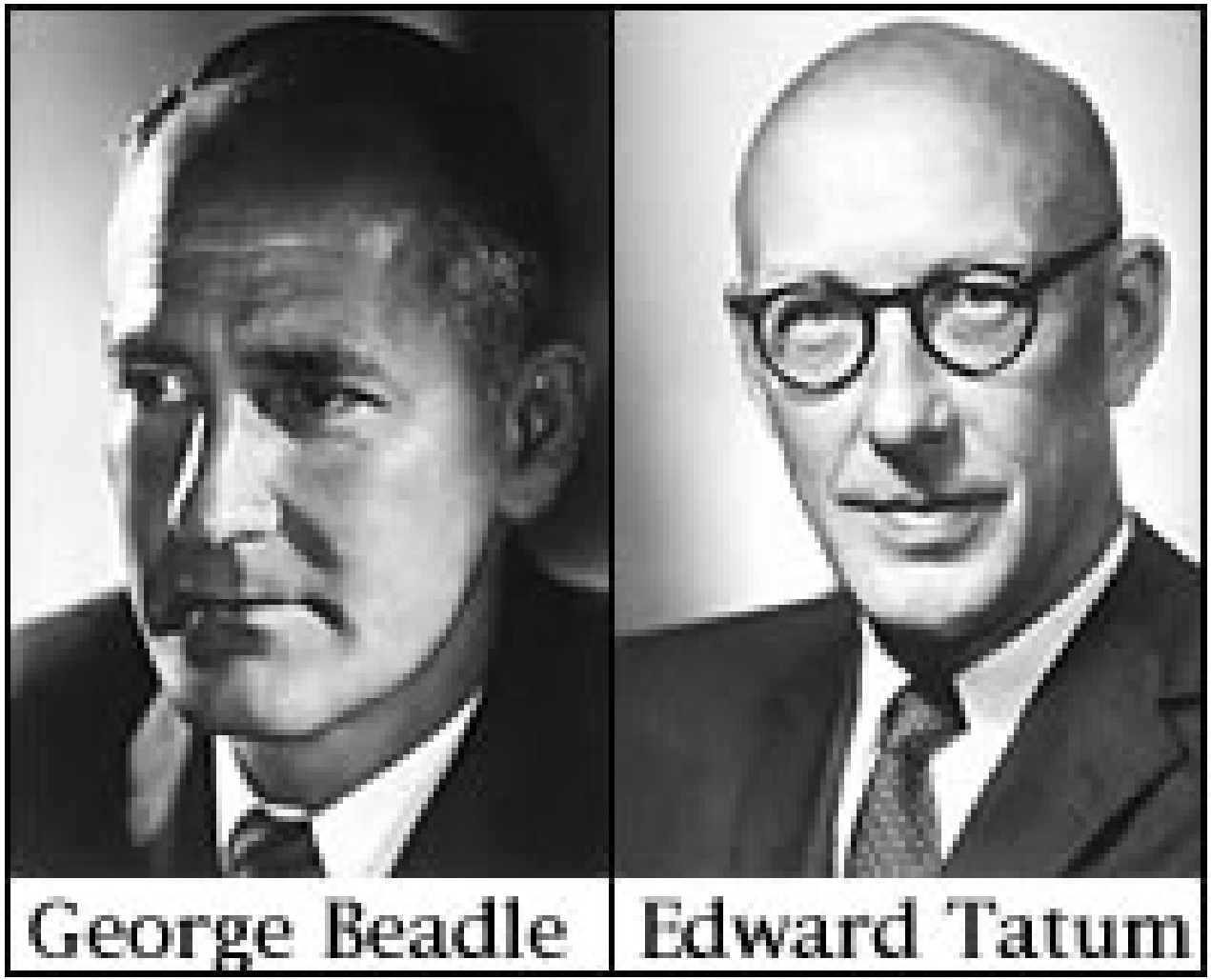
Pre – AP Biology

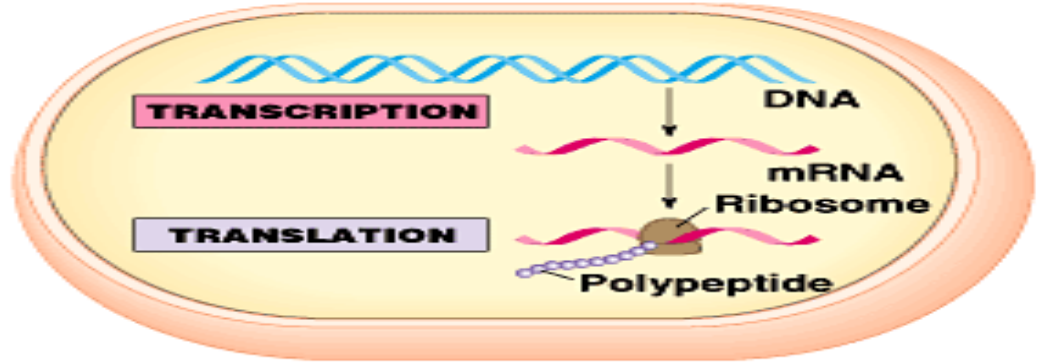
Protein Synthesis (4.2)

