Week#14, 2013-14		
Today	↓Copy first, then respond.↓	✍ Wednesday, Dec.4
ESSENTIAL QUESTION		✍ EQ: Why were peas a better model than humans for studying heredity?
Quotation to relate to science or life		✍ "Chains of habit are too light to be felt until they are too heavy to be broken."--Warren Buffett
Homework▶		✍ Homework: Proofread journal.
Announcements, Questions???, Review		▪ Progress Reports—Don't leave class without one.
Students' Objective		Obj. 7.L.2 reproduction and heredity
Teacher presents.		▪ Genetics Introduction, section 1
Students do.		☛ Genetics Introduction Guided Notes, section 1

Add to your Table of Contents

Record #6. SRA Science Reading Laboratory, 2nd Quarter Selections
Record #7. SLI Activity 57: Copycat
Record #8. Guided Notes for Protists Four ppt (revisited)
Record #9. Act. 57 Copycat (Reproduction)
Record #10. DNA Secret of Life (DNA Video Questions)
Record #11. DNA GN (Guided Notes) from ppt

Week#14, 2013-14		
Today	↓Copy first, then respond.↓	✍Thursday, Dec. 5
ESSENTIAL QUESTION		✍EQ: What are dominant and recessive alleles? Give examples.
Quotation to relate to science or life		✍"Those who do not move, do not notice their chains."--Rosa Luxemburg
Homework▶		✍Homework: Proofread journal.
Announcements, Questions???, Review		▪A, Q, R: How to make up work ▪SRA readings are due Dec. 19
Students' Objective		Obj. 7.L.2 reproduction and heredity
Teacher presents.		▪Extra Credit Opportunities ▪Genetics Introduction, section 2
Students do.		☛Genetics Introduction Guided Notes, section 2 (through p. 1, then Bikini Bottom Genetics 1)

Add to your Table of Contents

Record #6. SRA Science Reading Laboratory, 2nd Quarter Selections
Record #7. SLI Activity 57: Copycat
Record #8. Guided Notes for Protists Four ppt (revisited)
Record #9. Act. 57 Copycat (Reproduction)
Record #10. DNA Secret of Life (DNA Video Questions)
Record #11. DNA GN (Guided Notes) from ppt

Week#14, 2013-14		
Today	➔Copy first, then respond.➔	✍**Friday, Dec. 6**
ESSENTIAL QUESTION		✍**EQ: What did you learn this week in science class that was surprising or important?** [Write it and be prepared to tell about it.]
Quotation to relate to science or life		✍**Never chain your dogs together with sausages.-- unknown**
Homework►		✍**No homework.**
Announcements, Questions???, Review		▪**A, Q, R**
Students' Objective		**Obj.** 7.L.2 reproduction and heredity
Teacher presents.		▪**How to make up work** ▪**Genetics Introduction section 3**
Students do.		☛**Genetics Introduction Guided Notes, through p. 2.**

7th Grade 7.L.2.2

Introduction to Genetics

Genetics: True or False

1. Acquired characteristics such as playing a musical instrument are inherited. ➔ f
2. Identical twins are always of the same gender. ➔ t
3. Fraternal (non-identical) twins are more closely related to each other than to other children in the family. ➔ f
4. The father determines the gender of the child. ➔ t
5. Each parent contributes half of a child's genetic makeup. ➔ t
6. Color blindness is more common in males than in females. ➔ t
7. Parents can transmit to offspring characteristics that the parents themselves do not show. ➔ t
8. Identical twins are more closely related than fraternal twins. ➔ t
9. Certain inherited traits may be altered by the stars, moon or planets early in development. ➔ f
10. A craving for food, such as strawberries, may cause a birthmark on an unborn child. ➔ f
11. Many of a person's inherited traits are not apparent. ➔ t
12. The parent with the stronger will contributes more to a child's inheritance than the other parent. ➔ f
13. If a person loses a limb in an accident, it is likely that he or she will have a child with a missing limb. ➔ f
14. Children born to older parents usually lack the vitality of those born to younger parents. ➔ f
15. The total number of male births exceeds female births each year. ➔ f
16. Much of what we know about heredity was discovered by a monk. ➔ t

Mendel's Pea Plant Experiments

Gregor Mendel

- Austrian monk, who during the 1800s, discovered the basic laws of genetics by studying pea plants.

Why study peas and not humans?
(Your EQ)

Which is a better model? Experiments with Peas vs. Humans

Pea

- reproduces sexually
  - sperm fertilizes egg
- Genes are basis of heredity
- cooperative
- convenient

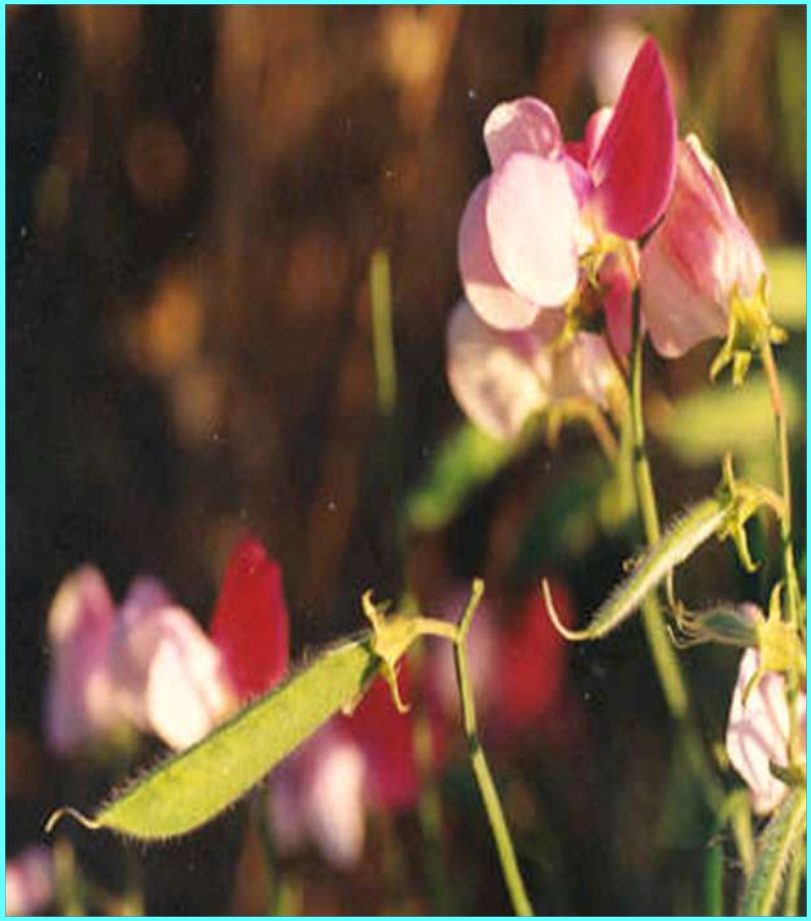
Human

- reproduces sexually
  - sperm fertilizes egg
- Genes are basis of heredity
- uncooperative
- inconvenient

Why peas and not humans?

Peas work better than humans because:

- Many can be grown in a small area*
- produce lots of offspring*
- can self-pollinate*



- *Not possible with humans.

Let's back up a bit—

Recall this stuff you'll need to know.

Asexual vs. sexual reproduction

- **Asexual** reproduction is just identical duplication of parent. Used especially by micro-organisms. **Offspring have same genes as parent.**

- **Sexual** reproduction requires two parents. **Offspring are genetically different from parents.**

More stuff you'll need to know:

How pea plants work—It's all or nothing.

