

## Chapter 4

### Modern Genetics

#### How Tall is Tall?

- Choose a partner. Use a meter stick to measure each other's height to the nearest inch.
- Write your measurements on a piece of paper.
- As a class, create a bar graph of the class heights on the board.

#### Traits Controlled by Single Genes

- Many human traits are controlled by a single gene
- These genes have two different alleles – dominant and recessive

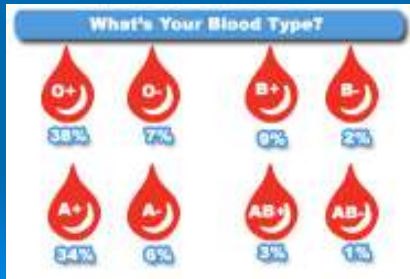
- Each allele controls a different form of the trait

#### Multiple Alleles

- Some human traits are controlled by a single gene that has more than two alleles
- Multiple Alleles: Three or more forms of a gene that code for a single trait

- Even though a gene may have multiple alleles, a person can only carry two of those alleles
- Chromosomes exist in pairs – Each chromosome in a pair only carries one allele for each gene

- Blood type is controlled by a gene with multiple alleles



## Traits Controlled by Many Genes

- Some human traits show a large number of phenotypes because the traits are controlled by many genes. The genes act together as a group to produce a single trait.
- Remember the height activity and the range of phenotypes we saw.

- Height is controlled by four genes working together.
- Skin color is controlled by at least three genes, each one containing two different alleles. Various combinations of alleles produce the many skin colors in humans

## The Environment

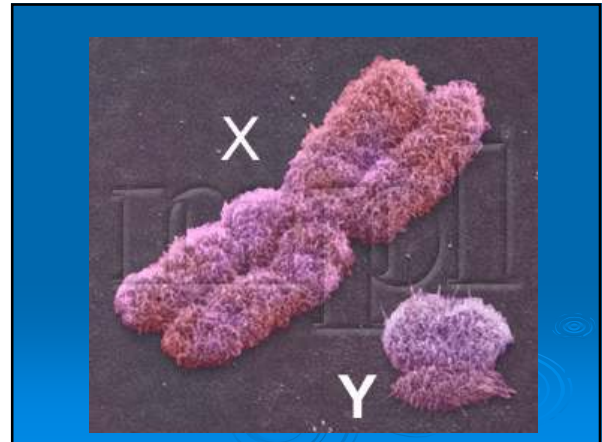
- The effects of genes are altered by our environment.
- EX: Diet can affect height – a diet that lacks proper nutrition can prevent a person from reaching their potential height

- Other factors include living conditions and modern health care

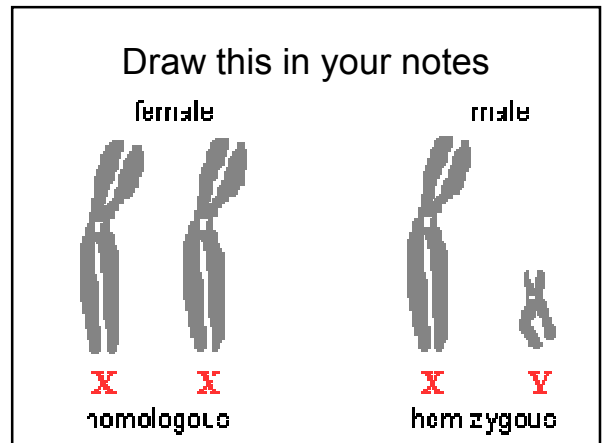
## Male or Female?

- The gender of a baby is determined by genes on chromosomes.
- There are 23 pairs of chromosomes in each of our cells. One of pair of chromosomes are called sex chromosomes.

- The sex chromosomes determine whether a person is male or female.
- The sex chromosomes are the only pair of chromosomes that do not always match.



- Females
  - The two sex chromosomes match - XX
- Males
  - The two sex chromosomes do not match - XY



- Since both of a female's sex chromosomes are X, all eggs carry one X chromosome
- Males have two different sex chromosomes, so sperm cells will either carry an X or a Y chromosome

- Figure 4 on pg. 121 – copy this into your notes
- Complete the “Try This” activity on pg. 122. Answer the questions in your notes

### Sex-Linked Genes

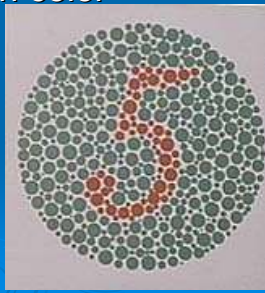
- Some human traits occur more often in one gender than the other.
- Sex-Linked Genes: Genes on the X and Y chromosomes, whose alleles are passed from parent to offspring on sex chromosomes

- In females, a dominant allele on one X chromosome will mask a recessive allele on the other X chromosome.

- In males, there is no matching allele on the X and Y chromosome. As a result, any allele on the X chromosome 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.

- Example of sex-linked trait controlled by a recessive allele: red-green color blindness
- Affects more males than females



### Pedigrees

- Pedigree: A chart or “family tree” that tracks which members of a family have a particular trait

### Discover Activity

- Turn to pg. 125
- Work with your neighbor to do the activity in your notes

### Genetic Disorders

- Genetic Disorder: An abnormal condition that a person inherits through genes or chromosomes
- Genetic disorders are caused by mutations

### Cystic Fibrosis

- Genetic disorder in which the body produces too much mucus in the lungs and intestines.
- The mucus makes it hard to breathe and digest food

### Sickle-Cell Disease

- Genetic disorder that affects the production of hemoglobin in the blood.
- This causes blocked blood vessels, which leads to difficulty breathing, pain and weakness

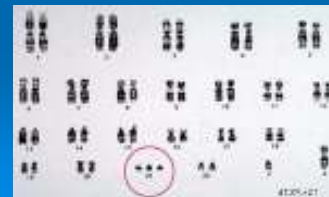


### Hemophilia

- Genetic disorder in which a person's blood clots very slowly or not at all.
- A person with hemophilia can bleed to death from a minor cut.

### Down Syndrome

- Genetic disorder resulting from having an extra copy of chromosome 21.



### Diagnosing Genetic Disorders

- Doctors use amniocentesis and karyotypes to detect genetic disorders.
- Amniocentesis: A doctor uses a long needle to remove a small amount of fluid that surrounds a baby while it is in the womb

- Karyotype: A picture of all of the chromosomes in the cell. The chromosomes are arranged in pairs.



### Advances in Genetics

- Three methods that people have used to develop organisms with desirable traits:
  - Selective breeding
  - Cloning
  - Genetic Engineering

### Selective Breeding

- Selective Breeding: Breeding organisms with desired traits so that their offspring will have those traits

- Inbreeding: Crossing two individuals with similar or identical alleles – increases genetic disorders (EX: Smokey)
- Hybridization: Breeding two genetically different individuals

### Cloning

- Clone: An organism that is genetically identical to the organism from which it was produced
- Cloning can be done with plants and animals

- Remember: Just because you could, doesn't mean that you should!

## Genetic Engineering

- Genetic Engineering: Genes from one organism are transferred into the DNA of another organism
- Used to produce medicine, improve crops, and cure genetic disorders

## The Human Genome Project

- The main goal of the human genome project is to identify every gene in human DNA.
- How can this help improve modern medicine?