Topic 3.1 DNA, Cells, and Variation

How does DNA help explain why living things are different?

Why Are Living Things Different?



Vocab	What it means
Variation	The presence of differences in characteristics

Easy explanation

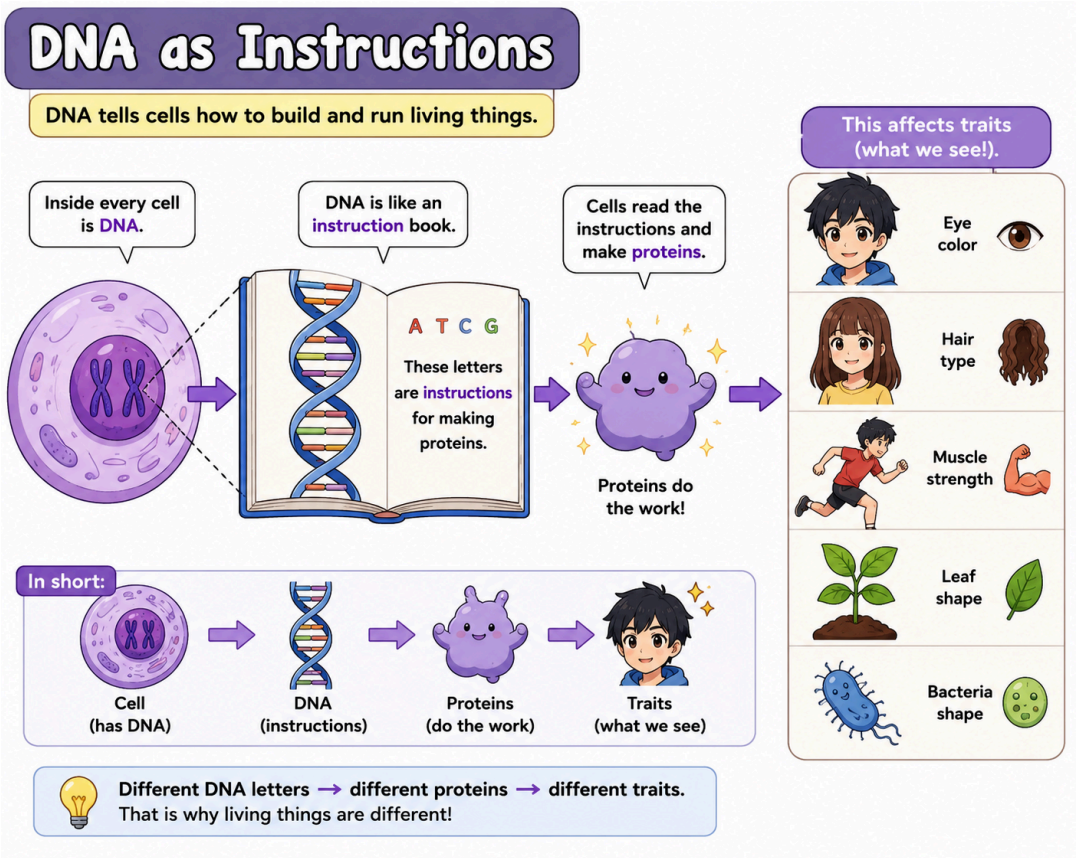
Living things are different.

Some fly.
Some jump.
Some grow leaves.
Some are microscopic(small).

These differences are called **variation**.

Many variations are linked to **DNA**.

DNA as Instructions



DNA as instructions		
DNA is inside every cell	DNA is like an instruction book *A T C G These letters are instructions for making proteins	Cells read the instructions and make proteins (Proteins do the work) → It leads to traits (what we see)

Vocab	What it means
DNA	instruction inside cells
Trait	a feature of a living thing
Variation	differences between living things
Organism	a living thing

Easy explanation

DNA is like an instruction book.

