NAME: _____ BLOCK: _____

SCIENCE 10: BIOLOGY UNIT

I. DNA & PROTEIN SYNTHESIS				
B	D	A	E	**SKILLS**
				1. I can describe location, structure & function of DNA
				2. I can list the stages of protein production in a cell
				3. I can identify and describe the structure and function of genes
II. GENETICS				
B	D	A	E	
				4. I understand the vocabulary words for simple inheritance
				5. I can show the F1 generation of a monohybrid cross using Punnet squares
				6. I can demonstrate inheritance patterns for incomplete dominance
				7. I can demonstrate inheritance patterns for co-dominance
				8. Blood Typing Lab
				a) Questioning & Predicting
				b) Planning & Conducting
				c) Processing & Analyzing Data
				d) Evaluating & Reflecting
III. MUTATION				
B	D	A	E	
				9. I can describe how a gene mutation can occur
				10. I can describe positive negative and neutral gene mutations
				11. I can describe mutations impacts on evolution
				12. I can describe mutagens and carcinogens
IV. NATURAL & ARTIFICIAL SELECTION				
B	D	A	E	
				13. I can differentiate between natural and artificial selection
				14. I understand how plants and animals can be selectively bred
V. PROJECTS				
B	D	A	E	
				15. Biology Key Terms Flashcards
				16. Application of Genetics Poster
				a) Procedures and Evidence
				b) Perspectives and Ethics
				c) Communication
			%	Biology Exam Result

Incomplete	Beginning	Developing	Accomplished	Exemplary
Not complete, received 0	Does not demonstrate a basic understanding of concepts.	Demonstrates a basic understanding of concepts.	Demonstrates a solid understanding of concepts.	Demonstrates a complete and deep understanding of concepts.
0 – 49%	50-60%	61-72%	73 – 85%	86 – 100%

To Do List

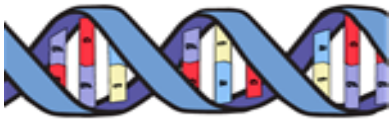
This is a list of the activities in this unit. You can check off the activities as you complete them.

√	ACTIVITY	FINISH BY DATE
	Using texts, and on-line sources, begin filling out your "DNA Dictionary"	
	Start your flashcards, using the terms from your dictionary	
	Use your template notes while listening to your teacher talk about DNA and Protein Synthesis	
	Colour your DNA and mRNA pictures (according to the directions)	
	Finish questions that follow the notes and colouring project	
	Complete the "Modelling DNA" activity	
	Complete the Protein Synthesis Worksheet	
	Using texts, and on-line sources, complete your notes on "Genes"	
	Watch Bill Nye "Genes" video on YouTube & complete the worksheet in your package	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on DNA and Protein Synthesis (Skills #1 - 3)	
	Using texts, and on-line sources, fill out your Introductory Genetics Glossary (use this to start your flashcards for this section)	
	Read the notes on-line about Punnett Squares	
	Complete the "Bikini Bottom Genetics" Worksheet and check answers	
	Complete "More Practice: Simple Mendelian Genetics" Worksheet. Again, check your answers.	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on Simple Mendelian Inheritance (Skills #4 & 5)	
	Read/watch the on-line material about Incomplete Dominance	
	Complete the sample questions, as a class, with your teacher	
	Do "More from Bikini Bottom…" questions and check your answers.	
	Read/watch the on-line material about Codominance	
	Complete the sample questions, as a class, with your teacher	
	Read/watch the on-line material about Blood Typing	
	Complete the worksheet "Blood Types". Check your answers.	
	Figure out what you want to have on your flashcards for this section	
	Participate in the Blood Typing Lab	
	Try the Principles of Heredity Word Search	
	Finish your flashcards and practice, practice, practice!	

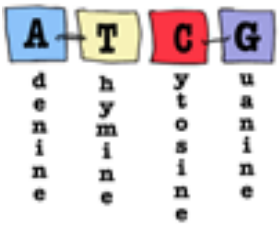
	Complete quiz on Incomplete Dominance and Codominance (Skills #6 & 7)	
	Read/watch the on-line material about mutation	
	Participate in the in-class lesson, using your template notes.	
	Figure out what you want to have on your flashcards for this section	
	Use our website to complete your notes on "Types and Causes of Mutations:"	
	Complete the "Mutations Concept Map" using the BC Science 9 text pp,136 - 141	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on Gene Mutation (Skills #8 & 9)	
	Answer the questions on the worksheet: Effects of Mutations	
	Add to your flashcards	
	Do the "Mutations Review" questions. Find three people who have also completed it and compare/discuss your answers.	
	Using the BC Science 9 text, pp. 141 – 143, read and take notes on Correcting Mutations. Complete the questions on p. 145 and turn them in to your teacher.	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on Impacts of Gene Mutation (Skills #10 & 11)	
	Read/watch the on-line material Natural and Artificial Selection	
	Complete the worksheet on "Natural Selection: How populations change"	
	Complete the worksheet on "Penguin Adaptations"	
	Add to Flashcards	
	Read the online information about Selective Breeding, and complete the questions that go with it (questions are in your skills package)	
	Watch Bill Nye on GMOs and complete accompanying worksheet	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on Natural and Artificial Selection (Skills #12 & 13)	
	Using resources available on our website, complete the template notes on "Selective Pressure"	
	Complete the question on Selective Pressure	
	Finish your flashcards and practice, practice, practice!	
	Complete quiz on Selection Pressures and Adaptive Radiation (Skills #14 & 15)	
	Organize your flashcards by skill/topic. You may use index card dividers (like in recipe boxes) or another method, but your sections must be clearly marked.	
	Flashcard Project Due Date:	
	Choose a partner (or choose to work alone) and decide on a poster project topic. You must have your topic approved before starting.	
	Look at the poster project marking rubric before going too far with your poster	
	Poster Due Date:	
	Review for Unit Exam	
BIOLOGY UNIT SUMMATIVE TEST (recall: no re-writes on a Unit Test! DATE OF TEST:		

DNA DICTIONARY

Key Term	Definition/Description
DNA	
Nucleus	
Chromosome	
Chromatin	
Gene	
Trait	
Nitrogenous Bases	
Phosphate group	
Double Helix	
mRNA	



DNA in the Nucleus



"**D**eoxyribo**N**ucleic **A**cid"

Recall that the _____is a small spherical, dense body in a cell.

It is often called the "control center" because it controls all the activities of the cell including cell reproduction, and heredity.

_____ are microscopic, threadlike strands composed of the chemical _____ (short for deoxyribonucleic acid).

In simple terms, DNA controls the production of _____within the cell.

These proteins in turn, form the structural units of cells and control all chemical processes within the cell. Think of proteins as the building blocks for an organism, proteins make up your skin, your hair, and parts of individual cells. The proteins that are made largely determine how you look.

The proteins that will be made for your body are determined by the _____in the nucleus.

Chromosomes are composed of _____, which are segments of DNA that code for a particular protein, which in turn codes for a _____.

Hence you hear it commonly referred to as the "gene for baldness" or the "gene for blue eyes". Meanwhile, DNA is the chemical that genes and chromosomes are made of.

DNA is called a _____ acid because it was first found in the nucleus. We now know that DNA is also found in some organelles such as the _____and _____.

It is the DNA in the nucleus that actually controls the cell's workings. _____ on chromosomes code for specific _____ in a cell.

In 1953, _____ and _____ established the structure of DNA.

The shape of DNA is a double _____, which is like a twisted _____.

The sides of the ladder are made of alternating _____and _____ molecules.

The sugar is a pentose called _____.

- Color all the phosphates pink (one is labeled with a "P").
- Color all the deoxyriboses blue (one is labeled with a "D").

The sides of DNA are made of _____and_____

The rungs of the ladder are pairs of 4 types of _____

The bases are known by their coded letters _____.

These bases always bond in a certain way. _____ will only bond to **thymine**.

Guanine will only bond with _____.

The bases can occur _____along a strand of DNA. The order of these bases is the code that contains the instructions.

For instance, **ATGCACATA** would code for a different gene than **AATTACGGA.** A strand of DNA contains millions of bases.

Pick colors for the following nitrogen bases and fill in the blanks with these color choices:

- Color the thymines _____ and label them with a T. 
- Color the adenines _____ and label them with an A. 
- Color the guanines _____ and label them with a G. 
- Color the cytosines _____ and label them with a C. 

*****Note that that the bases attach to the sides of the ladder the sugars and not the phosphate.**

The **DNA helix** is made of repeating units called _____.

Nucleotides are made of a pentose _____a _____and a nitrogen-containing _____

Color the nucleotides using the same colors as you colored them in the double helix.

The two sides of the DNA ladder are held together loosely by _____. The DNA can actually "unzip" when it needs to_____- or make a copy of itself.

DNA needs to copy itself when a cell divides, so that the new cells each contain a copy of the DNA. Without these instructions, the new cells would not have the correct information. The **hydrogen bonds** are represented by small circles.

Color the hydrogen bonds grey.

_____bonds between bases must be broken to copy DNA.

Copying DNA to make two, identical DNA molecule is called _____

Messenger RNA

So, now, we know the nucleus controls the cell's activities through the chemical DNA, but how?

It is the _____ that determine which protein is to be made.

The sequence is like a code that we can now interpret.

The sequence determines which proteins are made and the _____ determine which activities will be performed.

