

# DNA

How traits  
are inherited

ABGS Module  
Illustrated by Nicki Shaw



# Age-Based Genomic Screening

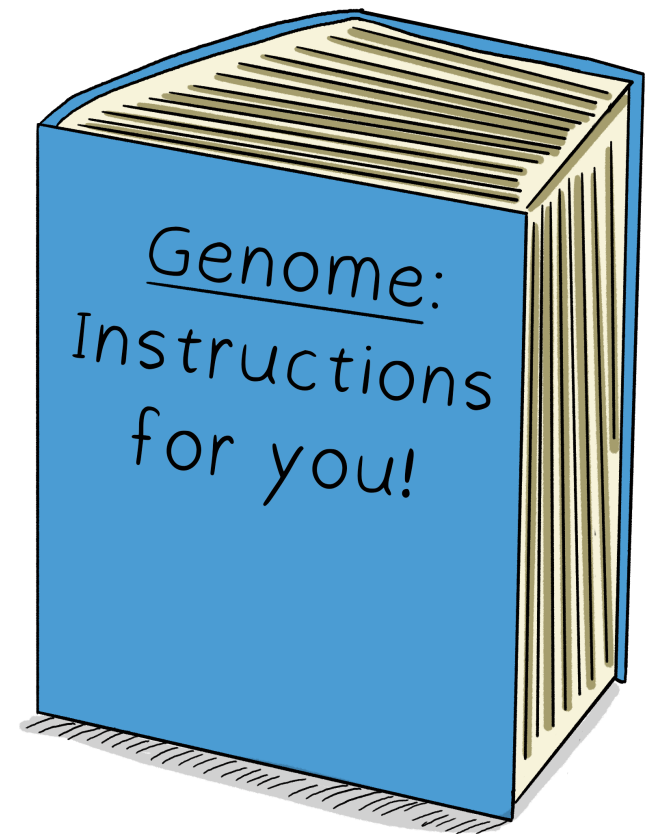
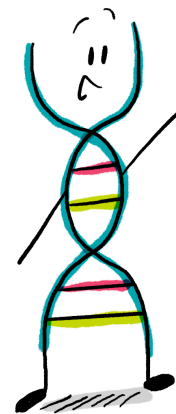
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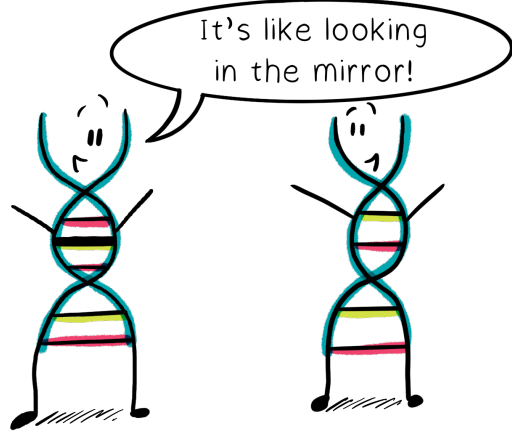
DNA is like an instruction manual for how a living being is built and how it functions.