Smooth or dented seeds

Yellow or green seeds

Green or yellow pods

tall or short

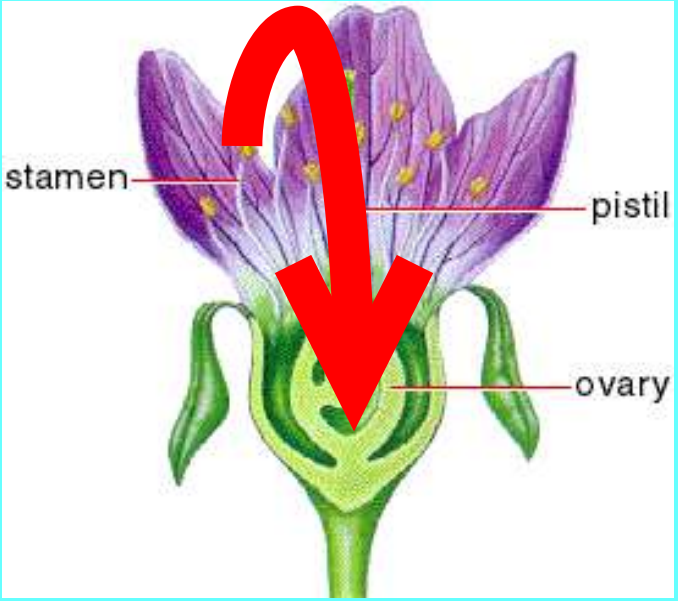
no in between

Purple or white flowers

- Back to your Guided Notes

Reproduction in Flowering Plants

- **Sperm AND egg are part of same flower**

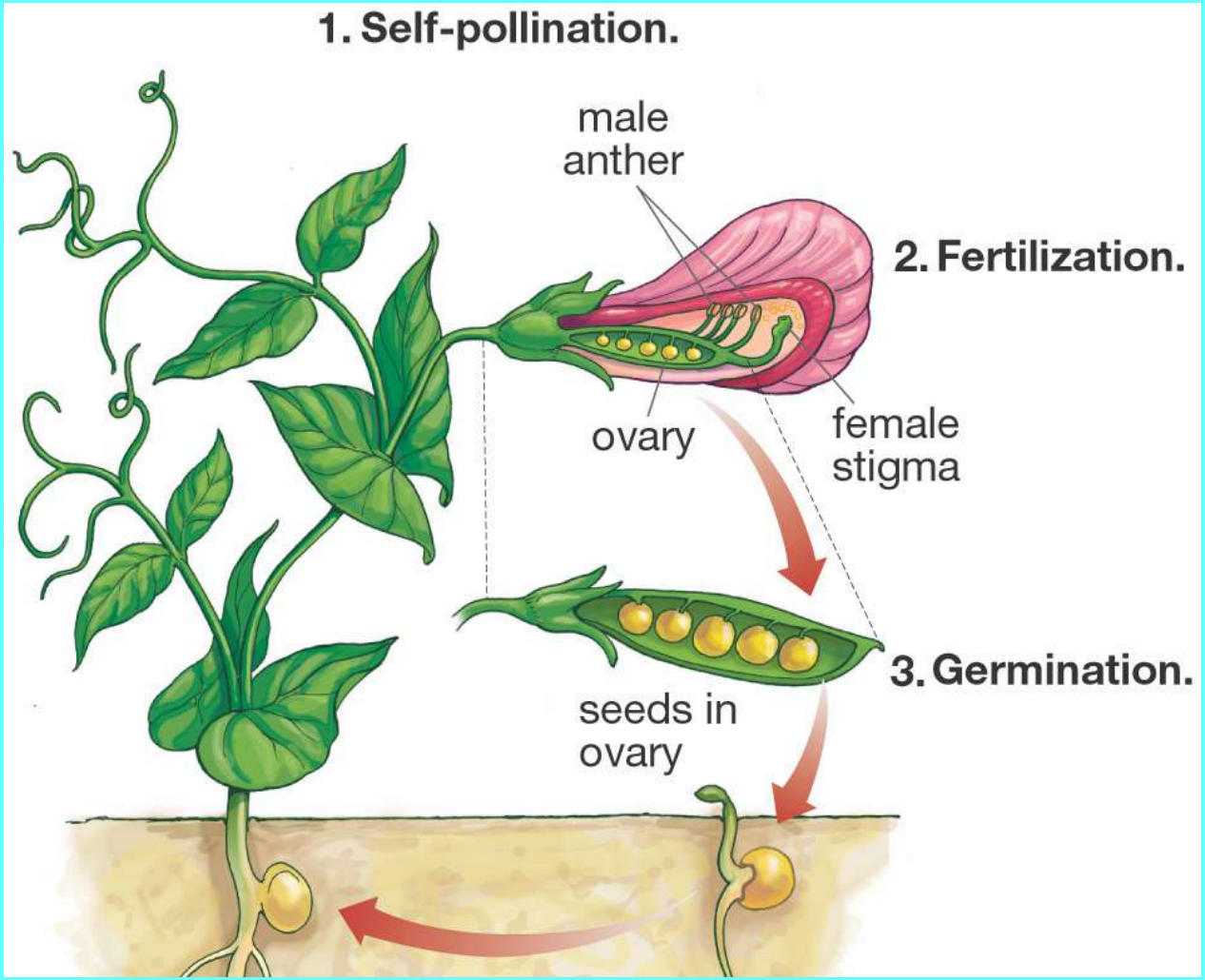


Self-fertilization can occur in the same flower

Cross-fertilization can occur between flowers

How Mendel started

Mendel produced **pure** strains (purebreds) by making the plants **self-pollinate** for several generations.



He also segregated traits.

A purebred has many generations of ancestors that are all alike.

Mendel's Experimental Methods

After he had the purebreds, Mendel **hand-pollinated** certain flowers using a **paintbrush.***

He **snipped the stamens** to prevent self-pollination.*

He recorded traits through **several generations.***

*These are more advantages of peas.

Mendelian Genetics

- Next are the result of Mendel's work.

MATH ALERT! MATH ALERT! The following concepts require understanding of PROBABILITY!

Remember this?
The Pea Plants – Some Traits

Smooth or dented seeds

Yellow or green seeds

Green or yellow pods

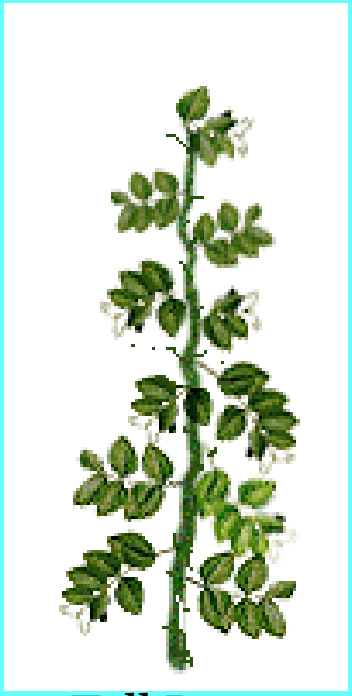
Purple or white flowers

tall or short

no in-between

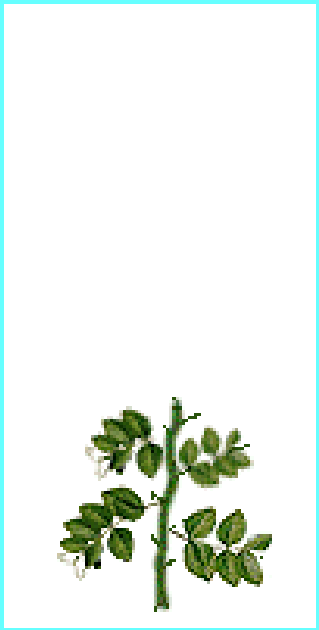
Mendel's data—what he found with Hybrids

- Hybrid – the offspring of a cross between parents with different traits. (Opposite of purebred!)



