosomes, X

and Y. The sex chromosomes determine whether you're a boy or a girl: females have two X chromosomes while males have one X and one Y.

But not every living thing has 46 chromosomes inside of its cells. For instance, a fruit fly cell only has four chromosomes!

How Do Genes Work?

Each gene has a special job to do. The DNA in a gene spells out specific instructions—much like in a cookbook recipe — for making proteins in the cell. Proteins are the building blocks for everything in your body. Bones and teeth, hair and earlobes, muscles and blood, are all made up of proteins. Those proteins help our bodies grow, work properly, and stay healthy. Scientists today estimate that each gene in the body may make as many as 10 different proteins. That's more than 300,000 proteins!

Like chromosomes, genes also come in pairs. Each of your parents has two copies of each of their genes, and each parent passes along just one copy to make up the genes you have. Genes that are passed on to you determine many of your traits, such as your hair color and skin color.

Maybe Emma's mother has one gene for brown hair and one for red hair, and she passed the red hair gene on to Emma. If her father has two genes for red hair, that could explain her red hair. Emma ended up with two genes for red hair, one from each of her parents.

You also can see genes at work if you think about all the many different breeds of dogs. They all have the genes that make them dogs instead of cats, fish, or people. But those same genes that make a dog a dog also make different dog traits. So some breeds are small and others are big.

Some have long fur and others have short fur. Dalmatians have genes for white fur and black spots, and toy poodles have genes that make them small with curly fur. You get the idea!

QUESTIONS:

1. In your own words, what is a gene?

2. List some traits you inherited from your parents

3. Where are genes found?

4. What are chromosomes and genes made of?

5. How many chromosomes do humans have?

6. Does everything have the same number of chromosomes?

7. Do you think that having more chromosomes means that organism is “better”?

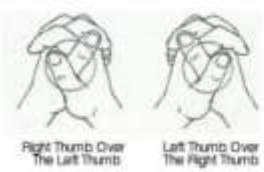
8. What do your genes make in your body?

OPTION 2

Name: _____ Date: _____

OBSERVABLE GENETIC TRAITS

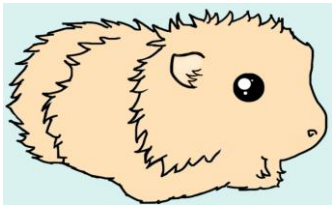
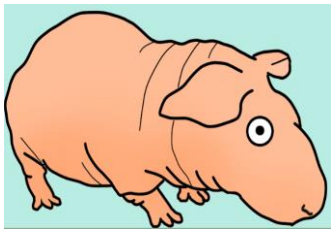
Directions: Go through the following list of traits and circle if you have them or not. Count up the number of people you live with that have the traits as well and write that down. In the last column, tell me if you think the trait YOU HAVE is dominant or recessive.

Trait	You	Household	Dominant or Recessive?
Attached Earlobes 	Attached Unattached	Attached ____ Unattached ____	
Tongue Rolling 	Can roll Can't roll	Can roll ____ Can't roll ____	
Dimples 	Have them Don't have	Have them ____ Don't have ____	
 Freckles	Have them Don't have	Have them ____ Don't have ____	
Cleft Chin 	Have Don't have	Have ____ Don't have ____	
 Hitchhiker's Thumb	Have Don't have	Have ____ Don't have ____	
Hand Clasping 	Right over left Left over right	Right over left ____ Left over right ____	

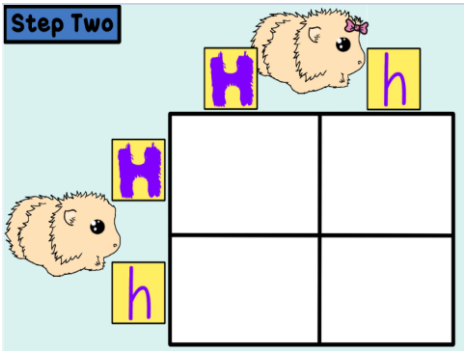
OPTION 3

Amoeba Sisters Video Recap: Monohybrid Crosses (Mendelian Inheritance)

Vocabulary practice! Fill in missing boxes assuming that having hair for guinea pigs follows Mendelian inheritance, where the H dominant allele codes for hair and h codes for a lack of hair (hairless).

