

DNA Notes

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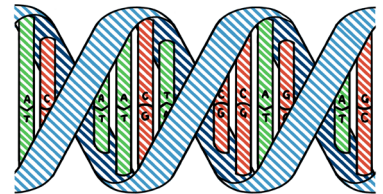
DNA is short for **deoxyribonucleic acid**.

Exam note - they often check for the correct spelling of deoxyribonucleic acid so that's definitely one to learn 😊

The Structure of DNA

What is the structure of DNA called? The double helix.

Who discovered the double helix of DNA? Dr James Watson and Dr Francis Crick determined the structure of DNA in 1953. For their work, both scientists received a Nobel Prize in 1962.



The DNA double helix

Were other scientists involved? Yes. Rosalind Franklin and Maurice Wilkins, neither received credit for their work at the time.

Exam note – the names of the scientists involved usually comes up as a multiple-choice question.

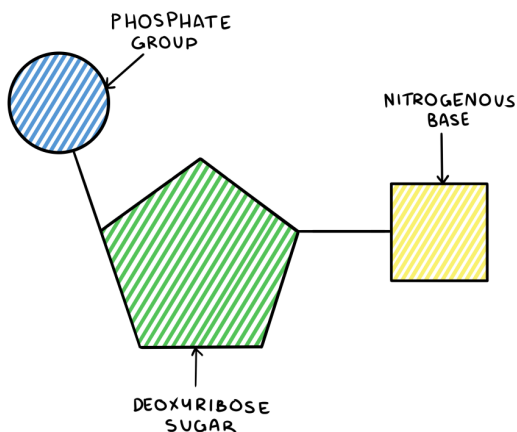
The Nucleotide and DNA bases

DNA is made up of many smaller units called nucleotides. The nucleotide is the smallest bit of DNA that is still a bit of DNA. Any smaller and it's not a bit of DNA anymore.

Each nucleotide has a nitrogenous base, a deoxyribose sugar and a phosphate group. The phosphate group and the deoxyribose sugar are constant and are in every single nucleotide. The base can be different, they can be one of four different bases. The figure below shows a DNA nucleotide.

There are **four** DNA bases:

1. Adenine – A
2. Thymine – T
3. Cytosine – C
4. Guanine – G



A DNA nucleotide

Which base bonds to which and with what type of bond?

Adenine bonds to Thymine with two hydrogen bonds.

A=T

Cytosine bonds to Guanine with a three hydrogen bonds.

C≡G

Adenine bonding to Thymine, and Cytosine bonding to Guanine is called complementary base bonding or complimentary base pairing. As the shapes must be complimentary (the same shape or similar) to bond.

Exam hint: say A to T and C to G over and over again help remember the bonding rule. Just keep saying it over and over again until it sticks, we hope it helps 😊

DNA is a **polymer** (a natural polymer not a man-made polymer like plastic) because it is made of lots of nucleotides joined together.

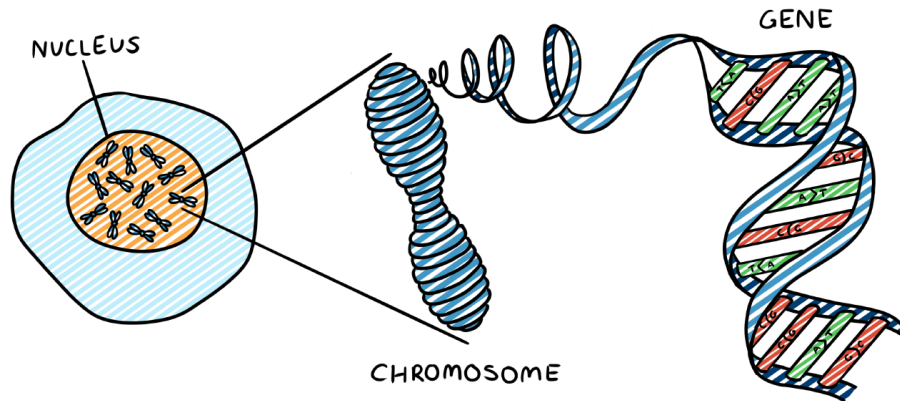
The Genome

The genome: the entire genetic material of an organism.

A gene: a short section of DNA that codes for the production of a particular protein.

The figure below shows one gene which is a small part of a chromosome and the chromosome being but one of many that can be found in the nucleus of a cell. I often think that DNA is like a cook book 😊

The DNA in the nucleus represents the whole cook book. In the book there are individual chapters (chromosomes) and in each chapter there are individual pages with instructions/recipes (genes). I hope that helps 😊



How to extract DNA from fruit

Note: when doing this practical the most common fruit used is Kiwi fruit. But most fruits will work perfectly fine. It could be done successfully with a strawberry so... whatever is to hand 😊 (Also pop some ethanol into the freezer a few hours before the practical).

Method:

1. Peel the skin from half a kiwi fruit and **crush** it up.
2. Mix a teaspoon of salt and **small volume of washing up liquid** into the fruit.
3. Gently heat this mixture at about 60°C for five minutes.
4. Filter the mixture and retain only the filtrate (the filtered liquid).
5. Gently pour **chilled/ice cold ethanol** onto the top of the filtrate. This will float on top of the filtrate.
You will see white strands of DNA in between the filtrate and the ice cold ethanol. It can be collected, use a wire loop if you are collecting it.

Exam note: we could be asked why we have done certain steps in the method above.

Here are ideal answers to the most commonly asked steps.

Q. Why do we crush the fruit?

This is done **to break the cell walls**. Remember the DNA is inside the cell, so we need to break open the wall to get in.

Q. Why do we add washing up liquid and heat the mixture?

This is done to break up the cell membrane and the nucleus so that the DNA is now free in solution. The heat helps the washing up liquid break up the membranes more quickly.

Q. Why do we add cold ethanol to the filtrate?

This will cause the DNA to precipitate (come out of solution) because DNA is insoluble in cold ethanol.