Tall Parent

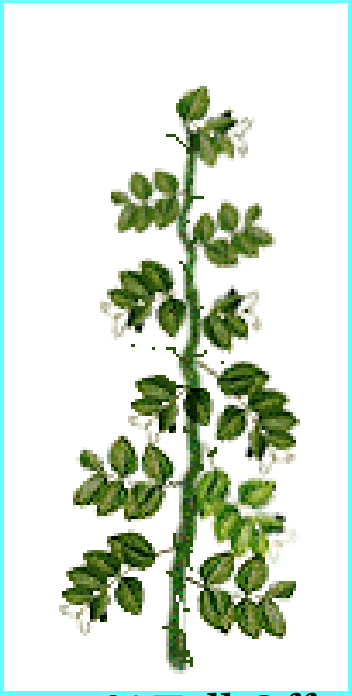
x



Short Parent

P Generation

=



100% Tall Offspring

F_1 Generation

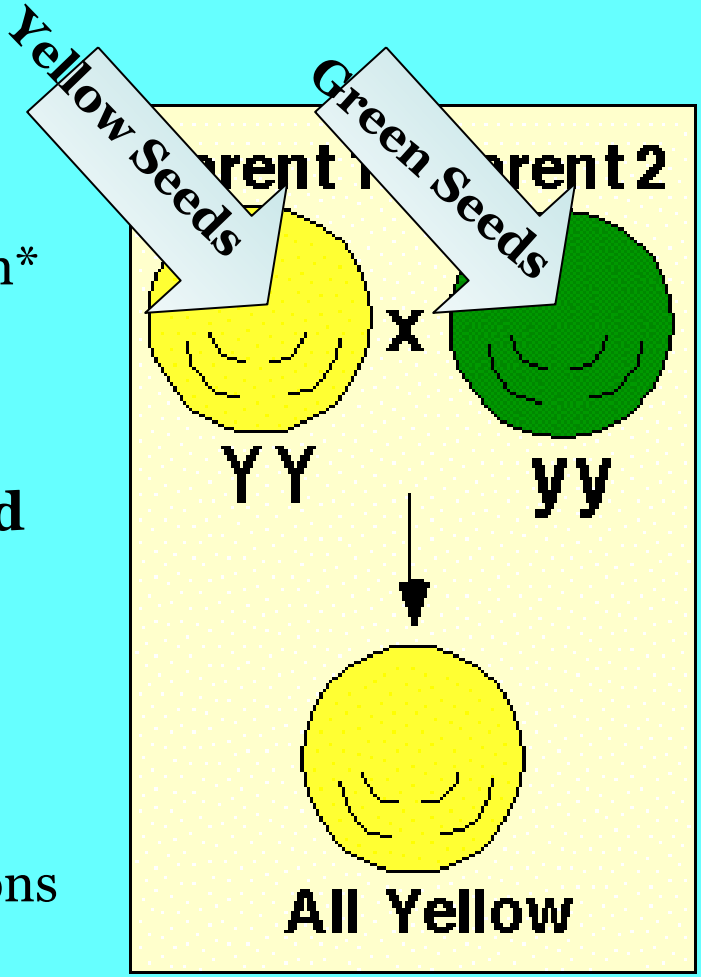
Explanation:

Genes and Alleles

- **Gene**
  - a section of DNA that codes for a protein*
- **Alleles** – two forms of the gene
  - one from mom, one from dad
- **(Like two forms of a letter: capital and lowercase)**

Traits for 2 alleles are shown here➔

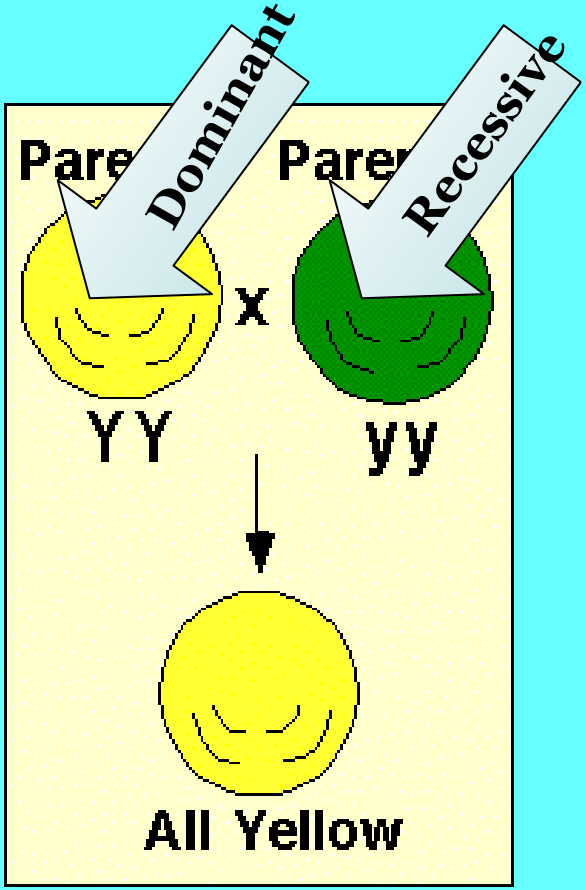
*In this case, “codes for” means “has instructions for making”.



Explanation:

Dominant masks Recessive

- **Dominant** – the stronger allele
  - We use CAPITAL LETTER.
  - If present, this is what you see.
- **Recessive** – the weaker allele
  - We use lower-case.
  - Only shows if no dominant allele is present.
- Mom and Dad can both give you DOMINANT alleles, both recessive, or one of each.

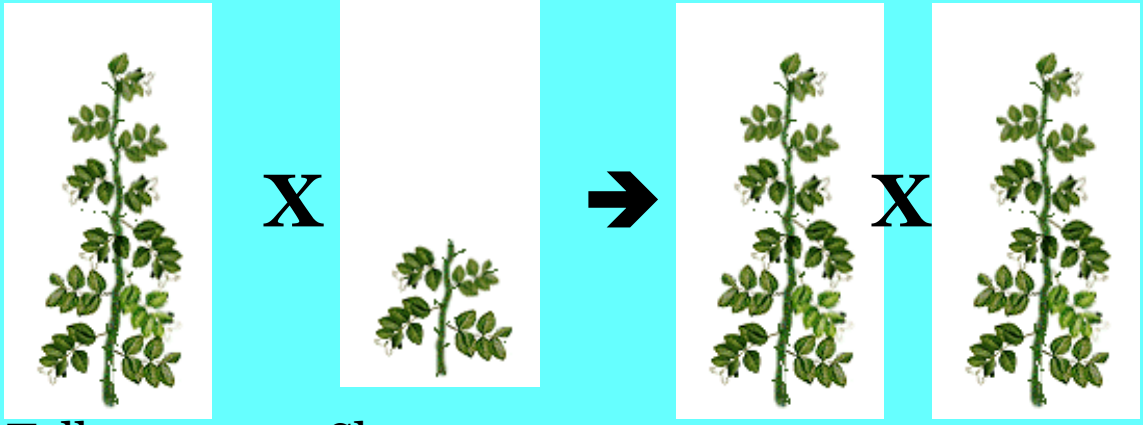


P, F1, and F2 Generation…

P x P cross → F1; F1 x F1 → F2.

