Name _____ Period _____

Due date _____

GENETICS PROJECT

PART 1: DNA BASICS

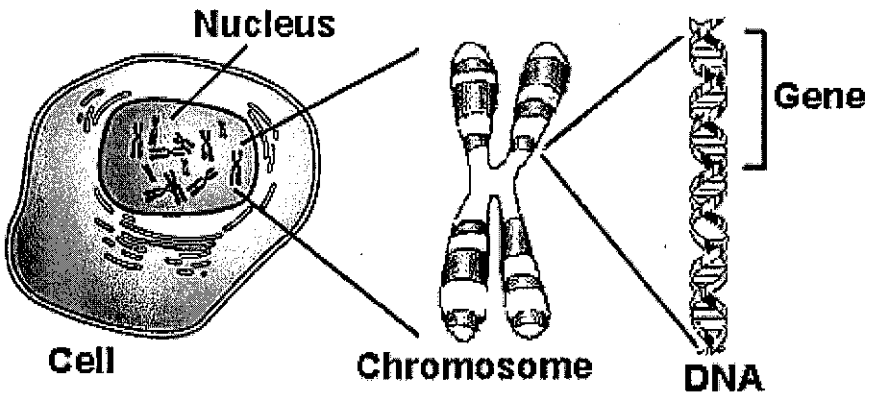
DNA can be extracted from strawberries in a few easy steps. Watch the demonstration, then answer the following questions?

A. What did the DNA look like? _____

B. What part of the cell was the DNA located in? _____
(ribosome/nucleus)

C. TRUE or FALSE: The DNA was shaped into little "X's" _____

ORGANIZATION OF GENETIC MATERIAL



A. COLORING: Nucleus = Red Chromosome = Blue DNA Stand = Yellow

B. ANALYSIS:

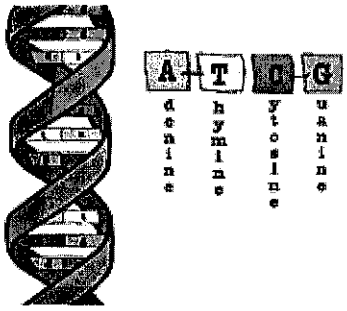
_____ 1. Which of the following is ranked from large to small?

A. Cell, nucleus, chromosome, gene, DNA
B. DNA, gene, chromsome, nucleus, cell
C. Chromsome, gene, DNA, cell, nucleus

_____ 2. What is a section of DNA called?

A. Cell B. Chromsome C. Nucleus D. Gene

C. READING – Read each of the following passages then answer the corresponding questions



The Basics of DNA

Your body contains 50 trillion tiny cells, and almost every one of them contains the complete set of instructions for making you. These instructions are encoded in your DNA. DNA is a long, ladder-shaped molecule. Each rung on the ladder is made up of a pair of interlocking units, called bases, that are designated by the four letters in the DNA alphabet - A, T, G and C. 'A' always pairs with 'T', and 'G' always pairs with 'C'.

1. What are the names of the 4 bases?

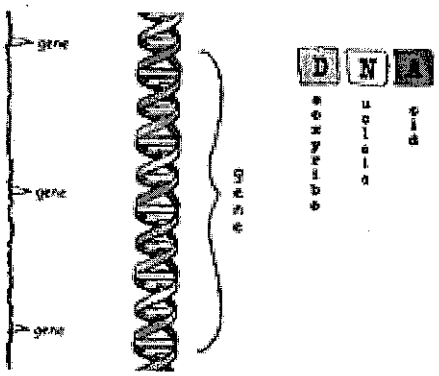
A = _____ T = _____ C = _____ G = _____

2. What does A always pair with? _____ What does G always pair with? _____

3. Make-a-Prediction: Based on what you know about enzymes, antibodies, and hormones, why does the base A always bond with T, and G always bond with C?

_____

DNA is Organized Into Chromosomes



The long molecules of DNA in your cells are organized into pieces called chromosomes. Humans have 23 pairs of chromosomes. Other organisms have different numbers of pairs - for example, chimpanzees have 24 pairs. The number of chromosomes doesn't determine how complex an organism is - bananas have 11 pairs of chromosomes, while fruit flies have only 4.

