



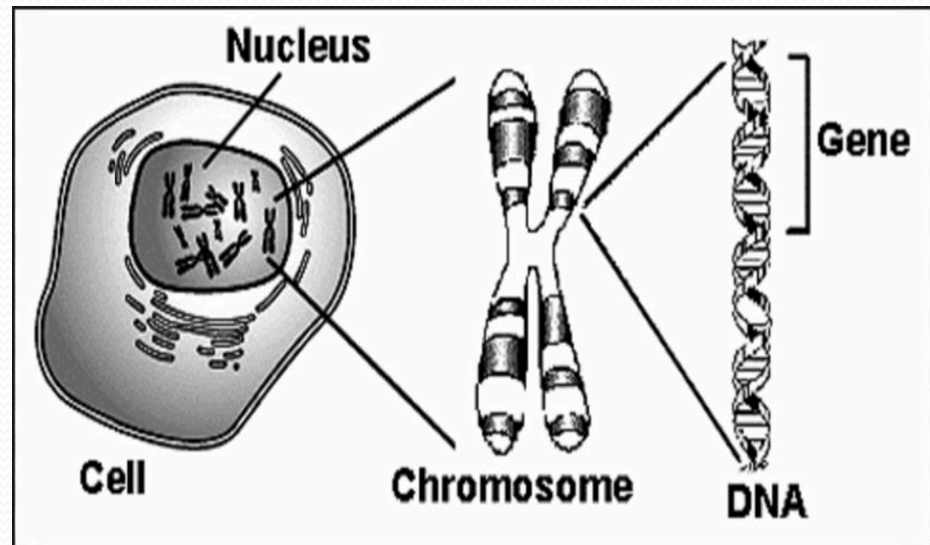
Genetics

Genetics

Recall from grade 8 & 9: Mitosis & Meiosis

- Your body is made of cells
- Cells are controlled by chromosomes in the nucleus
- Chromosomes are made of DNA (deoxyribonucleic acid)

What are DNA & Genes Video



The DNA molecule is organized into genes, which are:

- short sections of DNA that contain instructions to make a specific protein,

and it is genes that are responsible for the characteristics of a species.

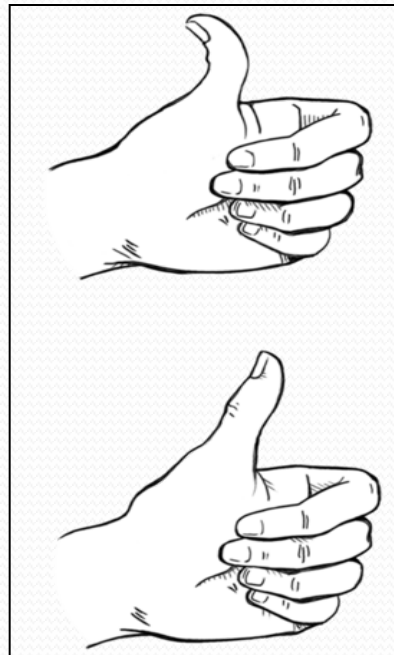
- Examples: humans have genes to make hair, nails and eyes whereas fir trees have genes to make needles, bark and roots
- A complete set of genes is called a genome
Protein Video



Within a single species, there are different versions of the same genes. These different versions produce variation within the species (traits)

What are Traits Video

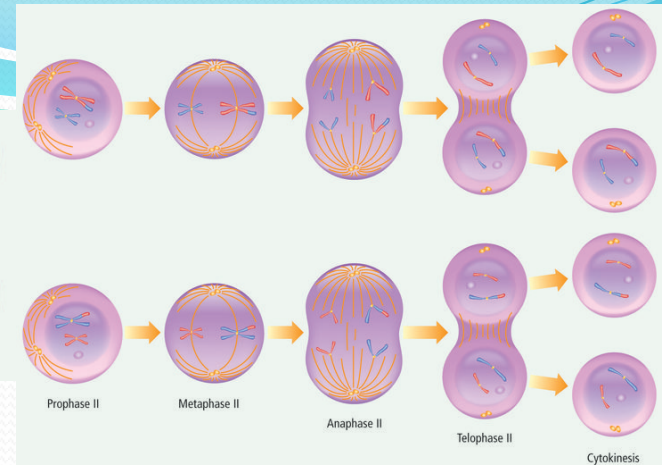
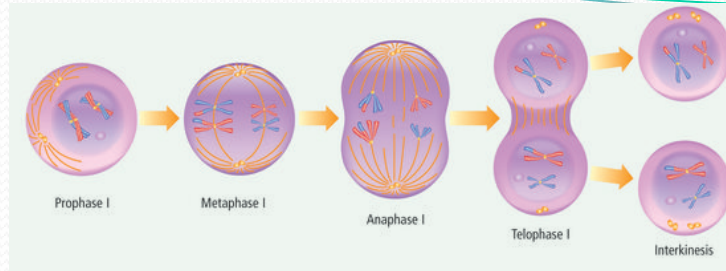
- Example: in humans, there are two traits for thumb shape: straight or curved (hitch-hikers thumb)



