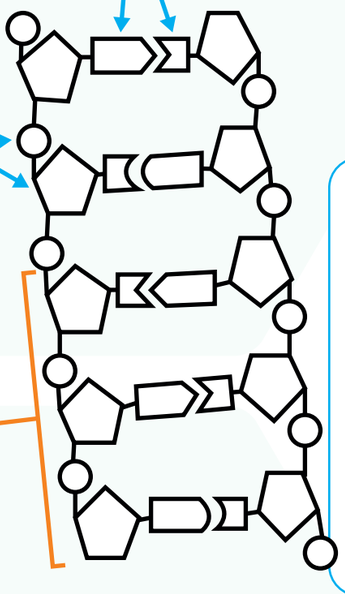
DNA and Inheritance

DNA structure

4 types of base connect the chains. The bases show **complementary** base pairing. **Guanine** (G) only pairs with **Cytosine** (C) and **Adenine** (A) only pairs with **Thymine** (T).

DNA is constructed from **2 long chains** of **alternating sugar and phosphate.**



3 bases form a **triplet code:** In this case TAG.

Diagram key

G C

A T

DNA is a **code**.

Reading down one of the chains the order of bases forms a triplet code. E.g. TAG

The triplet of bases will code for a particular **amino acid**.

Chains of amino acids form **proteins**. This is how DNA codes for the structure of different proteins.

Genetic profiling

A genetic profile can be used to **compare similarities** between DNA samples.

A DNA sample is cut into **short pieces** which are then **separated into bands.**
This technique can be used in:

- criminal cases
- paternity cases
- comparing species for classification purposes.

Another benefit is **identifying genes associated with disease.** However, there are **ethical concerns** with this technology.

Genetic crosses - Genes code for characteristics. Genes can have different versions called **alleles**. These alleles are inherited through **sexual reproduction**, one from each parent so they occur in **pairs**.

Alleles can be represented by letters. This is the **Genotype**. A dominant allele is represented by a capital letter, this allele is shown in the **phenotype** (how the organism looks) whenever present.

We can use the **Punnet square** to the right to estimate the outcome of genetic crosses. In this example the **gametes** (sex cells) are shown at the top and side. The yellow boxes represent the alleles found in the sperm. As each sperm only contains 1 of a pair of alleles it contains either B or b. The green boxes represent the alleles in the egg cell, either B or b.

	B	b
B	BB	Bb
b	Bb	bb

These parents were **heterozygous**. This means that they have 2 different alleles of the same gene.

The **recessive** allele is represented by a lower-case letter. This allele must be in a **homozygous** pair (both alleles are the same i.e. bb) to be shown in the phenotype.

The punnet square shows us that:

1. 3:1 ratio of dominant to recessives traits shown in the phenotype of the offspring in this cross.
2. 1:2:1 ratio of homozygous dominant to heterozygous to homozygous recessive genotypes in this cross.

Genetic modification

Genetic modification allows genetic material from one organism to be transferred into the DNA of another organism.

Advantages: Genes for **disease resistance** can be transferred to crop plants to **increase yield.**

Herbicide resistant genes can also increase yield as herbicides can be used to kill competing plants (weeds).

Disadvantages: Creation of super weeds if the herbicide resistance genes are taken up by weed species.

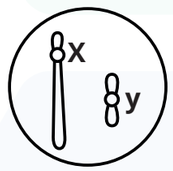
Unknown long-term effects of modifying genomes.

Unknown health effects of eating modified organisms.

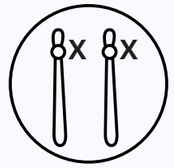
Sex determination

Sex is determined in humans by chromosome **pair 23.** These chromosomes are labelled as:

Male XY



Female XX



The inheritance of these chromosomes can be shown using a Punnet square.

This shows that in each fertilisation there is a **50%** chance the offspring will be male or female.

	X	X
X	XX	XX
Y	XY	XY