Central Dogma

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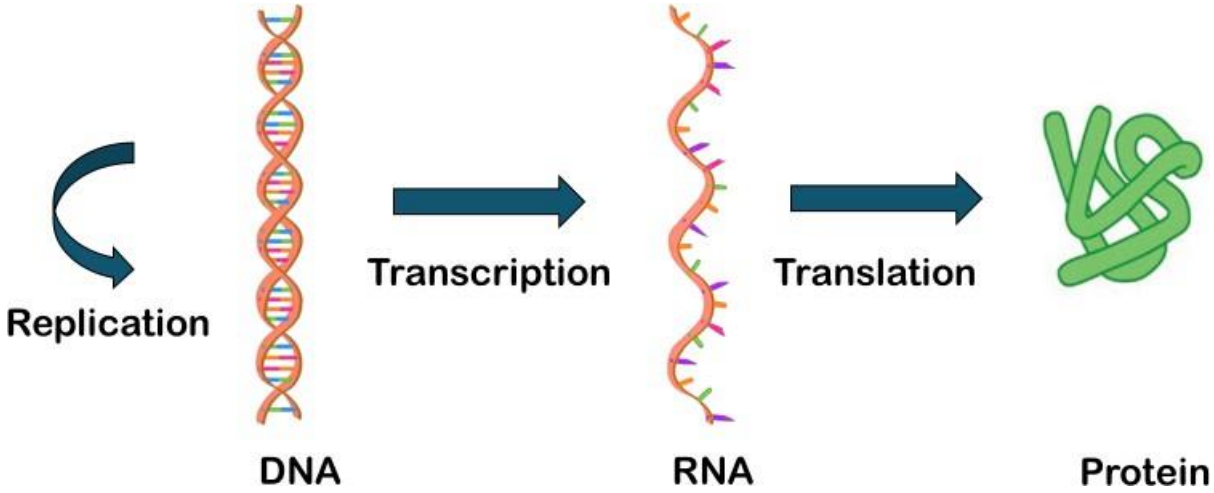
the process by which the instructions in DNA are converted into a functional product (proteins).