What combination of these traits do you have? Complete the survey to find out.

- | | | |
|-----------------------------|------------------------------|-----------------------------|
| 1. I have detached earlobes | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. I can roll my tongue | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. I have dimples | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. I am right-handed | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

- | | | |
|---|-------------------------------|---------------------------------|
| 5. I have freckles | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 6. I have naturally curly hair | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7. I have a cleft chin | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8. I have allergies | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 9. I cross my left thumb over my right when I clasp my hands together | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 10. I can see the colors red and green (I am not color blind) | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 11. The hairline on my forehead is straight. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 12. I am a: | <input type="checkbox"/> Male | <input type="checkbox"/> Female |



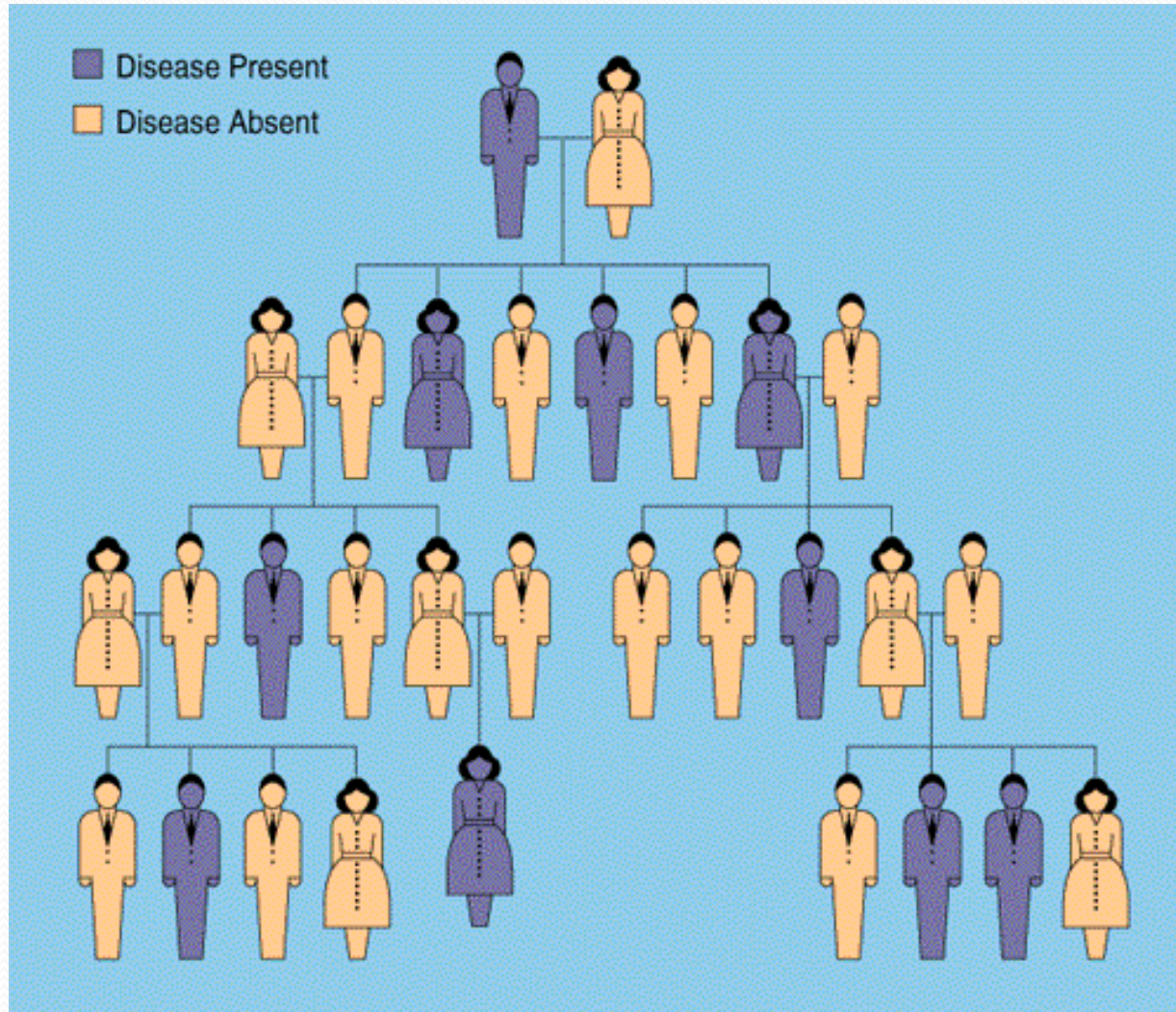
Recall from grade 9 that during meiosis, each sex cell (sperm and egg) contains half the genetic material of the original parent cell (only one set of chromosomes, rather than two). After sexual reproduction, an individual ends up with half their genes from their mother and the other half from their father.

