

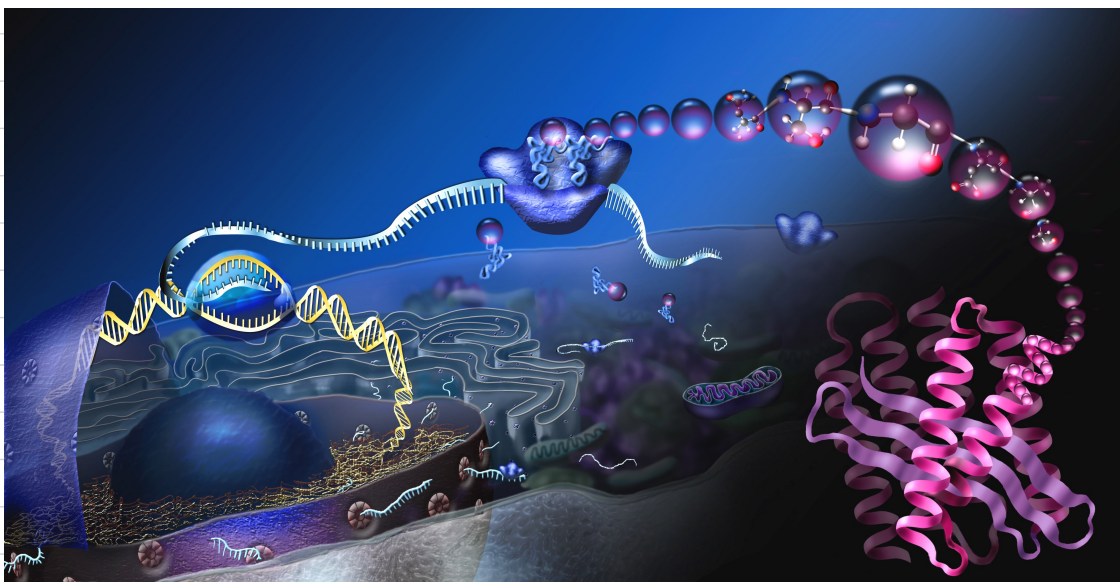
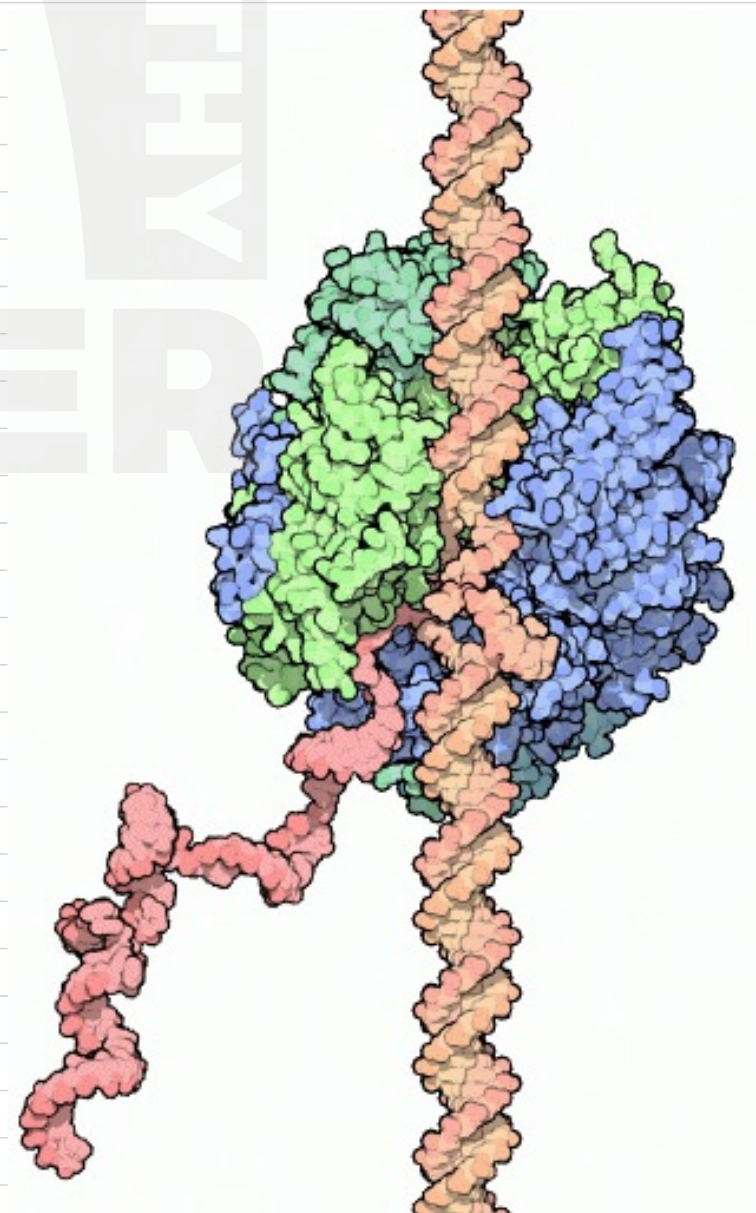
