CH 5 lessons one + two (New textbook) pp. 149–168

Green text - CH 3-4

(M)

Genetics, the study of Heredity Name_____ sec____

- In the mid 1800s, Gregor Mendel used garden peas to study how traits were passed form parents to offspring. A **trait** is a characteristic, such as seed color, shape, seed coat color, pod shape + color, etc
- The passing of traits from parent to offspring is called **heredity**. The study of heredity is **genetics**. inheritance - traits transmitted through genes passed from parents to offspring
- Mendel started his experiments with purebred pea plants. A **purebred** always produces offspring that have the same trait. True bred
- In one experiment, Mendel crossed true-breeding purebred tall plants with purebred short plants. When Mendel crossed the plants, he took pollen from a flower on the tall plant & used it to pollinate a flower on a short plant. He collected the seeds that formed and grew them. All the offspring were tall. The trait for shortness seemed to disappear. = Cross pollination
- He allowed the offspring to pollinate themselves. = self pollination When he planted the seeds, he saw some short plants. About ¼ of the plants were short.
- The parent generation (**P1**) when crossed produce the first offspring generation (**F1**- F stands for filial). If you take 2 offspring & cross them- you produce the 2nd generation of offspring (**F2**).
- Mendel concluded that separate factors control how traits are inherited. These factors are in pairs, with one factor from the female and one factor from the male.
- Scientists call the factors that control traits **genes**. → are located on thread-like structures called chromosome The different forms of a gene are called **alleles**. The alleles are represented by letters. The letter chosen is usually the first letter of the trait. (dominant form) Two letters are used represent a trait. An offspring gets one letter/ allele from each parent. ∴ each parent contributes 50% to an offspring.
- A dominant allele always shows up in an organism, even when the other allele is present. A recessive allele is hidden whenever the dominant allele is present. It can only be seen when it is paired up with another recessive allele.

- In Mendel's crosses, the purebred parent plants had 2 alleles for tall stems. The purebred short parent had 2 alleles for short stem. The offspring plant had one allele for tall from the tall parent and one allele for short from the short parent.

- The offspring plant from Mendel's crosses are called **hybrids**. A hybrid has two different alleles for a trait. – Heterozygous

- The **dominant** form gets the **capital letter & is written first**

- The **recessive** gets the **lower case letter and is written second**.

"letters" Alleles

- The **genotype** of an organism is "genetics", the combination of the letters (one from female, one from male). = will determine ⇓

- The **phenotype** is what that trait physically looks like. = observable expression which is determined by genotype

Trait	Dominant	Recessive	Genotype	Phenotype
Pea height	Tall T	Short t	TT Tt tt	Tall Tall short

(alleles) (the same)

- **Homozygous**- two letters are alike (purebred) = true-breeding
- **Homozygous dominant**- two Capital letters- ex. TT
- **Homozygous recessive**- two lower case letters- ex. tt
- **Heterozygous**- two different letters- ex. Tt (hybrid)

(alleles) (genotypes)

Name _____ Date _____ Class _____

Content Vocabulary

LESSON 1

Mendel and His Peas

Directions: *On each line, write the term from the word bank that correctly replaces the underlined words in each sentence. NOTE: You may need to change a term to its plural form.*

A. **dominant trait** C. **egg** E. **genetics** G. **heredity**
B. **hybrid** D. **recessive trait** F. **sperm**

Choices

B
E
G

G. Heredity — **1.** Mendel used his pea plants to study the passing of traits from parents to offspring.

E. Genetics — **2.** Mendel's research is considered to be the foundation of the study of how traits are passed from parent to offspring.

B. hybrid — **3.** Mendel cross-pollinated pea plants with different forms of the same trait to produce offspring with two different forms of the same trait.

A
C
D
F

C. egg — **4.** Mendel concluded that the haploid cell formed in a female reproductive organ contributed one genetic factor for each trait.

F. sperm — **5.** The other genetic factor for each trait comes from a haploid cell formed in the male reproductive system.

A. dominant trait — **6.** In some cases, one of the factors, such as purple flower color, was the factor that blocked the other genetic factor.

D. recessive trait — **7.** The other factor was the one that is blocked by the presence of the dominant factor.

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Name _____ Date _____ Class _____

Pollen = male sperm

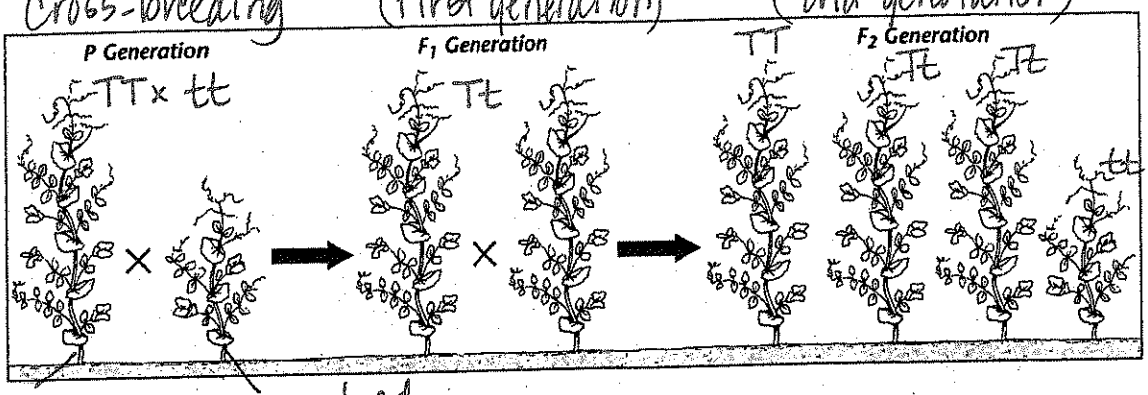
breeding: self-pollination cross-pollination