Here's how:

What is going on?



Tall Parent

Short Parent

P Generation

100% Tall Offspring

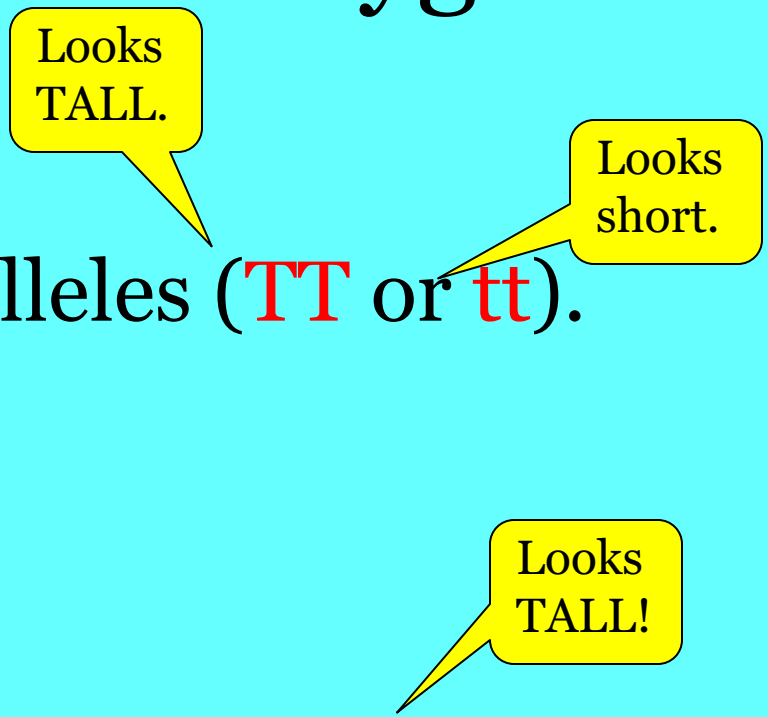
F1 Generation

F2 Generation

75% Tall 25%Short

Explanation:

Homozygous vs. Heterozygous



- **Homozygous** –same alleles (TT or tt). (also called **purebred**)

- **Heterozygous** – different alleles (Tt). (also called **hybrid**)

Explanation:

Phenotype vs. Genotype

- **Ph**enotype – the **ph**ysical characteristics.

  The way it looks (e.g. **tall** or **short**).

- **Gen**otype –the **gen**es.

  letter combination (e.g. **Tt** or **TT** or **tt**)

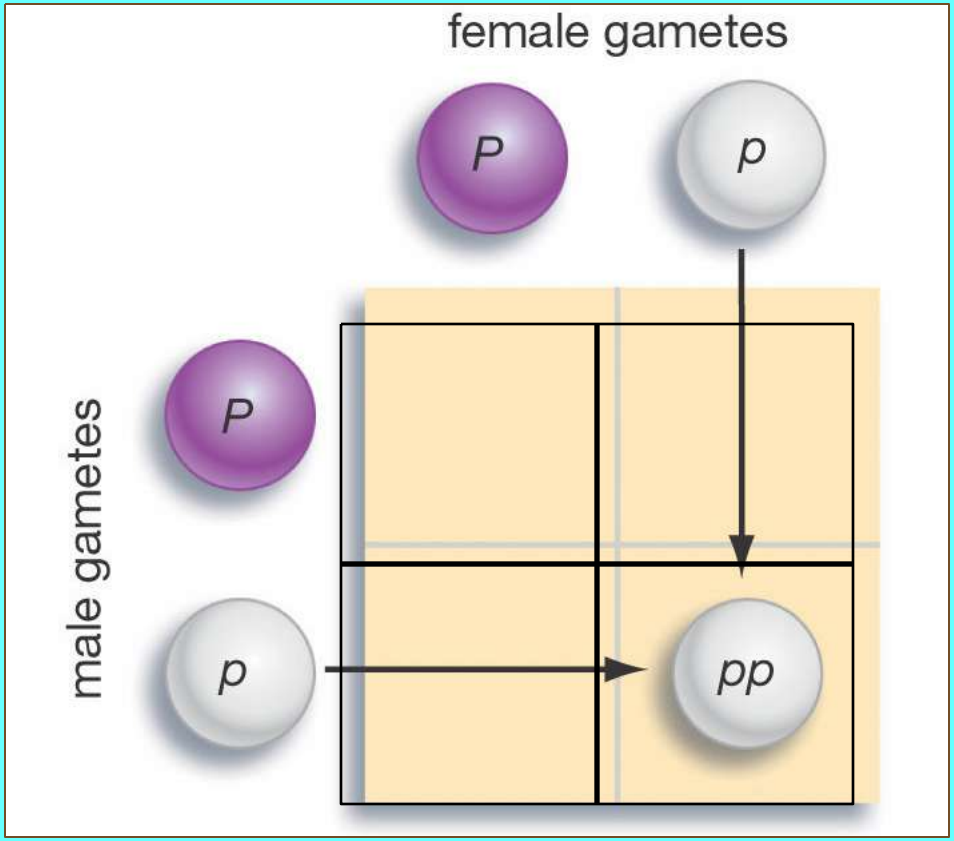
- **Mendel stated that physical traits are inherited as invisible "particles".**

–What do we now call these particles?

genes!

Punnett Square

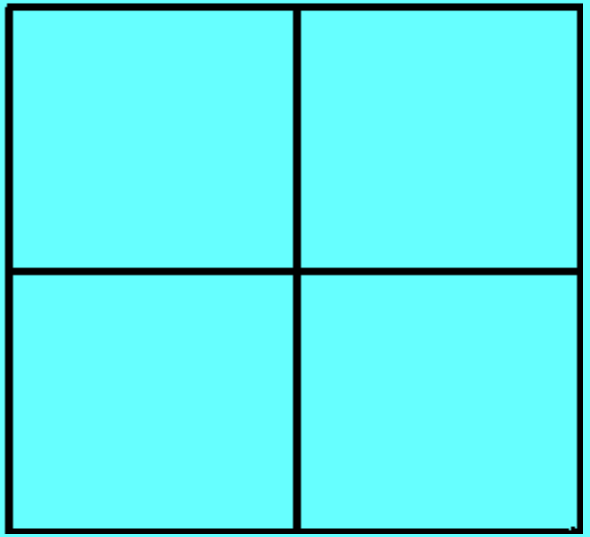
Used to help solve genetics problems



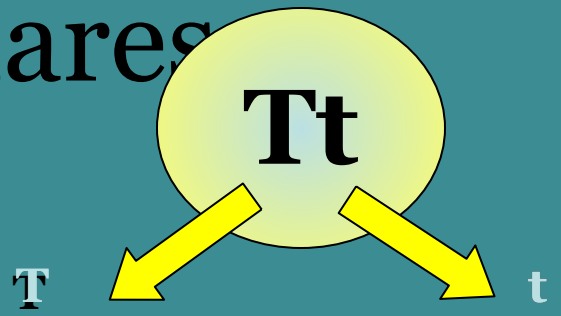
Punnett Squares

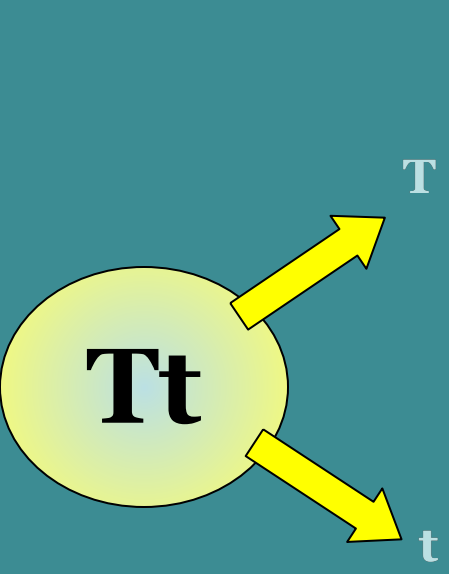
- more specifically, used to predict and compare the genetic variations that will result from a cross.