Chromosomes are Organized Into Genes

Chromosomes are further organized into short segments of DNA called genes. If you imagine your DNA as a cookbook, then your genes are the recipes. Written in the DNA alphabet - A, T, C, and G - the recipes tell your cells how to function and what traits to express. For example, if you have curly hair, it is because the genes you inherited from your parents are instructing your hair follicle cells to make curly strands.

4. TRUE or FALSE: All organisms have 23 pairs of chromosomes _____

5. Fill-in-the-Blanks:

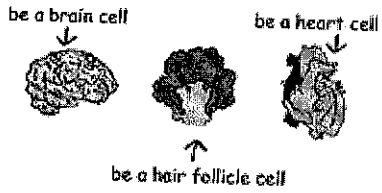
Chromosomes are further organized into short segments of DNA called _____.
If you imagine your DNA as a _____, then your genes are the _____.

Genes Make Proteins

Cells use the recipes written in your genes to make proteins - just like you use recipes from a cookbook to make dinner. Proteins do much of the work in your cells and your body as a whole. Some proteins give cells their shape and structure. Others help cells carry out biological processes like digesting food or carrying oxygen in the blood. Using different combinations of the As, Cs, Ts and Gs, DNA creates the different proteins - just as you use different combinations of the same ingredients to make different meals.

_____ 6. What products are made when the DNA recipes are read?

A. Proteins B. Fats C. Carbohydrates



Genetic Switches Control the Traits Cells Express

Cells come in a dizzying array of types; there are brain cells and blood cells, skin cells and liver cells and bone cells. But every cell contains the same instructions in the form of DNA. So how do cells know whether to make an eye or a foot? The answer lies in intricate systems of genetic switches. Master genes turn other genes on and off, making sure that the right proteins are made at the right time in the right cells.

7. TRUE or FALSE: Genes can be turned on and off _____

8. Thought Question – Can you think of a gene that is "turned on" for your entire life? (i.e. is there a protein that is produced for a lifetime?) _____
Can you think of a gene that is only turned on for a limited time in a person's life? _____

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PART 2: ONLINE askabiologist.asu.edu/build-monster

Read the 1st paragraph of "How to Build a Monster" and answer the following question:

_____ 1. What acts as the "blueprint" in humans?

A. Genetic code B. Brain cells C. Skeleton

2. Now scroll down to "The Monster Game" and click on the Monster Making button to begin building your own monster!

DIRECTIONS: A. Use each 3 base color code to determine the letters and traits of your monster.

B. When your monster is complete, name it and type in your name.

C. Now click on the Print icon at the top of the page and select "Coloring Page."

D. Print your monster (color it if you wish – this is optional) and staple it to the back of this project.

ANALYSIS

_____ 3. The 4 colors you used represent the 4 bases C, G, A, and T. In this simulation, each 3 color sequence was the code for one letter of the alphabet, but in real DNA each 3 base sequence codes for one:

A. Amino acid B. Gene C. Protein

_____ 4. In this simulation each letter became a part of a word, but in real DNA each amino acid becomes part of a:

A. Gene B. Protein C. DNA strand

PART 3 - CREATE-A-CHILD

DIRECTIONS: You will simulate the genetic "chance" that happens when genes are put into sperm and eggs during meiosis. Close your eyes and randomly select one bead out of bag #1. Circle the genetic trait selected in the list below. Return the bead to its bag, then go to the next station and select the next trait. When completed, repeat this procedure for Child #2. Then you will draw both of your children on the next page using the traits selected in the activity. Art skills don't count. 

	CHILD #1		CHILD #2	
1. GENDER	**MALE** Baby blue heart	**FEMALE** Pink heart	**MALE** Baby blue heart	**FEMALE** Pink heart
2. HEIGHT	**TALL** Red heart	**SHORT** Green heart	**TALL** Red heart	**SHORT** Green heart
3. WEIGHT	**HUSKY** Black heart	**SKINNY** Orange heart	**HUSKY** Black heart	**SKINNY** Orange heart
4. HAIR TEXTURE	**CURLY** Purple heart	**STRAIGHT** Dark blue heart	**CURLY** Purple heart	**STRAIGHT** Dark blue heart
5. HAIR COLOR	**BLONDE** Yellow circle	**BROWN** Brown circle	**BLONDE** Yellow circle	**BROWN** Brown circle
6. EYE COLOR	**BLUE** Blue circle	**GREEN** Green circle	**BLUE** Blue circle	**GREEN** Green circle
7. SHAPE OF NOSE	**WIDE** Yellow heart	**THIN** White heart	**WIDE** Yellow heart	**THIN** White heart
8. LIPS	**BIG LIPS** Red circle	**THIN LIPS** Orange circle	**BIG LIPS** Red circle	**THIN LIPS** Orange circle