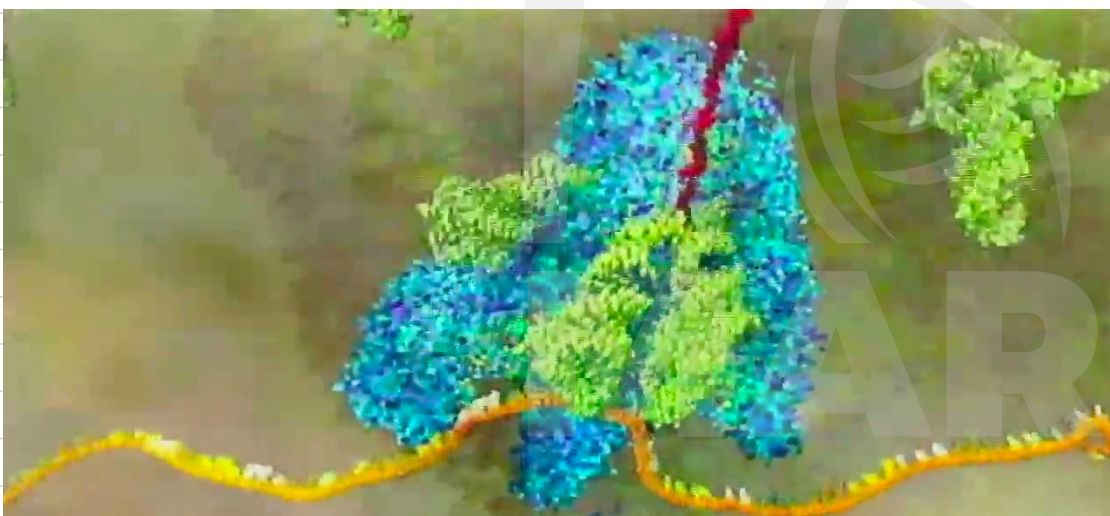
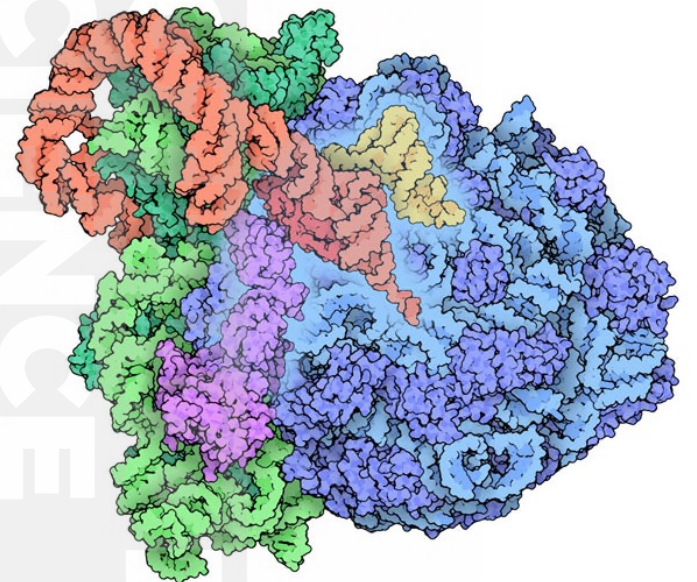
Genes and Protein Synthesis

