

DNA Notes

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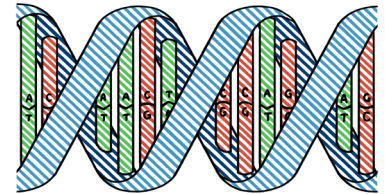
DNA is short for **deoxyribonucleic acid**.

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.

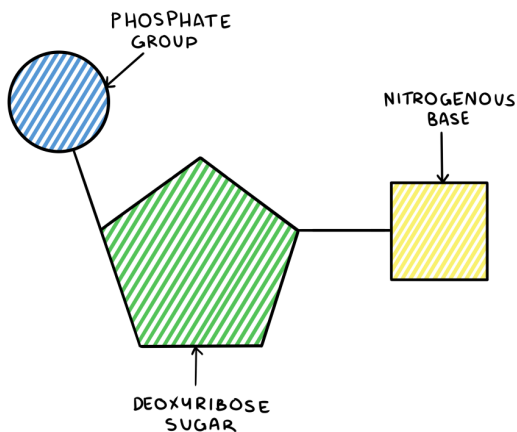


The DNA double helix

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.



A DNA nucleotide

There are **four** DNA bases:

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

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.

$C\equiv G$

Adenine bonding to Thymine, and Cytosine bonding to Guanine is called complementary base bonding or complementary base pairing. As the shapes must be complementary (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.

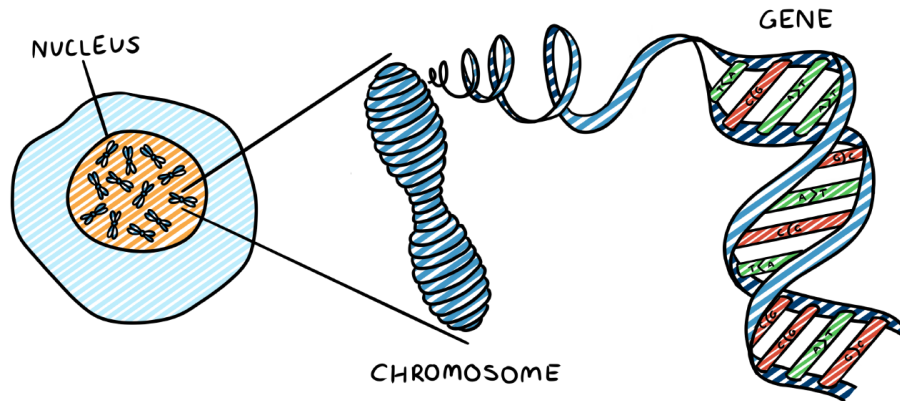
The Genome

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 😊



The Human Genome Project

The entire human genome has now been studied and fully mapped out by scientists. This massive, international effort was known as the Human Genome Project. **But why did scientists spend so much time and money doing this?**

Understanding the human genome is incredibly important for three main reasons:

1. **Searching for genes linked to different types of disease** – by studying the genome, scientists can identify specific genes that increase the risk of certain diseases (such as breast cancer or Alzheimer's). This helps doctors predict who is at risk and allows for earlier diagnosis and better prevention.
2. **Understanding and treating inherited disorders** – inherited disorders (like cystic fibrosis) are caused by faulty alleles. By mapping the genome, we can now quickly identify these faulty genes in patients. This helps us understand exactly how the disorders work and brings us closer to developing highly targeted medicines or even new gene therapies to treat them.
3. **Tracing human migration patterns from the past** – the human genome is mostly identical across all people, but tiny differences arise when populations separate and migrate. By studying these tiny genetic differences in people all over the world, scientists can accurately trace how early humans migrated out of Africa and populated the entire planet!