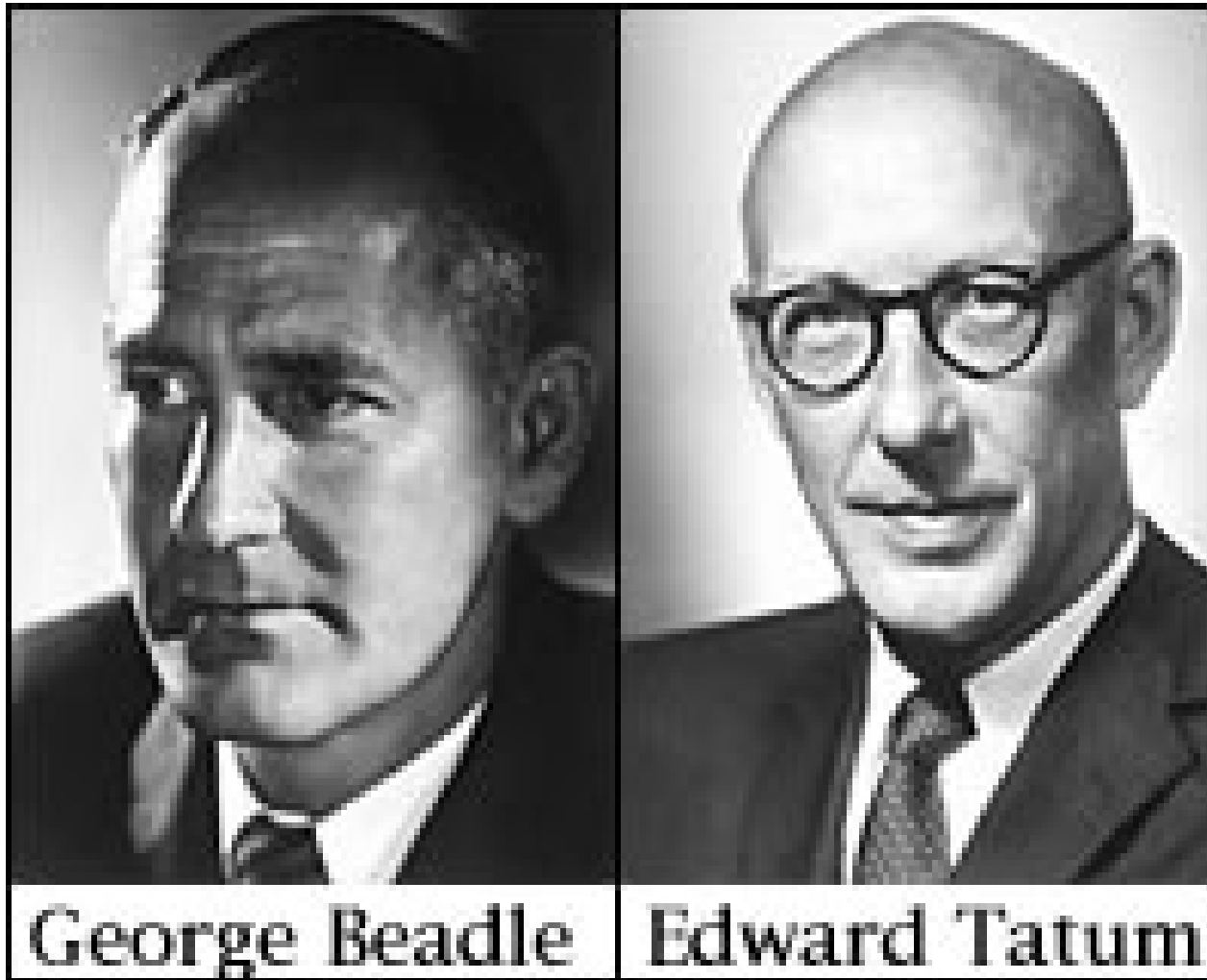


# Pre – AP Biology

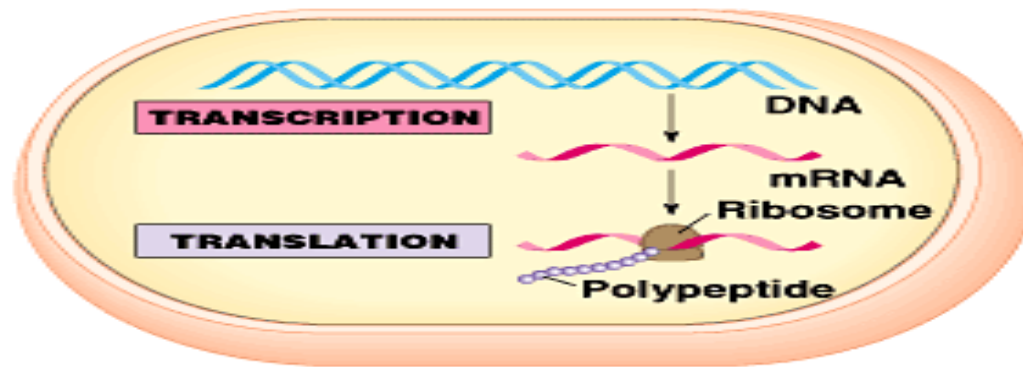
## Protein Synthesis (4.2)

