

Protein Synthesis Vocabulary

- > Protein Synthesis
- > Transcription
- > Translation
- > RNA Polymerase
- > Triplet Code

Protein Synthesis

The Recipe for Proteins

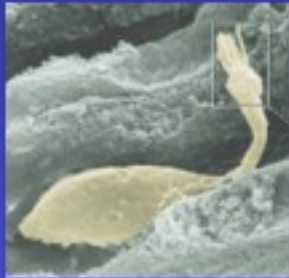
How are Cells Differentiated?

Almost every cell in an organism contains the exact same copy of DNA (the entire genome).

Question: Why do different types of cells look different and have different functions?

Answer: Different genes in the DNA are "turned on" or "turned off" in different cells.

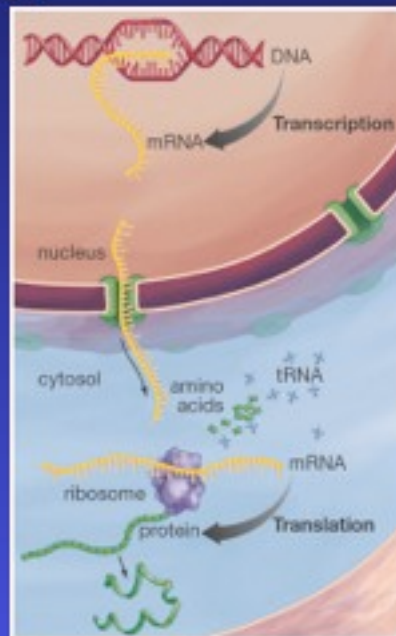
Protein Synthesis is the two step process of regulating which segments of DNA are turned into proteins, which explains the differentiation of cells.



Transcription and Translation

Transcription
↓
DNA → RNA

Translation
↓
RNA → Protein

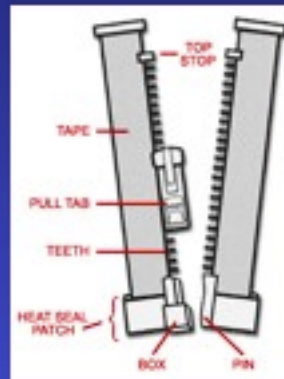
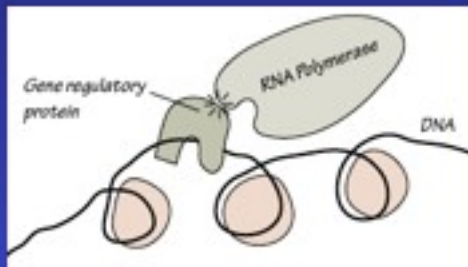


Main Theme of Genetics (Central Dogma)

Two-Step process of Transcription and Translation

- > Keeps DNA protected in the Nucleus.
- > Multiple proteins can be made from one copy of DNA.
- > Allows for control over which genes are turned off or on.

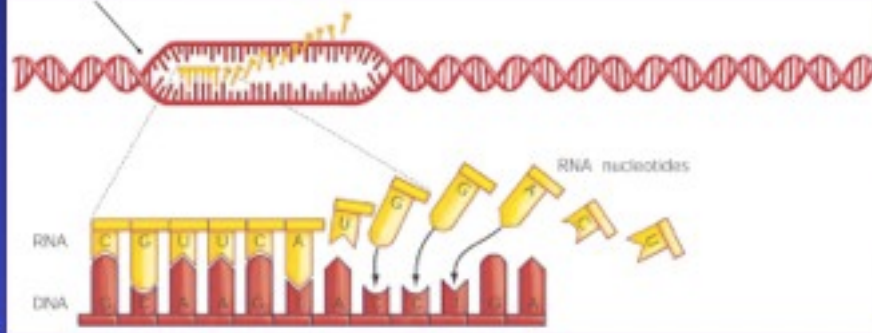
Promoter



Promoters bind to DNA and initiate the transcription of DNA by recruiting RNA polymerase.

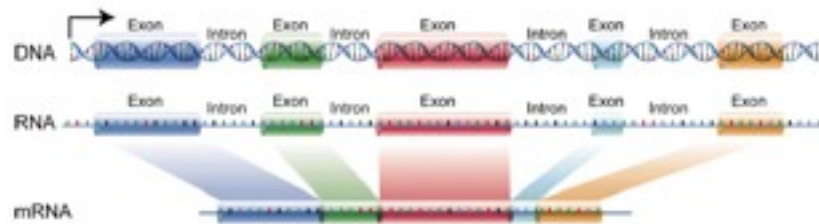
Transcription

Promoter acts here



The enzyme RNA polymerase copies one of the strands of DNA into a complementary RNA strand.