This is how the **nucleus** is the control center of the cell.

The only problem is that the _____ is too big to go through the nuclear pores so a chemical is used to _____. That chemical is _____ (mRNA).

The messenger RNA (mRNA) is small enough to go through the nuclear pores. It takes the "message" of the DNA to the _____and "tells them" what proteins are to be made. Recall that proteins are the body's building blocks. Imagine that the code taken to the ribosomes is telling the ribosome what is needed - like a recipe.

Messenger RNA is similar to DNA, except that it is a _____, and it has **NO** _____.

Instead of thymine, mRNA contains the base _____.

In addition to that difference, mRNA has the sugar _____instead of deoxyribose.

RNA stands for _____

- **Color** the mRNA as you did the DNA, except **Color** the ribose a DARKER BLUE
- **Color** the uracil brown.

mRNA has a _____ strand of nucleotides.

_____ replaces _____ on RNA.

_____ is the pentose sugar on RNA.

_____ not DNA can leave the nucleus through _____ in the nuclear envelope.

Proteins are made at the _____

The Blueprint of Life

_____ in your body has the same "blueprint" or the _____. Like the blueprints of a house tell the builders how to construct a house, the cellular DNA "blueprint" tells the cell how to build the organism.

Yet, how can a heart be so different from a brain if all the cells contain the same instructions? Although much work remains in genetics, it has become apparent that a cell has the ability to

_____ and only work with the _____.

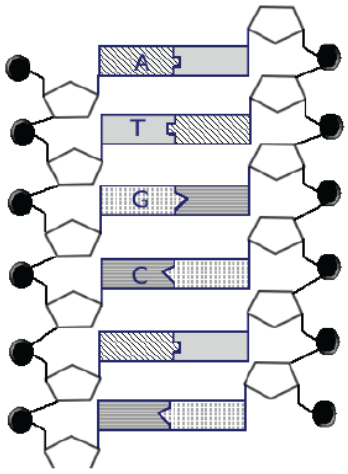
Questions:

1. Write out the full name for DNA.
2. What is a gene?
3. Where in the cell are chromosomes located?
4. DNA can be found in what organelles in the cell?
5. What two scientists established the structure of DNA?
6. What is the shape of DNA?
7. The sides of the DNA ladder are composed of what?
8. The "rungs" of the DNA ladder are made of what?
9. What sugar is found in DNA? In RNA?
10. How do the bases bond together?
11. A bonds with ____ G bonds with _____
12. The two purines in DNA are_____ and _____.
13. DNA is made of repeating units called _____.
14. Why is RNA necessary to act as a messenger? Why can't the code be taken directly from the DNA?
15. Proteins are made where in the cell?
16. How do some cells become brain cells and others become skin cells, when the DNA in ALL the cells is the same?
17. Why is the DNA molecule referred to as the "blueprint of life"?

18. Write the complementary sequence to following DNA strand:

A A T T C G C C G G T A T T A G A C G T T

19. Use the image at the right to complete the follow:



- **Circle a base.**
- **Label the sugar and phosphate.**
- **Label the bases that are not already labeled**

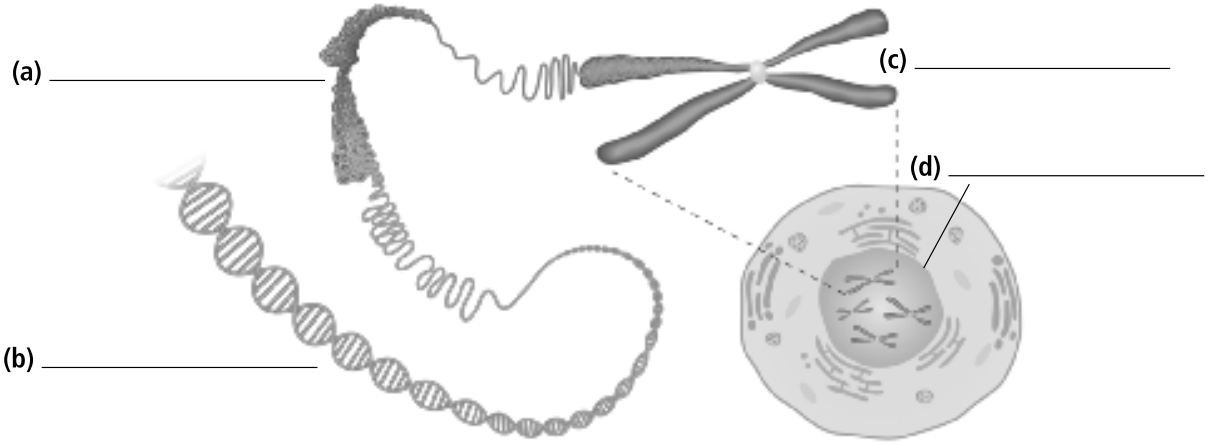
20. Describe how your DNA is different from the DNA of your classmates.

21. What are chromosomes made up from: _____

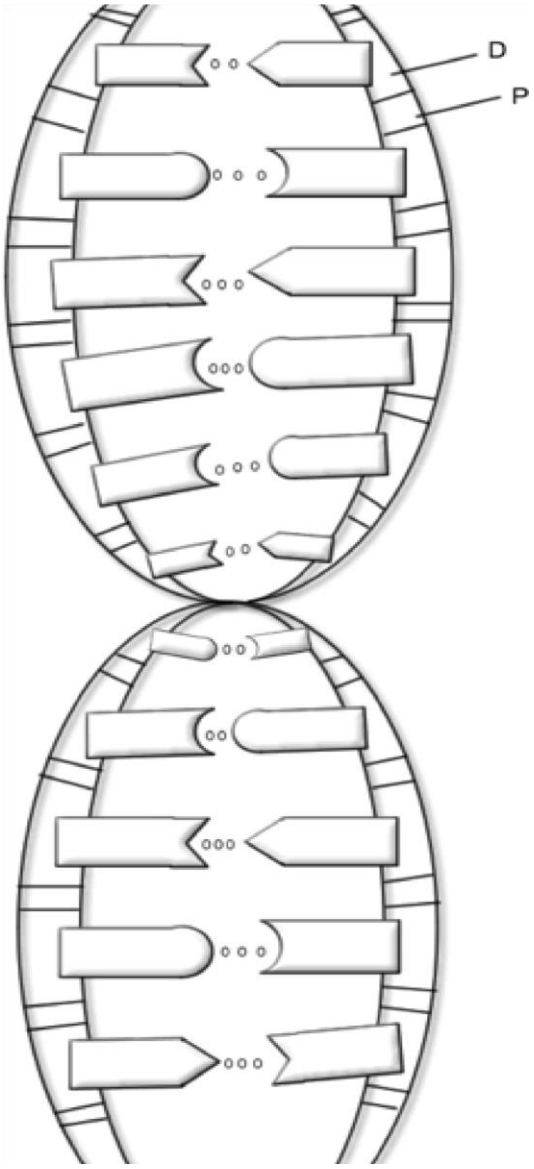
22. Look up the number of chromosomes for 3 other organisms of your choice.

a. Organism: _____ Number of chromosomes: _____
b. Organism: _____ Number of chromosomes: _____
c. Organism: _____ Number of chromosomes: _____

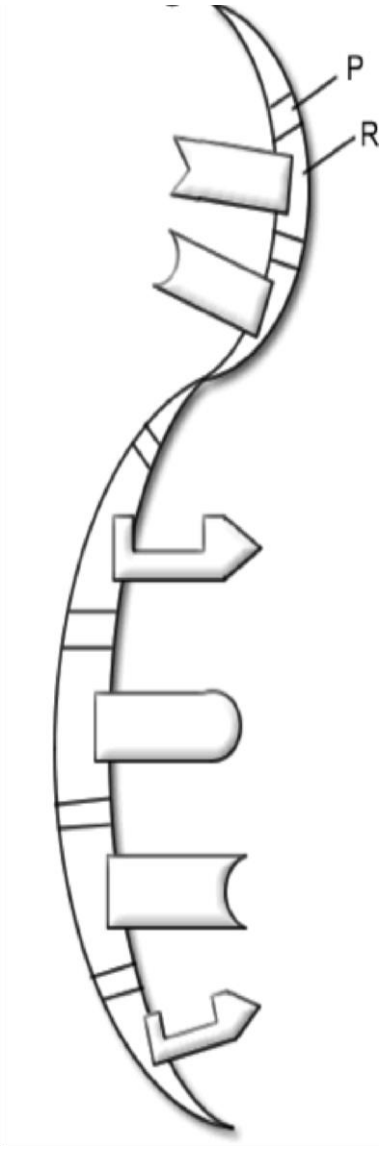
23. Fill in the blanks below.

