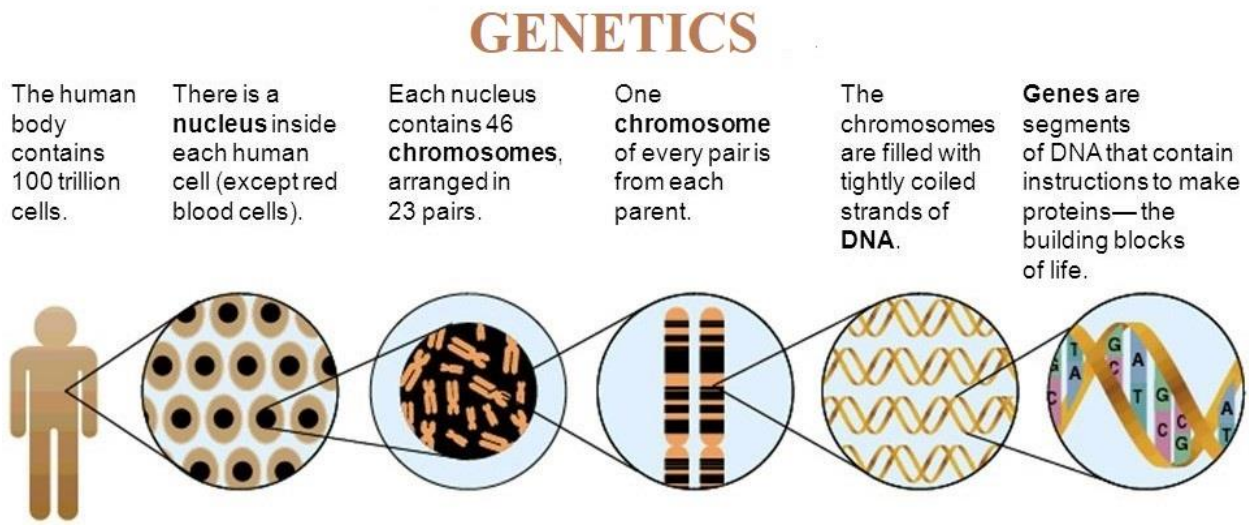


My Drift

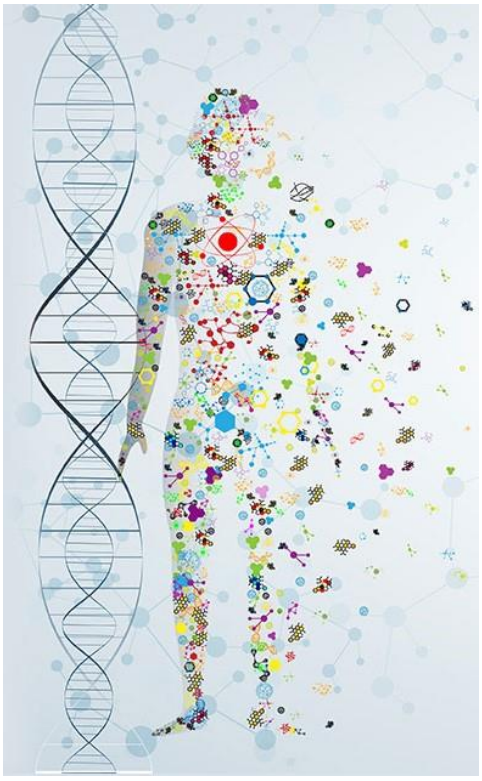
Title: Genetics

Written by: Jerry D. Petersen

Date: 2 Oct 2020

Article Number: 343-2020-21

Take a minute to look at the above header that shows where your genes come from with a brief explanation. This will give you a head start on this complex subject of genetics that I'm going to try to write about in this article.



Genetics is the study of how, in all living things, the characteristics and qualities of parents are given to their children by their genes.

What is a Gene?

Genes carry the information that determines your human traits, which are features or characteristics that are passed on to you from your parents. Each cell in the human body contains about 25,000 to 35,000 genes. Considering there are more than a trillion cells in your body, that is a lot of genes.

How Do Genes Work?

Each gene has a special job to do. The DNA in a gene spells out specific instructions for making proteins in the cell. Proteins are the building blocks for everything in your body. Bones and teeth, hair, nerves, muscles, blood etc. are all made up of proteins. Those proteins help our bodies grow, work properly, and stay healthy. Scientists today estimate that each gene in the body may make as many as 10 different proteins. That adds up to more than 300,000 proteins!