Mendel's Work

Understanding Main Ideas

Study the diagram. Then answer the following questions below

Cross-breeding (First generation) (2nd generation)



purebred purebred

1. What trait in pea plants is being studied in the cross above? height (length of stem)
2. What are the two alleles of this trait? Tall = T short = t
3. Which allele is the dominant allele? Explain how you know. Tall → trait is in F_1
4. Which allele is the recessive allele? Explain. short → masked by dominant
5. What alleles do the F_1 offspring have? Explain which allele was inherited from which parent. F_1 T t → from short parent; ↓ from Tall parent

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

Choices: D F G H A B C E

G	6. genetics	a. the passing of traits from parents to offspring
E	7. alleles	b. an organism with two different alleles for a trait
D	8. traits	c. factors that control traits
H	9. recessive allele	d. physical characteristics of organisms
C	10. genes	e. an allele whose trait always shows up in the organism
B	11. hybrid	f. the different forms of a gene
A	12. heredity	g. the scientific study of heredity
E	13. dominant allele	h. an allele whose trait is masked in the presence of a dominant allele

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Name _____ Date _____ Class _____

Modern Genetics • *Section Summary*

Human Inheritance

CH4 sec 1

Guide for Reading

- What are some patterns of inheritance in humans?
- What are the functions of the sex chromosomes?
- What is the relationship between genes and the environment?

Many human traits are controlled by a single gene with one dominant allele and one recessive allele. As with tall and short pea plants, these human traits have two distinctly different phenotypes, or physical appearances. For example, the allele for a widow's peak, which is a hairline that comes to a point in the middle of the forehead, is dominant over the allele for a straight hairline.

⇒ dimples
hitchhiker thumb
rolling tongue

Some human traits are controlled by single genes with two alleles, and others by single genes with multiple alleles. Still other traits are controlled by many genes that act together. Height and skin color are both examples of human traits controlled by many genes. When more than one gene controls a trait, there are many possible combinations of genes and alleles. There is an enormous variety of phenotypes for height, for example, and human skin color ranges from almost white to nearly black, with many shades in between.

blood-type ⇐
polygenic ⇐
-hair color
-skin color
-eye color
-height

Some human traits are controlled by a single gene that has more than two alleles. Such a gene is said to have **multiple alleles**—three or more forms of a gene that code for a single trait. An example of a human trait that is controlled by a gene with multiple alleles is blood type. There are four main blood types—A, B, AB, and O—controlled by three alleles.

The **sex chromosomes** are one of 23 pairs of chromosomes in each body cell. **The sex chromosomes carry genes that determine whether a person is male or female. They also carry genes that determine other traits.** If you are female, you have two X chromosomes. If you are male, you have an X and a Y chromosome. Whether you inherited an X or Y chromosome from your father determines your sex.

Genes on the X and Y chromosomes are often called **sex-linked genes.** Traits controlled by sex-linked genes are called sex-linked traits. Because males have only one X chromosome, males are more likely than females to have a sex-linked trait that is controlled by a recessive allele. One example of a sex-linked trait that is controlled by a recessive allele is red-green colorblindness. A **carrier** is a person who has one recessive allele for a trait and one dominant allele. Although a carrier does not have the trait, the carrier can pass the recessive allele on to his or her offspring. In the case of sex-linked traits, only females can be carriers.

⇒ heterozygous

The effects of genes are often altered by the environment—the organism's surroundings. **Many of a person's characteristics are determined by an interaction between genes and the environment.** Several genes determine human height. However, environment also influences people's heights. People's diets can affect their height. A poor diet can prevent a person from growing as tall as might be possible.

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Trait	Dominant	Recessive	Genotype	Phenotype
Tongue Rolling	**Roll tongue** R	**Can't roll tongue** r	RR Rr rr	Roll Roll _____
Ear lobes	**Free** F	**Attached** f	Homo. Dom Hetero. Homo. Rec	Free Free attached
Thumb Shape	**Hitchhiker** H	**Straight** h	HH Hh hh	Hitchhiker Hitchhiker Straight
Dimples	Dimples D	No dimples d	DD Dd dd	_____ _____ No dimples
Pinky Finger tips	Bent B	Straight b	BB Bb bb	_____ Bent Straight
Hand Clasping	Left over right L	Right over left l	LL Ll ll	_____ over _____ over _____ over

Other traits:
Hairline- Widow's peak vs. Straight hair line
Handedness- Right vs. Left
Cleft Chin- Cleft vs. Smooth
Freckles- Freckles vs. No freckles
Mid-digital hair- Hair vs. No hair
Eyebrow shape- Bushy vs. Fine
#Eyebrows- Non-connected vs. Connected (uni brow)
Lip Thickness- Thick vs. Thin
Ear Hair- Absent vs. Hairy
Nostril shape- Rounded vs. Pointes
Eye Lash Length- Long vs. Short
PTC (Phenylthiocarbamide) taste- Taste (bitter receptors on tongue) PTC-like chemicals are found in the Brassica family of vegetables, such as cabbage, Brussels sprouts, and broccoli. People who can taste PTC often do not enjoy eating these vegetables, since they taste bitter to them. Non-tasters tend not to notice bitter tastes and therefore may be more likely to become addicted to nicotine (which is bitter).

Sodium Benzoate Taste Paper – The most common taste reactions to sodium benzoate are: sweet, salty, or bitter, although some people note other or no response.

Name _____ Date _____ Class _____

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Put a check in the box for the version of the trait you have.

Trait	Dominant	Recessive	Genotype	Phenotype
Tongue Rolling	**Roll tongue** R	**Can't roll tongue** r	RR Rr rr	Roll Roll not
Ear lobes	**Free** F	**Attached** f	Homo. Dom FF Hetero. Ff Homo. Rec ff	Free Free attached
Thumb Shape	**Hitchhiker** H	**Straight** h	HH Hh hh	Hitchhiker Hitchhiker Straight
Dimples	Dimples D	No dimples d	DD Dd dd	Dimples Dimples No dimples
Pinky Finger tips	Bent B	Straight b	BB Bb bb	Bent Bent Straight
Hand Clasping	Left over right L	Right over left l	LL Ll ll	Left over Left over right over

Other traits:

Hairline- Widow's peak vs. Straight hair line
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Cleft Chin- Cleft vs. Smooth
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Genetic Crosses & Probability

Probability is the number that describes how likely it is that an event will occur.

