

DNA and the genome

Revision notes · Describe the structure of DNA, define the genome and a gene, and explain how DNA is extracted from fruit.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

DNA and the genome Spec 3.4-3.6

The structure of DNA Spec 3.4

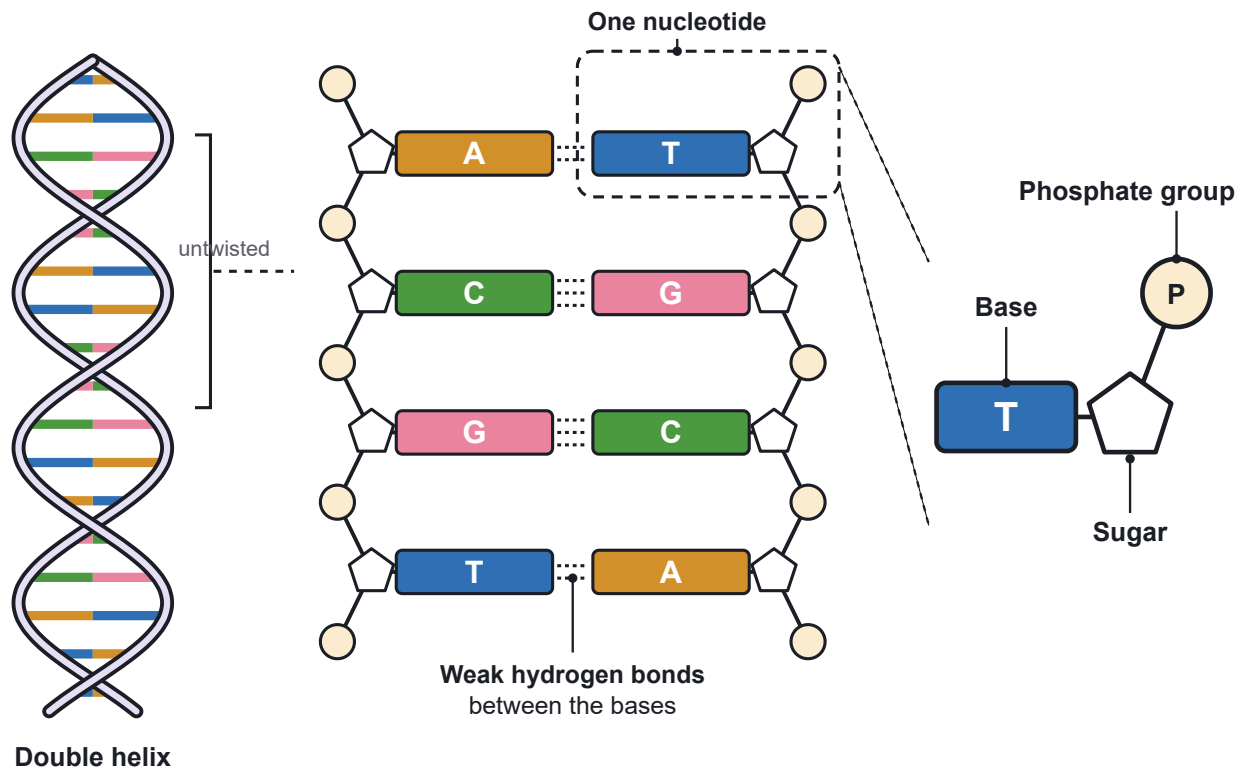
DNA is a **polymer** made up of many repeating units called **nucleotides**. A polymer is a long molecule made of many similar smaller units joined together.

- DNA is made of two strands coiled to form a **double helix**.
- Each nucleotide consists of a sugar and a phosphate group, with one of four different bases attached to the sugar.
- The two strands are linked by a series of **complementary base pairs**, joined together by **weak hydrogen bonds**.

The four bases and how they pair

Base	Pairs with
Adenine (A)	Thymine (T)
Thymine (T)	Adenine (A)
Cytosine (C)	Guanine (G)
Guanine (G)	Cytosine (C)

Because A always pairs with T and C always pairs with G, the base sequence on one strand tells you the sequence on the other. If one strand reads A T G C, the complementary strand reads T A C G.



Complementary base pairs: A with T, C with G

DNA is a double helix of nucleotides; the bases pair **A with T** and **C with G**, held by weak hydrogen bonds.

Common mistake: The bonds between the two strands are weak hydrogen bonds. They are between the bases, not between the sugar and phosphate groups.

The genome and genes Spec 3.5

Genome	The entire DNA of an organism.
Gene	A section of a DNA molecule that codes for a specific protein.

The genome includes all of the genes of an organism. A gene is a short section of the DNA. Each gene has a different sequence of bases and so codes for a different protein.

Exam tip: Use the exact wording. A gene codes for a specific protein, and the genome is the entire DNA, not just the genes.

Extracting DNA from fruit Spec 3.6

DNA can be extracted from the cells of fruit such as strawberries or kiwi fruit using simple equipment. Each step has a purpose.

1. Mash the fruit in a beaker. This breaks the fruit into small pieces and separates the cells.
2. Add a mixture of detergent and salt, and stir. The detergent breaks down the cell membranes (and the nuclear membranes) so the DNA is released. The salt helps the DNA to clump together.
3. Filter the mixture. This removes the solid pieces of cell, and the filtrate contains the DNA.
4. Carefully add ice-cold ethanol so that it forms a layer on top of the filtrate.
5. Look at the boundary between the layers. DNA is not soluble in cold ethanol, so it comes out of solution as white, stringy strands. These can be lifted out with a glass rod.

Exam tip: In a 'why' question, give the purpose of each reagent: detergent breaks down membranes, salt helps the DNA clump together, and ice-cold ethanol makes the DNA come out of solution (precipitate) so it can be seen.

Common mistake: Do not say that you can see the double helix. You see a mass of thousands of DNA strands clumped together.

Quick check

1. What are the two strands of DNA coiled into?
2. Which bases pair together in DNA?
3. What is a gene?
4. What is the purpose of the detergent when extracting DNA from fruit?

Quick check answers

DNA and the genome

1. A double helix.
2. A with T, and C with G.
3. A section of a DNA molecule that codes for a specific protein.
4. It breaks down the cell membranes to release the DNA.