Part 1

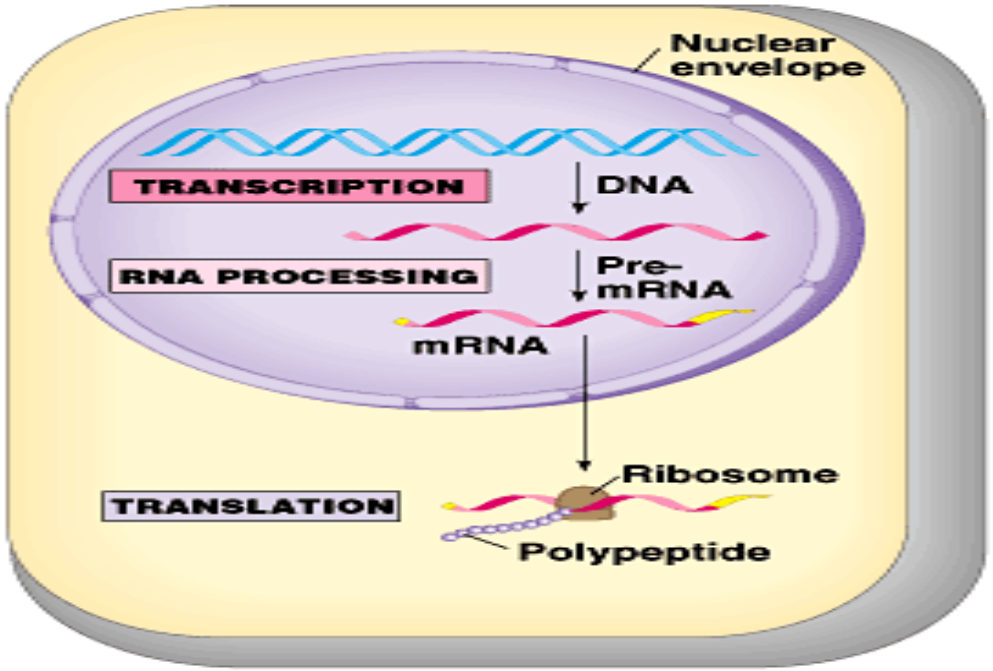
George Beadle & Edward Tatum



Transcription & Translation in Prokaryotic cells and Eukaryotic cells

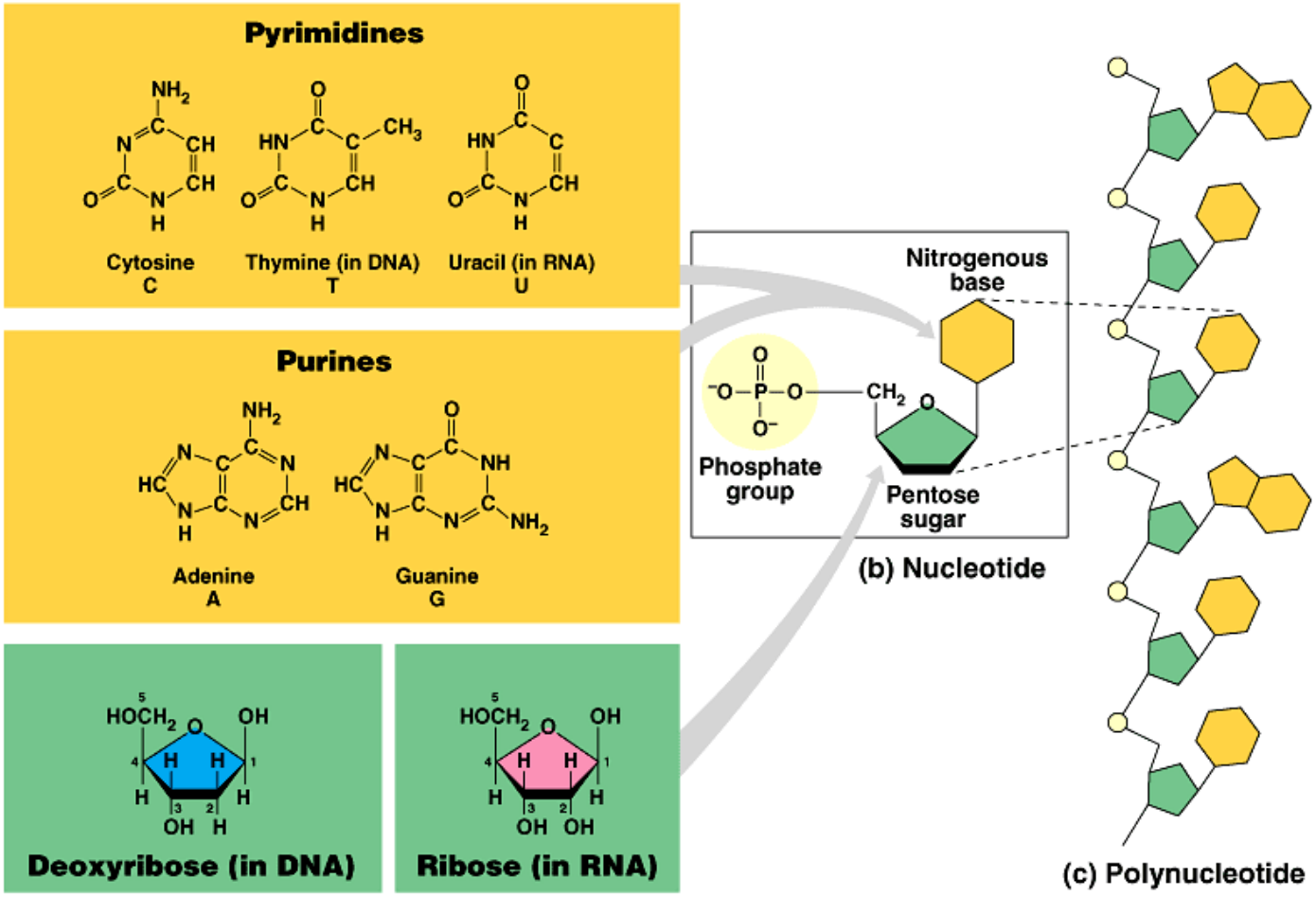


(a) Prokaryotic cell



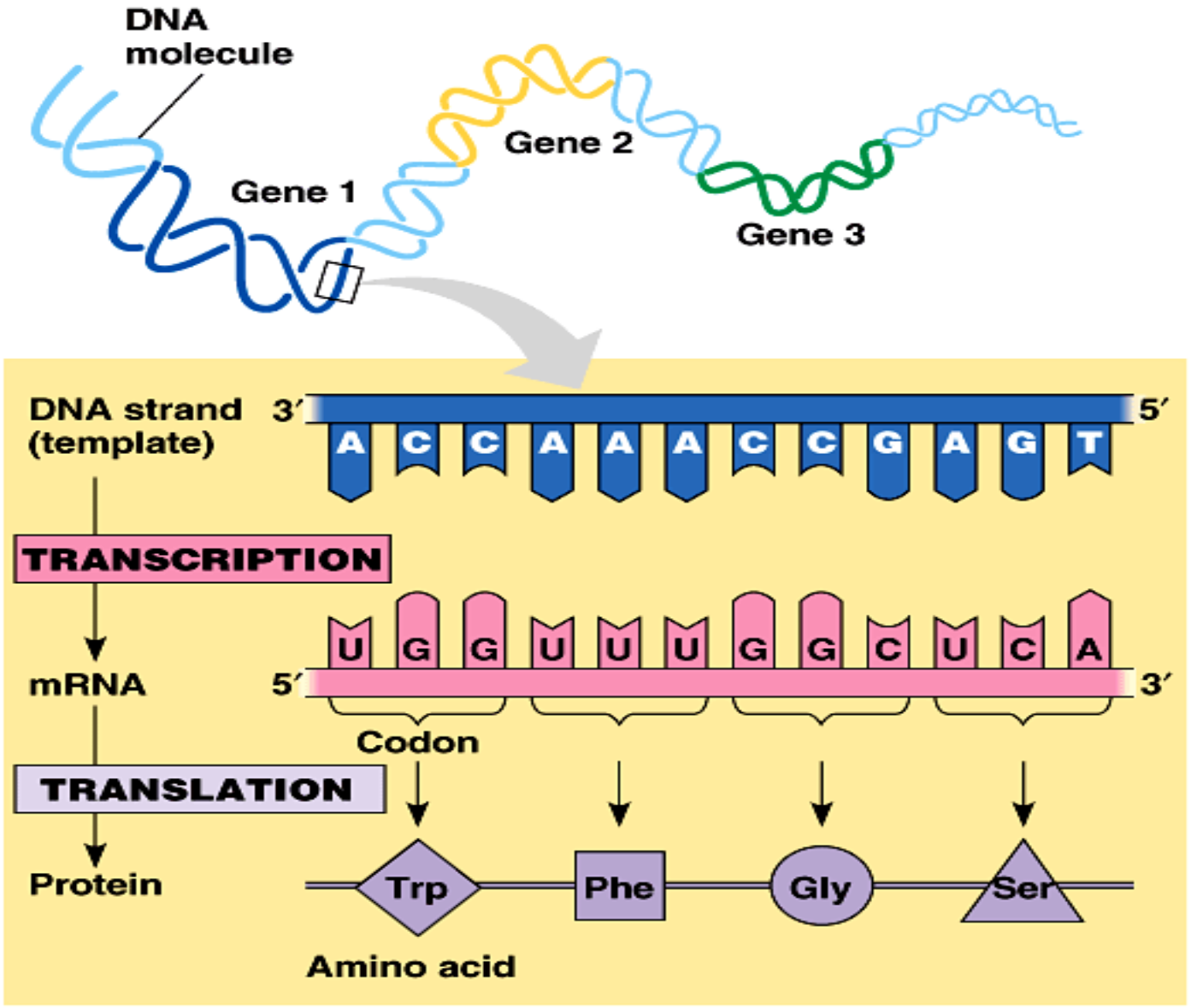
(b) Eukaryotic cell

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)

&

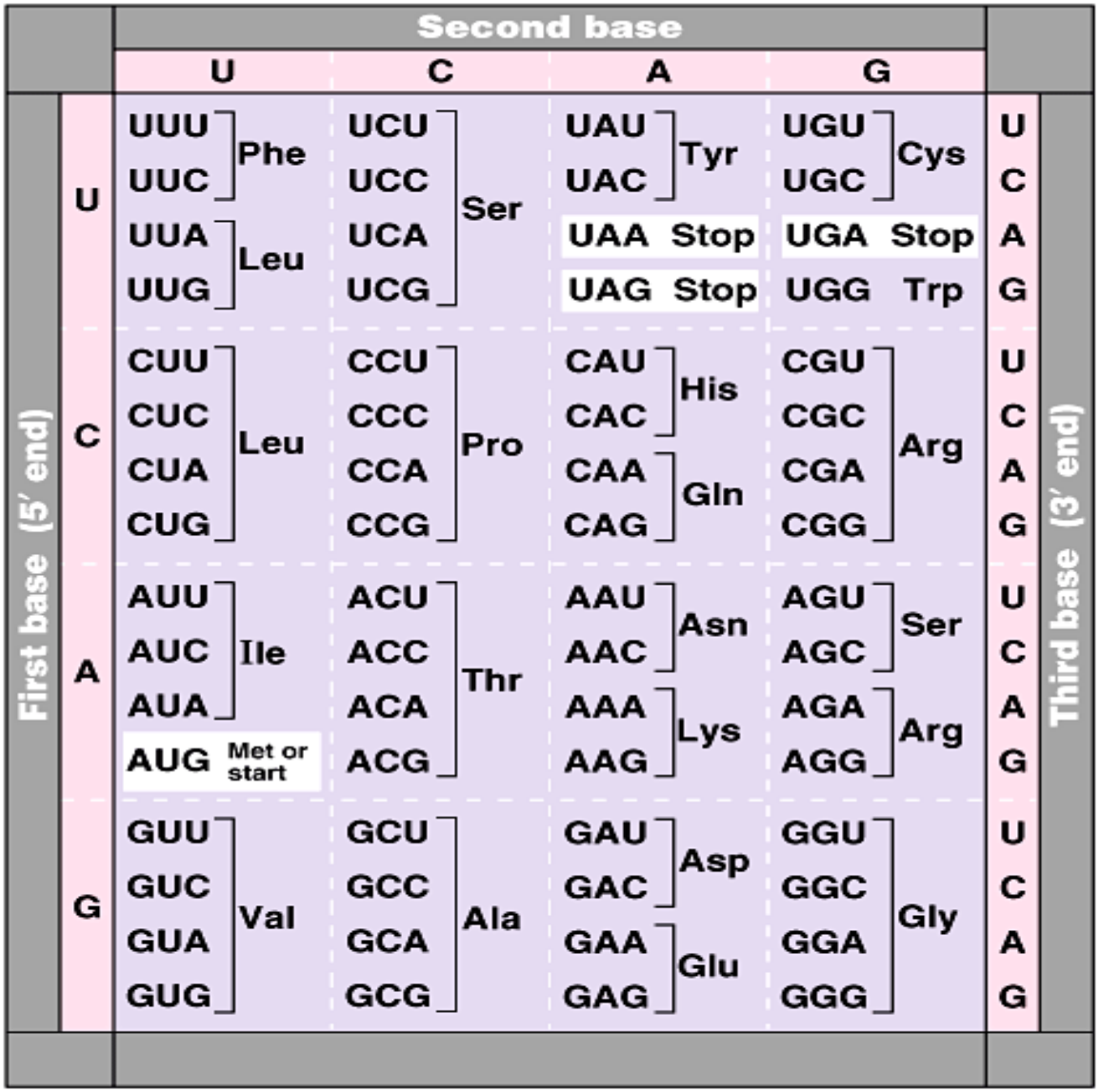
Guanine = Cytosine

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



First base (5′ end)	Second base: U	Second base: C	Second base: A	Second base: G	Third base (3′ 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

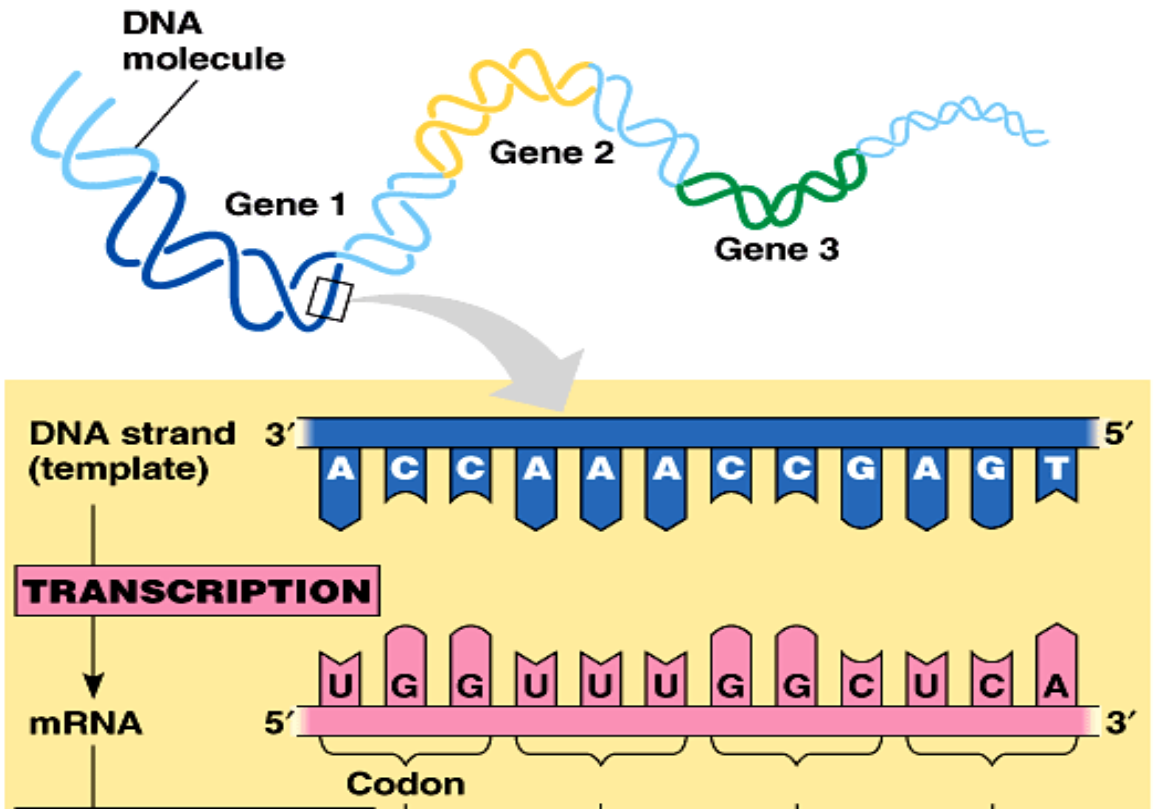
Pre – AP Biology

Protein Synthesis (4.2)

