

Protein Synthesis

-  **Introduction to DNA**
-  **Introduction to protein synthesis**

Adenine
Thymine
Guanine
Cytosine
Uracil

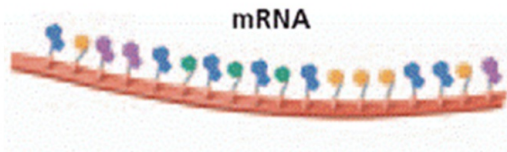
What is RNA?

DNA: Deoxyribonucleic Acid	RNA: Ribonucleic Acid
Double stranded	Single stranded
Deoxyribose sugar	Ribose sugar
Bases: A, T, C, G A-T C-G	Bases: A, U, C, G A-U C-G
Replicates DNA → DNA	Does not replicate
Only one type	Three types of RNA (mRNA, rRNA, tRNA)

Types of RNA



messenger RNA
mRNA



Carries the DNA
message

(nucleus, cytoplasm, ribosome)

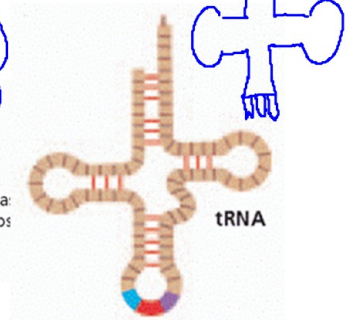
ribosomal RNA
rRNA



Makes up
ribosomes

(ribosome)

transfer RNA
tRNA



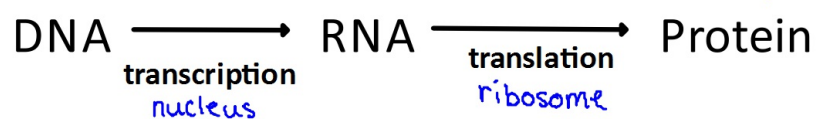
Links **amino**
acids

together
(cytoplasm, ribosome)

Protein Synthesis

- The whole point of a DNA is to make a **protein!**

- Basic overview: *Central Dogma Theory*



Two steps of protein synthesis:

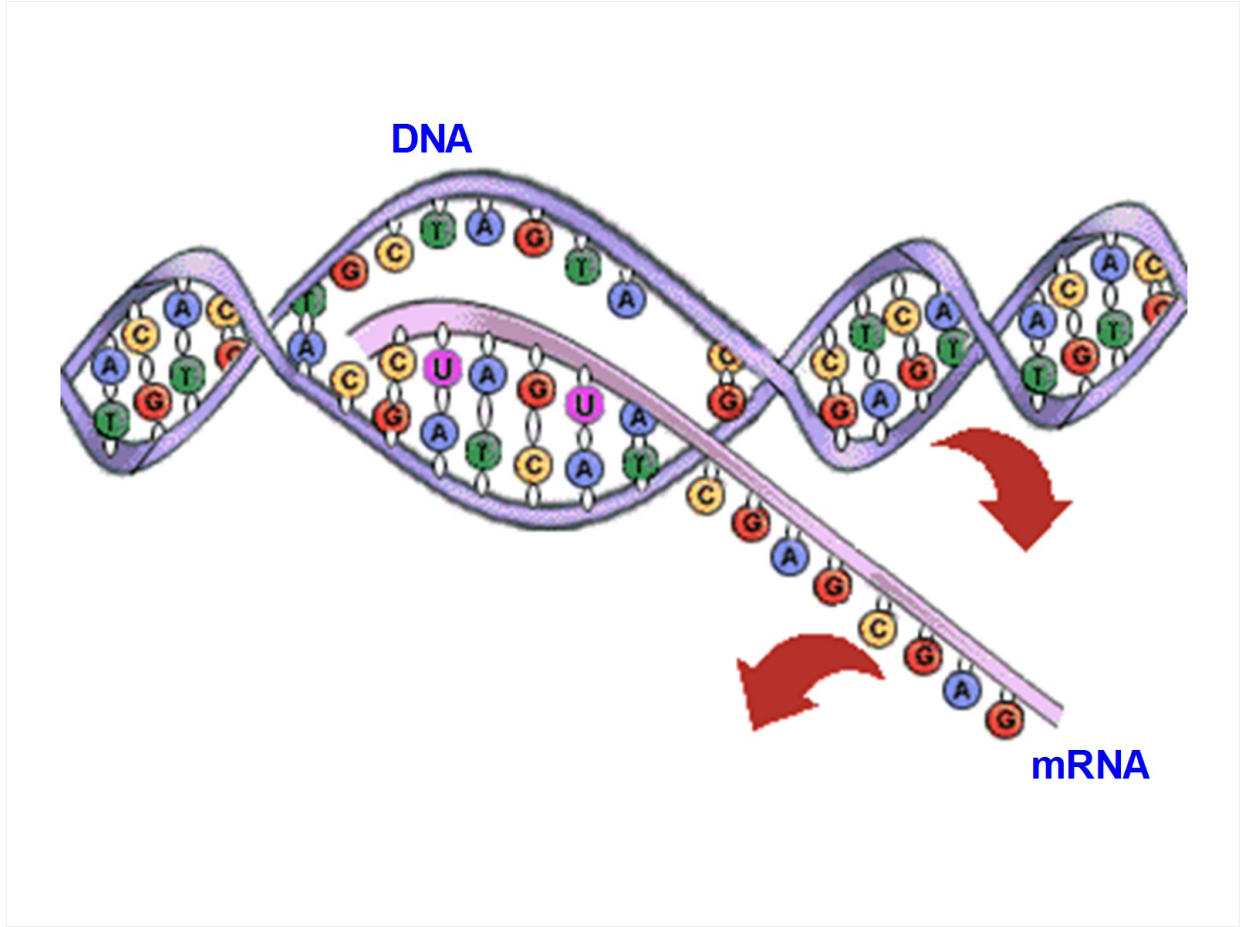
- 1) Transcription
- 2) Translation

Transcription

- Goal: To turn DNA into a mRNA message

STEPS

- RNA polymerase (enzyme!) transcribes the DNA
- Uses the DNA template to make an mRNA (messenger RNA): remember, RNA uses U (uracil) instead of T (thymine)
- mRNA leaves the nucleus and goes into the cytoplasm



Practice: Turning DNA into RNA

a. A A T G C A A C A G T T C A A

b. T T A G G C G T A C T C A A T C

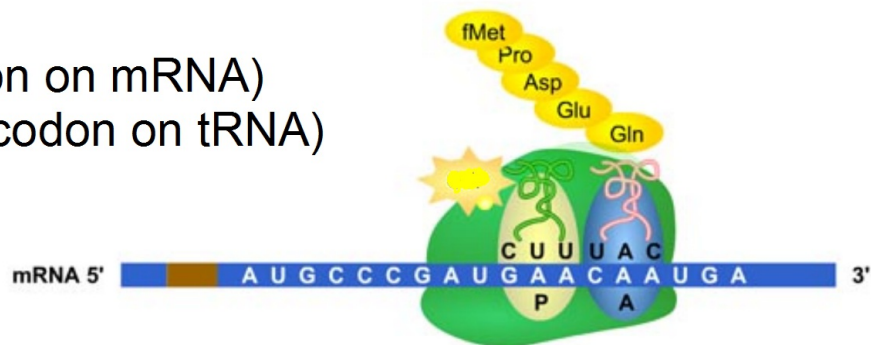
Translation

- Goal: to link together amino acids to make a protein.
 - Protein is made from the mRNA code at the ribosome
 - Codon: the ribosome reads the mRNA in groups of 3 bases.