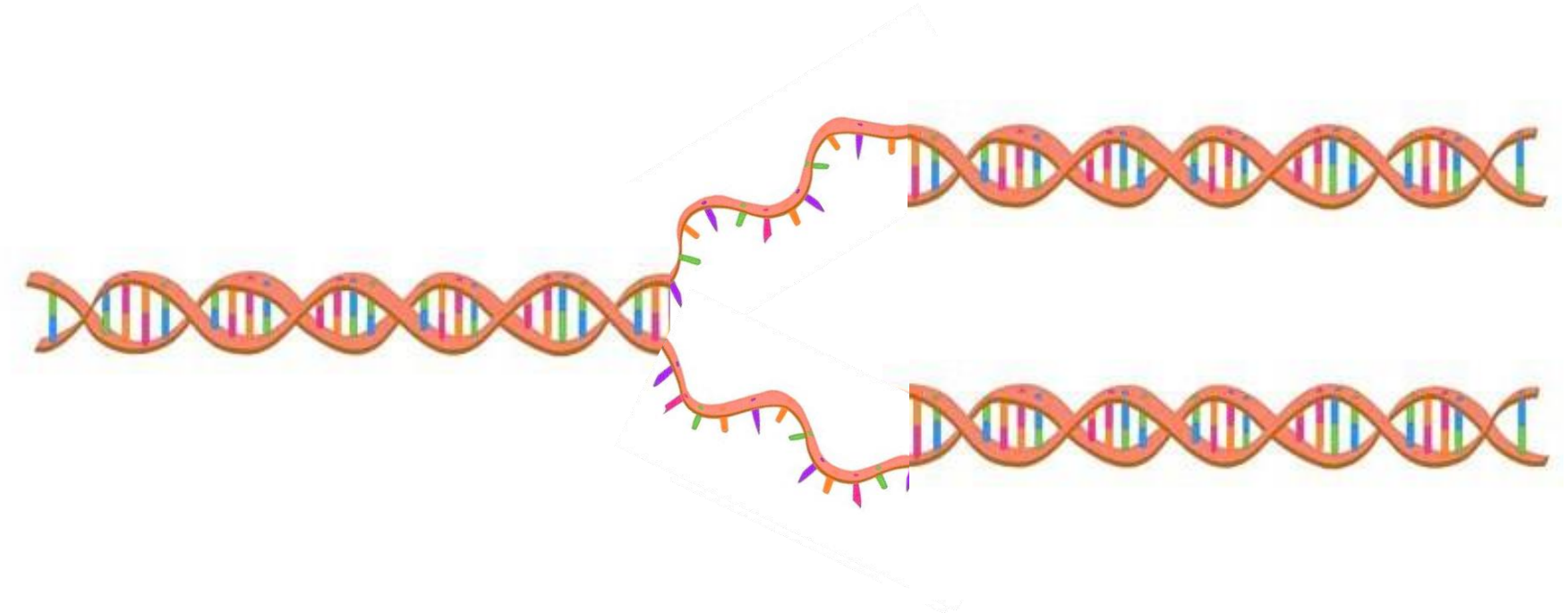


It is an explanation of the flow of genetic information in a cell, including replication of the DNA, the transcription of the RNA, and the translation of the RNA to create the proteins.

1

Replication

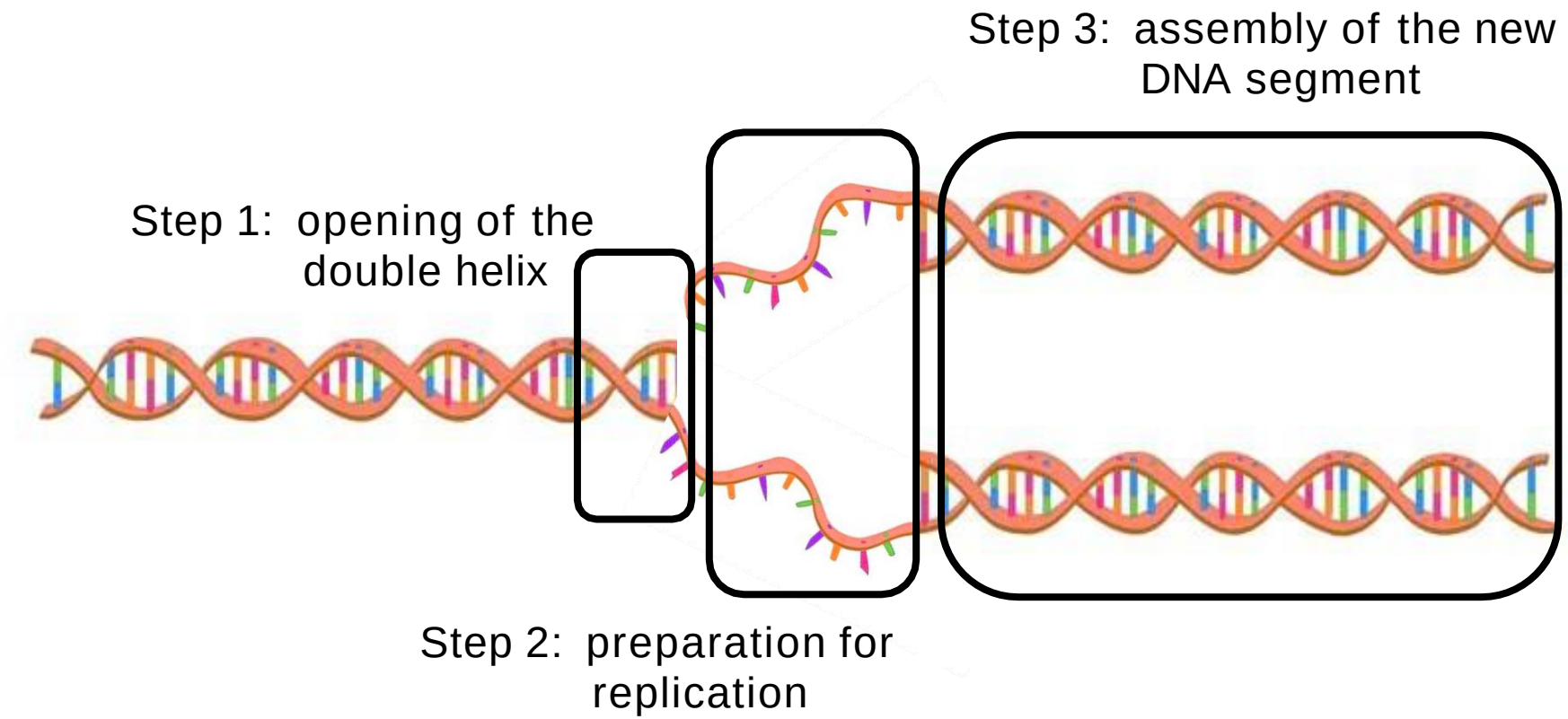
the process of producing two identical replicas of DNA from one original DNA molecule