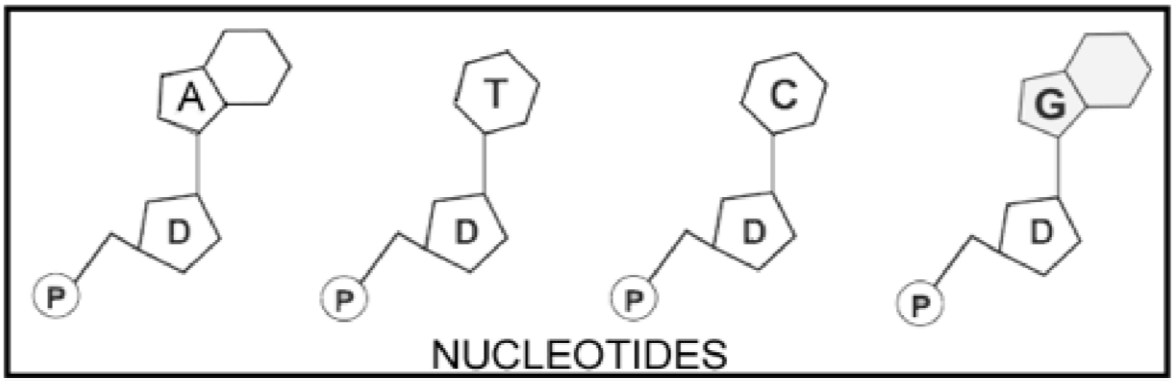


DNA MOLECULE

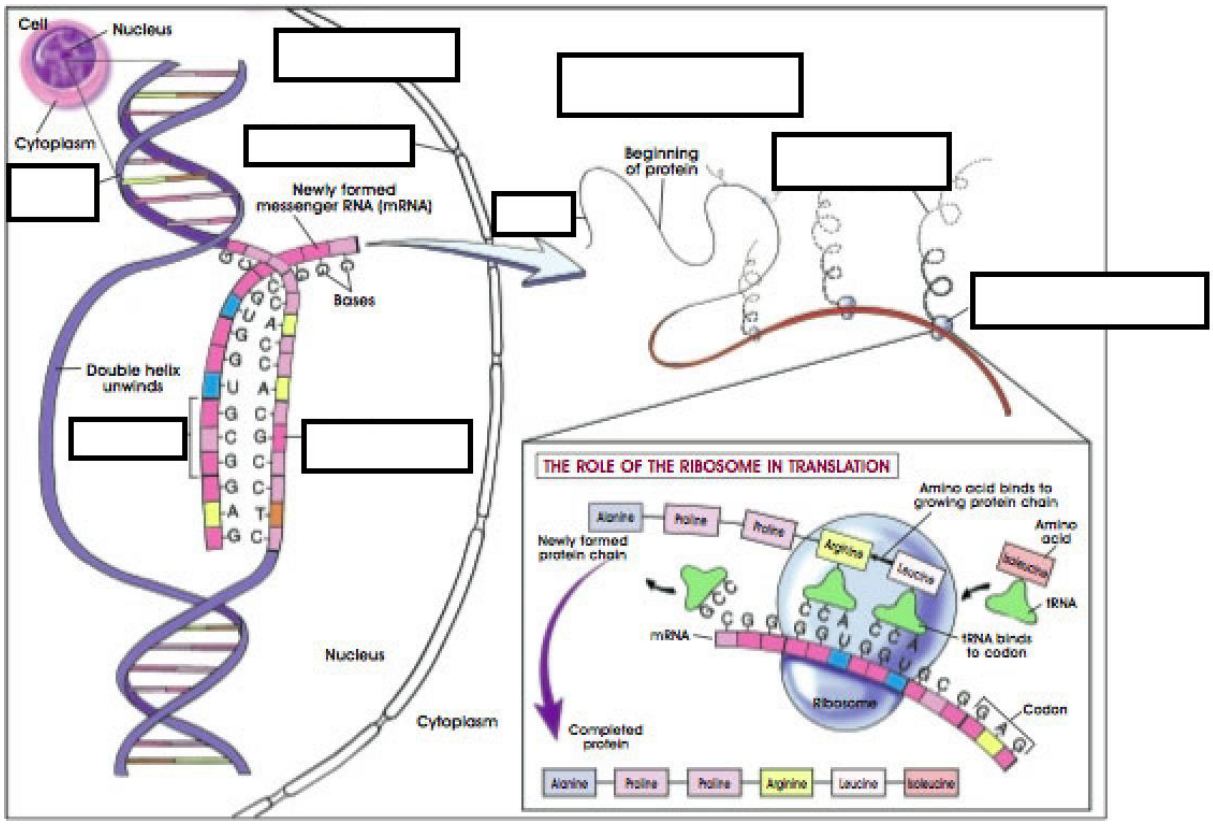


MESSENGER RNA





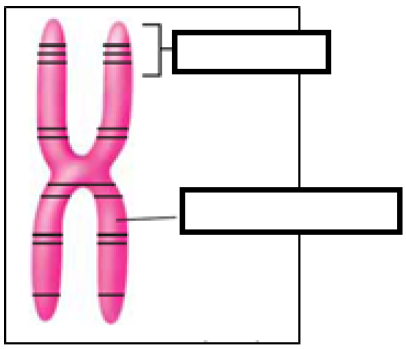
PROTEIN SYNTHESIS WORKSHEET

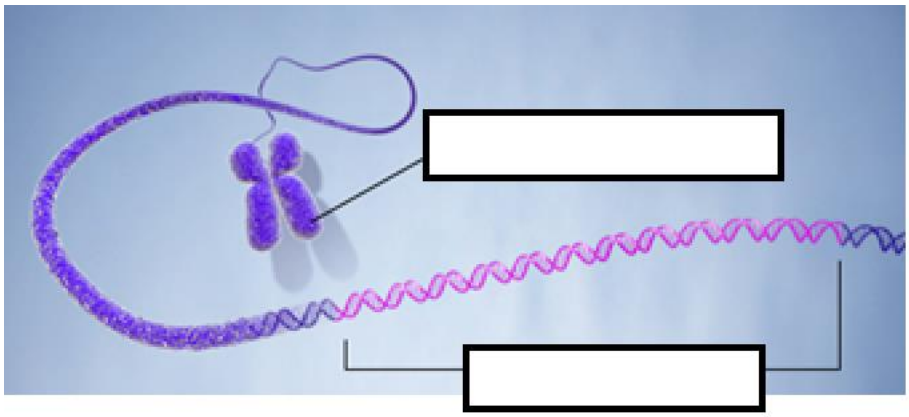


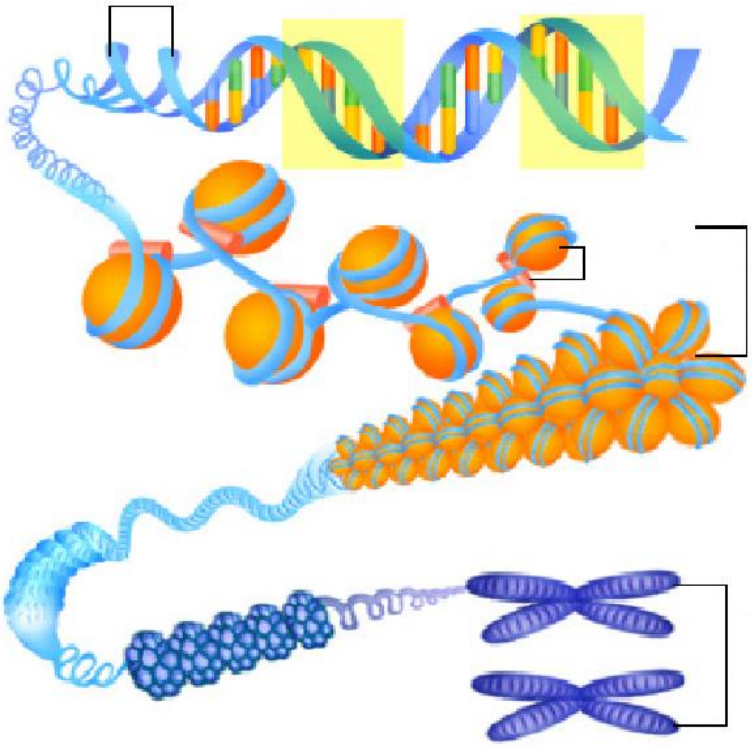
1. Fill in the labels in the diagram above.
2. Where does transcription occur?
3. Describe transcription in your own words.
4. What is RNA? How is it different from DNA (in form and function)?
5. Where does translation occur?
6. Differentiate between tRNA, mRNA and codons.

CHROMOSOMES AND GENES WORKSHEET

1. A gene is the basic physical and functional unit of heredity made up of _____and acts as instructions to make molecules called _____.
2. Each chromosome can carry thousands of _____
3. Every person has _____ copies of each gene, one inherited from each _____.
4. _____ are forms of the same gene with small differences in their sequence of DNA bases. These small differences contribute to each person's unique physical features.







"Bill Nye: Genes" Video Worksheet

Head to YouTube and find the video. Watch it and fill in your worksheet as you go!

1. Where do your genes come from? _____
2. What is inside every cell in your body? _____
3. What does DNA stand for? _____
4. What did Bill climb to get out of the Nye Lab? _____
5. How long is the DNA string model of science? _____
6. How many times longer is DNA than it is wide? _____
7. How does Bill define a Gene? _____
8. Why is the white blood cell dark on the computer screen? _____
9. What does the nucleus of the cell contain? _____
10. What can you do with DNA after you take it out of an organism?

    a. _____

    b. _____

11. What 2 organisms were combined to create the message to Bill in the petri dish?

12. What do genes do?

13. Mom tells Richie: Genes are the set of _____ _____ that get passed down from _____to child. In the process, of course, the genetic material is _____ in new ways, which is why people bear resemblance to their _____ and _____without looking like any one relative.

