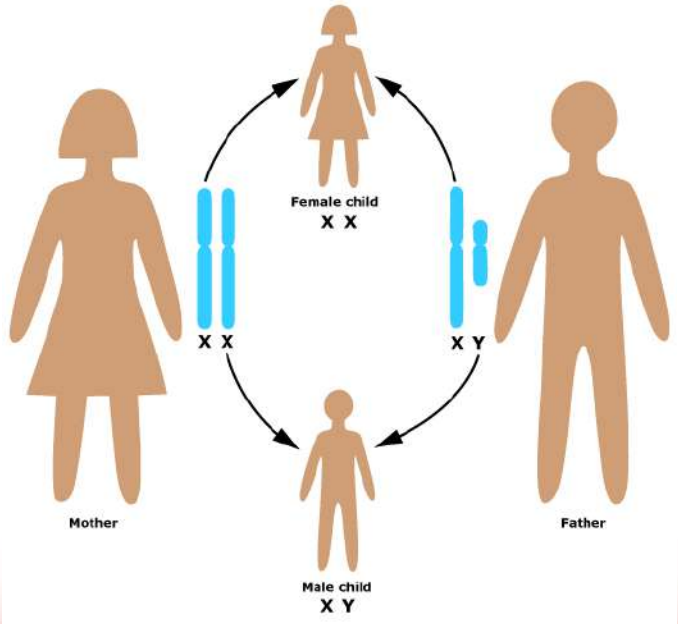
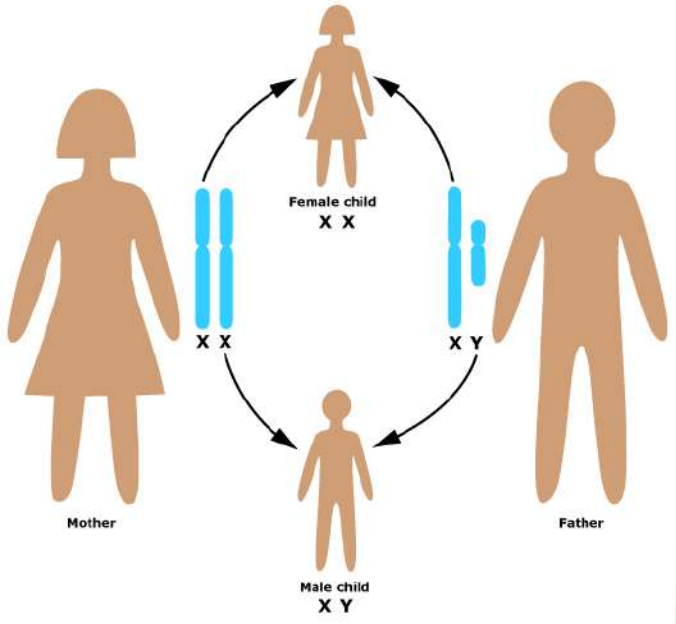
SEX DETERMINATION

The sex of an individual is determined by the sex chromosomes contributed to the zygote by the sperm and the egg



SEX DETERMINATION

An egg can donate an X
A sperm can donate an X or Y
Therefore the sperm determines the sex of a child

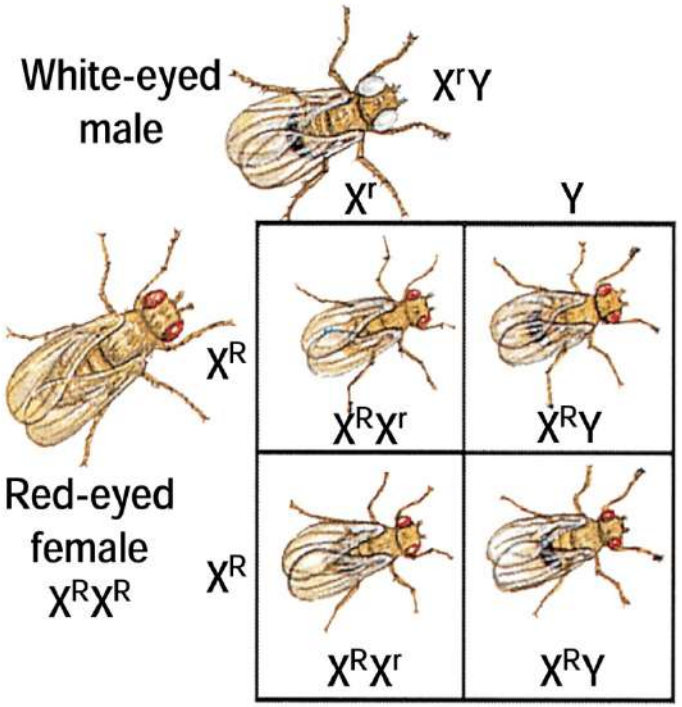


SEX-LINKED INHERITANCE

Using fruit flies as test subjects, Thomas Morgan studied eye colour using simple monohybrid crosses. Red eyes (R) are dominant over white eyes (r).

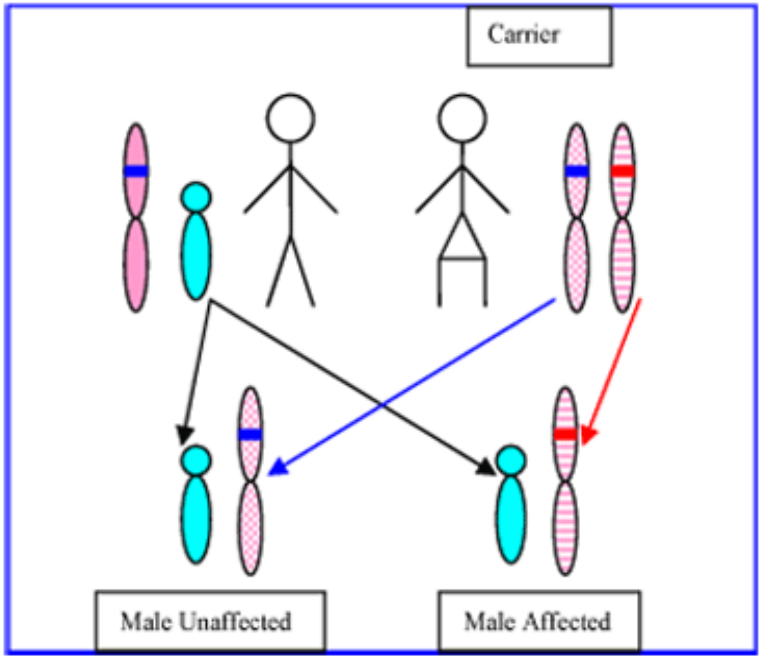
SEX-LINKED INHERITANCE

When he crossed purebred white-eyed males with red-eyed females, he was unable to produce a female with white eyes.
He concluded that the gene must be located on the X chromosome.