Part 2

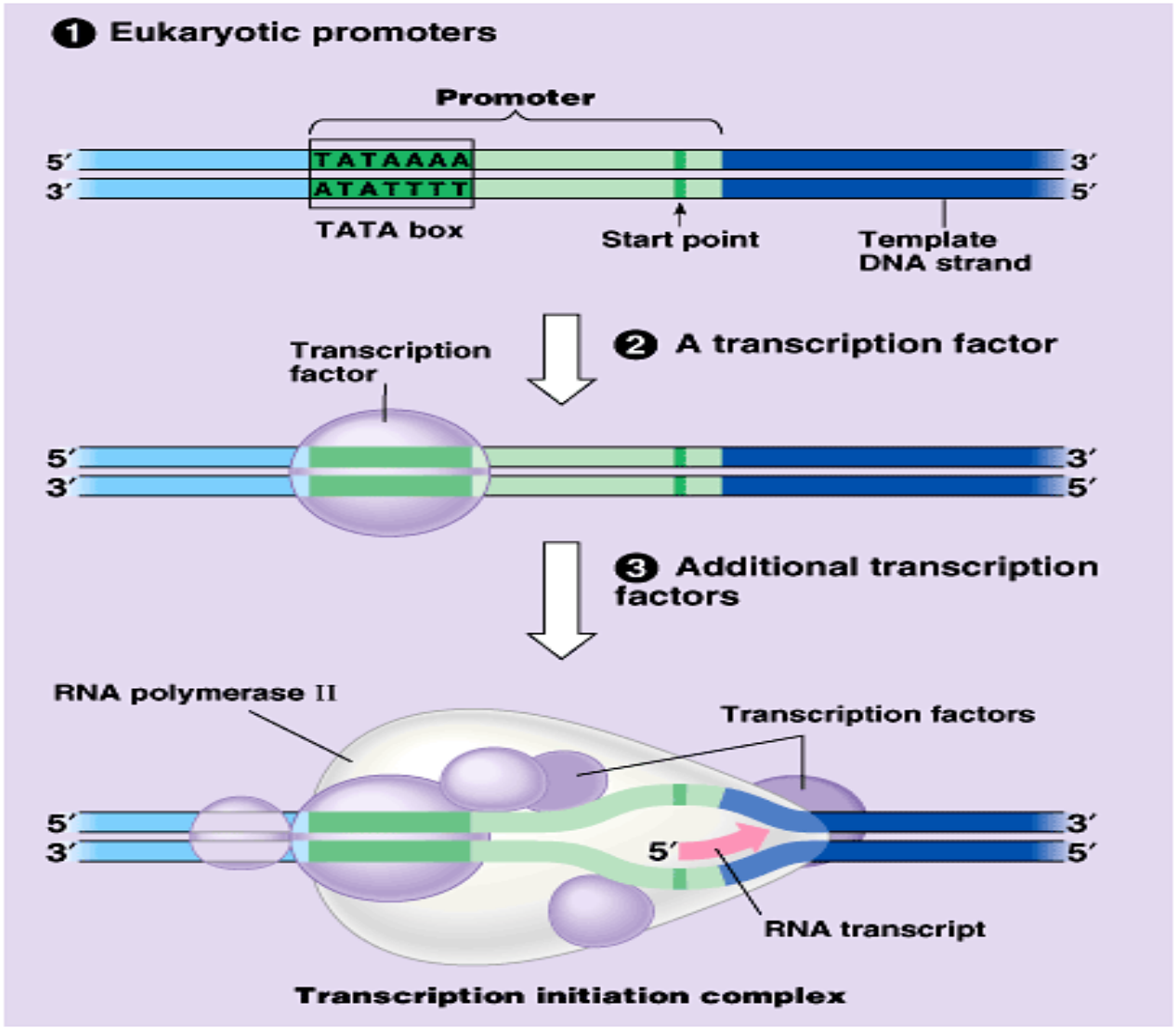
Transcription

Making DNA code into RNA code

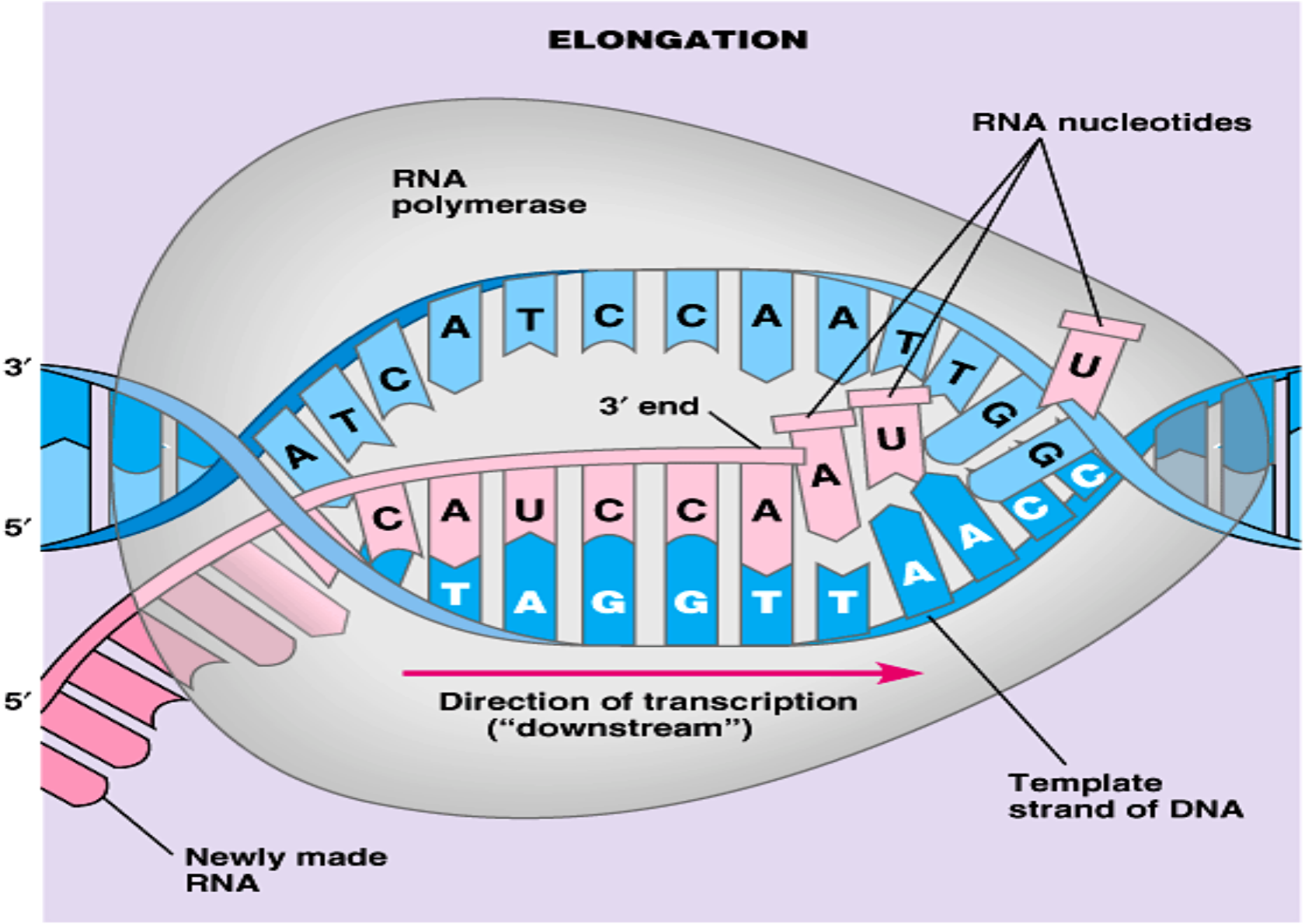


Initiation -"Build the factory"

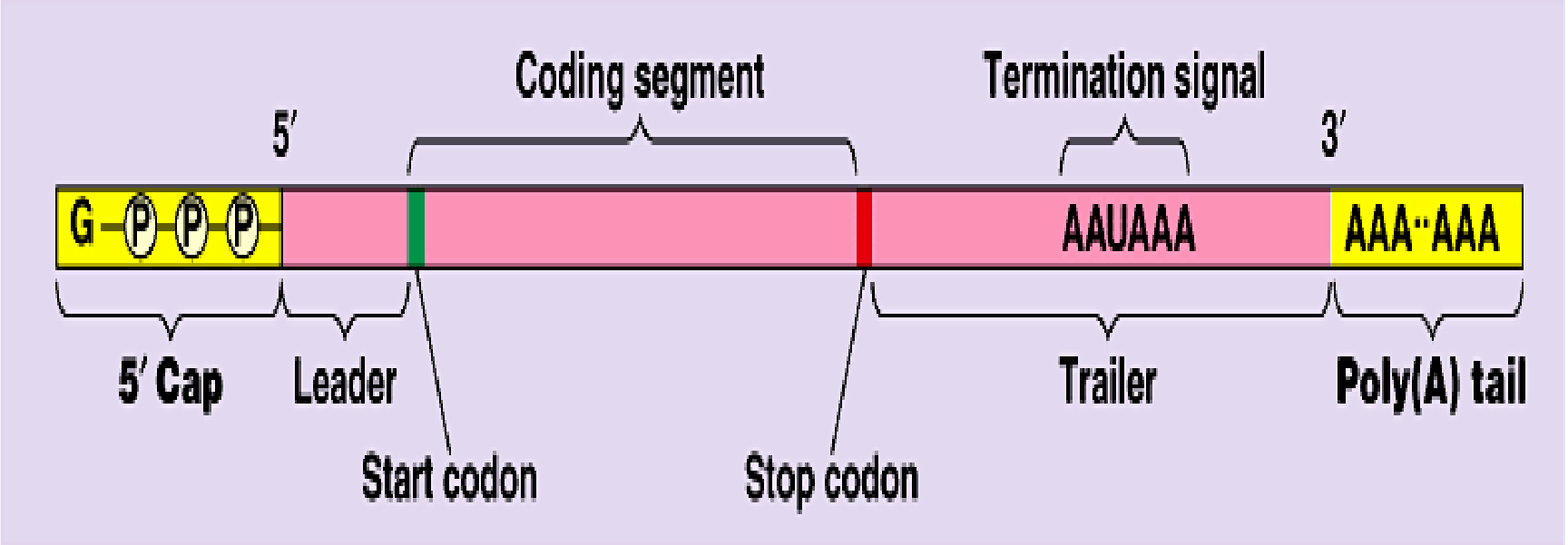
See the "factory" of enzymes at the bottom?