Learning outcomes

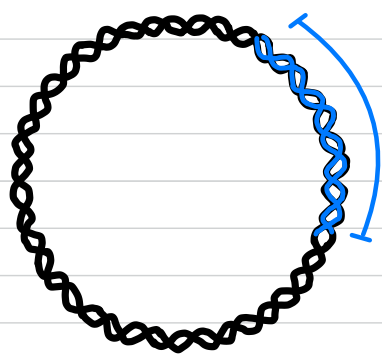
- ✓ understand the relationship between DNA, genes, genetic code and proteins
- ✓ use a table of mRNA codons and their corresponding amino acids to deduce the sequence of amino acids given a DNA or mRNA strand
- ✓ understand the process of DNA transcription, including the role of RNA polymerase
- ✓ understand the process of RNA translation, including the roles of ribosomes and tRNA molecules
- ✓ compare and contrast protein synthesis in prokaryotes and eukaryotes

Key terms

- gene
- genetic code
- codon
- gene expression
- transcription
- translation
- RNA polymerase
- peptide bond
- anticodon

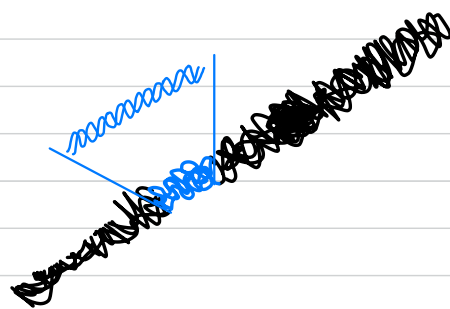


Genes and the Genetic Code



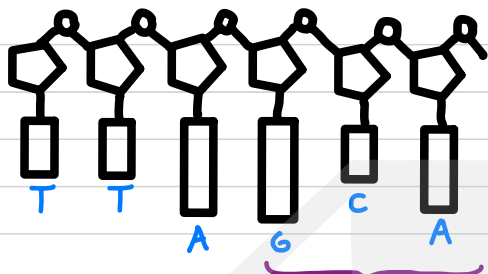
gene: a length/section of DNA that codes for a particular protein

- heritable (they are passed on from parent - offspring)
- controls / influences a specific characteristic



genetic code: the sequence of nucleotides in DNA / RNA

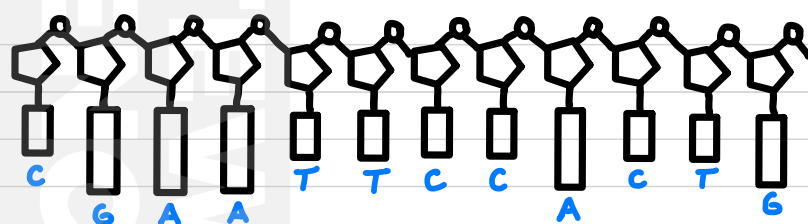
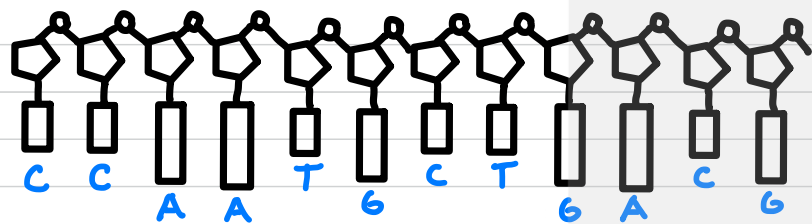
- the order of the code determines which amino acids are formed in what order



* genes/codons don't make proteins, they contain the instructions on how to make them

codon: nucleotide base sequence that codes for an amino acid

- the order of amino acids determines the structure of the protein: different structure, different protein