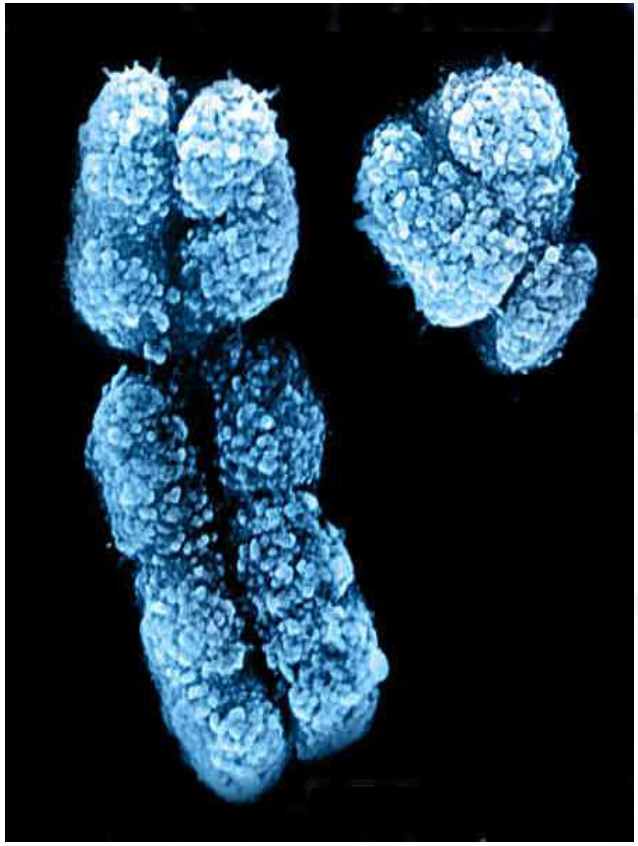
SEX-LINKED INHERITANCE

Some traits are located on the sex chromosomes, so the inheritance of these traits depends on the sex of the parent carrying the trait.



SEX-LINKED INHERITANCE

Most known sex-linked traits are X-linked (carried on the X chromosome). This is probably because the X chromosome is much larger than the Y chromosome.

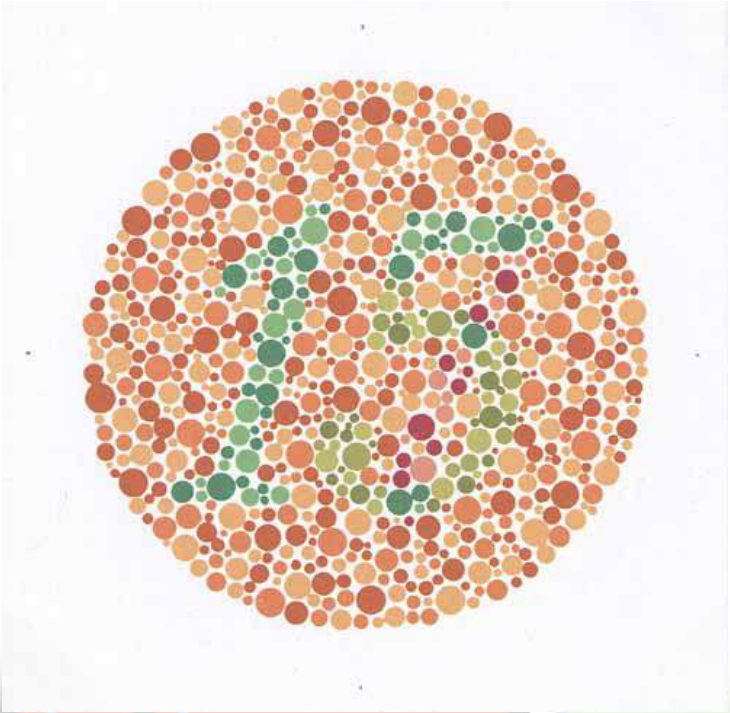


SEX-LINKED DISORDERS

Some sex-linked traits are associated with disorders.
Most are found on the X chromosome, Y-linked disorders are rare.
Males are at a much greater risk for inheriting sex-disorders because they only inherit one X, so if the X has the allele for the disorder, they will suffer from the disorder.
Recessive **lethal** X-linked traits result in death.

EXAMPLES OF SEX-LINKED TRAITS and DISORDERS

Male pattern baldness, red-green colour blindness, myopia, night blindness, hemophilia



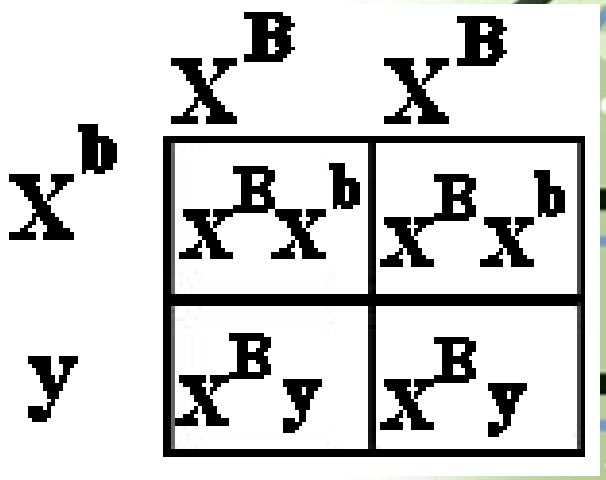
SEX-LINKED INHERITANCE

Punnett squares are used to predict the outcome of sex-linked inheritance.

Assume the trait is X-linked unless told otherwise!

Most disorders are recessive, some are dominant, the questi will tell you.

