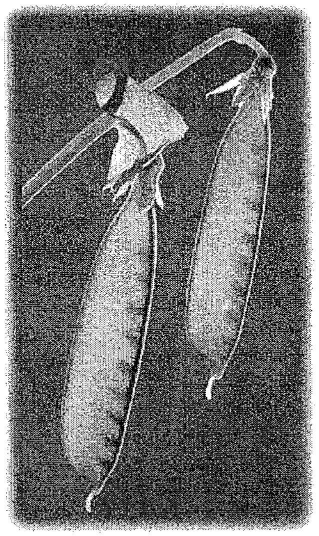
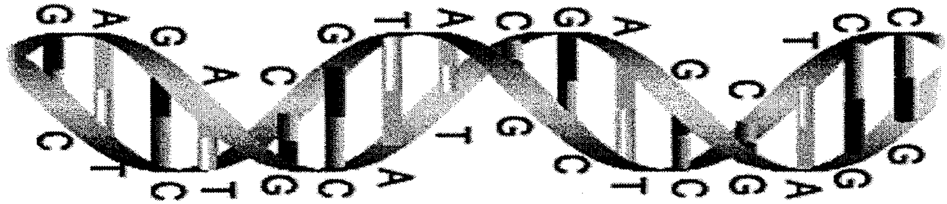
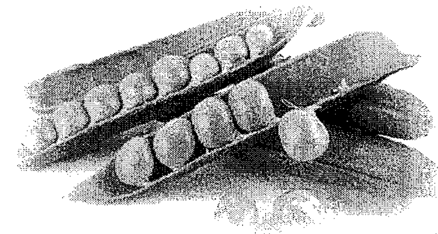
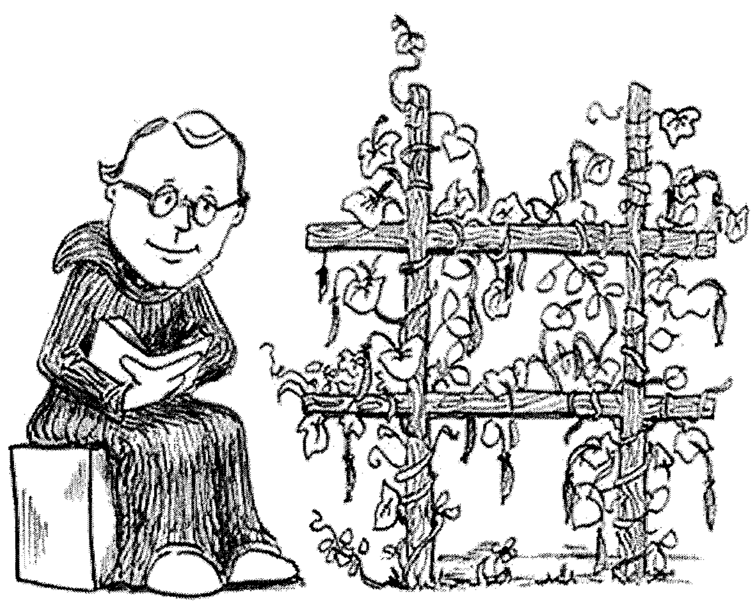






Mendelian Genetics

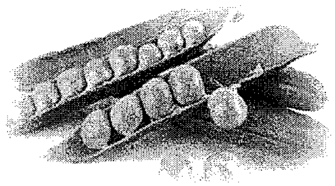


Introduction to Genetics

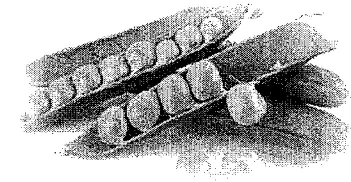
https://www.youtube.com/watch?v=Mehz7tCxjSE

Do Now –

1. Who is known as the "father of modern genetics" ?
2. He discovered the basic principles of heredity using what plants ?
3. Name the cell organelle where genetic material (DNA) is stored?



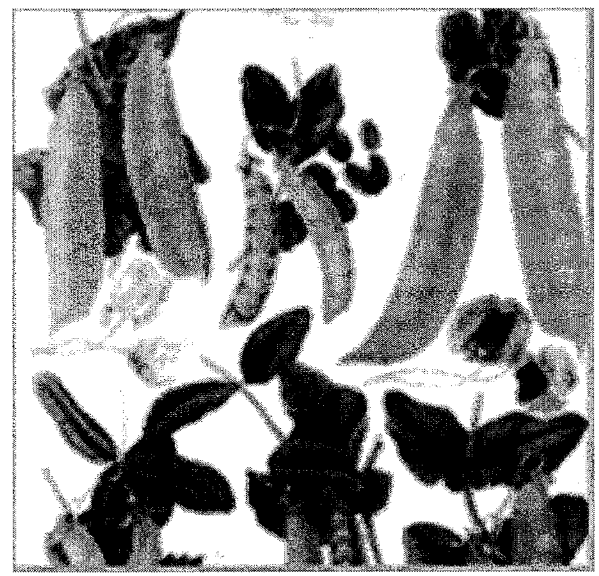
Gregor Mendel



- Mendel wanted to find out how lifeforms pass ______, from ____________________ ________________________.
- Using __________, he found indirect but observable evidence of how parents transmit genes to offspring
- He had <u>NO KNOWLEDGE</u> of ________ or ______________!

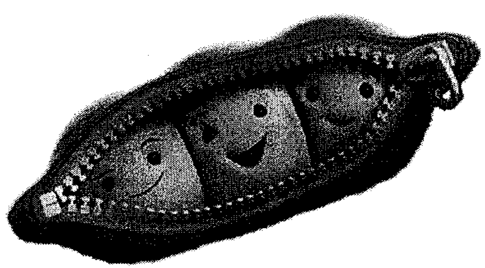
Mendel's Hypothesis

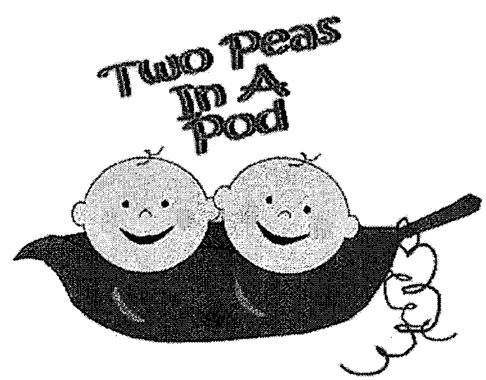
- Mendel was the first biologist to use Mathematics – to explain his results quantitatively.
- Mendel predicted
  - The concept of genes
  - That genes occur in pairs
  - That one gene of each pair is present in the gametes



Reproduction

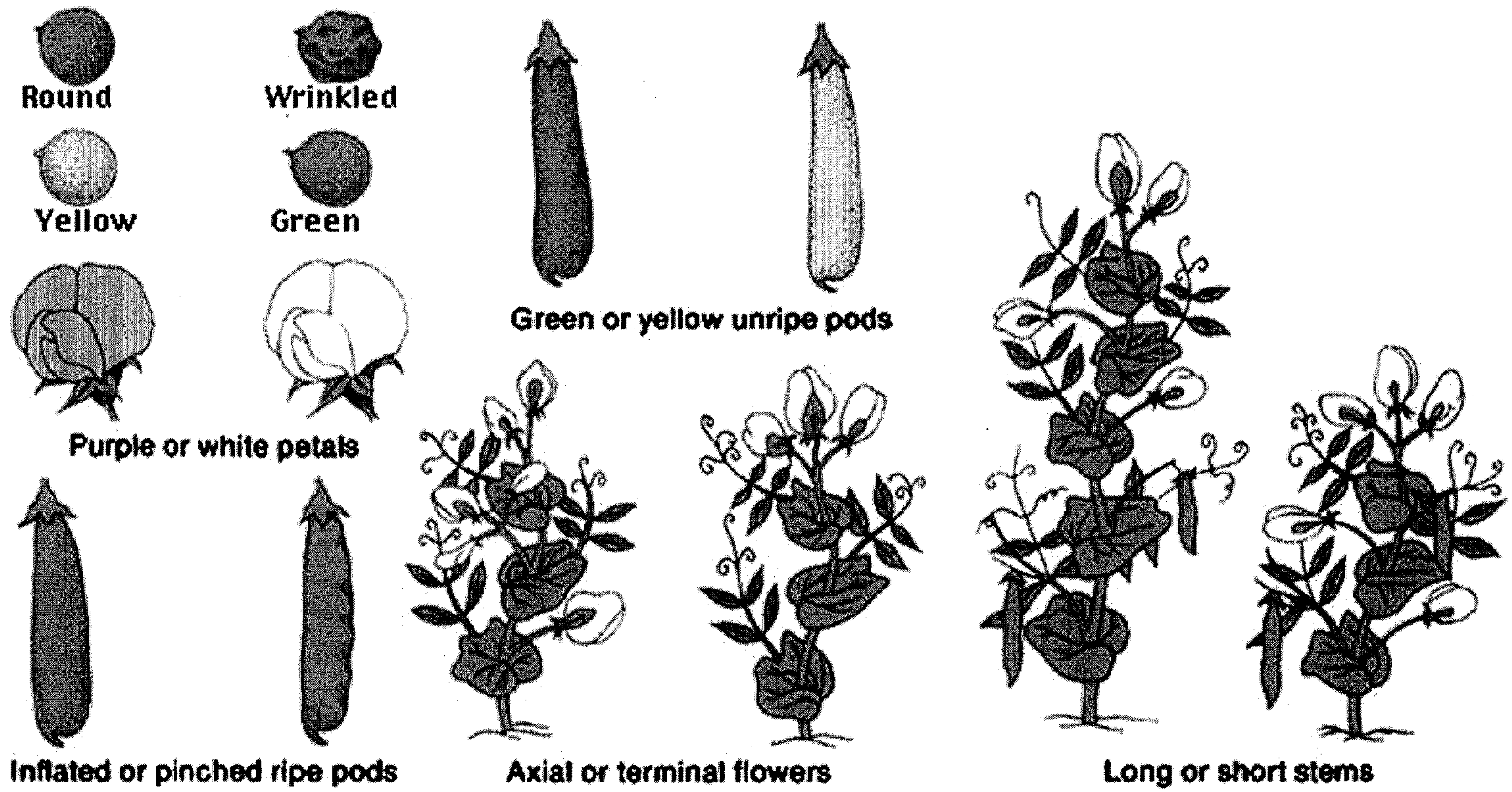
- In asexually reproducing organisms, all the genes come from a single parent. These genes are normally identical to the parent.
- Sexually reproducing organisms normally receive half their genetic information from the Mother's egg and half their genetic information from their Father's sperm. Sexually reproduced offspring resemble but are not identical to their parents.