[Inheritance Video](#)

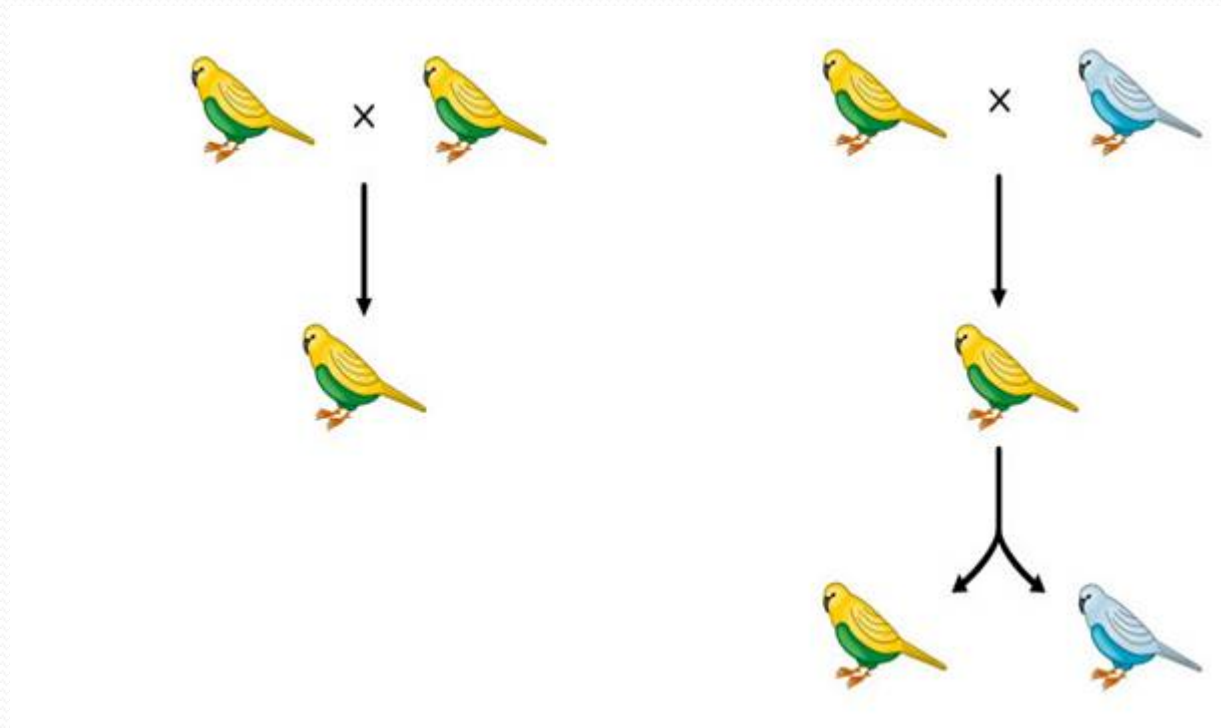
These sets of genes determine the outward appearance of an individual.