Eukaryotic Genes are Segmented

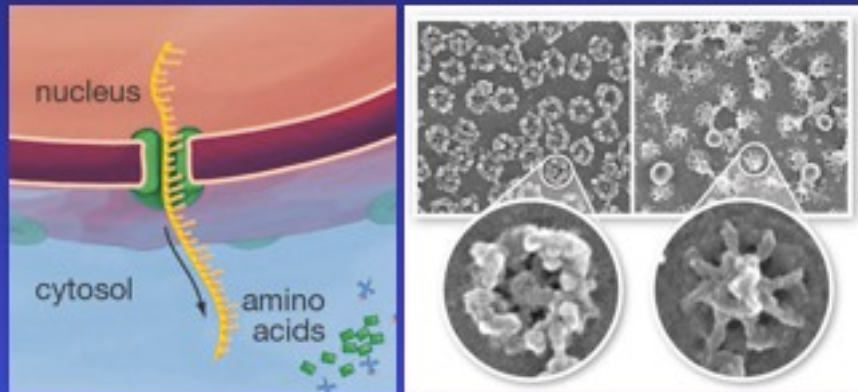


Exon - Sections of genes that appear in the final mRNA transcript.
Intron - Sections of genes that are spliced out of the mRNA transcript.

Many RNA molecules from eukaryotic genes have sections called introns, which are spliced out before they become functional.

Nuclear Pore

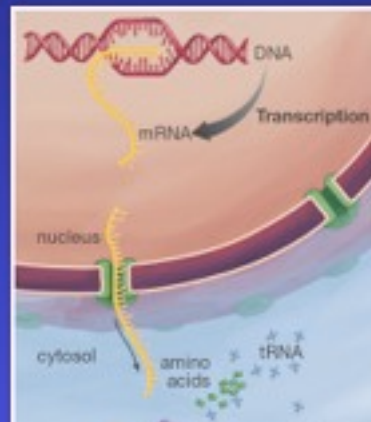
mRNA travels out of the nucleus to reach the ribosome.



Nuclear Pore

Summary of Transcription

- Transcription occurs in the nucleus.
- DNA is copied into messenger RNA (mRNA)
- Introns are spliced from the mRNA.
- mRNA travels out of the nuclear pore



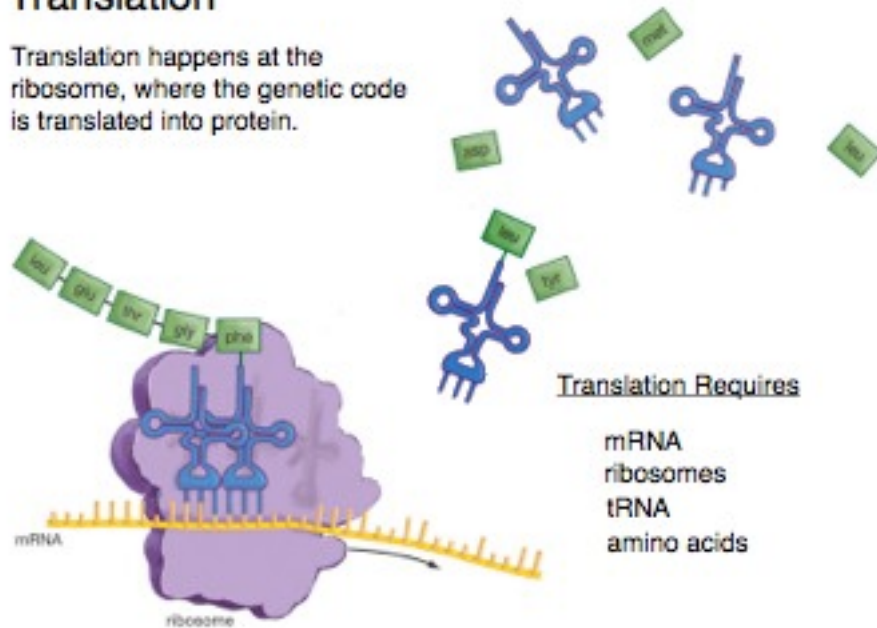
What is a Protein?

A **protein** is a long twisted chain of amino acids connected by peptide bonds. Proteins are sometimes called polypeptides.