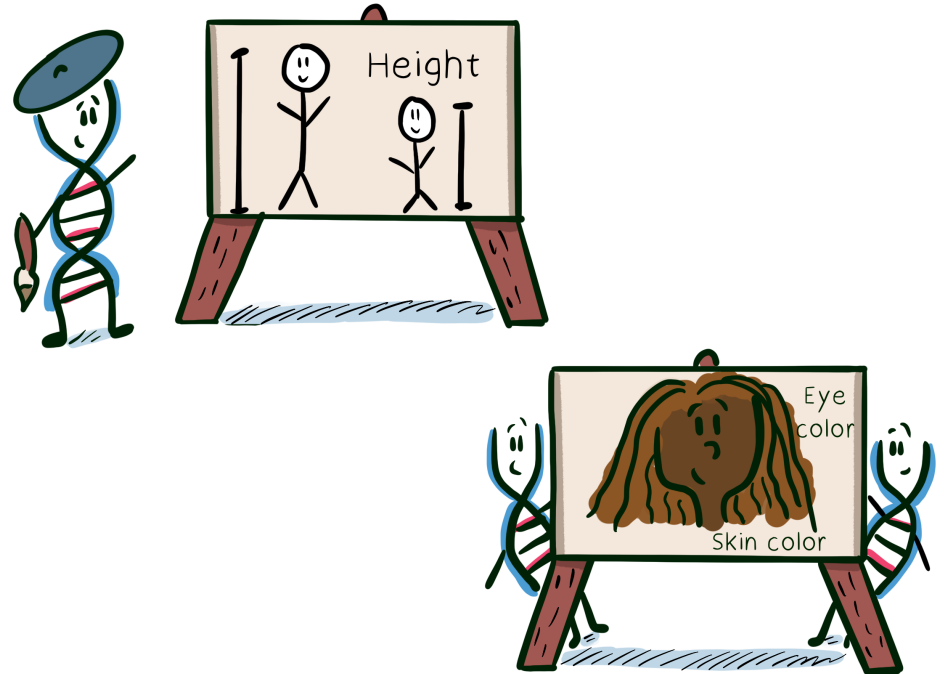
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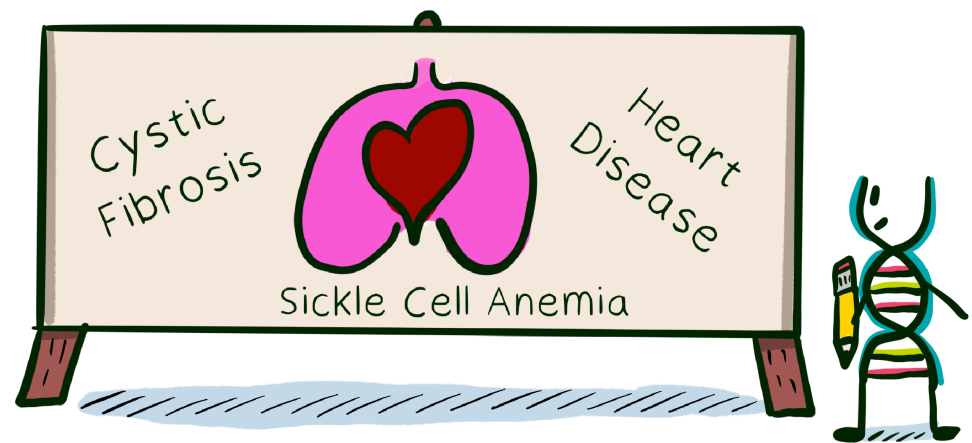
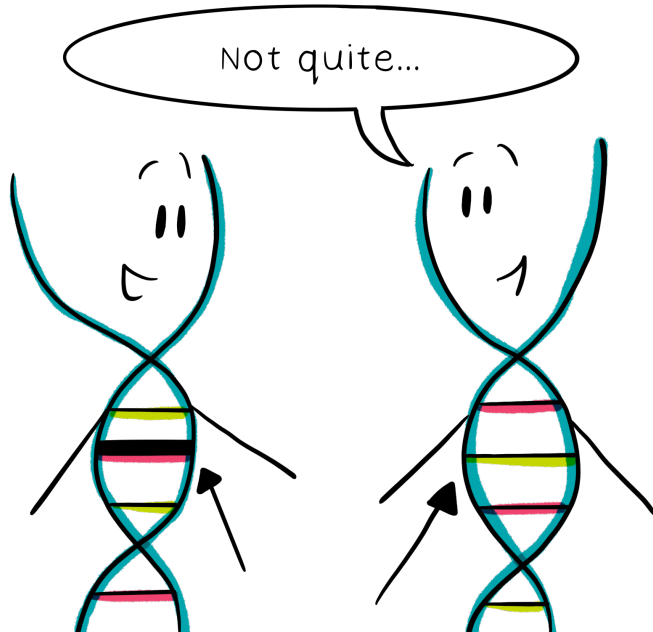
If you compared the DNA of any two people letter by letter, you would find them to be almost exactly identical - 99.9% the same!



The differences affect traits like height, eye color, or risk of disease.