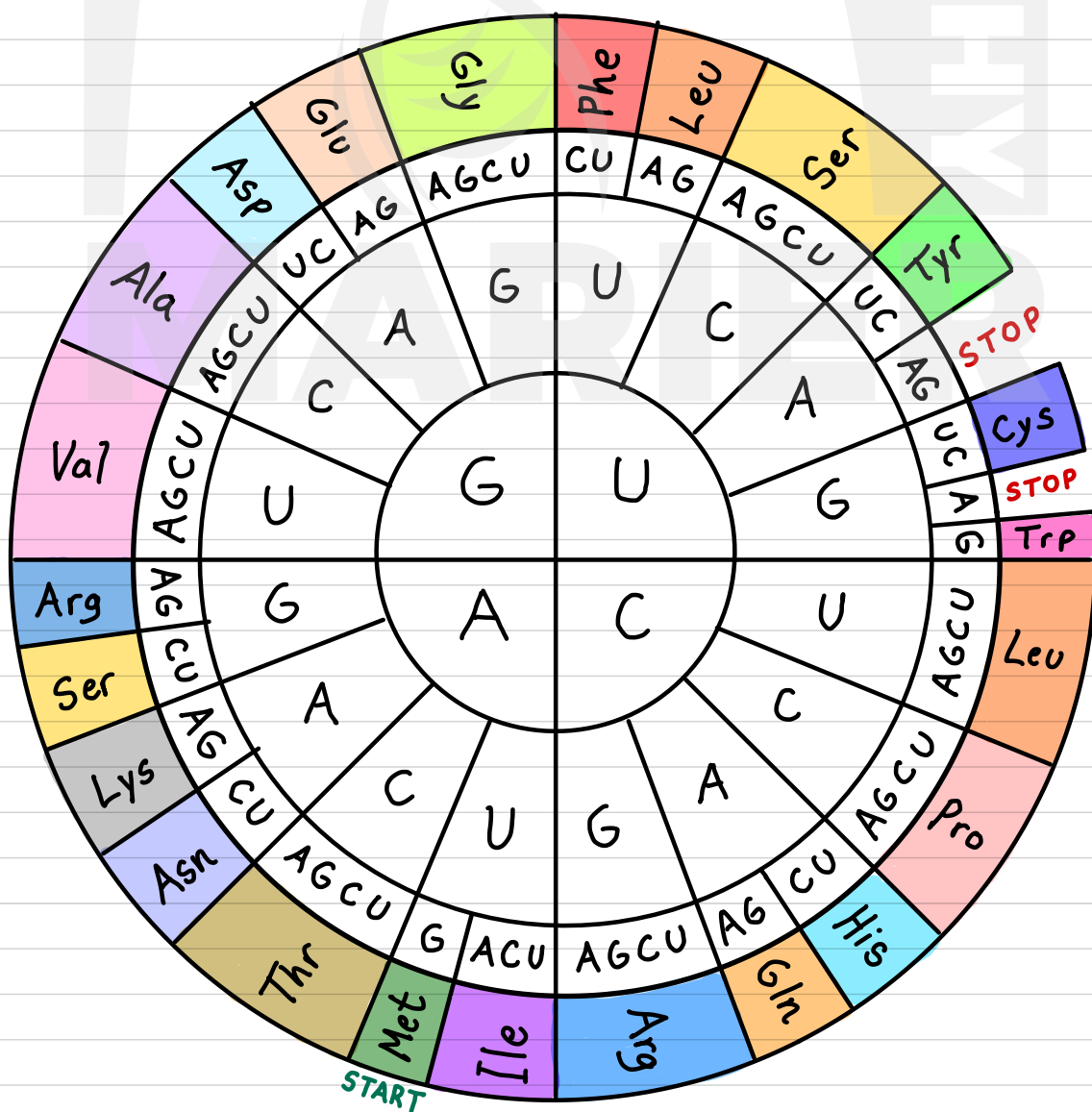
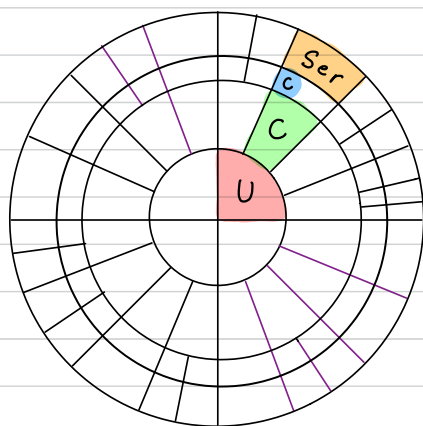
← base sequence →

← codons →

← amino acids →

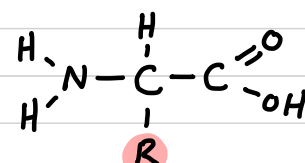
← polypeptides →

codon wheel:



There are 20 different amino acids

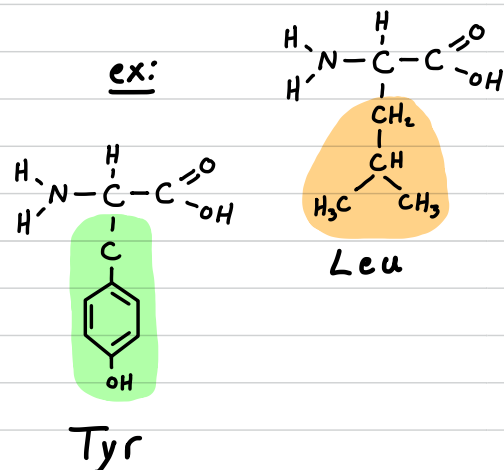
They all have the same base structure:



← varied by R group

codon
first base
second base
third base
amino acid

ex: UCC
Ser



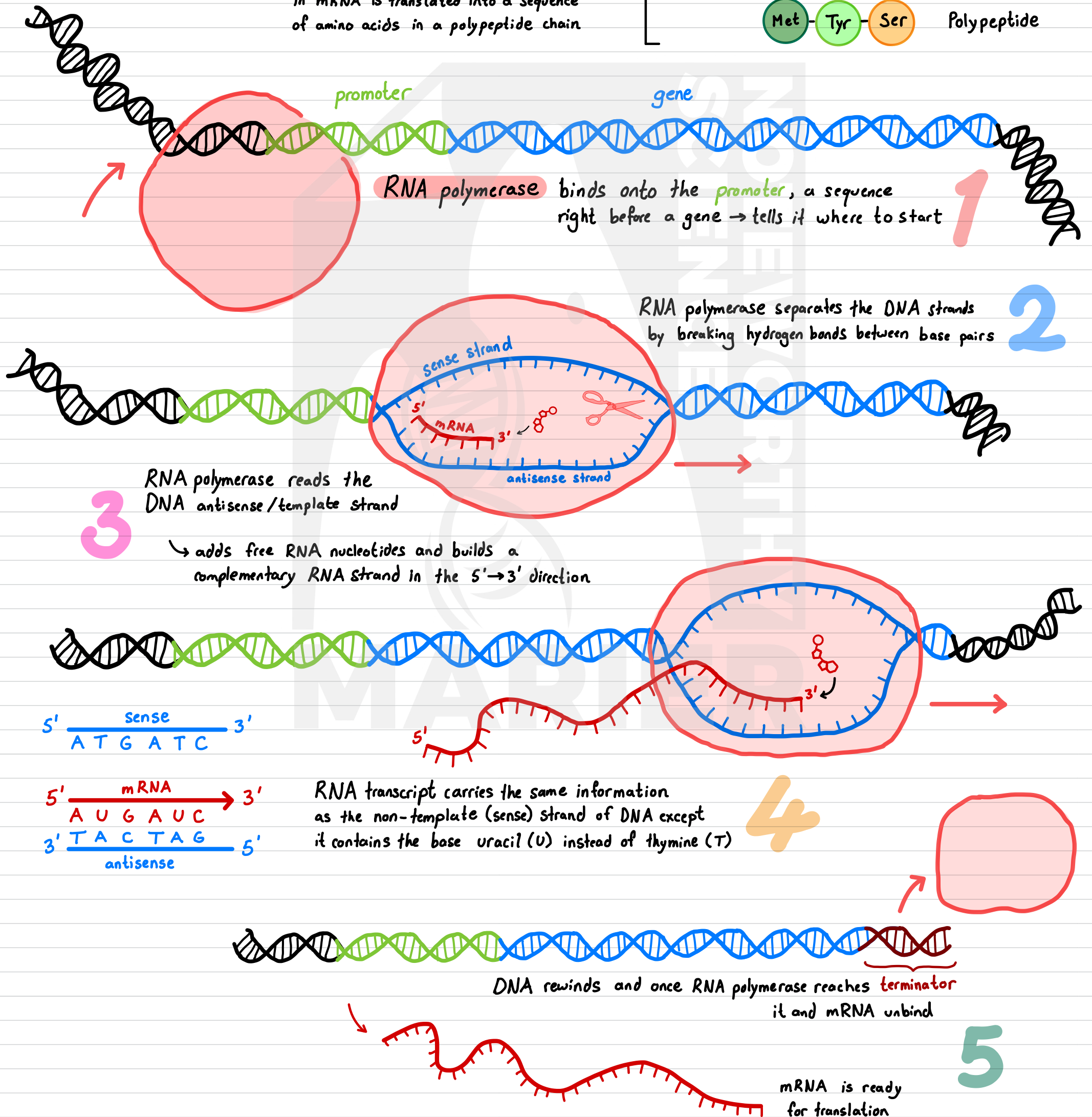
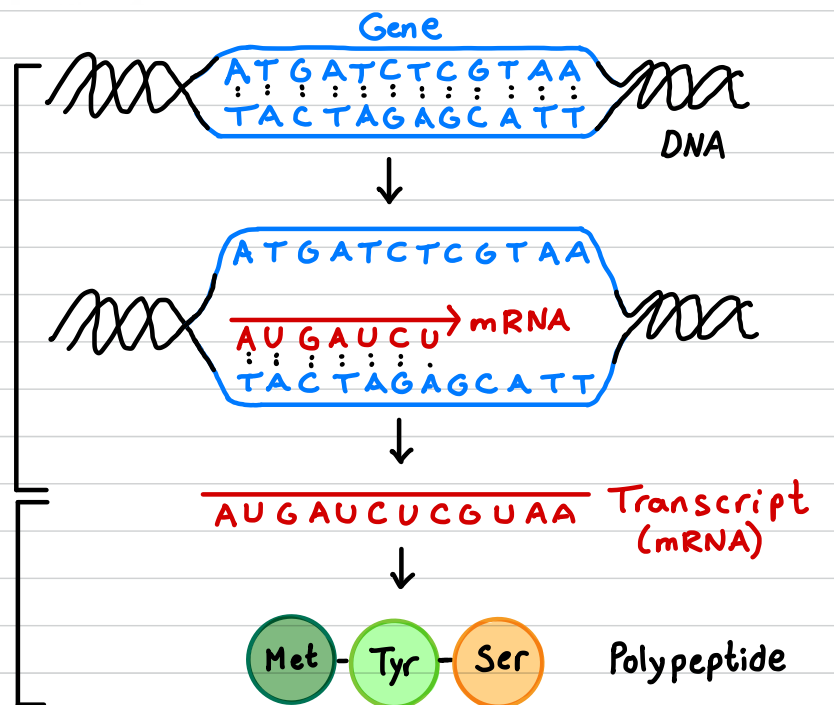
Transcription