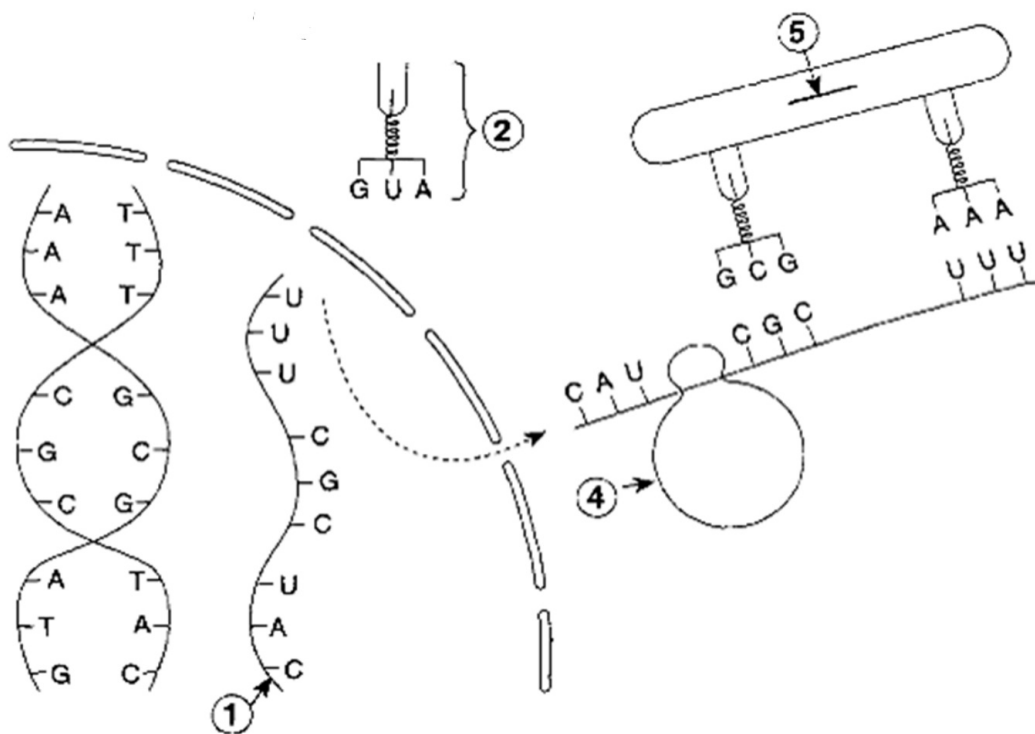
Example:

AAA (codon on mRNA)

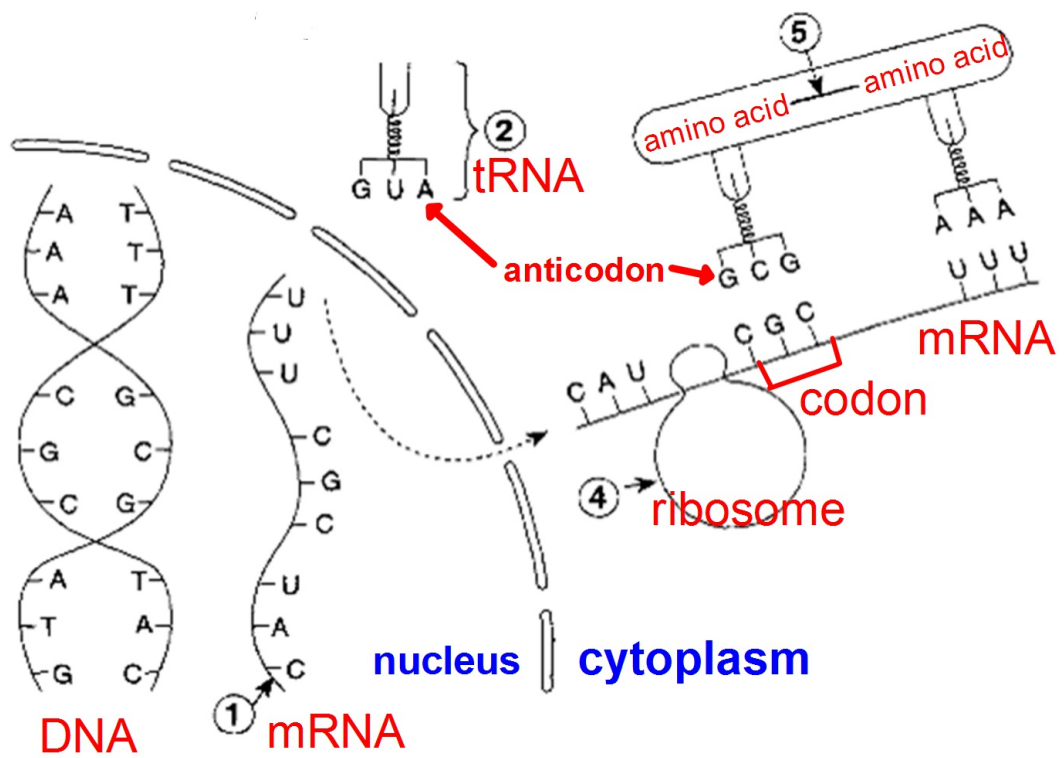
UUU (anticodon on tRNA)

