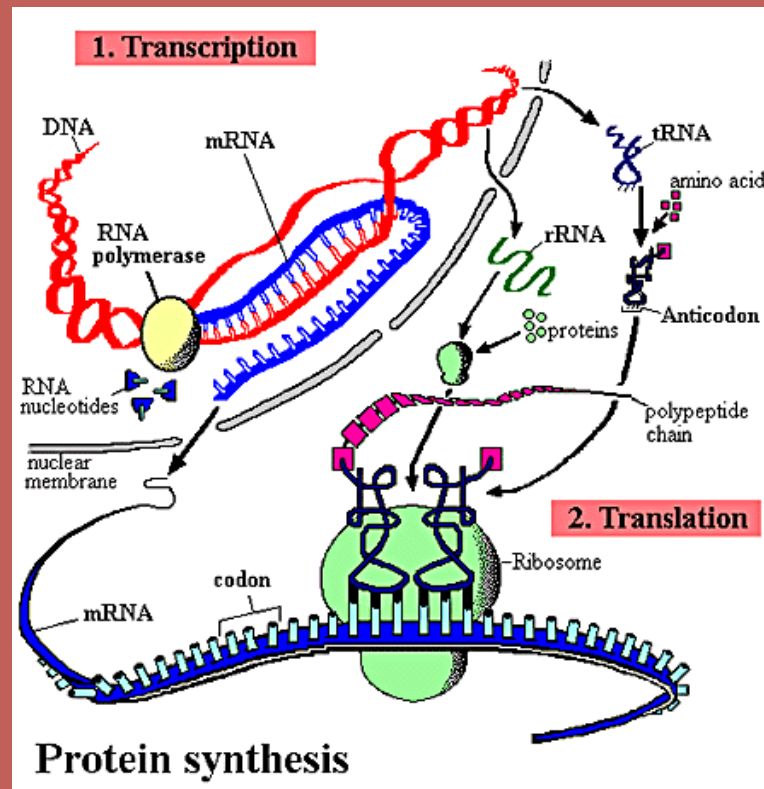


Protein Synthesis

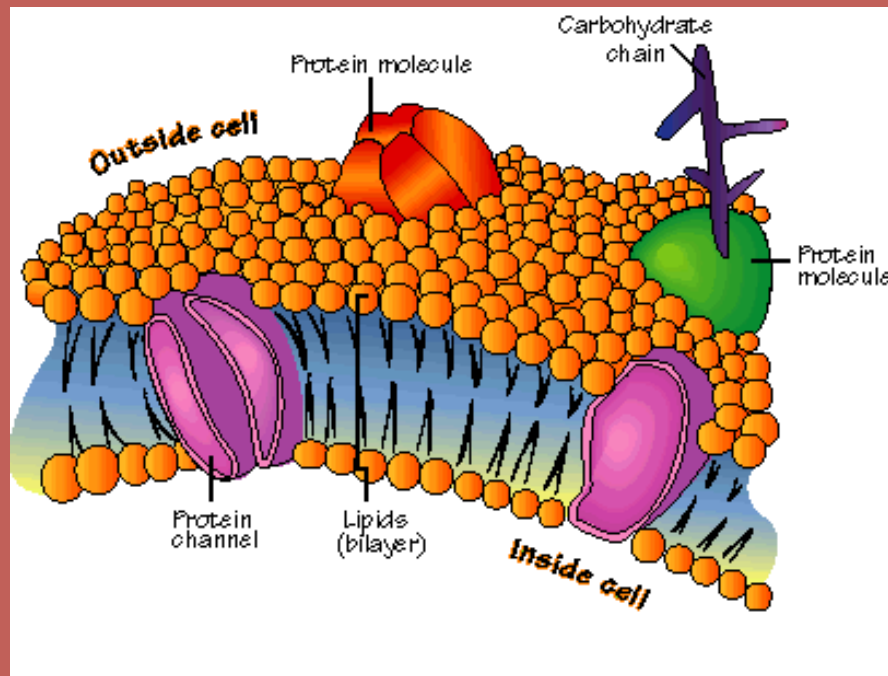
Making Proteins



Why Do We Need Proteins?