14. What analogy does Bill use to describe the human set of chromosomes?

15. What is each chapter analogous to? _____
16. How many genes to humans have? _____
17. What do cells in the body not need to do?
    _____
18. Most species have fewer than _____chromosomes but thousands and thousands of genes.

19. Bill calls the babies "bundles of _____"

20. The reproductive cell that a mother donates to her child is called the _____

21. The reproductive cell that a father donates to his child is called the _____

22. The number of cells needed to make a baby is: _____

23. DNA is the _____ print for the future.

24. Earlobes can be _____or _____

25. A _____is a piece of the _____ molecule.

26. The four chemicals of DNA are

    a. _____

    b. _____

    c. _____

    d. _____

27. The number of chromosomes that a mule foal has is _____

28. The number of chromosomes that a horse has is _____

29. The number of chromosomes that a donkey has is _____

30. In the demonstration, the _____ gene for rolling your tongue is represented by the letter "R"

31. In the demonstration, the _____ gene for rolling your tongue is represented by the letter "r"

32. If a person has the pattern RR, then the person _____ roll their tongue

33. If a person has the pattern Rr, then the person _____ roll their tongue

34. If a person has the pattern rr, then the person _____ roll their tongue

35. What is special about the turtle in this movie?

INTRODUCTORY GENETICS

TERM	DEFINITION
Gene	
Allele	
Genotype	
Heterozygous	
Homozygous	
Phenotype	
Dominant Allele	
Codominant Alleles	
Incompletely Dominant Alleles	
Recessive Allele	
Test Cross	
True Breeding	
P generation	
F1 generation	
F2 generation	
Pure-bred	

Hybrid	
Law of segregation	
Law of independent assortment	
Trait	
Genetics	
True-breeding	
P generation	
F1 generation	
F2 generation	

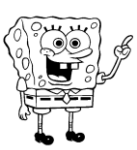
PUNNET SQUARES

- Punnet squares are used to identify the possible genotypes and phenotypes of offspring of two adults.
- They are a useful tool for recognizing the chance of offspring expressing certain traits.
- The punnet square below shows the potential genotypes of offspring when a homozygous dominant (BB) adult breeds with a homozygous recessive (bb) adult.

	b	b
B	Bb	Bb
B	Bb	Bb

- In this example, all the offspring will heterozygous (Bb) for this characteristic and only the dominant trait will be expressed.
- In terms of genotypes and phenotypes, if the 'BB' genotype coded for the dominant brown eye trait and the 'bb' genotype coded for recessive blue eye trait, all the offspring will have the genotype 'Bb' and the expressed phenotype will be the dominant brown eye trait.

BIKINI BOTTOM GENETICS



TRAIT	DOMINANT GENE	RECESSIVE GENE
BODY SHAPE	SQUAREPANTS (S)	roundpants (s)
BODY COLOUR	YELLOW (Y)	blue (y)
EYE SHAPE	ROUND (R)	oval (r)
NOSE STYLE	LONG (L)	Stubby (l)

1. Use the information for SpongeBob's traits to write the **phenotype** for each item:

(a) **LL** _____ (d) **yy** _____ (g) **Ss** _____

(b) **RR** _____ (e) **Rr** _____ (h) **ll** _____

(c) **ss** _____ (f) **Yy** _____

2. Use the information for SpongeBob's traits to write the **genotype(s)** for each item:

(a) **yellow body** _____ (d) **long nose** _____ (g) **blue body**_____

(b) **round pants** _____ (e) **stubby nose** _____

(c) **oval eyes** _____ f) **square pants** _____

3. Determine the phenotype for each genotype using the information provided.

(a) Yellow body colour is dominant to blue.

YY _____Yy _____yy _____

(b) Square shape is dominant to round.

SS _____ Ss _____ ss _____

4. For each phenotype, give the genotype(s) possible for Patrick

A tall head (T) is dominant to short (t)

(a) Tall = _____ (b) Short = _____

Pink body colour (P) is dominant to yellow (p)

(a) Pink = _____ (b) Yellow = _____

5. Use the information for SpongeBobs traits to write the genotypes for each item:

(a) Heterozygous for round eyes _____ (c) Homozygous for long nose _____

(b) Purebred squarepants _____ (d) Hybrid yellow body _____

6. Patrick met Patti at the dance. Both of them are heterozygous for their pink body color, which is dominant over a yellow body color. Create a Punnett square to show the possibilities that would result if Patrick and Patti had children.

A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with a pink body? ____ out of ____ or ____%

C. What are the chances of a child with a yellow body? ____ out of ____ or ____%

7. Everyone in Squidward's family has light blue skin, which is the dominant trait for body color in his hometown of Squid Valley. His family brags that they are a "purebred" line. He recently married a nice girl who has light green skin, which is a recessive trait. Create a Punnett square to show the possibilities that would result if Squidward and his new bride had children. Use B to represent the dominant gene and b to represent the recessive gene.

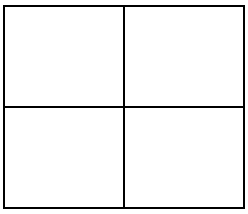
A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with light blue skin? ____%

C. What are the chances of a child with light green skin? ____%

D. Would Squidward's children still be considered purebreds? Explain!

8. Assume that one of Squidward's sons, who is heterozygous for the light blue body color, married a girl that was also heterozygous. Create a Punnett square to show the possibilities that would result if they had children.

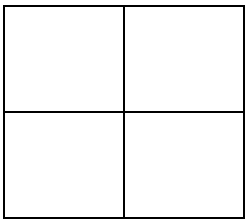


A. List the possible genotypes and phenotypes for their children.

B. What are the chances of a child with light blue skin? ____%

C. What are the chances of a child with light green skin? ____%

9. Mr. Krabbs and his wife recently had a Lil' Krabby, but it has not been a happy occasion for them. Mrs. Krabbs has been upset since she first saw her new baby who had short eyeballs. She claims that the hospital goofed and mixed up her baby with someone else's baby. Mr. Krabbs is homozygous for his tall eyeballs, while his wife is heterozygous for her tall eyeballs. Some members of her family have short eyes, which is the recessive trait. Create a Punnett square using T for the dominant gene and t for the recessive one.



A. List the possible genotypes and phenotypes for their children.

B. Did the hospital make a mistake? Explain your answer.

More Practice: Simple Mendelian Genetics

Answer following questions on a separate sheet of paper.

1. In cats, long hair is recessive to short hair. A true-breeding (homozygous) short-haired male is mated to a long-haired female. What will their kittens look like?

2. Two cats are mated. One of the parent cats is long-haired (recessive allele). The litter which results contains two short-haired and three long-haired kittens. What does the second parent look like, and what is its genotype?

3. Mrs. And Mr. Smith both have widow's peaks (dominant). Their first child also has a widow's peak, but their second child does not. Mr. Smith accuses Mrs. Smith of being unfaithful to him. Is he necessarily justified? Why or why not? Work the genetics problem predicting the frequencies of the versions of this trait among their prospective children.

4. Mr. and Mrs. Jones have six children. Three of them have attached earlobes (recessive) like their father, and the other three have free earlobes like their mother. What are the genotypes of Mr. and Mrs. Jones and of their numerous offspring?

5. In certain portions of the Jewish population, there is a genetic disease called Tay Sachs disease, which is fatal to infants within the first five years of life. This disease is caused by a recessive allele of a single gene. Why does this disease persist, even though it is **invariably** fatal long before the afflicted individual reaches reproductive age? (In other words, why doesn't the allele for Tay Sachs disease simply disappear?)

6. About 80% of the human population can taste the chemical phenolthiocarbamide (PTC), while the other 20% cannot. This characteristic is governed by a single gene with two alleles, a tasting allele, and a non-tasting allele. What does this statistic tell us about which allele (tasting or non-tasting) is dominant?

7. For each genotype below, indicate whether it is heterozygous (HET) or homozygous (HO)

AA _____	Ee ____	Ii _____	Mm _____
Bb _____	ff ____	Jj _____	nn _____
Cc _____	Gg ____	kk _____	oo _____
DD _____	HH ____	LL _____	Pp _____

8. For each of the **genotypes** below determine what **phenotypes** would be possible.

Purple flowers are dominant to white flowers.	*Brown eyes are dominant to blue eyes*
PP _____	BB _____
Pp _____	Bb _____
pp _____	bb _____

9. *Round seeds are dominant to wrinkled seeds.* *Bobtails in cats are recessive.*

RR _____ TT _____

Rr _____ Tt _____

rr _____ tt _____

10. For each **phenotype** below, list the **genotypes** (remember to use the letter of the dominant trait)

Straight hair is dominant to curly. *Pointed heads are dominant to round heads.*

____ straight _____ pointed

____ straight _____ pointed

____ curly _____ round

11. Set up the Punnet squares for each of the crosses listed below.

Round seeds are dominant to wrinkled seeds.

What percentage of the offspring will be **round**?

a. Rr x rr _____% c. RR x Rr _____%

b. RR x rr _____% d. Rr x Rr _____%

13. A TT (tall) plant is crossed with a tt (short plant). What % of the offspring will be tall?

14. A Tt plant is crossed with a Tt plant. What percentage of the offspring will be short?

15. A heterozygous round seeded plant (Rr) is crossed with a homozygous round seeded plant (RR). What percentage of the offspring will be homozygous (RR)?