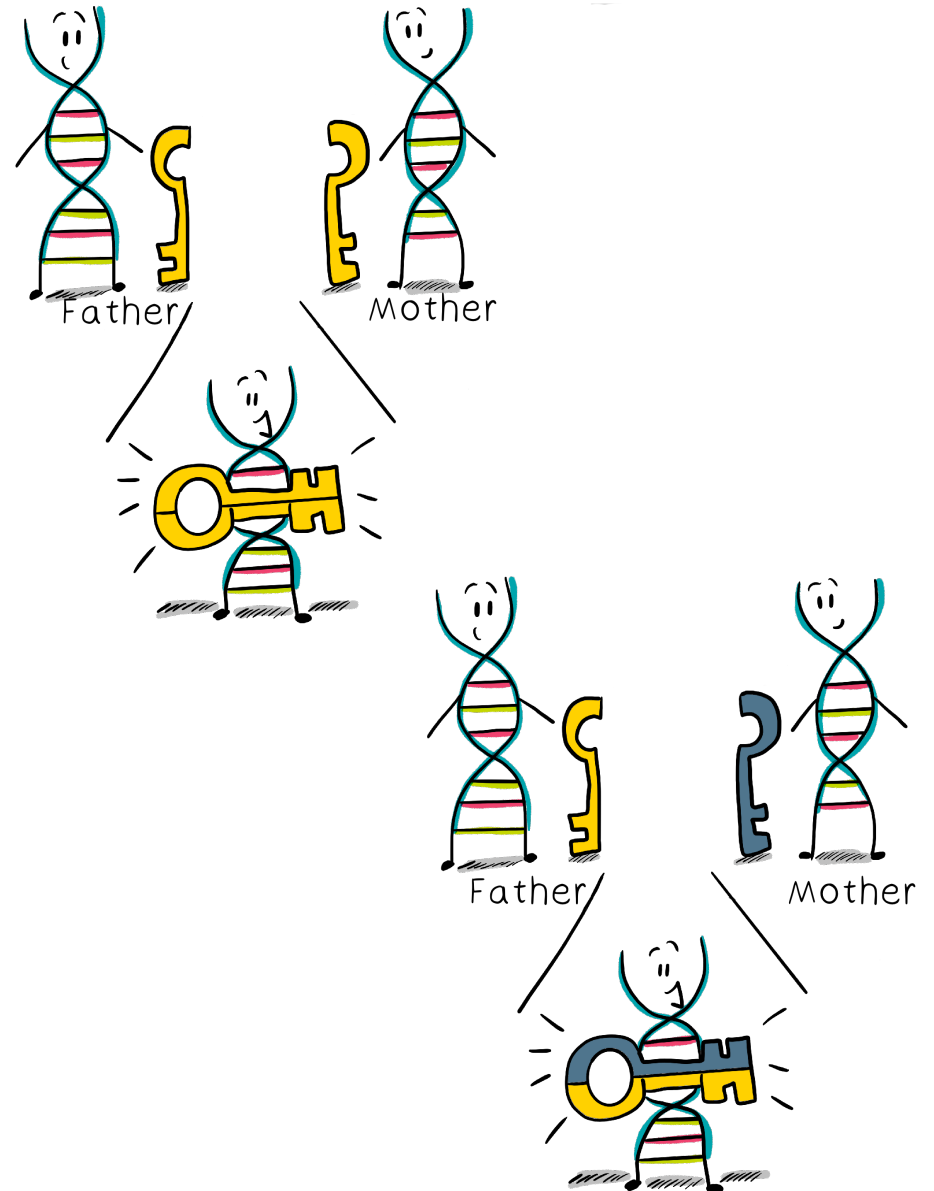
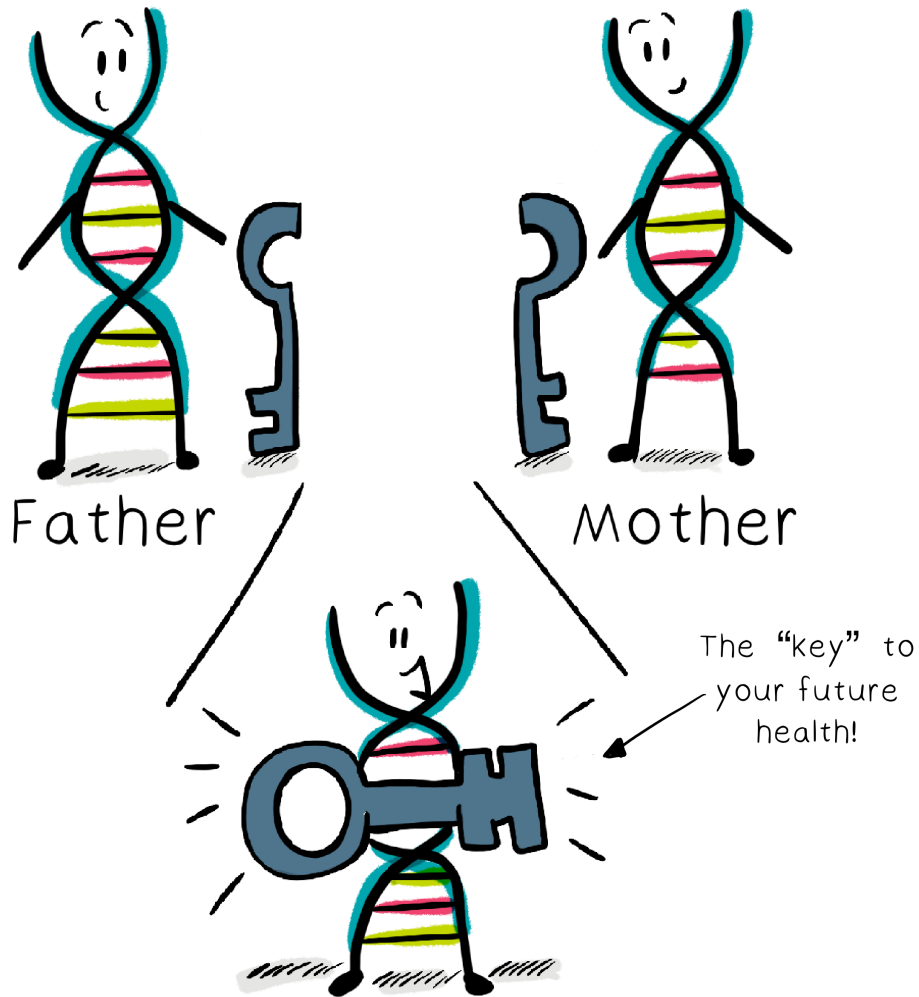