1. Cell Structure

- Cell = 80% protein



Cell membrane



Why Do We Need Proteins?

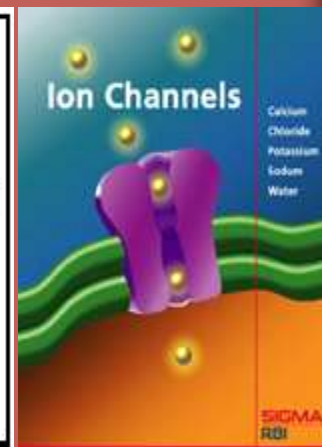
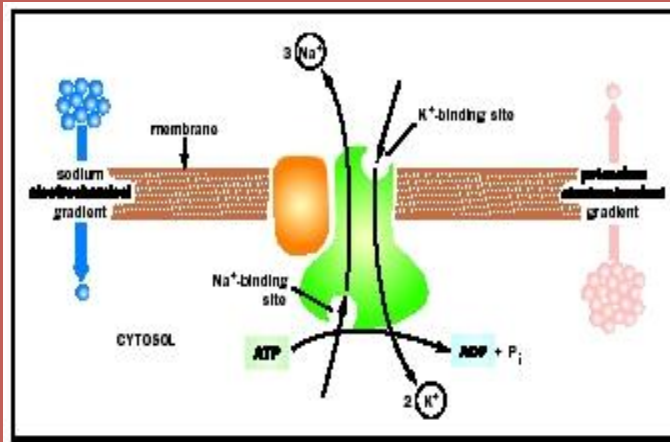
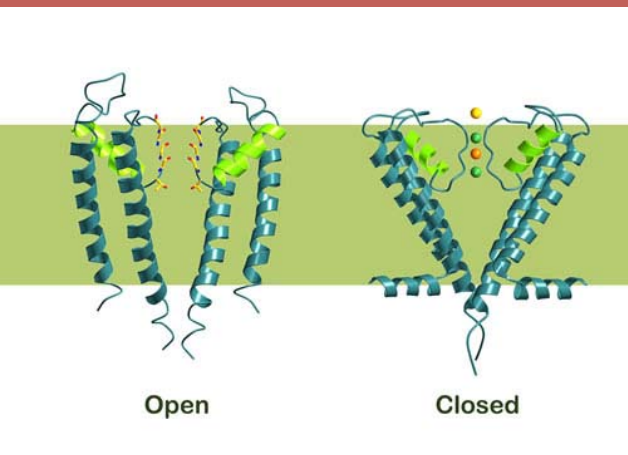
2. Cell Processes

- Hormones (signals)
- Enzymes (speed up reactions)



Why Do We Need Proteins?

- Membrane Channels
(remember transport?)



- Neurotransmitters
(carry nerve / brain messages)

What Do We Need For Protein Synthesis?

1. DNA

- Template for making mRNA during Transcription



What Do We Need For Protein Synthesis?

2. RNA

a. **mRNA** = messenger RNA

❖ makes & takes copy of DNA
to cytoplasm

b. **tRNA** = transfer RNA

❖ Matches w/ mRNA on ribosome

❖ Carries AA to add to protein chain

?s 1-7



What Do We Need For Protein Synthesis?