Image	Genotype	Heterozygous or Homozygous?	Phenotype
	HH	1.	2.
	3.	4.	Hairless
5.	6.	Heterozygous	7.

8. An **allele** is a form of a gene.



In the Punnett square on the right, how many H/h alleles does a baby guinea pig inherit from the **mother**? _____ How many H/h alleles does a baby guinea pig inherit from the **father**? _____.

If a baby girl guinea pig looks almost identical to its mother, does this then mean that it inherited more alleles from its mother? Explain. (Hint: Think about the vocabulary words **dominant** and **recessive**.)

Mysterious Fred: A Guinea Pig Test Cross

There is a teacher from Texas that loves hairless guinea pigs. In guinea pigs, the dominant allele H codes for the trait of having hair and the allele h codes for the trait of being hairless. (Assume Mendelian inheritance). Let's say that this teacher receives her wish of finding a hairless guinea pig at a pet store and names her Genevieve. She finds another guinea pig at a store with hair that she names Fred.

While she can be certain of Genevieve's genotype, how could she determine what genotype Fred is? She can do a **test cross**! A test cross involves breeding an organism with a dominant trait (like Fred) with an organism that exhibits a recessive trait (like Genevieve).

9. Genevieve has the genotype _____.

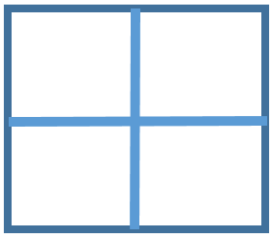
10. Fred's genotype could be _____ or _____.

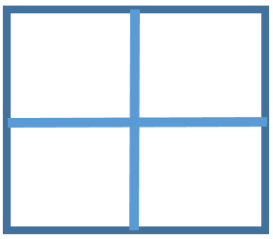
11. If Fred was genotype _____ and bred with Genevieve…

12. Please draw Punnett Square below to show prediction for offspring.

13. If Fred was genotype _____ and bred with Genevieve…

14. Please draw Punnett Square below to show prediction for offspring.





15. Explain in your own words how the offspring from the test cross could help determine Fred's genotype.

16. What could be some weaknesses with using a test cross to determine Fred's genotype?

OPTION 4

Monohybrid Cross Worksheet Name _____ Period_____

Part A: Vocabulary

Match the definitions on the left with the terms on the right.

1. genotypes made of the same alleles	A. alleles
2. different forms of genes for a single trait	B. dominant
3. gene that is always expressed	C. heterozygous
4. gene that is expressed only in the homozygous state	D. homozygous
5. genotypes made of two different alleles	E. recessive

Below each of the following words are choices. Circle the choices that are examples of each of those words.

6. Dominant allele

D e k L N n R S

7. Recessive allele

M n d F G r k P

8. Homozygous dominant

AA Gg KK mm uu Rr TT

9. Homozygous recessive

ee Ff HH Oo qq Uu ww

10. Genotypes in which dominant gene must show

AA Dd EE ff Jj RR Ss

11. Genotypes in which recessive gene must show

aa Gg Ff KK rr Oo Tt

Part B: Punnett Squares

12. Examine the following Punnett squares and circle those that are correct.

	D	d
d	Dd	dd
d	Dd	dd

	D	D
d	Dd	DD
d	Dd	Dd

	A	a
A	AA	aa
a	Aa	Aa

	A	a
a	Aa	aa
a	Aa	aa

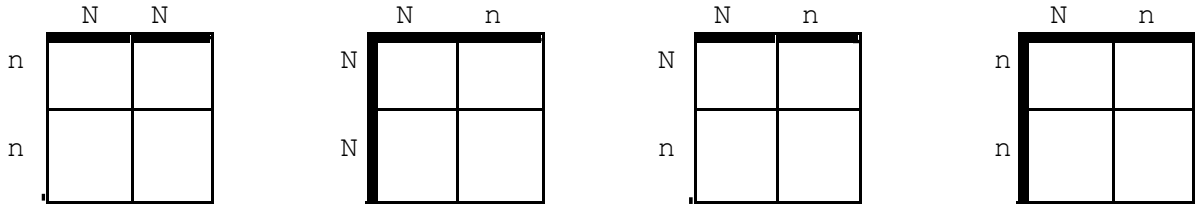
13. What do the letters on the outside of the Punnett square stand for?