The remaining tiny differences - only 0.1% - make people unique.



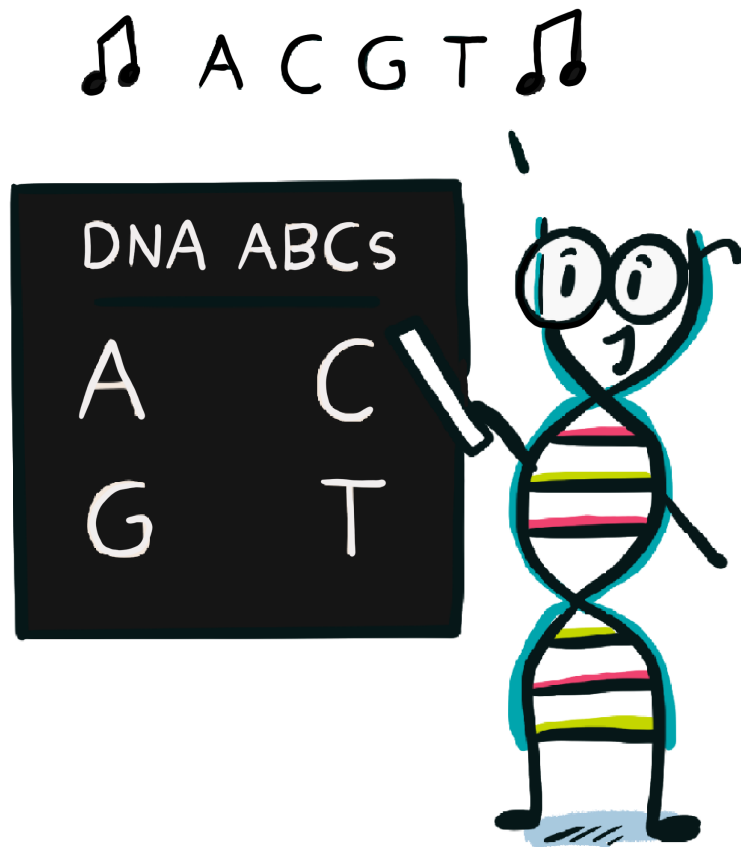
People have two copies of each gene in their body. One copy or version of each gene is inherited from each of their parents.