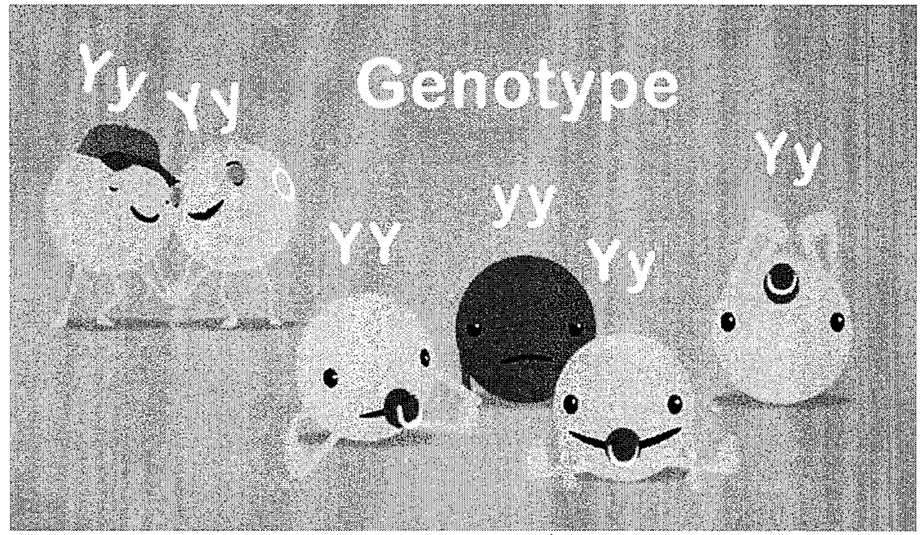
Mendel's peas

Mendel looked at <u>seven traits</u> or characteristics of pea plants:



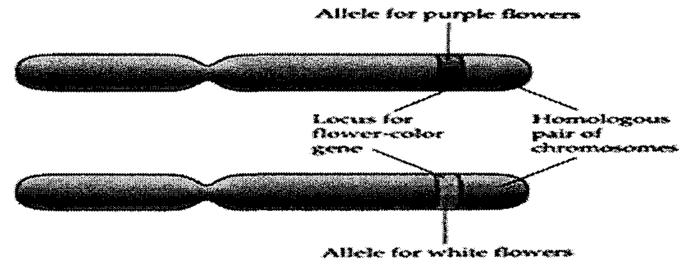
Allele Expression

YY	Yellow
Yy	Yellow
yy	Green

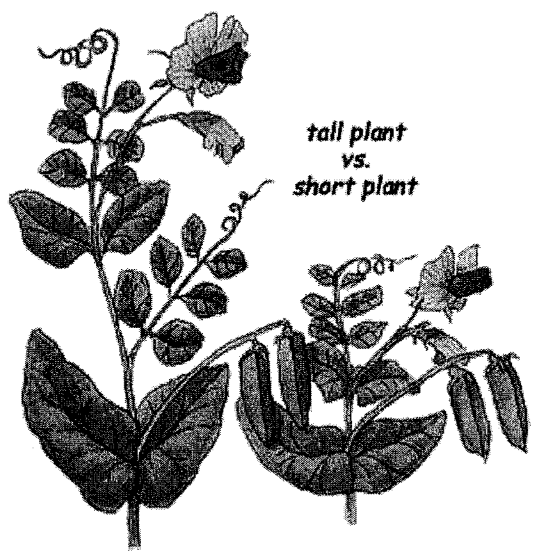


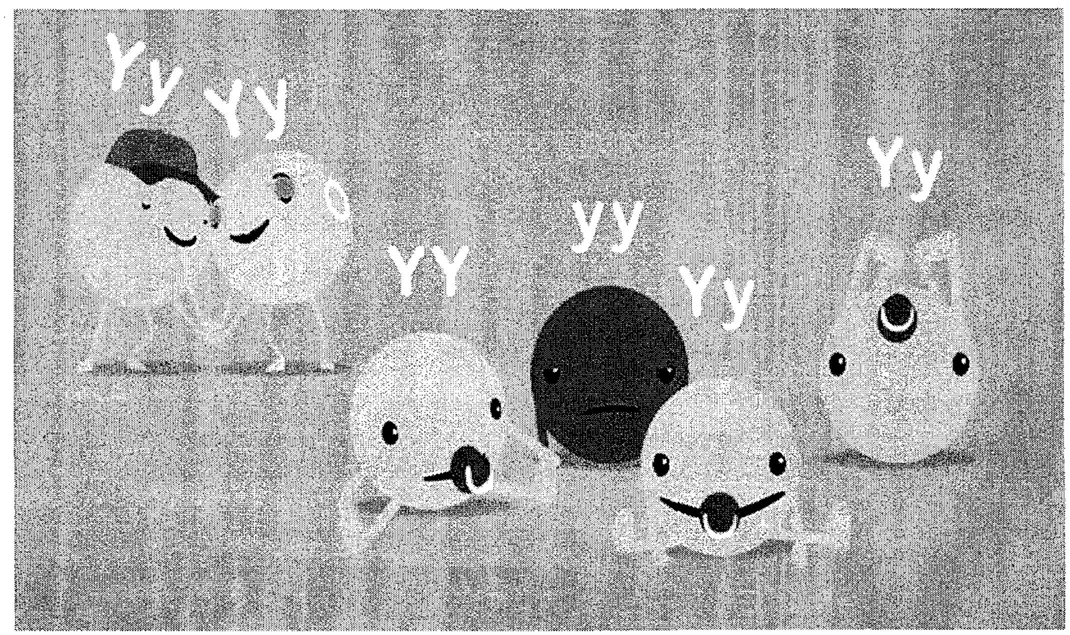
- ___________– the allele of a gene that masks or suppresses the expression of an alternate allele. "Y"
- ___________ – an allele that is masked by a dominant allele. "y"

Allele Combinations



- ____________ (pure) – having ____________ genes (one from each parent) YY or yy
- ____________ (hybrid) – having two ____________ genes for a particular characteristic Yy

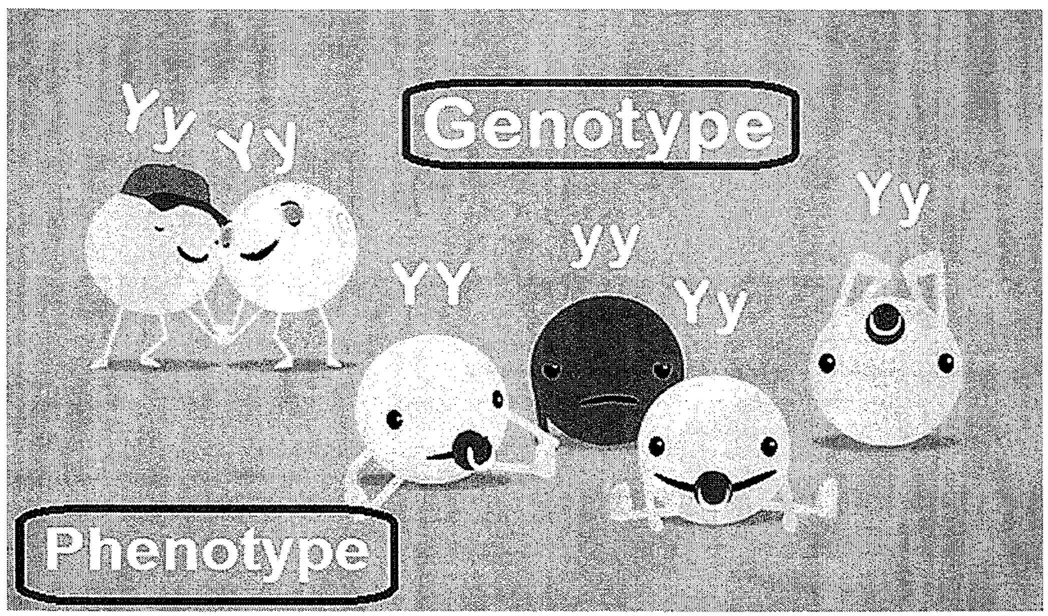




- **The ________________________states that for contrasting traits only the ________________(or one gene of an allelic pair) is expressed**
- **Mendel saw this unfold for all of the seven traits that he studied.**
- **He came up with the <u>Principle of Segregation</u> and <u>Recombination</u>.**
- **Mendel's <u>law of independent assortment</u>, states that allele pairs separate independently during the formation of <u>gametes</u>.**

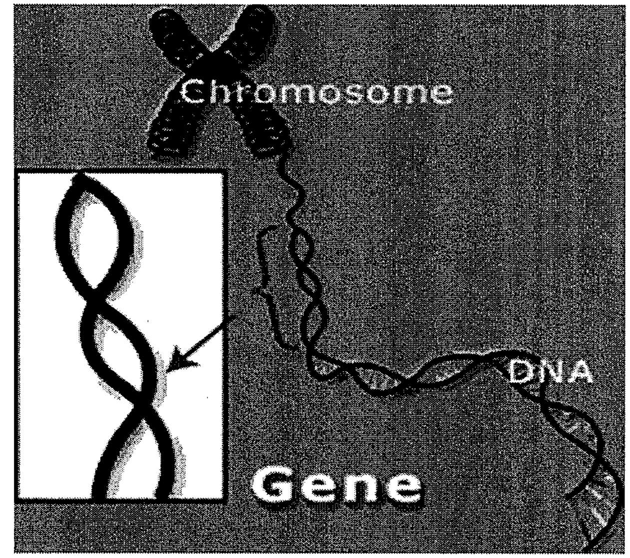
Genotype & Phenotype

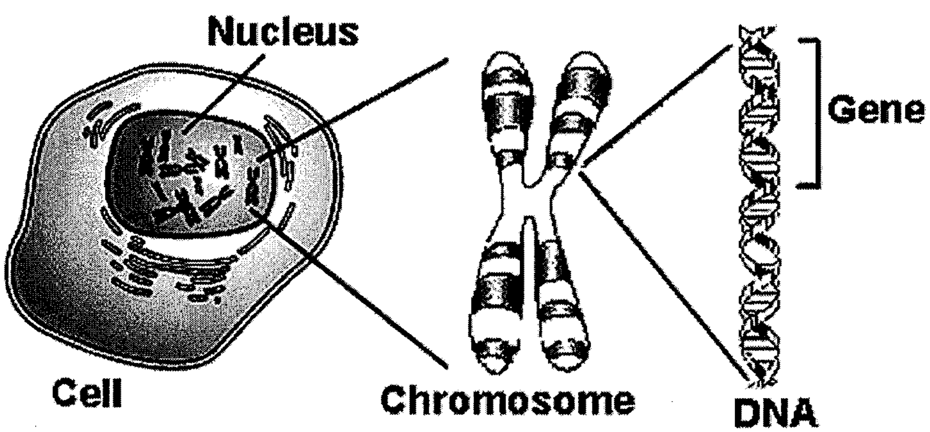
- _____________ refers to particular _________ an individual carries. Ex: BB, Bb, YY, yy, etc
- _____________ refers to an individual's ___________ _________. Ex: physical characteristics (blond hair, brown eyes, etc.)
- <u>Cannot</u> always determine genotype by observing phenotype