DNA replication occurs in all living organisms, and it is the most essential part for biological inheritance

The process of replication is a highly complex process and requires a concerted effort of many different proteins including but not limited to DNA Polymerases, Primase, Helicase, and DNA ligase. In eukaryotes, Polymerases δ and ε are the major replicative enzymes.
DNA is copied to produce an identical copy of the DNA molecule. This process ensures genetic information is passed on during cell division.

Replication: Steps

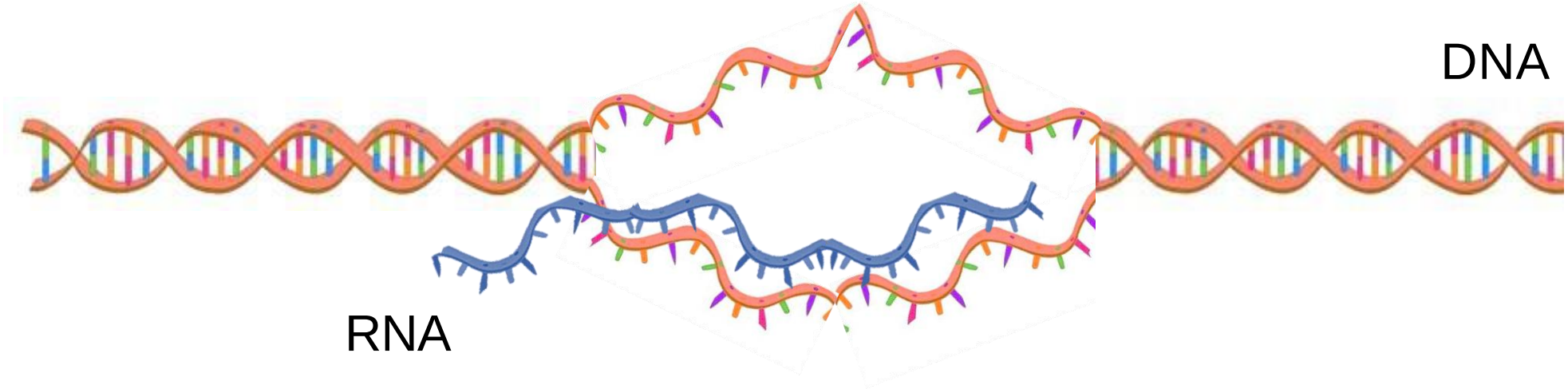


2

Transcription

the process of making RNA from DNA

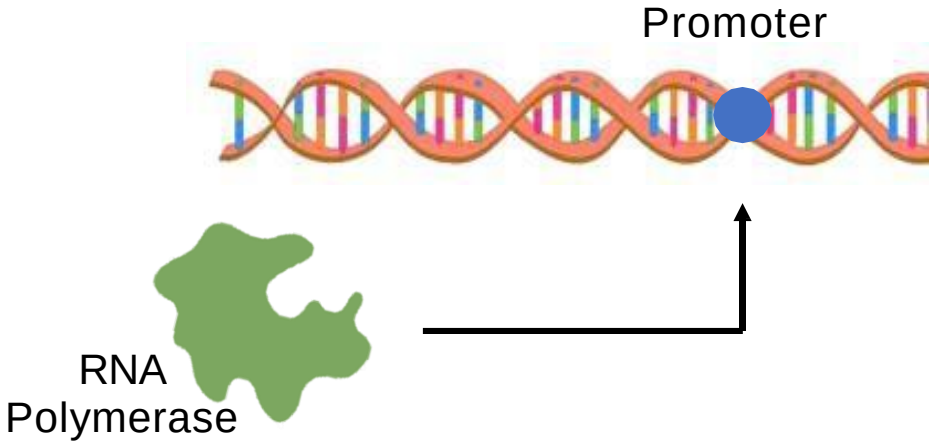
the information in a strand of DNA is copied into a new molecule of messenger RNA (mRNA).