These two copies can be the same or different from each other.



Sometimes there is a difference in the spelling of a gene, called a "genetic variant".  
such as a T instead of an A.

Many genetic variants do not affect the way a gene works or cause health problems.



CCTG**T**GGGAG

CCTG**A**GGGAG

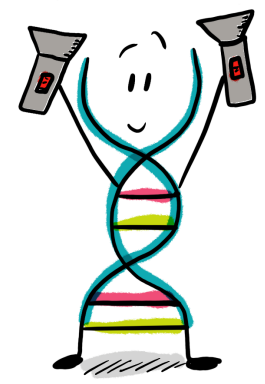
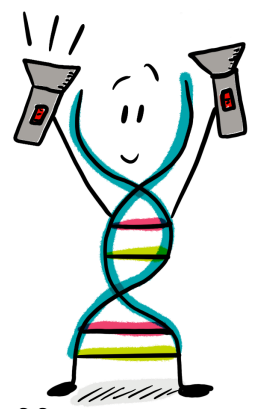
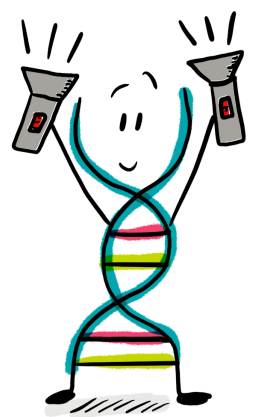
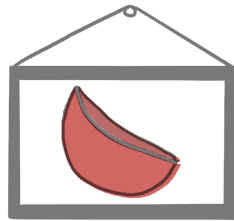
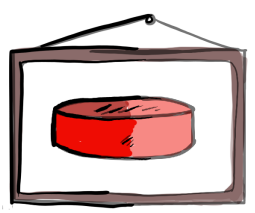
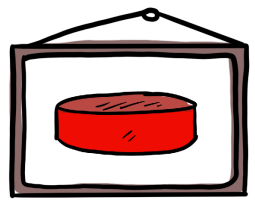
If the genetic variant causes the gene to not work correctly, a disease can result.

This is called a disease-related genetic variant.

In the case of recessive diseases, if both copies or a single copy of a gene are working, a person is unaffected.

Recessive diseases only happen when both copies of the gene are nonworking.

Recessive Example: Sickel Cell Disease



Unaffected person

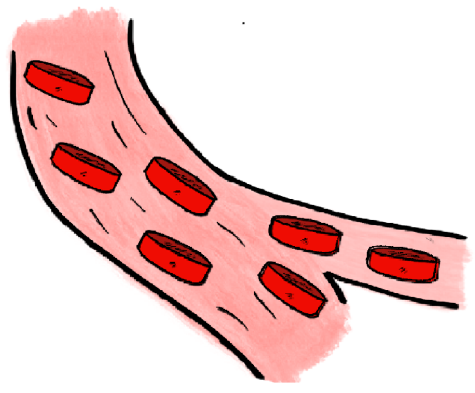
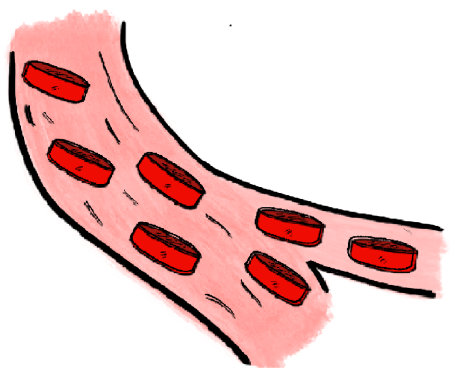
Unaffected person