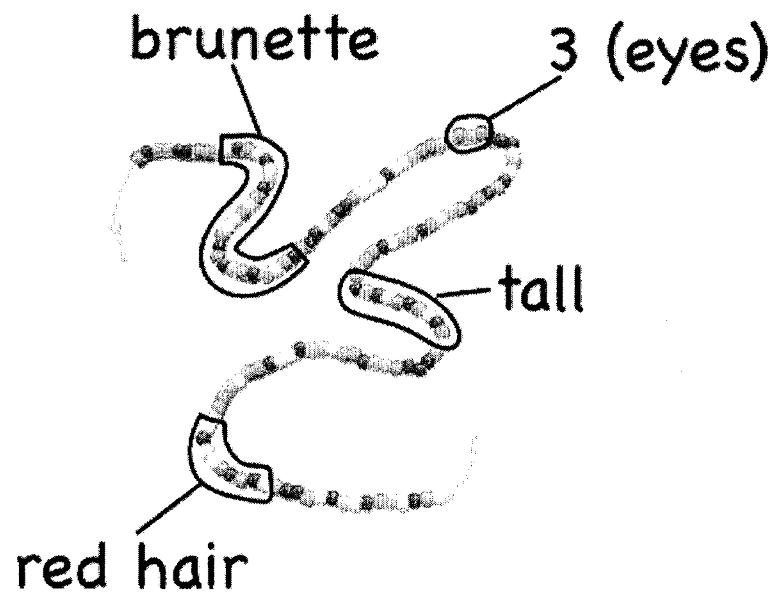


Genetics terms you need to know:

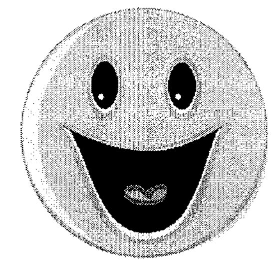
- ________ – a unit of heredity; a section of DNA sequence encoding a single protein
- ________ – the entire set of genes in an organism

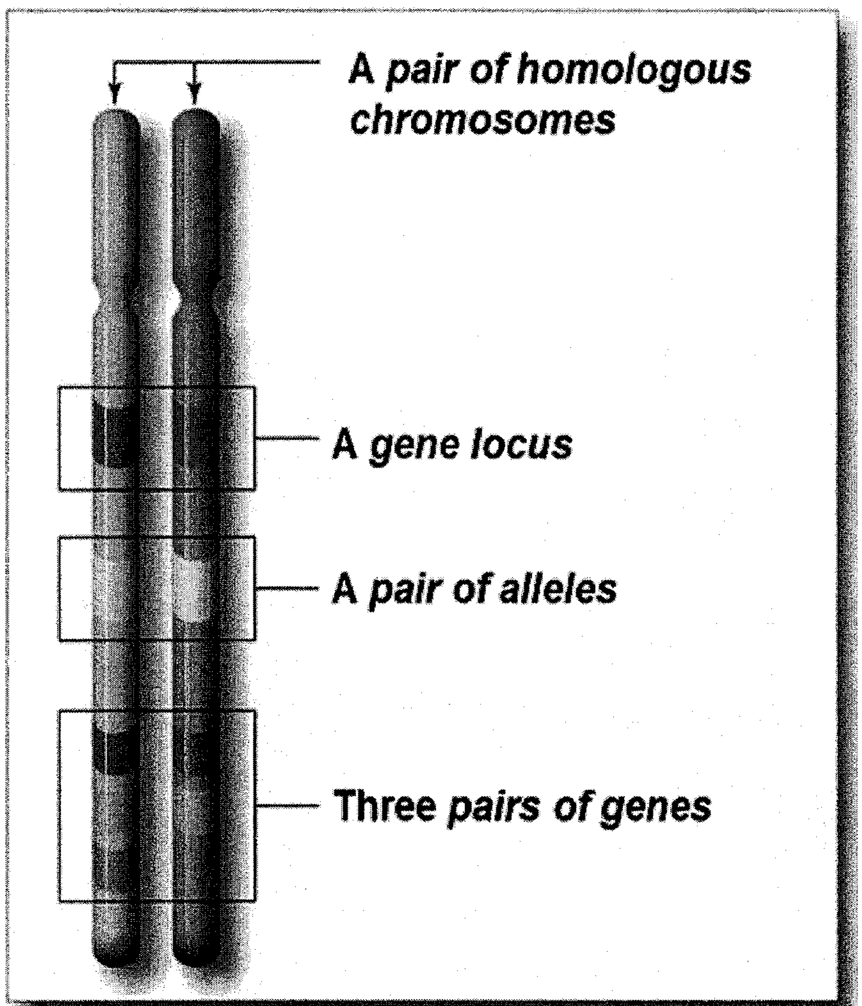






More genetic terms

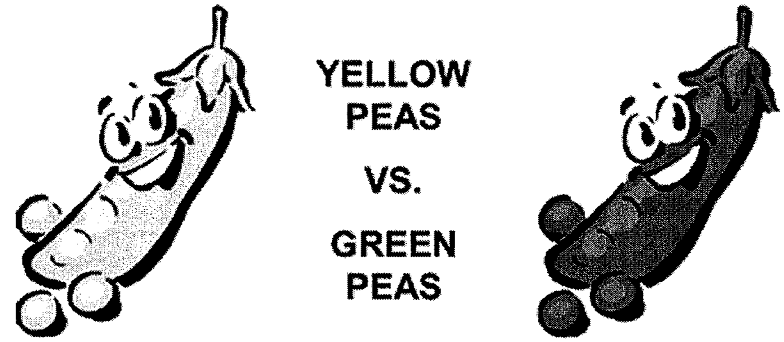




- ________ – two genes that occupy the same position on <u>homologous</u> <u>chromosomes</u> and that cover the same trait (like 'flavors' of a trait).
- <u>Locus</u> – a fixed location on a strand of DNA where a gene or one of its alleles is located.

Monohybrid cross

A cross that tracks the inheritance of a _________ characteristic.



- **Parents differ by a ______________.**
- **Crossing two pea plants that differ in stem size, one tall one short**

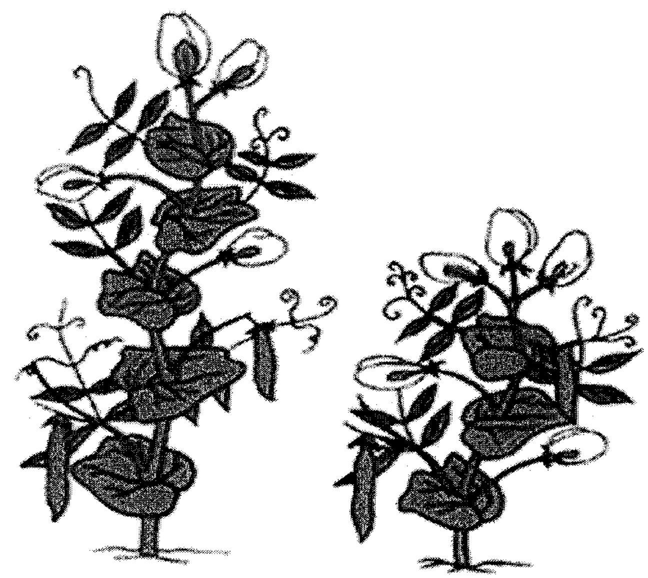
  T = allele for Tall

  t = allele for dwarf (short)

  TT = homozygous tall plant

  t t = homozygous dwarf plant

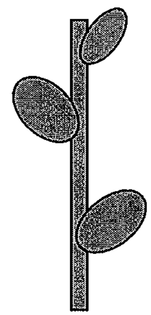
  T T × t t



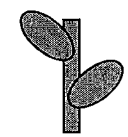
Long or short stems

Monohybrid cross for stem length:

P = parentals
true breeding,
homozygous plants:



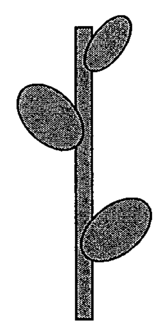
T T × *t t*
(tall) (dwarf)



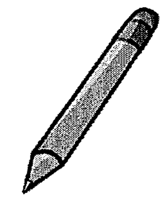
↓

F_1 generation
is heterozygous:

T *t*
(all tall plants)