### Part 1

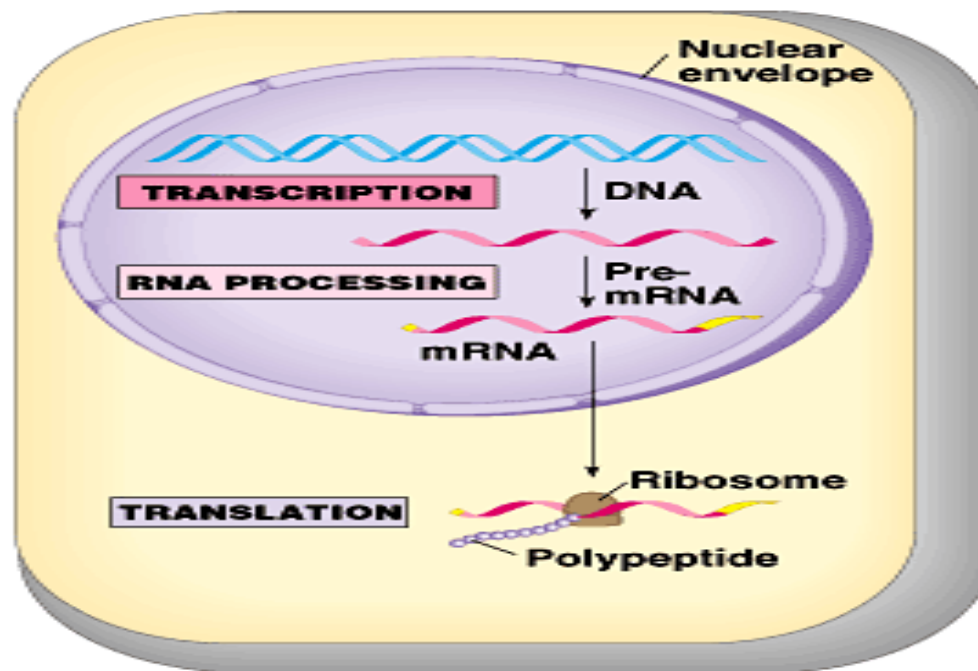
# George Beadle & Edward Tatum



# Transcription & Translation in Prokaryotic cells and Eukaryotic cells

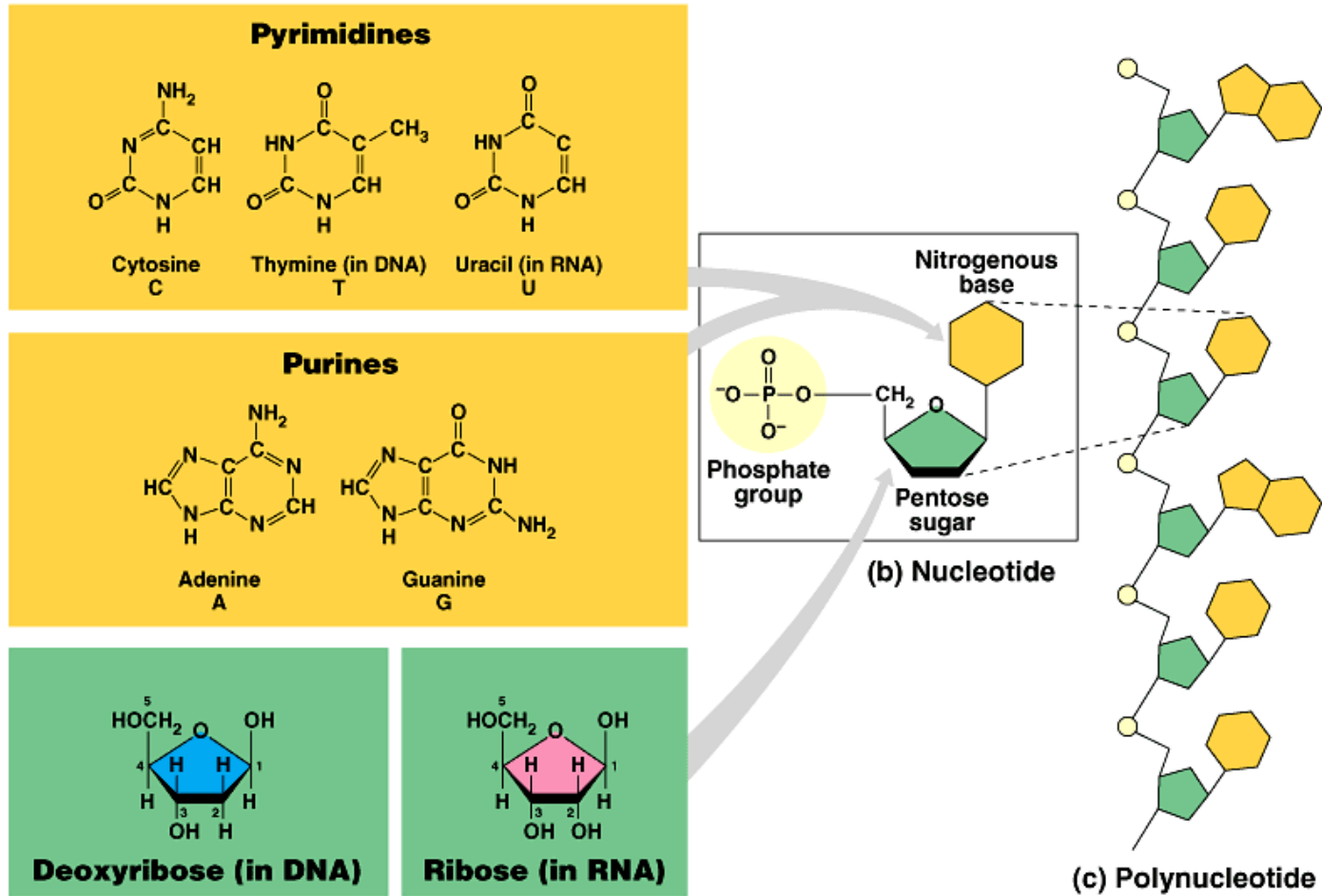


(a) Prokaryotic cell



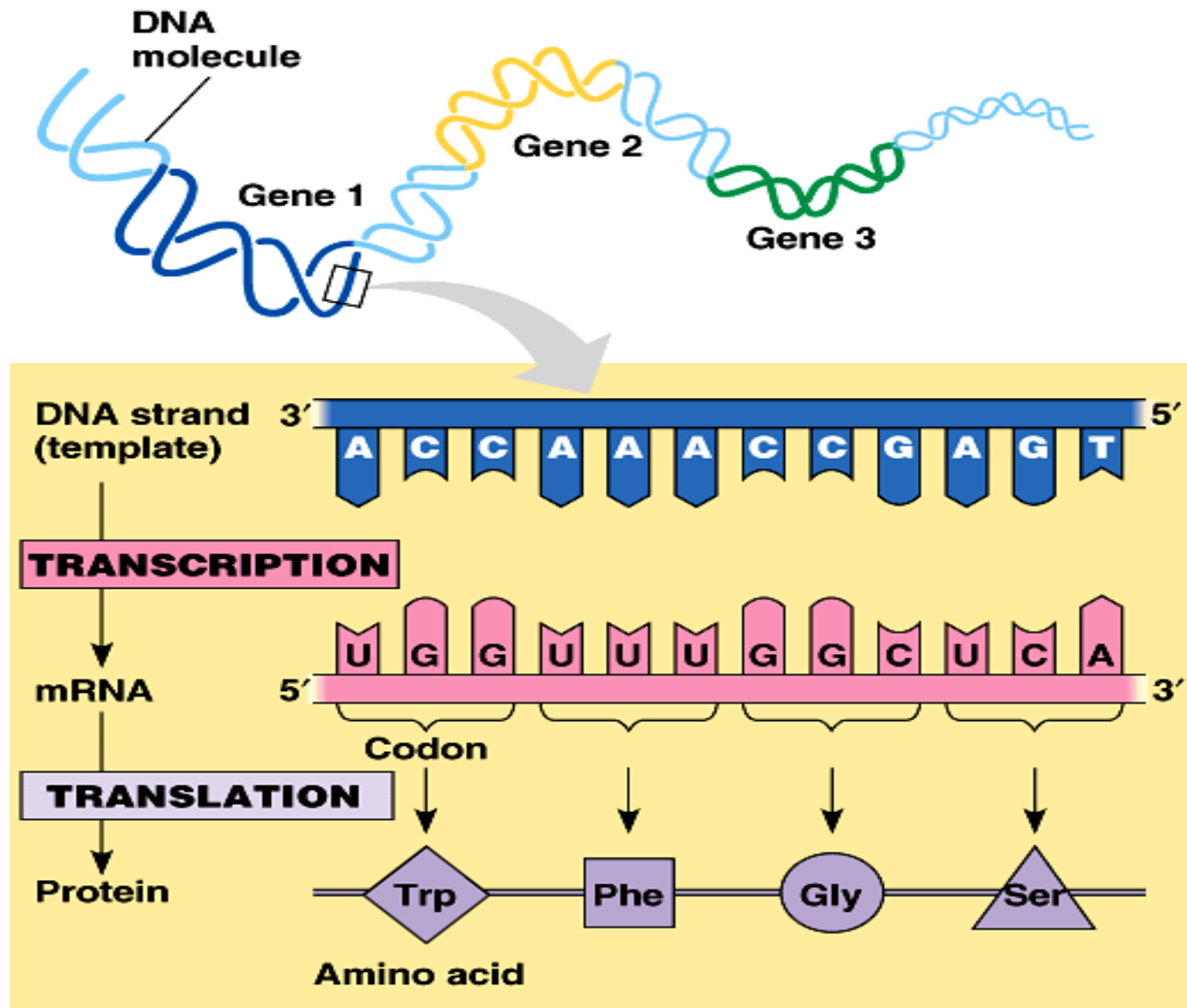
(b) Eukaryotic cell

# DNA(Long term) vs. RNA (Short term)



# Transcription & Translation

Can you “see” the “function” in the name?



# Chargaff's Rule

Adenine = Thymine (DNA) or Uracil (RNA)

&

Guanine = Cytosine

If you know the % composition of 1, you can find the % composition of the other 3.

# Marshall Nirenberg



# RNA codon chart

This uses the nucleotide sequence on the mRNA

		Second base					
		U	C	A	G		
First base (5' end)	U	UUU	UCU	UAU	UGU	U	
		UUC	UCC	UAC	UGC		C
		UUA	UCA	UAA Stop	UGA Stop		A
		UUG	UCG	UAG Stop	UGG Trp		G
	C	CUU	CCU	CAU	CGU	U	
		CUC	CCC	CAC	CGC		C
		CUA	CCA	CAA	CGA		A
		CUG	CCG	CAG	CGG		G
	A	AUU	ACU	AAU	AGU	U	
		AUC	ACC	AAC	AGC		C
		AUA	ACA	AAA	AGA		A
		AUG Met or start	ACG	AAG	AGG		G
	G	GUU	GCU	GAU	GGU	U	
		GUC	GCC	GAC	GGC		C
		GUA	GCA	GAA	GGA		A
		GUG	GCG	GAG	GGG		G



