

# Genes

By Cindy Grigg

---

<sup>1</sup> Have you ever seen a cat with a litter of baby kittens when all the kittens look different? Each kitten may have different hair colors, markings, or eye colors. Why? Each kitten received a different combination of genes from its parents.

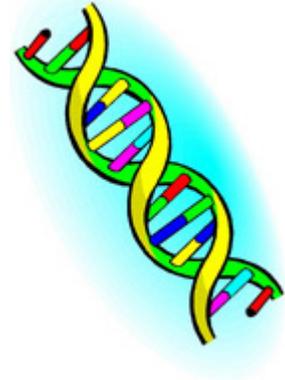
<sup>2</sup> **Genes** are segments of DNA that carry the instructions for the traits of an organism from parents to offspring. Genes are located on **chromosomes** in the nucleus of a cell. A chromosome is two very tightly coiled strands of **DNA** (deoxyribonucleic acid).

<sup>3</sup> Each type of organism has a fixed number of chromosomes. Humans have 46 chromosomes in every cell of their bodies, except in the egg and sperm cells. Each egg and sperm cell has only 23 chromosomes. When an egg and a sperm cell combine during fertilization, they produce one cell with 46 chromosomes.

<sup>4</sup> Whether that offspring will be a boy or a girl is determined by the chromosome given to it by the father. All egg cells have an X chromosome. All sperm cells have either an X or a Y chromosome. A female (the mother) can only give an X chromosome. A male (the father) can give either an X or a Y chromosome. If the father gives an X chromosome, the offspring will be a girl. If the father gives a Y chromosome, the offspring will be a boy. It's the Y that makes the guy. This is a good way to remember that males have a Y chromosome.

<sup>5</sup> Each chromosome is divided into small sections called genes. Genes are the basic units of heredity. They carry codes that control the individual traits that the offspring inherit. Traits in humans such as eye color, height, skin color, face shape, shape of ear lobes, hairlines, and tongue rolling are all inherited traits. Except for identical twins, each person has a unique arrangement of genes. A chromosome may contain thousands of genes. Genes control traits. You inherited your genes and the traits they carry from your parents. You don't look exactly like either parent because you received only some genes from each parent. These genes combine in new ways during fertilization. Some genes control more than one trait, and some traits are controlled by more than one gene.

<sup>6</sup> People inherit two genes for every characteristic, and they get one gene from each parent. Sometimes the two genes for one trait contain different codes. This affects how the trait appears in the child. For example, maybe both parents have brown eyes. Let's say that they each have one gene for brown eyes (B) and one gene for blue eyes (b). Brown eyes are dominant over blue eyes. That's why both the parents have brown eyes, even though they carry a gene for blue eyes. The gene for blue eyes is recessive. A person must have two genes for blue eyes for that person's eyes to be blue. There are four different ways these two parents can pass the gene for eye color to any children they might have. The father can give either a B or b gene. The mother can give either a B or a b gene. This results in four different combinations: Bb, bB, BB, or bb. The chance that a child born to these two parents will have brown eyes is 75%. Another way to say this is the probability is 3:1 that the child would have brown eyes. For the four combinations above, in every gene pair that has the gene for brown eyes, shown with a capital B, the child would have brown eyes. Two of those three children would also carry the gene for blue eyes and might pass



blue eyes to their own children. But the child who has the BB combination will have only brown-eyed children.

<sup>7</sup> Your genes determine your skin color, whether your hair is curly or straight, and whether or not you can roll your tongue into a U-shape. Each of these three traits is controlled by a gene. Humans have thousands of different genes. They are located on the 23 pairs of chromosomes in the nuclei of our body cells. One pair of chromosomes is different from all the others in your cells. This chromosome pair decides if you are male or female. Females have two X chromosomes (written XX). Males have one X and one Y chromosome (written XY). The X and Y chromosome pair is the only pair that doesn't match in size. The X chromosomes are larger than the Y chromosomes.

<sup>8</sup> Sometimes genes controlling other traits are located on the X or Y chromosome. They are said to be a sex-linked trait. One example is the trait for red/green colorblindness. It is a recessive trait found only on the X chromosome, not the Y. Because males have only one X chromosome, they are more likely to have colorblindness than females. Another example of a sex-linked trait is the bleeding disorder hemophilia.

<sup>9</sup> Your genes are not exactly the same as that of your parents or your siblings. The only exception is if you have an identical twin. Identical twins are two individuals that formed from one egg fertilized by one sperm. Because identical twins form from the same egg and sperm, they have exactly the same genes. Identical twins are always both boys or both girls. In science fiction, a clone is a person who has an exact copy of someone else's DNA.

<sup>10</sup> Not all twins are identical. Sometimes a female releases two egg cells at the same time. Each egg can be fertilized by a different sperm cell and develop into a baby at the same time. This results in fraternal twins. Unlike identical twins, fraternal twins are no more genetically similar than any other two children from the same parents. Fraternal twins can be the same sex or different sexes.

Name \_\_\_\_\_

Science Pd \_\_\_\_\_

## Genes

<p>1. Genes are _____.</p> <p><input type="radio"/> A Segments of DNA that carry the instructions for the traits of an organism from parents to offspring</p> <p><input type="radio"/> B Located on chromosomes in the nucleus of a cell</p> <p><input type="radio"/> C The basic units of heredity</p> <p><input type="radio"/> D All of the above</p>	<p>2. How many chromosomes are in the skin cells of your body?</p> <p><input type="radio"/> A 46</p> <p><input type="radio"/> B 23</p> <p><input type="radio"/> C 88</p>
<p>3. How many chromosomes are in the egg and sperm cells?</p> <p><input type="radio"/> A 88</p> <p><input type="radio"/> B 46</p> <p><input type="radio"/> C 23</p>	<p>4. Girls have an XX chromosome. What do boys have?</p> <p><input type="radio"/> A BX</p> <p><input type="radio"/> B XY</p> <p><input type="radio"/> C XX</p>
<p>5. Why don't you look exactly like one of your parents?</p> <p><input type="radio"/> A Because you are not a clone</p> <p><input type="radio"/> B Because you got only some genes from each parent</p> <p><input type="radio"/> C Because genes combine in different ways during fertilization</p> <p><input type="radio"/> D All of the above</p>	<p>6. Why are more males colorblind than females?</p> <p><input type="radio"/> A Because colorblindness is a sex-linked trait</p> <p><input type="radio"/> B Because males' eyes are different from females' eyes</p> <p><input type="radio"/> C Because males can't see as well as females</p>
<p>7. Identical twins can be different sexes.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>	<p>8. All twins have exactly the same DNA.</p> <p><input type="radio"/> A False</p> <p><input type="radio"/> B True</p>