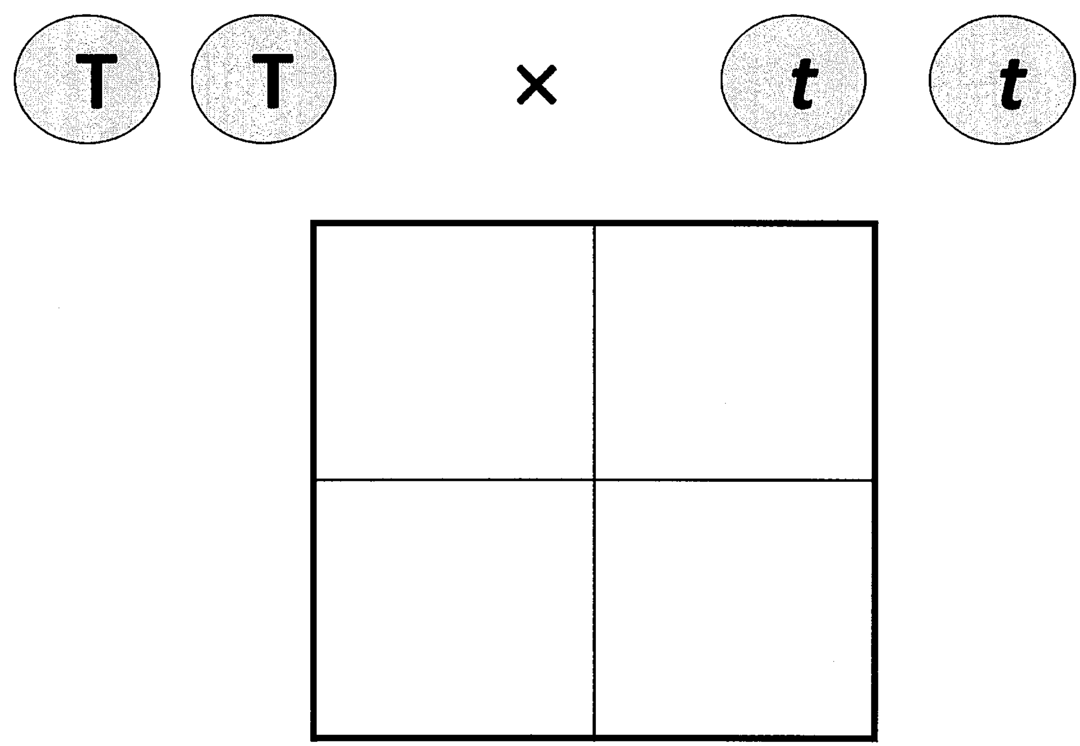


Using a Punnett Square



STEPS:

1. Determine the genotypes of the parent organisms
2. Write down your "cross" (mating)
3. Draw a p-square



Parent genotypes:

TT and *t t*

Cross

T T × *t t*

Punnett square

4. "Split" the letters of the genotype for each parent & put them "outside" the p-square
5. Determine the possible genotypes of the offspring by filling in the p-square
6. Summarize results (genotypes & phenotypes of offspring)

T T × *t t*

	T	T
t	25% Tt	25% Tt
t	25% Tt	25% Tt

Genotypes:
100% T t

Phenotypes:
100% Tall plants

Monohybrid cross: F_2 generation

- If you let the F1 generation self-fertilize, the next monohybrid cross would be:

T*t* × T*t*

(tall) (tall)

	T	*t*
T	TT	T*t*
t	T*t*	*tt*

Genotypes:

1 TT= ___________

2 T*t* = ___________

1 *tt* = ___________

Genotypic ratio= 1:2:1

Phenotype:

3 Tall

1 dwarf

Phenotypic ratio= 3:1

<u>Mono</u>hybrid cross in Humans

Bb× Bb

(Brown hair)

(blonde hair)

	B	**b**
B		
b		

<u>Genotypes:</u>

1 ____ = ____________

2 ____ = ____________

1 ____ = ____________

Genotypic ratio =__________

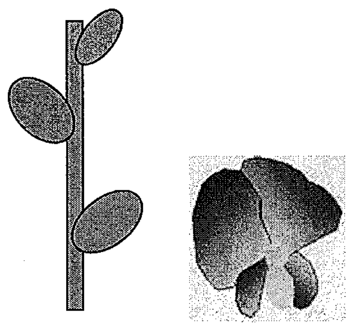
<u>Phenotype:</u>

3 _______________

1 _______________

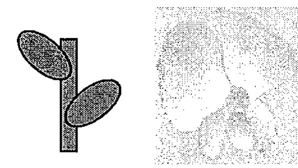
Phenotypic ratio= ________

Dihybrid cross: flower color and stem length



TT PP × *tt pp*

(tall, purple) (short, white)



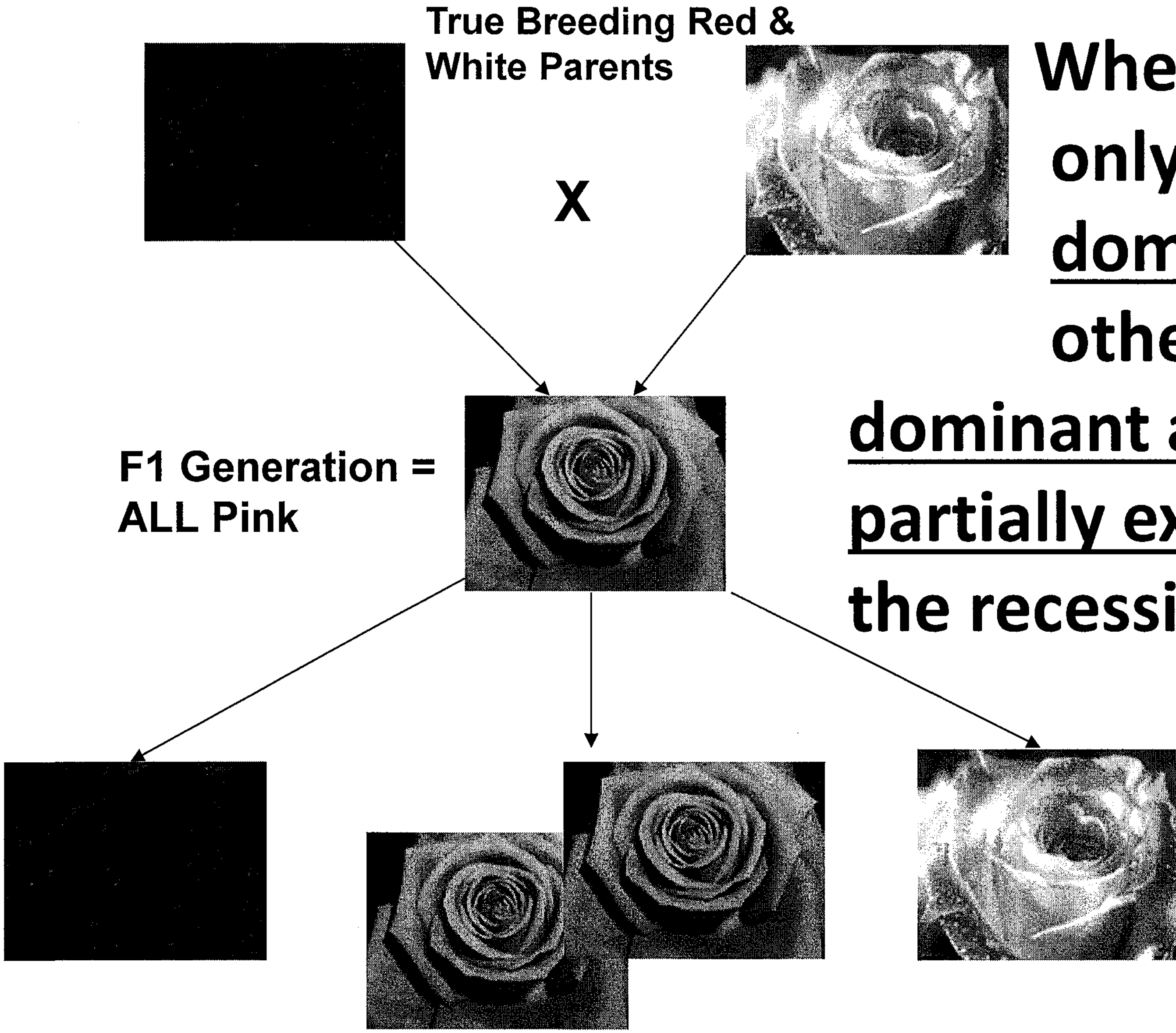
Possible Gametes for parents

(T P) and (*t p*)

	tp	*tp*	*tp*	*tp*
TP	T*t*P*p*	T*t*P*p*	T*t*P*p*	T*t*P*p*
TP	T*t*P*p*	T*t*P*p*	T*t*P*p*	T*t*P*p*
TP	T*t*P*p*	T*t*P*p*	T*t*P*p*	T*t*P*p*
TP	T*t*P*p*	T*t*P*p*	T*t*P*p*	T*t*P*p*

F1 Generation: All tall, purple flowers (T*t* P*p*)

Incomplete Dominance

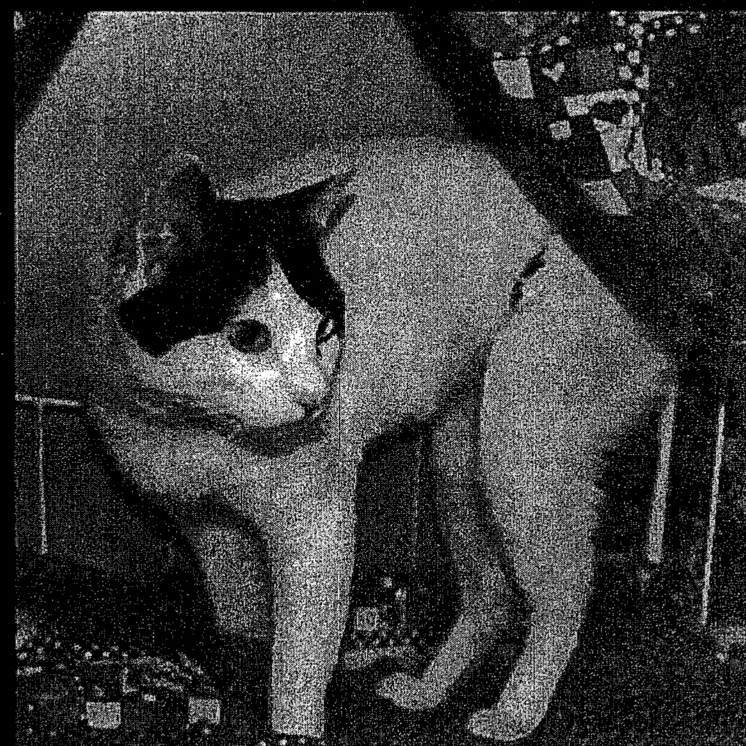


When one allele is only partially dominant over the other --the dominant allele is only partially expressed when the recessive allele is present.