16. A homozygous round seeded plant is crossed with a homozygous wrinkled seeded plant.

What are the genotypes of the parents? _____ x _____

What percentage of the offspring will also be homozygous? _____

17. In pea plants purple flowers are dominant to white flowers. If two white flowered plants are crossed, what percentage of their offspring will be white flowered?

18. A white flowered plant is crossed with a plant that is heterozygous for the trait. What percentage of the offspring will have purple flowers?

19. Two plants, both heterozygous for the gene that controls flower color are crossed. What percentage of their offspring will have purple flowers? What percentage will have white flowers?

In guinea pigs, the allele for short hair is dominant.

20. What genotype would a heterozygous short haired guinea pig have?
21. What genotype would a pure breeding short haired guinea pig have?
22. What genotype would a long-haired guinea pig have?
23. Show the cross for a pure breeding short haired guinea pig and a long-haired guinea pig. What percentage of the offspring will have short hair?

24. Show the cross for two heterozygous guinea pigs.
    What percentage of the offspring will have short hair?
    What percentage of the offspring will have long hair?

25. Two short haired guinea pigs are mated several times. Out of 100 offspring, 25 of them have long hair. What are the probable genotypes of the parents? **Show the cross to prove it!**

Heredity Simulation

1. The image shows a male and female monster each with different genetic traits. The allele for one horn is dominant over the allele for two horns.

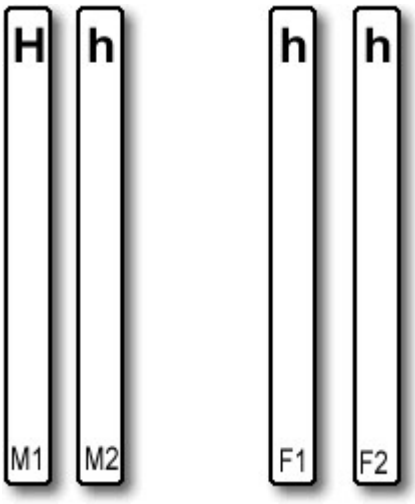
MALE

FEMALE

Which monster has the dominant allele? _____

2. Obtain four popsicle sticks that will represent the chromosomes of your parents. Arrange them so that the male's set (Hh) is on one side and the female's set (hh) is on the other side. The M1, M2, F1, F2 labels will help you if you get them confused.

3. Flip the sticks over so that you cannot see their labels. Choose one chromosome from the mother pile and another from the father pile. This represents the chromosomes each parent is "donating" to the next generation.



4. Data (Repeat the exchange 8 times to produce 8offspring)

	Genotype (letters)	Phenotype
Offspring 1		
Offspring 2		
Offspring 3		
Offspring 4		
Offspring 5		
Offspring 6		
Offspring 7		
Offspring 8		

5. Show the cross using a Punnet square. Hh x hh

6. Math: Determine the PERCENTAGE of offspring from your data table. Show your work.

   That have two horns _____

   That have one horn _____

7. From the cross above, how many have ONE HORN _____ out of 8

   How many have TWO HORNS _____ out of 8

8. Compare this number to your simulation (where you flipped the sticks). Do the Punnett square predictions match the results of your crosses? Why do you think this is?

9. What if the female had the genotype Hh? Show the cross between the new parents Hh x Hh

What percentage has one horn? _____% What percentage has two horns? _____%

10. Show the cross if the parents are HH x Hh

What percentage has one horn? _____% What percentage has two horns? _____%

INCOMPLETE DOMINANCE VS. CODOMINANCE NOTES

Incomplete dominance

This phenomenon occurs when the alleles received by parents are neither dominant nor recessive but blend together and produce a physical trait that is somewhere in between the two traits.

For example:

the cross between a plant with red flowers with a plant with white flowers may produce a plant with flowers that are neither white not red but are pink which is a color made by blending red and white together.

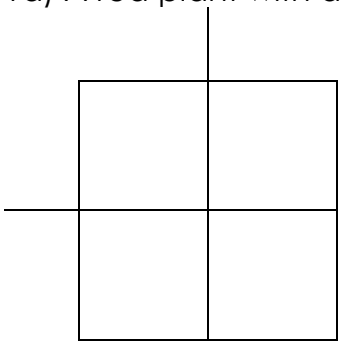
Sample Questions

1. In Japanese four o'clock plants red (R) color is incompletely dominant over white (r) flowers, and the heterozygous condition (Rr) results in plants with pink flowers. For each of the following construct a punnett square and give phenotypic and genotype ratios of the offspring.
    a) a red plant and a white plant
    b) a red plant and a pink plant
    c) a white plant and a pink plant
    d) two pink plants

2. In some cats the gene for tail length shows incomplete dominance. Cats with long tails and cats with no tails are homozygous for their respective alleles. Cats with one long tail allele and one no tail allele have short tails. For each of the following construct a punnett square and give phenotypic and genotype ratios of the offspring.
    a) a long tail cat and a cat with no tail
    b) a long tail cat and a short tail cat
    c) a short tail cat and a cat with no tail
    d) two short tail cats.

Sample Questions Answers

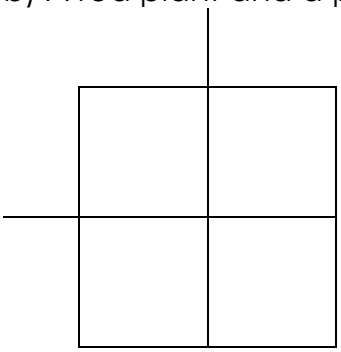
1a) A red plant with a white plant



phenotype ratio:

genotype ratio:

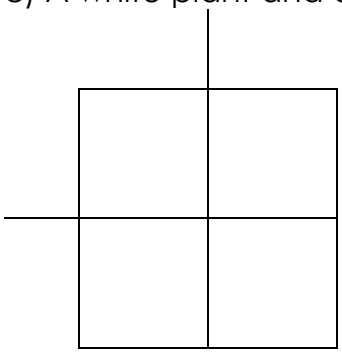
b) A red plant and a pink plant



phenotype ratio:

genotype ratio:

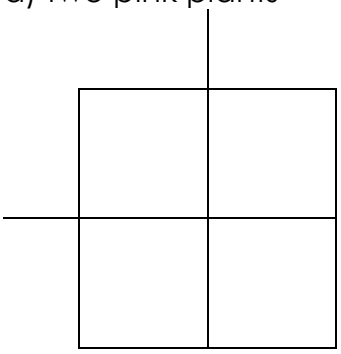
c) A white plant and a pink plant



phenotype ratio:

genotype ratio:

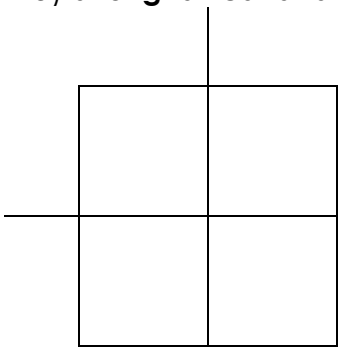
d) two pink plants



phenotype ratio:

genotype ratio:

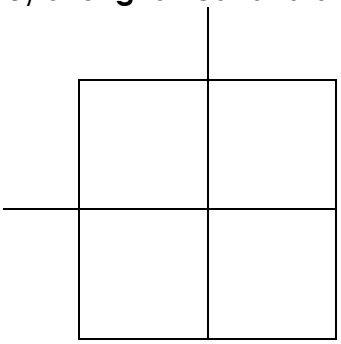
2 a) **a long tail cat and a cat with no tail**



phenotype ratio:

genotype ratio:

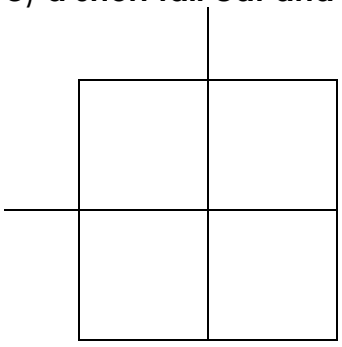
b) **a long tail cat and a short tail cat**



phenotype ratio:

genotype ratio:

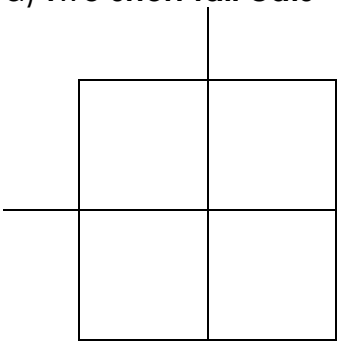
c) **a short tail cat and a cat with no tail**



phenotype ratio:

genotype ratio:

d) **two short tail cats**



phenotype ratio:

genotype ratio:

MORE FROM BIKINI BOTTOM…

SpongeBob loves growing flowers for his pal Sandy! Her favorite flowers, Poofkins are found in red, blue, and purple. Use the information provided and your knowledge of Incomplete Dominance to complete each section below:

3. Write the correct genotype for each colour if R represents a red gene and B represents a blue gene.

   Red = _____ Blue = _____ Purple = _____

4. What would happen if SpongeBob crossed a Poofkin with red flowers with a Poofkin with blue flowers. Complete a Punnett square to determine the chances of each flower colour.

5. What would happen if SpongeBob crossed a Poofkin with purple flowers with a Poofkin with blue flowers? Complete a Punnett square to show the probability for plants with each flower colour.