Given that there are thousands of possible combinations of genes, everyone is completely genetically unique (except for identical twins!).

Genetics: The study of heredity



Heredity: the passing on of characteristics from the parent to the offspring



Background (not in notes)



- Gregor Mendel: first lab in the garden
 - Studied garden peas
 - Performed cross-breeding with different types of pea plants
 - yellow peas x green peas
 - wrinkled peas x non wrinkled plants
- Determined that the inheritance of traits followed laws and that determined the ratios of how often those traits would be seen in the offspring of subsequent generations [Ted-Ed: Mendel's Pea Plants](#)

For Example

Gregor Mendel crossed pea plants:

Yellow X Green



Yellow (100%)



Then he crossed the offspring



Green (25%)

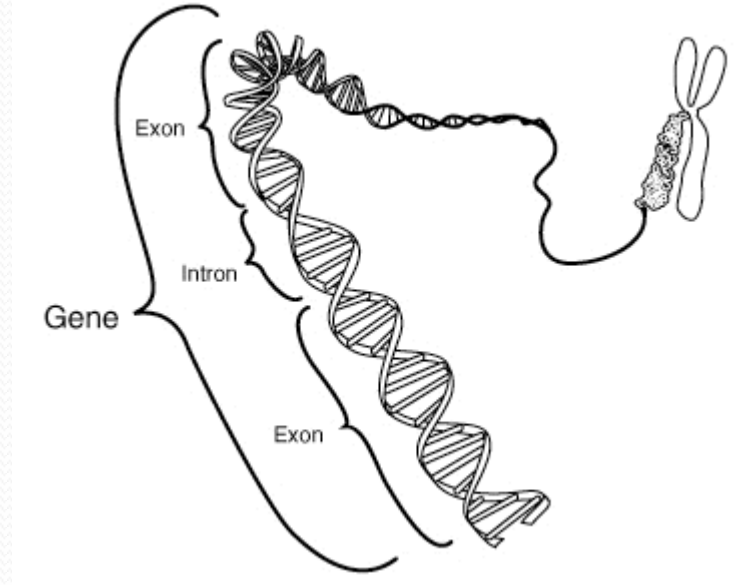


Yellow (75%)

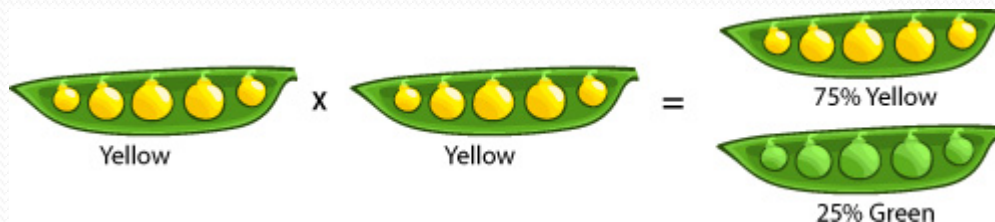
HMMM... Interesting

So before we go any further: Important Genetics Vocab!!!!