c. **rRNA** = ribosomal RNA

❖ Part of ribosome

❖ Reads mRNA

❖ Directs tRNA



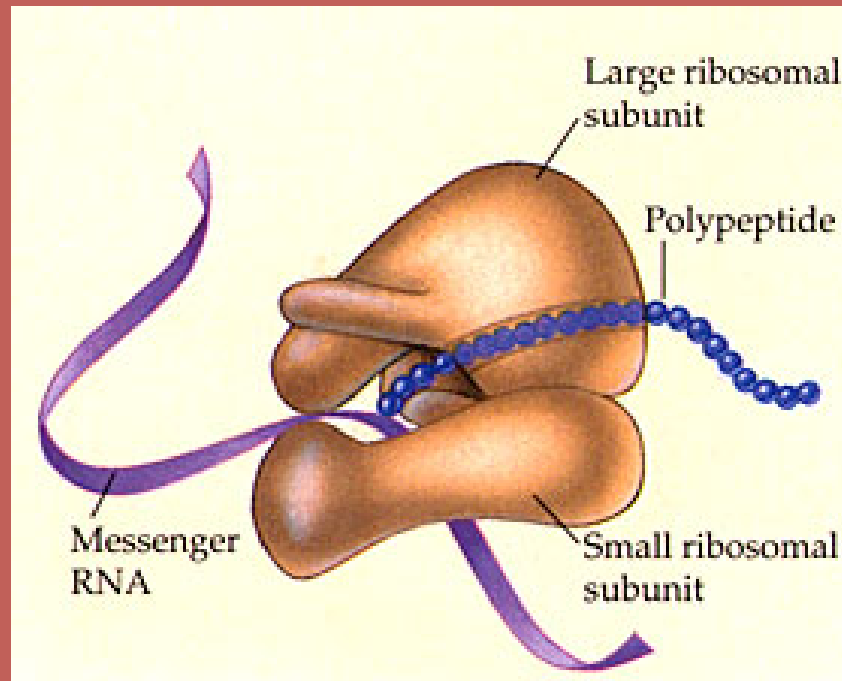
What Do We Need For Protein Synthesis?

3. Ribosome

❖ Reads mRNA

❖ Directs tRNA

❖ Creates peptide bonds between AAs
(makes polypeptide chain)



What Do We Need For Protein Synthesis?

4. Amino Acids (AAs)

- ❖ Building blocks of proteins
(20 AAs essential)
- ❖ Protein = AA chain
= polypeptide chain
- ❖ **ORDER MATTERS!**
AA order determines f(x) of protein