Affected person

Normal Red Blood Cells

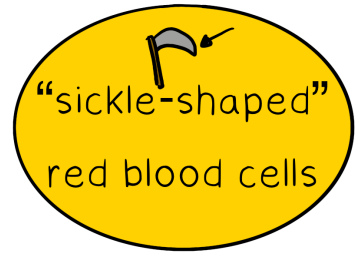
Normal Red Blood Cells

Crescent Shaped Red Blood Cells



Symptoms

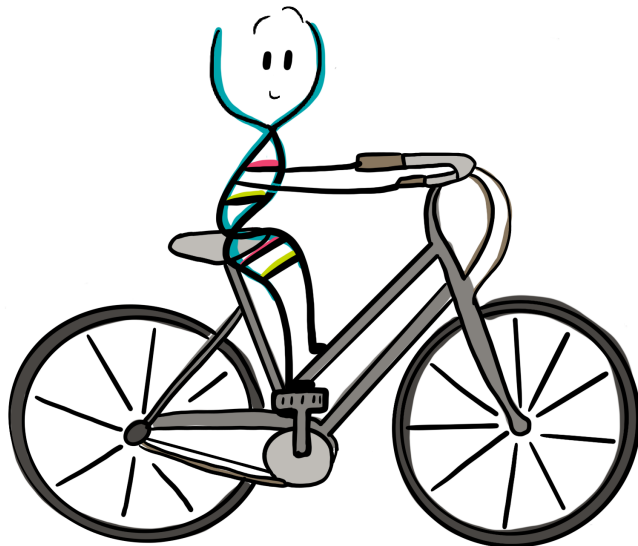
- Pain attacks 
- Swelling in hands and feet 
- Infections 
- Stroke 



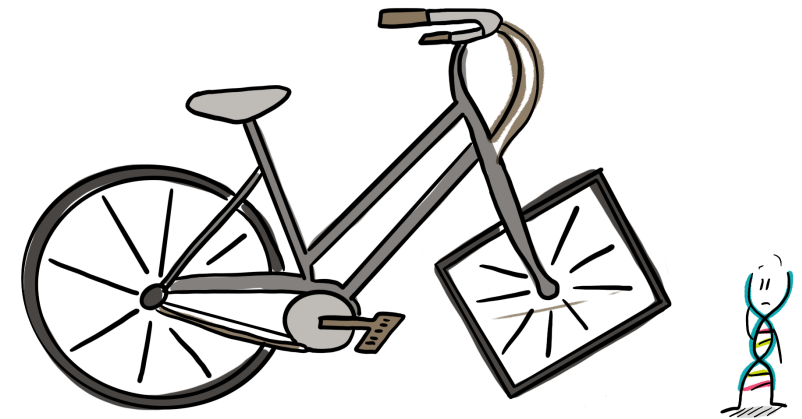
Dominant diseases happen when either of a person's copies of a gene is the misspelled or nonworking version. If a single copy of the gene is nonworking, a person is affected.

Think of a pair of gene copies as a pair of wheels on a bicycle. If either bicycle wheel is square (or nonworking), the bicycle will not roll.

Dominant Example: Marfan Syndrome

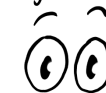
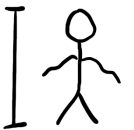


