

Genetic Disorders and Inheritance

To refresh your memory...

- **Heredity** - the transmission of genetic material from one generation to another generation. Half of the genes come from each parent
- **Genes** are passed down on strands of DNA, which contain genetic information and is in the nucleus of the cell.
- There are dominant and recessive genes. **Dominant genes** are the traits that are always shown when present. **Recessive genes** are those that are masked when in the presence of a dominant allele. There must be two recessive alleles for the trait to be shown.

Causes of Human Genetic Disorders

- A **genetic disorder** is an abnormal condition that a person inherits through genes or chromosomes.
- Some genetic disorders are caused by mutations in the DNA of genes.
- Other disorders are caused by changes in the overall structure or number of chromosomes.



Recessive Inheritance

- With **recessive genes**, children need to **inherit two** copies of the gene, one from each parent, in order to have the disorder. If children inherit only one copy, they won't develop the disorder, but will be **carriers** and possibly pass the gene to their own children.
- **Carrier** - A person who has **one recessive allele** for a trait, but does not have the trait.

Recessive Inheritance Disorders

- **Cystic Fibrosis** - thick, sticky mucus builds up in the lungs and digestive tract
- **Albinism** - little or no color (pigment) in the skin, hair, and eyes
- **PKU – phenylketonuria** - baby is born without the ability to properly break down an amino acid called phenylalanine



Dominant Inheritance

- One parent has a dominant gene that causes a genetic disorder. This gene overpowers the normal gene and the person will have the disorder
- Dominant genes leading to a disorder are very rare in the human population
- This type of disorder will not have carriers. You either have the disorder or you don't.

Dominant Inheritance Disorders

- **Marfan Syndrome** – person is very tall and thin
- **Huntington's Disease** – nervous system disorder
- **Achondroplasia** - a type of dwarfism



Co-Dominant Inheritance

- The allele for the trait is **co-dominant** with the normal allele.
- A person with two of the disorder alleles will have the disorder.
- A person with one disorder allele will produce both normal & abnormal traits. This person usually will not have symptoms of the disorder and will be considered a carrier

Examples of Co-Dominant Disorders

- Sickle-cell anemia - red blood cells form an abnormal crescent shape



Sex-linked Disorders

- These disorders are caused by a recessive allele on the X chromosome.
- This type of disorder occurs more frequently in males than in females because they only have one X chromosome.

Sex-Linked Genes

- Genes on the X and Y chromosomes are often called **sex-linked genes** because their alleles are passed from parent to child on a sex chromosome.
- Traits controlled by sex-linked genes are called **sex-linked traits**.
- Females have two X chromosomes and males have one X chromosome and one Y chromosome.
- The X and Y chromosomes have different genes. Most of the genes on the X chromosome are not on the Y chromosome.
- Because of this, an allele on an X chromosome may not have a matching allele on a Y chromosome.

Sex-Linked Traits

- Like other genes, sex-linked genes can have dominant and recessive alleles.
- In females, a dominant allele on one X chromosome will mask a recessive allele on the other X chromosome. This would make her a carrier
- In males, there is no matching allele on the Y chromosome to mask the allele on the X chromosome. As a result, any allele on the X chromosome—even a recessive allele—will produce the trait in a male who inherits it.
- Because males have only one X chromosome, males are more likely than females to have a sex-linked trait that is controlled by a recessive allele.

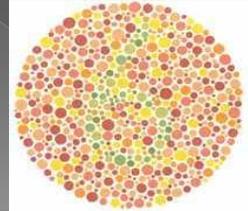
Sex-Linked Traits

- A **carrier** of a trait controlled by a recessive allele does not have the trait.
- The carrier can pass the recessive allele on to his or her offspring. In the case of sex-linked traits, only females can be carriers.



Examples of Sex-linked Disorders

- Hemophilia - bleeding disorder in which it takes a long time for the blood to clot
- Colorblindness - cannot see the colors red and green properly



Problems with Meiosis – Trisomy Disorder

- In certain cases, chromosomes will not separate properly during Meiosis. This will result in a sex cell with two copies of a chromosome instead of just one.
- This is a rare and unpredictable event and cannot be traced or predicted with a pedigree chart

Examples of Trisomy Disorders

- Down Syndrome – extra copy of the 21st chromosome
- Edward's Syndrome – extra copy of the 18th chromosome
- Klinefelter's - males have an extra X sex chromosome



Types of Inheritance Chart

- Complete the Punnett Squares in the [Inheritance Chart](#)
- [Teacher Copy](#)

Types of Inheritance: Punnett Squares

- [Inheritance Punnett Squares Practice](#)
- [Teacher Copy](#)