Elongation – adding nucleotides

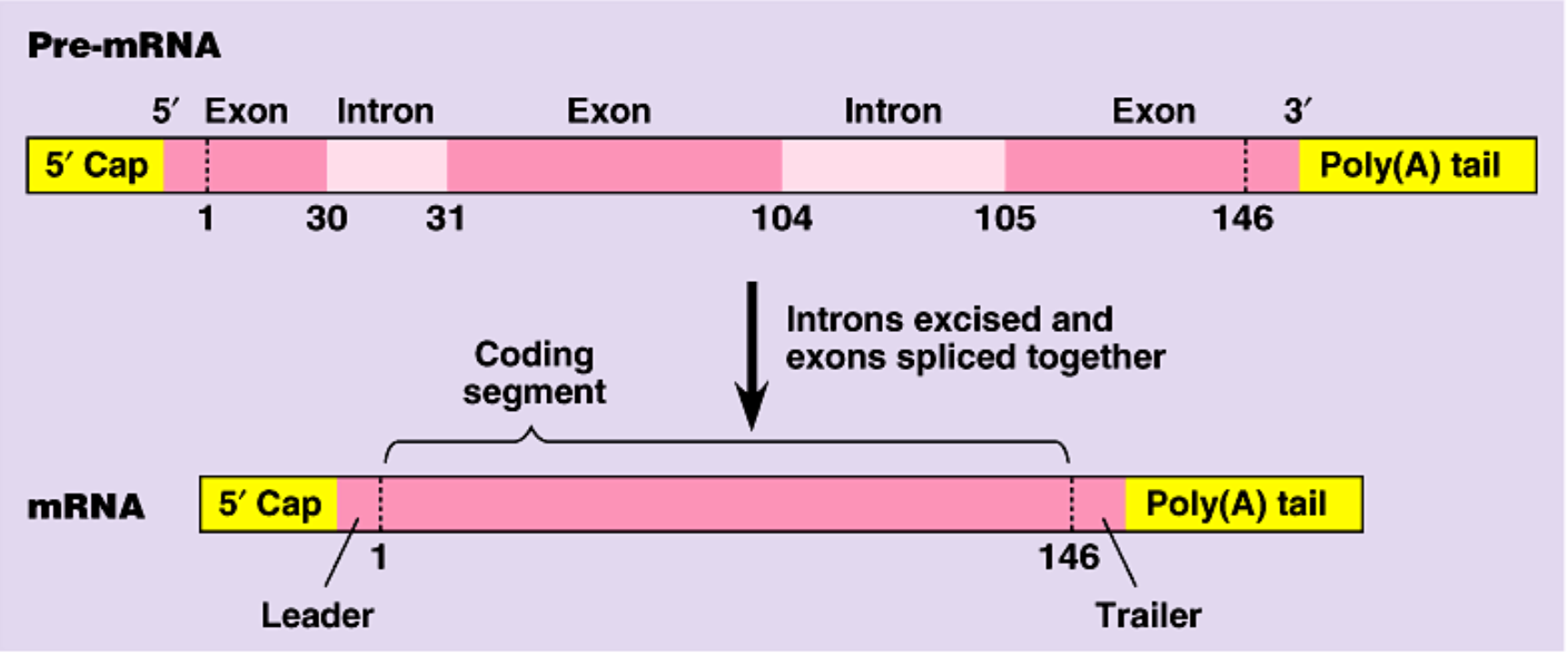


Termination

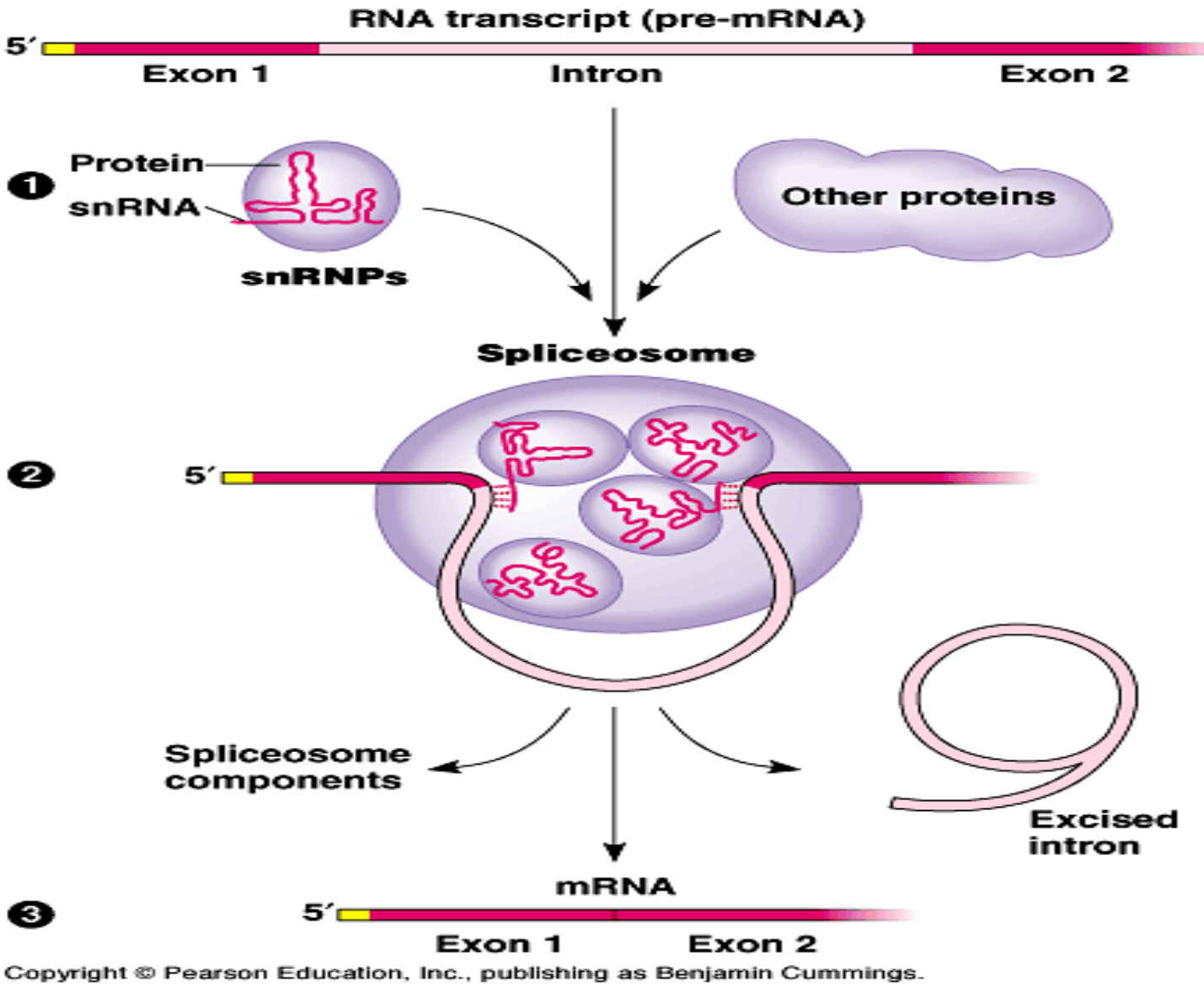


Post Transcription Modification

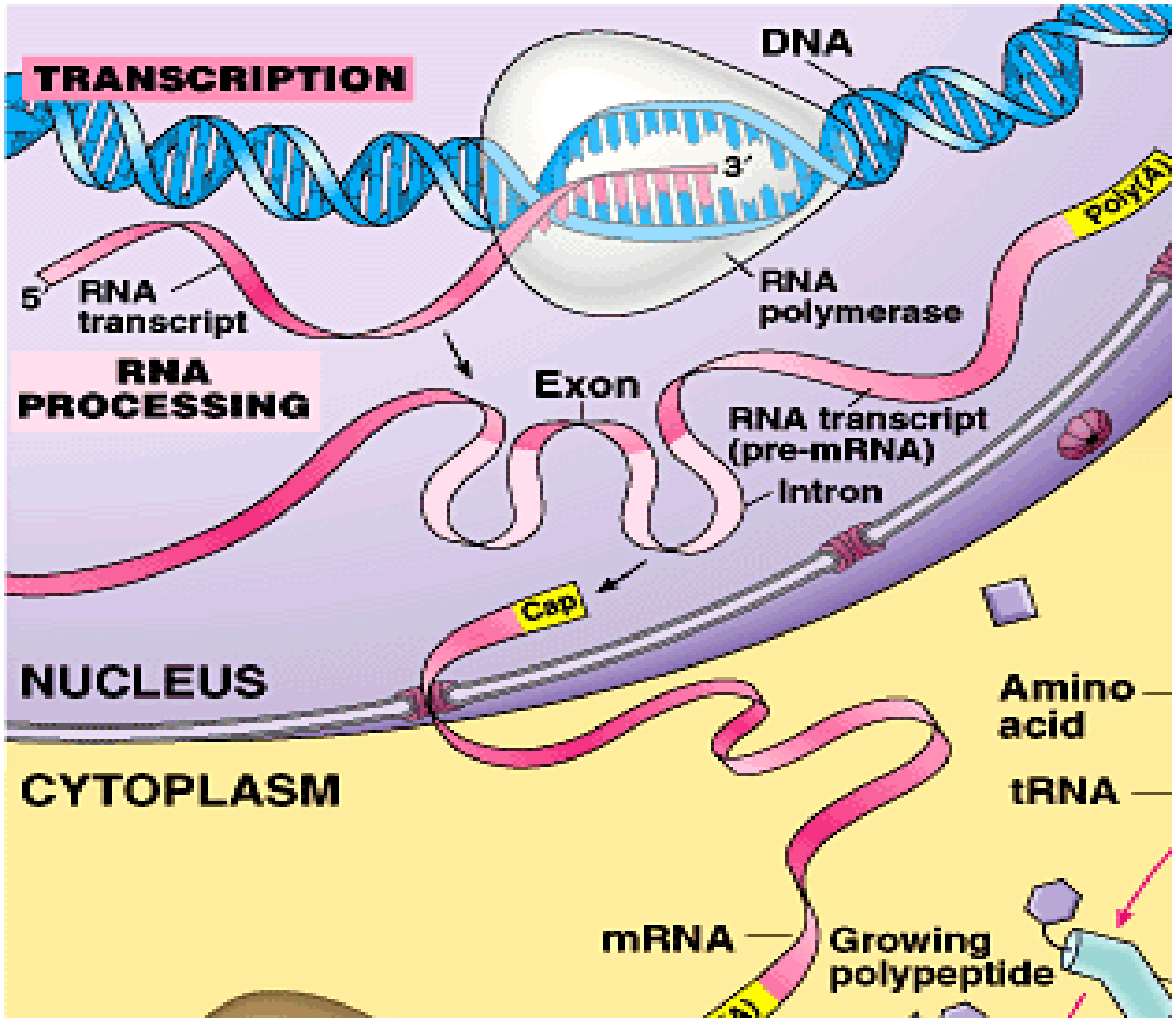
Primary transcript will be *modified* to become secondary transcript



Spliceosomes *removing* introns



mRNA will leave the nucleus now



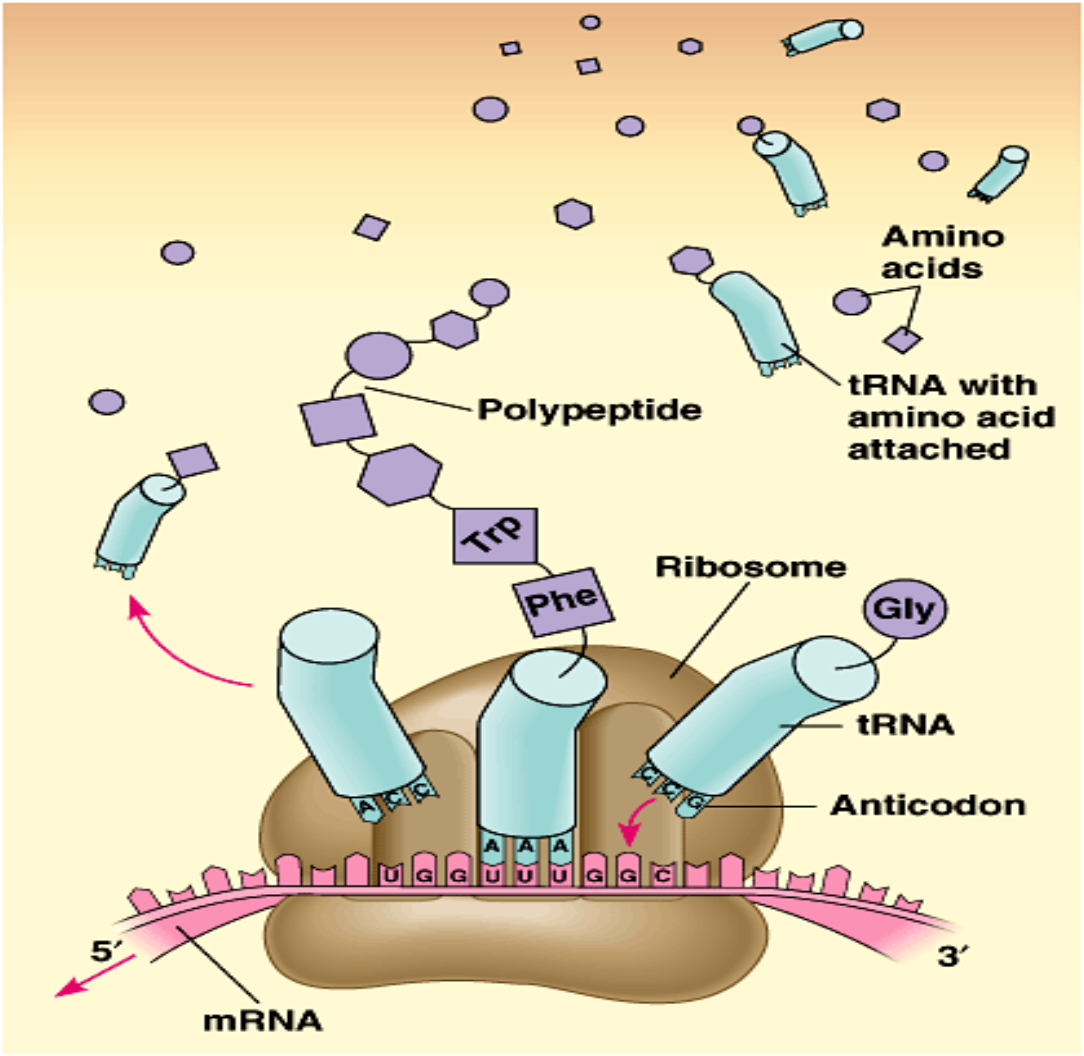
Pre – AP Biology

Protein Synthesis (4.2)