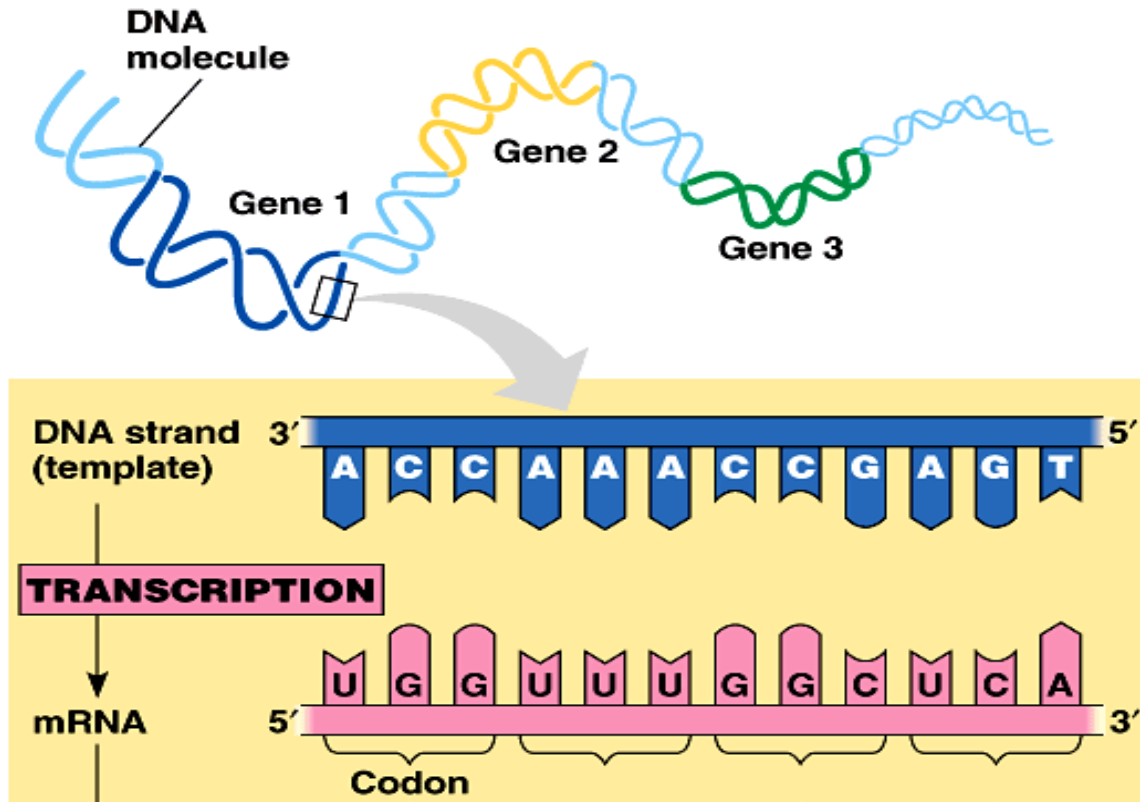
# Pre – AP Biology

## Protein Synthesis (4.2)

### Part 2

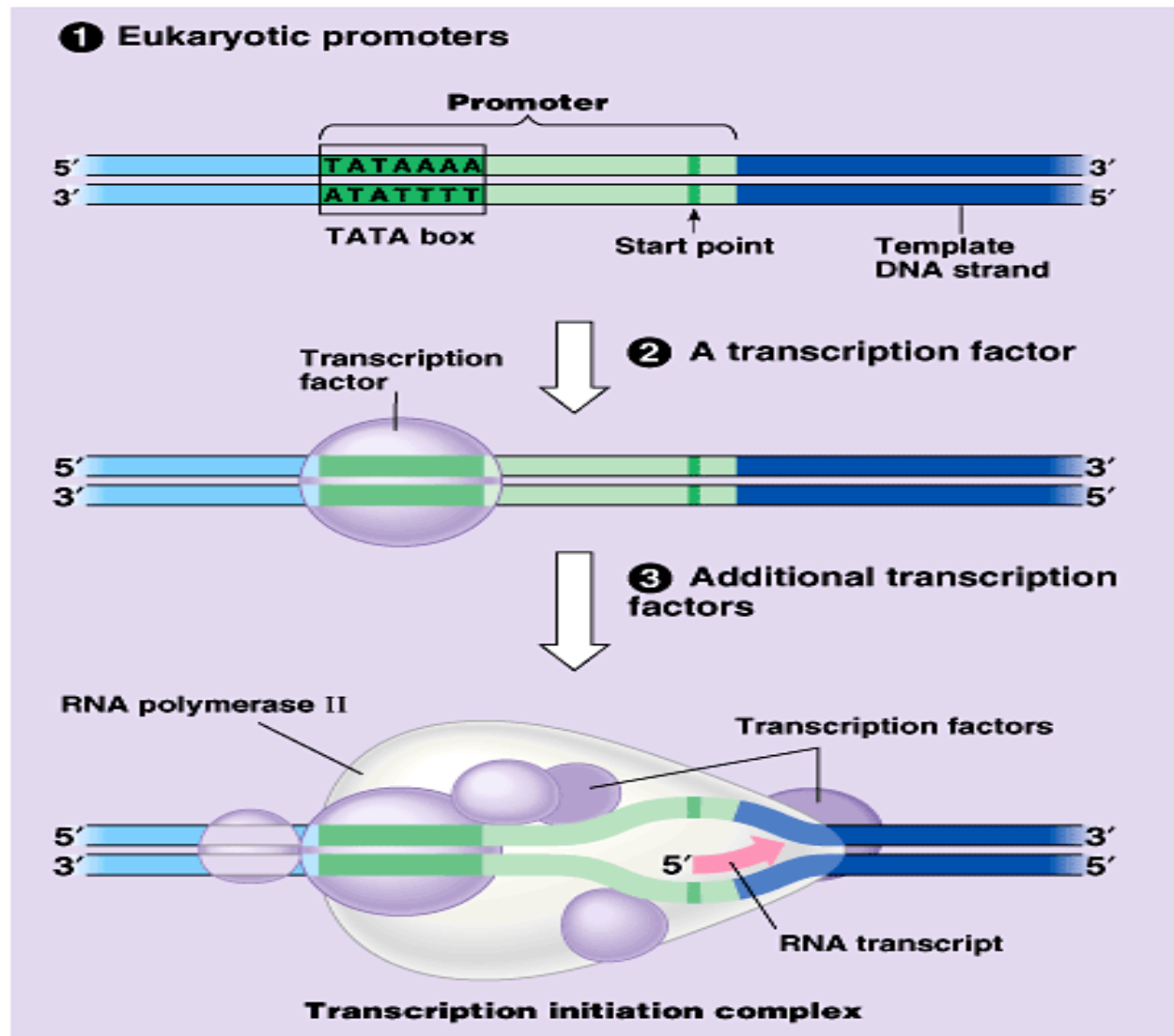
# Transcription

Making DNA code into RNA code

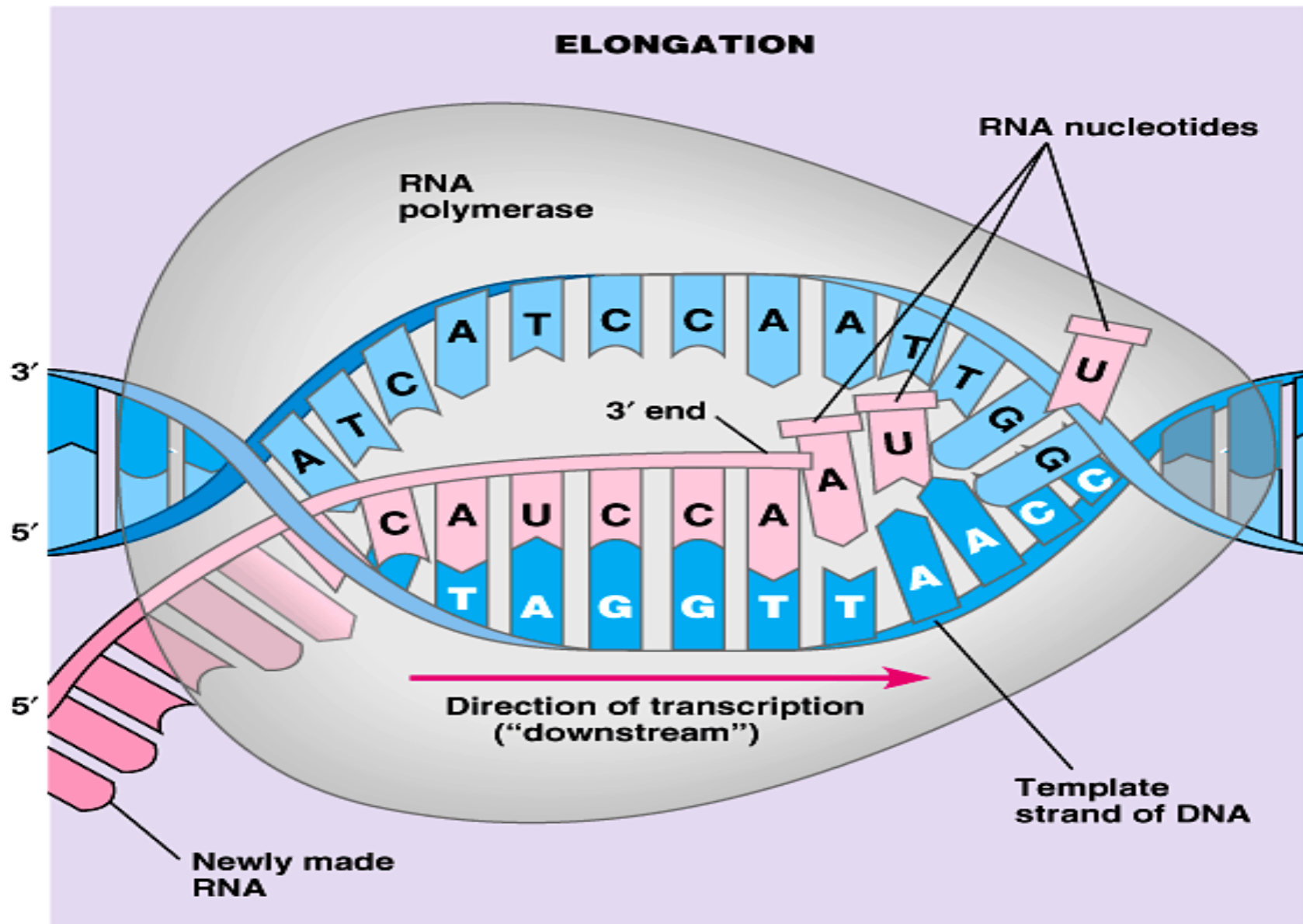


# Initiation - "Build the factory"

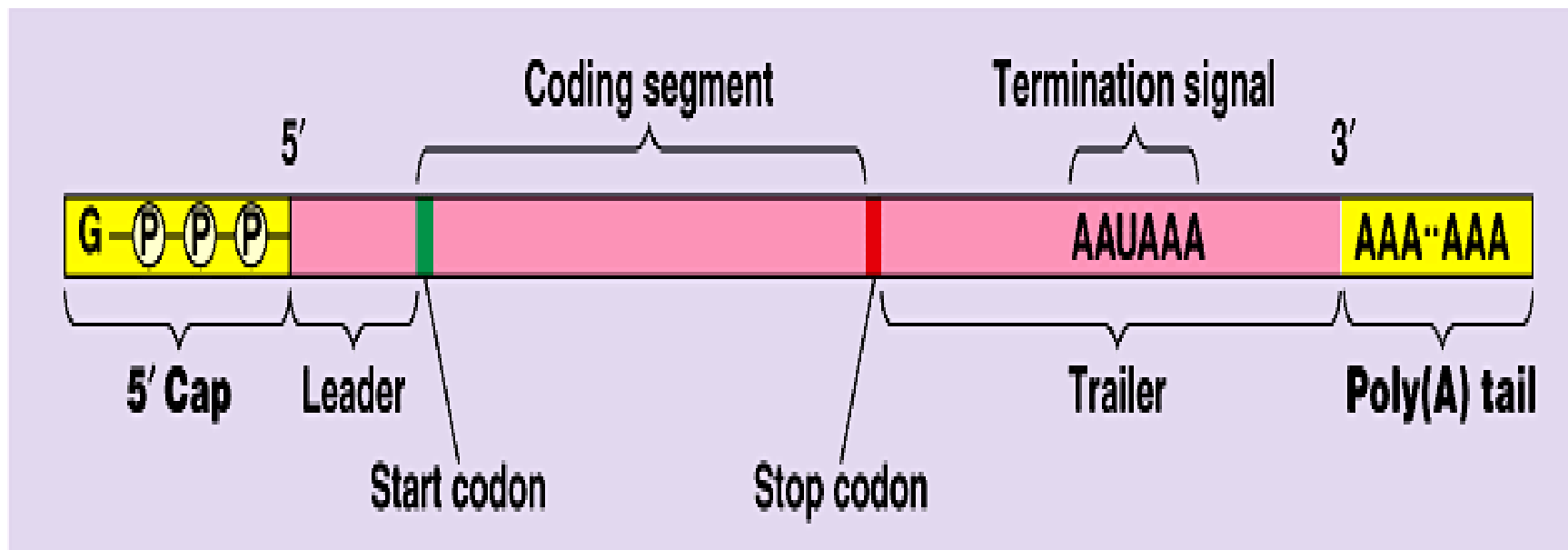
See the "factory" of enzymes at the bottom?