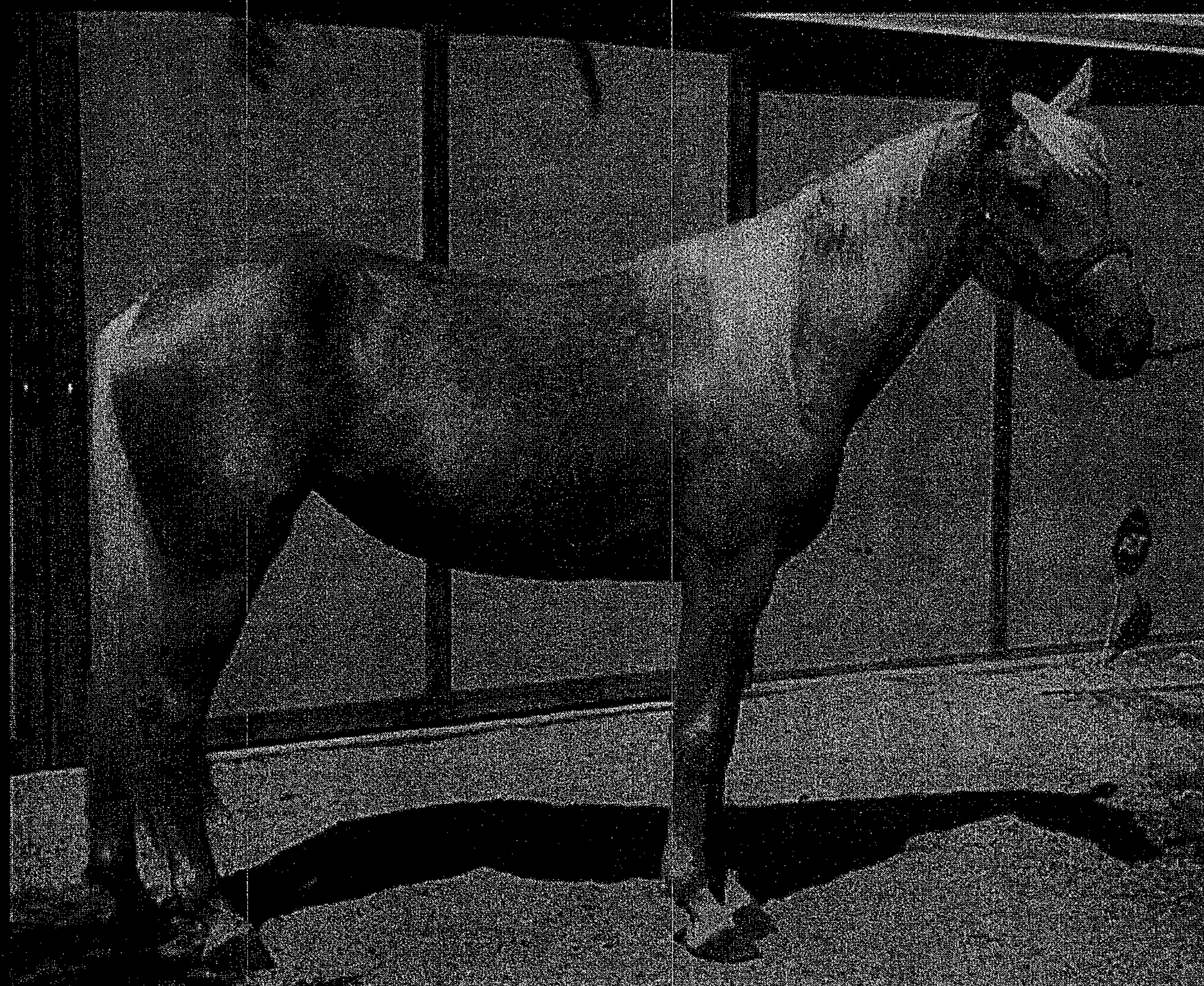
F2 Generation yields ratio of 1:2:1 Red: Pink: White

Incomplete Dominance

The allele for white spotting (S) is *incompletely dominant* to the allele for solid color (s). Left: Black cat with Ss genotype. Right: Black cat with SS genotype.

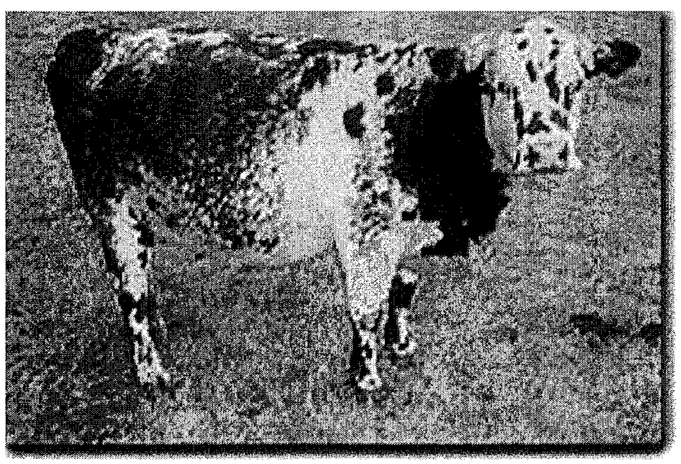


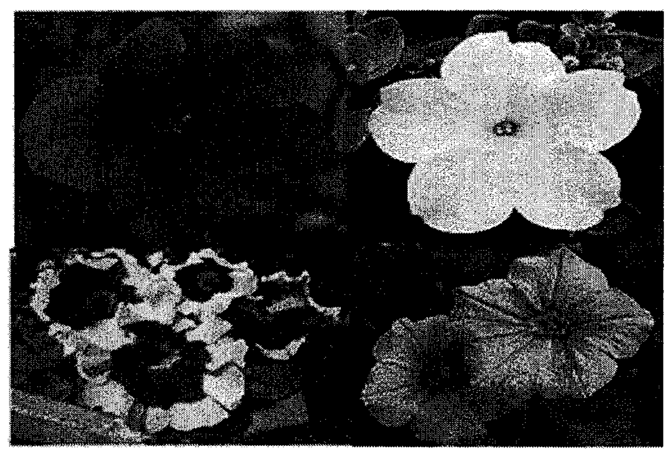
A non-cat example of incomplete dominance:
Cross a white horse and a chestnut brown horse
and the result is a *golden palomino*.



Co-dominance

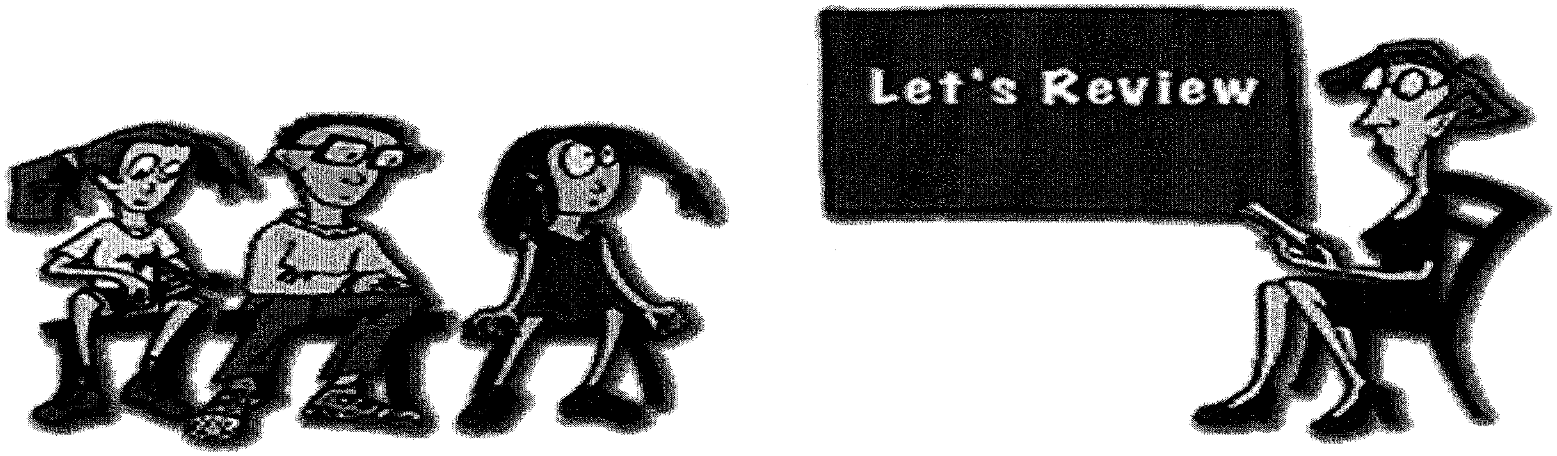
- When neither allele is dominant over the other (alleles have equal power).
- Both alleles can be expressed .
- For example, red cows crossed with white will generate roan cows. Roan refers to cows that have red coats with white blotches.





Mendel’s impact

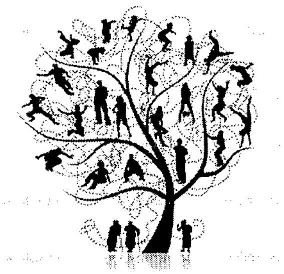
- Mendel’s theories of inheritance, first discovered in garden peas, are equally valid for figs, flies, fish, birds and human beings.
- Mendel’s impact endures, not only on genetics, but on all of science, as a case study of the power of hypothesis.



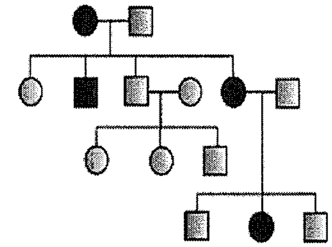
Seed shape

a. Round is dominant (R)
b. Wrinkled is recessive (r)
c. An RR father and an rr mother

d. What shape(s) are the parents?
e. What shape(s) are the children?