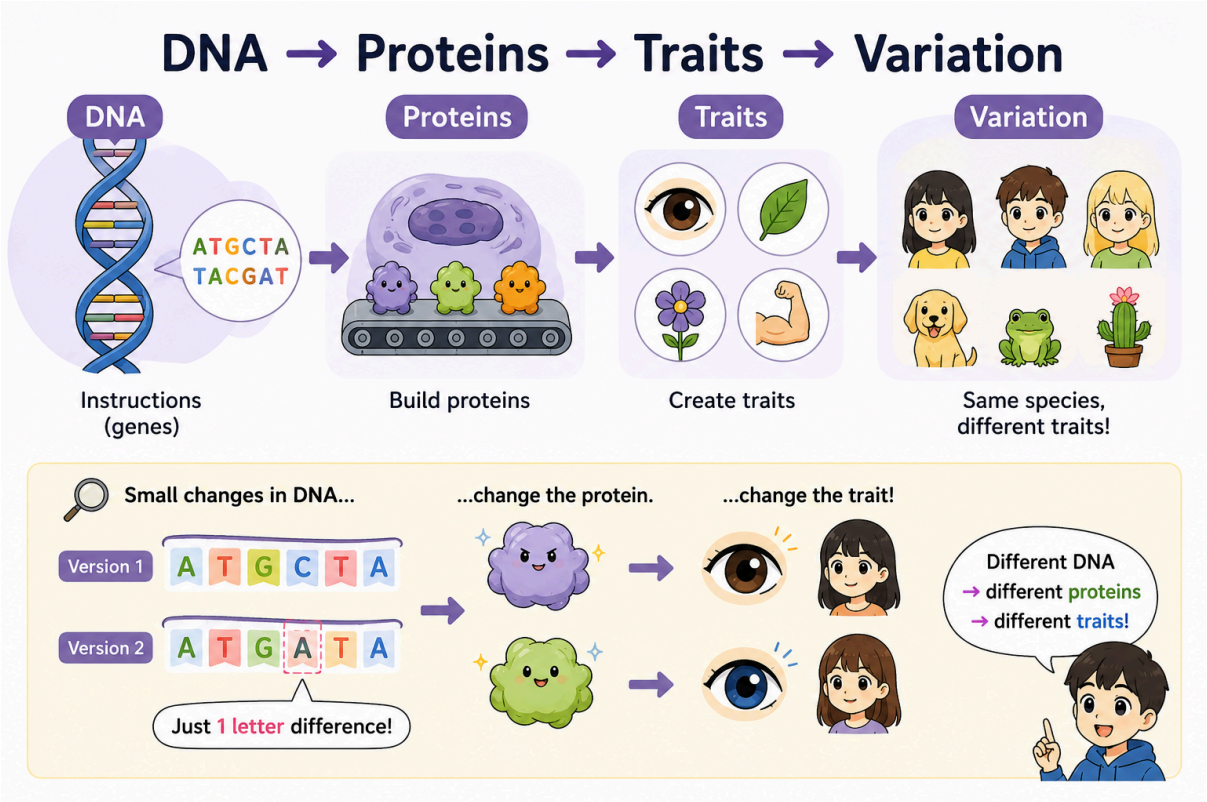
It gives cells information.

Cells use this information to build and run living things.

DNA can affect traits.

*Different DNA letters → Different proteins → Different traits

DNA and Variation



***Change in just one letter (in DNA) can change the trait**

Why? : Different DNA ⟶ Different proteins ⟶ Different traits

Easy explanation

Organisms in the same group can still be different.

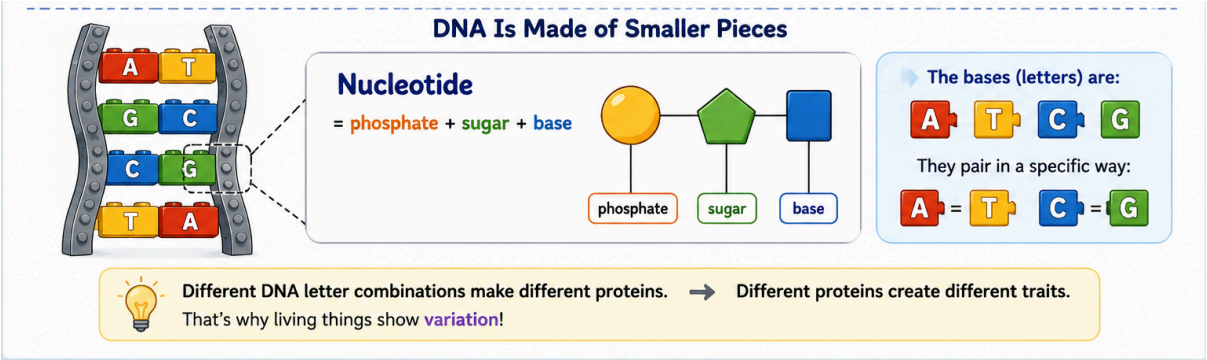
Plants are not all the same.

Animals are not all the same.

Tiny organisms are not all the same.

DNA helps create many of these differences.

DNA Is Made of Smaller Pieces



Easy explanation

DNA is made of small pieces.

Each piece is called a **nucleotide**.