# Elongation – adding nucleotides



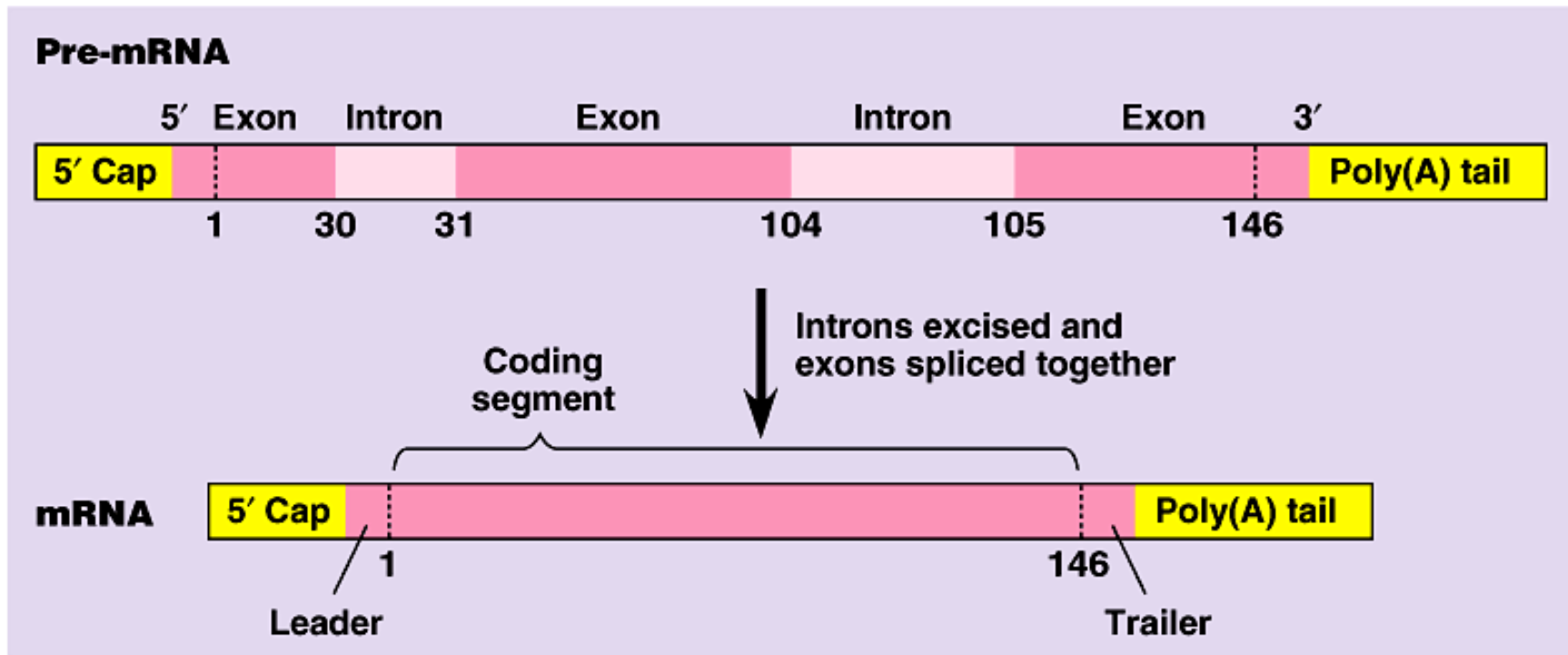
# Termination



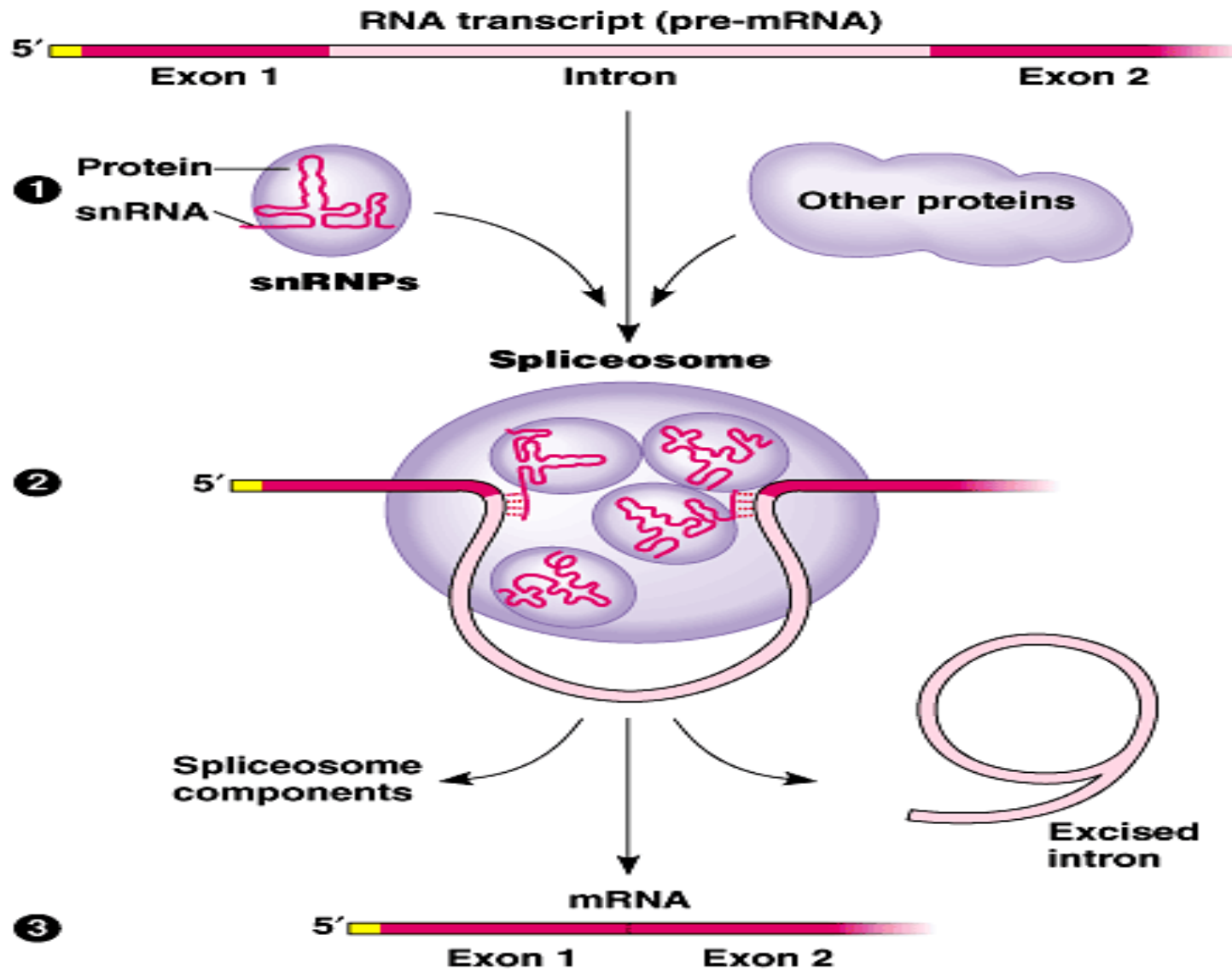
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# Post Transcription Modification

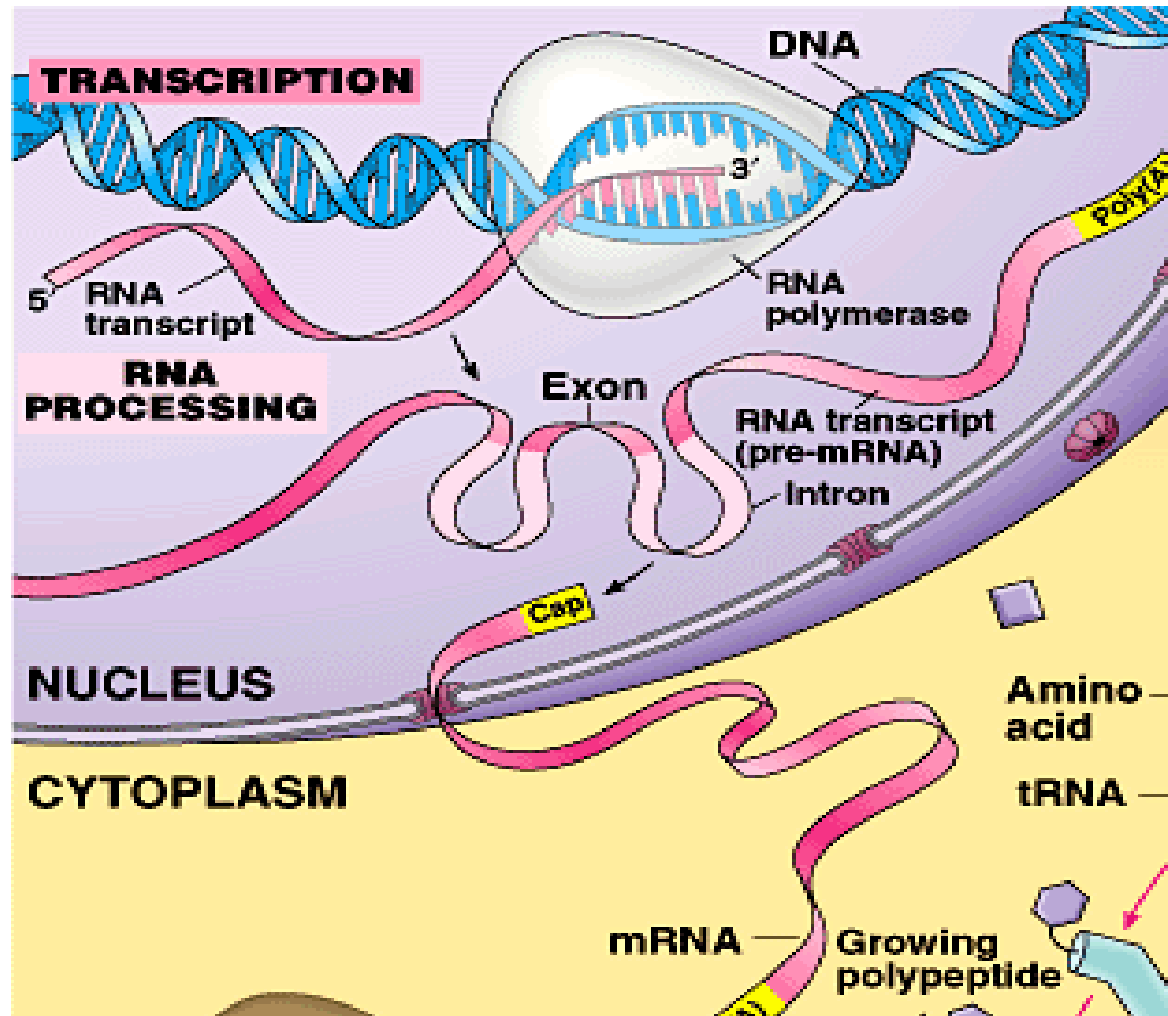
Primary transcript will be *modified* to become secondary transcript