- Here is how they work. Watch the next slide carefully so you, too, will be able to use Punnett Squares.



Punnett Squares





tall	tall
tall	short

75%Tall

25%Short

Let's make some Punnett squares! (handout)

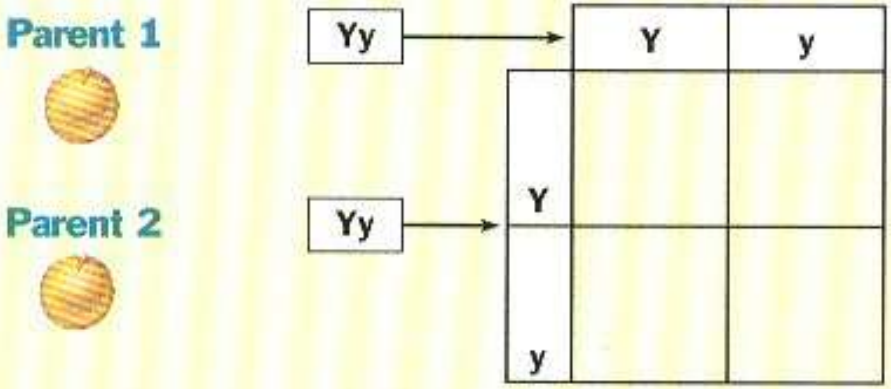
How to Make a Punnett Square

Punnett squares allow geneticists to predict the possible genotypes and phenotypes of offspring.

In this example, both parents are heterozygous for yellow-pea allele (*Yy*).

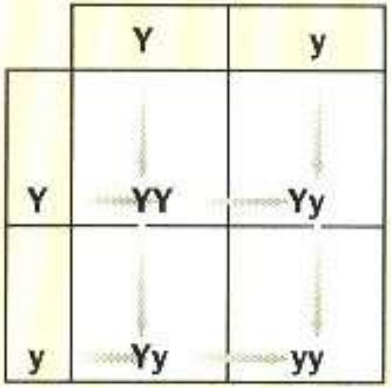
1 Make the grid

Place the alleles of the gametes of one parent along the top of a grid and those of the other parent along the left-hand side.



2 Fill in the grid

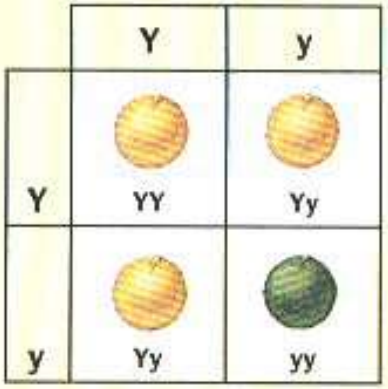
Combine the parent alleles inside the boxes. The letters show the genotypes of the offspring.



The genotype ratio is 1:2:1, meaning 1 *YY*, 2 *Yy*, 1 *yy*.

3 Fill in the offspring

Use the Law of Dominance to determine the phenotypes and phenotype ratio of the offspring.



The phenotype ratio is 3:1, meaning 3 yellow peas to 1 green pea.

Genotype & Phenotype:
How are they related in these flowers?

Genotype is the 2 alleles inside each cell. In this case, the letters R and r are used to represent the alleles for flower color.

R = allele for red flower

r = allele for yellow flower

Genes occur in pairs, but if one allele is dominant, it will determine the phenotype.

So the possible combinations here are:

Genotypes	**RR**	**Rr**	**rr**
Phenotypes	**RED**	**RED**	**YELLOW**

We have seen that the genotype determines the phenotype.

- But can anything ***besides*** genes determine your traits?

  Yes. (See next slide to help with the answer.)

Genes and Environment Determine Characteristics!

These ***Hydrangeas*** have the same genotype, but have been given different fertilizers.

Answer # 19-26b of your Guided Notes.

(These are review problems.)

You might need help with Mendel's 3 principles, which are often called "laws". Here they are.

- ***dominance**—Genes can have one dominant allele and one recessive allele.
- **segregation**—A parent has two alleles of each gene, but passes on only ONE to each gamete (egg or sperm).
- ***independent assortment**—When gametes are made, genes are distributed to gametes randomly.
- *As with most rules, there are exceptions.

Start page 3 of Guided Notes

from Mendelian to Non-Mendelian Genetics

1. Dominance

is Mendelian genetics.

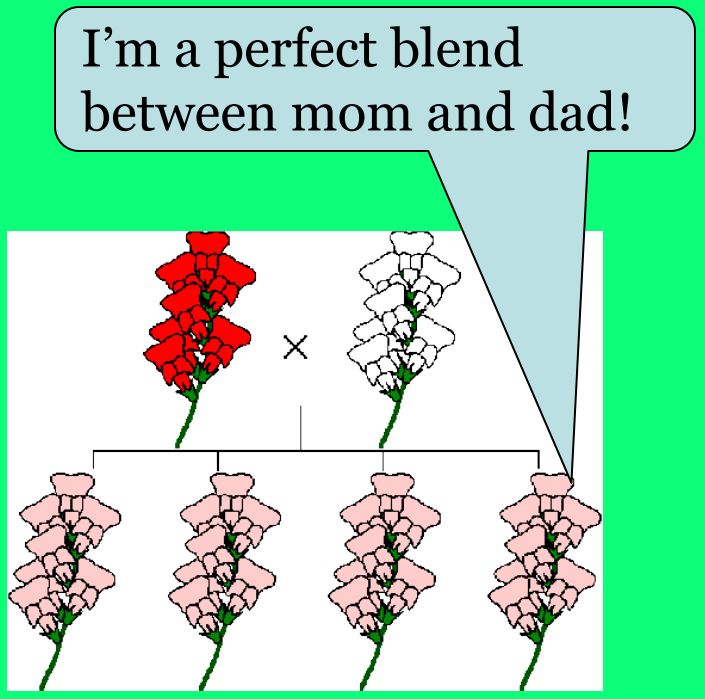
That's how peas work.

- But not all organisms are peas
- 2 types of non-Mendelian genetics

Some genes work by

2. Incomplete Dominance

- Neither allele is dominant.
- Traits are blended.
- e.g. White crossed with red make pink babies.