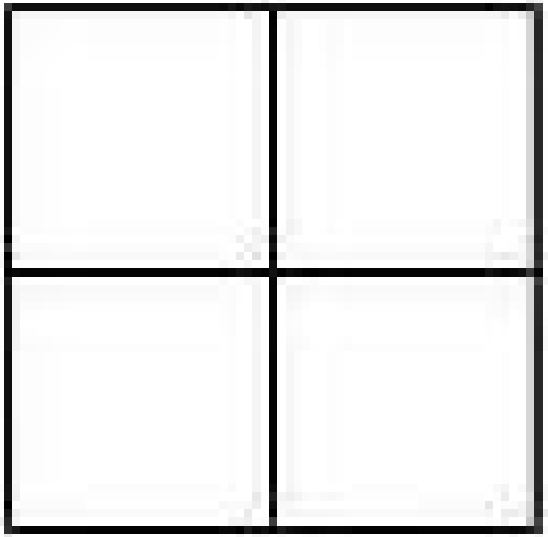
A “carrier” is a female who is heterozygous for the trait.



EXAMPLE

Hemophilia is a recessive X-linked trait. What is the probability of a couple having a hemophiliac child if the man does not have hemophilia and the woman is a carrier?

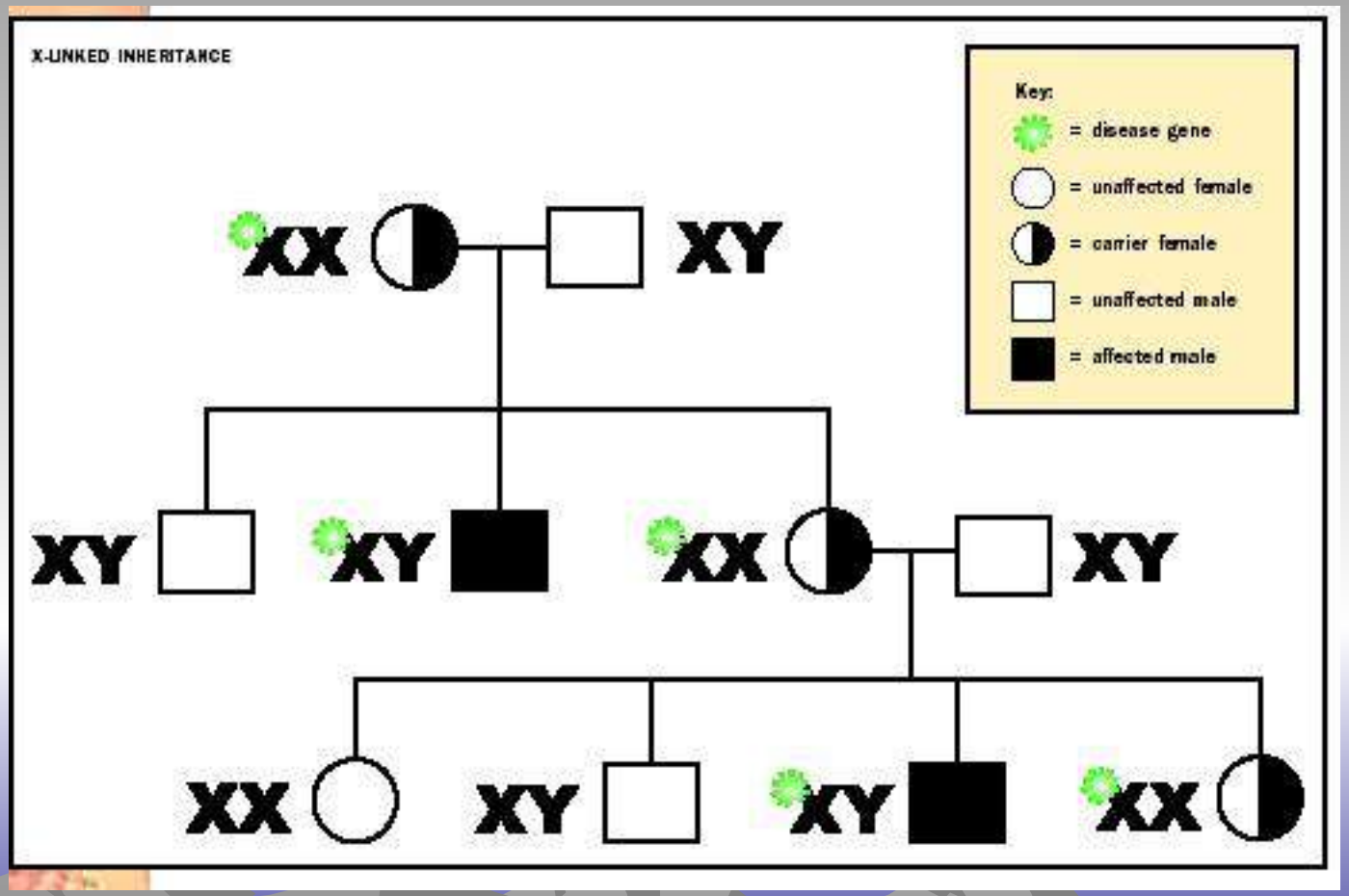
EXAMPLE



Sex determination

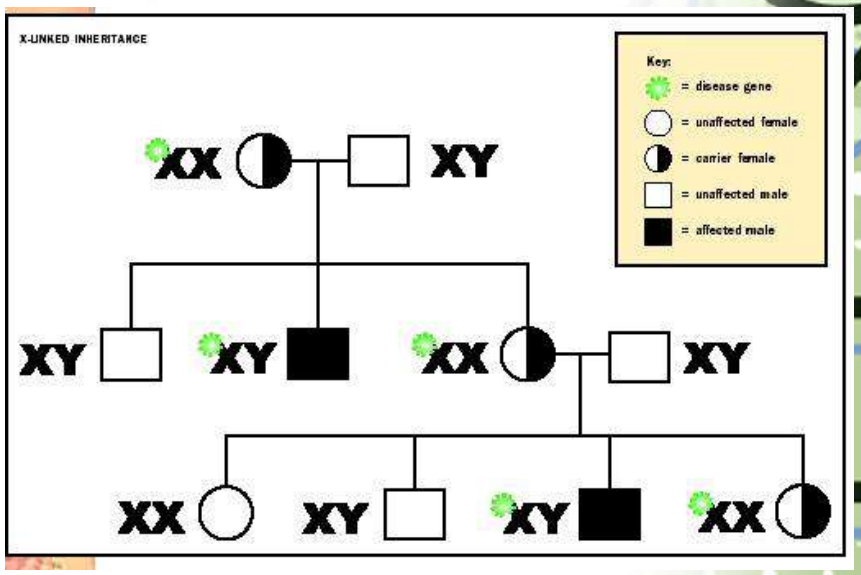
- TED Ed - Sex Determination

Patterns of Inheritance



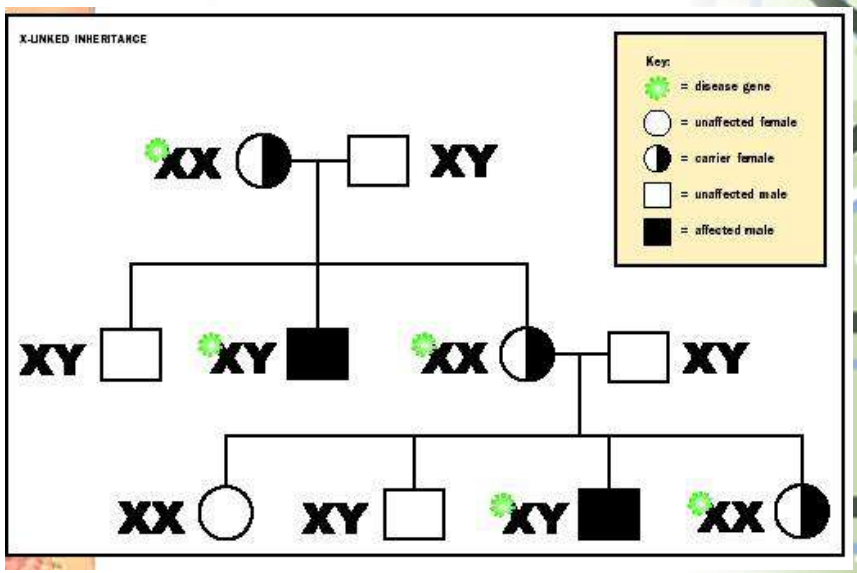
Pedigrees

- A pedigree is a genetic family tree that shows how prevalent a trait is in a family unit from generation to generation.