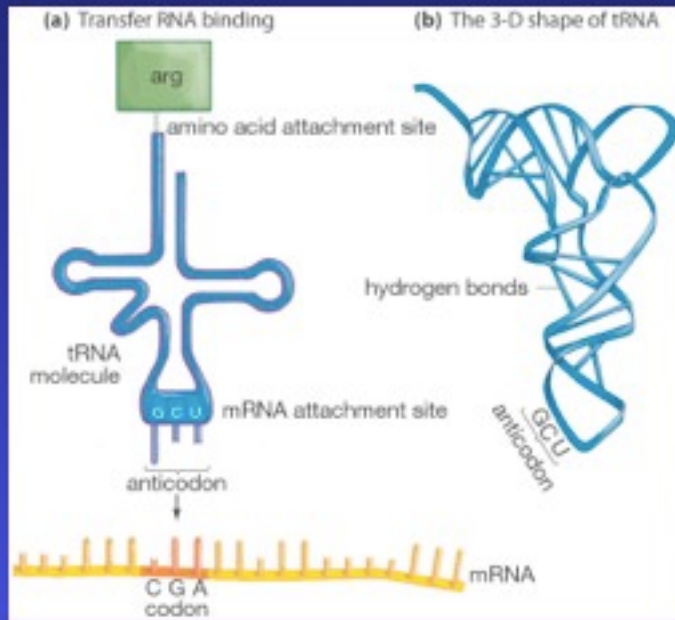


Translation

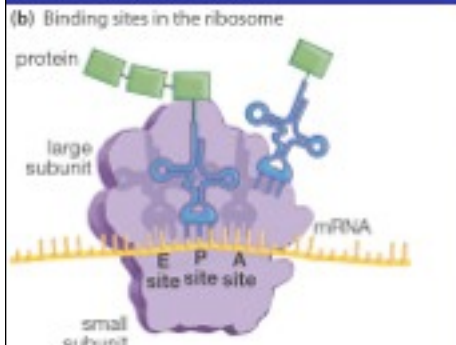
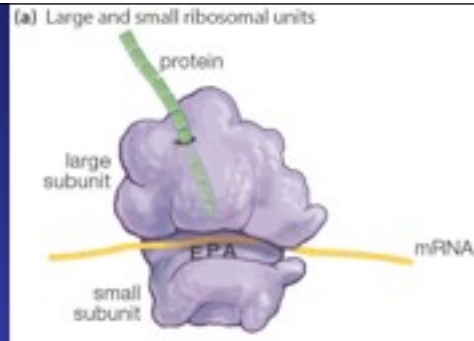
Translation happens at the ribosome, where the genetic code is translated into protein.



tRNA is an adaptor that connects codons and amino acids



Ribosomes make proteins by translating the mRNA code into amino acids.



The ribosome begins translation at the **AUG** codon, then continues three nucleotides at a time.

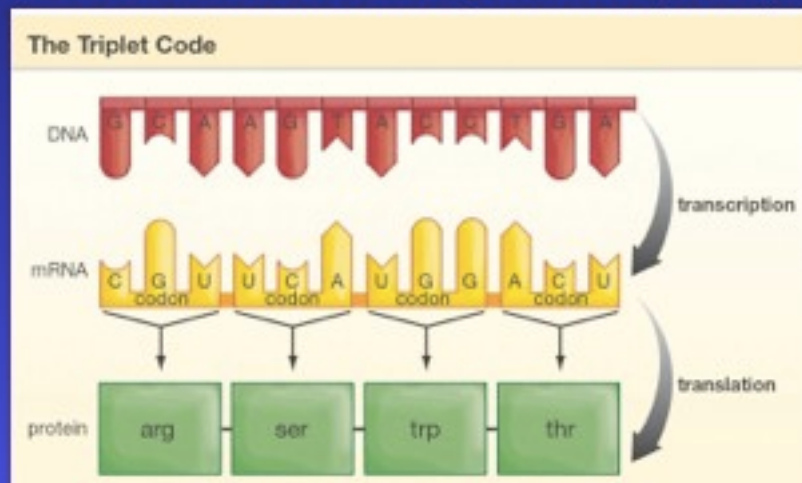
The Triplet Code

		second base				
		U	C	A	G	
U	UUU } phe	UCU } ser	UAU } tyr	UGU } cys	U C A G	
	UUC } leu	UCC } ser	UAC } tyr	UGC } cys		
	UUA } leu	UCA } ser	UAA } Stop	UGA } Stop		
	UUG } leu	UCG } ser	UAG } Stop	UGG } trp		
C	CUU } leu	CCU } pro	CAU } his	CGU } arg	U C A G	
	CUC } leu	CCC } pro	CAC } his	CGC } arg		
	CUA } leu	CCA } pro	CAA } gln	CGA } arg		
	CUG } leu	CCG } pro	CAG } gln	CGG } arg		
A	AUU } ile	ACU } thr	AAU } asn	AGU } ser	U C A G	
	AUC } ile	ACC } thr	AAC } asn	AGC } ser		
	AUA } met (start)	ACA } thr	AAA } lys	AGA } arg		
	AUG } met (start)	ACG } thr	AAG } lys	AGG } arg		
G	GUU } val	GCU } ala	GAU } asp	GGU } gly	U C A G	
	GUC } val	GCC } ala	GAC } asp	GGC } gly		
	GUA } val	GCA } ala	GAA } glu	GGA } gly		
	GUG } val	GCG } ala	GAG } glu	GGG } gly		

There are 20 different Amino Acids

The Triplet Code

The genetic language uses a 4-letter alphabet (A-U-C-G)
 And writes 3-letter words (codons)
 The words are combined into long sentences (proteins)



Universal Genetic Mechanisms

The mechanisms of the genetic code are the same in all organisms. Genetic comparisons can be made between different organisms. Genes can be extracted from one organism and expressed in a different organism.