Like chromosomes, genes also come in pairs. Each of your parents has two copies of each of their genes, and each parent passes along just one copy to make up the genes you have. Genes that are passed on to you determine many of your traits, such as your skin color, hair color, and eye color.

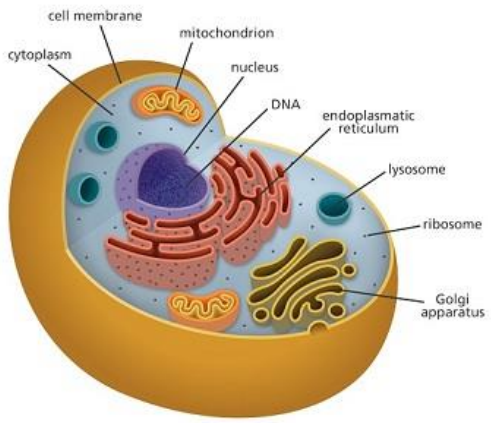
Example: Emma's mother has one gene for brown hair and one for red hair, and she passed the red hair gene on to Emma. Her father has two genes for red hair, that could explain her red hair. Emma ended up with two genes for red hair, one from each of her parents.

More examples: Emma's parents both have green eyes so she might inherit the trait for green eyes from them. Or if Emma's mom has freckles, she might have freckles too because she inherited the trait for freckles. Genes aren't just found in humans — all animals and plants have genes, too.

Where are these important genes?

Well, they are so small you can't see them. Genes are found on tiny spaghetti-like structures called chromosomes and chromosomes are found inside cells that make up all living things. A cell is so tiny that you can only see it using a strong microscope.

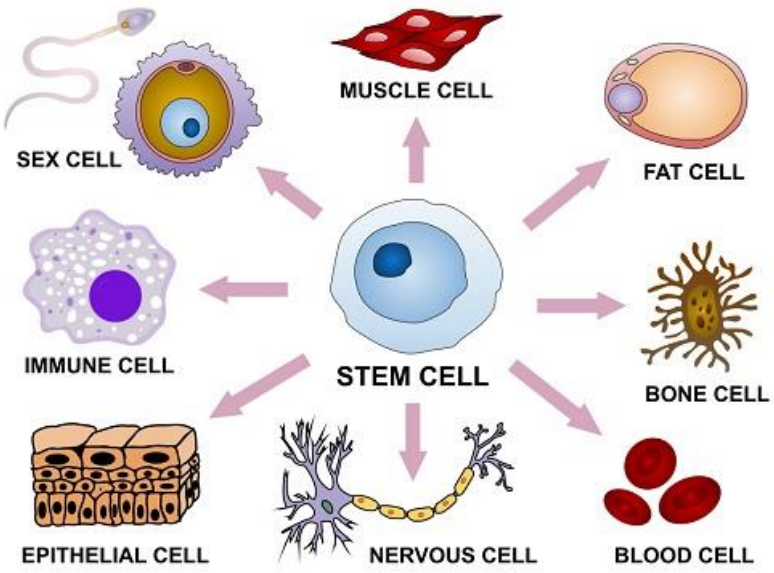
In this article, we are only concerned with stuff that is in the cell nucleus.



The Human Cell

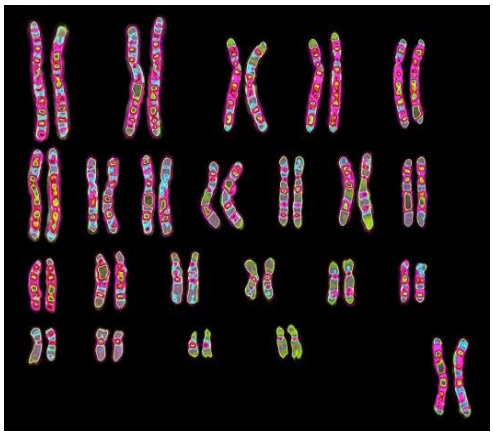
How many different types of cells are in the human body?

