

Name: \_\_\_\_\_

# Chapter 5: Human Genetics and Genetic Technology

## Lesson 1: Human Inheritance

### What Are Some Patterns of Human Inheritance?

- Single genes with Two Alleles
  - o Single gene with either a dominant or recessive allele.
    - Have two distinctly different physical appearances or phenotypes.
      - Example: Widow's peak or dimpled chin
- Single Genes with Multiple Alleles
  - o Single gene with three or more forms of it that code for a single trait.
  - o Person can only have TWO of those alleles, even though there are multiple forms.
    - Chromosomes exist in pairs → one from mother, one from father.
      - Example: Human blood type
- Traits Controlled by Many Genes
  - o Some human traits show many phenotypes because they are controlled by many genes.
    - Example Human height or skin color
  - o Alleles of different genes act together as a group to produce a single trait.



### What Are the Functions of the Sex Chromosomes?

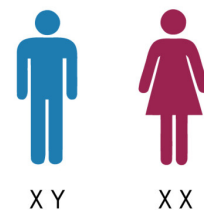
- **SEX CHROMOSOMES**: carry genes that determine a person's sex as being either male or female.
- Human body cells contain 23 chromosome pairs.

### Girl or Boy?

- Sex chromosomes are only chromosome pair that do not always match.
  - o Girls have two sex chromosomes that match (XX)
  - o Boys have two sex chromosomes that do not (XY)

### Sex Chromosomes and Fertilization

- All eggs carry one X chromosome because girls only carry X chromosome
- Males have two different sex chromosomes, so half of male's sperm cells carry X and half carry Y
- When sperm with X fertilizes egg → girl
- When sperm with Y fertilizes egg → boy



### Sex-Linked Genes

**SEX-LINKED GENES**: genes found on X and Y chromosomes.

- Traits controlled by sex-linked genes are sex-linked traits.
  - o Example: Red-green colorblindness.
- Sex-linked genes can have dominant and recessive alleles.
  - o In females, dominant allele on X chromosome masks a recessive allele on other X chromosome.
  - o Males only have one X, so they are more likely to express a sex-linked trait.

### Inheritance of Colorblindness

- Controlled by recessive allele on the X chromosome.
- **CARRIER**: a person who has one recessive allele for a trait and one dominant allele.

## Lesson 2: Human Genetic Disorders

### How Are Genetic Disorders Inherited in Humans?

**GENETIC DISORDER:** an abnormal condition that a person inherits through genes or chromosomes.

- Some are caused by mutations in DNA.
- Some caused by overall structure or number of chromosomes

**CYSTIC FIBROSIS:** genetic disorder in which the body produces abnormally thick mucus in the lungs and intestines, making it hard to breathe

- Two mutated alleles must be inherited → causes 3 bases to be removed from DNA molecule.

**SICKLE-CELL DISEASE:** caused by mutation that affects hemoglobin in blood.

- Hemoglobin is a blood protein that carries oxygen

RBCs of people with sickle-cell are crescent shaped instead of round.

People with this condition have a more difficult time breathing and have more blood clots.

**HEMOPHILIA:** genetic disorder in which a person's blood clots very slowly or not at all because of a lack of the proteins needed for normal blood clotting.

**DOWN SYNDROME:** a person's cells have an extra copy of chromosome 21, which can cause some degree of intellectual disability and heart defects.

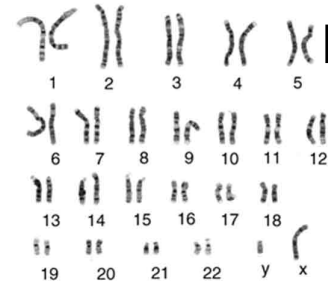
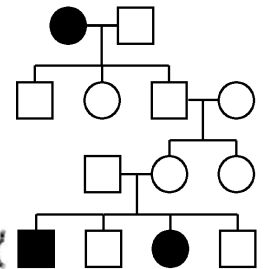
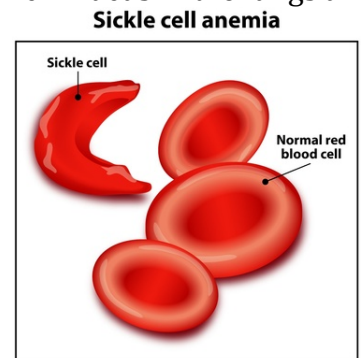
How Are Genetic Disorders Traced, Diagnosed, and Treated?

**PEDIGREE:** a chart or "family tree" that tracks which members of a family have a particular trait.

- Can be ordinary trait, like eye color, or a genetic disorder.

**KARYOTYPES:** a picture of all the chromosomes in a person's cell.

- Can reveal whether a person has the correct number of chromosomes in his or her cells.



## Lesson 3: Advances in Genetics

### How Can Organisms Be Produced With Desired Traits?

**SELECTIVE BREEDING:** the process of selecting organisms with desired traits to be parents of the next generation.

- Used for crops to create the healthiest plants that produce the best food.
- Used for animals to produce desired traits in pets, livestock, ect.
- Two types of selective breeding: inbreeding and hybridization

1) **INBREEDING:** involves crossing two individuals that have similar desirable characteristics.

- a. Example: Golden retrievers
- b. Can lead to health problems and genetic disorders.

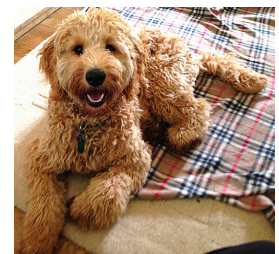
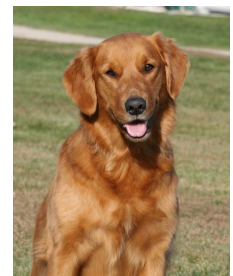
2) **HYBRIDIZATION:** involves crossing two genetically different individuals.

- a. Hybrids have two different alleles for a trait and result in the best traits from both parents.
- b. Example: Golden retriever crossed with poodle
- c. Hope to produce a hybrid that has both of desired traits.

- **CLONE:** an organism that has exactly the same genes as the organism from which it was produced.

Example: Plant cutting

- **GENETIC ENGINEERING:** genes from one organism are transferred into the DNA of another organism.



- Can produce medicines and improve food crops
- Genetic engineering in bacteria can produce insulin for people with diabetes.
- Genetic engineering in other organisms produces many useful products.
  - Plants that survive cold or poor soil, pest resistant crops, crops with more nutrients.
- **GENE THERAPY**: involves inserting copies of a gene directly into a person's cells to correct a genetic disorder in humans.
- Some people do not feel genetic engineering is safe or healthy

## **Lesson 4: Using Genetic Information**

### **What Are Some Uses of Genetic Information?**

#### **Human Genome Project**

- Scientists worked to identify the DNA sequence of the entire human genome.
- **GENOME**: an organism's full set of DNA.

#### **DNA Fingerprinting**

- DNA from a person's cells is broken down into small pieces or fragments and then used to produce a pattern → DNA fingerprint
  - No two people have the same DNA fingerprint EXCEPT identical twins.
- Can help identify criminals or identify skeletal remains.

#### **Genetic Discrimination**

- Some people are concerned about how DNA information will be used or who can access it.
- **ETHICS**: the study of principles about what is right and wrong, fair and unfair.
- Genetic Information Nondiscrimination Act (GINA): signed into law in 2008 and says that health insurance companies and employers may not discriminate against individuals based on genetic information.