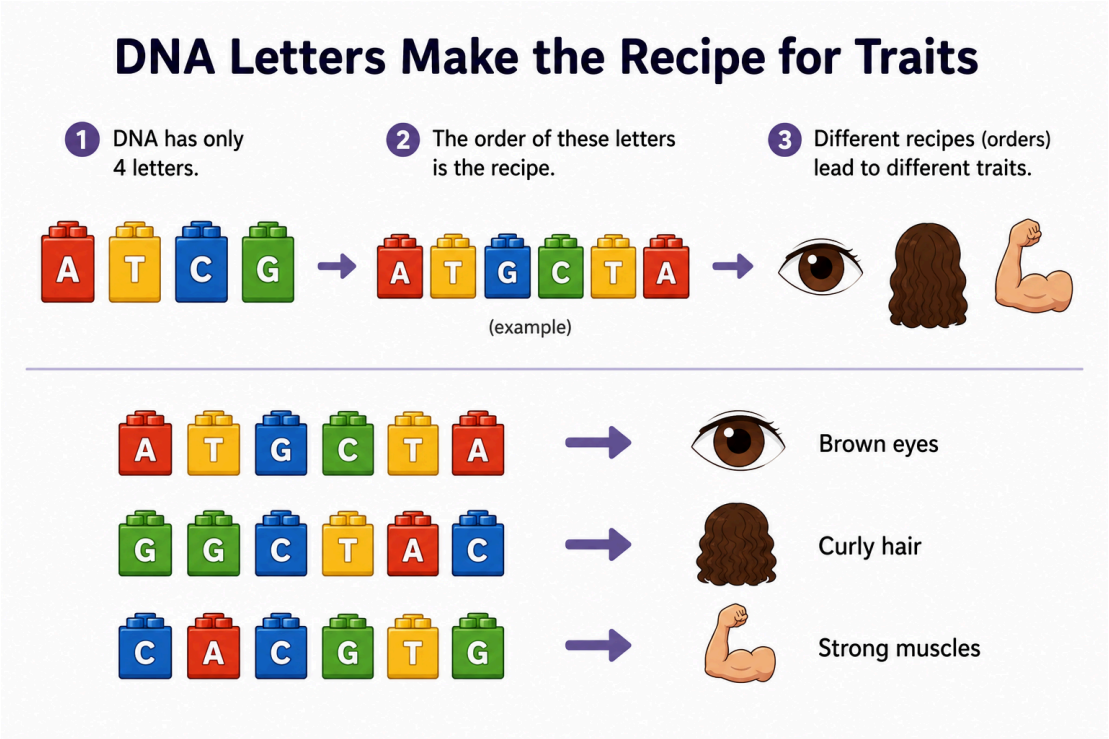
A nucleotide has:

1. phosphate
2. sugar
3. base

The bases are DNA letters.

They are:

A, T, C, G



DNA Letters Make the Recipe for Traits		
DNA has only 4 letters	The order of these letters is the recipe	Different recipes (orders) lead to different traits

Base Pairing



Vocab	What it means
Complementary base pairing	A pairs with T , C pairs with G

Easy explanation

DNA bases pair in a specific way.

A pairs with T.

