Learning objectives:

• Define the terms 'Gene' and 'Chromosome'

• Identify where chromosomes are found in the body

• Describe the basic structure of a chromosome
Genes

A gene is a unit of inheritance.
Genes

- Genes are made up of DNA
- A gene is a segment of DNA
- Genes act as instructions to make molecules called proteins.
Genes

A gene is one of the programs/codes which construct a living organism and cause it to function.

One of the programs/codes for making feather colour

One of the programs/codes for making head shape
In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases.
There are 3.2 billion base pairs in our genome (all the genes).

The Human Genome Project (1990-2003) has estimated that humans have between 20,000 and 25,000 genes.
Most genes are the same in all people, but a small number of genes (less than 1 percent of the total) are slightly different between people.

These small differences contribute to each person’s unique physical features – **Phenotype**.
Genes

Every person has two copies of each gene, one inherited from each parent.

These are called alleles.

- **Alleles** are forms of the same gene with small differences in their sequence of DNA bases (a bit like non-identical twins) because they come from two different people - your parents.
From genes to proteins to YOU

Genotype
the genetic code, your DNA.

Phenotype
the physical traits, the way you look.
Phenotype and Genotype

**Phenotype** = Appearance or Traits. What it looks like.

**Genotype** = DNA sequence or Genes. The genetic blueprint that carries information about what it looks like.
What is a Chromosome?

- All our genetic information is held within the DNA.

- Genes are sections of DNA that code for specific proteins that are the building blocks of life.

- Genes make chromosomes.
Chromosomes

• Only when cells **divide**, DNA condenses (gets bunched up) and forms **chromosomes**. This is when we can see them under the microscope.

This can happen during:

1. **Mitosis** - two identical cells are formed, used for growth, maintenance and repair of our body.

2. **Meiosis** - to form sex cells (egg and sperm).
Chromosomes

Every cell in the human body, apart from mature red blood cells (these don’t have nuclei or organelles), contains a set of chromosomes in its nucleus.

In human body cells (except gametes - egg and sperm) there are **46 chromosomes arranged in 23 pairs**.
Chromosomes

- Each species have different numbers of chromosomes in their cells. (This includes all living things on Earth - insects, animals, plants etc.)
- Each species has a unique chromosome complement (make up/arrangement) - these vary in size, shape and number.

- Human - 46 chromosomes
- Jumper Jack Ant - 2 chromosomes
- Aquatic Rat - 92 chromosomes
- Pineapple - 50 chromosomes
Chromosome
Genes → Chromosomes → Genome
In humans, of the **23 pairs** of chromosomes = **46 in total**.

- **22 pairs** are called *autosomes* (non-sex chromosomes).
- The 23rd pair are the **sex chromosomes** - these determine the gender of the individual (male or female)

Two chromosome partners = one from mum and one from dad

![Diagram of human chromosomes](image)