# 2.5.5 + 2.5.15.H Protein Synthesis

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## Protein synthesis essentials

1. A supply of amino acids – cytoplasm
2. Instructions as how to join the amino acids together – genetic code
3. An assembly line – ribosomes
4. A messenger to carry information from DNA to ribosomes

DNA has a code that determines the order of amino acids in a protein.

The code is made up of groups of three bases.

Each group codes for a specific amino acid which will be placed in that specific position.

There are more codes than amino acids => some amino acids have more than one code e.g. GCA and GGG code for the same amino acid.

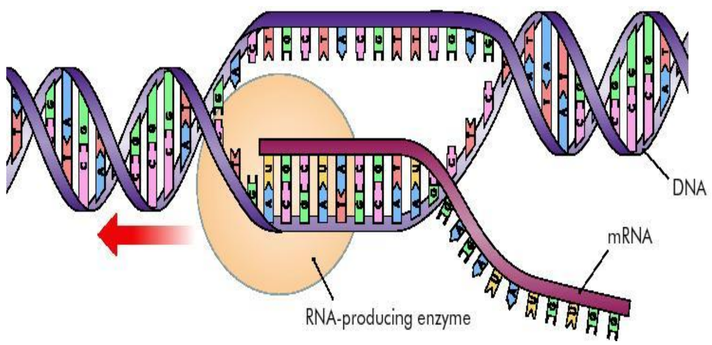
## Protein synthesis – how it works

### 1. Transcription

The piece of DNA which codes for a protein is rewritten – ***transcribed*** into a new molecule called messenger RNA (mRNA). This takes places in the nucleus of the cell.

DNA uncoils and unzips.

The exposed DNA bases are matched up with RNA bases in the nucleus to form mRNA.




The RNA leaves the nucleus and travels into the cytoplasm and attaches to a ribosome.

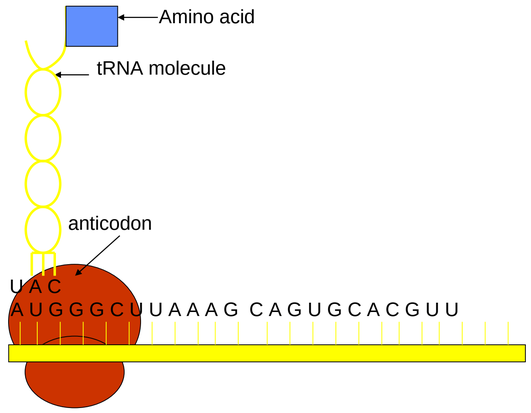
### 2. Translation

At the ribosome the message is ***translated.*** The strand of mRNA is pulled across the ribosome three bases at a time, in triplets.

Each of these triplets on the mRNA strand is called a codon.

A transfer RNA molecule (tRNA) brings an amino acid to the first three bases (codon) on the mRNA.

The three unpaired bases (anticodon) on the tRNA link up with the codon.

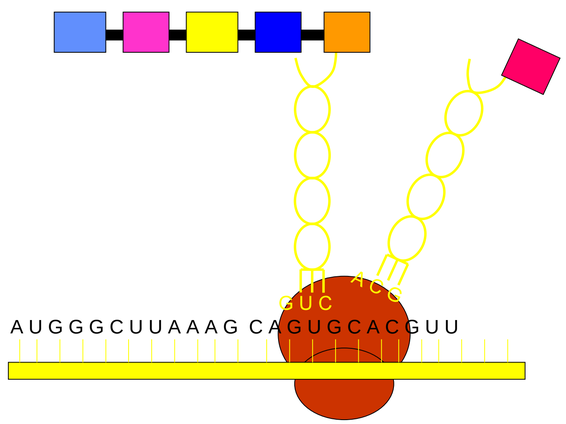



Another tRNA molecule comes into place, bringing a second amino acid.

Its anticodon links up with the second codon on the mRNA.

A peptide bond joins the two amino acids to start the formation of a polypeptide chain.

The process continues and amino acids are assembled in the correct sequence in a long chain to make the protein.

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The process requires enzymes and ATP.

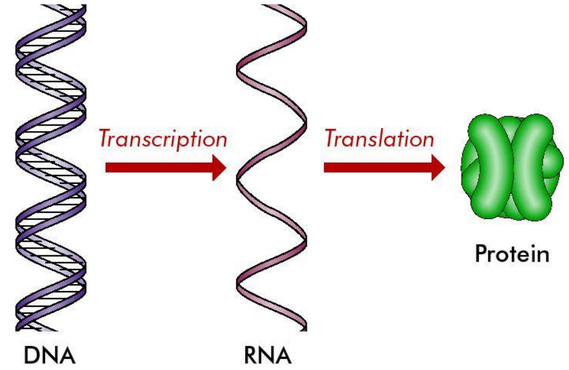
The polypeptide chain gets longer.

This process stops when a termination (stop) codon is reached.

The polypeptide is then complete.

The protein now has to undergo folding and the addition of bonds.

Folding allows the Protein to reach its 3D (Tertiary Shape) which influences its function




## Three Types of RNA

### messenger RNA (mRNA)

Contains the information for a specific **protein**.

Made up of **codons** (sequence of three bases)

Each **codon** is specific for one **amino acid**.

### transfer RNA (tRNA)

Picks up the appropriate **amino acid** floating in the cytoplasm

Transports **amino acids** to the **mRNA**.

Has **anticodons** that are complementary to **mRNA codons**.

Recognizes the appropriate **codons** on the **mRNA** and bonds to them with H-bonds.

### ribosomal RNA (rRNA)

Important structural component of a **ribosome.**

Associates with **proteins** to form **ribosomes.**

All RNA produced in the nucleus