



# Objectives

- ✿ Use a pedigree to describe an inheritance pattern through several generations.
- ✿ Describe how the gender of an offspring is determined.
- ✿ Explain how sex linked traits differ from autosomal traits.
- ✿ Explain how different major genetic disorders are passed on from parents to their offspring.
- ✿ Identify the possibilities that could come from the field of genetic engineering.



# Heredity

- ✿ **Heredity** explains how genetic material, and thus physical traits are passed on from parents to offspring.
- ✿ Parents give each offspring one-half of their homologous chromosomes.
- ✿ When the 2 parental gametes combine, the combination of the traits of the parents appear in the offspring following the dominant/recessive pattern.
- ✿ It is possible to track the genotypes through multiple generations to see what inheritance patterns emerge.

# Pedigrees

- ✿ A **pedigree** is a chart used to map out how a specific trait is inherited through multiple generations.
- ✿ There are simple rules on how to read a pedigree.
- ✿ On a pedigree chart there will be roman numerals at each row to represent generations.
- ✿ Numbers under each individual are used for reference.

 → Male who does not express the given trait.

 → Male who expresses the given trait.

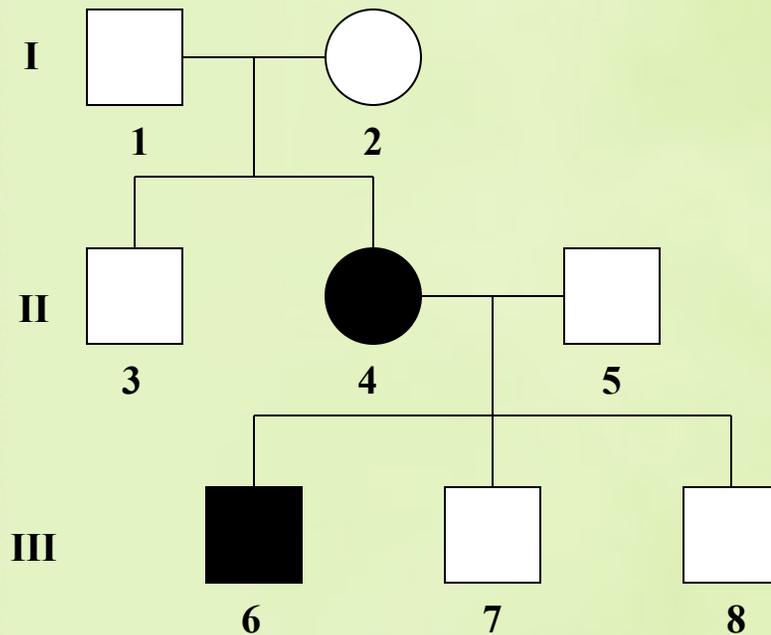
 → Female who does not express the given trait.

 → Female who expresses the given trait.

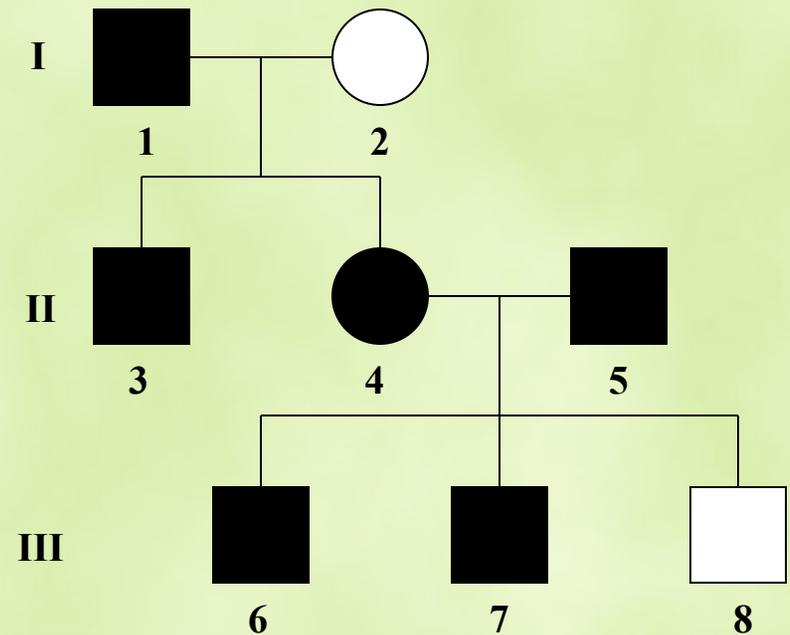
— → Connects a mating couple (Horizontal line.)

| → Connects parents to offspring. (Vertical line.)

# Practice with Pedigrees



✿ What are the genotypes of each individual?



✿ What are the genotypes of each individual?

