

What Is a Gene?

- 1 To understand how genes work, let's review some biology basics. Most living organisms are made up of cells that contain a substance called deoxyribonucleic acid (pronounced: dee-AHK-see-rye-bow-noo-klee-ik) acid (DNA).
- 2 DNA contains four chemicals (adenine, thymine, cytosine, and guanine — called A, T, C, and G for short) that are strung in patterns on extremely thin, coiled strands in the cell. How thin? Cells are tiny — invisible to the naked eye — and each cell in your body contains about 6 feet of DNA thread, for a total of about 3 billion miles of DNA inside you!
- 3 So where do genes come in? Genes are made of DNA, and different patterns of A, T, G, and C code for the instructions for making things your body needs to function (like the enzymes to digest food or the pigment that gives your eyes their color). As your cells duplicate, they pass this genetic information to the new cells.
- 4 DNA is wrapped together to form structures called chromosomes. Most cells in the human body have 23 pairs of chromosomes, making a total of 46. Individual sperm and egg cells, however, have just 23 unpaired chromosomes. You received half of your chromosomes from your mother's egg and the other half from your father's sperm cell. A male child receives an X chromosome from his mother and a Y chromosome from his father; females get an X chromosome from each parent.
- 5 Genes are sections or segments of DNA that are carried on the chromosomes and determine specific human characteristics, such as height or hair color. Because you have a pair of each chromosome, you have two copies of every gene (except for some of the genes on the X and Y chromosomes in boys, because boys have only one of each).
- 6 Some characteristics come from a single gene, whereas others come from gene combinations. Because every person has about 25,000 different genes, there is an almost endless number of possible combinations!

Genes and Heredity

- 7 Heredity is the passing of genes from one generation to the next. You inherit your parents' genes. Heredity helps to make you the person you are today: short or tall, with black hair or blond, with brown eyes or blue.

8 Can your genes determine whether you'll be a straight-A student or a great athlete? Heredity plays an important role, but your environment (including things like the foods you eat and the people you interact with) also influences your abilities and interests.

9 A person can have changes (or mutations) in a gene that can cause many issues for them. Sometimes changes cause little differences, like hair color. Other changes in genes can cause health problems.

10 Mutations in a gene usually end up causing that particular gene copy to not do its job the way it normally should. Since we have two copies of every gene, typically there's still a "normal" working copy of the gene. In these cases, usually nothing out of the ordinary happens since the body can still do the jobs it needs to do. This is an example of an autosomal recessive trait.

11 For someone to have a recessive disease or characteristic, the person must have a gene mutation in both copies of the gene pair, causing the body to not have working copies of that particular gene.

12 Genes can be either dominant or recessive. Dominant genes show their effect even if there is just one mutation in one copy of that gene pair; the one mutation "dominates" the normal back-up copy of the gene, and the characteristic shows itself.

13 A person can be born with gene mutations, or they can happen over a lifetime. Mutations can occur when cells are aging or have been exposed to certain chemicals or radiation. Fortunately, cells usually recognize these types of mutations and repair them by themselves. Other times, however, they can cause illnesses, such as some types of cancer.

14 If the gene mutation exists in egg or sperm cells, children can inherit the gene mutation from their parents. When the mutation is in every cell of the body (meaning a child was born with it), the body is not able to "repair" the gene change.