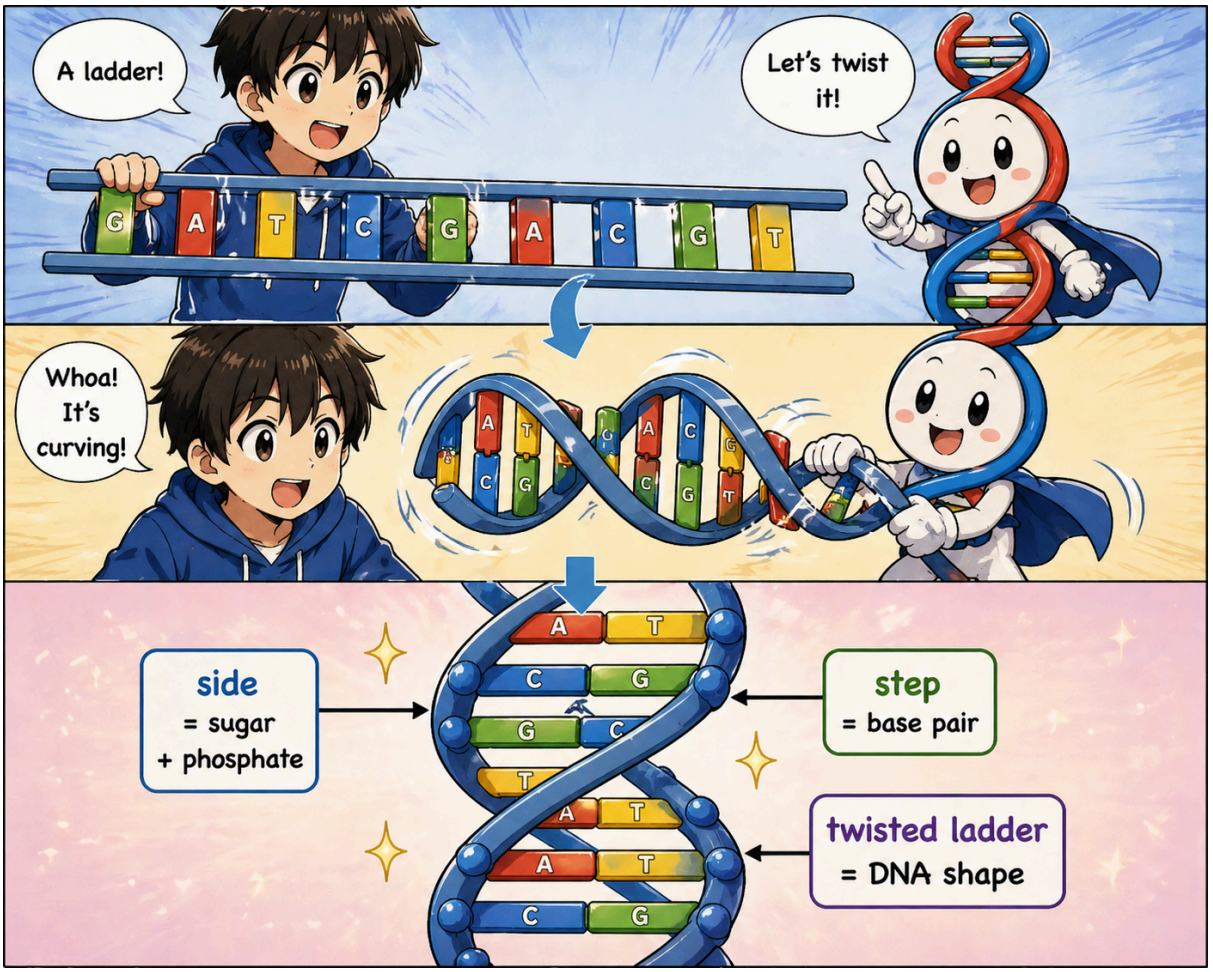
C pairs with G.

This is called **complementary base pairing**.

It is like puzzle pieces.

Only the correct pieces fit.

Twisted Ladder



Easy explanation

DNA has two strands.

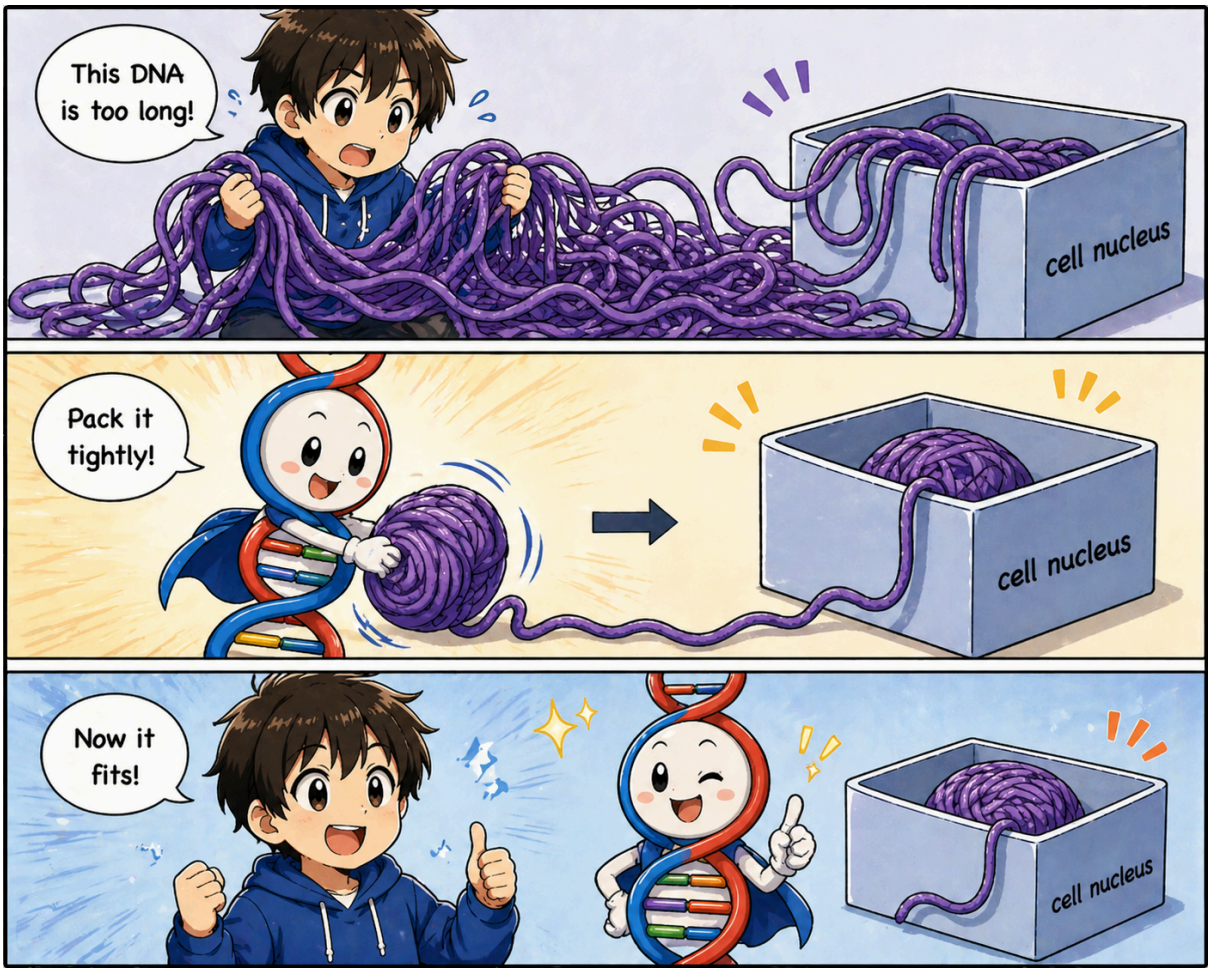
It looks like a twisted ladder.