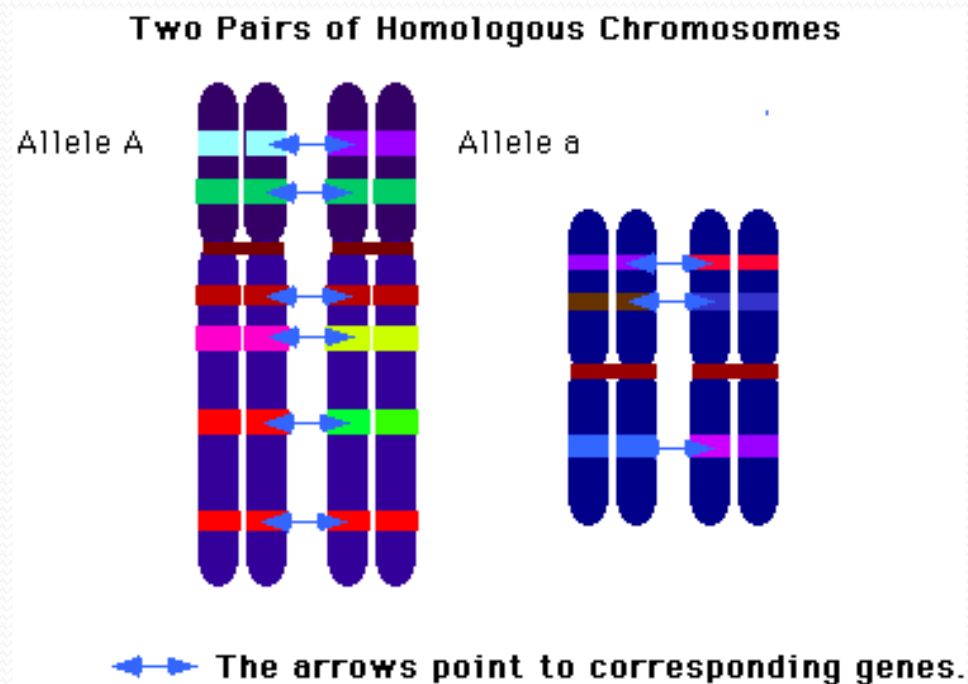
- **Genes** – a segment of a chromosome which codes for something specific





- Ex: seed colour




- Alleles: different forms of a gene
 - Eg: The gene is for seed colour but the alleles are for yellow and green
 - Each cell will have two alleles
 - Remember that each cell has homologous chromosomes



- Dominant: an allele that shows over the other allele of the gene. The dominant allele is written in uppercase.
- Recessive: an allele that does not show over the dominant allele. It only shows up when the other allele is recessive


		
Yellow	X	Green
(YY) Dominant		(yy) Recessive


Yellow (100%)

(Yy)

- Homozygous – an individual with copies of the same type of allele
 - Eg: YY (yellow peas) x yy (green peas)
 - Two copies of yellow Two copies of green
- Heterozygous – an individual with copies of two DIFFERENT alleles
 - Eg: Yy – (yellow peas)
 - One copy of the dominant yellow seed allele and one copy of the recessive allele (green)

- Genotype: The particular combination of alleles an organism has
 - Eg: YY or Yy or yy
- Phenotype: The physical appearance of the organism.
 - Yellow seed colour is the phenotype (YY or Yy genotype)
 - Green seed colour (yy is the genotype)

- 
- Hybrid – crossing of the two forms of a trait.
 - Pure bred- an individual with only one type of allele
 - F1 offspring (F1 generation) – the offspring of two pure bred individuals
 - F2 offspring (F2 generation)- the offspring of the F1 individuals bred with each other

For Example

Gregor Mendel crossed pea plants:

Yellow X Green

Pure bred individuals



Yellow (100%)

F₁ Offspring



Then he crossed the offspring



Green (25%)



Yellow (75%)