- They are often used to track the expression of genetic conditions and disorders.



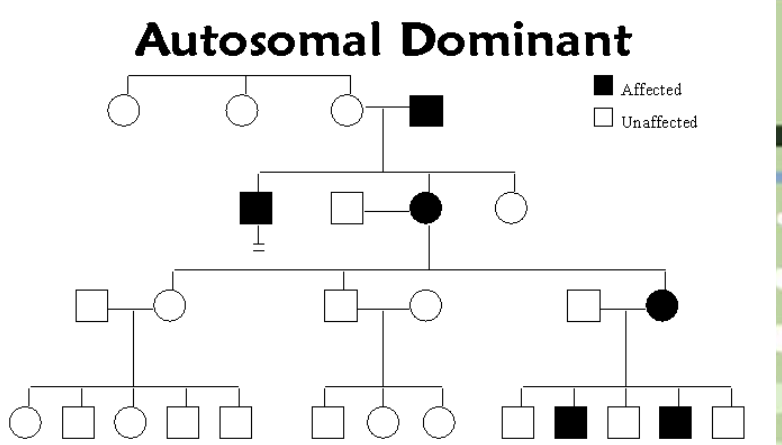
Pedigrees

- Squares represent males and circles females.
- A coloured in shape means that person has the trait in question.
- A half coloured in shape means that they are carrying an allele for a recessive trait.



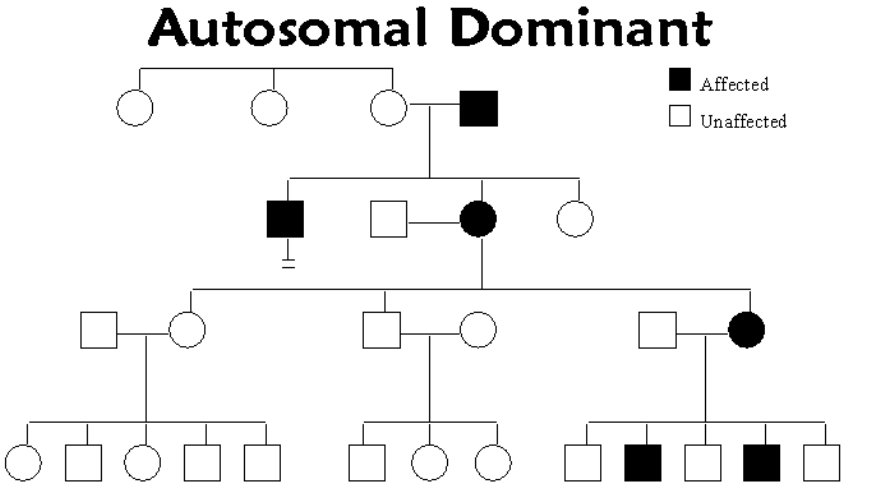
Autosomal Dominant Inheritance

- Autosomal means not on the sex chromosomes.
- Refers to those situations in which a single copy of an allele is sufficient to cause expression of a trait.