Probability predicts what is likely to occur, not what will actually occur.

In a genetic cross, the allele that each parent will pass on to its offspring is based on probability.

A Punnett square is a chart that show all the possible combinations of alleles that can occur in a genetic cross. Geneticists use Punnett squares to predict the results of a cross.

The boxes in a Punnett square represent the possible combinations of alleles that offspring can inherit from their parents.

You can use a Punnett square to find the probability that offspring will have a certain combination of alleles,

To set up a Punnett square:
One parent is represented across the top- the other down the side.

* Each parent can contribute only ONE allele (letter) to their offspring.
* Take the parents Genotype- put one allele above/ beside one box on the Punnett square, the other allele above/next to the other box on the Punnett square.
* Combine the alleles on the outside of the Punnett Square box to form a pair inside the Punnett square box. → letters

Trait: Tongue Rolling Dominant R=roll recessive r=not rolling
Parents Genotype Hetero X Homo. rec. = Rr x rr
Parents Phenotype Roller X non roller
Punnett Square:

One Parent →
One Parent ↓

	R	r
r	Rr	rr
r	Rr	rr

Offspring Probability:
Genotype: 2Rr : 2rr
Phenotype (whole #) 2 roller : 2 non roller

other ways to represent results
%: 50% roller : 50% non roller
fraction: ½ roller : ½ non roller

Hitchhiker = H straight = h

Trait: Thumb type Dominant _____ recessive _____
Parents Genotype Hetero. X Hetero. Hh x Hh
Parents Phenotype Hitchhiker X Hitchhiker
Punnett Square:

One Parent →
One Parent ↓

	H	h
H	HH	Hh
h	Hh	hh

Offspring Probability:
Genotype: 1 HH : 2 Hh : 1 hh
Phenotype (whole #) 3 Hitchhiker : 1 straight

%: 75% hitchhiker : 25% stra
fraction: ¾ Hitchhiker : ¼ stra

Single Gene with 2 allele

Complete Dominance- One allele is dominant over the other

Examples: dimples, widows peak

widows = W

Trait: Hairline Dominant peak recessive straight hair line = w

Parents Genotype Homo. dom. X Homo. rec. = WW x ww

Parents Phenotype Widows X Straight

Punnett Square:

Offspring Probability:

Genotype: 4 Ww

Phenotype 4 widow

One Parent →

One Parent ↓

	W	W
w	Ww	Ww
w	Ww	Ww

Incomplete Dominance- Neither allele is dominant over the other so only lower case letters are used and the heterozygous is a blend of the two.

Trait: Feather color Homozygous alleles bb Homozygous alleles WW Heterozygous alleles bw

Parents Genotype homo. black X homo. white = bb x WW

Parents Phenotype black X white

Punnett Square:

Offspring Probability:

Genotype: 4 bw

Phenotype 4 grey

One Parent →

One Parent ↓

	b	b
w	bw	bw
w	bw	bw

b = black (bb) w = white (ww) bw = grey

Codominant ↓ ← Recessive

Single Gene with more than 2 alleles
Multiple Allele/ codominance- Ex. Blood Type- alleles A, B, O: A=B > O

Phenotype=Blood Type	Genotype	(Homo.) (Hetero.)
Type A	I^AI^A or I^Ai	AA or AO
Type B	I^BI^B or I^Bi	BB or BO
Type AB	I^AI^B	AB
Type O	ii	OO

Parents Genotype Homo. B X Homo. A = BB x AA
Parents Phenotype B X A
Punnett Square:

Offspring Probability:
Genotype: 100% AB
Phenotype 100% AB

One Parent →
One Parent ↓

	B	B
A	AB	AB
A	AB	AB

Simulated Blood Typing: Agglutination = + Clumping - NO Clumping

Simulated blood sample	Agglutination in Well A +/-	Agglutination in Well B +/-	Blood Type	Observations
Crime Scene				
Suspect 1				
Suspect 2				
Suspect 3				

1 W
2 X
3 Y
CS Z

+ = clumping (present) - = No clumping (absent)

males ♂ Females ♀

* male/fem Punnett square

Sex Chromosomes are one of the 23 pair of chromosomes in each body cell. The sex chromosomes carry the genes that determine if a person is a male or female. They also carry genes that determine other traits.

Females: XX Males: XY
The trait is written as a superscript on the X chromosome

* fann picture
* Ishihara Test

Sex Linked Traits- Trait is linked to the sex chromosome
Ex. Red-Green Colorblindness. – recessive trait

Color blindness or color vision deficiency is the decreased ability to perceive differences between some of the colors that others can distinguish. It is most often of genetic nature, but may also occur because of some eye, nerve, or brain damage, or exposure to certain chemicals.

Male: Normal Vision XY
Colorblind X^cY

Female: Normal Vision X^CX^C
Normal Vision "carrier" X^CX^c
Colorblind X^cX^c

* punnett Square

Parents Genotype X^CY x X^CX^c
Parents Phenotype normal ♂ x carrier ♀
Punnett Square:

One Parent →
One Parent ↓

	X^C	Y
X^C	X^CX^C	X^CY
X^c	X^CX^c	X^cY

Offspring Probability:
Genotype: $1X^CX^C : 1X^CX^c : 1X^CY : 1X^cY$
Phenotype 1 normal ♀ :
1 carrier ♀ :
1 normal ♂ :
1 CB ♂

Sex Influenced traits- trait is influenced by your gender/ hormones
And begins around the age of 13 or so. Your gender influences if the trait is dominant or recessive.

To display the trait:
If its dominant: the person needs ONE allele
If its recessive: the person needs TWO alleles

Example: Baldness B= bald b= normal hair growth

Genotype	Phenotype	
	Males	Females
BB	**Bald**	**normal but thin**
Bb	**Bald**	**normal**
bb	**normal**	**normal**

Sex Limited traits- the trait is limited to expression in one sex only due to hormones. It begins around the age of 13.