_____

14. What do the letters on the inside of the Punnett square stand for?

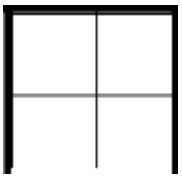
_____

15. In corn plants, normal height, N, is dominant to short height, n. Complete these four Punnett squares showing different crosses. Then, shade red all the homozygous dominant offspring. Shade green all the heterozygous offspring. Leave all the homozygous recessive offspring unshaded.



16. In guinea pigs, short hair, S, is dominant to long hair, s. Complete the following Punnett squares according to the directions given. Then, fill in the blanks beside each Punnett square with the correct numbers.

a.One guinea pig is Ss and one is ss.

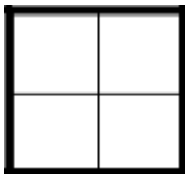


Expected number of offspring:

Short hair (SS or Ss)

Long hair (ss)

b. Both guinea pigs are heterozygous for short hair.



Expected number of offspring:

Short hair

Long hair

OPTION 5

Genetics with a Smile

Name _____

Part A: Smiley Face Traits

(1) Obtain two coins from your teacher. Mark one coin with a "F" and the other with a "M" to represent each of the parents. The parents are heterozygous for all the Smiley Face traits.

(2) Flip the coins for parent for each trait. If the coin lands with heads up, it represents a dominant allele. A coin that lands tails up indicates a recessive allele. Record the result for each person by circling the correct letter. Use the results and the Smiley Face Traits page to determine the genotype and phenotype for each trait.

Trait	Female		Male		Genotype	Phenotype
Face Shape	C	c	C	c		
Eye Shape	E	e	E	e		
Hair Style	S	s	S	s		
Smile	T	t	T	t		
Ear Style	V	v	V	v		
Nose Style	D	d	D	d		
Face Color	Y	y	Y	y		
Eye Color	B	b	B	b		
Hair Length	L	l	L	l		
Freckles	F	f	F	f		
Nose Color	R	Y	R	Y		
Ear Color	P	T	P	T		

Part B: Is it a boy or girl?

To determine the sex of your smiley face, flip the coin for the male parent. Heads would represent X, while tails would be Y.

	Female	Male		Genotype	Phenotype
Sex	X	X	Y		

Part C: Create Your Smiley Face!

Use the Smiley Face Traits chart and your results from Part A to create a sketch of your smiley face in the box. Once you have completed the sketch, use the drawing tools in Microsoft Word to create your smiley face!

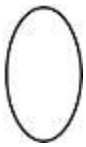
Two things to remember ...

Ö Do not add color on the computer! Print a black and white copy and then use crayons or colored pencils to finish it.

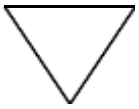
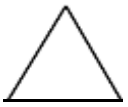
ÖDon't forget to give your smiley face a name! You will also need to include your name as parent and your class hour.

Smiley Face Traits

Face Shape
Circle (C) Oval (c)

Nose Style
Down (D) Up (d)

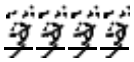



Eye Shape
Star (E) Blast (e)


Face Color
Yellow (Y)
Green (y)

Eye Color
Blue (B)
Red (b)

Hair Style
Straight (S) Curly (s)
Short (l)



Hair Length
Long (L)

Freckles
Present (F)
Absent (f)

Smile
Thick (T) Thin (t)


Nose Color
Red (RR)
Orange (RY)
Yellow (YY)

Ear Color
Hot Pink (PP)
Purple (PT)
Teal (TT)

Ear Style
Curved (V) Pointed (v)


Sex

To determine the sex, the flip the coin for the male parent. Heads equals X and tails equals Y.

XX - Female - Add pink bow in hair
XY - Male - Add blue bow in hair