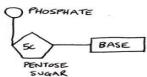


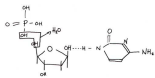
Nucleic Acids

Remember: Phosphate, Base, Pentose Sugar!

Nucleic acids such as DNA or RNA are made up from nucleotides. These nucleotides are made of three parts, a phosphate (or phosphoric acid H_3PO_4), organic base and a pentose sugar. The Phosphate part of a nucleic acid has the same regular structure for any nucleic acid. The organic base can be one of five different bases. The pyrimidine bases are thymine, cytosine and uracil. The Purine bases are adenine and guanine. There are also two different types of pentose sugar which differ between DNA and RNA, the pentose sugar in DNA is deoxyribose and in RNA it is ribose. Shown below is a simplified diagram of a nucleotide.



And again below this is a full diagram of a nucleotide. You can see the separate parts, the phosphate molecule which is linked with the pentose sugar by a condensation reaction. You can also see the hydrogen bond between the pentose sugar and the organic base.



Deoxyribonucleic Acid (DNA)

- DNA is a double stranded polymer in the form of a double helix.
- It may be made up from millions of nucleotides.
- Pentose Sugar: deoxyribose
- Choice of four organic bases, adenine, guanine, cytosine and thymine. They pair up, cytosine with guanine and adenine with thymine.
- DNA has two main functions, replication when the cell divides and to carry information during protein synthesis.

Ribonucleic Acid (RNA)

- RNA is a different to DNA in the fact that it's single stranded polymer rather than a helix.
- Pentose Sugar: Ribose
- Choice of four organic bases, adenine, guanine, cytosine and uracil (mainpoint: not thymine). They also pair up, cytosine with guanine and adenine with uracil.
- Three types of RNA, ribosomal (rRNA), transfer (tRNA) and messenger (mRNA).

DNA Replication

When cells divide the daughter cell must receive an exact copy of the genetic material from the parent.

1. DNA replicates by unwinding into separate strands with help from DNA polymerase which adds free nucleotides to the exposed bases.
2. Each chain acts as a template for free nucleotides so that they can be joined to their complementary bases.
3. The result is that there are two DNA molecules, each with one new synthesised strand of DNA and one strand from the original.

An example of this would be with the bacteria *Escherichia coli* and with different isotopes of Nitrogen. The bacteria was exposed to N_{15} for several generations until it was exposed to a lighter N_{14} . Scientists could then distinguish between the different DNA densities by centrifuging them.

Protein synthesis

Protein synthesis can be split up into five main stages:

1. The DNA helix unzips itself and RNA polymerase makes an exact copy of the DNA strand in the form of mRNA. This process is called transcription.
2. The mRNA moves out of the nucleus via a nuclear pore and goes to a ribosome. A codon is made up from three organic bases and these are what code for specific amino acids.
3. The mRNA lines up on a ribosome, which has two tRNA binding sites, one binding site is for a tRNA to bind with the polypeptide being formed, the other binding site is for a tRNA and new amino acids.
4. Each codon is read in turn and a chain of amino acids is formed with peptide bonds (via a condensation reaction).
5. Once the last codon (stop codon) is reached then the protein is formed.