# Spliceosomes *removing* introns



mRNA will leave the nucleus now





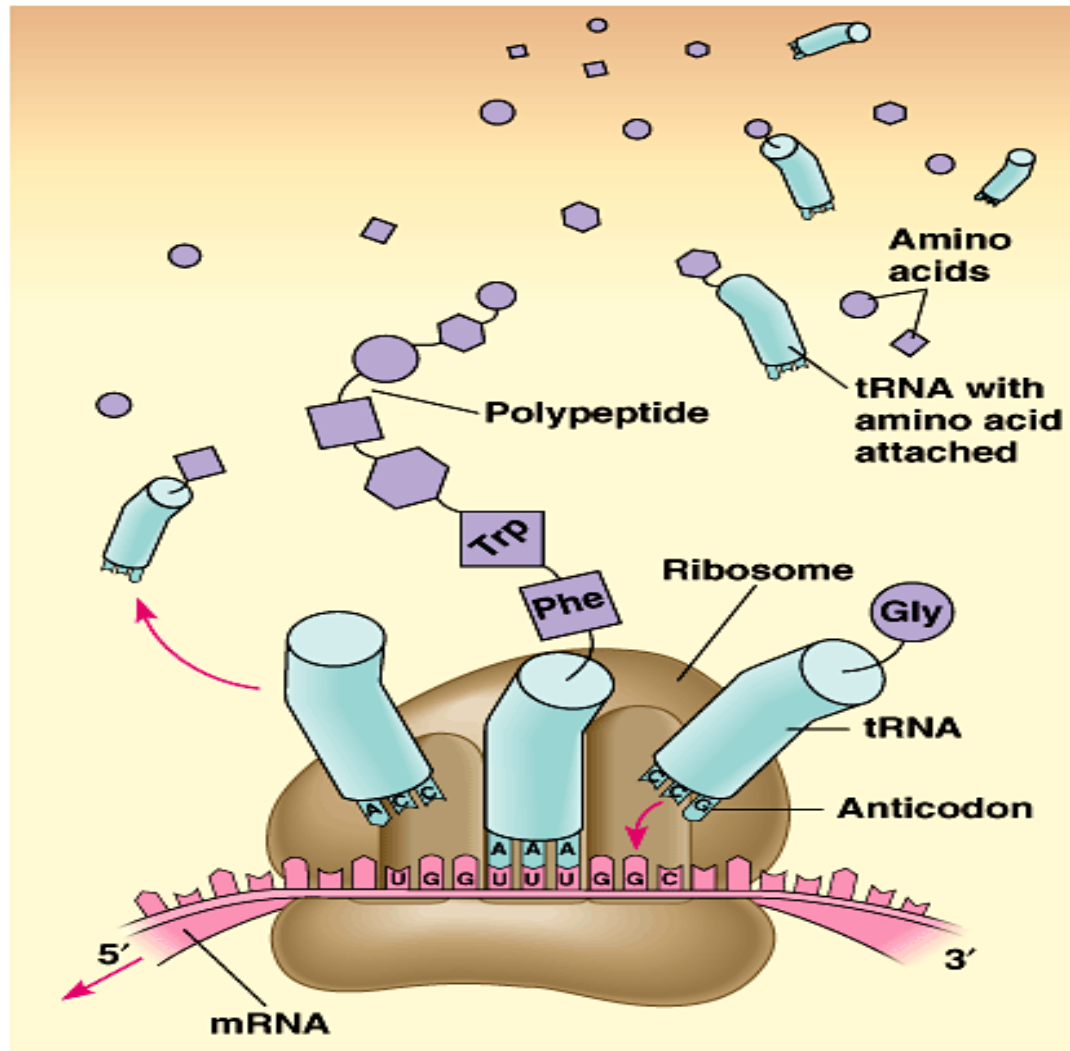
# Pre – AP Biology

## Protein Synthesis (4.2)

### Part 3

# Translation by the Ribosome

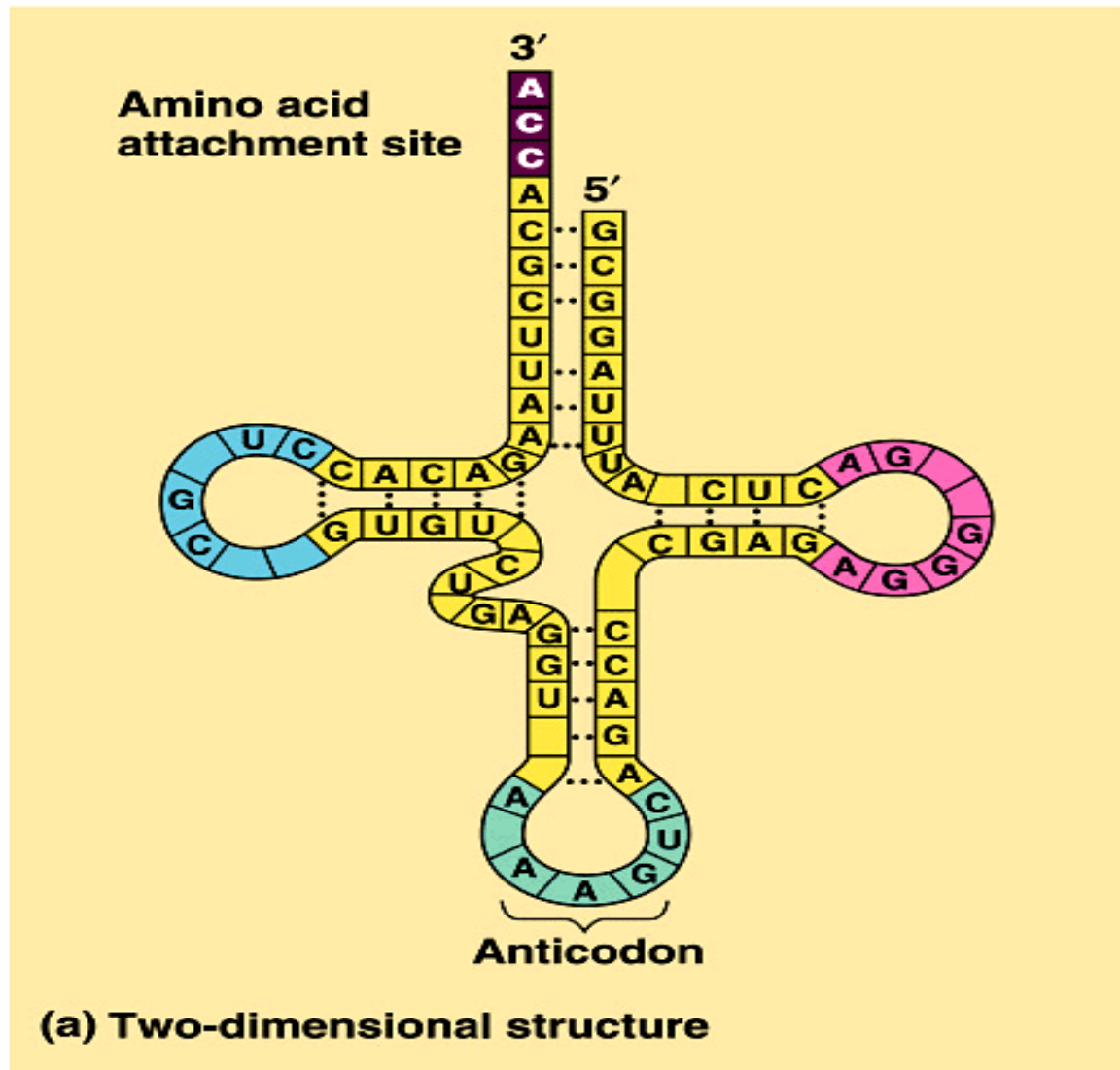
Turning the nucleotide mRNA sequence into a sequence of amino acids



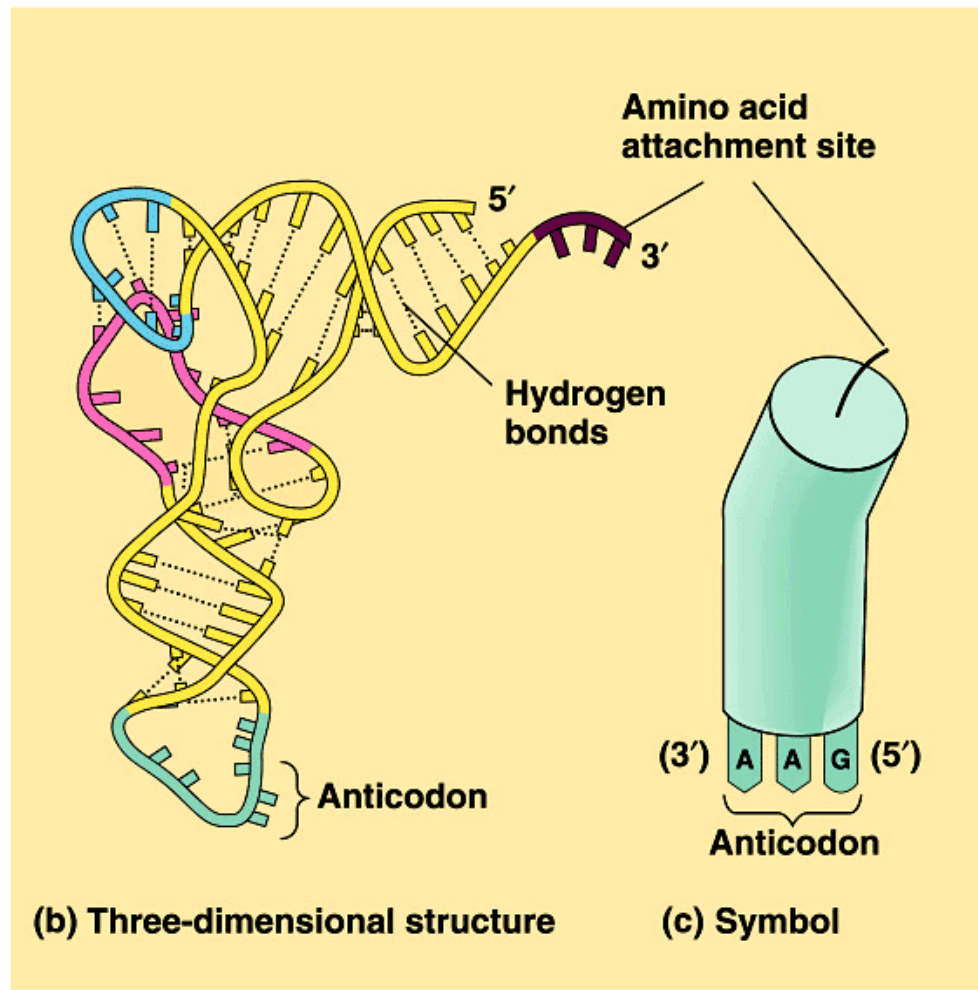
# Amino Acid Codon Chart

		Second base					
		U	C	A	G		
First base (5' end)	U	UUU } Phe	UCU } Ser	UAU } Tyr	UGU } Cys	U	
		UUC } Phe	UCC } Ser	UAC } Tyr	UGC } Cys	C	
		UUA } Leu	UCA } Ser	UAA Stop	UGA Stop	A	
		UUG } Leu	UCG } Ser	UAG Stop	UGG Trp	G	
	C	CUU } Leu	CCU } Pro	CAU } His	CGU } Arg	U	
		CUC } Leu	CCC } Pro	CAC } His	CGC } Arg	C	
		CUA } Leu	CCA } Pro	CAA } Gln	CGA } Arg	A	
		CUG } Leu	CCG } Pro	CAG } Gln	CGG } Arg	G	
	A	AUU } Ile	ACU } Thr	AAU } Asn	AGU } Ser	U	
		AUC } Ile	ACC } Thr	AAC } Asn	AGC } Ser	C	
		AUA } Ile	ACA } Thr	AAA } Lys	AGA } Arg	A	
		AUG Met or start	ACG } Thr	AAG } Lys	AGG } Arg	G	
	G	GUU } Val	GCU } Ala	GAU } Asp	GGU } Gly	U	
		GUC } Val	GCC } Ala	GAC } Asp	GGC } Gly	C	
		GUA } Val	GCA } Ala	GAA } Glu	GGA } Gly	A	
		GUG } Val	GCG } Ala	GAG } Glu	GGG } Gly	G	

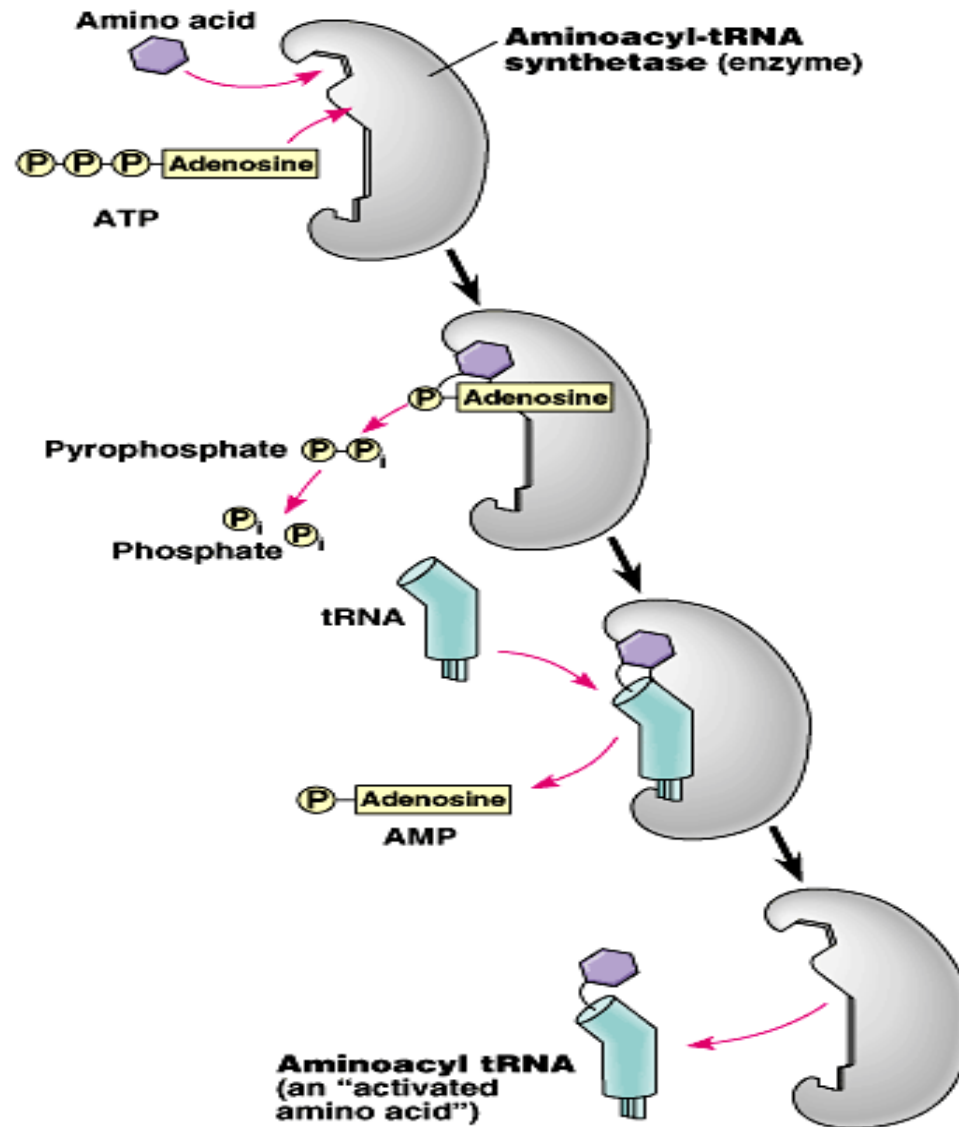
# Transfer RNA molecule structure up close