Gene expression: the process by which the instructions in DNA (genes) are converted into a functional product, like proteins

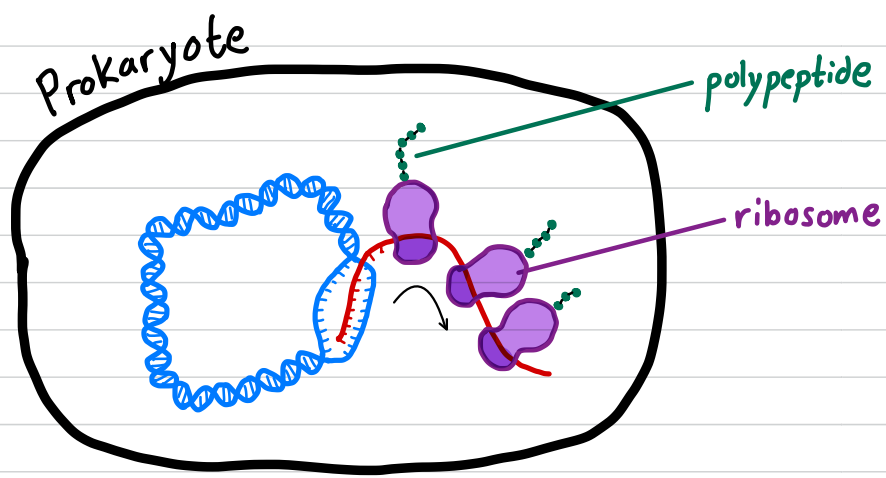
2 steps:

Transcription: complementary mRNA transcript created from a template DNA section (gene)

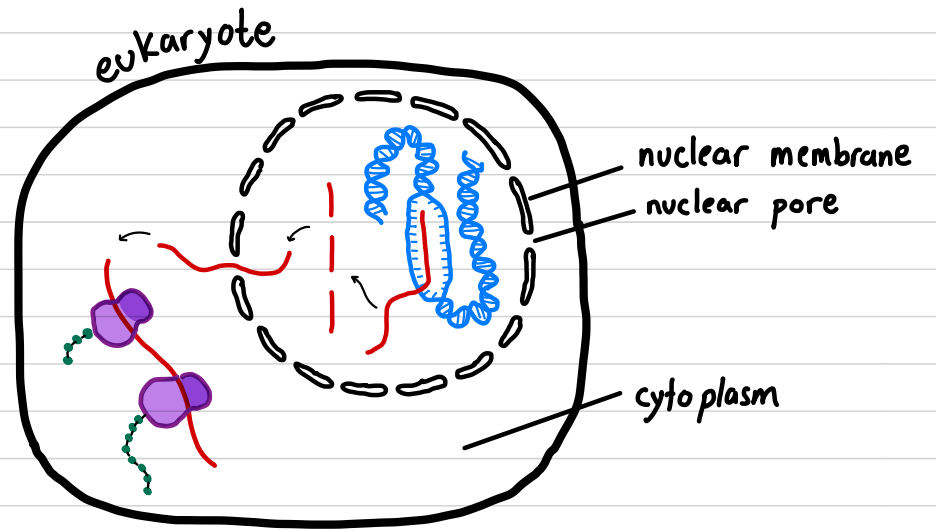
Translation: the process of protein synthesis in which the genetic information in mRNA is translated into a sequence of amino acids in a polypeptide chain