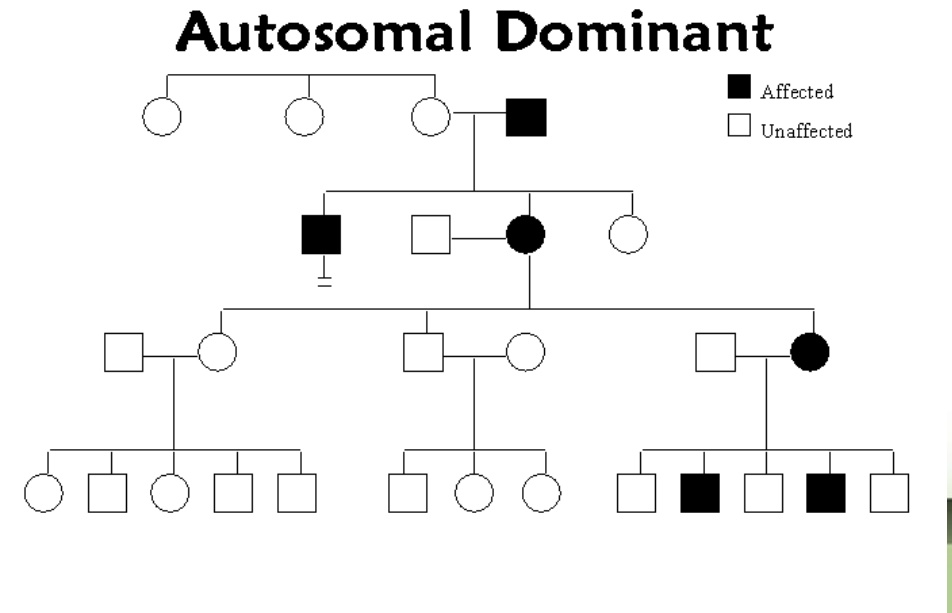
Autosomal Dominant Inheritance

- 1. Every affected person should have at least one affected parent.
- 2. Males and females should be equally often affected.
- 3. An affected person has at least a 50% chance of transmitting the dominant allele to each offspring



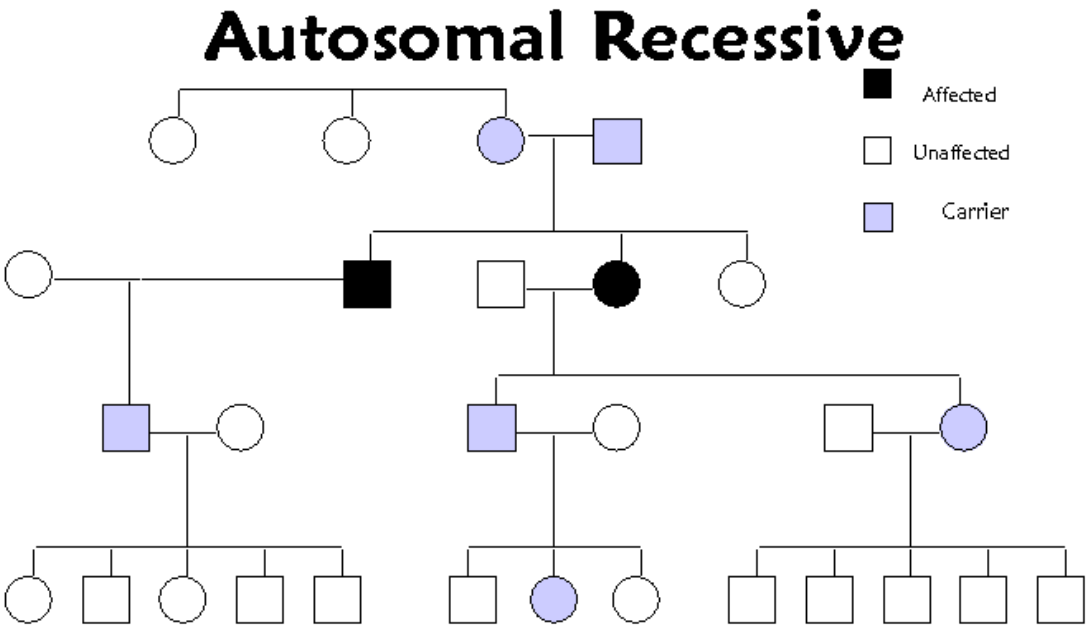
Autosomal Dominant Inheritance Examples

- Progeria (caused by a mutation) in which the person ages very rapidly. They die before they can reproduce.
- Huntington's Disease in which the central nervous system starts to break down around the age of 30.



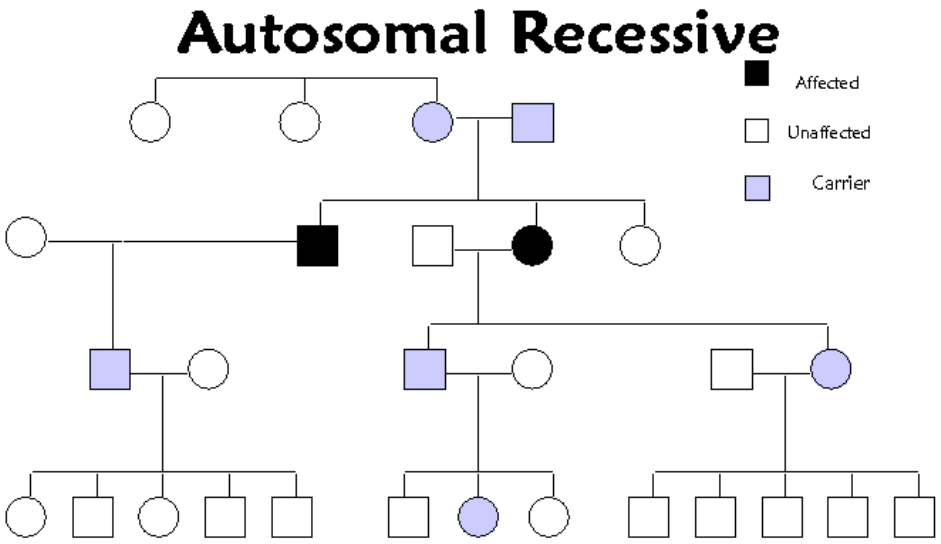
Autosomal Recessive Inheritance

- Refers to those situations where two recessive alleles result in a trait being expressed