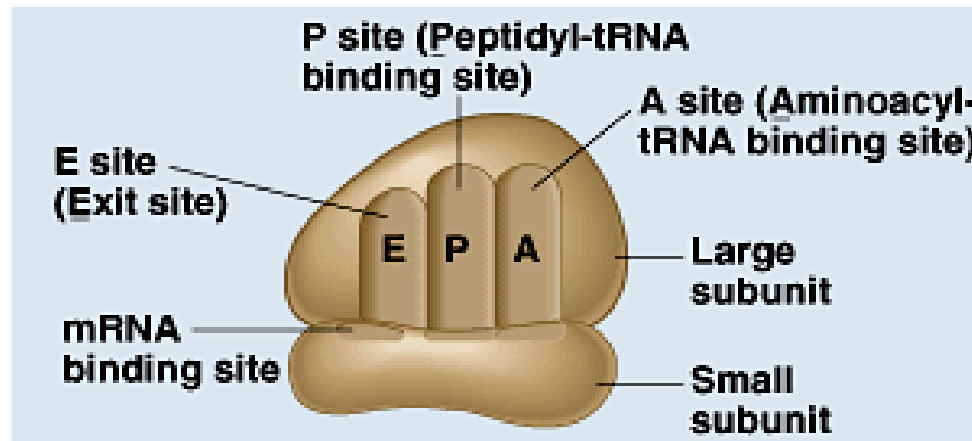
# Transfer RNA molecule again



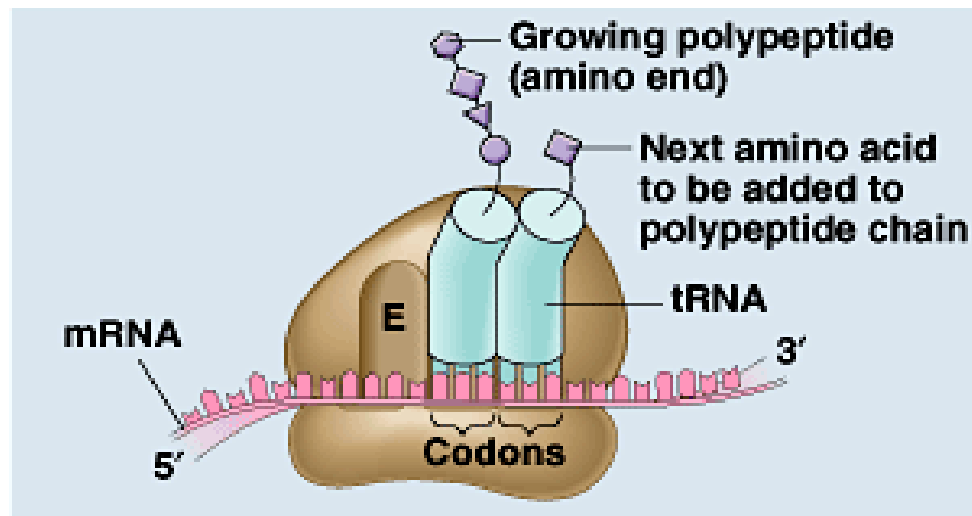
# Using **enzymes** and **ATP (energy)** to *combine* a tRNA molecule with an Amino Acid



# Ribosome structure

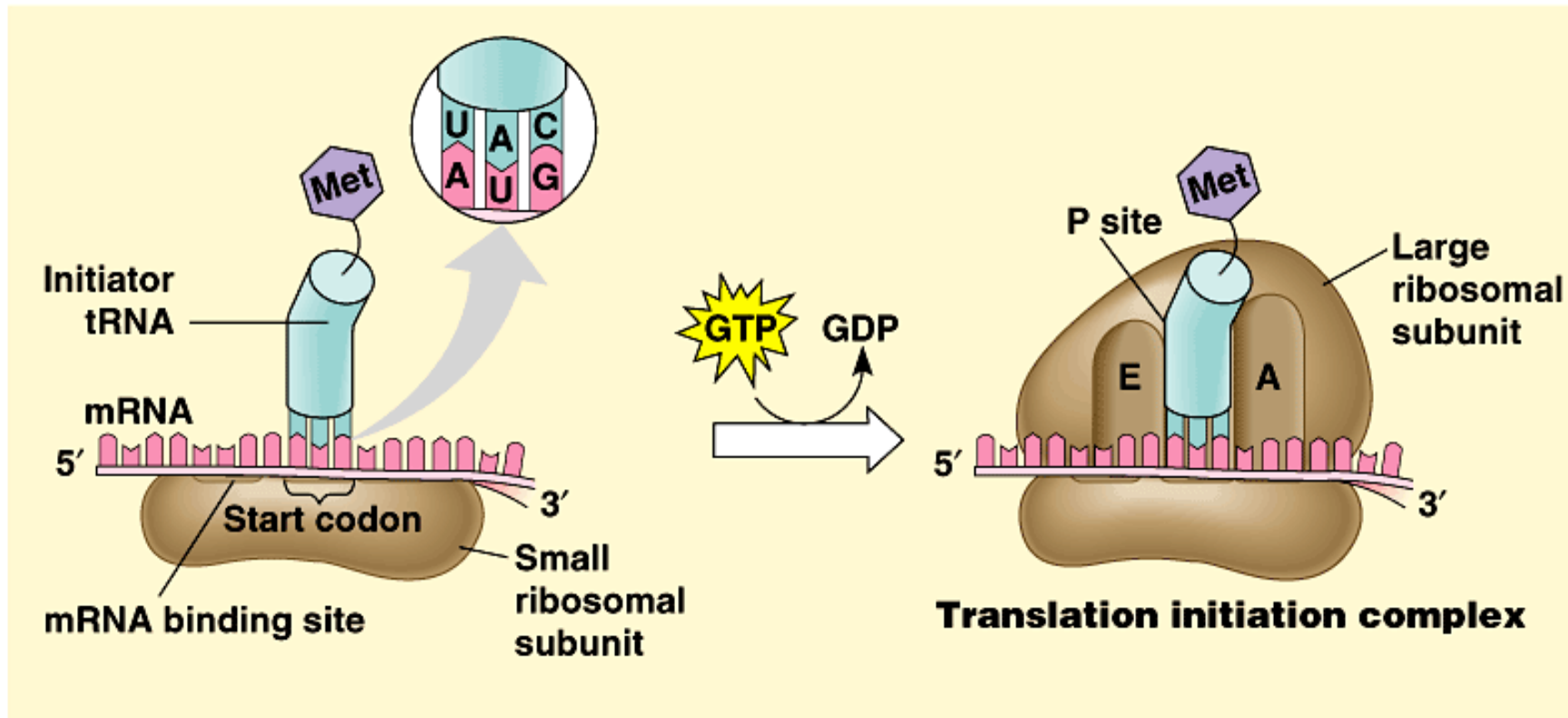


**(b) Schematic model showing binding sites**



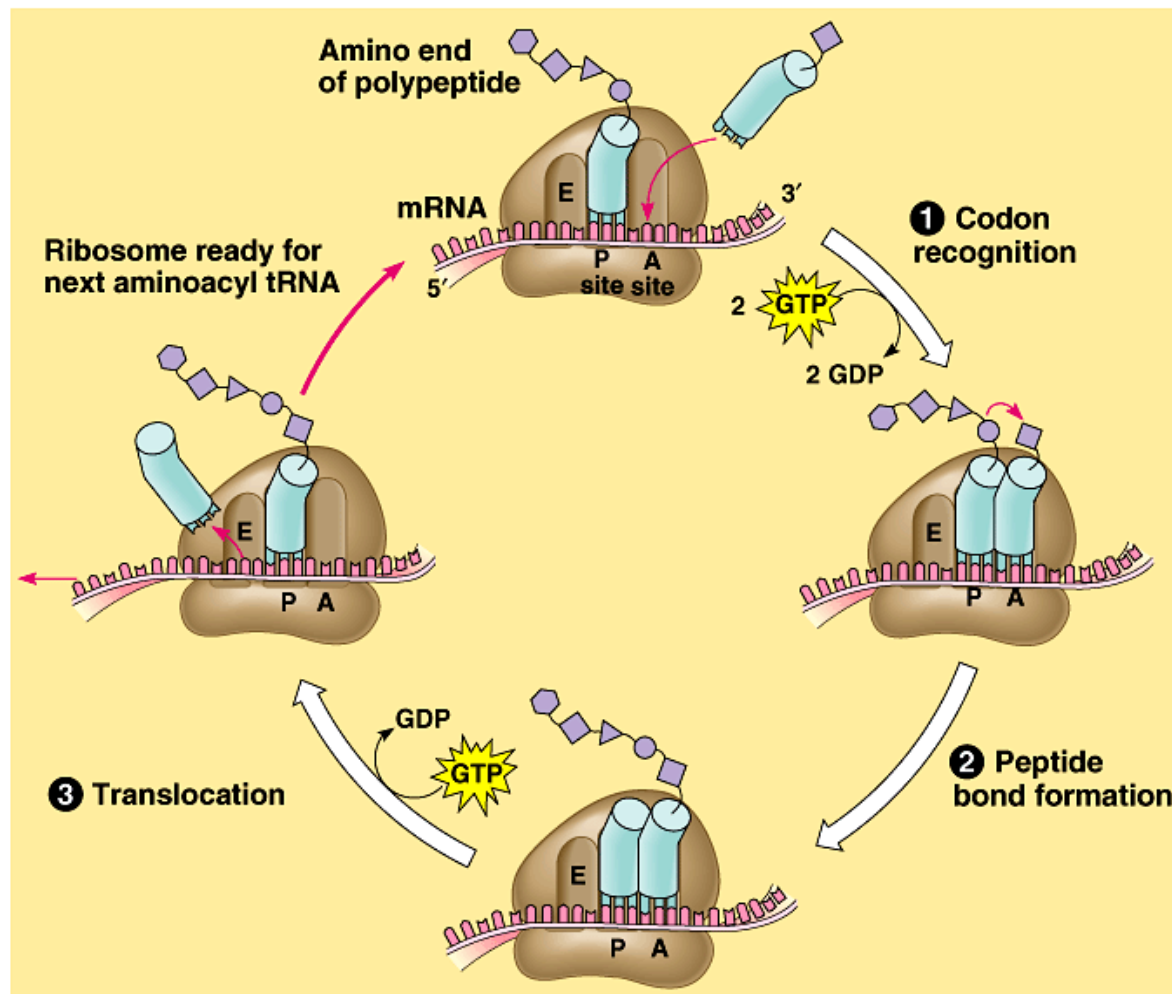
**(c) Schematic model with mRNA and tRNA**