9. FRECKLES	**YES** Grey circle	**NO** White circle	**YES** Grey circle	**NO** White circle
10. WEARS GLASSES	**YES** Black circle	**NO** Pink circle	**YES** Black circle	**NO** Pink circle

DRAW YOUR CHILDREN HERE

CHILD #1	CHILD #2

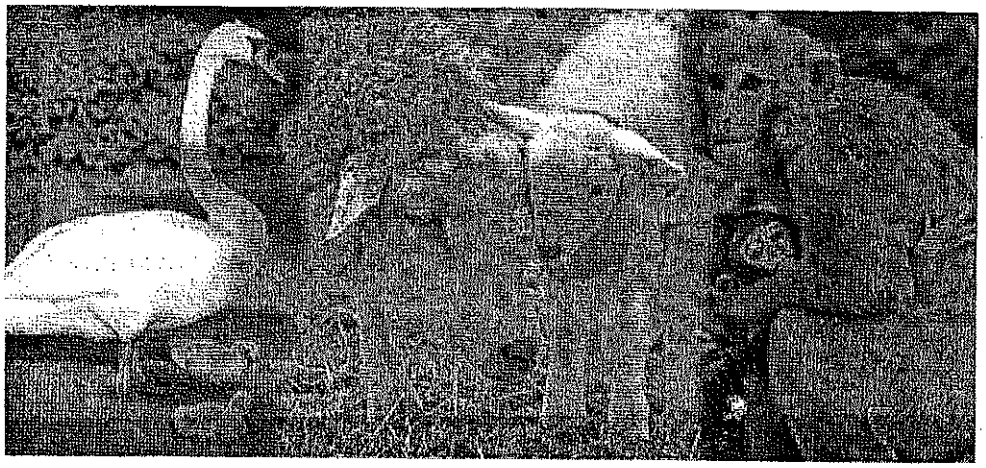
ANALYSIS:

1. Did your 2 children come out looking exactly alike? _____

_____ 2. What did the random choice of beads illustrate in this activity?

A. The random assortment of genes (traits) as eggs and sperm are made
B. The random chance of meeting your "soul mate" in life and getting married
C. The random chance of having identical or fraternal twins during pregnancy

Inherited Traits



Heredity is the passing of **traits** from parent to offspring. For example, you inherit traits from your parents. So, what are traits? Before children are born, they receive half of their traits, or characteristics, from their mother and the other half from their father. That is why you may have your father's nose and your mother's eye shape. Other traits include eye color, hair color, hair texture, weight, and skin color. Plants, like humans and other animals, also have inherited traits. Think of the shape of a flower such as the number of petals it has, and that is an inherited trait. These traits are carried in all the cells in your body. More specifically, they are carried in the cell's nucleus. The study of inherited traits is called **genetics.**