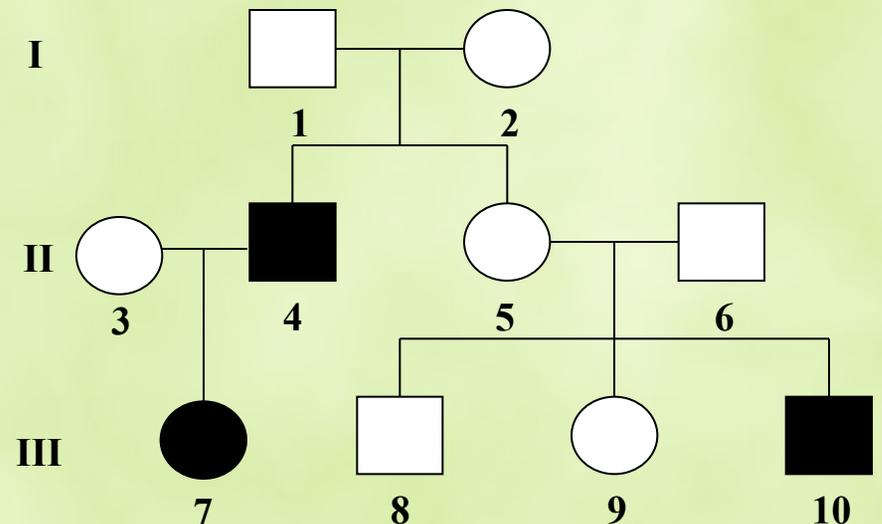
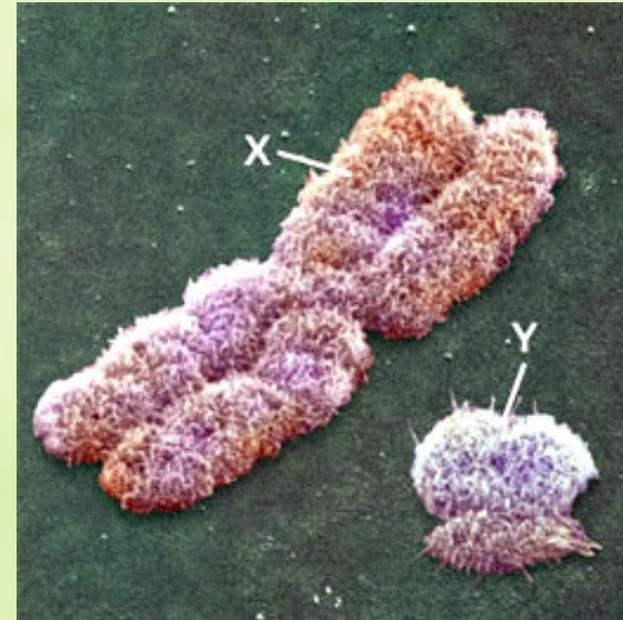


# The Humble Fruit Fly

- ✿ In the early 1900's, Thomas Hunt Morgan was studying *Drosophila melanogaster*, the common fruit fly and noted a specific trend. (Male flies had a higher occurrence of white vs. red eyes.)
- ✿ He noticed that fruit flies had 3 pairs of chromosomes and in females they all looked similar, but in males one of the pairs differed.
- ✿ He had discovered "sex chromosomes".
- ✿ In females, the last set of chromosomes were the same, meaning they had two "X" chromosomes.
- ✿ In males, the last set had one long chromosome ("X") and one short chromosome ("Y")

# Sex-Linked Traits

- Because of the difference in size, the X chromosome can contain instructions for certain traits that do not exist on the Y chromosome.
- Sex-Linked traits have a different inheritance pattern than traits on other chromosomes because they are not truly homologous.
- The genotypes for sex-linked traits are represented with X or Y and the letter that represents the trait as a superscript. (EX:  $X^B X^b$  or  $X^B Y$ )



- What are the genotypes of each individual?