# Initiation - “Build the factory”

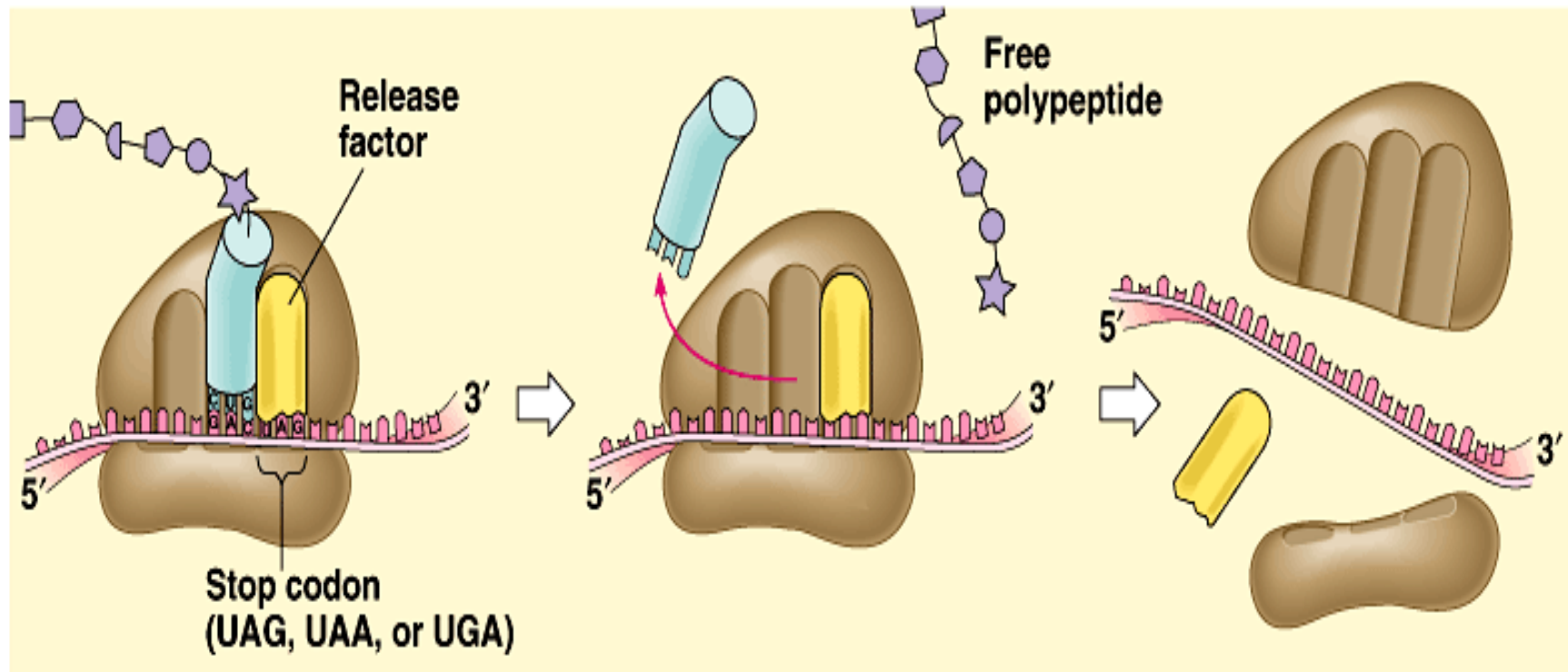




# Elongation by translocation



# Termination – *releasing* the 1' of Amino Acids

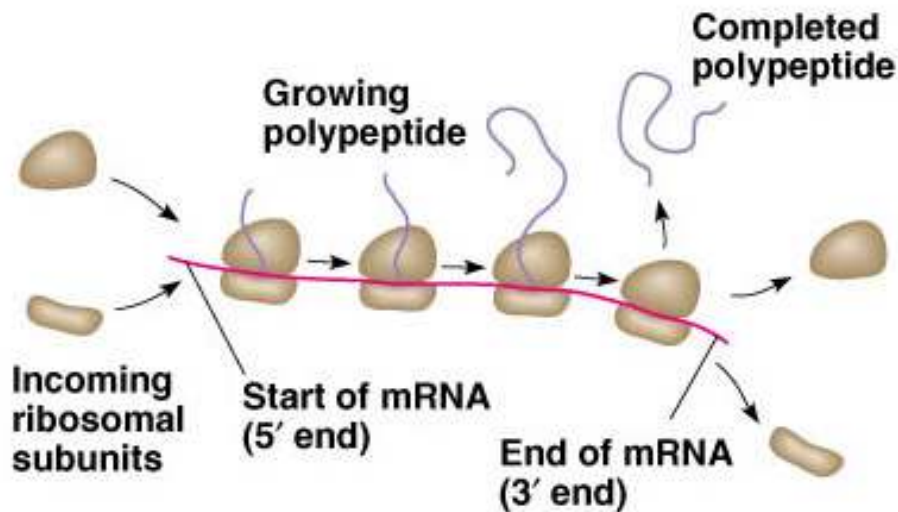


1

2

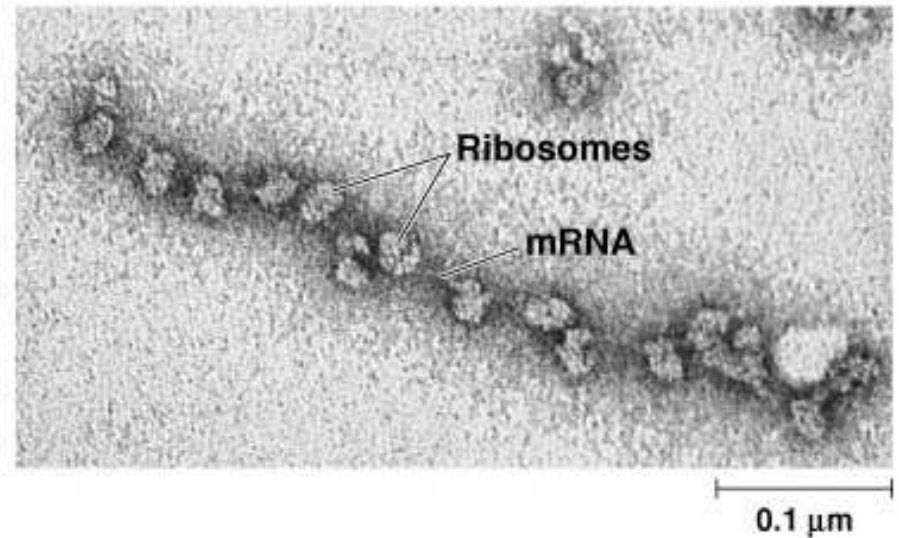
3

# Polyribosomes



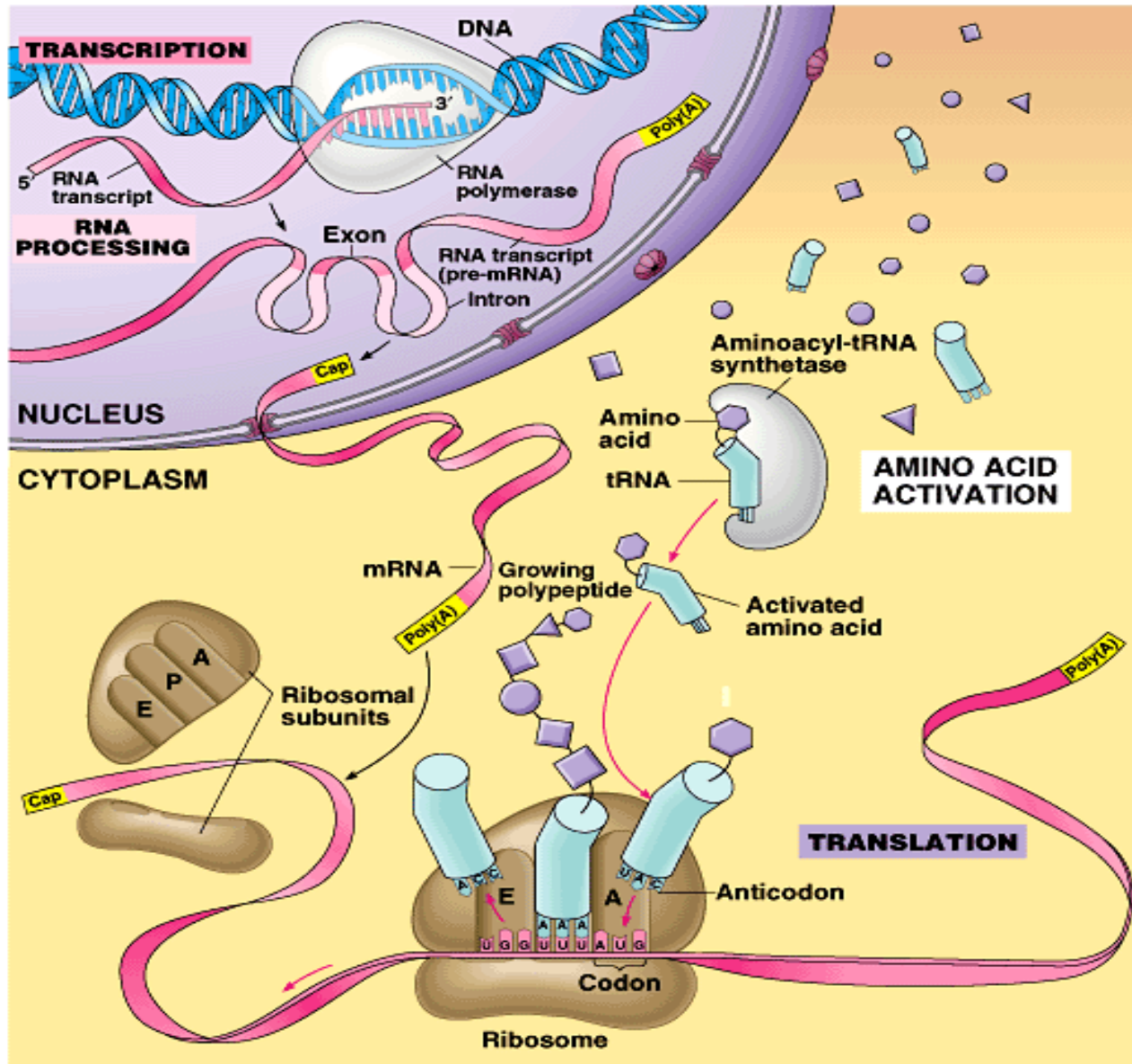
(a) An mRNA molecule is generally translated simultaneously by several ribosomes in clusters called polyribosomes.