3. Give any 2 traits that you clearly received from your parents:

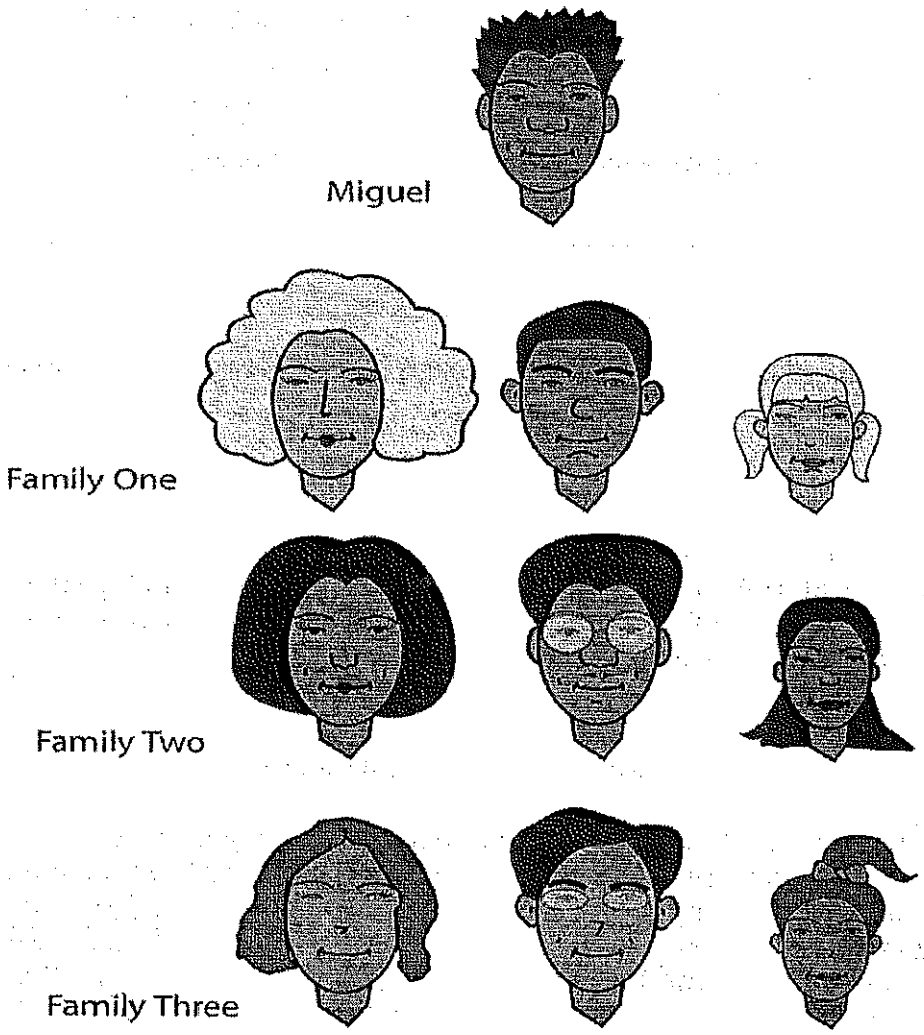
_____ _____

____ 4. What is the study of inherited traits called?

A. Reproduction B. Evolution C. Genetics

Activity 1: Can You Find Miguel?

Miguel needed a new pair of sneakers. His family decided to take a trip to the mall. While walking through the stores, he stopped to look at a bike. When he looked around, he did not see his mother or father. He did not get upset because he knew what to do. He walked up to the nearest salesperson and said that he was lost. The salesperson sent a message to a security officer. The officer had pictures of 3 families looking for lost boys. How can you help the officer match Miguel up with his family by comparing inherited traits? You must identify at least three observable traits to solve the mystery.

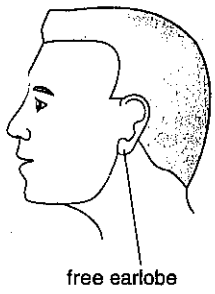


5. List the 3 observable traits you used to solve this mystery

_____ _____ _____

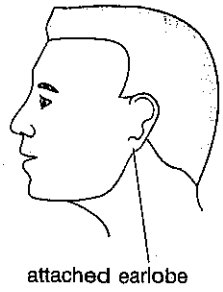
_____ 6. Which family does Miguel belong to?

A. Family One B. Family Two C. Family Three



PART 4:

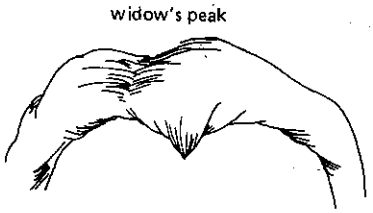
WHAT GENETIC TRAITS DO WE HAVE?



Using the principles of genetics, biologists have learned about the heredity of many human traits. In many of these traits, several pairs of genes are involved and the pattern of inheritance is complex. For this activity we will assume that the traits we are studying are regulated by only one pair of genes, one gene from the father and one from the mother. Knowledge of your own traits and genetic makeup can give you information about the genetic makeup of your parents and perhaps your children.

OBJECTIVES:
- Determine the appearance of several of your genetic traits
- Determine (as far as possible) your gene pairs for these traits.
- Analyze the genes and traits of the classroom as a whole

MATERIALS: PTC paper



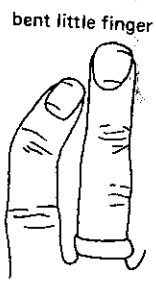
UNDERSTANDING GENETIC SYMBOLS:

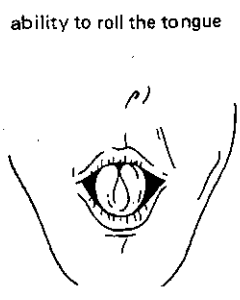
You will determine your appearance and gene pairs for the traits listed in the table on the next page. If you show the dominant trait, your gene pair must include at least one dominant gene (from one of your parents). If you show the recessive trait, you must have two recessive genes (one from your mom, and one from your dad).