?s 8-12



Steps of Protein Synthesis

1. Transcription (writing the “message”)

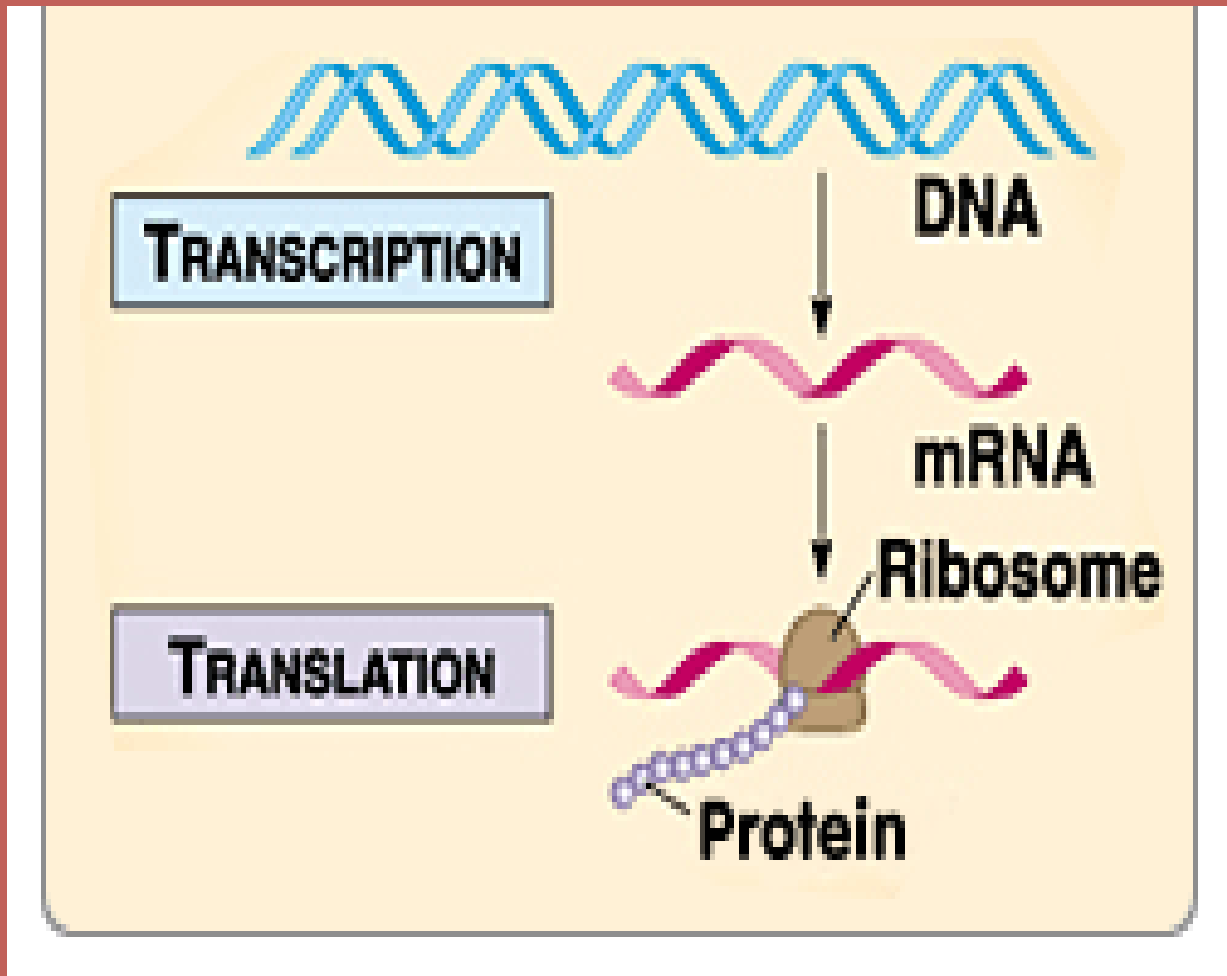
- DNA ► mRNA
messenger carries code
to cytoplasm