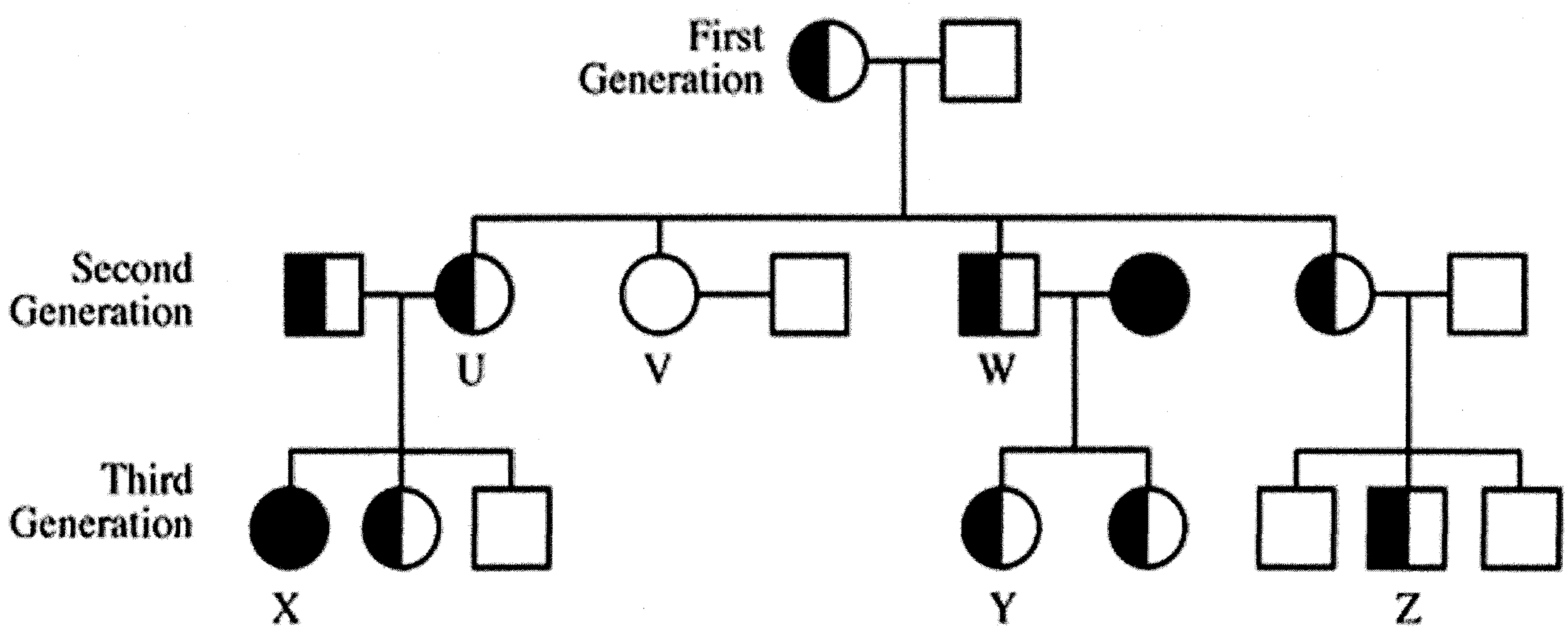


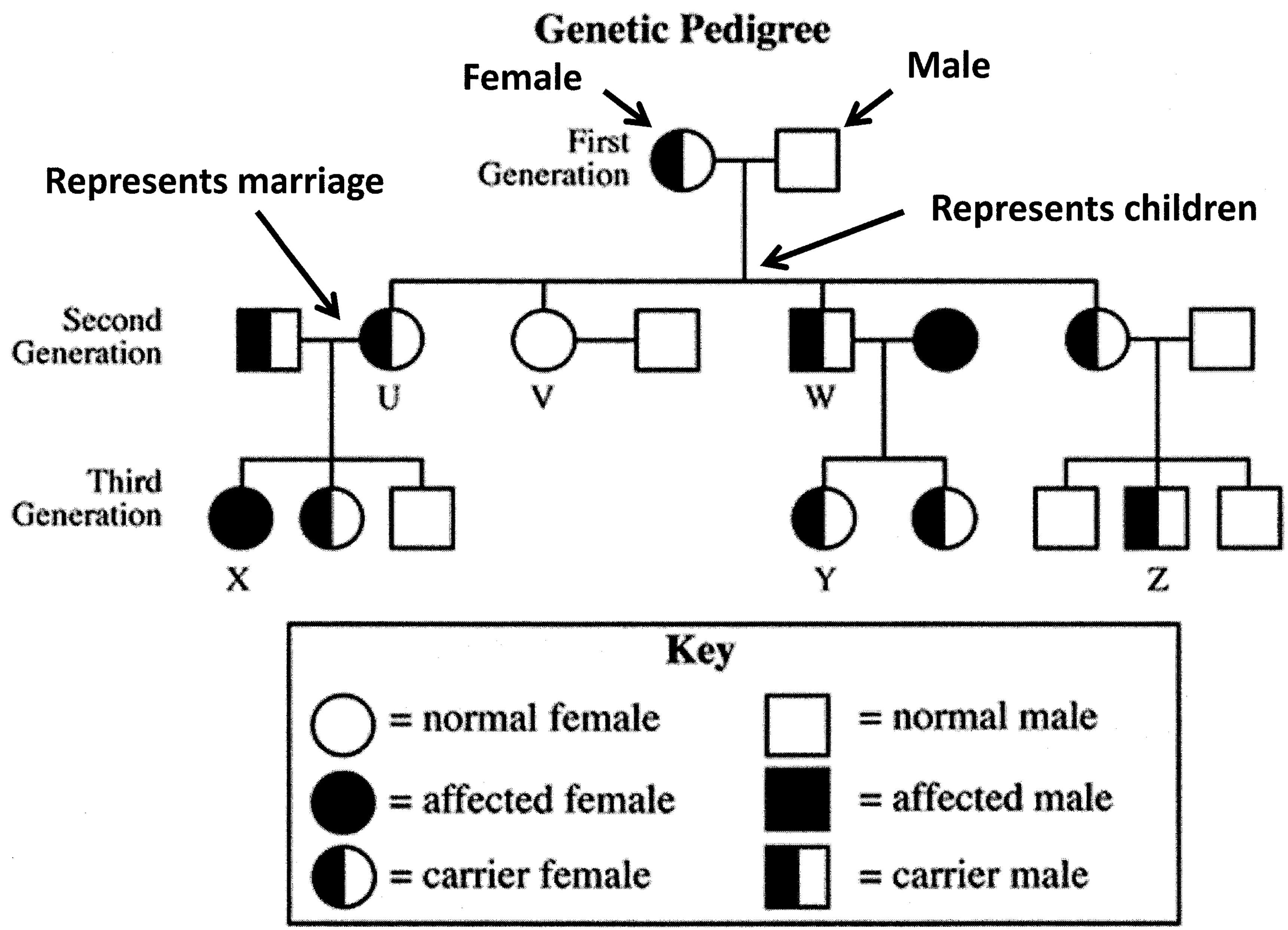
Pedigree
Inheritable traits



The Pedigree Chart

- A chart that shows a ____________________.
- Can show the ____________________of a particular ________ in each member of each generation.