# Polygenic Traits

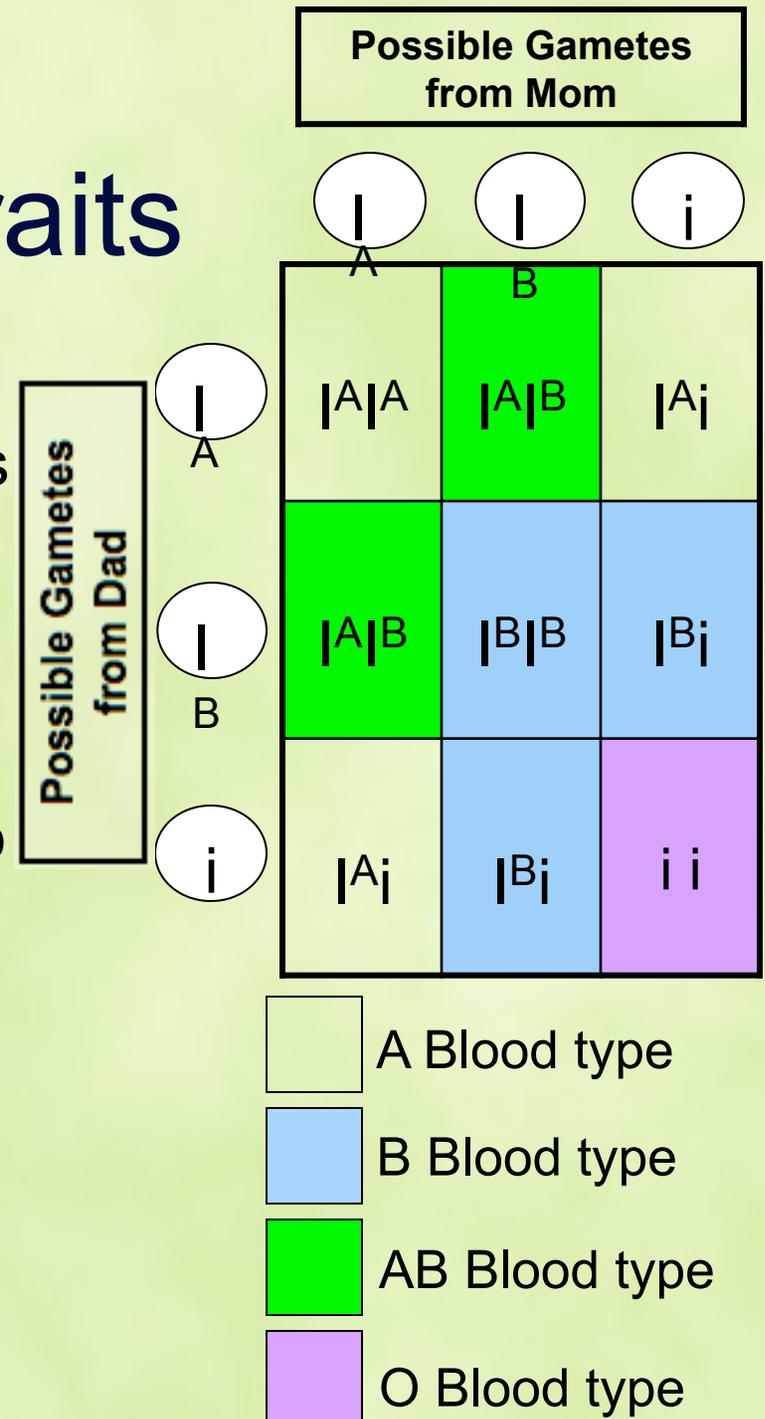
- ✿ Some traits are not simply expressed as either present or absent, but are expressed with variations because there are multiple genes that code for the trait (EXAMPLE: Skin tone, hair color, height, etc.)
- ✿ In these traits, the more often the dominant trait appears in the series of genes that code for it, the closer the trait appears to the dominant trait.
- ✿ Environmental conditions often play a role in the expression of these traits (more sun=darker skin.)

| Genes for Skin Tone |   |   |
|---------------------|---|---|
| Gene 1              | B | B |
| Gene 2              | B | b |
| Gene 3              | B | b |
| Gene 4              | B | B |
| Dark Skin           |   |   |

| Genes for Skin Tone |   |   |
|---------------------|---|---|
| Gene 1              | B | B |
| Gene 2              | b | b |
| Gene 3              | b | b |
| Gene 4              | B | b |
| Lighter Skin        |   |   |

# Multiple Allele Traits

- Some genes have multiple alleles that can result from different genetic combinations (EXAMPLE: Blood type.)
- In this case, multiple traits can appear.
- We use a similar form of notation as sex-linked traits to display how these traits are expressed. (EX:  $I^A I^B$  or  $I^A i$ ).
- In the case of blood, the gene codes for which antigen is on the outside of the red blood cell, thus determining what blood can be transfused.





# Common Genetic Diseases & Disorders

- ✿ There are many different diseases and disorders that result from variations in one's genetic code.
- ✿ There are different types of genetic diseases based on where they are and how they are expressed:
  - ✿ Color-blindness & Hemophilia - Sex-linked traits more common in males because a counter gene is not present of the Y-chromosome.
  - ✿ Huntington's Disease - Autosomal dominant trait on chromosome 4. (Destroys nervous tissue)
  - ✿ Sickle-Cell Anemia - Autosomal recessive trait on chromosome 11. (Misshapen blood cells.)



# Common Genetic Diseases & Disorders (Cont...)

- Down Syndrome (Trisomy 21) - When an offspring gets an extra copy of the 21st chromosome.
  - Non-Disjunction is when chromosomes do not separate at the centromere and 2 copies of the same chromosome end up in the same gamete.
- Cancer - Results from a mutation in a cells DNA.
  - Gametal mutations can be passed on to offspring, but mutations that occur in somatic can not.



# Teach Me! Project

- ✿ Pick a Genetic Disease/Disorder
- ✿ You will have 2 in-class days to research/work
- ✿ Create and deliver a 15 minute lesson to explain:
  - ✿ What the disease/disorder is
  - ✿ What causes the disease/disorder
  - ✿ The inheritance pattern using a pedigree
  - ✿ How the disease manifests
  - ✿ What the symptoms/traits are
  - ✿ What the treatments are
  - ✿ Other interesting/unique information about the disease/disorder

# Project Must Include

- ✿ No more than 5 minutes of lecture
- ✿ A Visual Aid
  - ✿ PowerPoint
  - ✿ Poster
  - ✿ Handout/Brochure
- ✿ An assignment/activity (Include a pedigree.)
  - ✿ Worksheet
  - ✿ Puzzle
  - ✿ Lab
  - ✿ Activity
- ✿ An answer key (Turn-In)



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