DNA
- deoxyribonucleic acid
- store genetic material
- code for all genes
- double helix
  - Watson & Crick
- made up of nucleotides

1. Phosphate group
2. Sugar
3. Nitrogen-base
   - adenine
   - thymine
   - cytosine
   - guanine

Chargaff: 
A = T 
C = G

Base Pairing Rules

Purines
- adenine & guanine
- contain 2 rings

Pyrimidines
- cytosine & thymine
- contain 1 ring

"backbone" sides made up of:
- phosphate
- sugar

"rungs" made up of: bases
held together by hydrogen bonds
DNA Replication

- Copying one strand of DNA to get 2 identical strands

Helicase:
- Unzips the DNA
- Breaks the hydrogen bonds

DNA Polymerase:
- Adds new bases to each strand
- Takes place in the NUCLEUS

RNA
- Ribonucleic acid
- Contains the sugar ribose
- Single stranded
- Contains uracil but no thymine
  \[ A = \text{\underline{T}} \text{ or } \underline{U} \]
3 Types of RNA

1. Messenger RNA (mRNA)  
   - Carry genetic info from nucleus to the ribosomes

2. Ribosomal RNA (rRNA)  
   - Makes up ribosomes

3. Transfer RNA (tRNA)  
   - Move amino acids to the ribosome depending on the mRNA code

[Transcription]

- Synthesis of mRNA using a DNA strand as a template
- Occurs inside the nucleus
  1. DNA unzips (helicase)
  2. One DNA strand acts as a template for RNA
  3. RNA polymerase will attach new nucleotides to make a new strand (mRNA)
  4. mRNA is released and leaves the nucleus
Translation | Protein Synthesis

- Use mRNA code to make a protein or polypeptide chain
- This chain is made up of amino acids
- Order of amino acids is determined by the mRNA nucleotide sequence

Every 3 nucleotides (codon) is specific for a certain amino acid

\[ \text{ACU, GCA, GGA, CGU} \]

1. mRNA codons match up to a specific tRNA anti-codon
2. This continues down the strand
3. Amino acids (that are brought by tRNA) link together
4. New polypeptide chain is released
Start codon is always AUG methionine

3 stop codons

tRNA molecules: Amino Acid
    anti-codon

20 amino acids
64 codons
Gene mutation
Change in DNA sequence
that could result in a
change in gene expression
Point mutations:

1. Substitution: the wrong nucleotide is paired

ATG
UAA

2. Insertion: extra nucleotide is added

ATG
UCAC

3. Deletion: nucleotide is removed

Result in major changes!

ATG
UC

Mutations are beneficial in many organism cases!