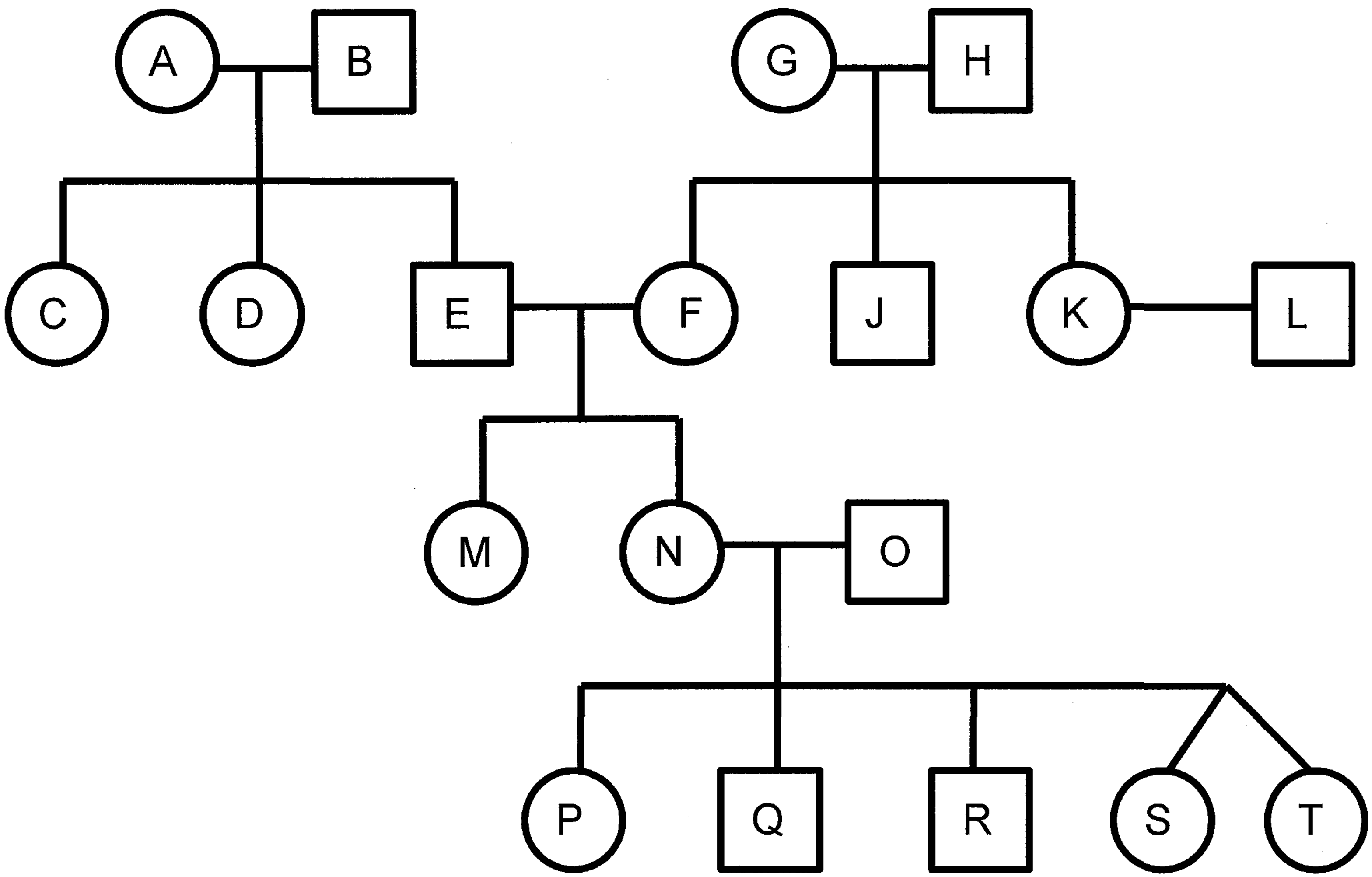


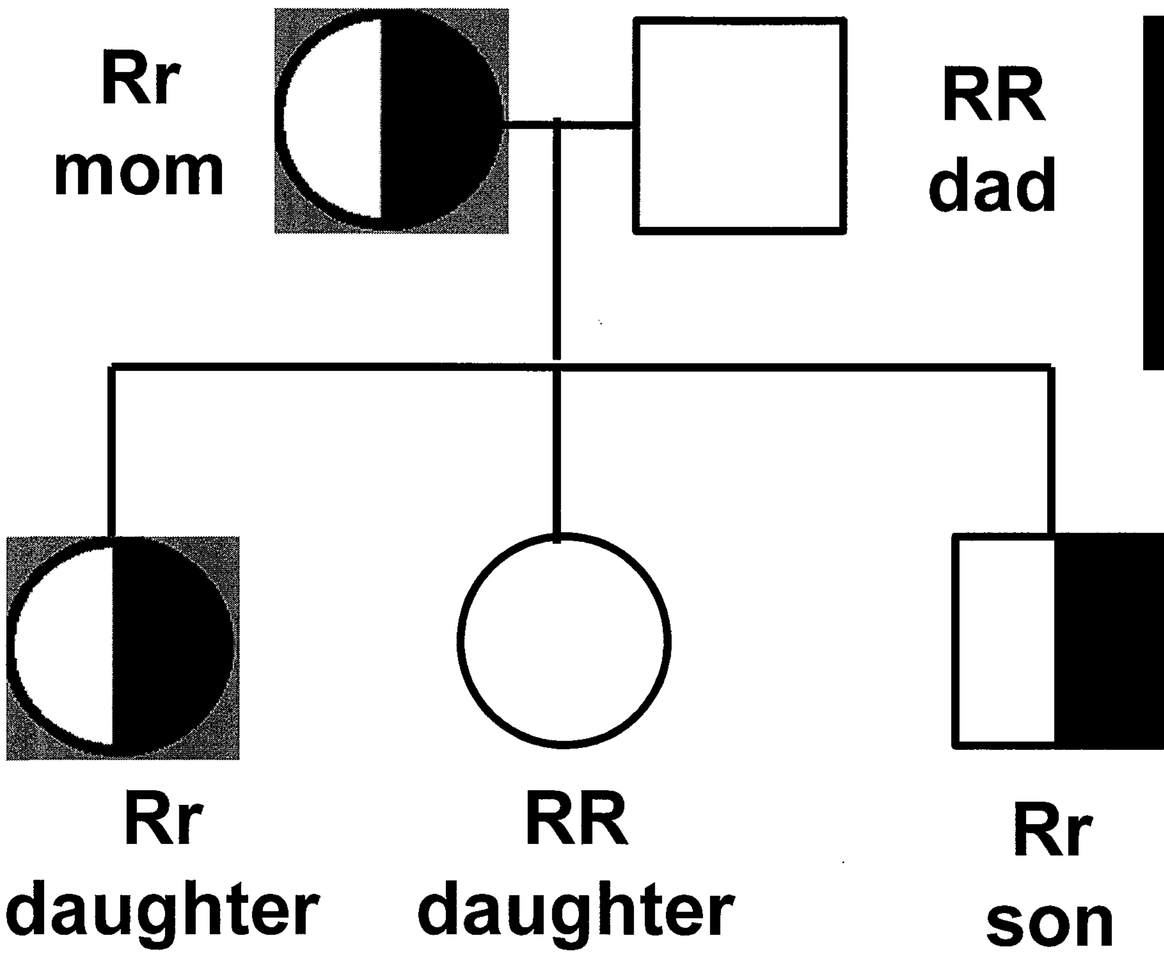

Genetic Pedigree
Female
Male
First Generation
Represents marriage
Represents children
Second Generation
U
V
W
Third Generation
X
Y
Z
Key
= normal female
= affected female
= carrier female
= normal male
= affected male
= carrier male

How many girls? _____

How many boys? _____

How many couples have children? _____





R = tongue roller
r = non-roller

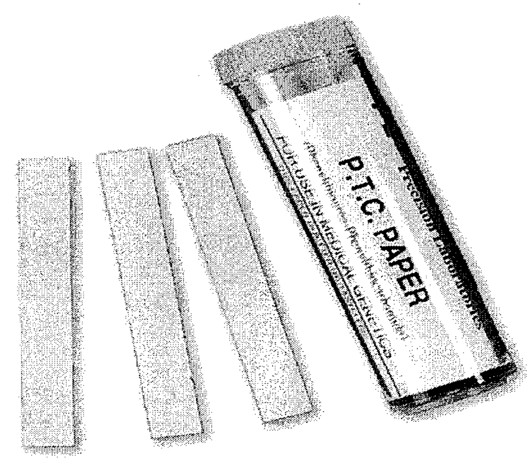
	R	R
R	RR	RR
r	Rr	Rr

PTC test

A single gene which codes for a protein found in our tongues.

- PTC will bind with the protein if it present and a person will taste it.
- If the protein is not present, PTC will not bind and a person cannot taste it
- Being able to taste PTC is a dominant trait.

Phenylthiocarbamide Paper

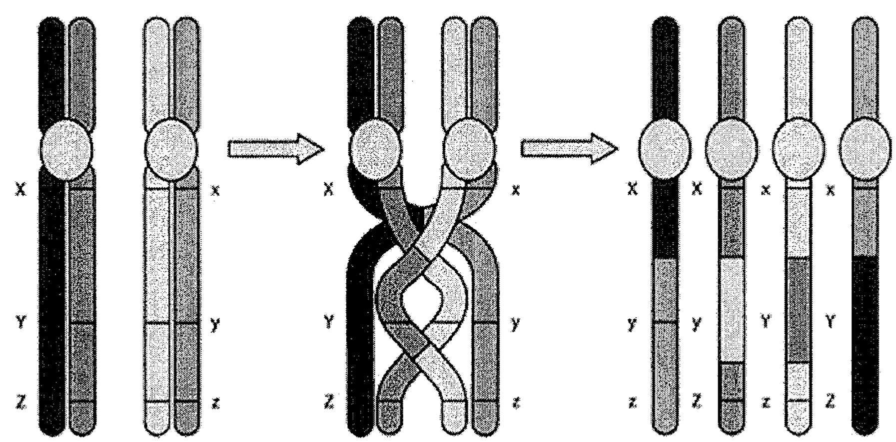


Linked Genes

- When genes for two different traits are located on the same chromosome pair
- Linked genes are USUALLY inherited together.

- The exception to this principle can be found when crossing over occurs. For example not all persons with red hair have freckles.

- Crossing over: during first meiotic division, homologous chromosomes exchange portions of their chromatids.
- Crossing over results in the rearrangement of linked genes and increases the variability of offspring.



Genetic Disorders

- A woman is considered a ______________ if she has one recessive sex-linked trait:

$$X^H X^h$$

- In a woman, the recessive trait is ______________by the dominant gene.
- BUT if a man inherits one recessive sex-linked trait he always shows that trait:

$$X^h Y$$

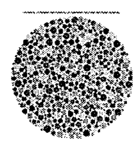
- _____________________– found on the X chromosome
  - Less common than X-linked recessive
- _____________________– found on the X chromosome
  - Only boys have affected, and girls are carriers

Sex Linked Genes

- Sex linkage depends on the sex of the individual and is directly tied to the ____________________.
- Genes on X and Y chromosomes are called sex-linked genes.

Colorblindness

	X	Y^c
X^c	X^cX^c	X^cY
X^c	X^cX^c	X^cY



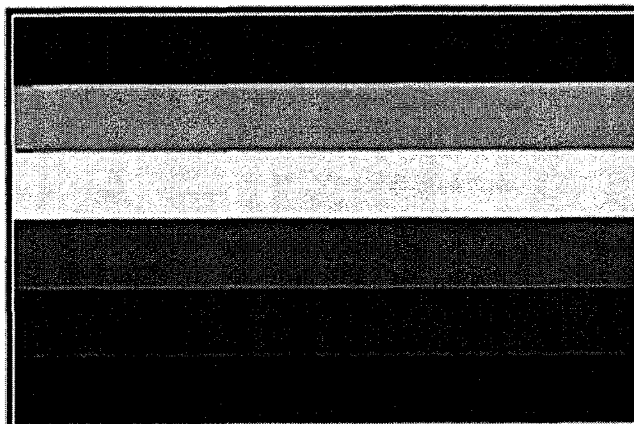
Key:
X^CY = Not affected
X^CX^C = Not affected
X^CX^c = Carrier
X^cY = Has disease

Hemophilia

	X	Y
X	XX	XY
X	XX	XY

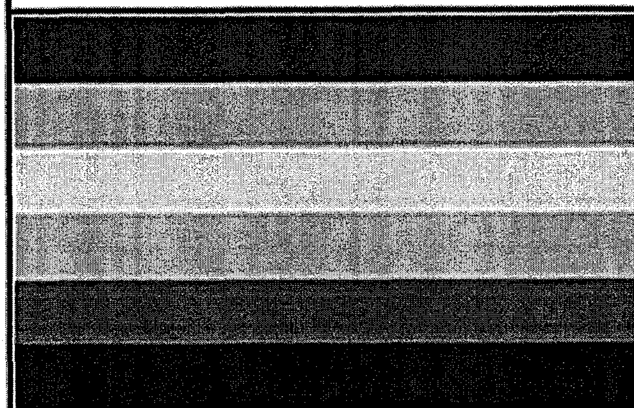
Key
XY - Normal Male
XX - Normal Female
XX -Female Carrier
XY - Male With Hemophilia

Here are some illustrations of the most common forms of color-blindness:

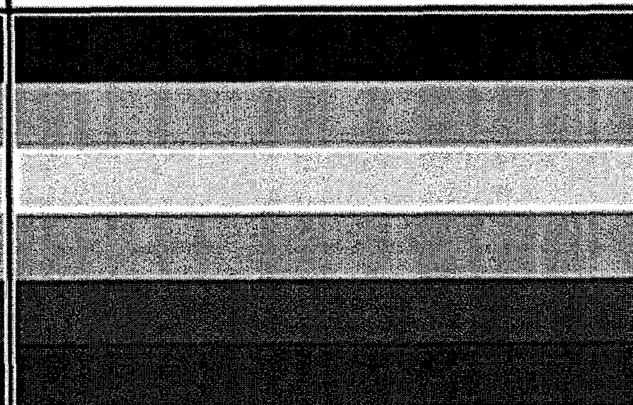


The colors of the rainbow
Normal color vision

The colors of the rainbow
Deuteranope (simulation)
Absence of green retinal photoreceptors