	R	R
W	RW	RW
W	RW	RW

Other genes work by

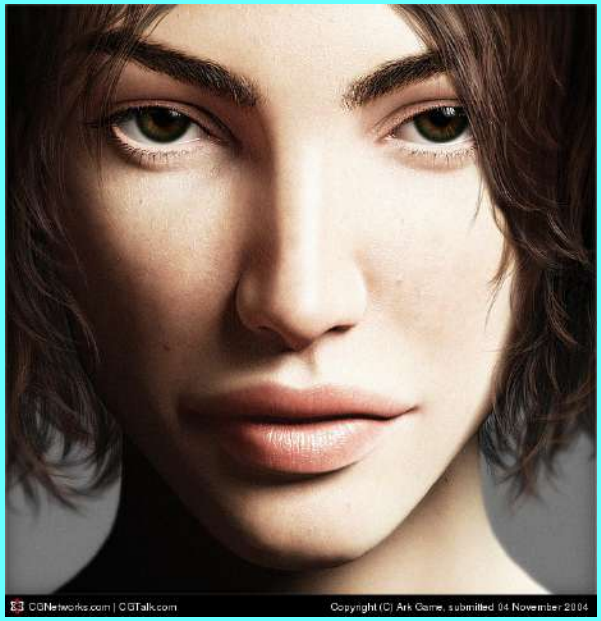
3. Codominance

- Both alleles contribute to the phenotype.
- Both show up. There is no blending.

Multiple Alleles, Polygenic Traits

- **Multiple alleles** – one gene with more than two **alleles**.
  - (e.g. fur color in rabbits)
  - only two can exist at once

- **Polygenic trait** –two or more **genes** influence a single trait.
  - (e.g. skin color in humans, also hair color in humans)

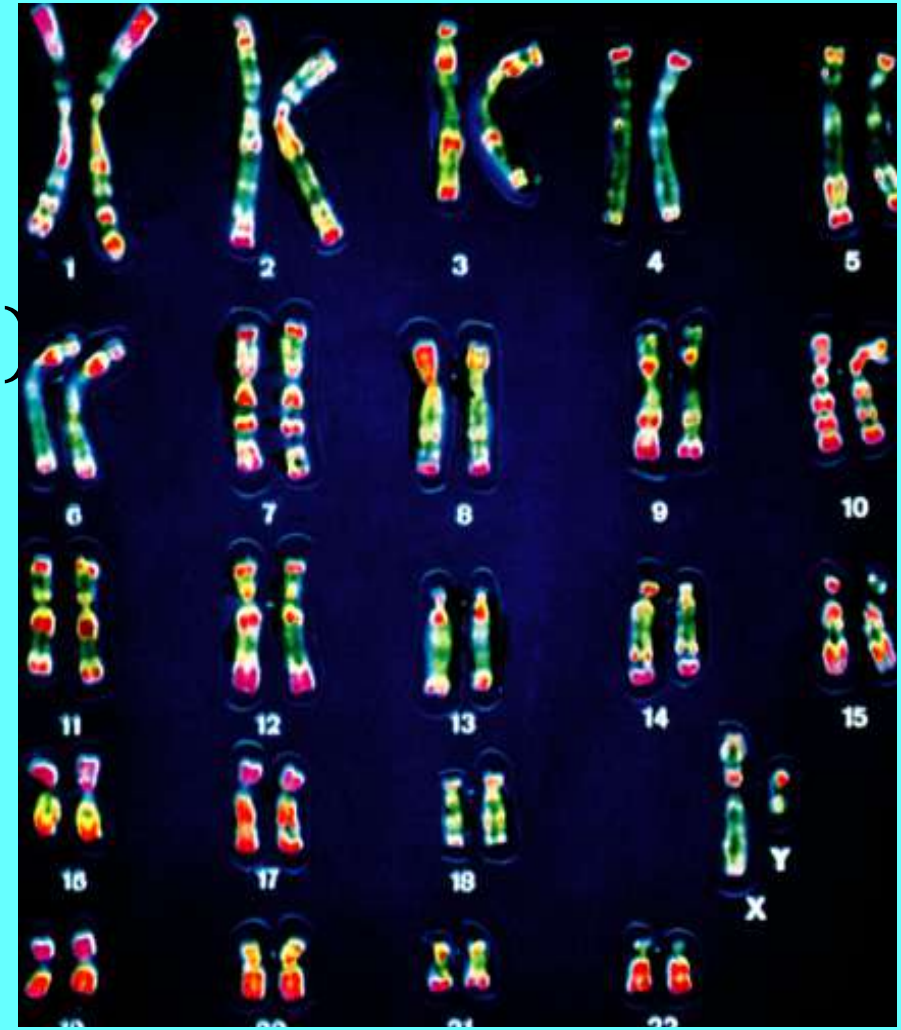


From peas to

Human Heredity

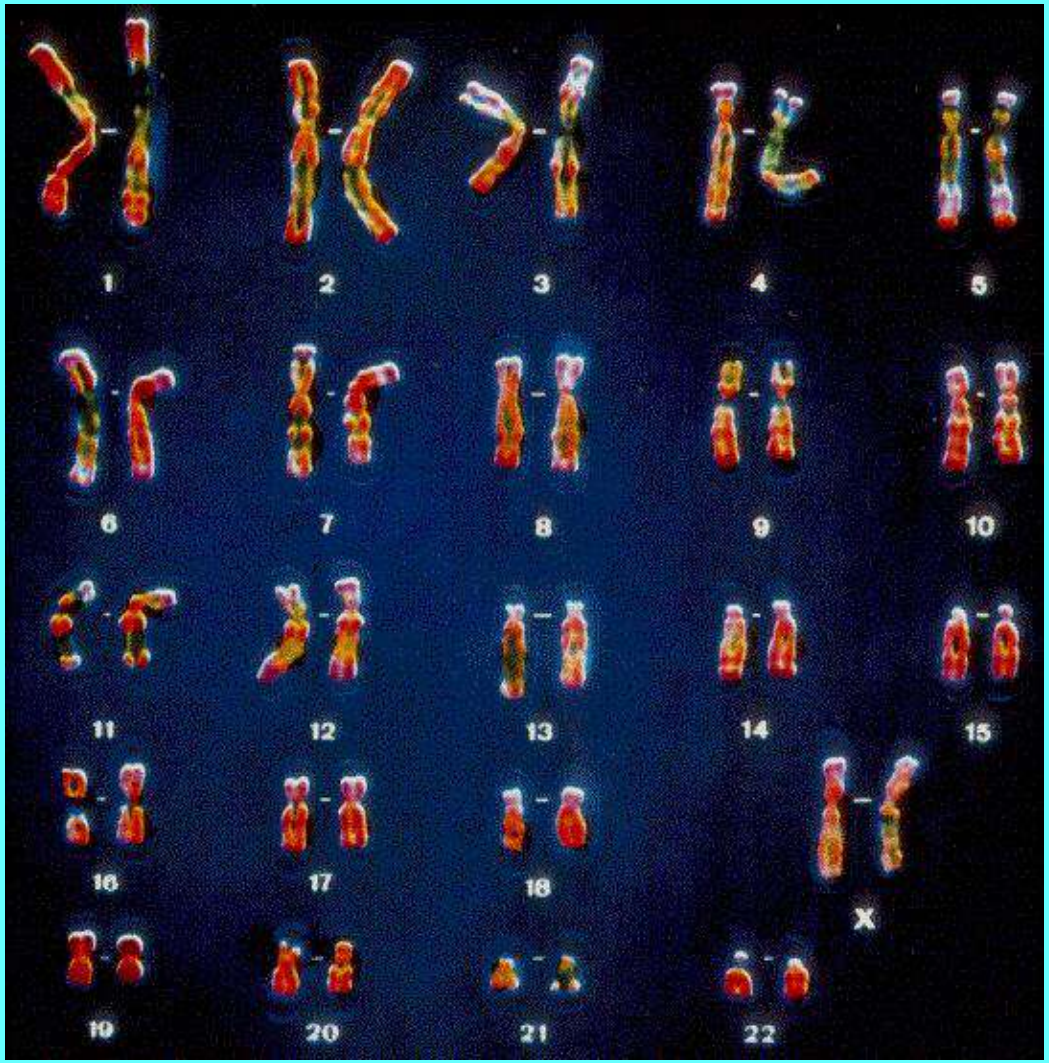
Karyotype

- An arranged picture of the chromosomes
- **autosomes**=first 22 pairs (44 chromosomes)
- **sex chromosomes** =the last pair
  - **XX female**
  - **or XY male**
- Which is shown here?