The sides are made of sugar and phosphate.

The steps are base pairs.

A—T
C—G

How Does Long DNA Fit Inside a Cell?



Vocab	What it means
Chromosome(s)	Packed DNA

Easy explanation

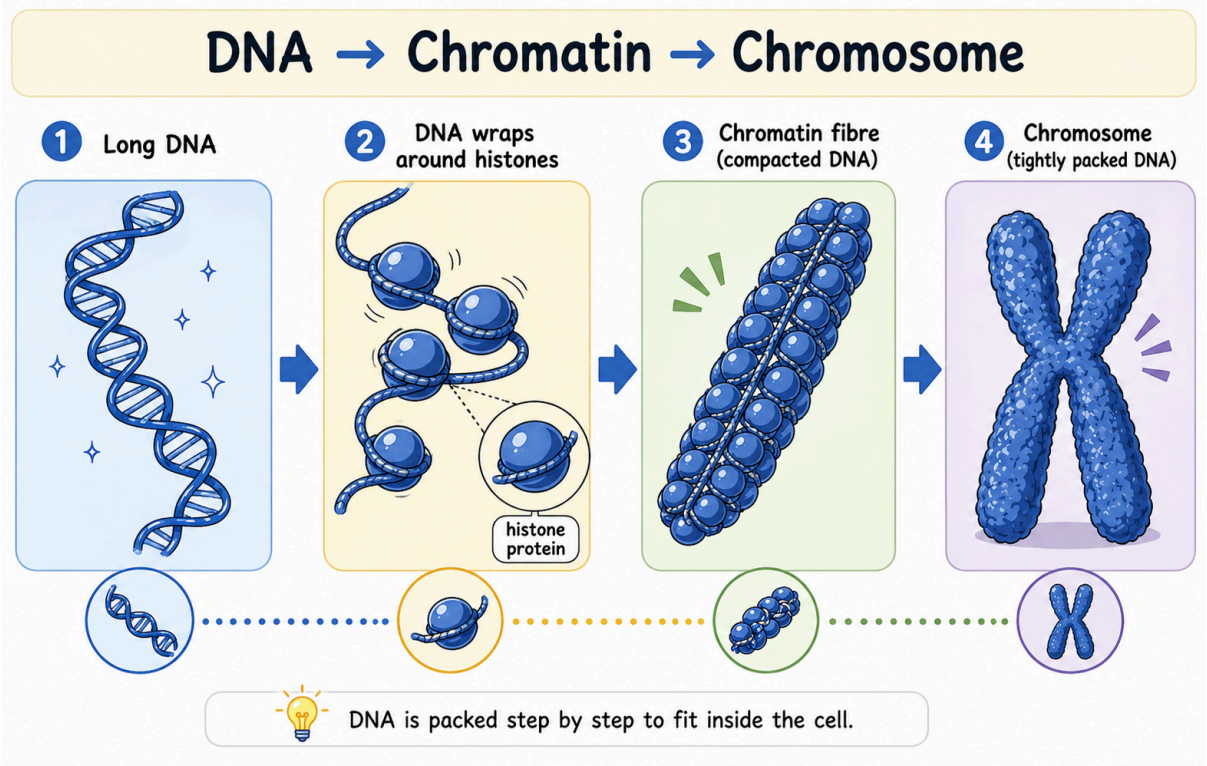
DNA is very long.

