



How Genes Are Inherited

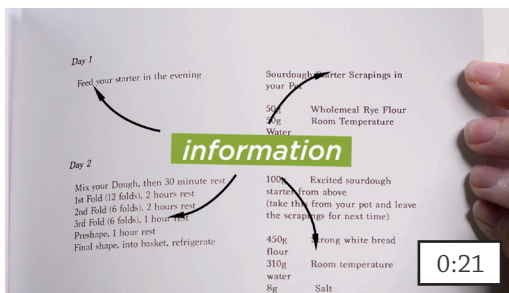
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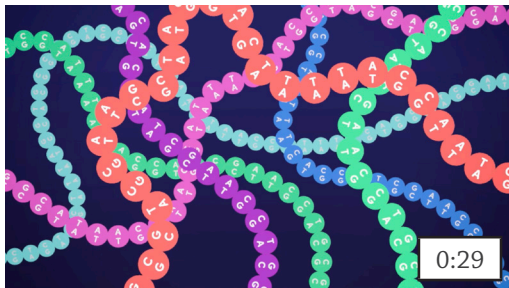
Genes are inherited, but how does that work?

They're really two things like once. Like this **cookbook**.

On the one hand, it's a physical **object** made out of paper and ink.

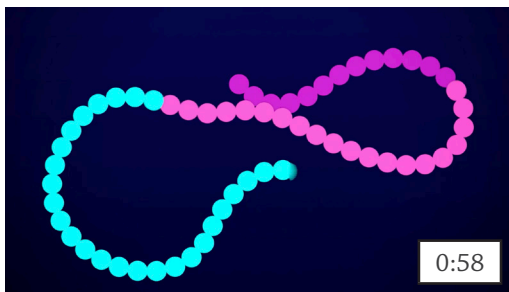


But if you can read it, you also have access to **information** that can help you make a grand buffet of delicious foods.



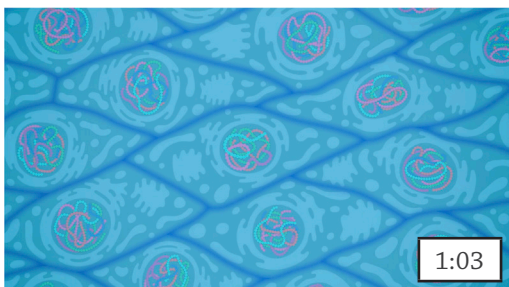
Genes are kind of like that too. They're **objects** and **information** at the same time.

It can be tricky to hold both of these ideas in your head at once. But if you can, it might be a little easier to understand how genes, and the traits they make, are inherited. And that's true for all living things, from single-celled bacteria to people.



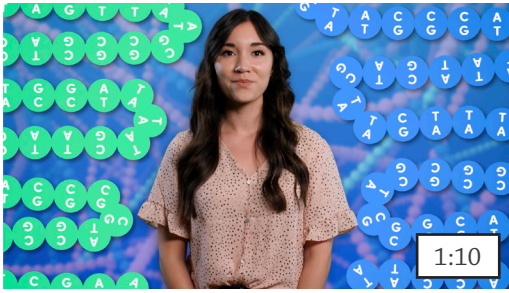
In the physical object sense, genes are made from building blocks that link together to make really long DNA molecules.

Genes are segments of these molecules, spaced out end to end.



They're actual things that are sitting inside nearly every living cell.

<< Note: Times here are counted from the beginning of the video. If the video player is showing a negative number (time from the end), click or tap the number to switch the display to time from the beginning.



In the information sense, the order of a gene's building blocks is a literal code – sort of like how letters make words.



Cells read this information to build **proteins**.

So all your genes together are instructions for building all the proteins it took to make you.

Genes are **inherited** as both objects and information.



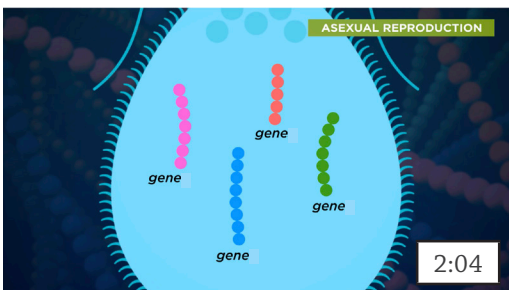
But the details of how this all works depend on how a living thing goes about reproducing. There are two ways to do it.

Some, like people, need to reproduce with a partner. That's called **sexual reproduction**.

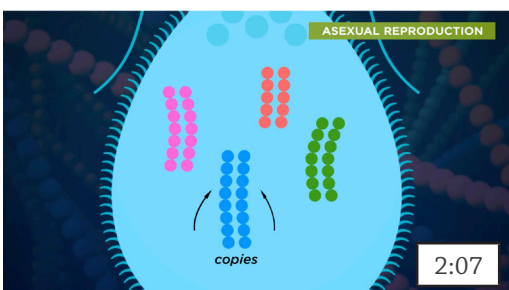


And others can reproduce without a partner. That's called **asexual reproduction**.