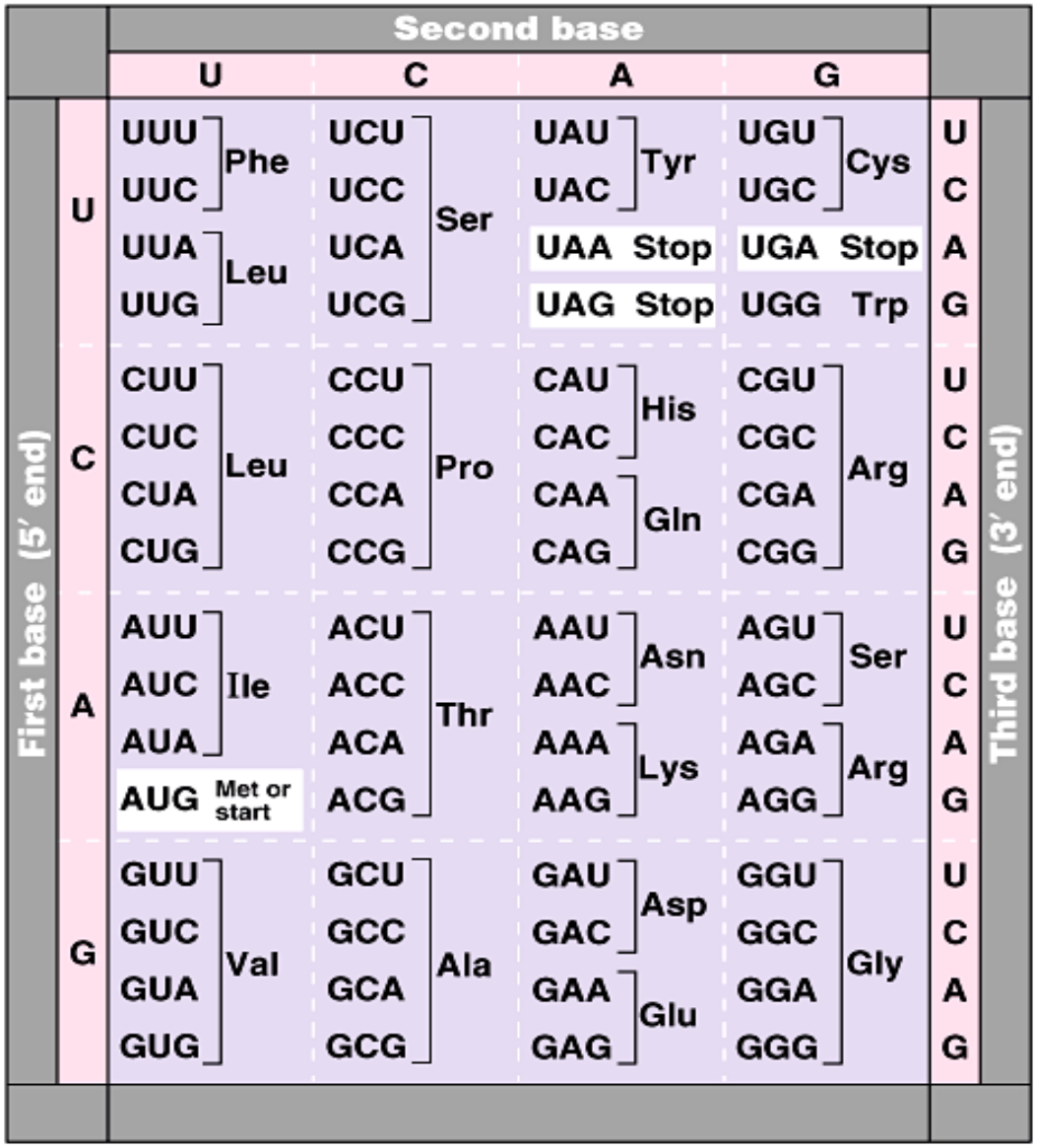
Part 3

Translation by the Ribosome

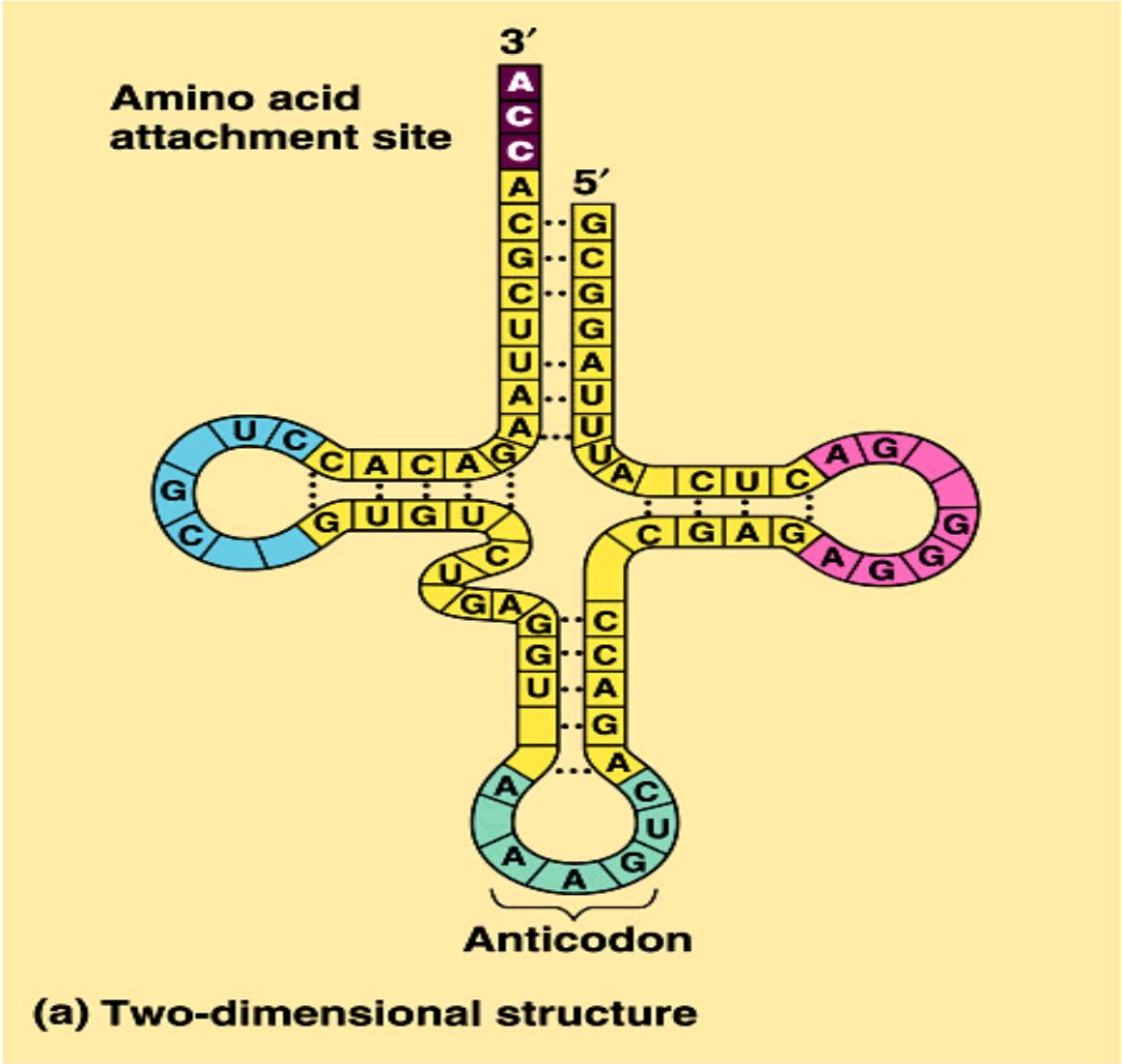
Turning the nucleotide mRNA sequence into a sequence of amino acids



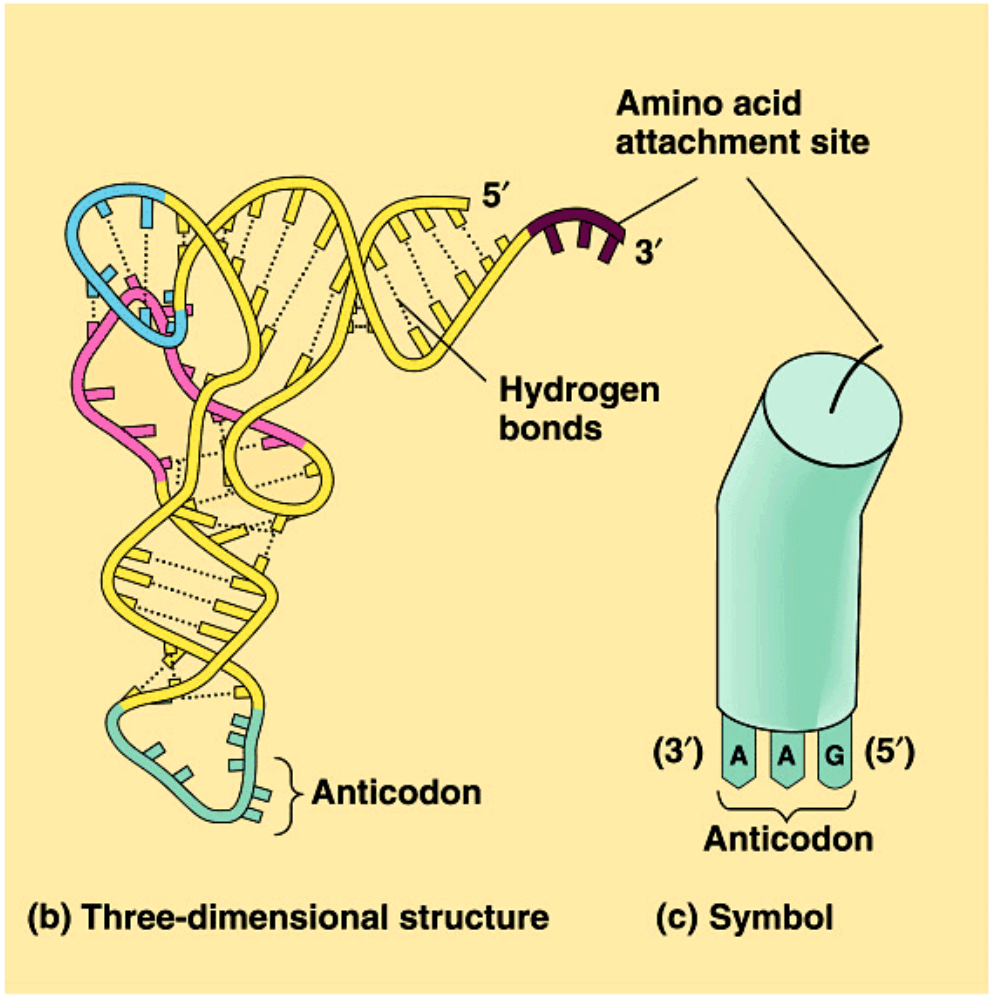
Amino Acid Codon Chart



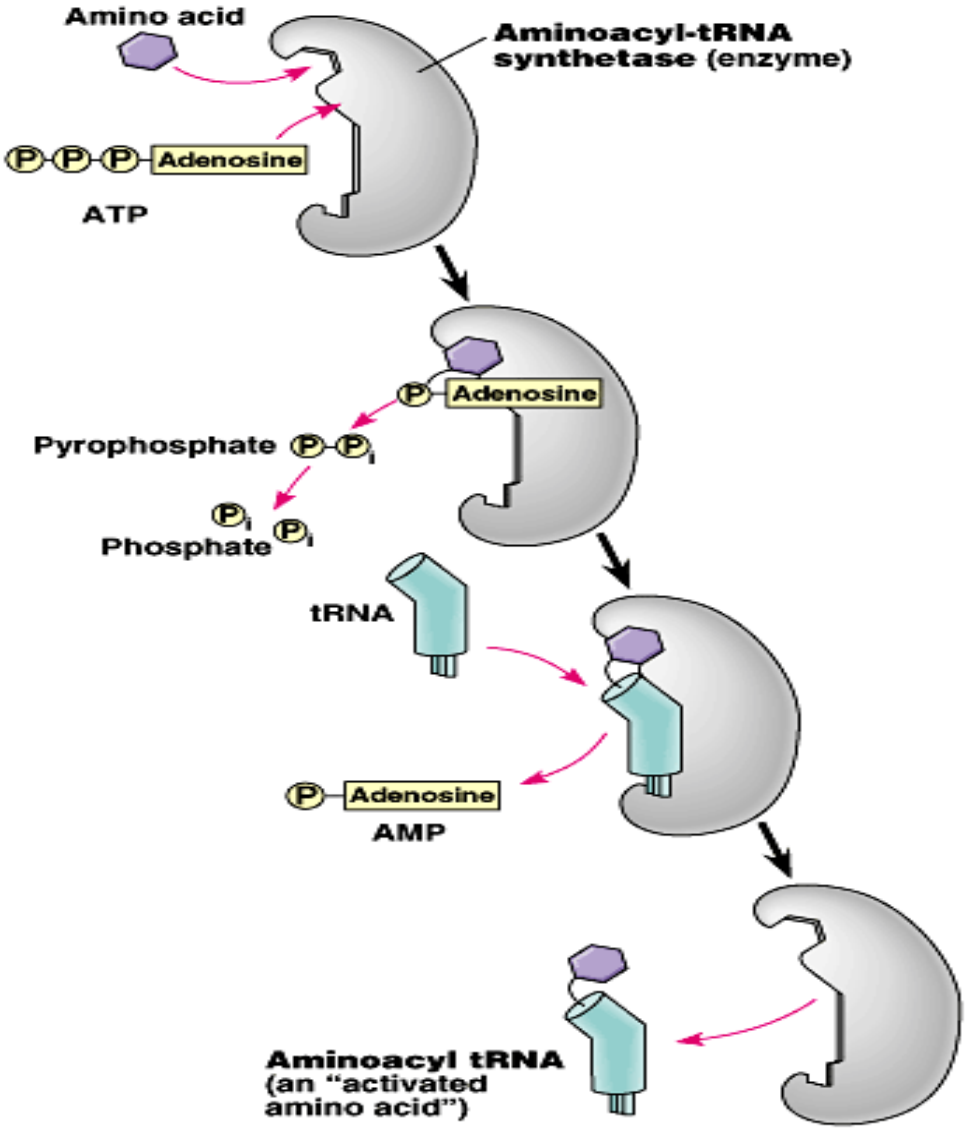
Transfer RNA molecule structure up close