Unaffected Person



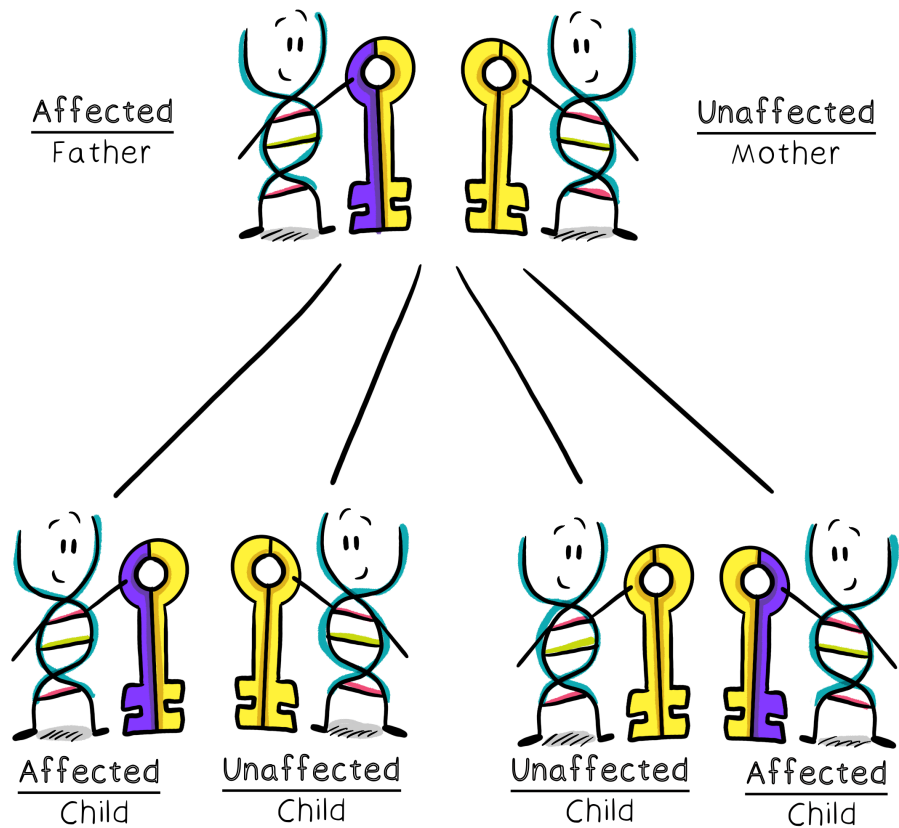
Affected person with Marfan Syndrome

- Patient tends to be overly tall, with overly flexible joints
- Eye problems
- Weaknesses in blood vessels



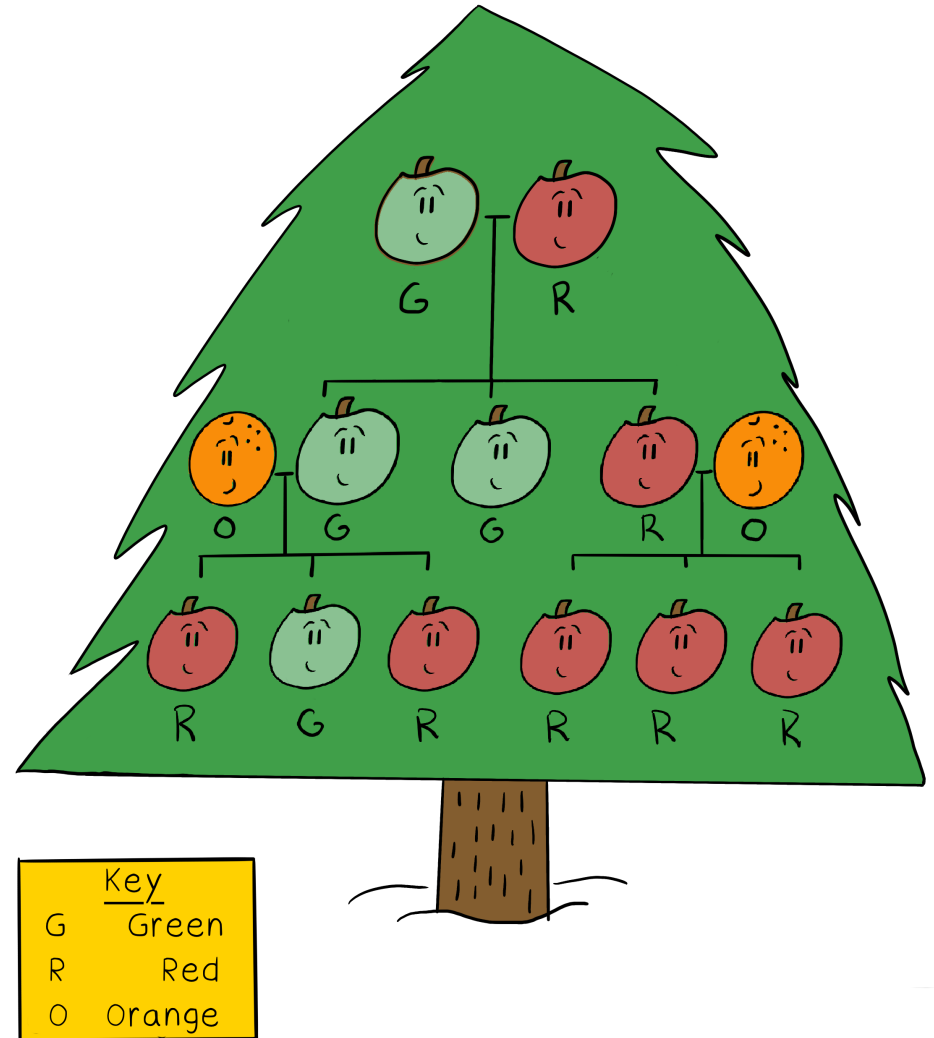
Many traits and diseases are inherited in a dominant or recessive pattern. Let's look at how dominant traits are inherited.