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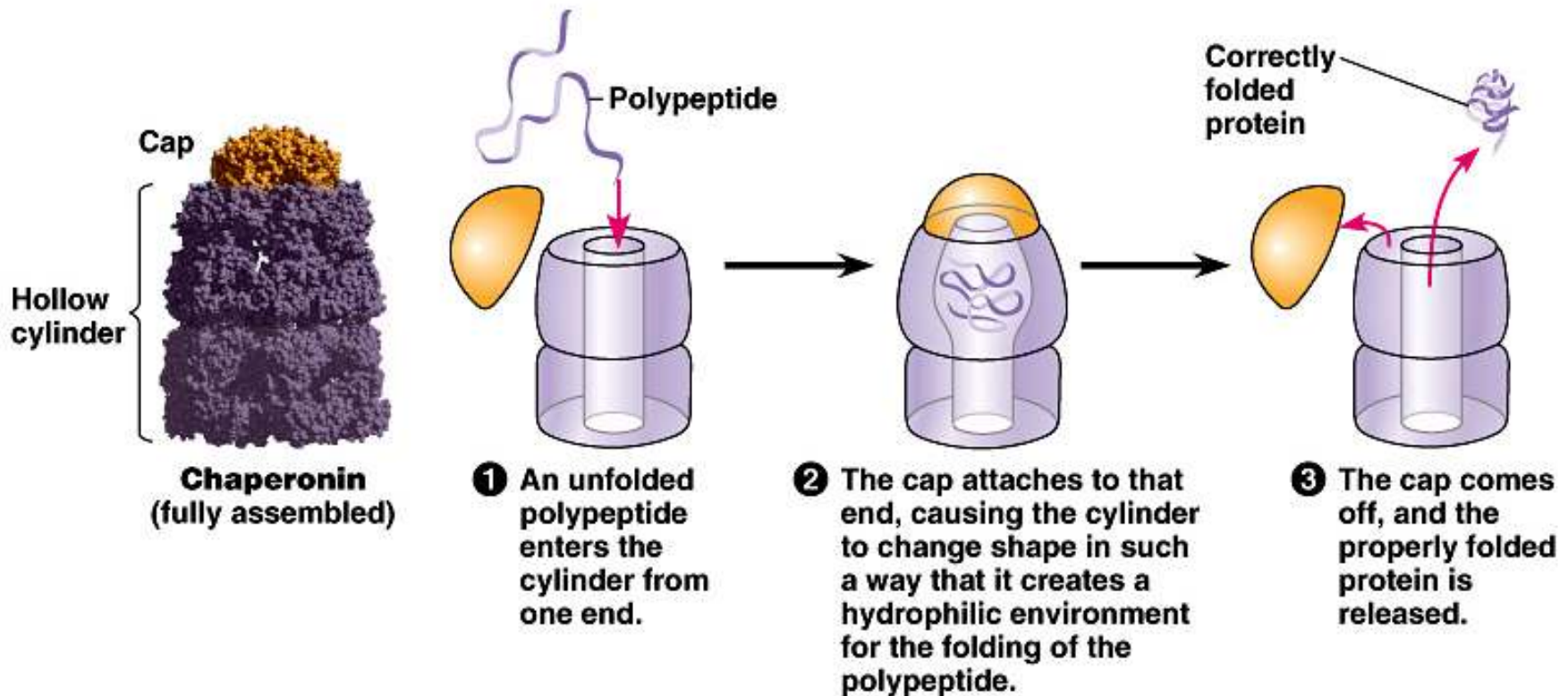
(b) This micrograph shows a large polyribosome in a prokaryotic cell (TEM).

# The **BIG** Picture



# Chaperonin

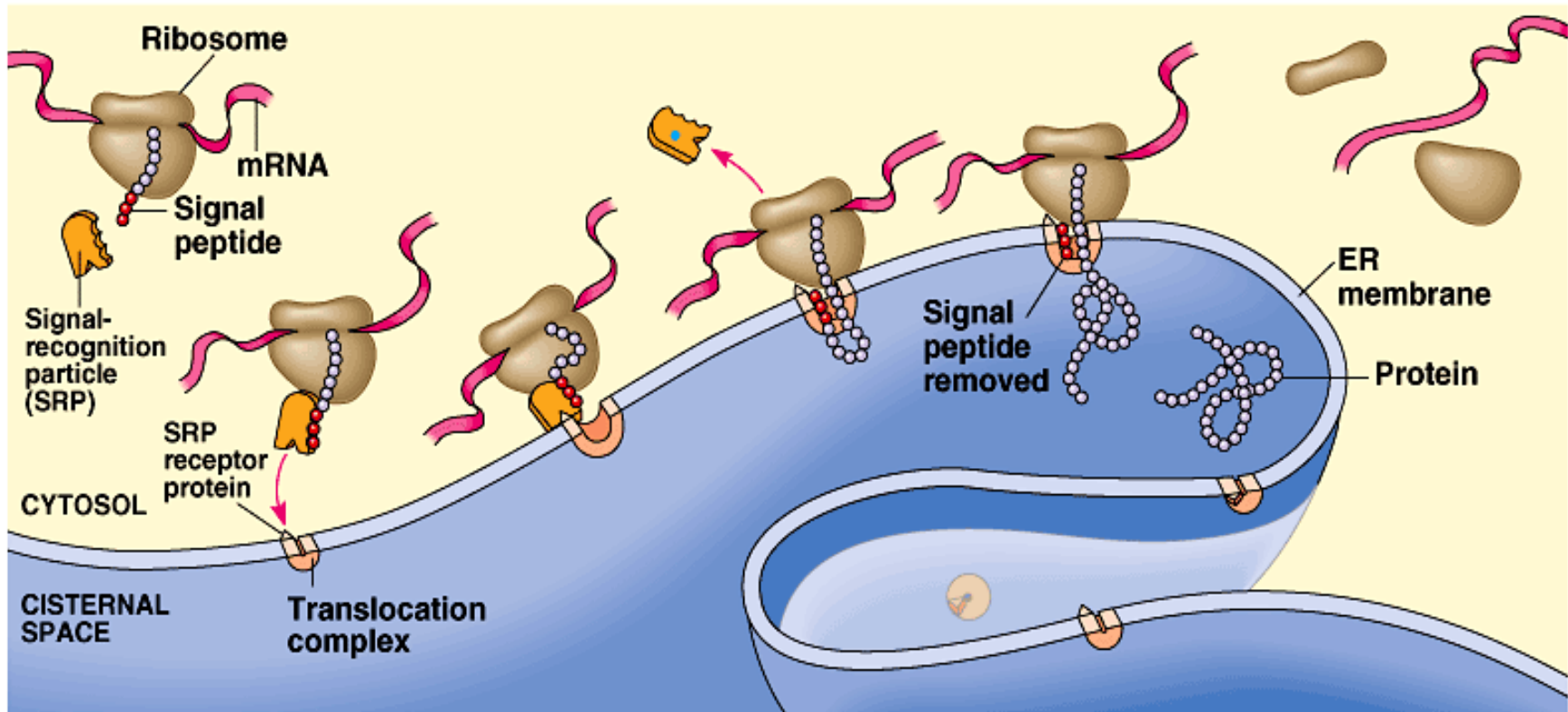
Protein will **stay in** the cell





# Rough Endoplasmic Reticulum (RER)

Protein **will leave** the cell



# Pre – AP Biology

## Protein Synthesis (4.2)

### Part 4

# Codon Chart, Yet again

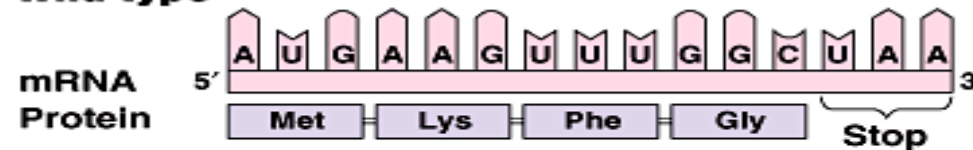
		Second base					
		U	C	A	G		
First base (5' end)	U	UUU	UCU	UAU	UGU	U	
		UUC	UCC	UAC	UGC		C
		UUA	UCA	UAA Stop	UGA Stop		A
		UUG	UCG	UAG Stop	UGG Trp		G
	C	CUU	CCU	CAU	CGU	U	
		CUC	CCC	CAC	CGC		C
		CUA	CCA	CAA	CGA		A
		CUG	CCG	CAG	CGG		G
	A	AUU	ACU	AAU	AGU	U	
		AUC	ACC	AAC	AGC		C
		AUA	ACA	AAA	AGA		A
		AUG Met or start	ACG	AAG	AGG		G
	G	GUU	GCU	GAU	GGU	U	
		GUC	GCC	GAC	GGC		C
		GUA	GCA	GAA	GGA		A
		GUG	GCG	GAG	GGG		G



# Point Mutation

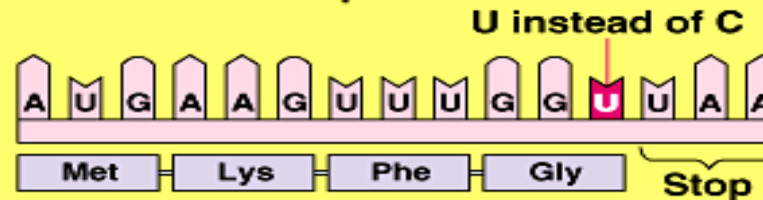
A **single nucleotide** changed in the sequence

## Wild type



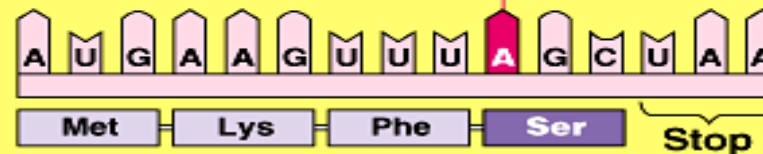
## Base-pair substitution

No effect on amino acid sequence



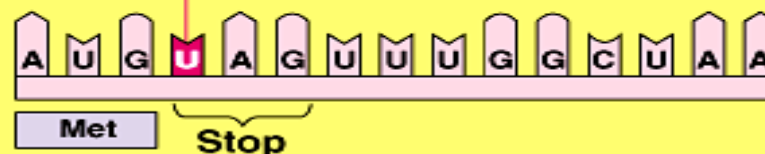
## Missense

A instead of G



## Nonsense

U instead of A



# Reading Frame Mutations

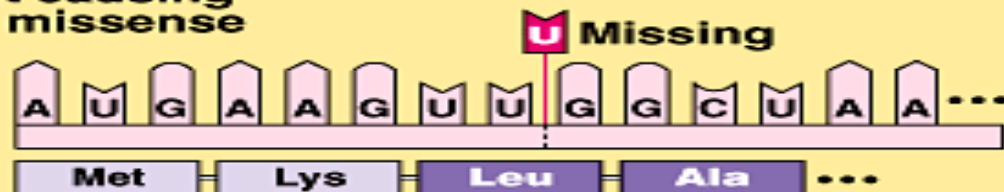
Nucleotides were **added** or **deleted** in the sequence

## Wild type

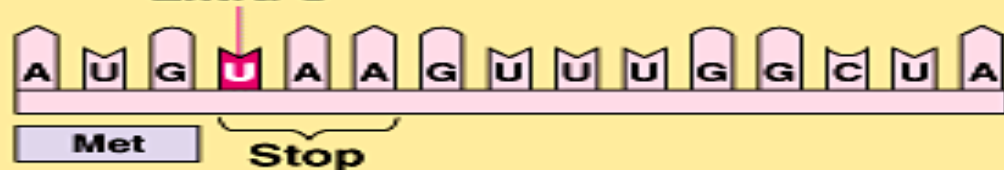


## Base-pair insertion or deletion

Frameshift causing extensive missense



Frameshift causing immediate nonsense



Insertion or deletion of 3 nucleotides: no frameshift; extra or missing amino acid