F₂ Offspring

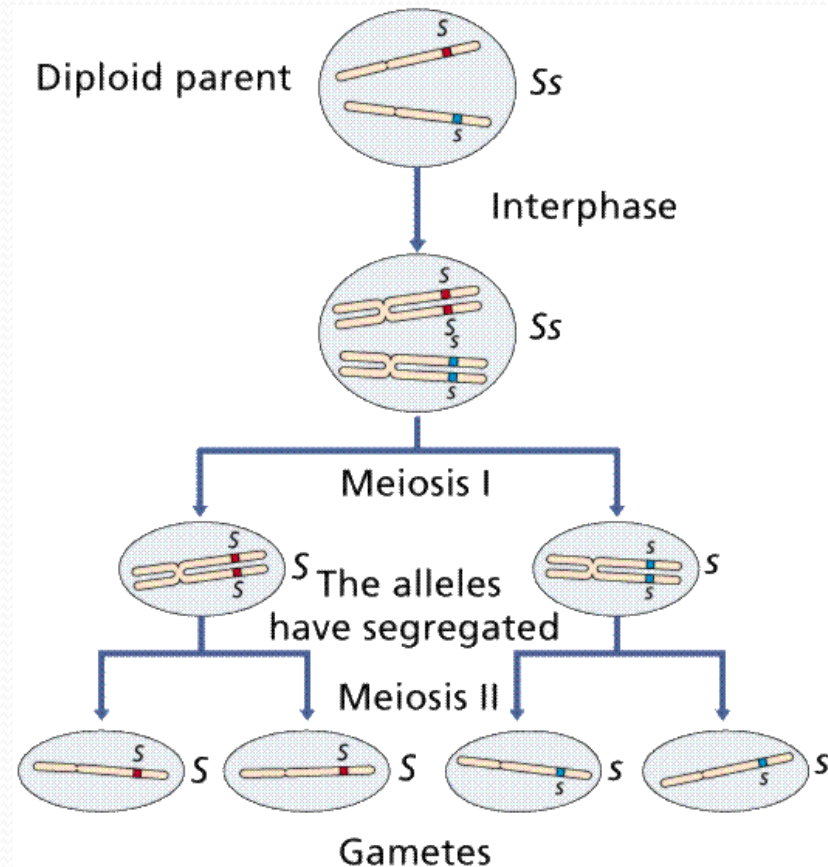
HMMM... Interesting

Genetics and Probability

- Probability is the chance or likelihood of something occurring
- Does not tell you what it will be but what is possible
- Ex. 50% chance a baby is a boy or girl
- Ex. Chance of tossing two heads in a row is:
$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

So:

- During meiosis different alleles can go into different cells

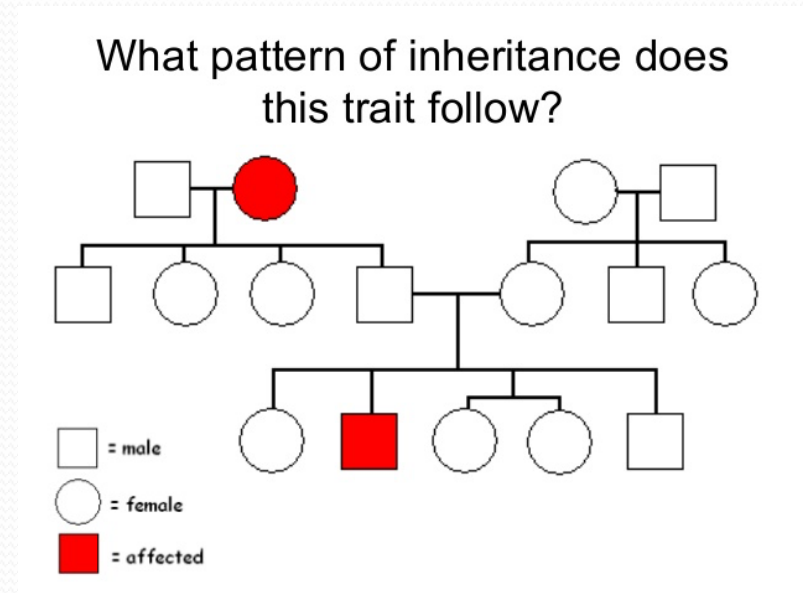


- A plant that is heterozygous for the seed colour Yy can give a Y allele or a y allele
- A Punnett square is one way to show all the possible genotypes of offspring

ANIMATION

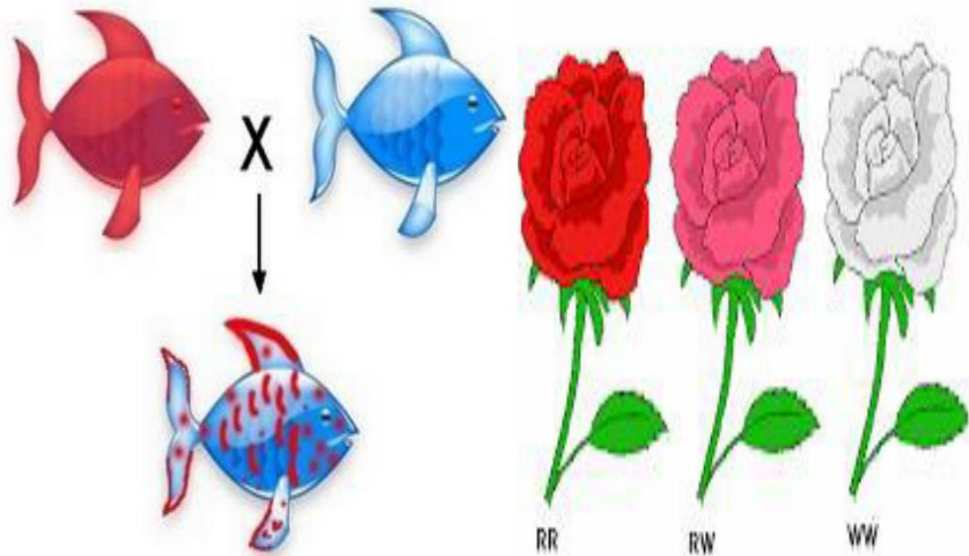
- Tracking a trait through generations can be accomplished with a Pedigree chart