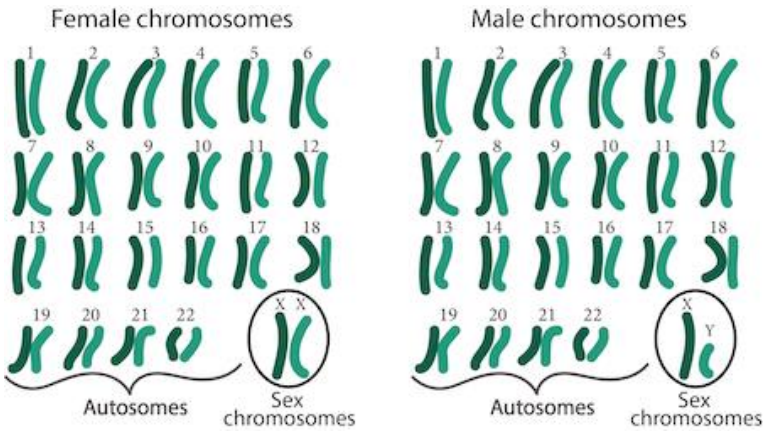
There are about 200 different types of cells in the body. The picture below shows a few of them:



The cells inside our bodies are "specialized." This means that each type of cell performs a unique and special function. For this reason, each of the 200 different types of cells in the body has a different structure, size, shape, and function. All the cells work together to keep the human body running efficiently.

What are Chromosomes and what do they do?





In humans, a cell nucleus contains 46 individual chromosomes or 23 pairs of chromosomes. Half of these chromosomes come from one parent and half come from the other parent. Under the microscope, we can see that chromosomes come in different lengths and striping patterns. When they are lined up by size and similar striping pattern, the first twenty-two of the pairs are called autosomes; the final pair of chromosomes are called sex chromosomes, X and Y. The sex chromosomes determine whether you're a boy or a girl: females have two X chromosomes while males have one X and one Y.

What does Deoxyribonucleic Acid (DNA) do?

DNA contains the instructions needed for an organism to develop, survive, and reproduce. To carry out these functions, DNA sequences must be converted into messages that can be used to produce proteins, which are the complex molecules that do most of the work in our bodies.

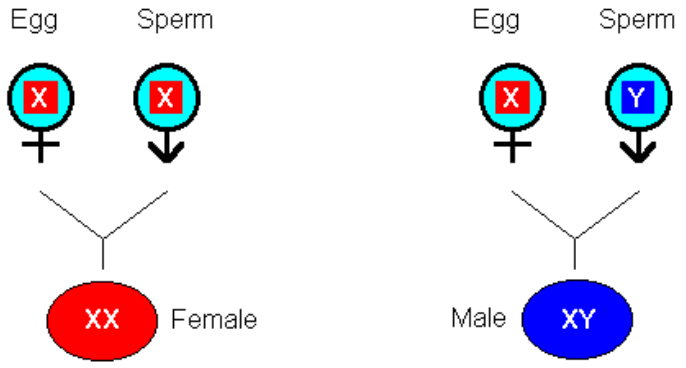
EVERYBODY'S DNA IS DIFFERENT!

Each DNA sequence that contains instructions to make a protein is known as a gene. The size of a gene may vary greatly but the average size is 10-15 kbp (kilobase pairs) in humans. Genes only make up about 1 percent of the DNA sequence. DNA sequences outside this 1 percent are involved in regulating when, how and how much of a protein is made.

Time for another example: Both of Emma's parents have green eyes but Emma has blue eyes. How can this happen? Now, before you start blaming the mailman or the UPS driver, you should consider the eye color of the grandparents. Yes, the grandparent's genes can affect how their grandchildren look. After all, grandchildren get 25% of their genes from each of their grandparents. And genes have the instructions for how we look (and most everything else about us). So, your kids will definitely inherit some of your parent's genes. Most likely one or more of the Emma's grandparents have blue eyes. It is also common that your son or daughter will look more like your father or mother then you.

Exception to the rule: Sex Chromosomes

There is a pair of chromosomes that don't get inherited evenly from all 4 grandparents! This is the last pair of chromosomes: the sex chromosomes.