Example- Heavy beard H= heavy beard h= no heavy beard

Genotype	Phenotype	
	Males	Females
HH	heavy beard	No
Hh	heavy beard	No
hh	No	No

Polygenic trait- More than one gene controls the trait; its an additive affect.
Ex. eye color, hair color, skin color (all controlled by the amount of **melanin**/ brown pigment) and height.

Especially height- your genetic makeup might have you at 6 feet tall but your diet can affect how tall you actually get. Poor diets can result in you not achieving your potential,

Sponge Bob Genetics Power Point Name_____ sec 7-____

Trait- nose length **alleles**: L- Long nose l- stubby nose
body color Y- yellow body y- blue body
pant shape S- square pants s- round pants
eye shape R- round eyes r- oval eyes

1. Use the information for SpongeBob's traits to write the phenotype (physical appearance).
a. LL- Long nose e. Rr- round eyes
b. yy- blue body f. ll- stubby nose
c. Ss- square pants g. ss- round pants
d. RR- round eyes h. Yy- yellow body

2. Use the information in the chart in #1 to write the genotype(s) for each trait below.
a. yellow body- YY or Yy e. stubby nose- ll
b. round pants- ss f. round eyes- RR or Rr
c. oval eyes- rr g. square pants- SS or Ss
d. long nose- LL or Ll h. blue body- yy

3. Determine the genotypes for each using the information in the chart in #1
a. Heterozygous round eyes- Rr c. Homozygous long nose- LL
b. Purebred squarepants- SS d. Hybrid yellow body- Yy

4.
a. Phenotypes: Gerdy Ss Father Ss Mother ss
Genotypes of Sponge Gerdy's Father Squar Mother round Gerdy's genotype square

	S	s
s	Ss	ss
s	Ss	ss

b. Phenotype: BillyBob Square Genotype: Ss

c. Genotypes: BillyBob Ss X Gerdy Ss

	S	s
S	SS	Ss
s	Ss	ss

d. Possible Genotypes: 1SS: 2Ss: 1ss Phenotypes: 3 square : 1 round
e. Probability of having squarepant kids? 75%
f. Probability of having roundpants kids? 25%

5. Nose shape- Long nose= dominant-letter = L Button nose= recessive- letter= l
Phenotype SpongeFred: Long X SpongeWilma: Long
Genotype SpongeFred: LL X SpongeWilma: Ll

6. Pant Color- Blue= dominant – letter= B Pink= recessive- letter = b
Phenotype SpongeBillyBob: blue X SpongeGerdy: pink
Genotype SpongeBillyBob: Bb X SpongeGerdy: bb

7. Tentacle presence- Tentacles= dominant – letter= T No tentacles= recessive- letter = t
Phenotype Squidward: tentacles X wife: tentacles
Genotype Squidward: Tt X wife: Tt

8. Eyeball size- Skinny eyes= dominant- letter= S Wide eyes= recessive – letter= s
Phenotype Mr. Krabbs: Skinny X wife, Mrs. Krabbs: Skinny
Genotype Mr. Krabbs: SS X wife, Mrs. Krabbs: Ss

9. Head shape- pointy head= dominant- letter= P square head= recessive – letter= p
Phenotype Patrick: pointy X Helga: Square = Baby pointy
Genotype Patrick: PP X Helga: pp = Baby Pp

10. Eyeball size- Huge eyes= dominant- letter= H small eyes= recessive – letter= h
Phenotype Plankton: huge X Claudette: tiny
Genotype Plankton: HH or Hh X Claudette: hh
Child? Not possible to be purebred since claudette only has h to give

11. Height- Dwarfism (Achondroplasia)= dominant- letter= D Normal height= recessive – letter= d
Phenotype Matt Rolof: Dwarf X Amy: Dwarf
Genotype Matt Rolof: Dd X Amy: Dd
Child: 25% normal : 75% Dwarf

	D	d
D	DD	Dd
d	Dd	dd

Review
1. Coat color in Tigers: Dominant- Orange= O- genotypes OO, Oo Recessive- white = o- genotype oo
2. Complete the chart:
T= Tall/ t= short; Y=yellow seed color/ y= green; R= round shape/ r= wrinkled; G= gray seed coat/ g= white seed coat

Genotype	Phenotype
TT	Purebred Tall
Yy	Hybred Yellow
Rr	Hybred Round
yy	Green seeds
GG or Gg	Gray seed coat color

3.

Trait		#	Symbol	Alleles	Trait 2	#	Symbol	Alleles
Earlobe shape	Free ear lobes				Attached ear lobes			
Finger hair	Mid digital hair				No mid digital hair			
Hairline	Widows peak				No Widow's peak			
Hair type	Curly hair				Straight hair			
Chin shape	Cleft (dimple)				Smooth chin			
PTC taste	Can taste PTC				Can not taste PTC			

Bikini Bottom Genetics Name _____

Scientists at Bikini Bottoms have been investigating the genetic makeup of the organisms in this community. Use the information provided and your knowledge of genetics to answer each question.

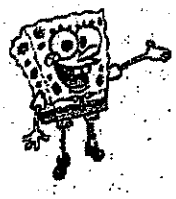
1. For each genotype below, indicate whether it is a heterozygous (He) OR homozygous (Ho).

TT Ho Bb He DD Ho Ff He tt Ho dd Ho
Dd He ff Ho Tt He bb Ho BB Ho FF Ho

Which of the genotypes in #1 would be considered purebred? TT, ff, DD, bb, tt, BB, dd, FF

Which of the genotypes in #1 would be hybrids? Dd, Bb, Tt, Ff

2. Determine the phenotype for each genotype using the information provided about SpongeBob.



Yellow body color is dominant to blue.
YY Yellow Yy Yellow yy blue

Square shape is dominant to round.
SS Square Ss Square ss round

3. For each phenotype, give the genotypes that are possible for Patrick.

A tall head (T) is dominant to short (t).
Tall = TT or Tt Short = tt



Pink body color (P) is dominant to yellow (p).
Pink body = PP or Pp Yellow body = pp

4. SpongeBob SquarePants recently met SpongeSusie Roundpants at a dance. SpongeBob is heterozygous for his square shape, but SpongeSusie is round. Create a Punnett square to show the possibilities that would result if SpongeBob and SpongeSusie had children. HINT: Read question #2!