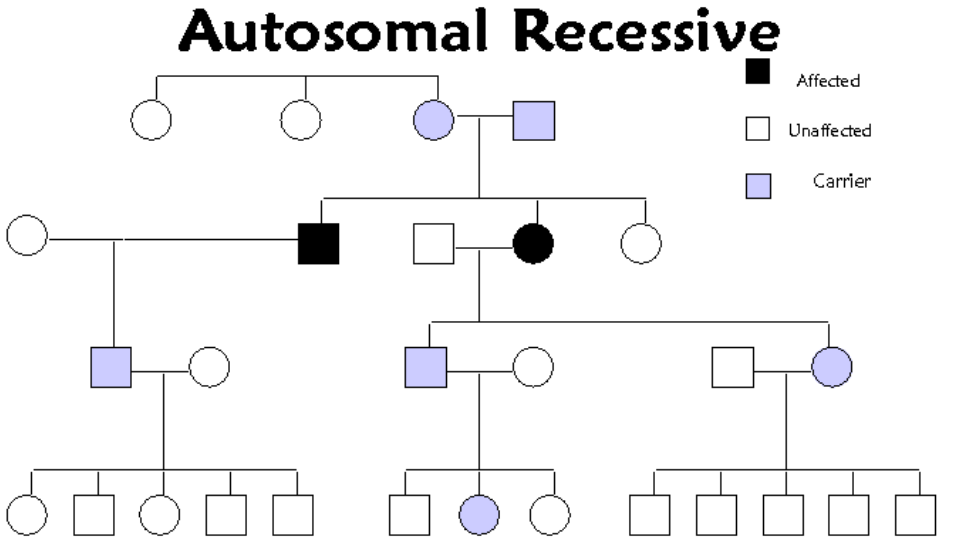
Autosomal Recessive Inheritance

- 1. An affected person may not have affected parents. Parents would be carriers.
- 2. Affects both sexes equally. Can appear to skip generations.
- 3. Two affected parents will have affected children 100% of the time.



Autosomal Recessive Examples

- Albinism is a genetic condition which is the loss of pigment in hair, skin and eyes.
- Tay Sachs is a genetic disorder which is a build up of fatty deposits in the brain, eventually provin



Codominant Inheritance

Sickle cell Anemia is a codominant condition/disorder in which there is a defect in hemoglobin, an important protein in red blood cells.

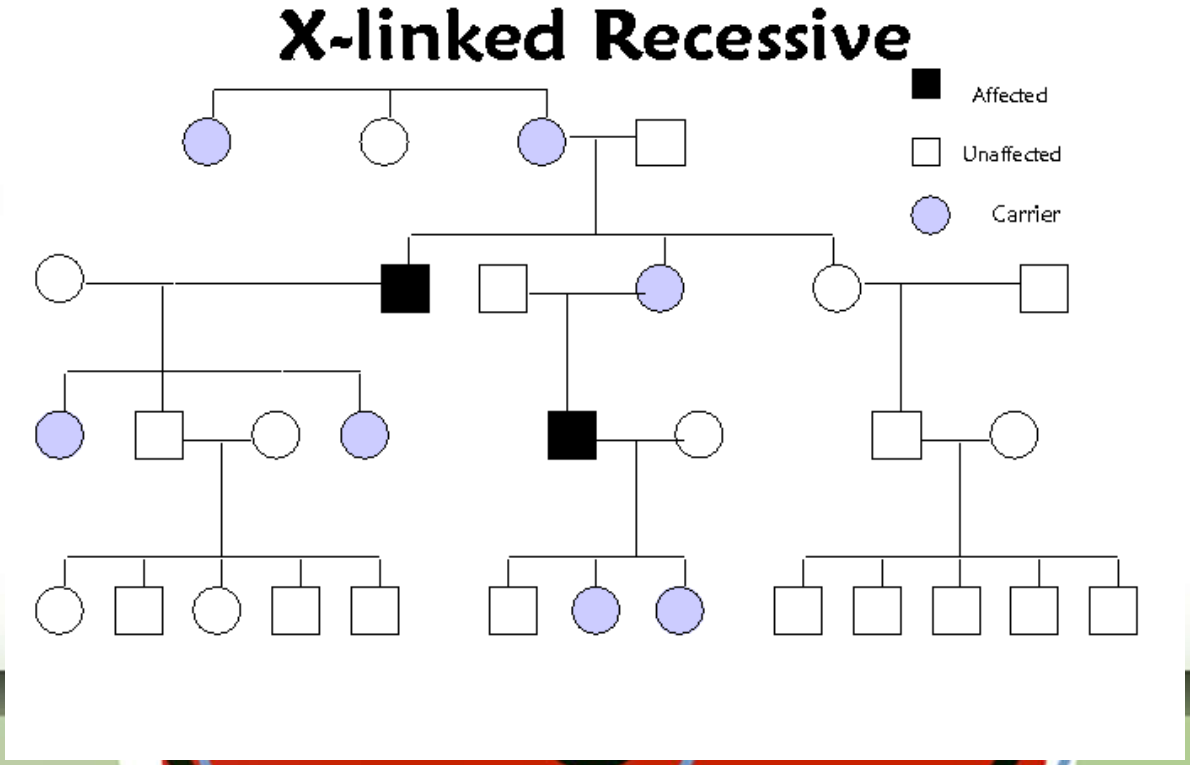
An individual homozygous for sickle cells suffers from blood clots to important organs, anemia and usually dies prematurely.

An individual heterozygous for normal and sickle cells does not suffer the full disorder, but some red blood cells still have defective hemoglobin.

In certain areas of the world this is an advantage. Malaria is caused by a protist that prefers normal blood cells. If some of your blood cells are damaged, you are less likely to become a host! (Heterozygous Advantage)

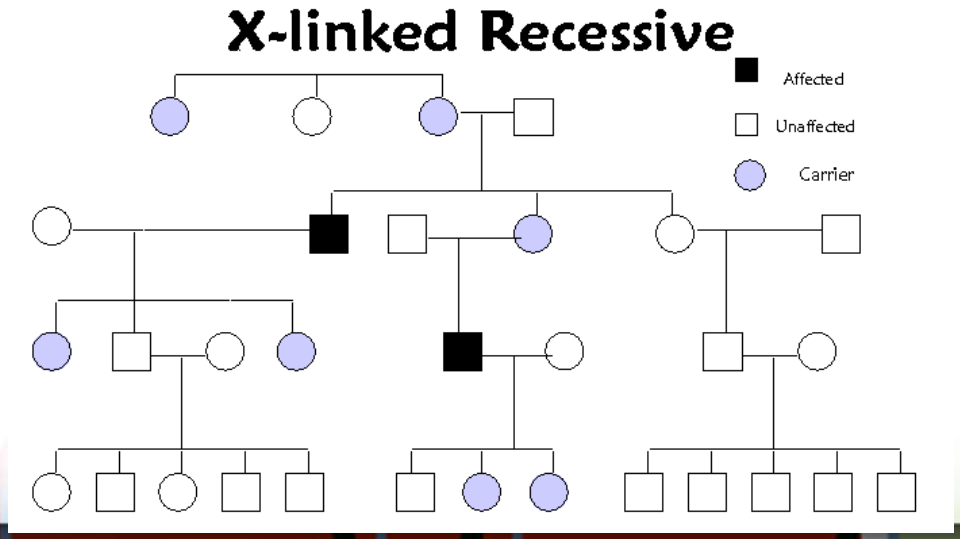
X – linked Recessive Inheritance

- Refers to those situations where a recessive allele on the X chromosome can lead to a tra