Cells are very small.

So DNA must be packed.

Packed DNA forms chromosomes.

DNA → Chromatin → Chromosome



DNA		Chromatin	Chromosome
Long DNA	DNA wraps around histones	Chromatin fibre (Compacted DNA)	Tightly packed DNA
*DNA is packed step by step to fit inside the cell			

Easy explanation

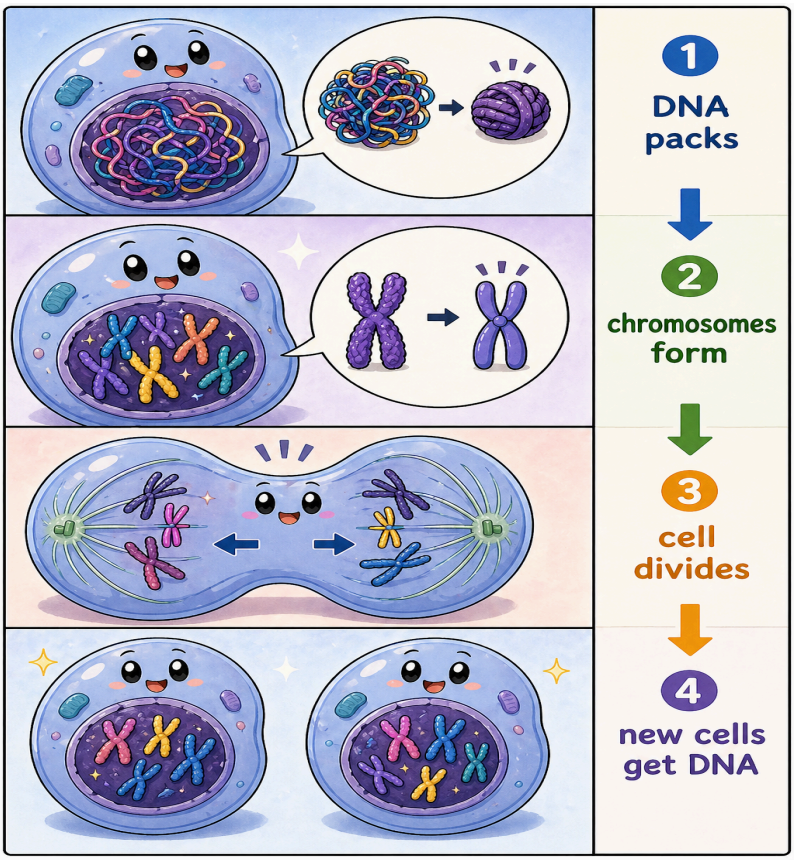
DNA can be loose.

Loose DNA is called **chromatin**.

Before cell division, DNA packs tightly.

Tightly packed DNA is called a **chromosome**.

Chromosomes and Cell Division



Cell Division			
(1) DNA packs	(2) Chromosomes form	(3) Cell divides	(4) New cells get DNA