Only boys have Y chromosomes. **This means that a male can only inherit the Y chromosome from his father, and his father could have only inherited it from his father. Therefore, males always inherited their Y chromosome from their paternal grandfather.**

On the other hand, all males inherited their X chromosome from their mother. **Notice that the grandson's X chromosome is a combination of both maternal grandparents. In contrast, the granddaughter has two X chromosomes. The one from mom is a combination of both maternal grandparents, just like in her brother. But the X chromosome from dad is entirely from the paternal grandmother. Since the father inherited a Y chromosome from the paternal grandfather, neither grandchild inherited any X chromosome DNA from the paternal grandfather.**

I told you that genetics can be complex and confusing, right?

Not all genes passed down from parents to their children are good. Some genes can result in an increased risk for "Genetically Inherited Diseases".

Researchers have identified more than 4,000 diseases that can be caused by mutations. **But having a genetic mutation that may cause a disease or condition doesn't always mean that a person will actually develop that disease or condition. In fact, the odds are much greater that you will not develop that disease or condition.**

These are the most common diseases and conditions that tend to run in families:

- **Heart disease:** **coronary atherosclerosis (a buildup of plaque inside the artery walls), high blood pressure, hyperlipidemia (high concentration of fats or lipids in the blood)**
- **Cancer:** **colon, stomach, lung, bladder, breast, skin (melanoma)**
- **Diabetes:** **type 1 and 2**
- **Neurological illnesses and disorders:** **Alzheimer's disease, amyotrophic lateral sclerosis (Lou Gehrig's disease), Huntington's disease (progressive brain disorder), multiple sclerosis, Parkinson's disease (disorder of the central nervous system), Tourette's syndrome (uncontrollable repetitive movements)**
- **Mental illnesses and behavioral conditions:** **alcoholism, anxiety disorders, attention deficit disorder, eating disorders, manic depression, schizophrenia**

- **Other genetic diseases: cleft lip, clubfoot, cystic fibrosis, muscular dystrophy, hemophilia (blood can't clot properly), sickle cell disease (red blood cells become misshapen)**
- **Medical conditions with genetic links: arthritis, asthma, baldness, migraine headaches, obesity, periodontal disease, speech disorder, lupus.**

Well, that seems like a lot of bad things that tend to run in families!

No wonder knowing this can cause huge amounts of anxiety and stress in many families. However, many of the medical conditions people worry about are not genetic at all. And many of the diseases and conditions listed above are extremely rare and nobody in your family is likely to get them.

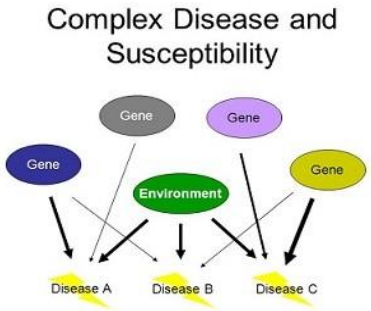
Health Anxiety Can Kill You


Coronavirus does not "Run in Families"

What are complex or multifactorial disorders?

Researchers are learning that nearly all diseases and conditions have a genetic component. Some disorders, such as sickle cell disease and cystic fibrosis, are caused by mutations in a single gene. The causes of many other disorders, however, are much more complex. Common medical problems such as heart disease, type 2 diabetes, and obesity do not have a single genetic cause—they are likely associated with the effects of multiple genes (polygenic) in combination with lifestyle and environmental factors. Conditions caused by many contributing factors are called complex or multifactorial disorders.

Although complex disorders often cluster in families, they do not have a clear-cut pattern of inheritance. This makes it difficult to determine a person's risk of inheriting or passing on these disorders. Complex disorders are also difficult to study and treat because the specific factors that cause most of these disorders have not yet been identified.



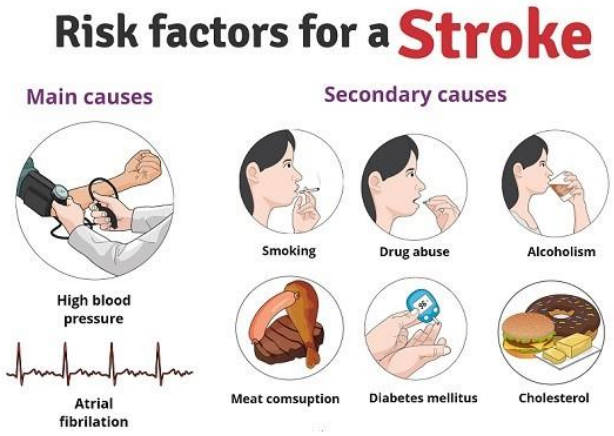
Multifactorial disorders

Let's take a look at a few of the more common genetically inherited diseases and the odds of getting them.