2. Translation (reading the “message”)

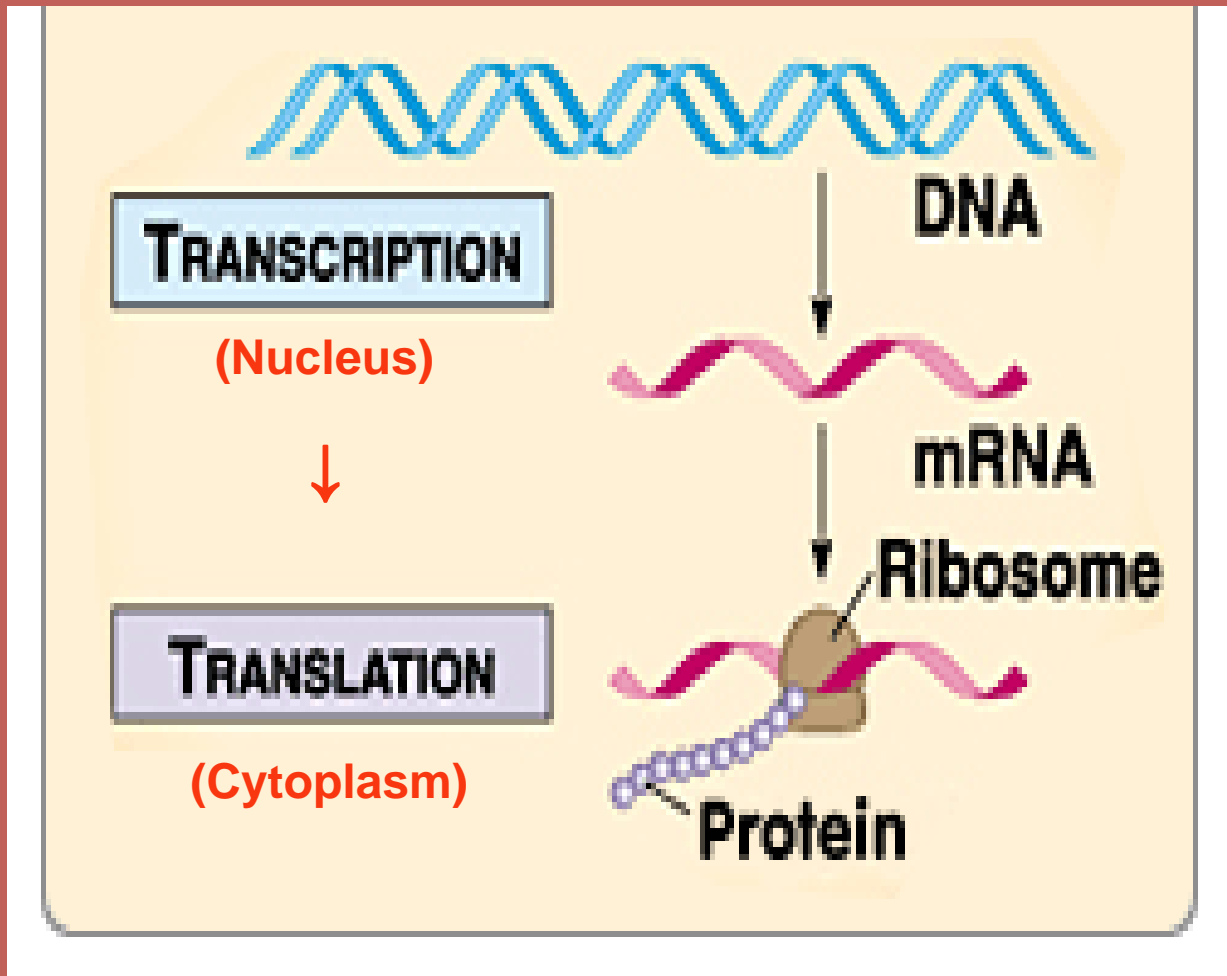
- mRNA ► tRNA ► protein (AA chain)
message translated into a **protein**



Steps of Protein Synthesis



Steps of Protein Synthesis



Transcription

DNA ► mRNA

1. Location = nucleus
2. Steps
 - a. **Enzyme** binds to DNA, unzips it
 - b. mRNA copy of gene made from DNA template
 - *U replaces T in RNA



Transcription

- 3 DNA nucleotides (triplet)
 - ▶ mRNA codon

Codons



Translation

❖ mRNA ► tRNA ► protein (AA chain)

Location = cytoplasm

(first **codon** in mRNA is
the **start codon AUG**)