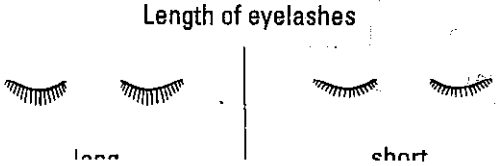
Genes are represented by letters. If you show the dominant trait, the gene is represented by a capital letter. Recessive traits are represented by lower case letters. You will pretend, for the sake of this lab, any time you show the dominant trait, you have two dominant genes.

FOR EXAMPLE: In humans, freckles are caused by a dominant gene. We will represent it with an "F." Not having freckles is recessive and will be represented by "f."

If you have freckles your gene pair is FF.
If you do not have freckles your gene pair is ff.







TRAITS AND SYMBOLS	DESCRIPTION	APPEARANCE	GENE PAIR
(1) Shape of ear lobe FF ff (free or attached)	Free ear lobes are dominant. People whose ear lobes connect in a straight line to the side of their head have attached ear lobes.		
(2) Eye color BB bb (not blue or blue)	People with blue eyes show the recessive trait. All other eye colors are caused by dominant genes.		
(3) Shape of hairline WW ww (widow's peak or smooth)	A widow's peak is a hairline that forms a downward point in the middle of the forehead. This is caused by a dominant gene. People with a smooth hairline show the recessive trait.		
(4) Roll tongue RR rr (roller or non-roller)	A dominant gene gives people the ability to roll their tongues into a "U" shape. People with the recessive trait cannot roll their tongues.		
(5) Fold tongue FF ff (folder or non-folder)	A dominant gene gives people the ability to fold the tip of their tongues into a star shape. People with the recessive trait cannot.		
(6) Little finger shape BB bb (bent or straight)	A dominant gene results in the end joint of the little finger of each hand bending inward. Straight little fingers are the recessive trait.		
(7) Taste PTC TT tt (taster or non-taster)	Individuals who can taste the chemical phenylthiocarbamide (PTC) show the dominant trait. Non-tasters express the recessive trait.		
(8) Hair on fingers HH hh (hairy or not hairy)	People with hair between the middle joints of their fingers show the dominant trait. Those with the recessive trait, do not have hair between these joints.		
(9) Hair color RR rr (not red or red)	Red hair is the recessive trait while all other colors are dominant.		
(10) Hair curliness CC cc (curly or straight)	Individuals with curly hair show the dominant trait. Straight hair is recessive.		
(11) Eyelash length LL ll (long or short)	Long eyelashes are the result of dominant genes while short eyelashes are recessive.		
(12) Number of fingers NN nn (not 5 or 5)	A dominant gene causes people to be with 6 or more fingers. Individuals with 5 fingers on each hand are recessive.		

PART II: DATA TABLE FOR CLASS

DOMINANT TRAIT	#	RECESSIVE TRAIT	#
1. Free earlobes	_____	Attached earlobes	_____
2. Not blue eyes	_____	Blue eyes	_____
3. Widow's peak	_____	Smooth	_____
4. Tongue roller	_____	Not roller	_____
5. Tongue folder	_____	Not folder	_____
6. Bent finger	_____	Straight finger	_____
7. PTC taster	_____	Non-taster	_____
8. Hairy fingers	_____	Not hairy	_____
9. Not red hair	_____	Red hair	_____
10. Curly hair	_____	Straight hair	_____
11. Long eyelashes	_____	Short eyelashes	_____
12. Not 5 fingers	_____	5 fingers	_____

ANALYSIS QUESTIONS:

1. List any traits from the table above in which you were <u>in the majority</u> of people in the class: _____

2. List any trait(s) above in which you were the <u>only person</u> exhibiting that trait. (If none, write "none.") _____

3. What does PTC taste like? (If you are a non-taster, ask a taster.) _____

_____ 4. In this activity you looked a t different versions of human traits such as a widow's peak and a smooth hair line. What determines the traits you will have?

A. The order of the bases in your DNA
B. The order of the sugars in your DNA
C. The order of the phosphates in your DNA