Heart Disease and Stroke

What are the odds of getting heart disease?

And the results are sobering. At age 45, the lifetime heart disease risk is 60.3% for men and 55.6% for women, according to the researchers. That means that, on average, a 45-year-old man without heart disease can expect that he will develop the disease at some point in his life with 60.3% probability. So, your best chance of not getting heart disease is to reduce the number of risk factors that you have control or some control over. There is not much you can do about your genetics, sex, age, and ethnicity.

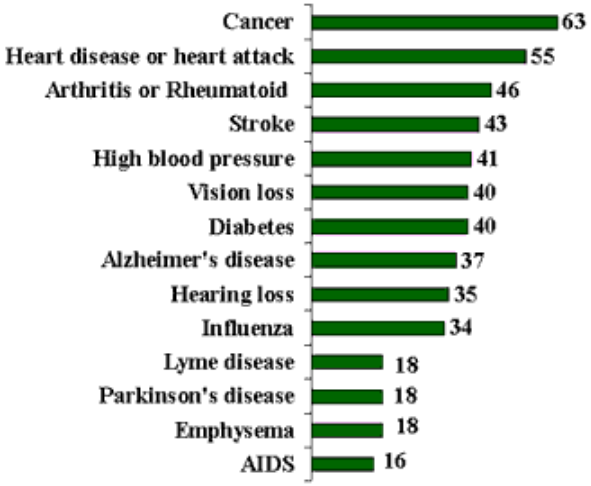


Stroke is not a genetic disease, but it does seem to run in some families. This is because some members of a family might have a genetic tendency for stroke risk factors such as high blood pressure (hypertension) and/or diabetes. Me – I worry more about having a stroke than any other disease or condition. That is probably because my dad had multiple strokes and died at an early age.

Cancer

Americans Worry Most About Getting Cancer

(Recent Gallup Poll – Percent of People)



Are we more at risk for getting cancer if our relatives have it?

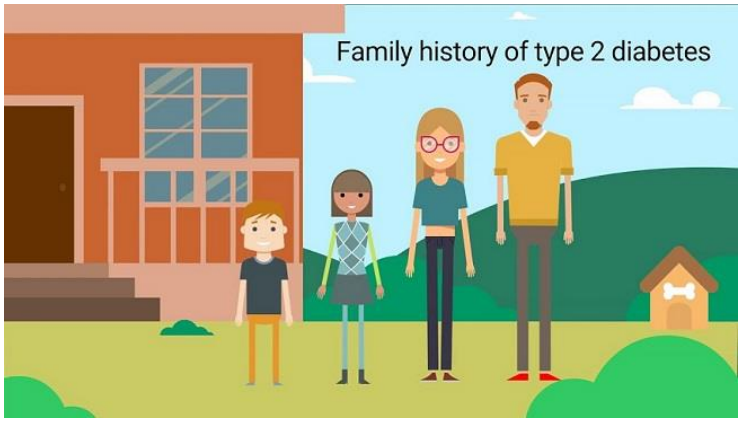
Some types of cancer can run in families. For example, your risks of developing certain types of breast cancer, ovarian cancer or prostate cancer are higher if you have close relatives who developed the condition.

This doesn't mean you'll definitely get cancer if some of your close family members have it, but that you may have an increased risk of developing certain cancers compared to other people. It's estimated that 7 in every 100 cancers are associated with an inherited faulty gene.

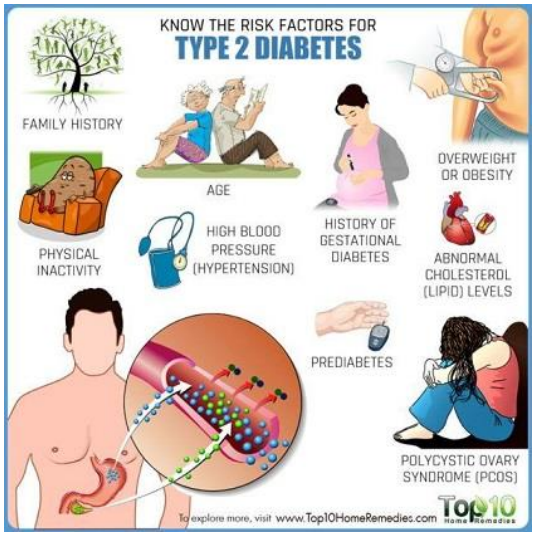
Cancers caused by inherited faulty genes are much less common than those caused by other factors, such as ageing, smoking, being overweight and not exercising regularly, or not eating a healthy balanced diet. Most cancers develop as a result of a combination of risk factors which include family history.