?s 13-17



Translation

Steps of Translation

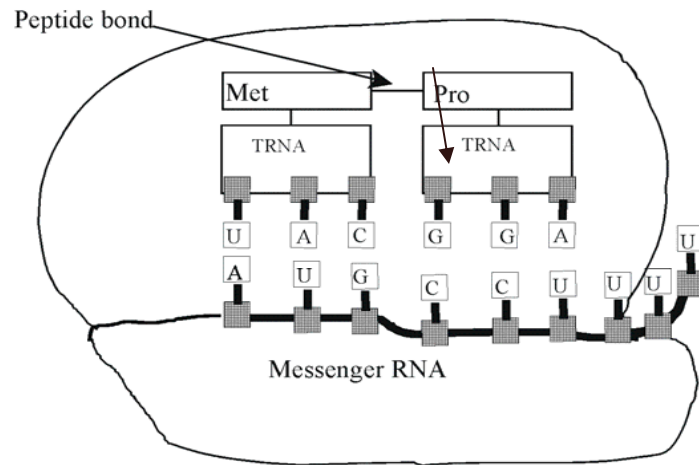
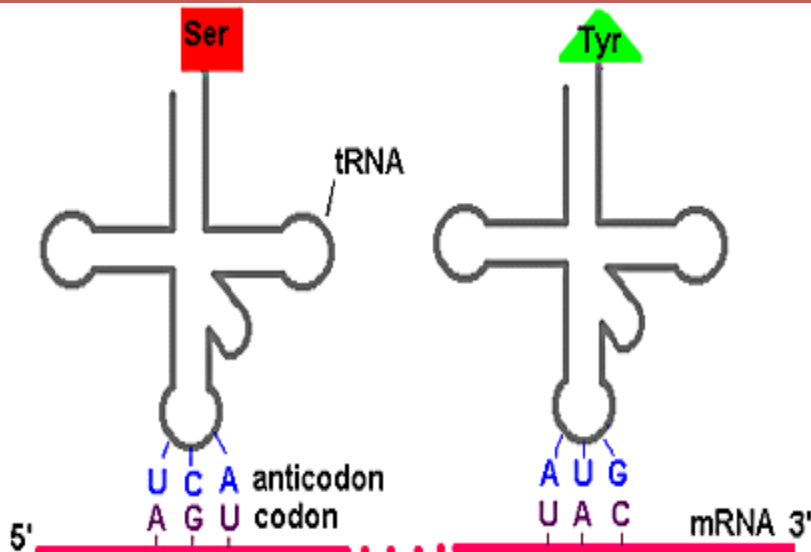
1. mRNA moves to cytoplasm,
binds to ribosome
2. tRNA **anticodon** UAC brings
AA (methionine)
to mRNA **codon**
on ribosome



Translation

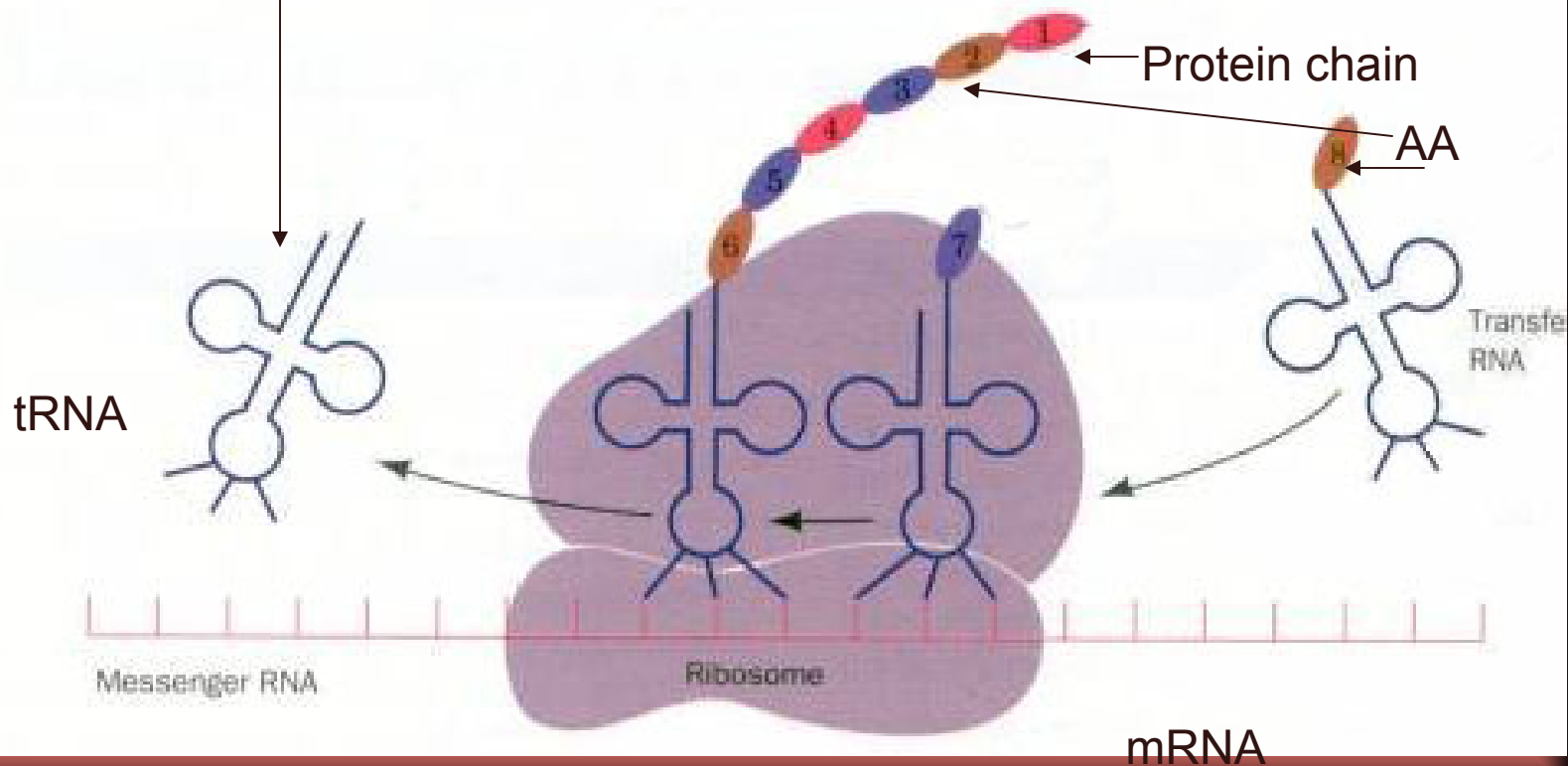
3. Ribosome moves down mRNA to next **codon**