Pedigree Charts Video



- Polygenic Inheritance!
- Co-Dominance vs Incomplete Dominance....not the same thing!
- Animation
- Animation on Blood Type

Codominant vs Incomplete Dominant- What's the difference?





Sex Determination in Humans

- Humans have 22 numbered chromosomes and a 23rd pair that is labeled XX or XY

Ted-Ed: Sex Determination is Complicated!

- A pair of XX produces a female
- A pair of XY produces a male



- The male parent determines the sex of the offspring

	X	X	
X	XX	XX	50% girl
Y	XY	XY	50% boy

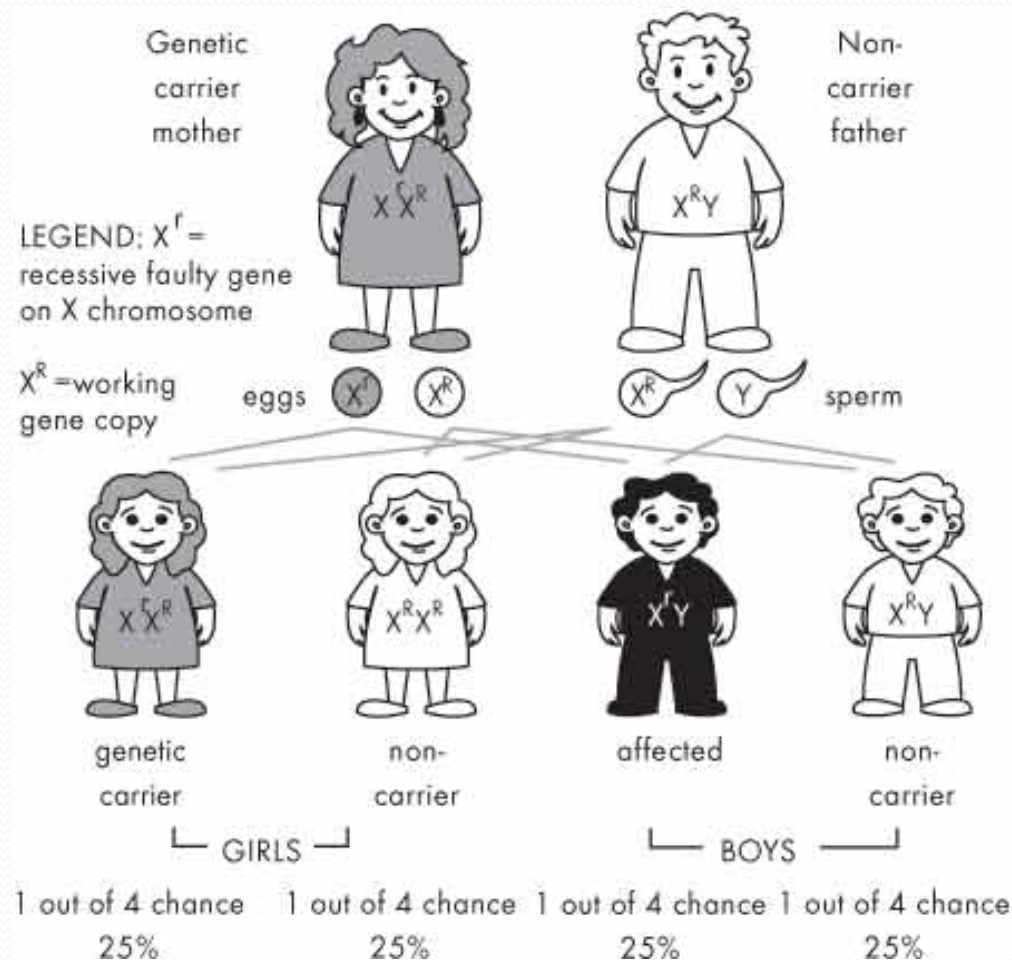
Hemophilia

- A body's inability to clot blood properly
- Animation

	X^H (Normal allele)	X^h (hemophilia allele)
X^H (Normal allele)	$X^H X^H$	$X^H X^h$
Y	$X^H Y$	$X^h Y$

