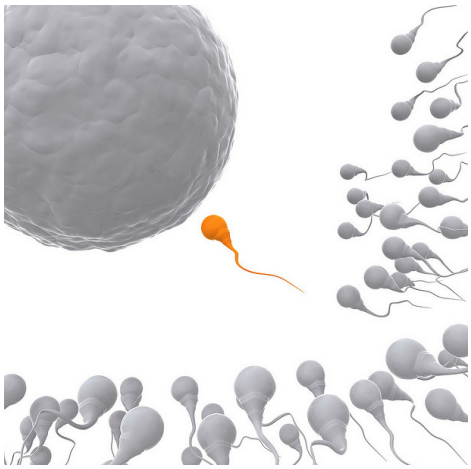
Reflect

Have you ever been told you have your “mother’s eyes” or your “father’s smile”? Have you ever noticed you share your grandfather’s eye color or possibly your grandmother’s curly hair, and yet your parents do not? Why does that happen?

Look at the family picture on the right. Which traits do you think the daughter inherited from her mother? Which traits do you think she inherited from her father? Now compare the siblings. Do the brother and sister look identical or just similar? The siblings definitely look similar, but they are clearly not identical. Variations in inherited traits make everyone unique.

Children inherit traits from both parents.



Each sperm cell contains half of the father’s DNA. However, it is not the same half every time, which makes every sperm cell unique.

How are traits inherited?

In sexual reproduction, an offspring is created by the fertilization of an egg by a single sperm. These sex cells, or **gametes**, are very unique; instead of containing the parents’ entire set of DNA, like other cells in the parents’ bodies, the egg and sperm cells only contain half. The egg cell contains exactly half of the mother’s DNA or genetic material. Similarly, the sperm cell contains exactly half of the father’s DNA or genetic material. When the sperm fertilizes the egg, a *zygote* is formed. This zygote now has a complete set of chromosomes, and as it splits and replicates, each future cell will contain that full set of genetic information.

If you look more like one of your parents, does that mean you have more of that parent’s genes and less of your other parent’s? No. You are genetically made up of exactly 50% of your mother’s alleles and 50% of your father’s alleles. There is something else happening, however, that causes this phenomenon.

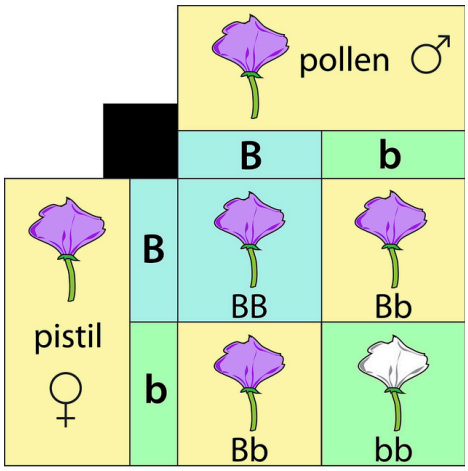
Reflect

Phenotypes and Genotypes

Even though you get two alleles, or genes, you may only display one allele for each trait. The trait that is physically shown is called your **phenotype**. For example, think about your hair color. Do you have the same hair color as both of your parents or just one? Look at the family pictured on the right. One sister has brown hair while the other has blond hair. Having either brown or blond hair is a phenotype.

Siblings from the same set of parents can display very different traits.

The **genotype**, on the other hand, is a way to represent both alleles a person has for a certain trait. Genotypes are written with lower case and upper case letters. A capital letter denotes a dominant allele, while a lower case letter denotes a recessive allele. Each genotype must have two letters to represent the alleles given by both the mother and the father.



Punnett squares can be used to demonstrate all of the possible variations of a certain trait.