4. tRNA **anticodon** brings & attaches next AA with peptide bond



Translation

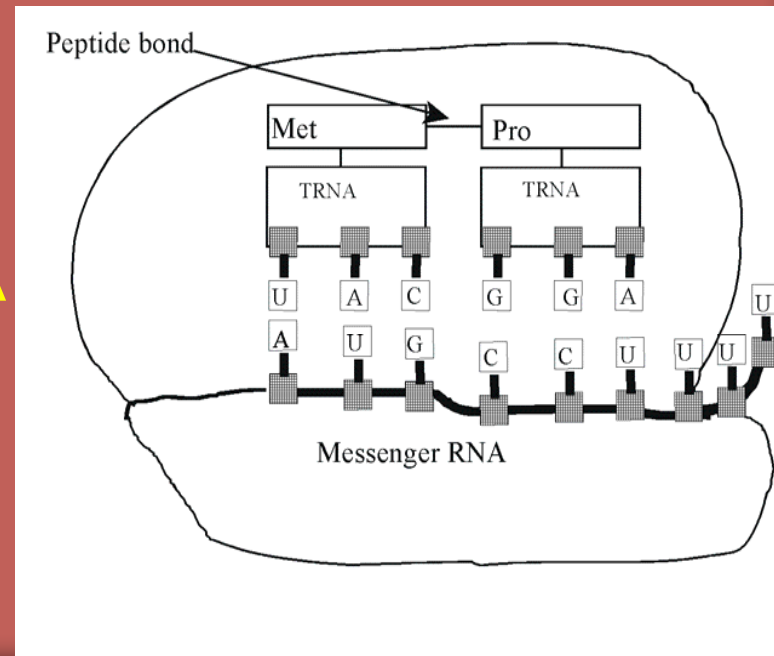
5. **tRNA** leaves ribosome
once AA attached



Translation

- Steps 1-5 repeated, adding AAs until **STOP CODON** *
signals end of protein
- Polypeptide chain released from ribosome

* UAG, UAA, or UGA



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC		
GGA		
CCT		
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	
GGA		
CCT		
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA		
CCT		
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	
CCT		
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT		
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	CCU
TAT		
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	CCU
TAT	AUA	
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	CCU
TAT	AUA	UAU
ACT		



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	CCU
TAT	AUA	UAU
ACT	UGA	



Synthesis Practice

DNA Triplet	mRNA Codon	tRNA Anti-codon
TAC	AUG	UAC
GGA	CCU	GGA
CCT	GGA	CCU
TAT	AUA	UAU
ACT	UGA	ACU



AMINO ACID FUN!!