S = square
s = round

	S	s
s	Ss	ss
s	Ss	ss

A. List the possible genotypes and phenotypes for their children.
genotype 2 Ss : 2 ss
phenotype 2 Square : 2 round

B. What are the chances of a child with a square shape? 2 out of 4 or 50 %

C. What are the chances of a child with a round shape? 2 out of 4 or 50 %

5. 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. HINT: Read question #3!

P = pink
p = yellow

	P	p
P	PP	Pp
p	Pp	pp

A. List the possible genotypes and phenotypes for their children.
genotype 1 PP : 2 Pp : 1 pp
phenotype 3 pink : 1 yellow

B. What are the chances of a child with a pink body? 3 out of 4 or 75 %

C. What are the chances of a child with a yellow body? 1 out of 4 or 25 %

6. 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. B = Blue, b = green



	B	B
b	Bb	Bb
b	Bb	Bb

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

B. What are the chances of a child with light blue skin? 100 %

C. What are the chances of a child with light green skin? 0 %

D. Would Squidward's children still be considered purebreds? Explain!
No, hybrid. They are heterozygous for the trait

7. 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.

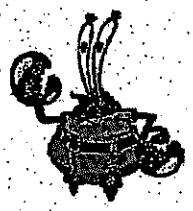
	B	b
B	BB	Bb
b	Bb	bb

A. List the possible genotypes and phenotypes for their children.
genotype 1 BB : 2 Bb : 1 bb
phenotype 3 Blue : 1 green

B. What are the chances of a child with light blue skin? 75 %

C. What are the chances of a child with light green skin? 25 %

8. 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.



	T	T
T	TT	TT
t	Tt	Tt

A. List the possible genotypes and phenotypes for their children.
genotype 2 TT : 2 Tt
phenotype 100% tall

B. Did the hospital make a mistake? Explain your answer.
Yes, Mr. Krabb doesn't have a short eyeball allele to give

Bikini Bottom Genetics 2 Name _____

Use your knowledge of genetics to complete this worksheet.

1. Use the information for SpongeBob's traits to write the phenotype (physical appearance) for each item.

Trait	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)
Nose Style	Long (L)	Stubby (l)

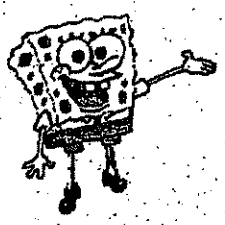
(a) LL- Long nose (e) Rr- Round eye

(b) yy- blue body (f) ll- Stubby nose

(c) Ss- Square pants (g) ss- roundpants

(d) RR - Round eyes (h) Yy - Yellow body

2. Use the information in the chart above to write the genotype (or genotypes) for each trait below.



(a) Yellow body - YY or Yy (e) Stubby nose - ll

(b) Roundpants - RR or Rr (f) Round eyes - RR or Rr

(c) Oval eyes - rr (g) Squarepants - SS or Ss

(d) Long nose - LL or Ll (h) Blue body - yy

3. Determine the genotypes for each using the information in the chart above.

(a) Heterozygous round eyes - Rr (c) Homozygous long nose - LL

(b) Purebred squarepants - SS (d) Hybrid yellow body - Yy

4. One of SpongeBob's cousins, SpongeBillyBob, recently met a cute squarepants gal, SpongeGerdy, at a local dance and fell in love. Use your knowledge of genetics to answer the questions below.

(a) If SpongeGerdy's father is a heterozygous squarepants and her mother is a roundpants, what is her genotype? Complete the punnett square to show the possible genotypes that would result to help you determine Gerdy's genotype.

What is Gerdy's genotype? Ss

	S	s
s	Ss	ss
s	Ss	ss

(b) SpongeBillyBob is heterozygous for his squarepants shape. What is his genotype? Ss

(c) Complete the punnett square to show the possibilities that would result if Billy Bob & Gerdy had children.

	S	s
S	SS	Ss
s	Ss	ss

(d) List the possible genotypes and phenotypes for the kids.

genotype 1 SS: 2 Ss: 1 ss

phenotype 3 Square : 1 round

(e) What is the probability of kids with squarepants? 75 %

(f) What is the probability of kids with roundpants? 25 %

5. SpongeBob's aunt and uncle, SpongeWilma and SpongeWilbur, have the biggest round eyes in the family. Wilma is believed to be heterozygous for her round eye shape, while Wilbur's family brags that they are a pure line. Complete the punnett square to show the possibilities that would result if SpongeWilma and SpongeWilbur had children.

(a) Give the genotype for each person. Wilma - Rr Wilbur - RR

(b) Complete the punnett square to show the possibilities that would result if they had children.

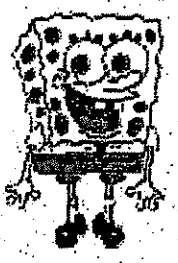
	R	R
R	RR	RR
r	Rr	Rr

(c) List the possible genotypes and phenotypes for the kids.
genotypes 2 RR : 2 Rr
phenotypes 4 Round

(d) What is the probability that the kids would have round eyes? 100 %

(e) What is the probability that the kids would be oval eyes? 0 %

6. SpongeBob's mother is so proud of her son and his new wife, SpongeSusie, as they are expecting a little sponge. She knows that they have a 50% chance of having a little roundpants, but is also hoping the new arrival will be blue (a recessive trait) like SpongeSusie and many members of her family. If SpongeBob is heterozygous for his yellow body color, what are the chances that the baby sponge will be blue? Create a punnett square to help you answer this question.



	Y	y
y	Yy	yy
y	Yy	yy

chance of a blue baby
50%

7. SpongeBob's aunt is famous around town for her itty, bitty stubby nose! She recently met a cute squarepants fellow who also has a stubby nose, which is a recessive trait. Would it be possible for them to have a child with a regular long nose? Why or why not? Create a punnett square to help you answer this question.

	l	l
l	ll	ll
l	ll	ll

Can they have a child w/a long nose?
Yes (No) - because Neither has the allele for long nose

8. If SpongeBob's aunt described in #7 wanted children with long noses, what type of fellow would she need to marry in order to give her the best chances? Create a punnett square to help you answer this question.