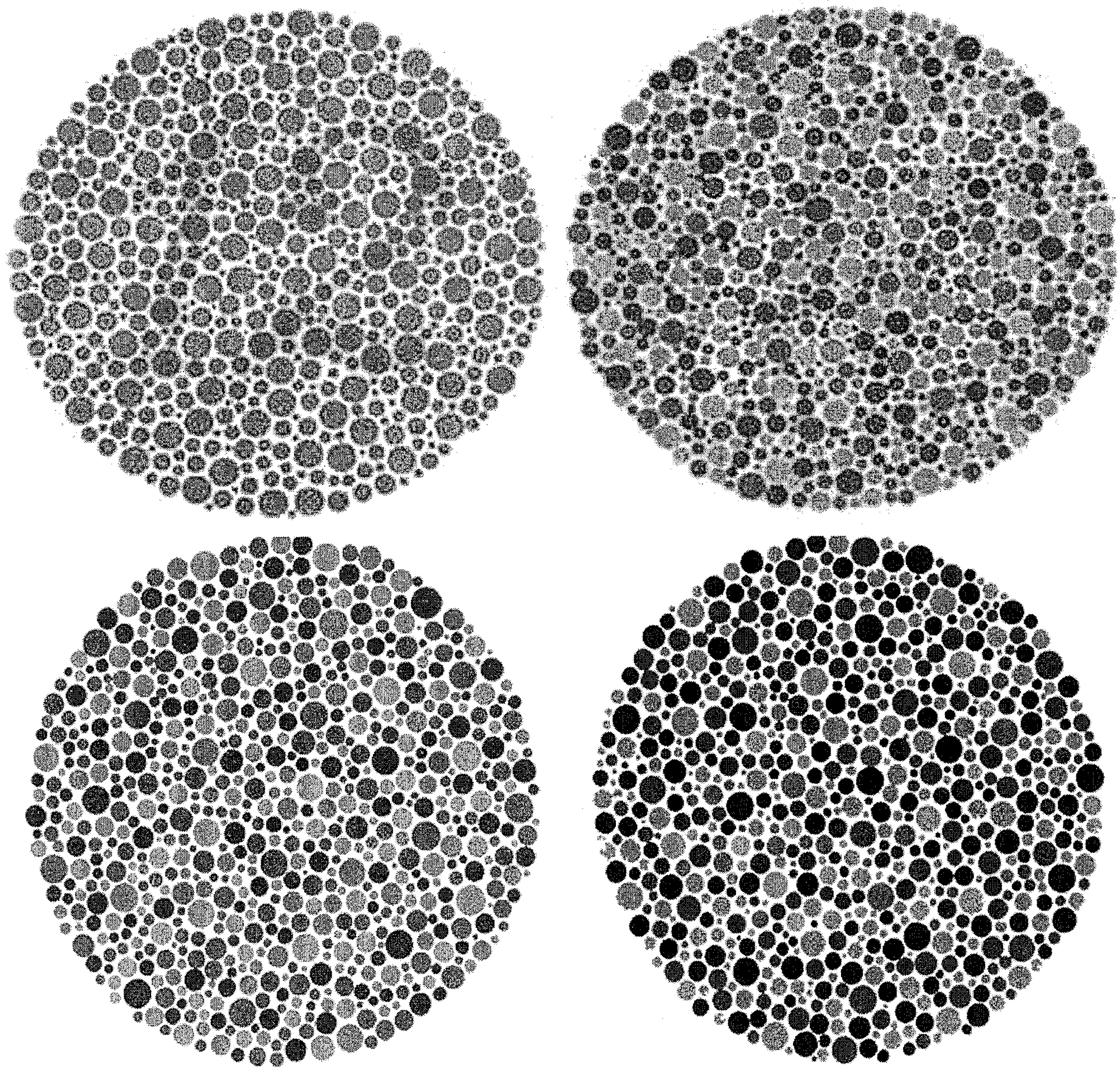


The colors of the rainbow
Protanope (simulation)
Absence of red retinal photoreceptors.

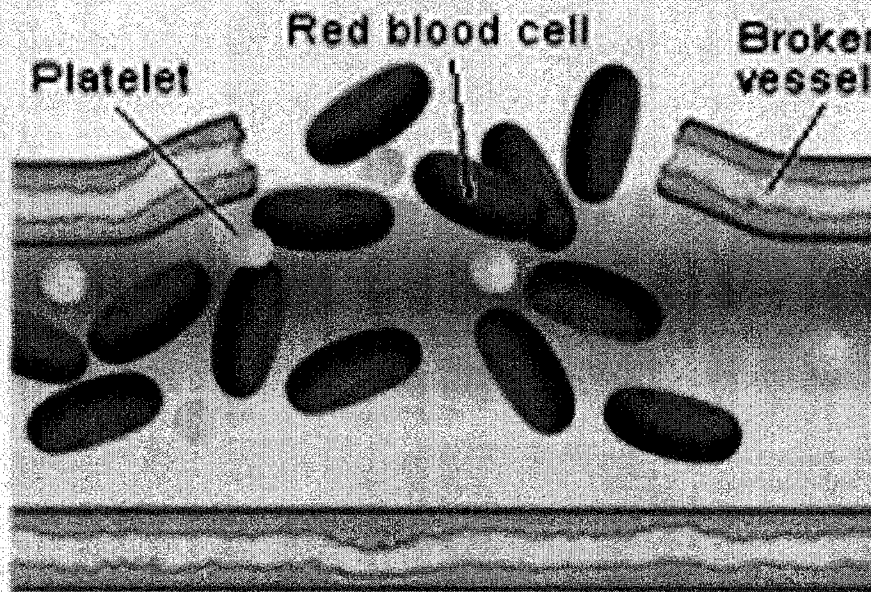


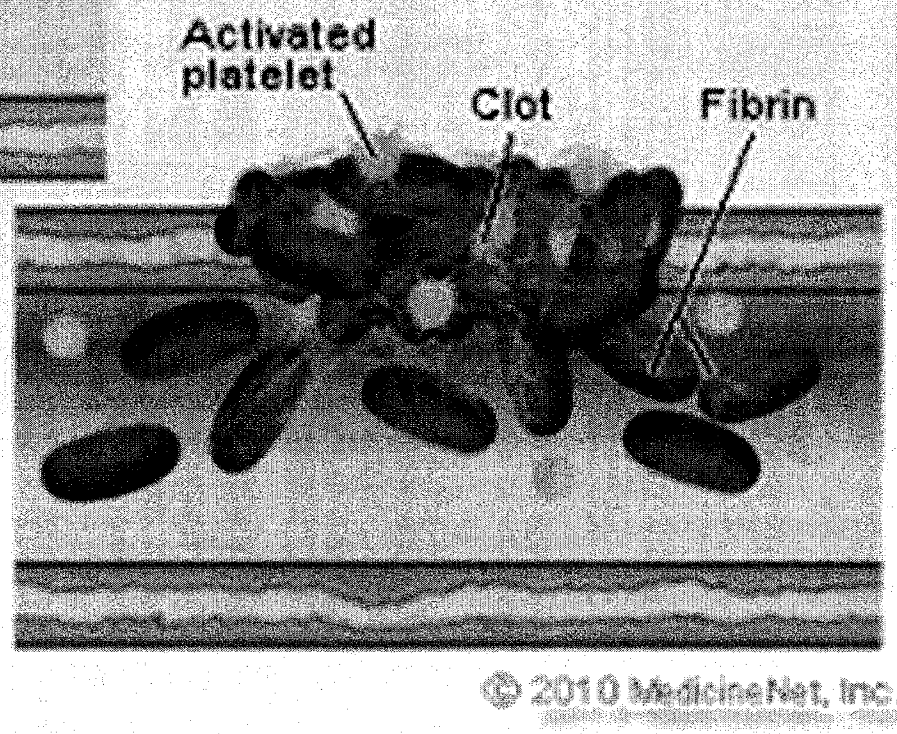
The colors of the rainbow
Tritanope (simulation)
Absence of blue retinal receptors

Colorblindness



Hemophilia

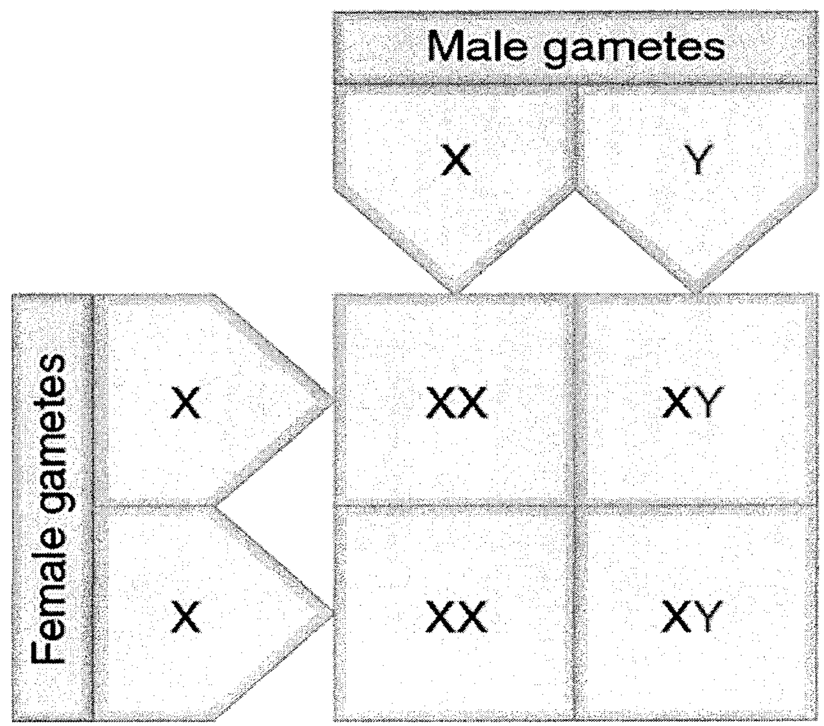




Hemophilia is a inherited blood disorders in which the blood does not clot properly.

X-linked disorders

- X-linked genes are never passed from father to son. The Y chromosome is the only sex chromosome that passes from father to son.



X-linked recessive, carrier mother