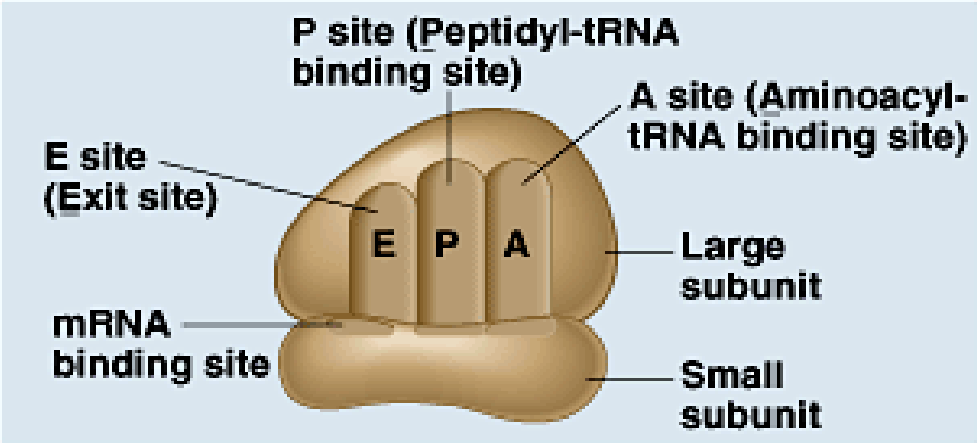
Transfer RNA molecule again



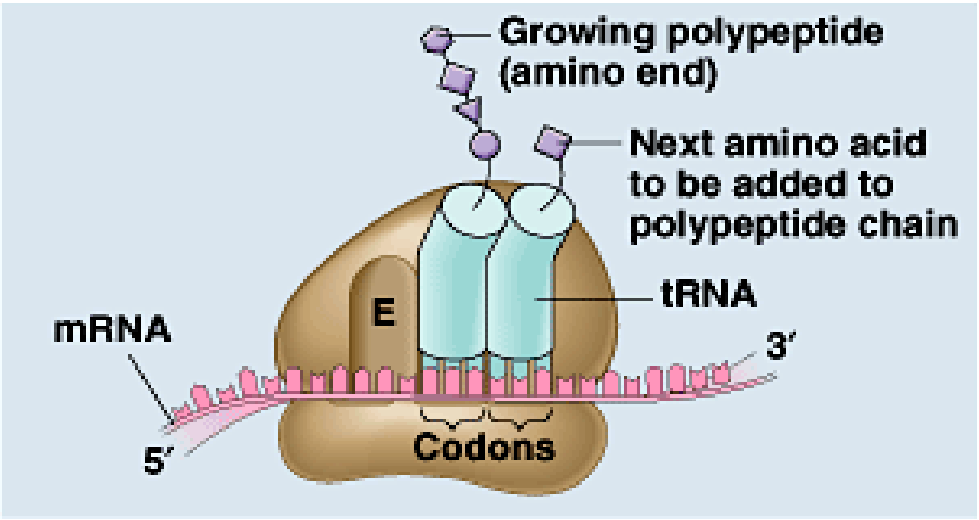
Using enzymes and ATP (energy) to *combine* a tRNA molecule with an Amino Acid