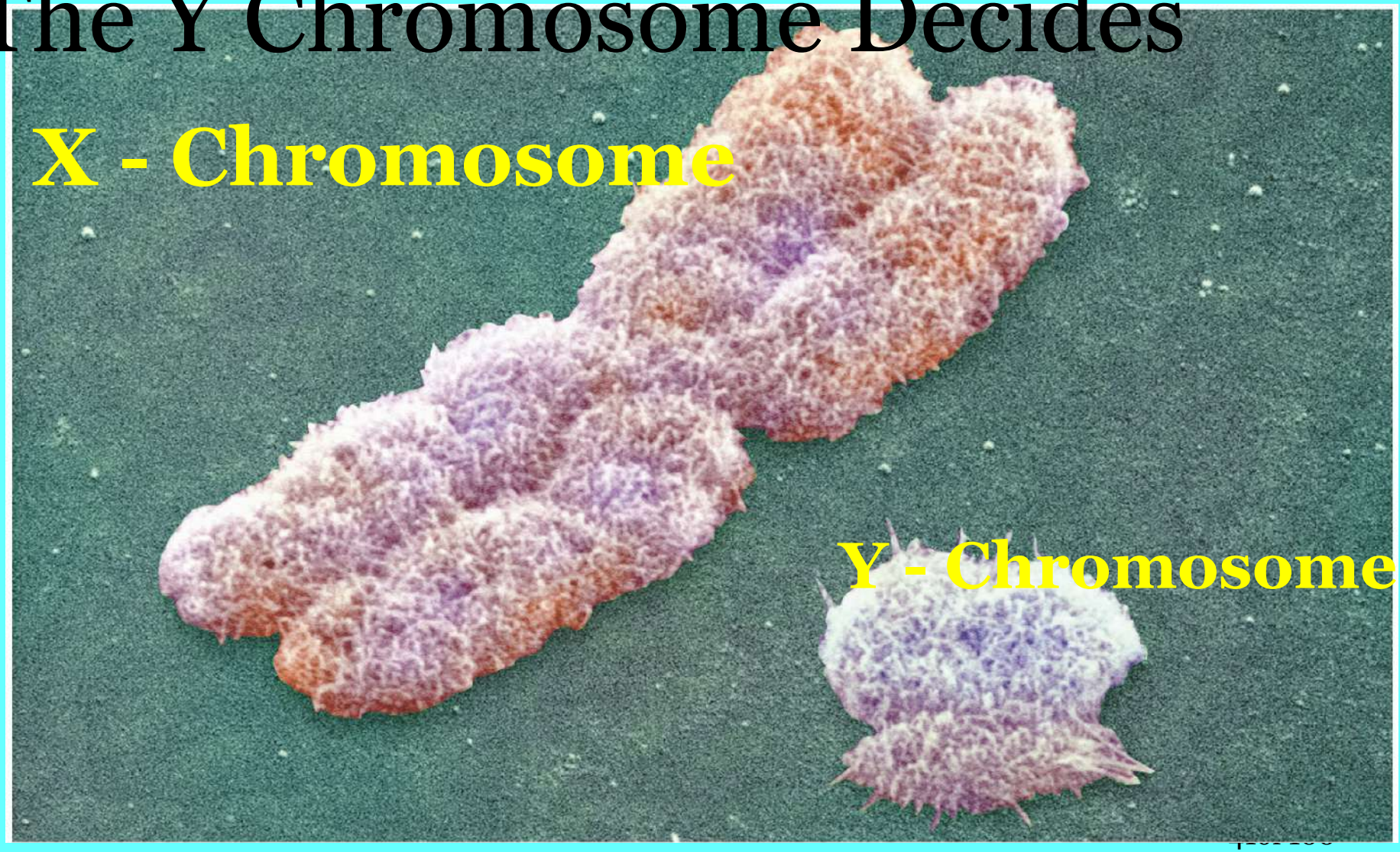
Another karyotype

- ✓XX female?
- ✓ or XY male?



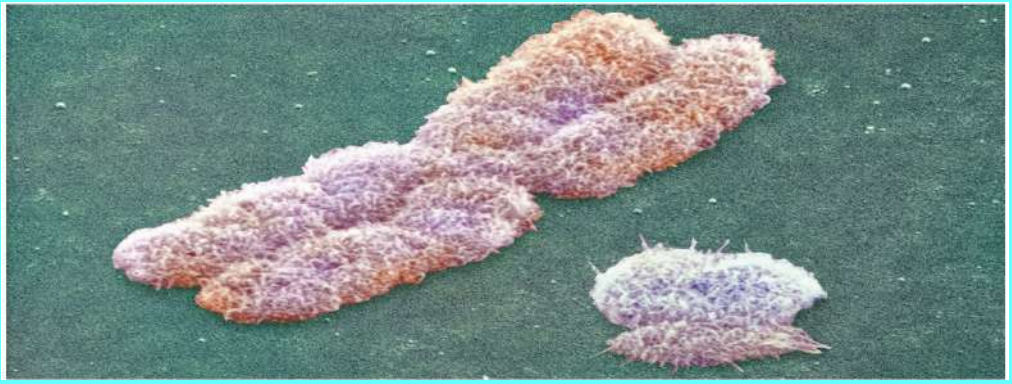
Boy or Girl?

The Y Chromosome Decides



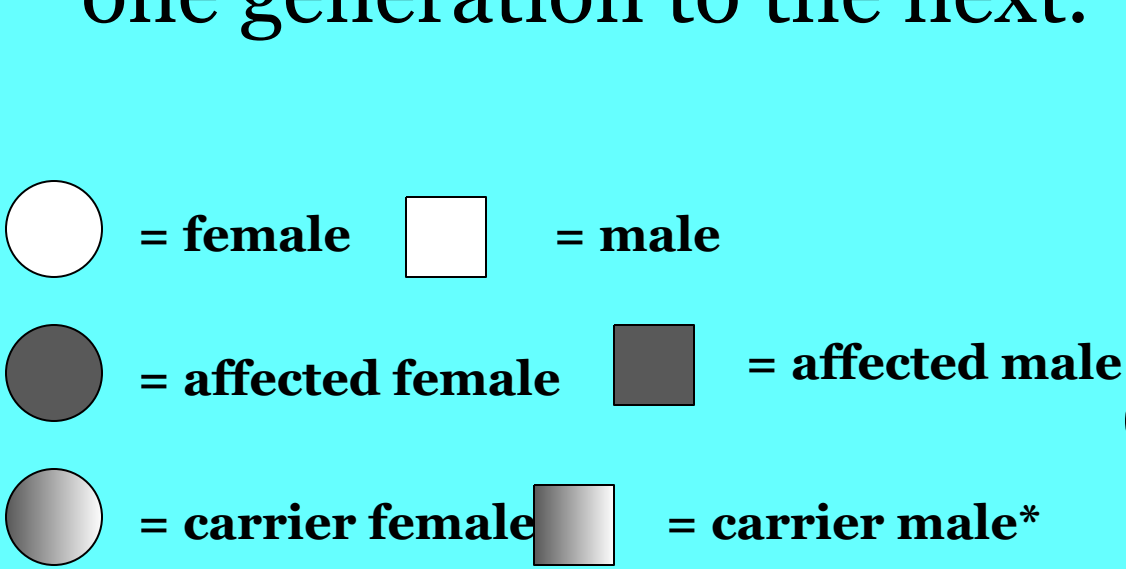
Sex-linked Genes (=X linked)