About 1 in 8 U.S. women (about 12.4%) will develop invasive breast cancer over the course of her lifetime.

Type 2 Diabetes



The odds. A child has a 1 in 7 chance of developing diabetes if one parent was diagnosed before age 50. If the parent was diagnosed after age 50, the child has a 1 in 13 chance. The child's risk may be greater if the mother has diabetes. If both parents have diabetes, the child's risk is about 50 percent.



Type 2 Diabetes Risk Factors

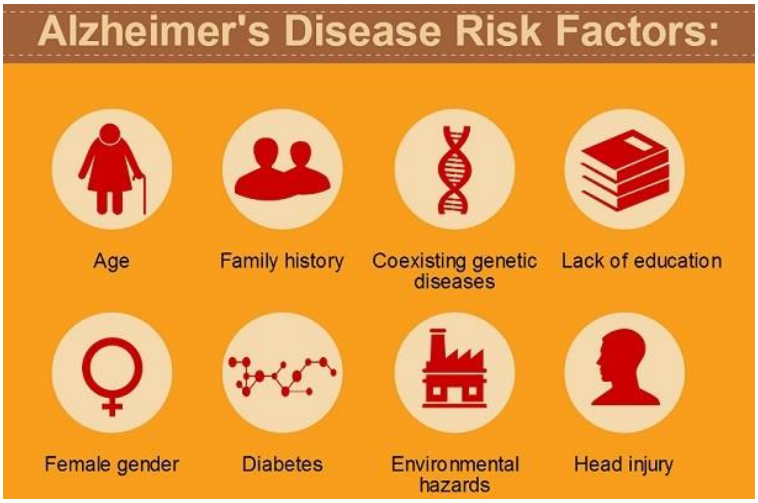
Getting type 2 diabetes is only partially due to genetics. Lifestyle habits such as an unhealthy diet, obesity, and lack of physical activity tend to run in families and are all risk factors for developing diabetes. This makes it difficult to figure out if type 2 diabetes is caused by genetics or lifestyle habits or both. By making changes in these lifestyle habits, however, you can delay or prevent the onset of type 2 diabetes.

Genes vs Lifestyle

Genes do play a role in type 2 diabetes, but lifestyle choices are also important. You can, for example, have a genetic mutation that may make you susceptible to type 2 diabetes, but if you take good care of your body, you may not develop diabetes.

Say that two people have the same genetic mutation. One of them eats well, watches their cholesterol, and stays physically fit, and the other is overweight and inactive. The person who is overweight and inactive is much more likely to develop type 2 diabetes because certain lifestyle choices greatly influence how well your body uses insulin.

Alzheimer’s Disease



Alzheimer’s Disease is a progressive disease that destroys memory and other important mental functions. Brain cell connections and the cells themselves degenerate and die, eventually destroying memory and other important mental functions. Memory loss and confusion are the main symptoms. No cure exists, but medications and management strategies may temporarily improve symptoms.

The odds: Women have a 1 in 5 chance of developing Alzheimer's, compared to a 1 in 11 chance for men. Above the age of 65, a person's risk of developing Alzheimer's disease or vascular dementia doubles roughly every 5 years. It is estimated that dementia affects one in 14 people over 65 and one in six over 80.