	L	L
l	Ll	Ll
l	Ll	Ll

Her fellow must be Homo. Dom. for long nose

Bikini Bottom – Dihybrid Crosses Name _____

Use the chart to identify the genotypes of the following traits:

1. Heterozygous round eyes, blue body Rr yy
2. Hybrid eye shape, purebred roundpants Rr ss
3. Purebred roundpants, heterozygous long nose ss Ll

Trait	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)
Nose Style	Long (L)	Stubby (l)

4. SpongeBob's aunt, who is a roundpants, has a cute stubby nose. She has finally found the sponge of her dreams and is ready to settle down. Her fiancé always comments on how adorable her nose is (he says it reminds him of his mother's – aww, how sweet!). They wonder what the chances are of that trait being passed on. Her fiancé is a purebred squarepants and is a hybrid for his long nose.

F - First two
O - outer two
I - Inner two
L - Last two

A. Identify the genotypes of the aunt and her fiancé.

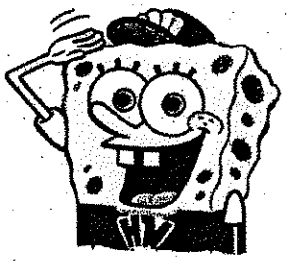
Aunt = Roundpants, Stubby Nose = ssll Fiancé = Purebred Squarepants, Long Nose = SSLl

B. What are the possible gamete combinations for each person?

Aunt = sl sl sl sl Fiancé = SL Sl SL Sl

C. What are the possible genotypes for their children? SsLl Ssll

5. As we know, SpongeBob is heterozygous for his yellow body color and his squarepants, while his wife SpongeSusie is blue and has roundpants. Use this information to answer the following questions.



A. Give the genotypes for each.

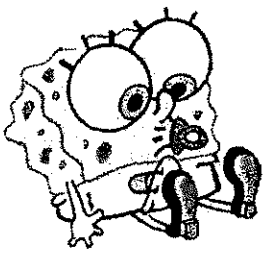
SpongeBob = Yy Ss SpongeSusie = yyss

B. What are the possible gamete combinations for each person?

SpongeBob = YS Ys yS ys SpongeSusie = ys

C. Complete the Punnett square based on the information provided in #5.

	YS	Ys	yS	ys
ys	YySs	Yyss	yySs	yyss



D. Answer the questions based on your Punnett square.

What is the chance of a blue baby? 50%

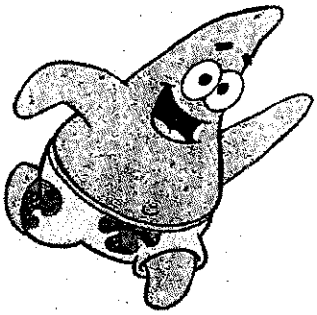
What is the chance of a blue squarepants? 25%

What is the chance of a squarepants? 50%

What is the chance of a purebred recessive for both traits? 25%

Contributed by Andrea Stonebraker

6. In starfish, pink body color (P) is dominant to orange (p), and thick eyebrows (T) are dominant over thin (t) ones. Patrick, who is heterozygous for body color but purebred for thick eyebrows, has met Patti, who is recessive for both traits. Patrick PpTT



A. What is Patti's phenotype? orange body thin brow

B. Is it possible for the new couple to have offspring that resemble their mother? Explain.
No, Patrick doesn't have a lower case t to give

C. Before Patrick commits to this relationship, he would like to guarantee that his offspring would have his thick eyebrows as he thinks they make him smarter! You need to provide evidence for or against the marriage with regards to eyebrows ONLY.

	T	T
t	Tt	Tt
t	Tt	Tt

Patrick's genotype will guarentee a thick eyebrow offspring since he only has capital "T's" to give

7. While Squidward's family boasts about being a purebred line for dominant light blue skin color, they are also purebred for a less distinguished trait: the recessive trait of baldness. Lack of hair causes Squidward some self-esteem issues that he does not want his children to face. He would like to ensure that his offspring have hair AND with his blue skin color. What traits should he look for in a bride?



A. Must she have hair? Explain. Yes, best option if she is homo, dominant for hair (HH)

B. Must she be blue? Explain. No, Squidward is homozygous dominant and only has a B to give

Squidward Traits: BBhh

Skin Color
Blue = B, Green = b

Hair
Hair = H, Bald = h

C. Squidward has found a potential bride prospect with the green squid Octavia. While Octavia has hair, her father does not. Determine the chances of their child being blue and having hair.