Sex Linked Genes

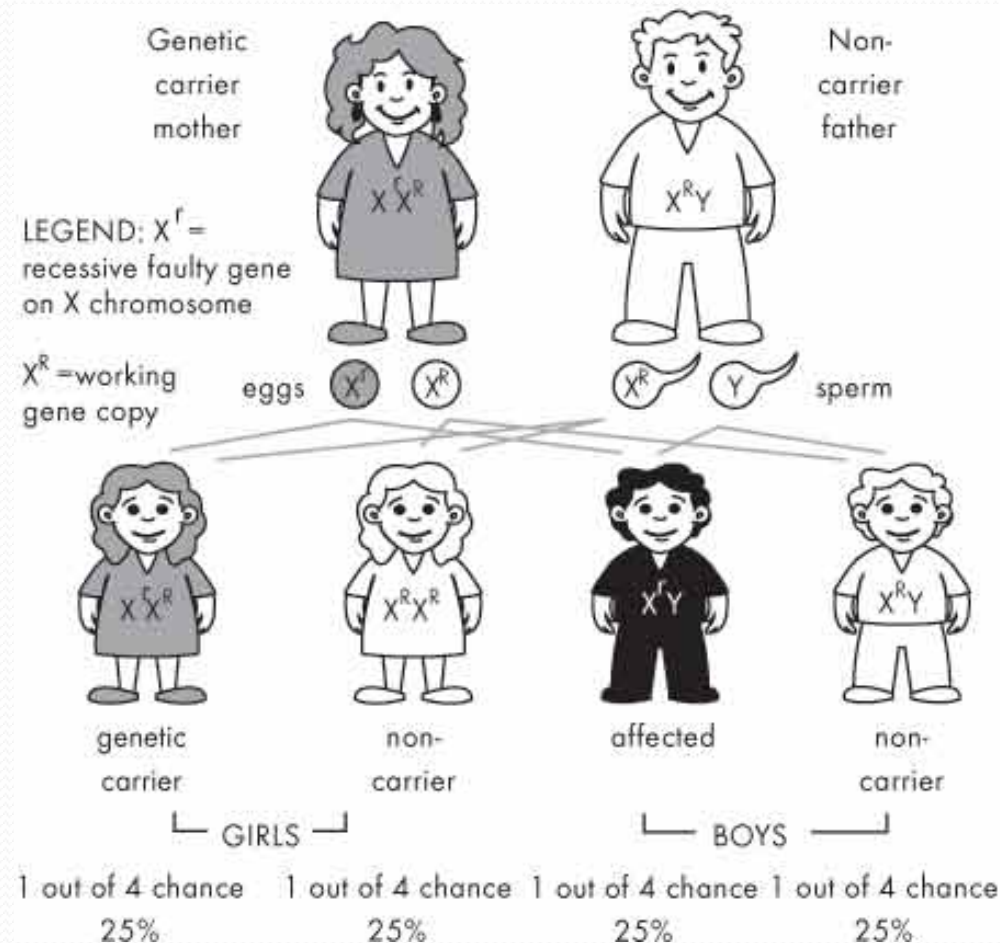
- Some genes are located only on the X or Y chromosome
- Eg: colourblindness is a recessive gene found on the X chromosome
- A male with the recessive X gene will have colourblindness
- A female with the recessive X gene may have another copy that is dominant and therefore is only a carrier for colourblindness



- Sex linked traits are usually exhibited by males rather than females because males have only one copy of the X chromosome (XX vs. XY)

- If the X chromosome carries the recessive allele, only the male will be affected

- Females are often carriers because the second copy of the X chromosome is dominant and the recessive trait is oppressed.





Finish With.....

Left handed Ted ed

Epigenetic Ted ed

....Good lead in's to next half of
Bio!