

Reflect

When you look at yourself in the mirror, do you resemble your mother or your father? Maybe you have your grandmother's eye color or your grandfather's height. The reason you resemble your family is because of heredity.

Heredity is the passing of genetic material from parent to offspring.

Genetics is the study of how traits are inherited. Genes, made up of DNA located in the chromosomes, are the instructions that express our traits. The environment can also influence traits.

genetics: the study of how traits are inherited



heredity: passing of genetic material from parent to offspring

In sexually reproducing organisms, each parent contributes half of their genetic material to the offspring. Humans have 23 pairs of chromosomes, making a total of 46 chromosomes in each individual. During conception, the offspring will receive 23 chromosomes from the mother and 23 from the father. The offspring will therefore have two versions of genes, known as **alleles**.

Alleles determine the traits of all living organisms. Any single allele can be either dominant or recessive. An organism with two of the same alleles for a gene is homozygous. An organism with two different alleles for a gene is heterozygous.

allele: the form of a gene

How Do Alleles Influence Traits?

The combination of alleles inherited from your parents is your **genotype**. An organism's genotype is the set of genes and alleles that it carries. An organism's **phenotype** is the observable physical characteristics that it carries. Dominant alleles contribute to the phenotype when either one or two copies are present. Recessive alleles contribute to the phenotype only when two copies are present.

For example, brown eyes are a dominant trait and blue eyes are a recessive trait. Dark hair is a dominant trait; blonde and red hair are recessive traits. Traits such as dimples and freckles are dominant.



Reflect

Environmental Influences of Traits

The environment can influence the phenotype of an organism. For example, nutrition, temperature, or stress can contribute to phenotypic variation.



genotype:
set of genes and alleles an organism carries

phenotype: observable physical characteristics

Describe the phenotypes of these kids.

Exceptions

There are instances when a trait is not completely dominant over another. You can have **incomplete dominance** or **codominance**. Incomplete dominance is the blending of the parental phenotypes to create a phenotype that is an intermediate of the two parental phenotypes. Wavy hair texture is an example of incomplete dominance in humans.

With codominance, both parental phenotypes appear together in the offspring. An example of codominance in humans is the blood type AB.

Examples of codominance and incomplete dominance in flowers:

Dominant	Recessive
	
	
Codominance	Incomplete dominance

codominance:
both parental traits appear together

incomplete dominance:
intermediate of two parental traits

Look Out!

Father of Genetics

Gregor Mendel, who is known as the Father of Genetics, was successful in describing basic heredity principles by observing how traits pass from one generation to the next in pea plants. He used probability and a Punnett-square diagram to make predictions for what offspring would look like. In a Punnett square, dominant alleles are represented by capital letters and recessive alleles are represented by lowercase letters.



Gregor Mendel
1822-1884



Pea plant

Try Now

Using Probability to Make Predictions:

Punnett Square

	Black Rabbit R	Black Rabbit r
White Rabbit r		
White Rabbit r		

probability:
the chance that
something will happen

$$R = \frac{\text{\# of outcomes with black fur}}{\text{\# of possible outcomes}}$$

1. What is the probability that a rabbit offspring's fur will be black?

Connecting With Your Child

Take some time to explore and answer the questions below. Use technology to conduct research if necessary.

1. What did Gregor Mendel discover about heredity?
2. Are the traits listed below dominant or recessive?

Farsightedness	
Nearsightedness	
Attached earlobes	
Baldness	
Hazel eyes	
Double-jointed	
Widow's peak	
Thin lips	

3. Review what happens to the different alleles of a gene when a pair of chromosomes separate during meiosis.