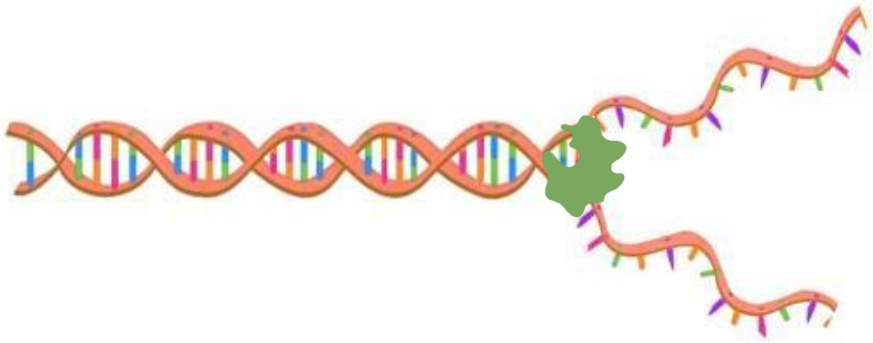


The enzyme RNA Polymerase transfers information from one strand of DNA to another strand of RNA during transcription. Three parts of the DNA strand are involved in this process: the promoter, the structural gene, and the terminator. DNA strands that synthesize RNA are called template strands, and DNA strands that Code for RNA are called coding strands. RNA polymerases that are DNA-dependent bind to the promoter and catalyze the 3' to 5' directions of polymerization. The newly synthesized RNA strand is released from the terminator sequence as it approaches the terminator. RNA strands released after transcription undergo further modifications post-transcriptionally.

Step 1 – Initiation

RNA polymerase moves along the DNA molecule until it recognizes a promoter sequence, which indicates the starting point of transcription.





RNA polymerase unwinds a part of the DNA double helix, exposing the bases on each of the two DNA strands.

Step 2 – Elongation (the addition of nucleotides to the mRNA strand)

RNA polymerase reads the DNA strand and builds the mRNA molecule, using complementary base pairs.

T G C A T A C T A G
| | | | | | | | | |
A C G U A U G A U C

Adenine (A) in the DNA binds to Uracil (U) in the RNA.

Adenine (A)

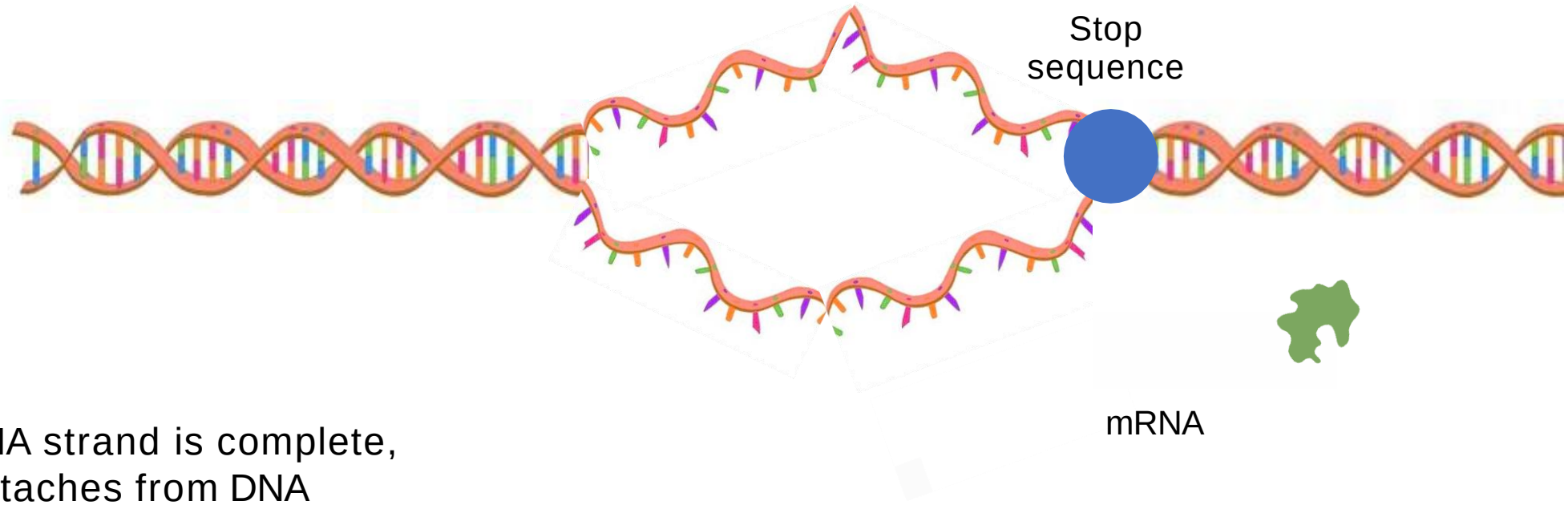
Cytokine (C)