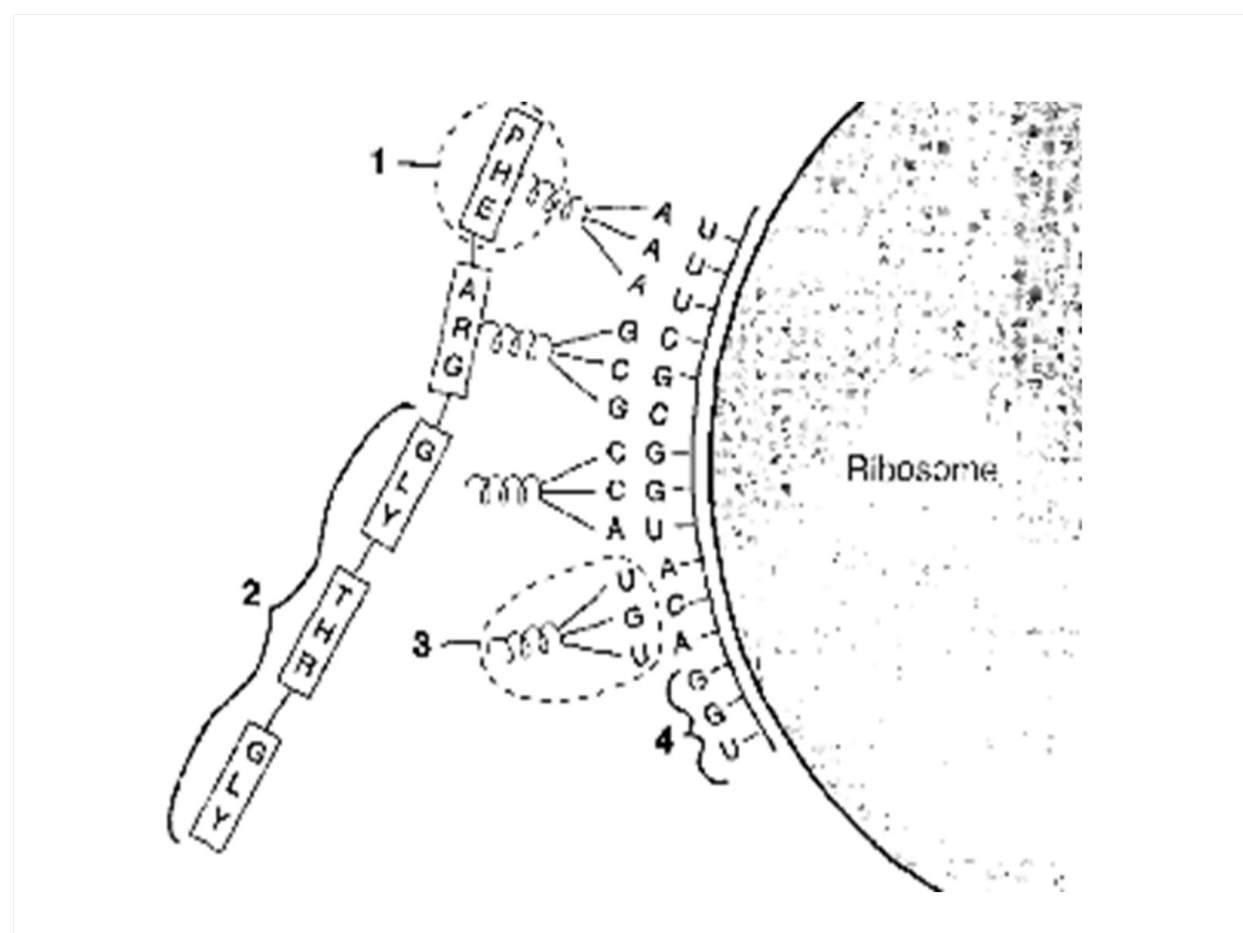


Picture of Transcription and Translation



Picture of Transcription and Translation

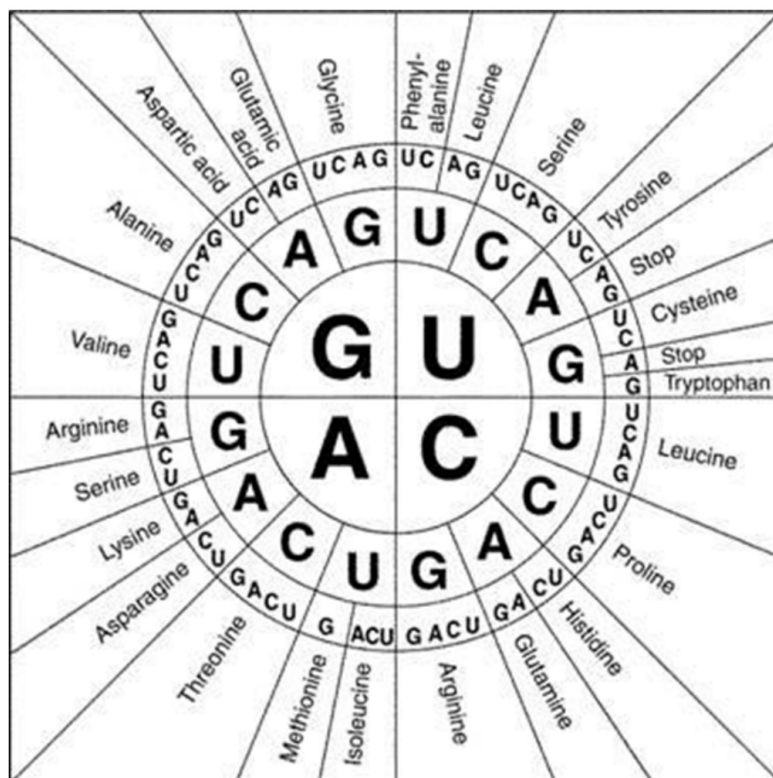




Steps:

1. mRNA leaves the nucleus.
2. Codons on mRNA are read and matched up to anticodons on tRNA.
3. tRNA "transfers" amino acids to mRNA. The protein (polypeptide) is built from many amino acids being bonded together by peptide bonds.

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	stop	stop	A
	leucine	serine	stop	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	(start) methionine	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G



Protein Synthesis Practice

Ex:

DNA: GCA CCT TTA — = codon
mRNA: CGU GGA **AAU**
Amino Acid: Arg Gly Asp

DNA: TTT CGA AAG
mRNA: AAA GCU UUC
AA: Lys Ala Phe

DNA: TTT CGA AAG
mRNA: AAA GCU UUC
tRNA: UUU CGA **AAG** - Anticodon
AA: Lys Ala Phen

Mutations

Mutations are any change in the DNA sequence. Some mutations are harmless, some are beneficial, and some are harmful to the organism.

Two Types of Mutations:

1) Point Mutations

-change in one single nitrogen base and amino acid. May not affect the protein that is made.

Ex: Substitutions

2) Frameshift Mutations

-change in one or more nitrogen bases and amino acids. Causes the reading of the codons to become different and alters the protein that is made.

*Hint: count the # of bases!

Ex: Insertions/Addition & Deletion

Examples

Point Mutation / Substitution

Original DNA: AAA GCT ACC

mRNA :

AA :

Mutated DNA: AAG GCT ACC

mRNA :

AA :

Frameshift/ Deletion

Original DNA:

mRNA:

AA :

Mutated DNA:

mRNA:

AA :