Easy explanation

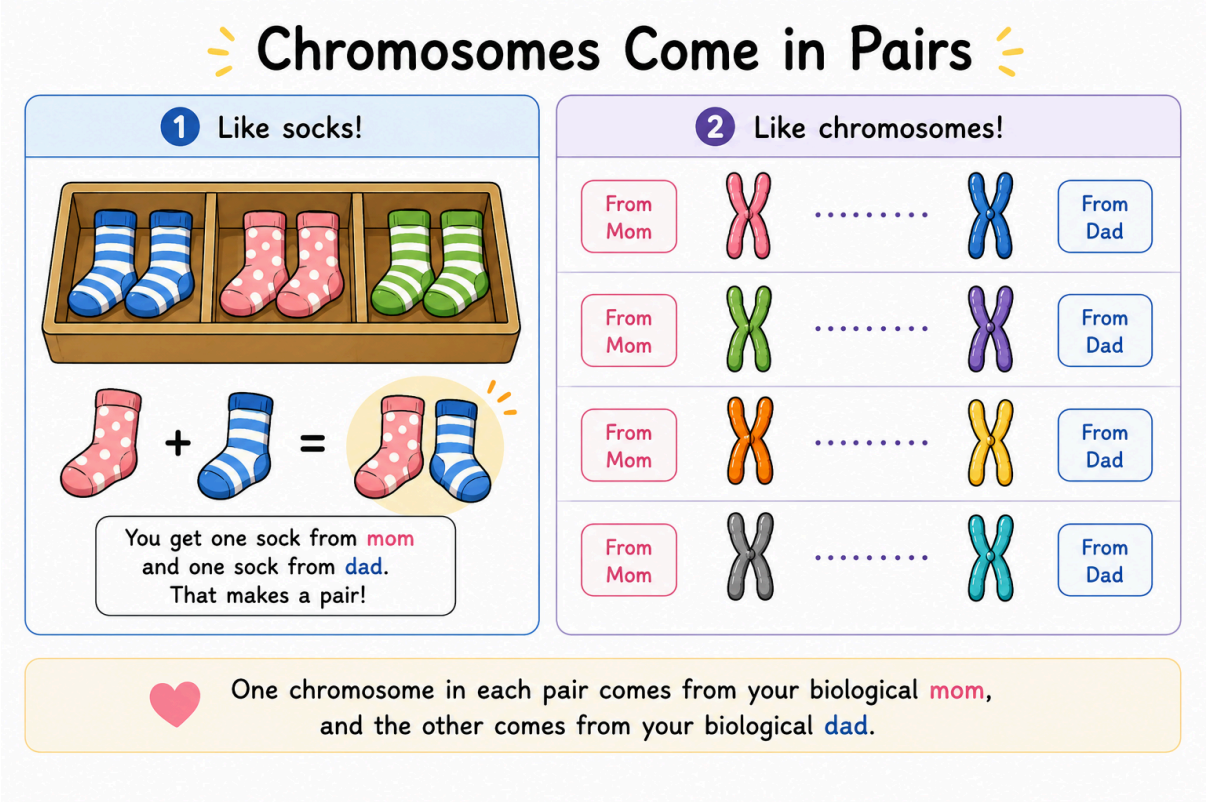
Cells divide to make new cells.

Before cell division, DNA must be organized.

Chromosomes help DNA move correctly into new cells.

This connects to **mitosis** and **meiosis** (later)

Chromosomes Come in Pairs



Easy explanation

Human body cells usually have chromosome pairs.

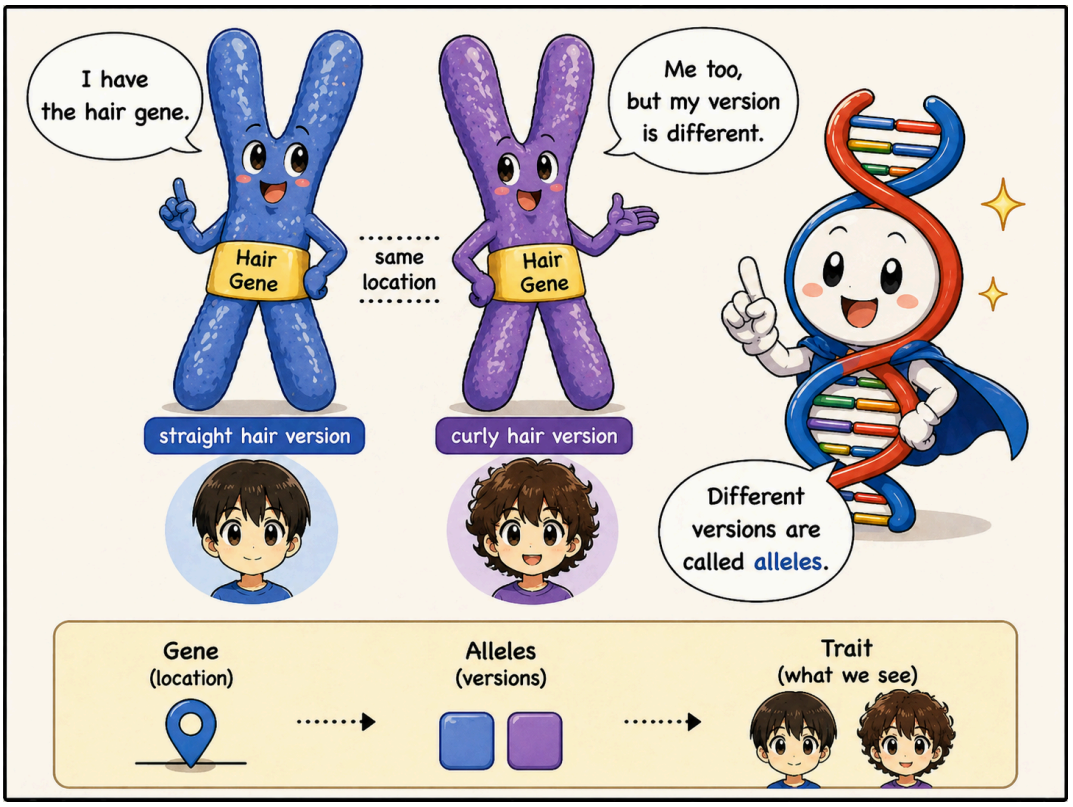
One chromosome in a pair comes from the biological mother.