Guanine (G)

Thymine (T)

Step 3 – Termination

RNA polymerase crosses a stop (termination) sequence in the gene



The mRNA strand is complete, and it detaches from DNA

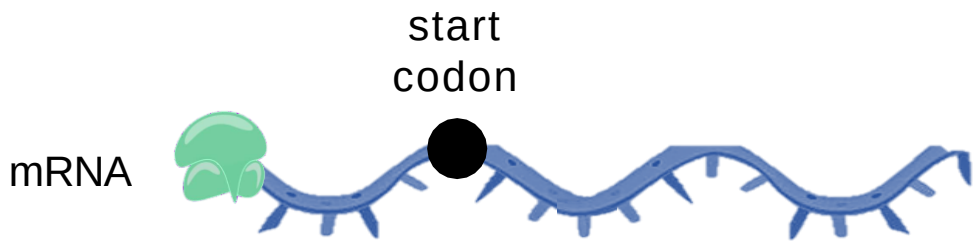
3

Translation

the process of synthesizing proteins from the information contained in a molecule of mRNA

Proteins are encoded by RNA by a process called translation. Translation involves energy and is an active process. The energy comes from the charged tRNA Molecules. The translation process is initiated by ribosomes. Ribosomes are made up of two subunits, one larger and one smaller. As a result, the larger subunit consists of two tRNA Molecules positioned together so that enough energy can be expended to form a peptide bond. The mRNA enters the smaller subunit and is then held by the tRNA Molecules present in the larger subunit that are complementary to the codon. In this way, two codons are held together by two tRNA Molecules placed close together and a peptide bond is formed between them. This process results in long polypeptide chains of amino acids.

Step 1 – Initiation

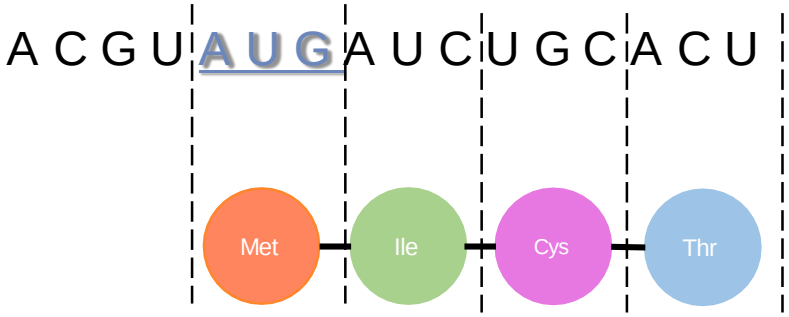


the start codon AUG must be recognized in the mRNA by the ribosome

A C G U **A U G** A U C U G C A C U

(start codon)

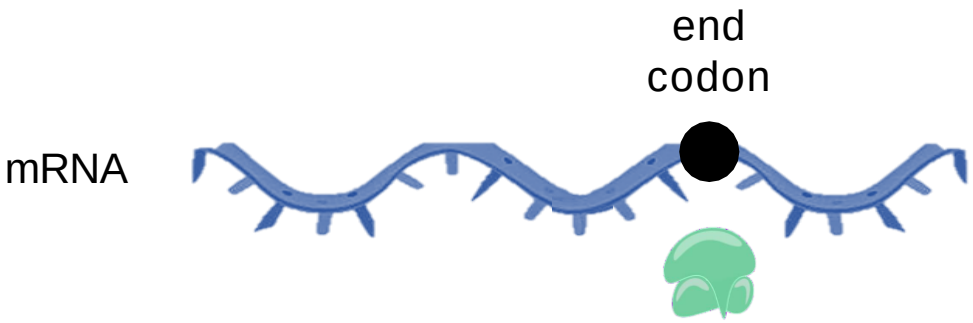
Step 2 – Elongation



The ribosome continues to translate each codon in turn.

Each amino acid is added to the growing chain and linked via a bond called a peptide bond.

Step 3 – Termination



U A U G A U C U G C A C U U A G G C A

(end codon)

Termination occurs when the ribosome reaches a stop codon:

- UAA
- UAG
- UGA

The protein created is