SpongeBob and his pal Patrick love to go jelly fishing at Jellyfish Fields! The fields are home to a special type of green jellyfish known as Goobers and only really great jelly fishermen are lucky enough to catch some on every trip. Many of the jellyfish are yellow (YY) or blue (BB), but some end up green as a result of incomplete dominance. Use this information to help you complete each section below:

6. What would happen if SpongeBob and Patrick crossed two "Goobers"? Complete a Punnett Square to help you determine the probability for each colour of jellyfish.

7. What would happen if they crossed a yellow jellyfish with a Goober? Complete a Punnett Square to help you determine the probability for each colour of jellyfish.

8. What would happen if they crossed a blue jellyfish with a yellow jellyfish? Complete a Punnett Square to help you answer the questions.

9. What would happen if they crossed a blue jellyfish with a Goober? Complete a Punnett Square to help you answer the questions.

10. Mr. and Mrs. Crabby both have tightly curled hair. (The hair form gene shows incomplete dominance. There are two alleles, curly and straight. The heterozygote has wavy hair.) The Andersons have a child with wavy hair. Mr. Crabby accuses Mrs. Crabby of being unfaithful to him. Is he necessarily justified? Why or why not?

11. Two wavy haired merpeople (one merman and one mermaid) marry and have eight children. Of these eight, how many would you expect to be curly haired, how many wavy haired and how many straight haired, assuming that the family follows the expected statistically predicted pattern? Suppose you examine the actual children and discover that three of the eight have curly hair. What do you suppose went wrong?

12. Basic body color for seahorses is influenced by several genes, one of which has several different alleles. Two of these alleles—the chestnut (dark brown) allele and a diluting (pale cream) allele (often incorrectly called 'albino')—display incomplete dominance. A horse heterozygous for these two alleles is a palomino (golden body color with flaxen mane and tail). Is it possible to produce a herd of pure-breeding palomino horses? Why or why not? Work the Punnett's square for mating a palomino to a palomino and predict the phenotypic ratio among their offspring.

CODOMINANCE NOTES

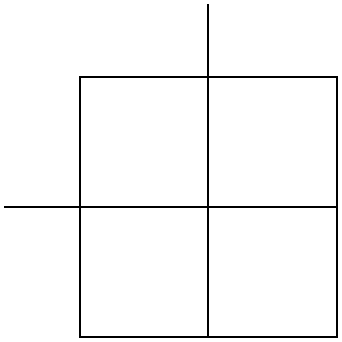
Codominance is a similar phenomenon where offspring receives neither dominant nor recessive genes. But instead of a blend of the two, both alleles get mixed up and are shown in the offspring.

Example:
in a cross with incomplete dominance, with red and white flowered plants, the offspring may show up white flowers with freckles of red spots. This is codominance in the sense that both genes are showing up, but neither is dominant.

Example:
Another very common phenotype used in questions about codominance is roan fur in cattle. Cattle can be red (RR = all red hairs), white (WW = all white hairs), or roan (RW = red & white hairs together.

Sample questions:

1. Predict the phenotypic ratios of offspring when a homozygous white cow is crossed with a roan bull.

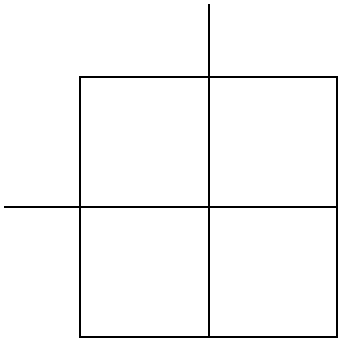


Phenotypically:

2. What should the genotypes & phenotypes for parent cattle be if a farmer wanted only cattle with red fur? Explain.

3. A cross between a black cat & a tan cat produces a tabby pattern (black & tan fur together).
   a. What pattern of inheritance does this illustrate?

   b. What % of kittens would have tan fur if a tabby cat were crossed with a black cat?



Blood Typing

Genotype	Phenotype	Surface Antigen	Can accept type…	Can Donate to…

WORKSHEET: Blood Types

1. List all the possible genotypes for each of the 4 blood types:

Type **O**: _____ Type **A**: _____

Type **B**: _____ Type **AB**: _____

2. A man with AB blood is married to a woman with AB blood. What blood types will their children be and in what proportion?

3. A man who has type B blood (genotype: BB) is married to a woman with type O blood. What blood type will their children have?

4. A woman with type A blood (genotype: AO) is married to a type B person (genotype: BO). What blood types will their children have?

5. A woman with type A blood is claiming that a man with type AB blood is the father of her child, who is also type AB. Could this man be the father? Show the possible crosses; remember the woman can have AO or AA genotypes.

6. A man with type AB blood is married to a woman with type O blood. They have two natural children, and one adopted child. The children's blood types are: A, B, and O. Which child was adopted?

7. A person with type A blood (unknown genotype) marries a person with type O blood. What blood types are possible among their children. (Show 2 crosses)

8. A person with type B blood (genotype BO) has children with a type AB person. What blood types are possible among their children?

9. A person with type O blood is married to a person with type A blood (unknown genotype). They have 6 children, 3 of them have type A blood, three of them have type O blood. What is the genotype of the two parents?

10. A person has type B blood. What are ALL the possible blood types of his parents. Show the crosses to prove your answer.

11. A man of unknown genotype has type B blood; his wife has type A blood (also unknown genotype). List ALL the blood types possible for their children. Use a sheet of lined paper for this. (you may need to do multiple crosses to consider the different possible genotypes of the parents)

12. Two people with type O blood have 3 children. How many of those 3 children also have type O?

13. Why is a person with type O blood called a "universal donor"?

14. Why is a person with type AB blood called a "universal acceptor"?

15. A woman with type A blood is claiming that a man with type AB blood is the father of her child who is type **B**. Could this man be the father of the child? Assuming that he is the father, what must the mother's genotype be?

16. A woman is searching for her father and she has type O blood. She looks through records of men who could be her father. Which blood type can she eliminate from her search? (In other words, her dad CANNOT be what blood type.) Explain how you know this.

MUTATION NOTES

Please follow along in class and fill in the blanks.

Mutagens

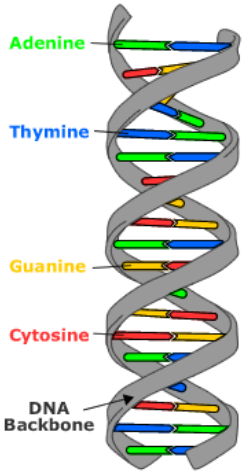
Carcinogens

Why is this rat hairless?

QUICK REVIEW ON PROTEIN SYNTHESIS:

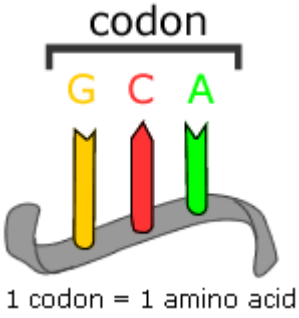
Your DNA contains a set of instructions for "building" a human.

These instructions are inscribed in the structure of the DNA molecule through a genetic code. It works like this:



- DNA is made of a long nucleotide sequence; made up of 4 bases (_____).
- The sequence of these bases encodes instructions.
- Some parts of your DNA are genes that carry the instructions for making _____ — which are long chains of _____. These proteins help build an organism.

- Protein-coding DNA can be divided into _____ — sets of three bases that specify an amino acid or signal the end of the protein.
- The _____ uses these instructions to assemble a string of corresponding amino acids (one amino acid for each three bases) that form a protein.
- After the protein is built based on the sequence of bases in the gene, the completed protein is released to do its job in the cell.



DNA IS CONSTANTLY SUBJECT TO MUTATIONS

- _____ can lead to _____ or _____ proteins, and that can lead to disease.

We all start out our lives with some mutations.

- These mutations inherited from your parents are called _____.

However, you can also acquire mutations during your lifetime.

- Some mutations happen during _____ when DNA gets _____.
- Still other mutations are caused when DNA gets damaged by _____, including _____, _____, and _____.

Few mutations are _____. In fact, some mutations can be beneficial. Over time, genetic mutations create _____, which keeps populations healthy.

But the mutations we hear about most often are the ones that cause _____. Some well-known inherited genetic disorders include _____, _____, _____, and _____, among many others. All these disorders are caused by the mutation of a single gene.

- Most inherited genetic diseases are _____, which means that a person must inherit _____of the mutated gene to inherit a disorder. This is one reason that marriage between _____is discouraged; two genetically similar adults are more likely to give a child two copies of a defective gene.

- Scientists estimate that every one of us has between _____potentially deadly mutations in our genes-the good news is that because there is usually only one copy of the bad gene, these diseases are not expressed.

- _____ usually results from a series of mutations within a single cell. Often, a faulty, damaged, or missing _____ gene is to blame. The _____ gene makes a protein that stops mutated cells from dividing. Without this protein, cells divide unchecked and become tumors.