Ribosome structure

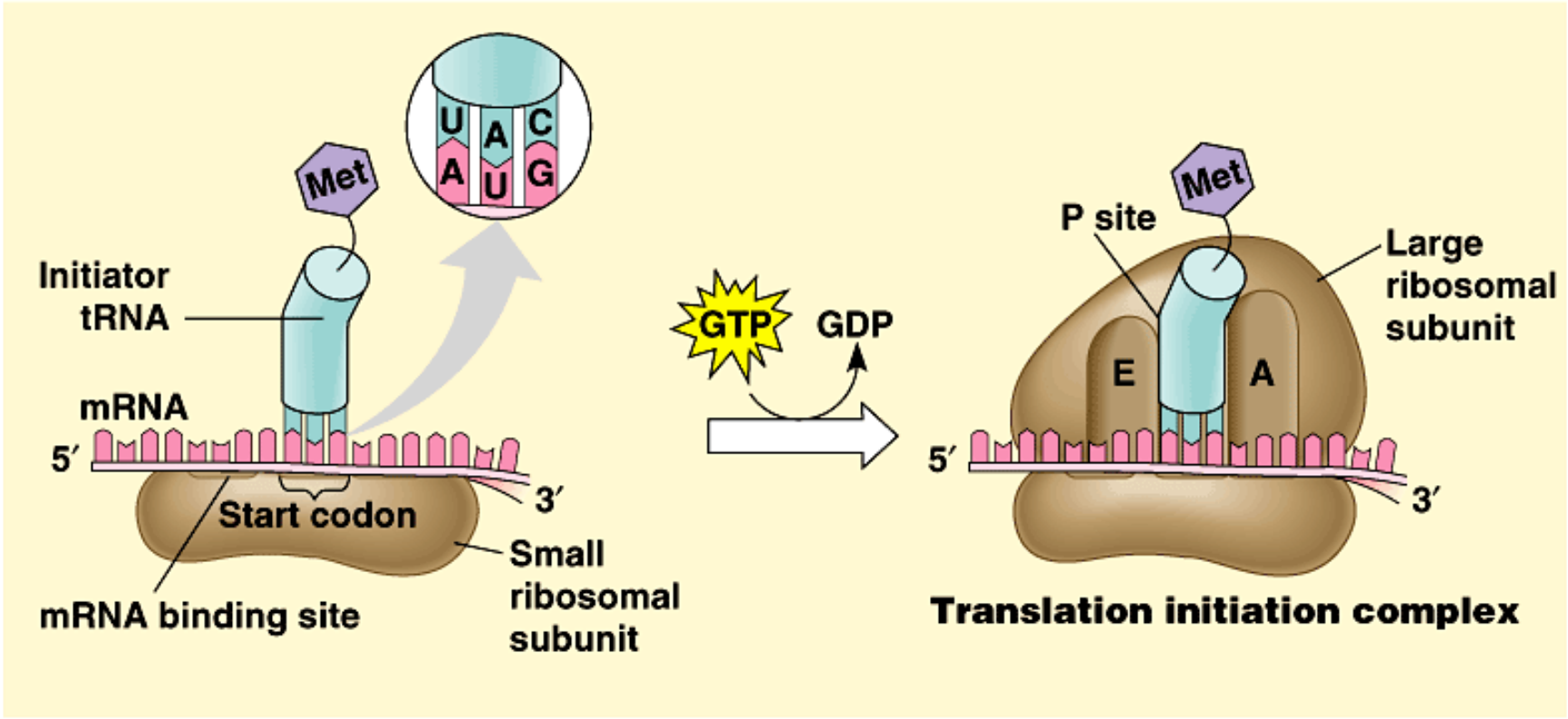


(b) Schematic model showing binding sites

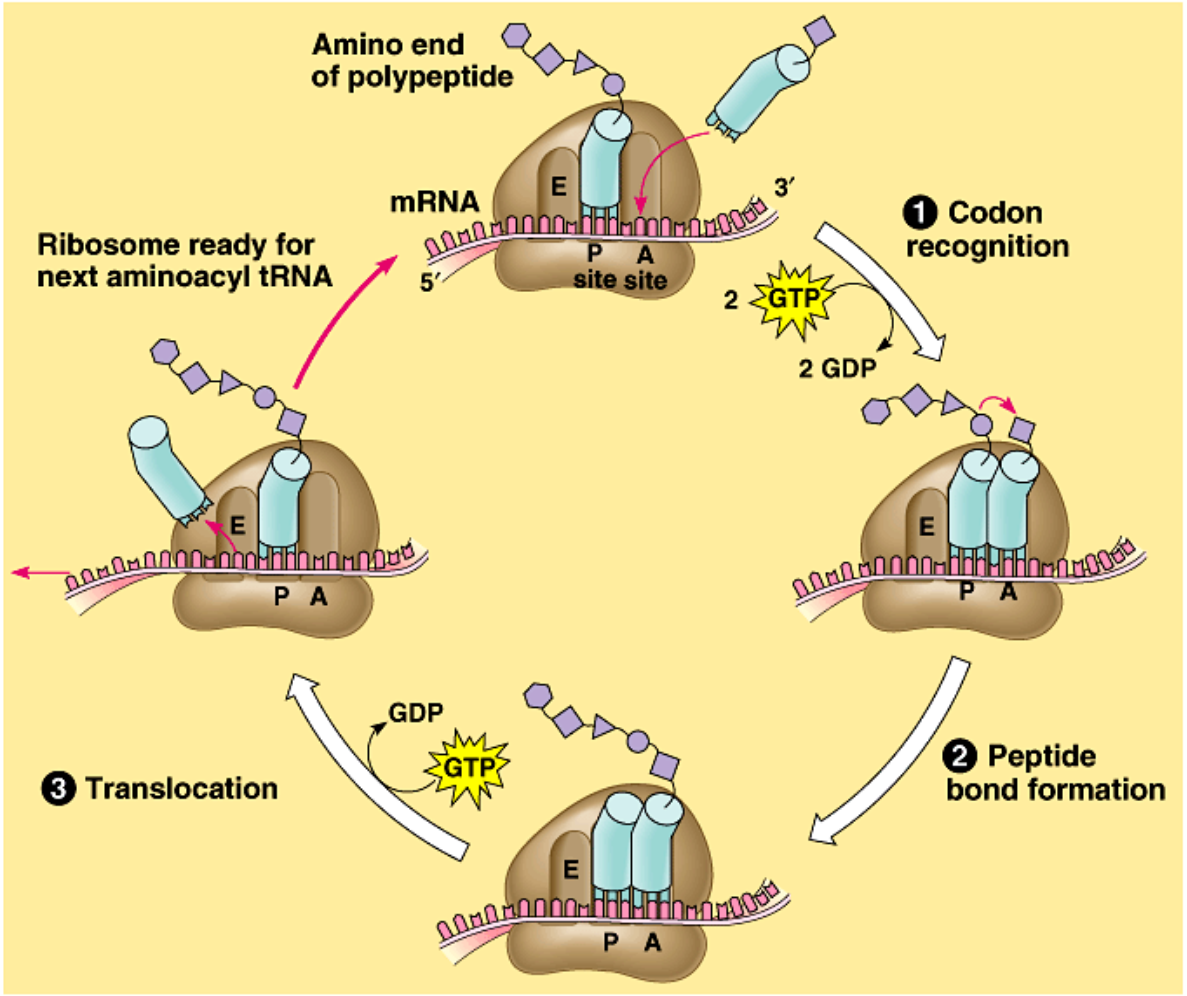


(c) Schematic model with mRNA and tRNA

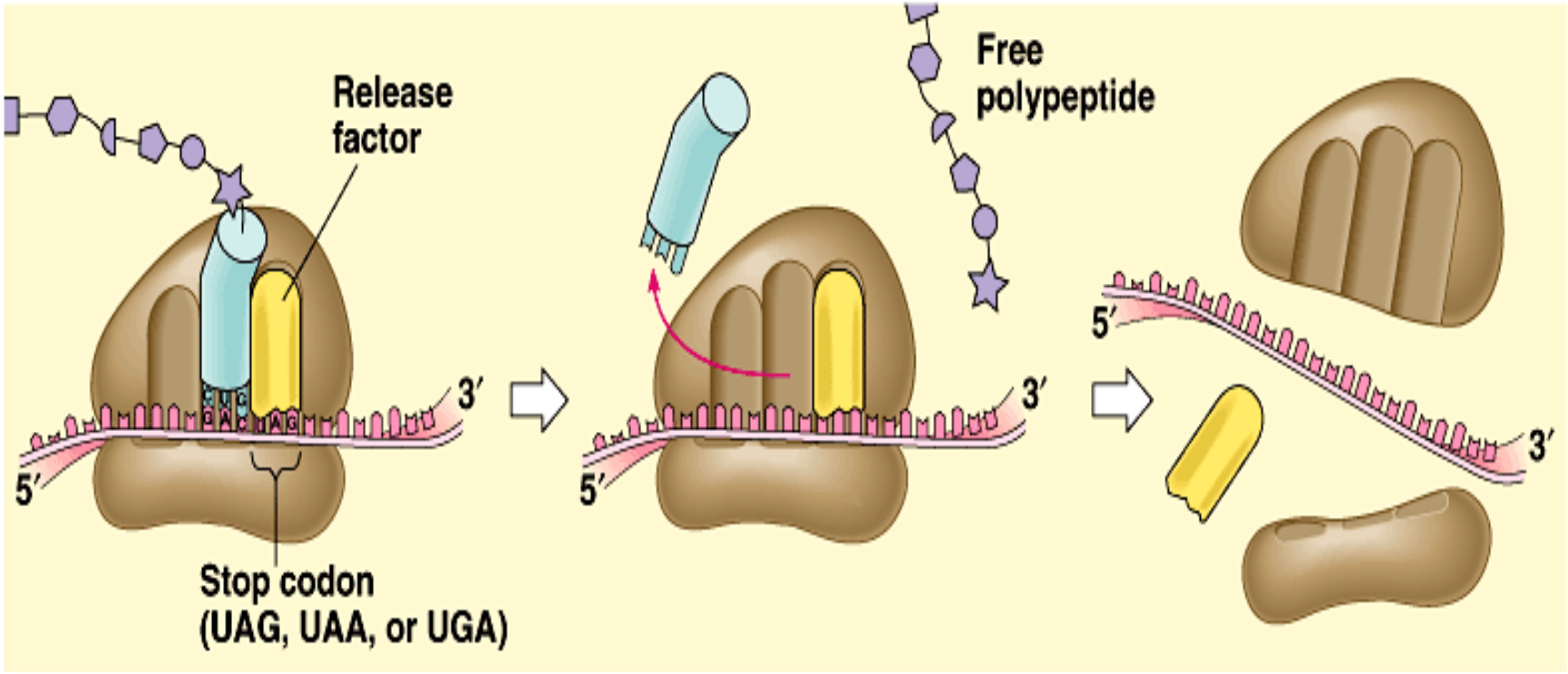
Initiation -
“Build the factory”



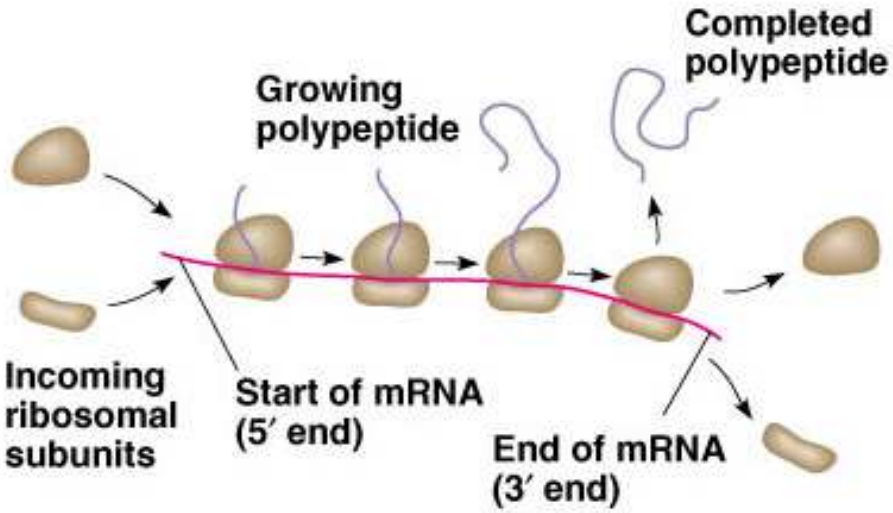
Elongation by translocation



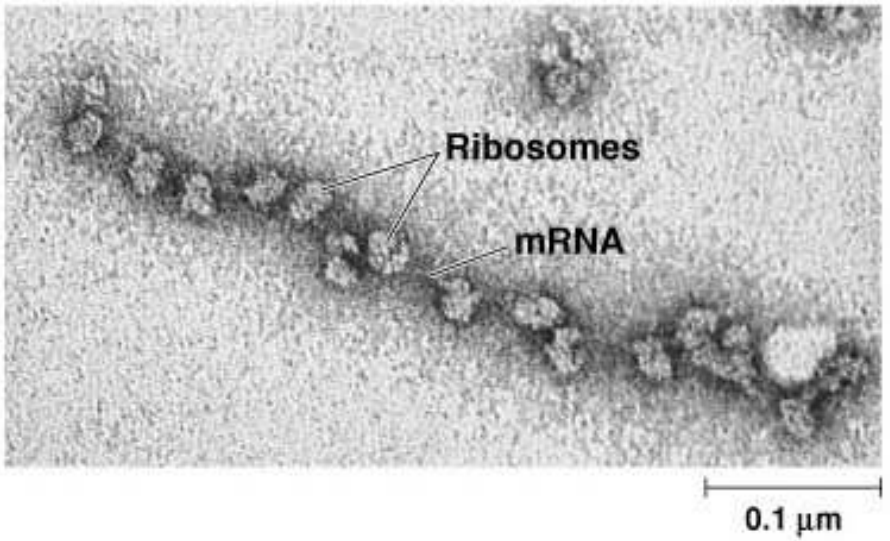
Termination – *releasing* the 1'of Amino Acids



Polyribosomes

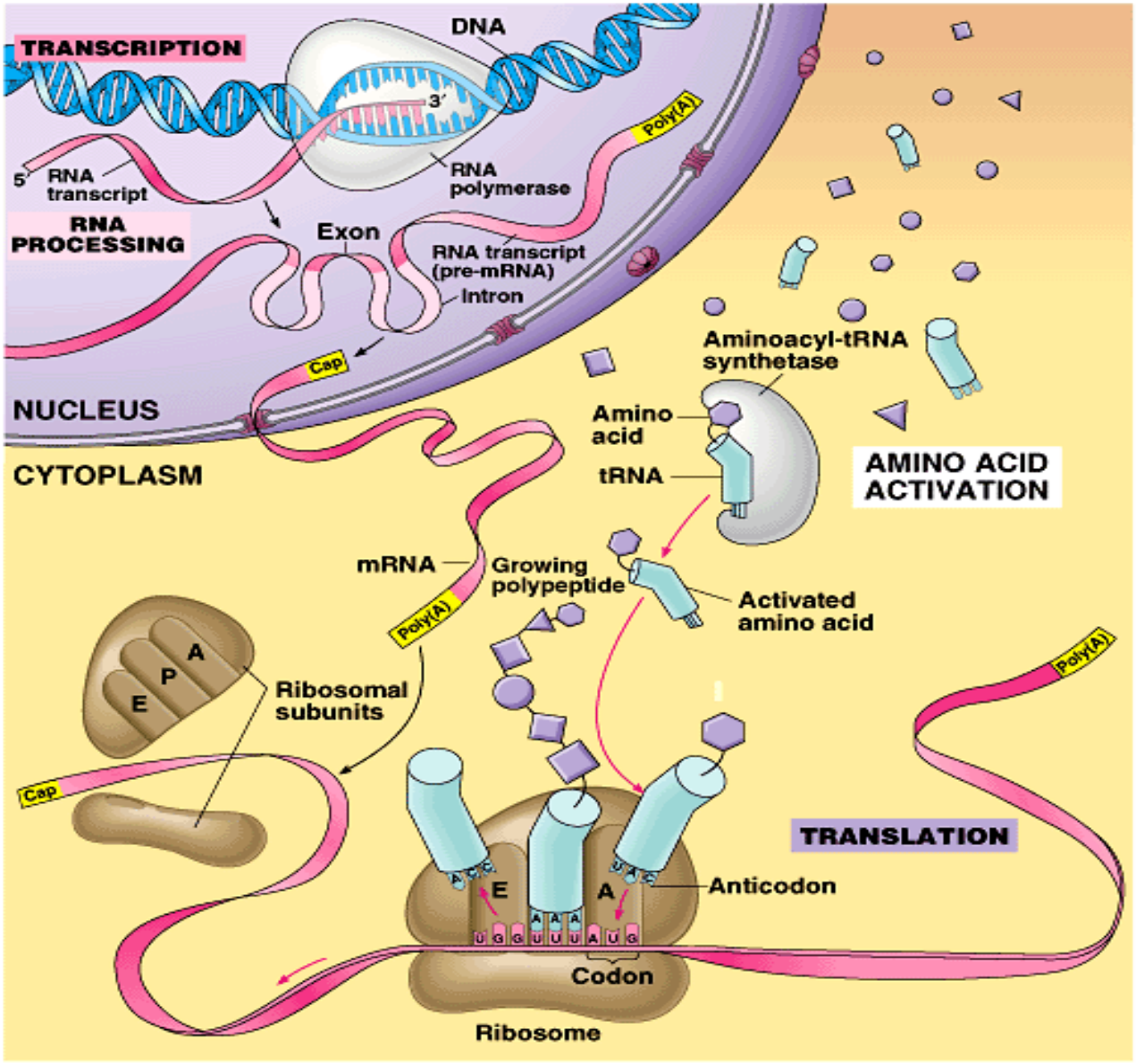


(a) An mRNA molecule is generally translated simultaneously by several ribosomes in clusters called polyribosomes.

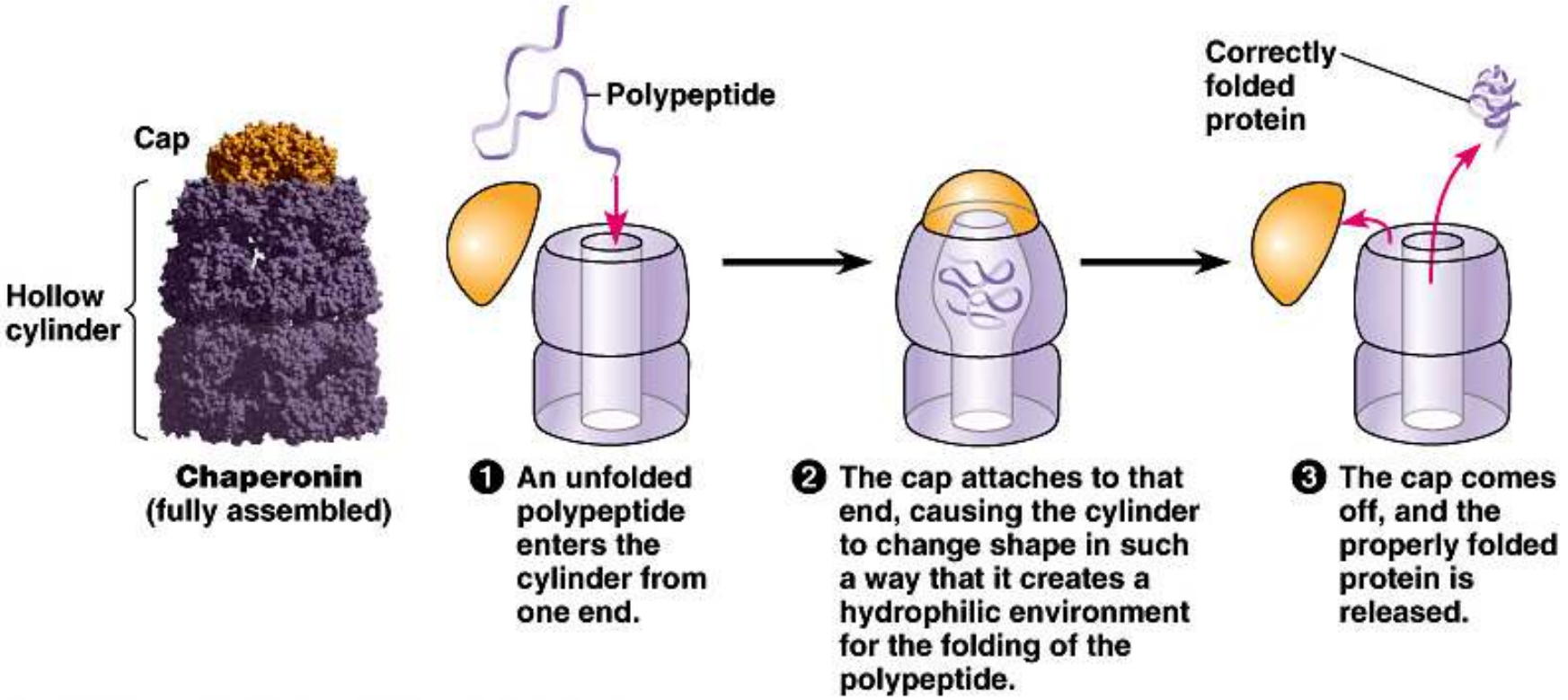


(b) This micrograph shows a large polyribosome in a prokaryotic cell (TEM).

