# DNA for the classroom:

**DNA stands for Deoxy-ribose Nuclei Acid**

**The structure of DNA**

Each DNA strand is made up of a chain of subunits called nucleotides. Nucleotides are themselves made up of three molecules:

- A 5 carbon sugar
- A phosphate group
- A base

Although the sugar and phosphate groups are the same on each nucleotide they can have one of four different bases:

- Adenine
- Thymine
- Cytosine
- Guanine

Nucleotides bond together in a long chain to make up a single strand of DNA. This chain has a sugar/phosphate 'backbone' where the sugar group on each nucleotide has bonded to the phosphate group on the one before. The bases stick out from this backbone.

The DNA found in all living things is in the form of a double helix. This describes the spiral shape formed when two anti parallel (running in different directions) strands of DNA bond together. The bases from each strand form hydrogen bonds with each other and hold the strands together like rungs on a ladder. The order of the bases along a DNA strand makes up the genetic code.

**Base pairing**

Each base will only pair/bond with its partner. Adenine will only bond with Thymine and Cytosine will only bond with Guanine. This is important as it allows a double stranded bit of DNA to be copied exactly. An original strand of DNA can act as a template for a new strand and the information contained on the strand is conserved.

**Copying DNA**

A new DNA strand can be copied from a template DNA strand, this is called DNA replication. Or a RNA strand can be 'copied' from the same template this is called DNA transcription.

RNA stands for Ribose Nucleic acid. It is very similar to DNA but has a slightly different chemical structure and in place of the base thymine it uses a base called uracil. It is more easily damaged than DNA.

**The genetic code**

The genetic code is divided into genes. A gene is a section of DNA that codes for a particular product.

Most genes code for proteins; first they are transcribed into messenger RNA then this RNA is translated into amino acids, which joined together form a poly peptide chain. This chain then folds up to become a functional protein.

In some cases, however, the RNA transcribed from the DNA is the product itself and has a role other than that of messenger.

**Making a protein/translating RNA**
The order of the bases along the RNA strand is read in groups of three called codons. There are 64 possible codons (64 possible 3 base combinations of four different bases). Each codon codes for a particular amino acid. For example, GCC codes for the amino acid alanine. As there are more possible codons (64) than amino acids used in protein synthesis (20), many codons code for the same amino acid. For example GCC, GCA and GCG all code for alanine. There are other codons, which don't correspond to a particular amino acid. For example, Start and Stop codons define where the coding section begins and ends.

RNA translation occurs at a ribosome, which 'reads' the RNA code from the Start codon to the Stop codon. For each codon that it 'reads' it adds the appropriate amino acid to a steadily growing poly-peptide chain.

The order of amino acids in this poly-peptide chain affects how the chain folds itself up and the ultimate three dimensional shape of the protein it creates. In turn the composition of and shape of the protein determine it's use.

**The role of proteins**
Proteins have two very important roles in the body:

- Structural: Proteins form the structure supporting cells and make up the majority of our dry mass including the basis of our muscles, hair, and nails. The properties different structural proteins have depends on there chemical structure and hence their shape.
- Chemical: There are also proteins called enzymes that catalyse chemical reactions, or to put it another way, help them to occur. The specific chemical composition and shape of an enzyme determines what reaction it will catalyse.