Protein synthesis

Overview: Messenger RNA (mRNA) is the link between DNA and proteins: It carries a copy of the base sequence of a gene from the nucleus to the ribosome where the protein is assembled.

Protein synthesis:

Step 1 = Transcription (forms mRNA from DNA)

Step 2 = Translation (protein chain is assembled)

[More generally, transcription refers to the same language with different accents ie DNA to RNA. Translation refers to two languages ie RNA to Protein]

Transcription

1 The enzyme RNA polymerase binds to the start codon (triplet) of the gene.

2 This makes a section of DNA unwind, by breaking weak hydrogen bonds holding the two strands of DNA together.

* ie the base pairs in one region of DNA unpair*

3 RNA polymerase then organises the assembly of a single strand of RNA which is complementary to one of the unwound DNA strands (this is always the same, and is called the template strand)

4 T is substituted for U; apart from this, the sequence of bases is identical to the other DNA strand (the coding strand). The mRNA carries a triplet code sequence.
5 RNA polymerase moves along the gene until it reaches the stop codon of the gene. The DNA starts to rewind.

6 At this point, transcription ends, the mRNA detaches from the DNA, and the RNA moves out of the nucleus (through nuclear pores). DNA rewinds completely.

[Actinomycin is a drug which binds tightly to DNA of bacterial and cancer cells, preventing it unwinding for transcription; it is therefore an effective antibiotic and anti-cancer drug].

Translation

Translation takes place on ribosomes: These organelles are made up of ribosomal RNA (rRNA) and protein. They consist of a large and a small subunit; the latter locks on to a part of the mRNA called the ribosome building site. The whole ribosome then acts as a machine that assembles the protein chain in the order specified by the code carried on the mRNA:

The genetic code tells us which codons literally code for each of the 20 amino acids.