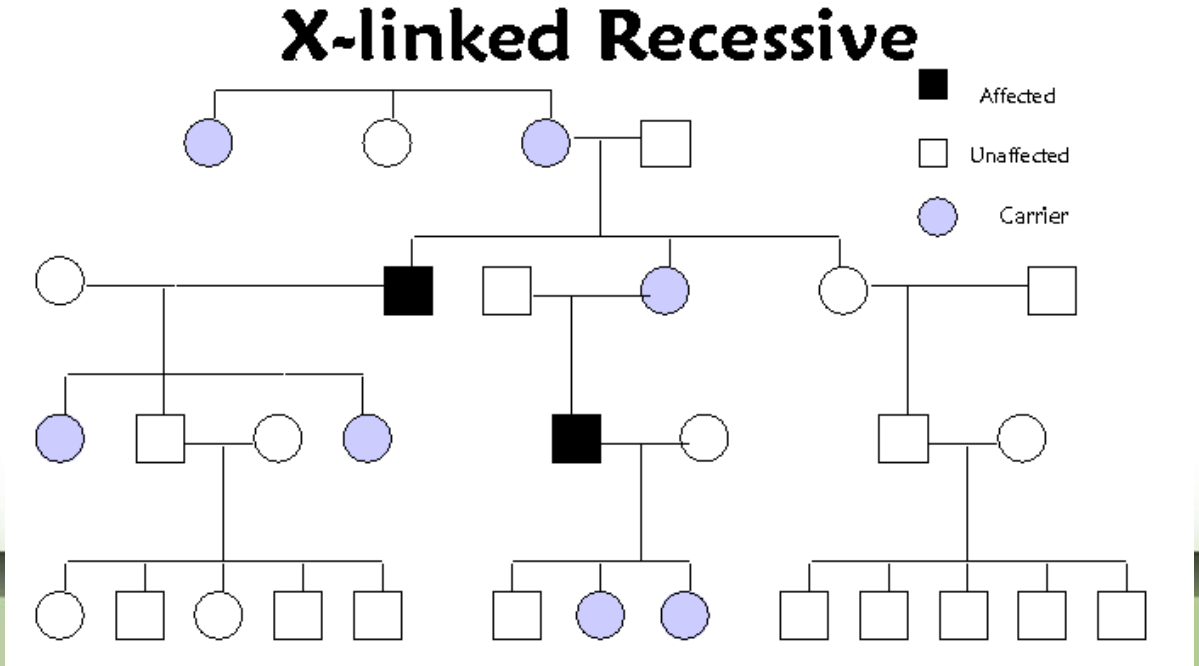
X – linked Recessive Inheritance

- Males are affected more often than females. Ratio of 8:1.
- Affected males will transmit the allele to all daughters, but not to sons.
- Homozygous recessive females can arise only from matings in which the father is affected and the mother is affected or a carrier.