Example: White Kermode Bear (Spirit Bear)

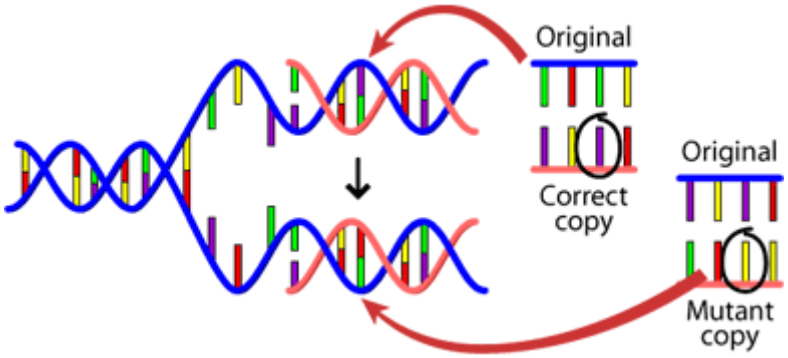
	B	b
B	BB	Bb
b	Bb	bb

- Mutation in a single base in the gene for coat colour is found in 1 out of every 10 black Kermode bears.
- Both parents must have this altered gene to have a white cub, and the cub must have received the altered gene form both parents.
- B = dominant brown colour

THE CAUSES OF MUTATIONS

(Take your own notes using online resources)

1. DNA fails to copy accurately



2. External influences can create mutations

TYPES OF MUTATIONS

(Take your own notes using online resources)

1. Point Mutations:

Deletion:

Addition:

Substitution:

2. Chromosome Mutations:

Inversion:

Duplication:

Translocation:

Deletion:

EFFECTS OF MUTATIONS

(Take your own notes using online resources)

Neutral Mutations

Beneficial or Positive Mutations

Harmful or Negative Mutations

MUTATIONS QUESTIONS

(answer in your notebook)

1. Describe a neutral mutation. Does this increase or decreases an organism's survival?
2. What happens when a cell is permanently damaged and cannot be fixed?
3. How can a mutation have a positive effect on an organism's survival? Think of two examples and describe them.
4. Explain how a negative mutation can cause cancer.

SICKLE CELL ANEMIA QUESTIONS

*Read the online document and answer the following questions. Feel free to use other online resources as well.

1. What is sickle cell anemia and what causes this disease?

2. Do people with one copy of the sickle cell gene have the disease? Why or why not?

3. Describe how this disease affects DNA. Use a diagram to explain.

4. Describe how this disease affects protein.

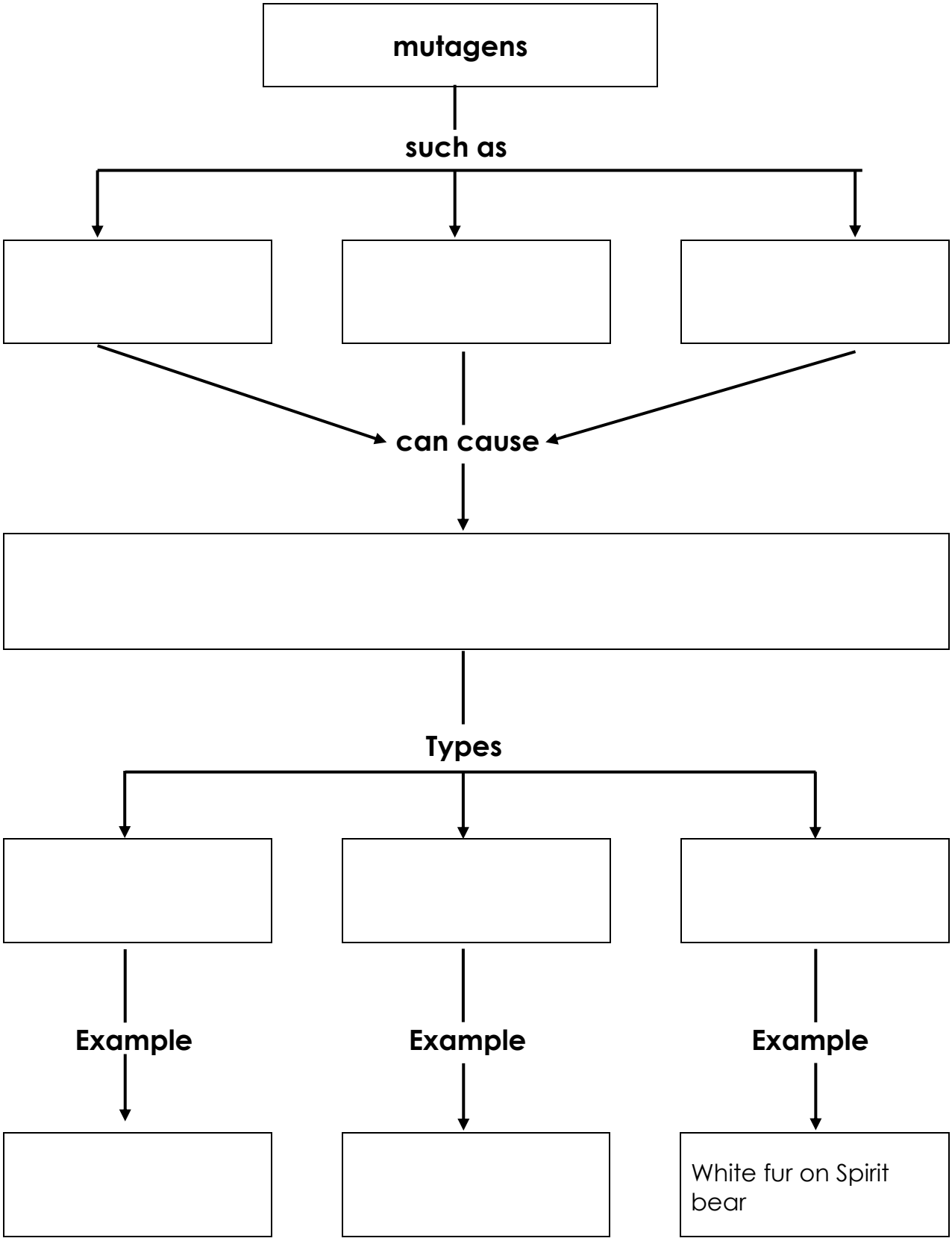
5. Compare and contrast red blood cells carrying the mutant gene with healthy red blood cells.

6. Describe what a "carrier" of sickle cell anemia means.

7. Are there positive effects of this mutation? Describe them.

MUTATIONS CONCEPT MAP

Use BC Science pp.136-141



Review (answer in your notebook)

1. Why are mutations essential for evolution to occur?
2. What is a genetic disorder?
3. What is cancer? What usually causes cancer?
4. What are chromosomal mutations?
5. What are mutations?
6. What are the two basic categories of mutations?
7. What are genetic mutations?
8. What happens in a "point mutation?"
9. When do point mutations occur?
10. What is the impact of a point mutation?
11. What are the types of point mutations?
12. What happens in genetic substitution?
13. What do genetic substitutions affect?
14. What happens with Insertions and Deletions?
15. What is another name for Insertions and Deletions?
16. What is the impact of "frameshift mutations?"
17. What is the impact of chromosomal mutations?
18. What is "deletion" in chromosomal mutation?
19. What is "duplication" in chromosomal mutation?
20. What is "inversion" in chromosomal mutation?
21. What is "translocation" in chromosomal mutation?
22. What can be the cause of mutations?
23. What are examples of a chemical mutagen?
24. What is are examples of physical mutagens?
25. How do mutagens effect DNA?
26. What determines whether a mutation will have a negative or beneficial affect?
27. Are mutations always negative?
28. Give an example of a beneficial effect of mutation.
29. Give two examples of the harmful effects of genetic mutations.

Correcting Mutations

Read about the topic in BC Science 9 on pp.141-143
Complete the "Check your understanding" questions on p. 145, then ***show your completed assignment to your teacher.***

NATURAL SELECTION: HOW POPULATIONS CHANGE

As the abiotic and biotic components of an ecosystem change, the populations of organisms living within it change as well. This is made possible through the process of Natural Selection.

Define the following:

Natural Selection:

Snail Example:

In every population there is _____. Each individual snail is slightly different than every other snail in many aspects (e.g., Colour)

1. Where do the different colour variations come from?

2. If this snail population lived on trees with dark coloured bark, which snails do you think would have the BEST colour adaptation to hide from predatory birds? Why?

3. If there are more light snails eaten over time than dark snails, who do you think has more time to reproduce?

4. Since shell colour is inherited (passed from parents to offspring), what colour will most of the snail population be over time?

5. What happens to the light-coloured snails? Are they completely wiped out?

6. Do snails have the ability to choose their colour? Can they "change" their colour?

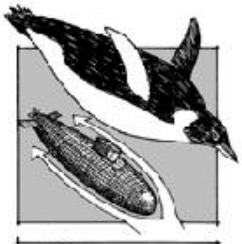
7. What if the dark-coloured trees were replaced with trees that have light coloured bark? What would happen to the snail population?

8. What factor determines who survives/reproduces and who does not?

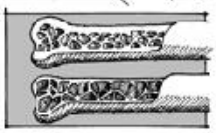
PENGUIN ADAPTATIONS

The following outlines some adaptations penguins have that make them successful inhabitants of Antarctica. Read the article and try to find as many adaptations as you can. Write the adaptations in the correct column below and indicate how this adaptation helps the penguin survive and reproduce.

Penguins are designed for life in the sea. Some species spend as much as 75% of their lives in the water. (They lay their eggs and to raise their chicks on land.) Heavy, solid bones act like a diver's weight belt, allowing them to stay underwater. Their wings, shaped like flippers, help them "fly" underwater at speeds up to 15 mph. A streamlined body, paddle-like feet, insulating blubber, and watertight feathers all add to their efficiency and comfort underwater. They also have a remarkable deep-diving ability.