DNA Triplet: ACC

mRNA codon: UGG

tRNA anti-codon: ACC

Amino acid: Tryptophan

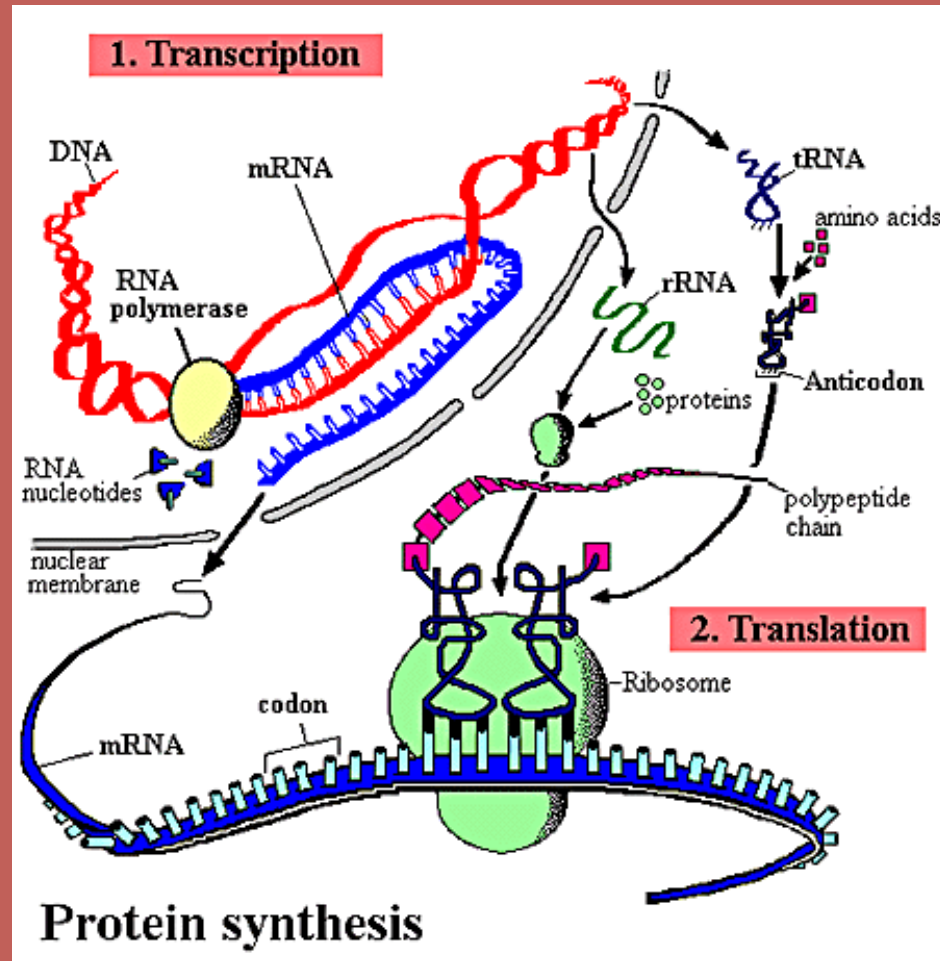
Why you should know this?

Tryptophan is in **TURKEY** – makes you sleepy



Protein Synthesis Animation

<http://www.columbia.edu/cu/biology/courses/c2005/images/animtransln.gif>



?s 18-25