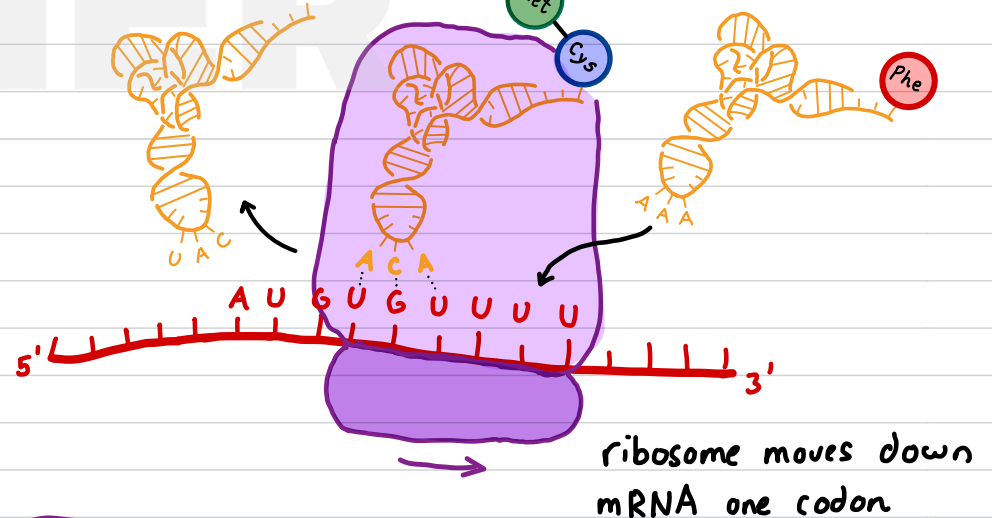
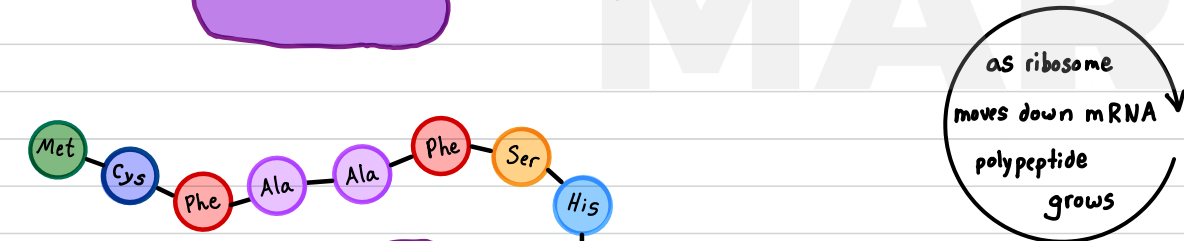
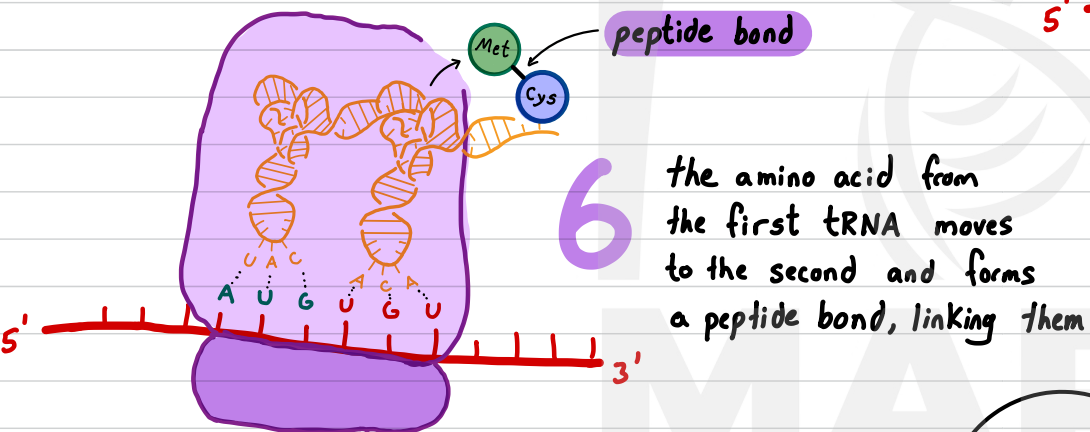
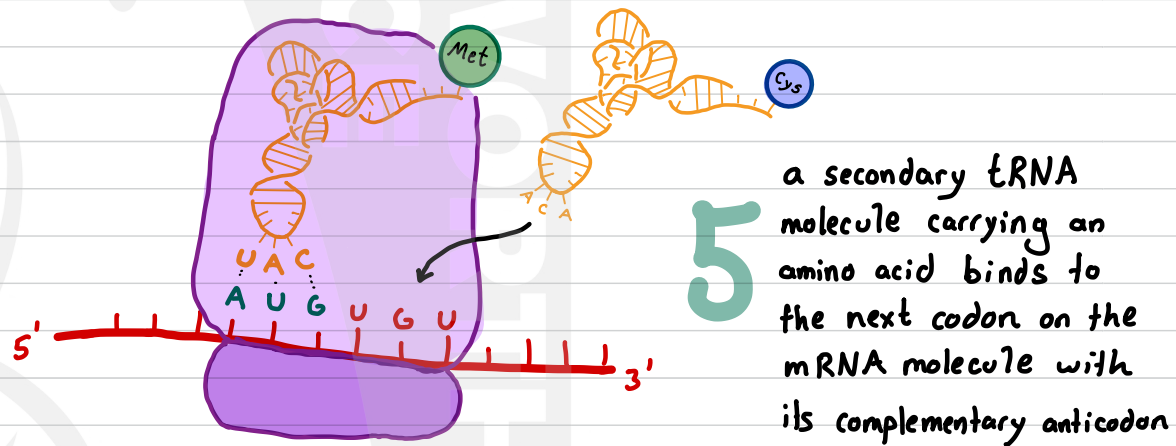
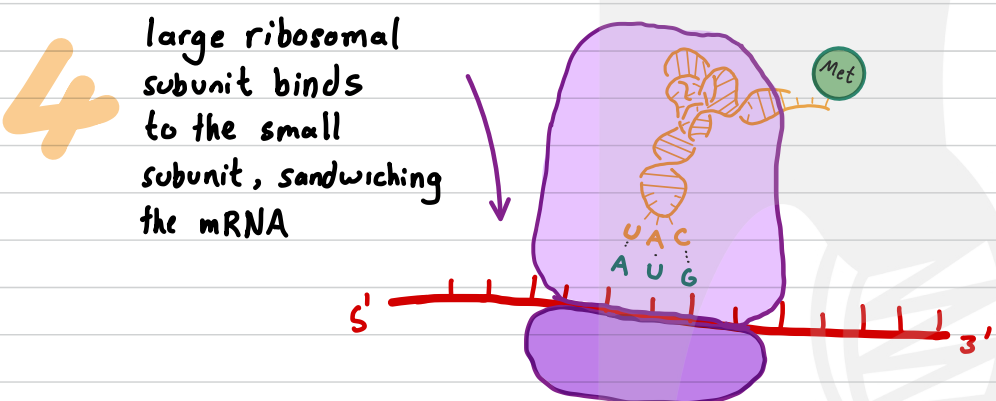
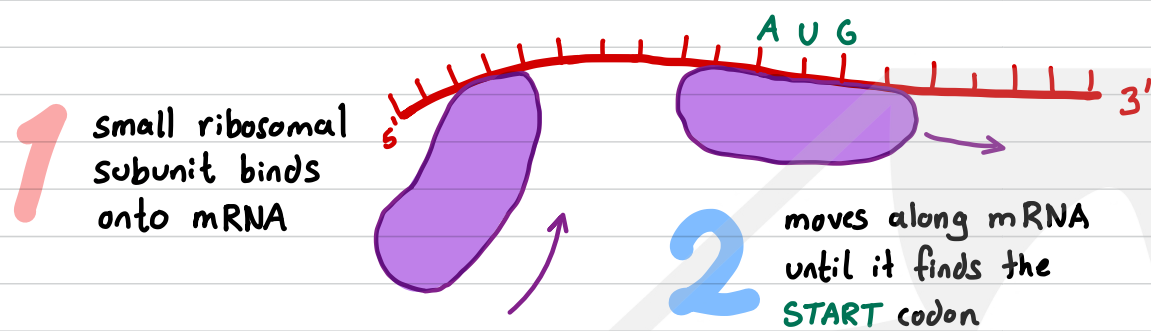
Translation



DNA transcription occurs in cytoplasm
Translation occurs immediately after/during



DNA transcription occurs in the nucleus mRNA is then modified and spliced leaves via nuclear pore into cytoplasm



Assessment Tasks

Answer the following questions:

- ① Compare and contrast protein synthesis in prokaryotes and eukaryotes
- ② Using the following DNA segment, determine the following:

sense strand	
<u>ATGTTAGCGAAACCATTTTGA</u>	
<u>TACAATCGCTTTGGTAAACT</u>	
antisense strand	

- a) the mRNA strand
- b) the polypeptide strand

- ③
 - a) What is the relationship between the sense, antisense and mRNA strand?
 - b) Where does the sense strand get its name and why is it also known as the coding strand?
 - c) Where does the antisense strand get its name and why is it also known as the template strand?
- ④ Protein synthesis is an essential and ongoing biological process. Research and explain 3 different roles proteins play in an organism (with a named example) and why these are so vital for life.
- ⑤ Explain the importance of complementary base pairing in both transcription and translation
- ⑥ Contrast DNA replication and transcription
- ⑦ Many antibiotics (drugs that kill bacteria) work by targetting bacterial protein synthesis. Research one type and explain how it interrupts this process in bacteria and how this ends a bacterial infection.