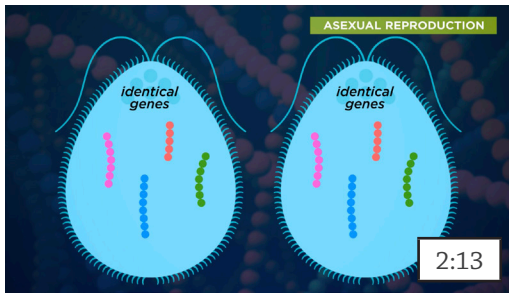
Asexual reproduction is the simpler case. Usually, when things reproduce this way, one individual just makes a genetically identical copy of itself.



Take this little single-celled creature. It has **DNA** molecules inside; that's where its **genes** are.

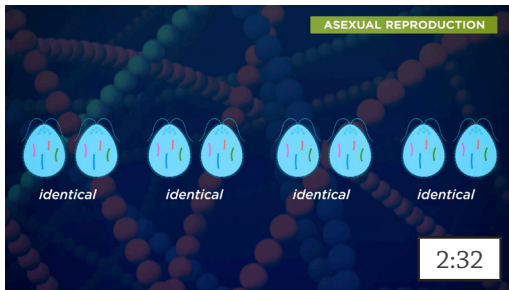


It **makes a copy** of all this DNA...

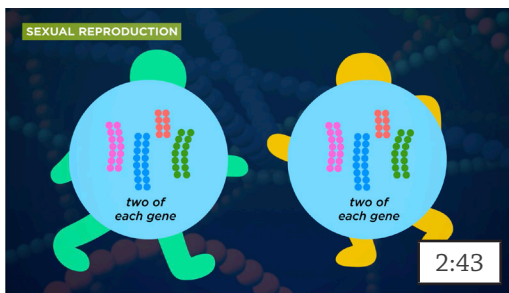


...and **divides in two**. That makes two new creatures with identical genes – you could even call them clones.

Since the information in their genes is the same, they'll make all the **same proteins**, and their **traits** will be the same too—barring any differences in their external environment.

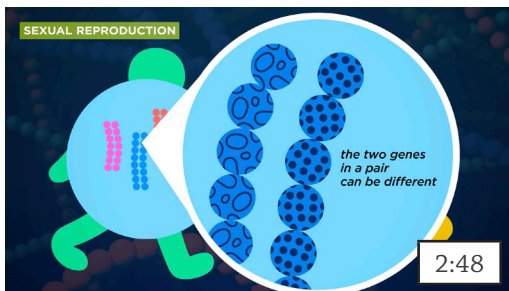


And they can keep reproducing this way to make a whole group of **identical** little creatures.

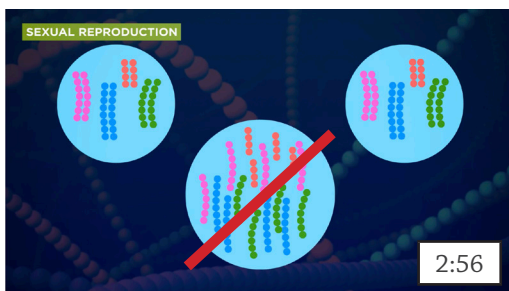


Now **sexual reproduction** is different because it combines genetic information from **two parents**.

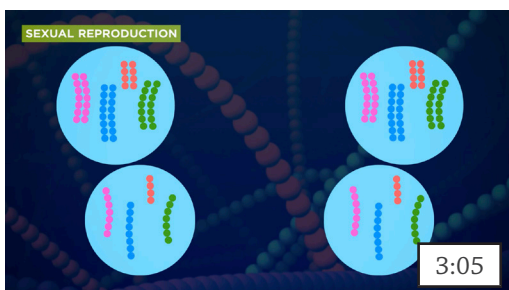
Plus, living things that reproduce this way have **two of each gene**.



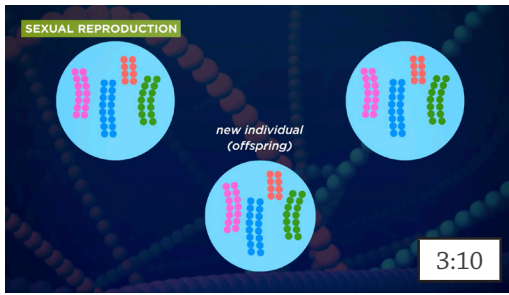
And since genes can come in different versions, the two **genes in a pair can be different**.



If both parents gave their kids all their genes, the amount of genetic information would keep increasing!