In addition to blubber for insulating warmth, penguins have stiff, tightly packed feathers (up to 70 per sq. in.) that overlap to provide waterproofing. They coat their feathers with oil from a gland near the tail to increase impermeability. Black and white countershading makes them nearly invisible to predators from above and below.



Like most birds, penguins have little or no sense of smell. Like other birds, their sense of taste is also limited. Their vision appears to be better when they are underwater. Scientists suspect they may be nearsighted on land.

Penguins are considered to be the most social of birds. Rookeries (penguin communities) may contain thousands of individuals. (As many as 24 million penguins visit the Antarctic continent!) Even at sea, they tend to swim and feed in groups.

Most species of penguins build nests, but the nests may consist only of a pile of rocks or scrapings or hollows in the dirt. Emperor penguins build no nests; they hold the egg on top of their feet under a loose fold of skin called the brood patch.

Types of Adaptations	
Behavioural Adaptations	**How it helps the penguin survive and reproduce**

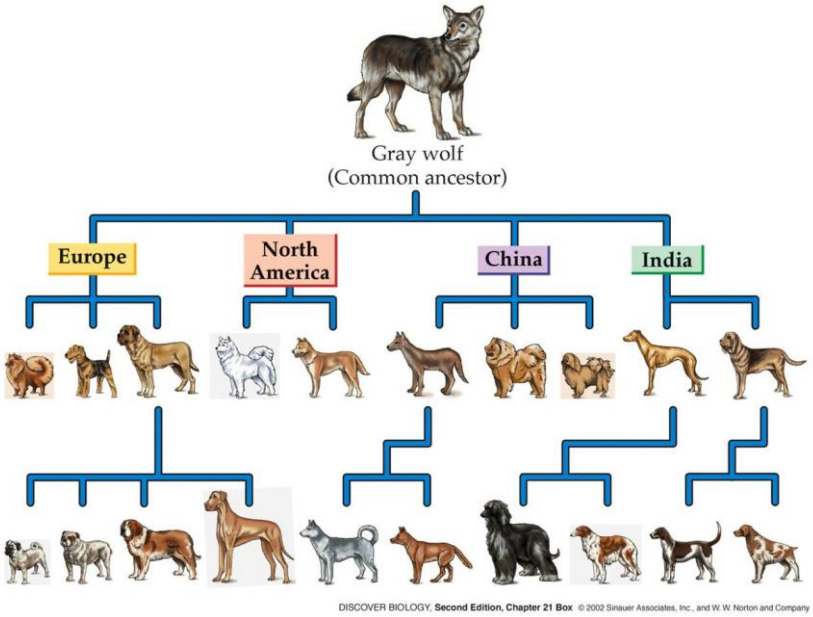
Types of Adaptations	
Physiological Adaptations	**How it helps the penguin survive and reproduce**
Structural Adaptations	**How it helps the penguin survive and reproduce**

Humans have adaptations as well. One example is how our eyes are located on the front of our head giving us binocular vision. This structural adaptation helps us hunt down quick moving prey. Something unique about humans is how we can artificially adapt to new extreme environment (when we travel for instance).

In the space provided below, list as many artificial adaptations you can think of.

ARTIFICIAL SELECTION; SELECTIVE BREEDING

Dogs



1. Why are purebred dogs highly susceptible to health problems?

2. How do cattle farmers use artificial selection? Why do they do this and what is the result?

3. How are humans affecting fish populations?

4. Why are bananas becoming "extnct"? *(further research needed)*

5. Find three more food products that have been artificially selected for our benefit. Describe what trait was selected for and what the result is. What are the consequences of these food products?

6. Do you have GMOs in your home?

BILL NYE VIDEO: GENETICALLY MODIFIED FOODS

1. In the United States, grocery shelves are filled with _____

   _____ foods. An example would be _____.
2. Can you take a gene from a fish and put it into a tomato? _____
3. If genes provide instructions to build a living thing, what happens if you change one of the genes? _____.
4. True or false: Most if the food you eat CANNOT be found in nature. _____
5. What was the difference between the two papayas?

6. What does transgenic mean?

7. "Agro-chemical companies created Golden Rice, a genetically modified species of rice, to help fight _____ on developing countries."
8. BT corn crops take proteins from _____ to help fight certain insects.
9. When are you eating genetically modified foods? What are some examples of genetically modified foods used in many products which you commonly eat everyday?

   a.

   b.

   c.
10. What are the three things Nye suggests for the human race:
    a. Let's farm _____
    b. Let's require _____
    c. And lets carefully _____ these foods case by case.
11. Do you think genetically modified foods have more risks or benefits and are comfortable eating genetically modified foods (like fish genes in tomatoes or bacteria proteins in corn)?

SELECTIVE PRESSURE REVIEW

1. Define the following terms:

a) Adaptation

b) Extinction

c) Invasive species

2. How do the three terms you defined apply to the concept of selection pressure?

3. What happens to genes that improve survival and reproduction?

4. How is climate a selective pressure?

5. How is food and energy sources a selective pressure?

6. How is predation a selective pressure?

7. How are humans a selective pressure?

V. KEY TERMS ASSIGNMENT RUBRIC

Flashcard Rubric

1. Cards can be:
    I. Handwritten
    II. Typed out and printed
    III. On a flashcard app. (Have to be able to send this to me in some way)
2. Term must be written clearly on one side and the definition must be on the other side.
3. Definition should be in own words and defined correctly. DO NOT copy terms from a dictionary or a textbook.
4. Cards must be stored together properly (ring, flashcard holder, etc.) *Do not shove all cards into binder pocket or backpack

Category	E	A	D	B
Organization	Cards are stored neatly. Dividers are used and categories make sense.	Cards are somewhat neatly stored, and some dividers are used.	Cards are not stored neatly. Dividers are not used.	Missing cards. Cards are not stored neatly. Dividers not used
Terms	All key terms are included. Additional terms are added.	All key terms are included. Only a few other terms were added	Some key terms are missing. No additional terms were added	Missing cards.
Presentation	Writing is legible. Colours are used. Images for terms are used where appropriate.	Writing is legible. Colours are used.	Handwriting is messy and hard to read	Messy, disorganized, and hard to read.
Definition	All definitions are correct and complete for context and written in your own words.	Most definitions are correct and complete for context and written in your own words.	Missing some definitions & or definitions are incorrect. Definitions have been plagiarized.	Definitions are poorly done, missing and/or plagiarized
Use of time	Used time well during each class period with no reminders.	Used time well during most class periods with few reminders.	Mostly used time well, but required reminders more than a few times	Used time poorly in spite of several reminders to do so.
Overall Mark for Skill 16:				

APPLICATIONS OF GENETICS (Poster Walk)

Technologies that allow beneficial manipulation of genes & ethical consideration of modern genetics

- You may choose a partner, or you may choose to do this project individually.
- You may come up with your own topic, but you must have your idea approved by your teacher.
- You must a minimum 5 sources; 2 of these sources cannot be websites.

Suggestions:

1. Genetically modified crops
2. Personal DNA data
3. Gene therapy
4. Pharming (the process of genetically modifying plants and animals so that they produce substances that may be used as pharmaceuticals.)
5. Cloning animals (we are animals, too!)
6. Would you want to know you had the gene for a fatal/disabling disease? Know when you were likely to die?
7. Selective abortion
8. Stem cell research
9. Trisomy 21
10. Inherited Disease (Pick One)
11. A topic of your own Choice

Use the space below and on the reverse to create an outline for your topic

Name: **Block: 1 -_____**

Partners Name:

POSTER RUBRIC

CATEGORY	E	A	D	B
PROCEDURES AND EVIDENCE	Plans and uses a variety of investigation methods and materials to collect reliable data Finds and uses data from a variety of reliable sources	Plans and uses a few investigation methods and materials to collect reliable data Finds and uses data from a reliable source	Collects some data Finds and uses data from unreliable sources	Data not cited Very few sources, or sources are not indicated
PERSPECTIVES AND ETHICS	Evaluates social, ethical, and environmental implications in investigations Considers perspectives relevant to a given context Discusses Pros and Cons from various sources	Evaluates social, ethical, and environmental implications in investigations Considers perspectives relevant to a given context Discusses Pros and Cons from one source	Discusses social, ethical, and environmental implications in investigations Somewhat considers perspectives relevant to a given context	Briefly touches on social, ethical, and environmental implications in investigations Does not consider perspectives relevant to a given context
COMMUNICATION	Information is very organized with well-constructed subheadings Diagrams and illustrations are neat, attractive, accurate, and add to the reader's understanding of the topic Clearly and concisely communicates scientific ideas and information Provides supportive and constructive feedback during collaborative planning, sharing, and reflection	Information is organized Diagrams and illustrations are neat and accurate and add to the reader's understanding of the topic Provides somewhat supportive and constructive feedback during collaborative planning, sharing, and reflection	Information is organized but not well-constructed Diagrams and illustrations are accurate and add somewhat to the reader's understanding of the topic Does not supportive and constructive feedback during collaborative planning, sharing, and reflection	The information appears to be disorganized Diagrams and illustrations are absent, inaccurate and add little to the reader's understanding of the topic No feedback during collaborative planning, sharing, and reflection