

DNA and RNA

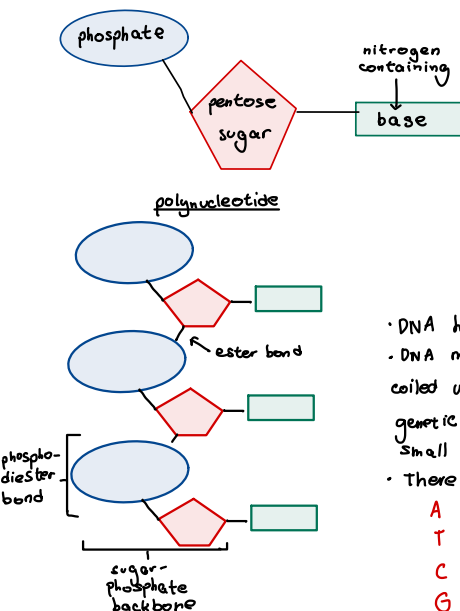
What are DNA and RNA?

- DNA (**deoxyribonucleic acid**) is used to store your genetic information - the **instructions** needed to grow and develop from a fertilised egg to a fully grown adult
- RNA (**ribonucleic acid**) is used to transfer genetic information from the DNA (in the nucleus) to the ribosomes.
- In ribosomes, **proteins are made**: they read the RNA to make proteins (polypeptides) in a process called **translation**.

DNA and RNA are polymers of nucleotides

- A nucleotide is made up of a pentose sugar (sugar with 5 carbon atoms), a nitrogen-containing organic (contains carbon) base, and a phosphate group.

DNA

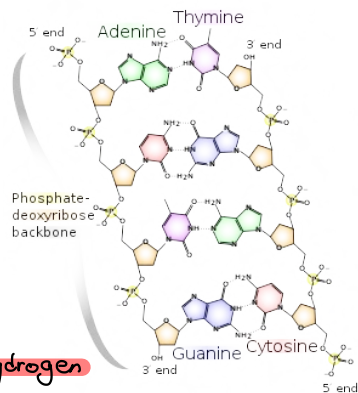


What is the structure of polynucleotide?

- Nucleotides join together to form **polynucleotide** strands
- Nucleotides join up via a **condensation reaction** between the phosphate group of one nucleotide and the sugar of another.
- A **phosphodiester bond** consists of the phosphate group and two ester bonds.
- The side of the DNA double helix forms a **sugar-phosphate backbone**.

- DNA has a **double-helix** structure.
- DNA molecules are really long and are coiled up very tightly, so a lot of genetic information can fit into a small space in the cell nucleus.
- There are 4 possible bases:

A - adenine
T - thymine
C - cytosine
G - guanine

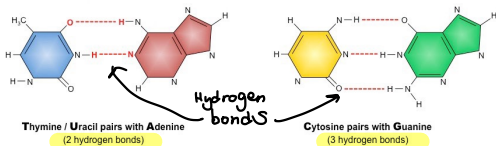


Complementary base pairing

- In DNA, the two polynucleotide strands are held together by **hydrogen bonds** between two bases.

- **Adenine** always pairs with **thymine**. (A=T)
- **Guanine** always pairs with **cytosine**. (C≡G)

Acronym: Apple Turns Google Crazy



- The two polynucleotide strands are **antiparallel** - they run in opposite directions.
- Due to base pairing: A% = T%, C% = G%
- Usually, **cytosine** makes up 30%; **guanine** makes up 30%, **adenine** makes up 20% and **thymine** makes up 20%.

RNA

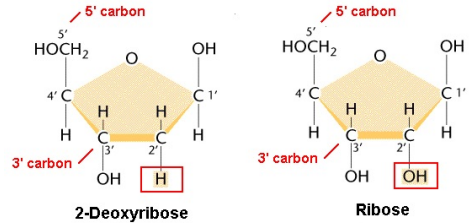
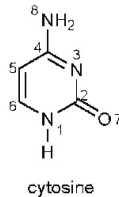
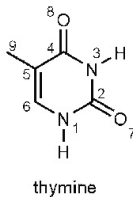
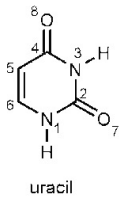
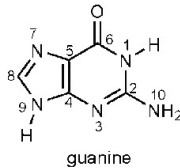
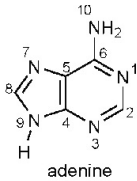
- RNA acts as a **messenger molecule** - it helps transfer information from DNA to ribosomes to make proteins and to other proteins. ← only mRNA
- Like DNA, RNA is also a **polynucleotide** - it is a polymer made up of nucleotide monomers.

What is the difference in structure between DNA and RNA?

- Unlike DNA, RNA is composed of only one polynucleotide chain - it is single stranded.
- RNA strands are much **shorter** than most DNA polynucleotides.
- The pentose sugar in RNA nucleotides is a **ribose** sugar (not deoxyribose).
- The nitrogen-containing organic bases are guanine (G), adenine (A), cytosine (C) and **uracil (U)**. Uracil replaces thymine.
- Uracil always pairs with adenine in RNA.

Purine vs Pyrimidine bases

- Guanine and adenine are **purine bases** (two-carbon rings) (large ones).
- Cytosine and uracil (thymine in DNA) are **pyrimidine bases** (one-carbon ring).



Who discovered DNA?

- **James Watson** and **Francis Crick** discovered the structure of DNA and their model of the DNA double helix.

Doubts of DNA Discovery

- DNA is first observed in 1800, but lots of scientists doubted it could carry genetic code due to its **simple chemistry composition**.
- Some argued that genetic information must be carried by **proteins**, which are more chemically varied.