Squidward's Genotype = BBhh Octavia's Genotype = bbHh

D. Use the genotypes in above to complete the Punnett square below and then answer the questions.

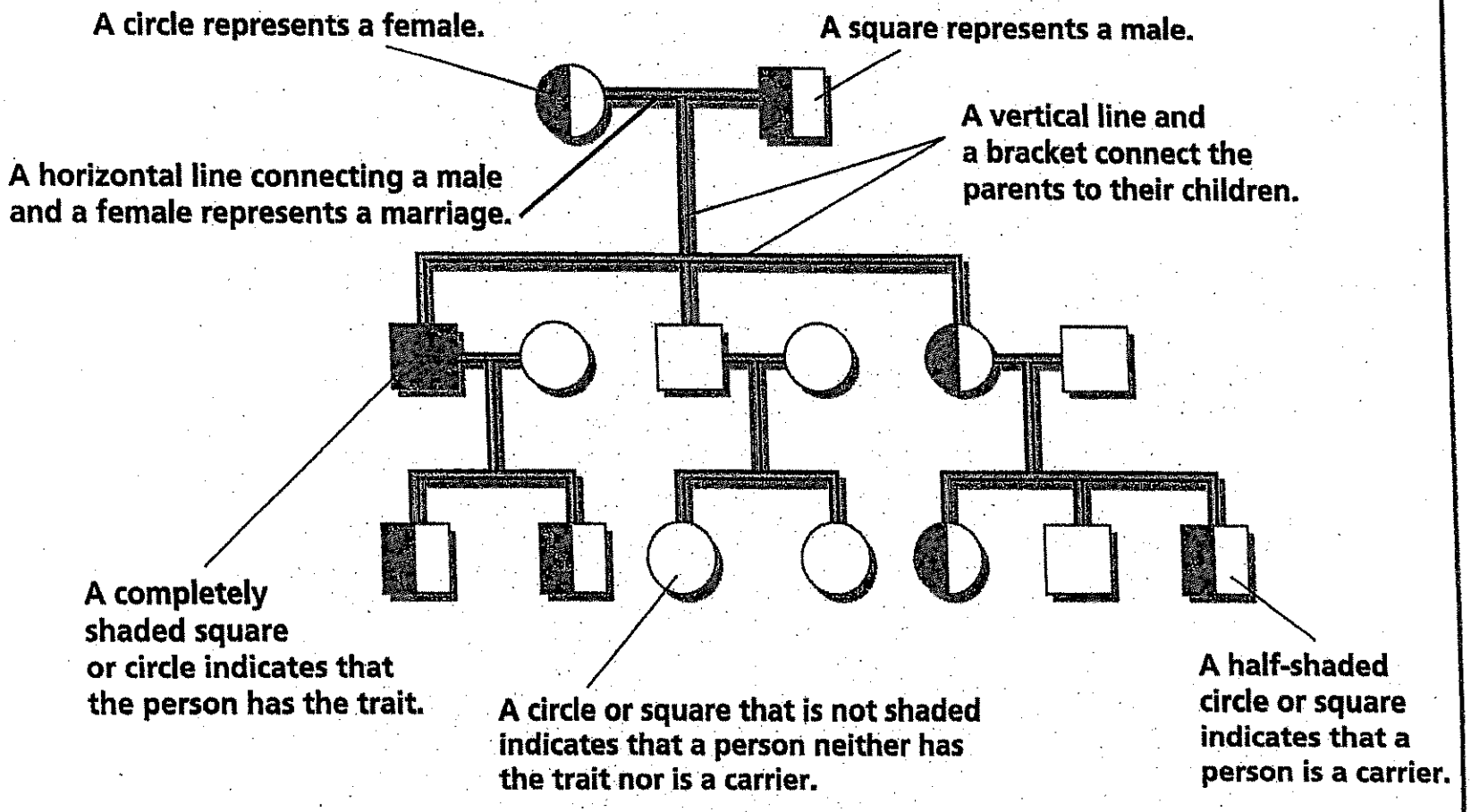
	bH	bH	bh	bh
Bh	BbHh	BbHh	Bbhh	Bbhh

E. Answer these questions based on your Punnett square.

For which traits, if any, is it possible for their offspring to be purebred? Neither

What is the probability of their children being heterozygous for both traits? 50%

C36 A Pedigree



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Pedigrees (page 119)

Key Concept: **One important tool that geneticists use to trace the inheritance of traits in humans is a pedigree.**

- A **pedigree** is a chart or "family tree" that tracks the members of a family that have a certain trait.
- Geneticists use pedigrees to follow a human trait through several generations of a family. This helps geneticists learn how the trait is inherited.
- In a pedigree, a circle stands for a female (woman). A square stands for a male (man). A line connecting a square and circle shows that the man and woman are married. Children are connected to their parents by a line and a bracket.
- A shaded square or circle stands for a person who has the trait. A half-shaded square or circle stands for a person who carries just one allele for the trait, but does not show the trait. A person who carries one allele for a trait, but does not have the trait is called a carrier. A circle or square that is not shaded stands for a person who does not have the trait.

Answer the following questions. Use your textbook and the ideas above.

3. What is a chart that follows a trait through several generations of a family? Circle the letter of the correct answer.

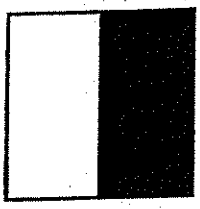
   a. Punnett square

   b. allele combinations

   (c.) pedigree

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4. Look at the symbol below.



a. Does this symbol stand for a male or a female?

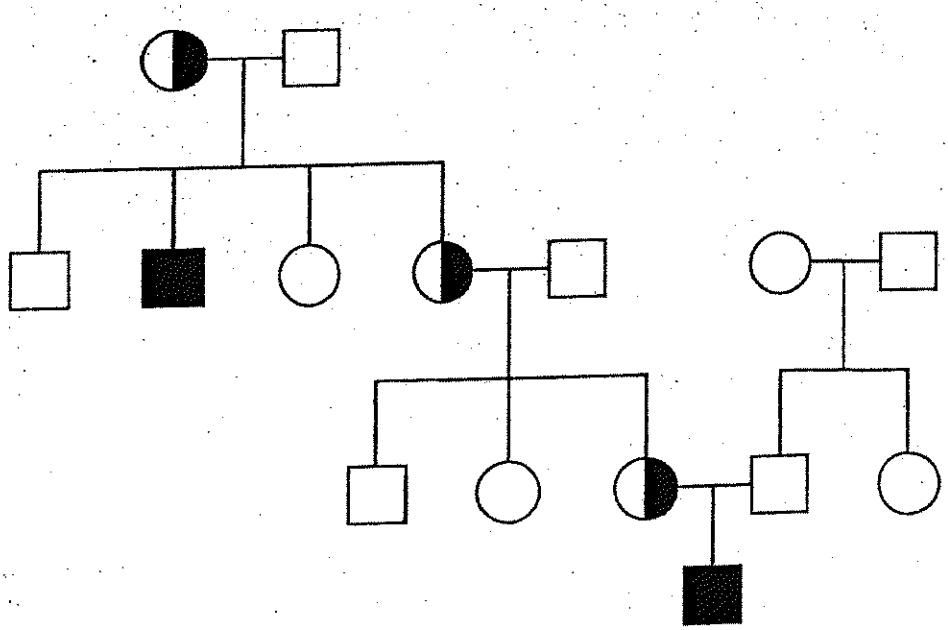
_____

b. Does this symbol stand for a person who has the trait or one who is a carrier for the trait?