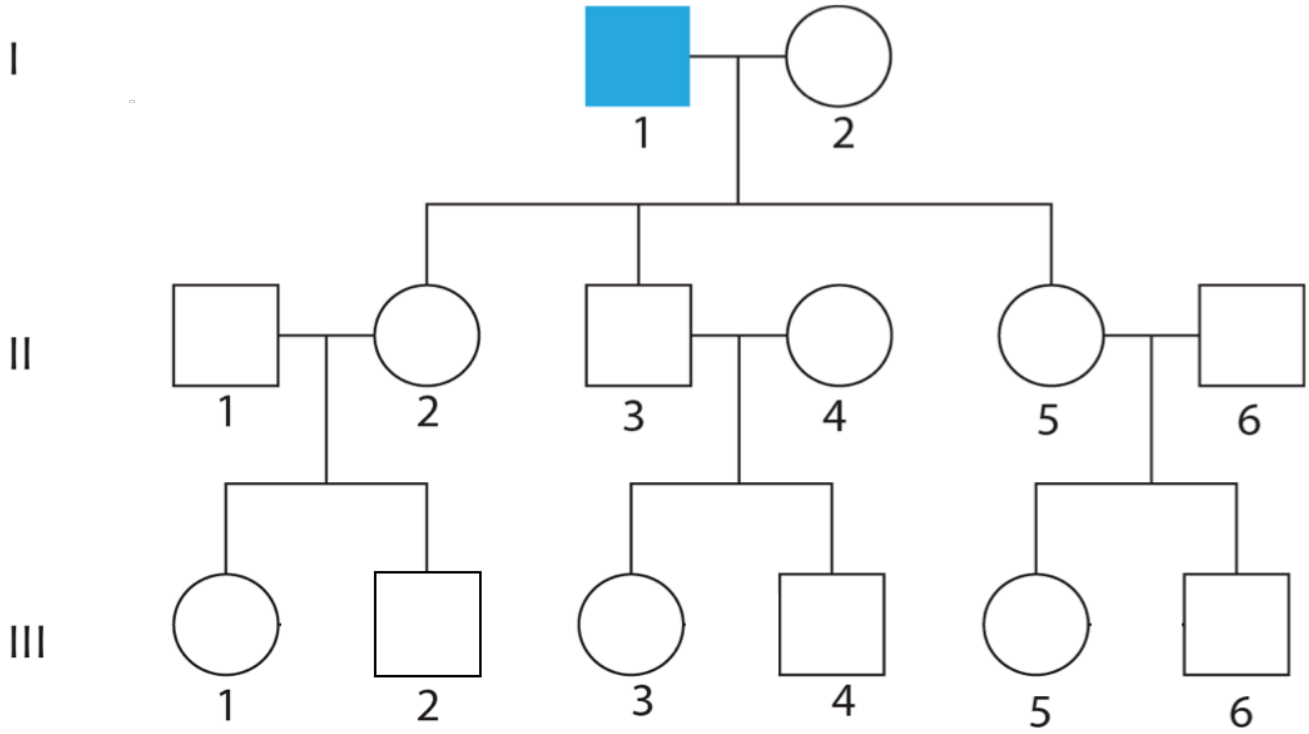
Dominant vs. Recessive Alleles

Dominant alleles "dominate" over recessive alleles. Therefore, if a dominant allele is present, it will automatically determine that individual's phenotype. For a recessive trait to be shown, both parents need to give the recessive allele. In the example above, the brown hair allele is dominant over the blond hair allele. How many dominant alleles did the daughter with brown hair need to show the brown hair trait? How many recessive alleles did the the daughter with blond hair need to show the blond trait?

The daughter with brown hair only needed one dominant allele, but the daughter with blond hair needed two recessive hair color alleles. Punnett squares are used to demonstrate all the possible variations of a certain trait. The Punnett square example on the left shows how two purple flowers can still produce a white-flower offspring. If both parent flowers give the recessive allele (represented by the lower case b), the offspring will display that recessive phenotype.

Try Now

Pedigrees are another tool used to predict traits in future offspring. Use the pedigree chart below to help demonstrate how some traits can seem to skip generations. The male (represented by the square) in the first generation is shaded blue to indicate he has heart disease. The female is not shaded because she does not have heart disease. Flip a coin to determine if each of their three children will display heart disease (if heads) or just be a carrier of heart disease (if tails). Any time a person has heart disease, shade their shape on the pedigree below. Continue this for the couple's six grandchildren as well.



1. How many of the couple's children have heart disease? _____

2. How many of the couple's grandchildren have heart disease? _____

3. Did the disease ever seem to skip a generation? _____

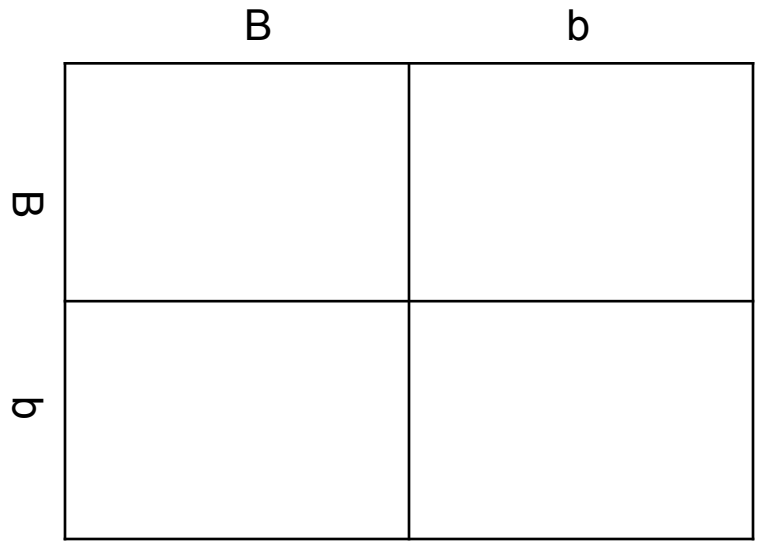
4. Why do you think that happens? _____

_____

Try Now

What Do You Know?

Demonstrate what you have learned about variation in inherited traits by completing the Punnett square and answering the questions below.



Key

BB = Brown eyes
Bb = Brown eyes
bb = Blue eyes

1. What color eyes do both parents have? _____
2. What percentage of the children would likely have brown eyes? _____
3. What percentage of the children would likely have blue eyes? _____

Connecting With Your Child

A Small Environment

To help your child learn more about inheritance, make a “family tree of traits” together. Start with easily seen physical traits (e.g., eye color, hair color, etc.) and try to trace back those traits through the generations. Then move to more unique traits of your child (e.g., curly hair when everyone in the immediate family has straight hair, extra height when both parents are shorter, etc.) and try to trace those traits back through the generations.

Work with your child to identify patterns in the family tree of traits. Discuss which traits are dominant and which traits are recessive. Note: Even if a trait is prevalent in your family, it is not necessarily dominant.

Here are some questions to discuss with your child:

- Why is there variation in inherited traits between parents and their children?
- Is it possible for an offspring to have identical traits to its parents? Explain.
- What is inheritance?
- What is a chromosome? What does it do?