When these two parents have a child, that child will inherit one copy of their genes from each parent.



In this example, children will always inherit a yellow copy from their mother but could inherit either a yellow or purple copy from their father.

This family tree shows three generations, from grandparents through grandkids. The green shading shows a condition that is inherited in a dominant pattern. The red and orange shading shows family members who were unaffected by the condition.





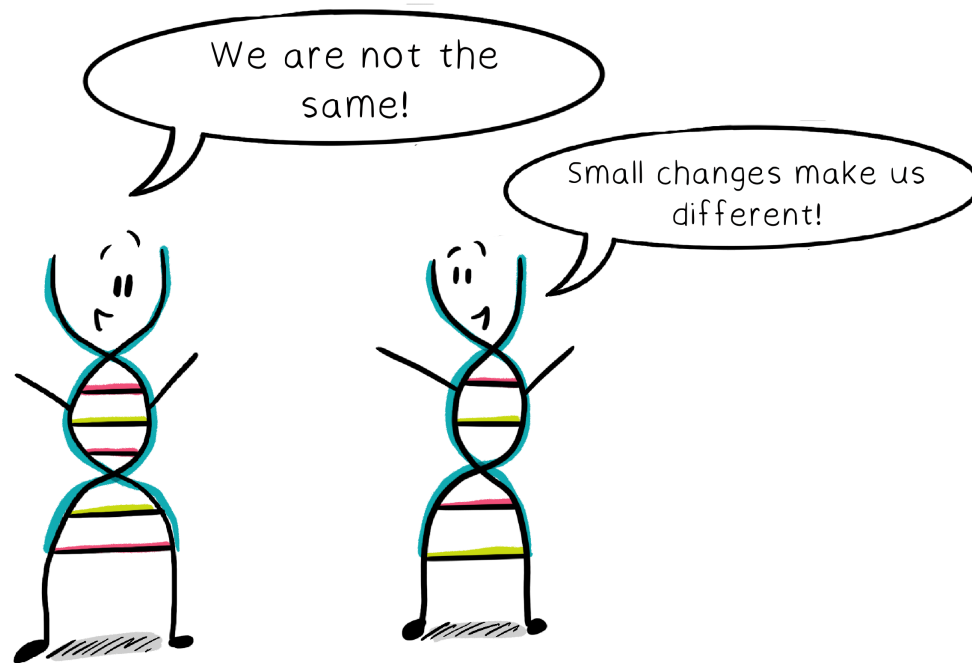
Physical traits and risk for certain disease, such as heart disease, diabetes, and some cancers can be inherited. This explains why diseases "run in families."



Sometimes the risk can be reduced by medicine or changes to diet and exercise habits.

To summarize, sometimes differences in the spelling of genes, called genetic variants, can cause genes not to work correctly.

Nonworking genes can cause disease. These disease-related genetic variants can be inherited in a dominant pattern (when one nonworking copy of a gene causes disease) or a recessive pattern (when both copies of a gene have to be nonworking to cause disease).



Knowing about your genes helps you understand your health!

## Plain Language Glossary

### ○ DNA:

The blueprint for a person which is written in the letters "A, G, C, T" and inherited across each generation.

### ○ Gene:

A small piece of DNA that provides the code for specific functions or traits.

### ○ Trait:

Any characteristic of a person; can be based on one or multiple genes as well as the setting that a person lives.

### ○ Chromosomes:

Tight coils of DNA, containing multiple genes, held within each cell.

### ○ Genome:

All of a person's DNA organized in chromosomes.

### ○ Genetic variant:

A difference in the spelling of a gene's "ATGC" alphabet. Synonyms: mutation, variation, change.

### ■ Disease-related genetic variant:

A spelling difference that causes the gene not to work correctly and can cause disease.

### ○ Inherited:

A trait, disease, or condition that is passed down through a family by each generation.

### ○ Recessive disease:

A disease that happens when both of a person's two copies of a gene are not working.

### ○ Dominant disease:

A disease that happens when either one of a person's two copies of a gene is not working.

### ○ Affected:

A person who has symptoms of a disease or condition.

### ○ Unaffected:

A person who does not have symptoms of a disease or condition.