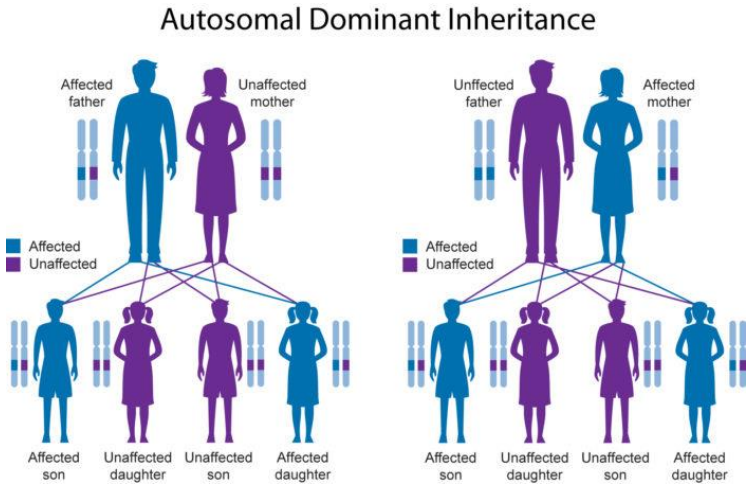
If your mother has Alzheimer's, you are more likely to develop the disease than if your father has Alzheimer's, according to a study published in the journal of Neurology. The study adds to a growing body of evidence that a tendency for the disease appears to be passed down through the mother's genes.

Being a carrier: **Your genes come with a built-in backup system. You get two copies of each gene, one from your mother and one from your father. If one version doesn't work good, chances are the other will. If a gene that does not work properly can cause a disease, our bodies usually compensate by using the working copy of that gene. In this case, you are a carrier of the disease. The disease does not affect you directly. If you have a child, you only pass along one of your two copies of the gene. There is a 50/50 chance that the child will get the version of the gene that does not work the way it should.**

Figuring Out the Chances

A family health portrait can help show a pattern in a family. That pattern helps healthcare providers and genetic counselors understand how a gene moves from parent to child. That way, they can get a sense of where a gene is in different people, even in the people who don't have the condition caused by that gene.

When we speak of the chance of inheritance of a gene or condition, we often use terms like "50%" or "1 in 2." These numbers are a bit like tossing a coin. If you toss a coin, there is a 50% (or 1 in 2) chance that it will come up heads, and 50% that it will come up tails. If it does come up heads, and you toss it again, there is still a 50% chance of getting heads. The first toss doesn't change the chance of getting heads a second time. In fact, you could toss a coin 10 times in a row and get heads every time. It's very rare, but it can happen.



Autosomal dominance is a pattern of inheritance characteristic of some genetic diseases. "Autosomal" means that the gene in question is located on one of the numbered, or non-sex, chromosomes. "Dominant" means that a single copy of the disease-associated mutation is enough to cause the disease.

Recap with a few Examples and Statistics

Well, I think we have enough genetics information to be totally confused and worried. Right?

Did you know that doctors, scientists, and medical researchers have discovered about 10,000 different diseases and conditions? That's scary, especially when you consider that there are only cures for about 500 of these diseases and conditions.

These same doctors, scientists, and medical researchers have identified more than 4,000 diseases that can be caused by gene mutations and can result in an increased risk for "Genetically Inherited Diseases".

I have figured out how to determine the odds of getting a bad gene.

Flip a Coin!

Heads = You have no bad genes - Tails = You have a bad gene

From two weeks of researching the Internet for this article, it is clear to me that these genetics doctors, scientists, and medical researchers have no idea if you or me have a gene mutation or two or none at all.

Here are some Examples and Statistics to prove my point:

1. **Remember, you can get a disease or condition with NO FAMILY HISTORY of that disease or condition. For example, in 2020, 34.2 million Americans—just over 1 in 10—have diabetes. About half of these people have no family history of diabetes or the diabetes gene.**
2. **Worst case – a disease or condition run in the family and both parents have the disease or condition. There is a 50-50 chance that each of their children will inherit the disease or condition gene. Remember, each parent has two (one normal and one with the disease or condition) genes and each parent passes one gene to the baby. This baby could get zero, one, or two genes with the disease or condition.**
3. **Remember, just because you have a disease or condition gene, there is no guarantee that you will come down with the disease or condition. A gene with a disease or condition mutation just adds another risk factor. The more risk factors you have, the greater the chances are that you will get the disease or condition.**
4. **For many diseases and conditions, the experts don't know if they run in families or what all the risk factors are. For example, it's likely that lupus disease results from a combination of your genetics and your**

environment. It appears that people with an inherited predisposition for lupus may develop the disease when they come into contact with something in the environment that can trigger lupus. The cause of lupus in most cases, however, is unknown.

BOTTOMLINE: Getting a bad gene is matter of LUCK!

I WISH YOU AND YOUR FAMILY GOOD LUCK!!

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