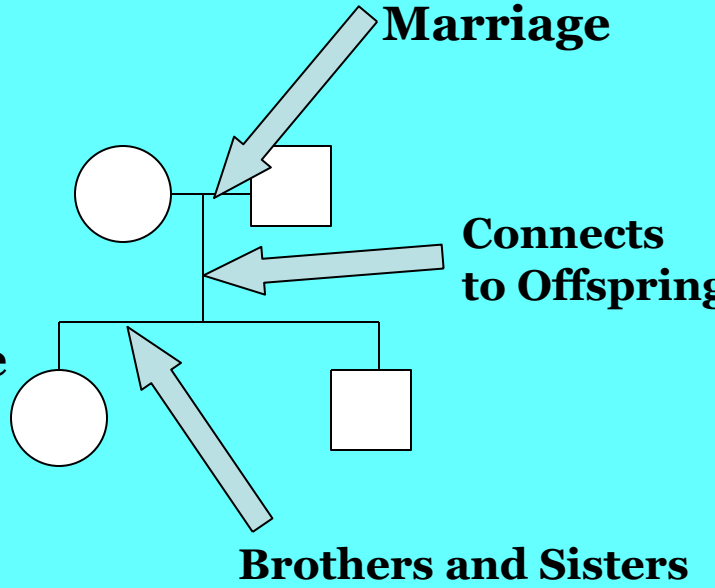
- Sex-linked genes – genes that are located on the X chromosome.
  - The puny Y chromosome is not all there! (It is missing alleles)
  - Since males only have one X, they are more likely to suffer from X-linked disorders.
- Colorblindness, hemophilia.



Pedigree

- Pedigree – a chart that shows the relationships within a family that can be used to study how a trait is passed from one generation to the next.



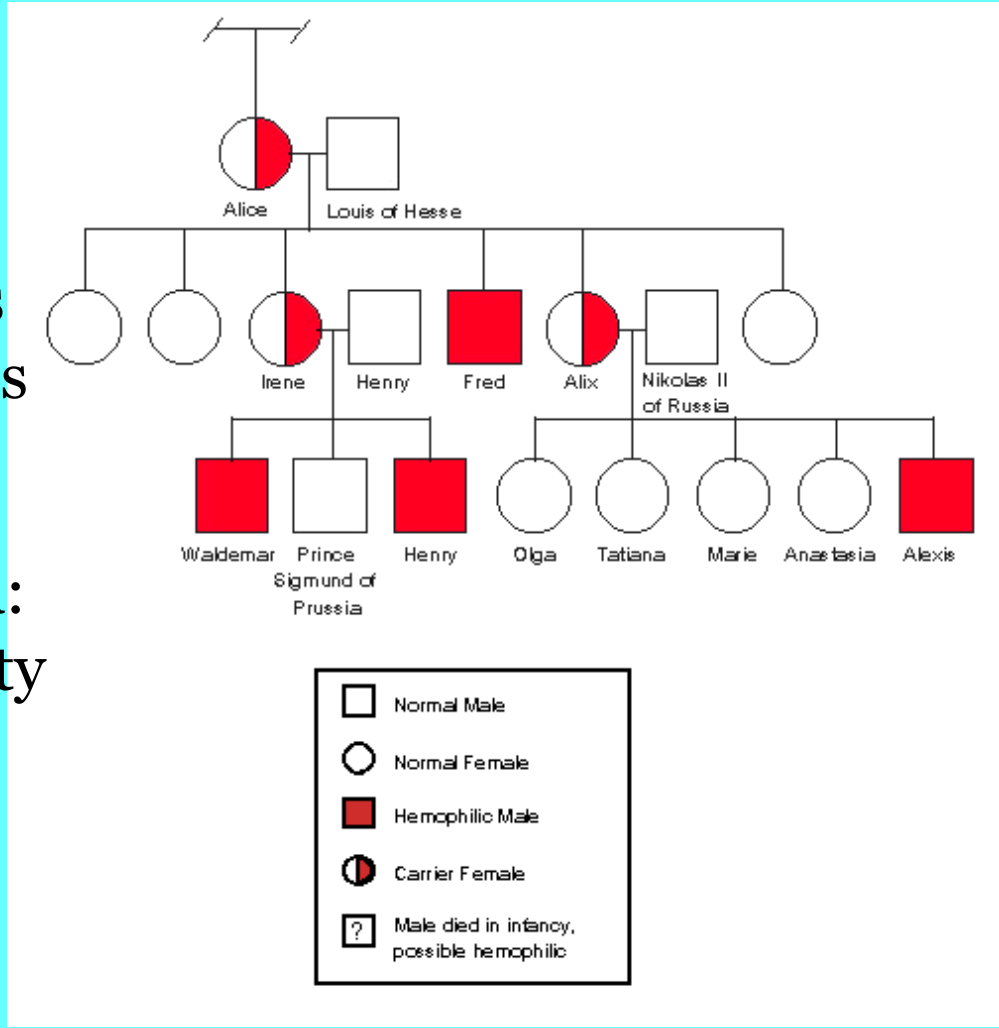


*Carriers are not usually shown.

Human Sex Linkage, a royal example

Hemophilia:
- faulty protein, no clotting
- recessive, on X chromosome
  - so mostly male phenotypes
- Queen Victoria of England was a carrier.

Why we know about hemophilia:
- Inbreeding of European royalty
- Pedigrees existed



Autosomal Disorders in Humans

Human Blood Type

(not a disorder)

- There are three alleles for blood type. Two are codominant.
- I^A, I^B, and i. (multiple alleles ***and*** codominance)

Phenotype (Blood Type)	Genotype	Protein Found on Blood Cells
A	$I^A I^A$ or I^A i	protein A
B	$I^B I^B$ or I^Bi	protein B
AB	$I^A I^B$	proteins A & B
O	ii	none

Chromosomal Disorders

- **Nondisjunction** –when chromosomes fail to separate during meiosis.
- Results in gametes with **extra chromosomes.**
- Down Syndrome – extra 21st.
- Turner's Syndrome – X
- Klinefelter's Syndrome - XXY

Mutation

- a change (error) in the chemistry of DNA
- can occur during DNA copying
- much more likely to occur when there is an ENVIRONMENTAL cause, such as frequent smoke inhalation
  - can be inconsequential (likely)
  - can be harmful (likely)
  - can be beneficial (unlikely)
- can cause change in offspring's gene ONLY if the mutation occurs in gamete-producing cells

The Average American Phenotype
(just for fun)

Of course, not all Americans are average....

The Average Phenotype for a High School-Dropout

- Questions?
- Comments?
- Stories?