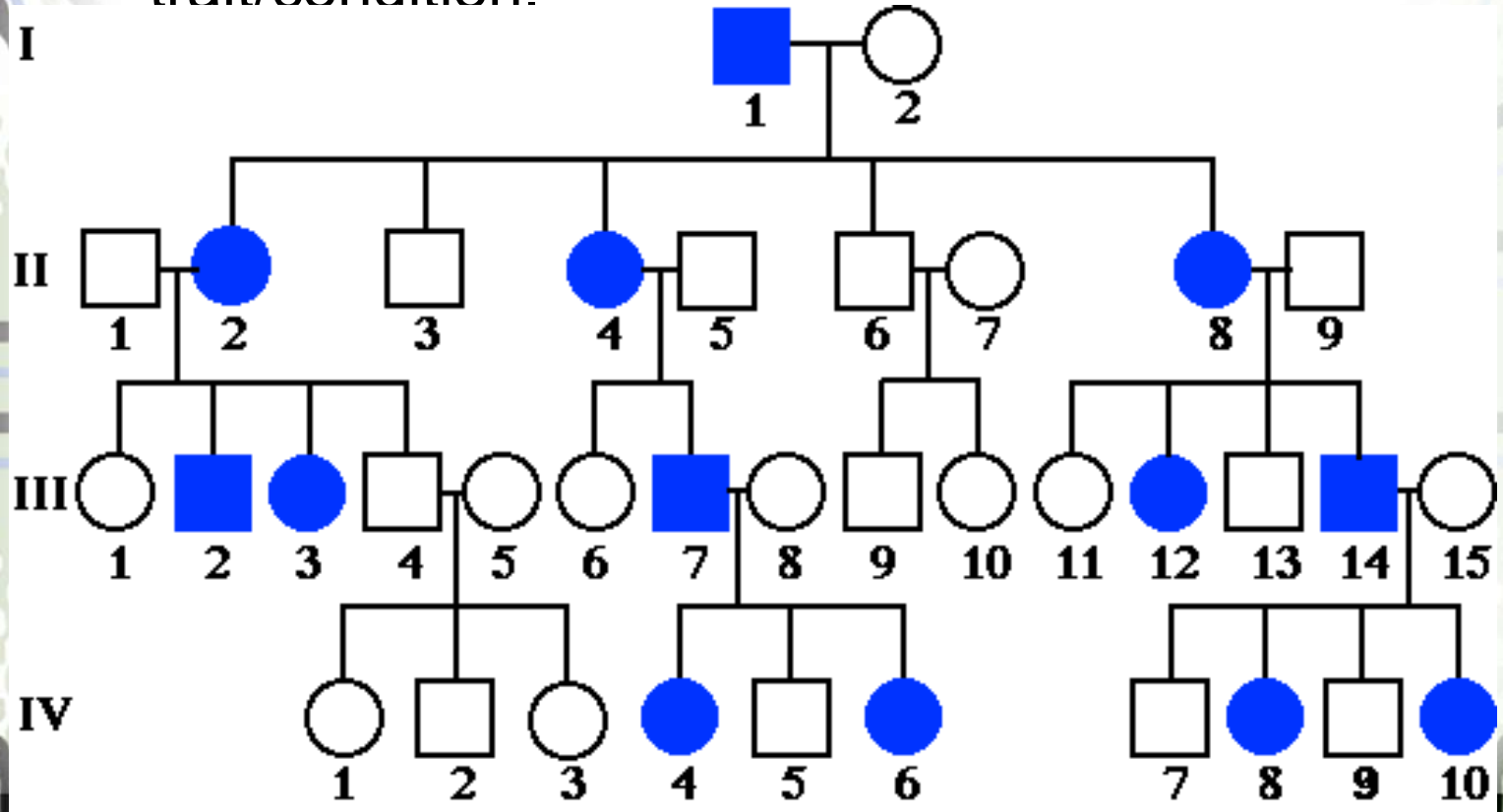
X – linked Recessive Disorders

- Hemophilia which is the inability of the blood to clot properly.
- Duchenne Muscular Dystrophy which causes progressive and degenerative muscle weakness.



X – Linked Dominant Inheritance

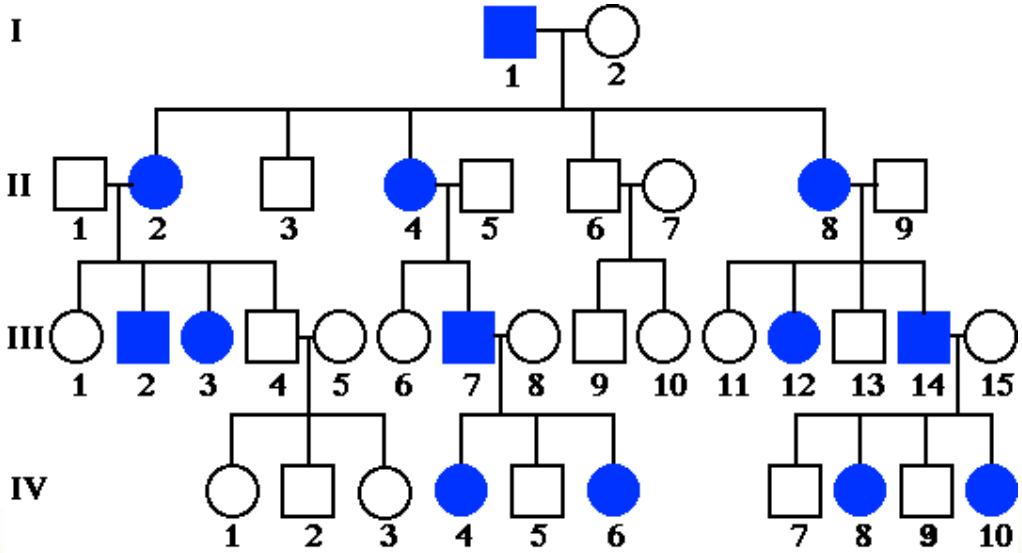
- Refers to situations where a single dominant allele on the X chromosome can lead to a trait/condition.



Pedigree 5. X-linked dominant inheritance.

X – Linked Dominant Inheritance

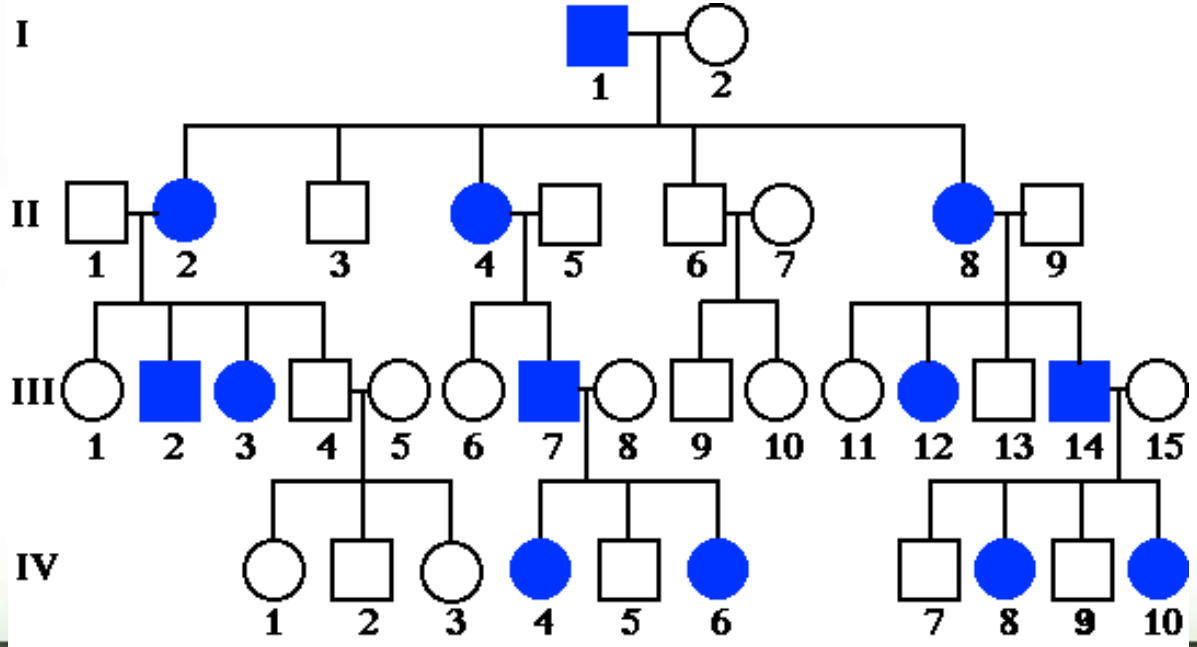
- 1. Twice as many females are affected as males.
- 2. Usually half the children of an affected female will be affected, regardless of sex.
- 3. All the daughters of an affected male will be affected but none of the sons.



Pedigree 5. X-linked dominant inheritance.

X – Linked Dominant Example

- Vitamin D resistant rickets which can lead to bone deformities, particularly in the lower limbs (bowed legs).



Pedigree 5. X-linked dominant inheritance.

PEDIGREES

Chart showing genetic relationships between members of a family

Squares represent males, circles females

Colour shows infected person, ½ shaded shows carrier