_____

5. The chart below follows hemophilia in a family. Hemophilia is a genetic disorder in which the blood does not clot normally. How many males (men) have hemophilia? Circle the letter of the correct answer.

a. 1
b. 2
c. 3



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Name _____ Date _____ Class _____

Content Practice A **LESSON 2**

Understanding Inheritance

Directions: *On the line before each definition, write the letter of the term that matches it correctly. Each term is used only once.*

E **1.** threadlike structures in cells
I **2.** contain instructions for traits
K **3.** two different forms of a gene
P **4.** outward appearance
C **5.** determines outward appearance
A **6.** represented by uppercase letters
M **7.** represented by lowercase letters
G **8.** *RR*
D **9.** *Rr*
O **10.** shows possible outcomes of genetic crosses
B **11.** shows inherited traits in a family
H **12.** produces a blend of the parents' phenotypes
F **13.** when both alleles are expressed
L **14.** determines human blood type
N **15.** when multiple genes determine a phenotype
J **16.** can sometimes influence expression of genes

A. dominance
B. pedigree
C. genotype
D. heterozygous
E. chromosomes
F. codominance
G. homozygous
H. incomplete dominance
I. genes
J. environmental factors
K. alleles
L. multiple alleles
M. recessiveness
N. polygenic inheritance
O. Punnett square
P. phenotype

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HW 31

Key

Genotypes:

Phenotypes:

Trait: _____

Trait information:

you + your siblings

parents + siblings

grandparents

Student Name: _____ sec: 7-____ 32

Name _____ Date _____ Class _____

CH4 sec 3

Advances in Genetics

Guide for Reading

- What are three ways of producing organisms with desired traits?
- What is the goal of the Human Genome Project?

For thousands of years, people have tried to produce plants and animals with desirable traits. **Selective breeding, cloning and genetic engineering are three methods for developing organisms with desirable traits.**

The process of selecting organisms with desired traits to be parents of the next generation is called **selective breeding**. People have used selective breeding with many different plants and animals. One selective breeding technique is called inbreeding. **Inbreeding** involves crossing two individuals that have similar characteristics. One goal of inbreeding is to produce breeds of organisms with specific traits. For example, by only crossing horses with exceptional speed, breeders can produce purebred horses that can run very fast. Unfortunately, inbreeding also increases the probability that organisms may inherit alleles that lead to genetic disorders. Another selective breeding technique is called hybridization. In **hybridization,** breeders cross two genetically different individuals. The hybrid organism that results is bred to have the best traits from both parents. For example, a farmer might cross corn that produces many kernels with corn that is resistant to disease.

For some organisms, another technique, called cloning, can be used to produce offspring with desired traits. A **clone** is an organism that is genetically identical to the organism from which it was produced. One way to produce a clone of a plant is to cut and grow a small part of a plant, such as a leaf or stem. Several types of animals have been cloned in recent years.

Another technique for producing organisms with desired traits is called genetic engineering. In **genetic engineering,** genes from one organism are transferred into the DNA of another organism. Genetic engineering can produce medicines and improve food crops, and may some day correct human genetic disorders. In a type of genetic engineering called **gene therapy,** working copies of a gene may be inserted directly into the cells of a person with a genetic disorder. Some people are concerned about the long-term effects of genetic engineering.

A **genome** is all the DNA in one cell of an organism. **The main goal of the Human Genome Project has been to identify the DNA sequence of every gene in the human genome.** From the Human Genome Project, scientists hope to learn more about what makes the body work and what causes things to go wrong. A genetic technique called DNA fingerprinting is used to identify people. No two people, except for identical twins, have the same DNA.

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Artificial methods of Genetic control

Controlled breeding- Allowing only those organisms with the desired traits to reproduce.

Mass Selection- Choosing the desired organisms (those with the desired traits or characteristics) from a large mass or Number of organisms. This method is used to produce new varieties but not new characteristics. It merely reshuffles alleles so new combinations of various characteristics occur in offspring.

Inbreeding-The process of crossing two closely related individuals. This ensures that succeeding generations carry the desired trait it preserves desirable characteristics within a breed. In animals- siblings are crossed, with plants- self fertilization is used.
Negative side is inbreeding depression which results in a decrease in the health or fertility of each succeeding generation.
Solution- Outcrossing. An inbred organism is crossed with a less closely related organism. Basically, introducing a new genes into a blood line

Hybridization- the crossing of two breeds to obtain an offspring with characteristics of both parents. This technique increases the number of desirable characteristics in an organism. This process can lead to new breeds or varieties,
Ex. Mule = female horse (large size & strength) X male donkey (hardiness)
Unfortunately, mules are sterile since 2 different species (different number of chromosomes) were bred.

Cloning- A method of asexual reproduction in which a single body cell produces large numbers of identical cells resulting in organisms identical to other offspring and its parent.

Genetic Engineering- Scientists manipulate the genes of organisms~ isolating genes, creating artificial genes and moving genes from one DNA molecule to another.
Ex. Producing insulin from genetically altered bacteria.
Insulin regulates the amount of sugar in the bloodstream. Until recently; people with diabetes have been given insulin produced from cows & pigs. This insulin contains foreign proteins which may cause allergic reactions. Insulin from genetically altered bacteria contains no foreign proteins.

Ex. Human growth hormone controls bone growth. Children with lack enough of this protein grow very slowly and never reach normal size. Genetic engineering has made it possible to make large amounts of this hormone to treat children and also treat slow-healing bone fractures.

Ex. Agricultural uses have created genetically engineered food products and plants resistant to herbicides. Concern arises to how these products will affect the human population eating these products. For example, wide use of herbicides is linked to genetic damage, birth defects & cancer.

As technology for genetic engineering advances, new benefits and new problems arise. It is important that citizens keep informed about these pro's and cons.

→ **Extra credit option**: Research a product produced by genetic engineering. (+5)
1. Explain, in detail, the product and how it was genetically engineered.
2. List One "pro" and one "con" for this development.
3. Express your view point. Do you agree or disagree with the development of this product? Why or Why not?

Due by _____