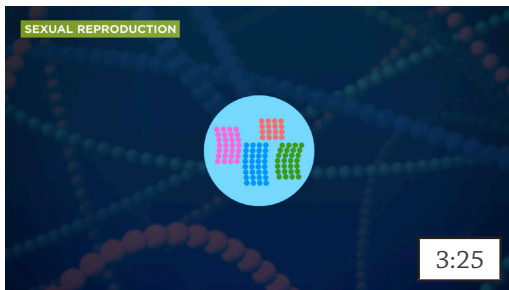


To keep the number of genes constant, the first step is to make **reproductive cells** that just have **one of each gene**.

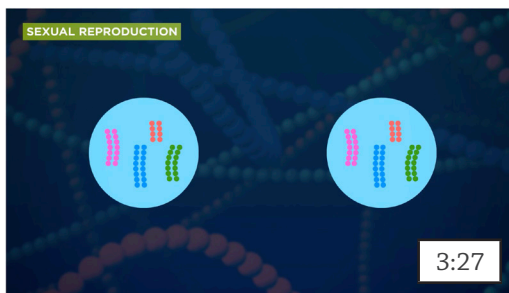


Two reproductive cells come together to make a new individual. It has two of every gene—and one came from each parent.

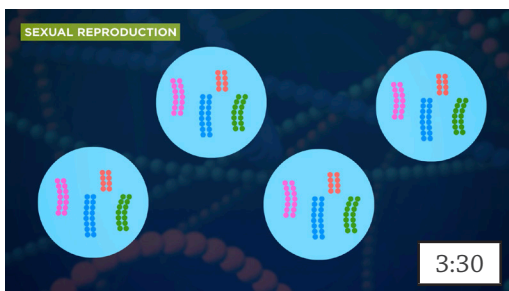
In the **object** sense, these genes are actual things that literally came from the parents' bodies.



Once all that DNA comes together, it's copied...

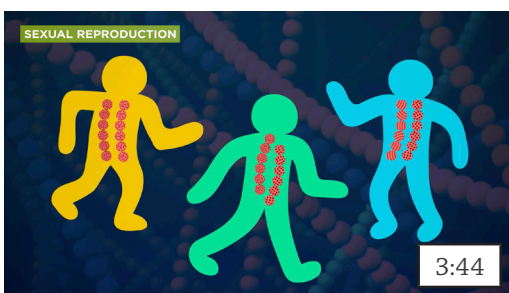


...and split into two cells, ...



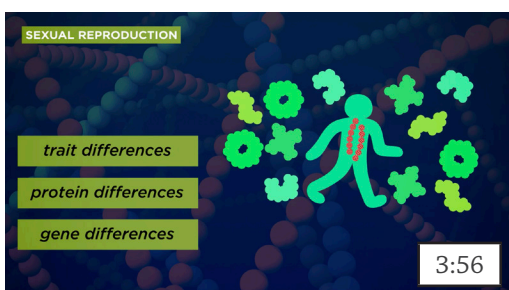
...copied again and split into four, and so on. The genes in each cell are all copies of that original stuff.

In the **information** sense, these genes also help to build traits.



Remember how the two genes in a pair can be different?

The **gene combination** in the offspring [**green**] can also be different from the combination in either parent [**yellow** and **blue**].

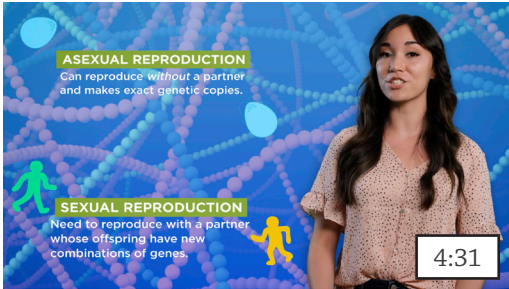


In the information sense, that means the **proteins** they code for can be different, and that can cause **trait differences**.



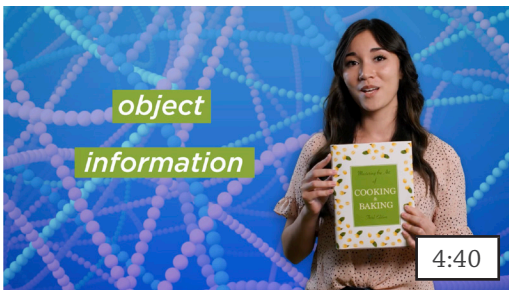
Think of it this way. Half the proteins you make are the same as proteins your biological mom makes. And half are the same as your biological dad's. Since proteins build traits, that's why you share some traits with each parent.

But because all your proteins work together to build your traits, you can have some traits that are different from both parents'.



Of course there are more details that we're not getting into here.

But you can think of **asexual reproduction** as making exact genetic copies, while **sexual reproduction** makes offspring with new combinations of genes from two parents.



And remember, no matter how genes are inherited, they're two things at once. Like this cookbook, they're **physical objects** and **coded information** that cells read to help build traits.

To see the video version, visit <https://learn.genetics.utah.edu/content/change/howgenesareinherited/>