One chromosome in a pair comes from the biological father.

Pairs help explain inheritance.

Inheritance means traits can pass from parents to offspring.

Genes and Alleles

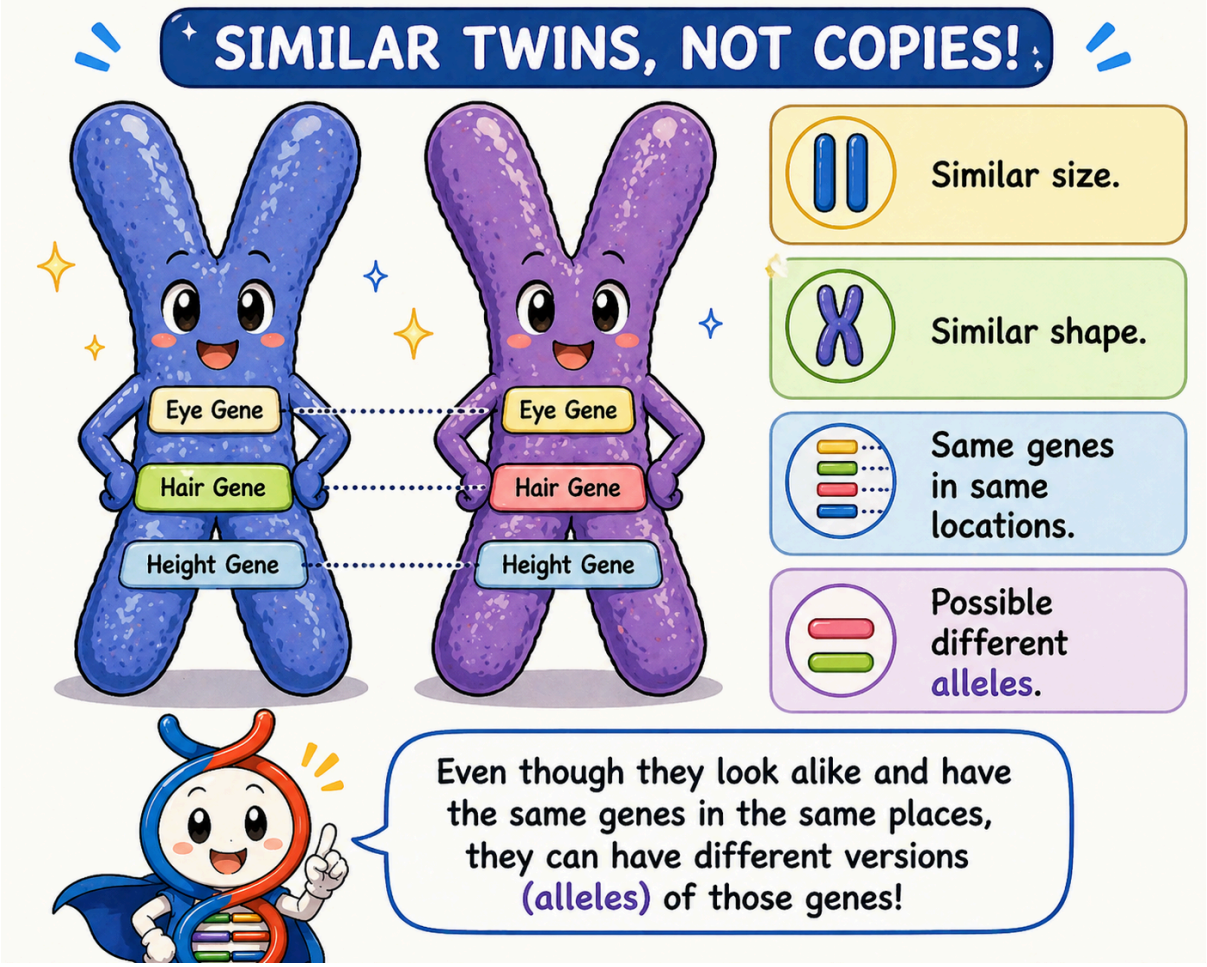


Vocab	What it means
Gene	a section of DNA
Allele	a version of a gene

Example:

Gene: hair type
Allele 1: straight hair
Allele 2: curly hair

Homologous Chromosomes



Short explanation

Homologous chromosomes are a pair.

They are similar.

They have the same genes in the same places.

But they may have different alleles.

So they are not exact copies.

Summary

Short explanation

DNA stores instructions.

Nucleotides build DNA.

Base pairs help DNA keep its order.

DNA packs into chromosomes.

Chromosomes contain genes.

Genes can have different alleles.

This helps explain variation.