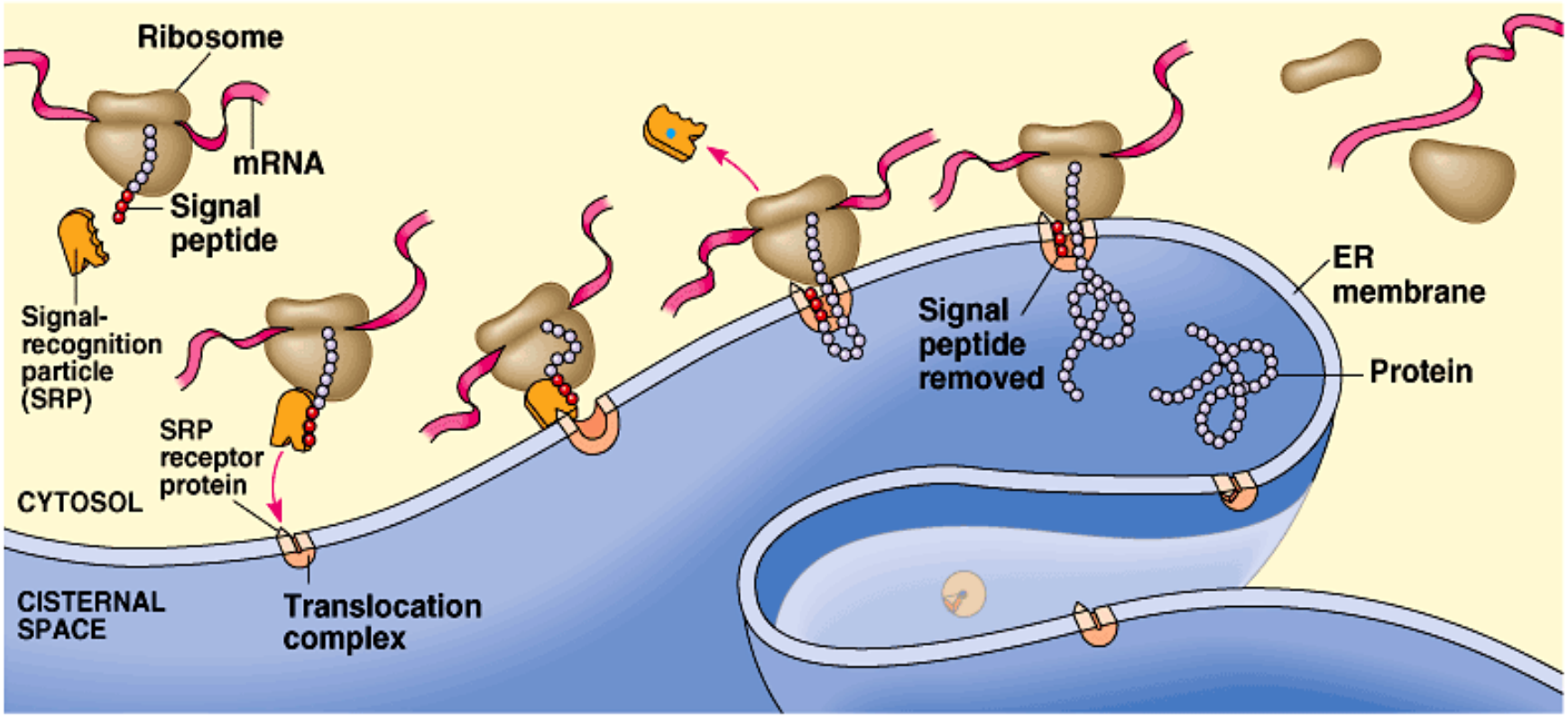
The BIG Picture



Chaperonin
Protein will stay in the cell



Rough Endoplasmic Reticulum (RER)
Protein will leave the cell

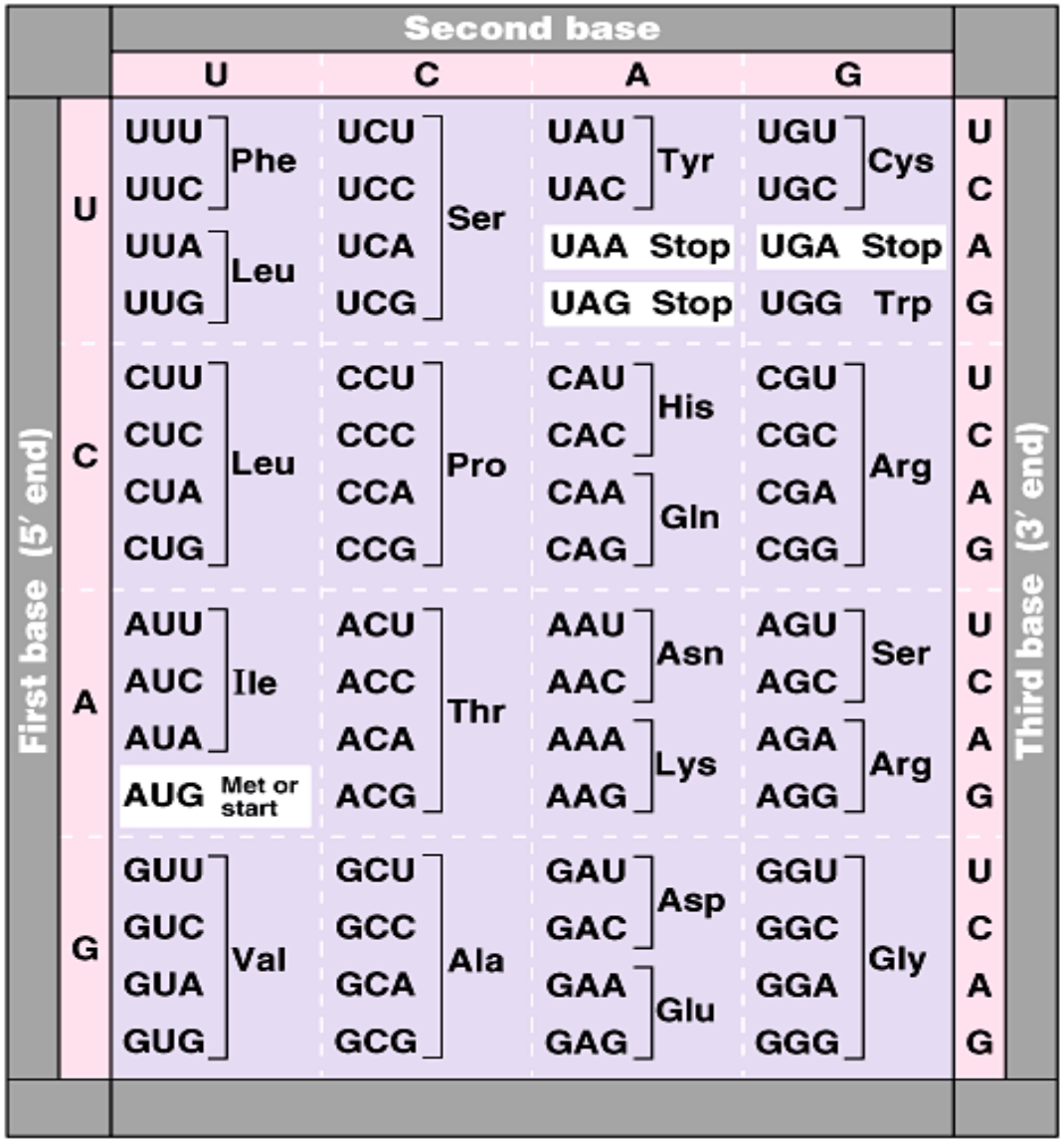


Pre – AP Biology

Protein Synthesis (4.2)

Part 4

Codon Chart, Yet again



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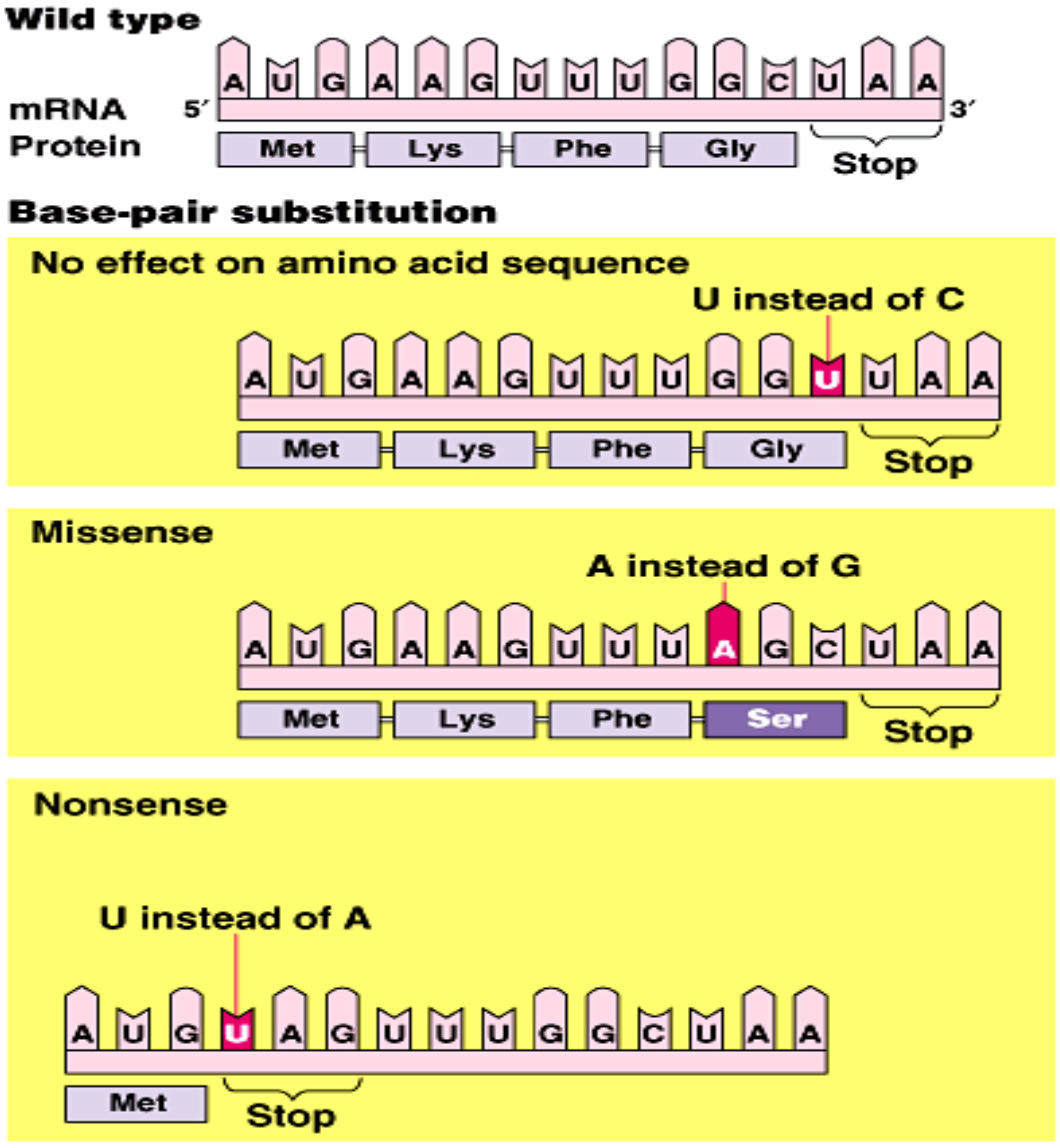
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A
	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	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

Point Mutation

A single nucleotide changed in the sequence



Reading Frame Mutations

Nucleotides were added or deleted in the sequence