

Unit 6 PPT #2

Transcription and Translation
Central Dogma



Chapter 8.4 Transcription pgs 239-242

DNA carries the info to make Proteins. How does
it work?

DNA → RNA → Proteins

Starts with DNA....**transcribed** into mRNA.....**translated**
into proteins by tRNA

This process is known as:

***Central Dogma of
Molecular Biology***

Segments of DNA (**GENES**) are the instructions that control the production of proteins.

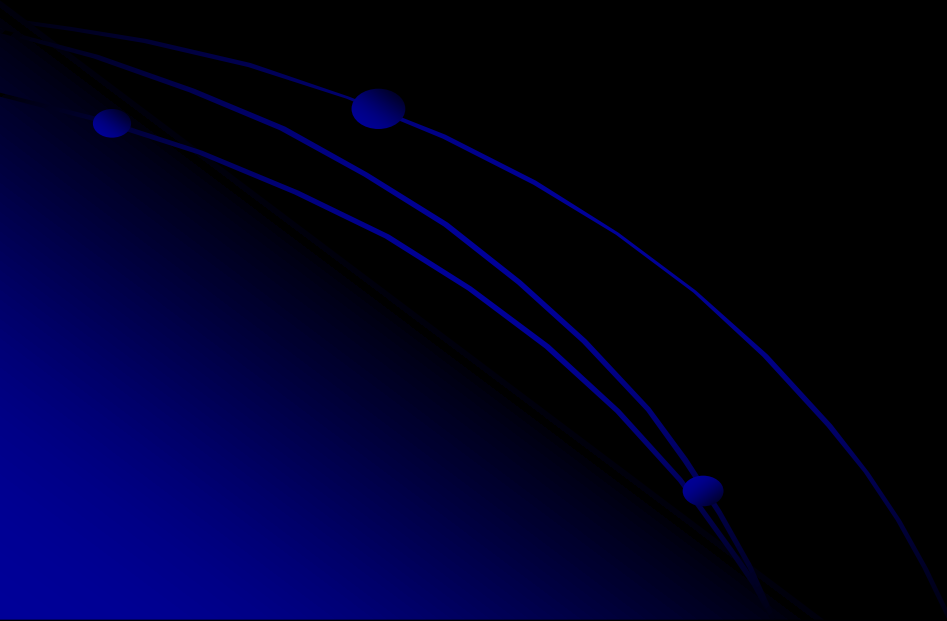
Genetic messages can be decoded by copying part of the nucleotide sequence from DNA into RNA.

RNA contains coded information for making proteins

How does the DNA get made into RNA and that made into Protein???

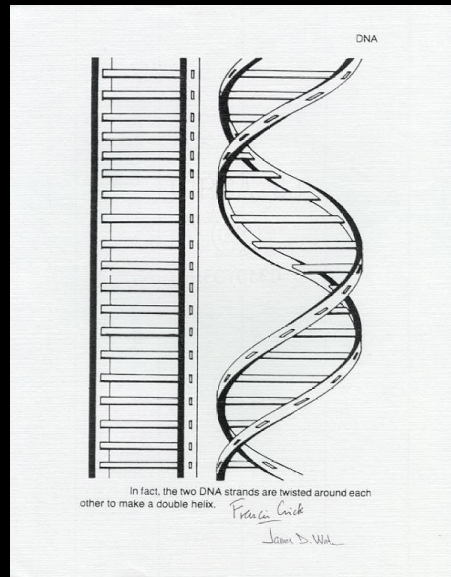
Transcription

- **Double stranded DNA** must be **TRANSCRIBED**
 - Into **Single stranded RNA**



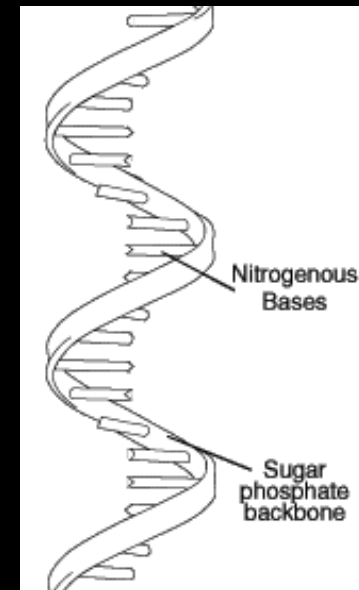
DNA

1. sugar = **deoxyribose**
2. bases = A, C, G, **T**
3. **double** strand
4. **stays** in nucleus

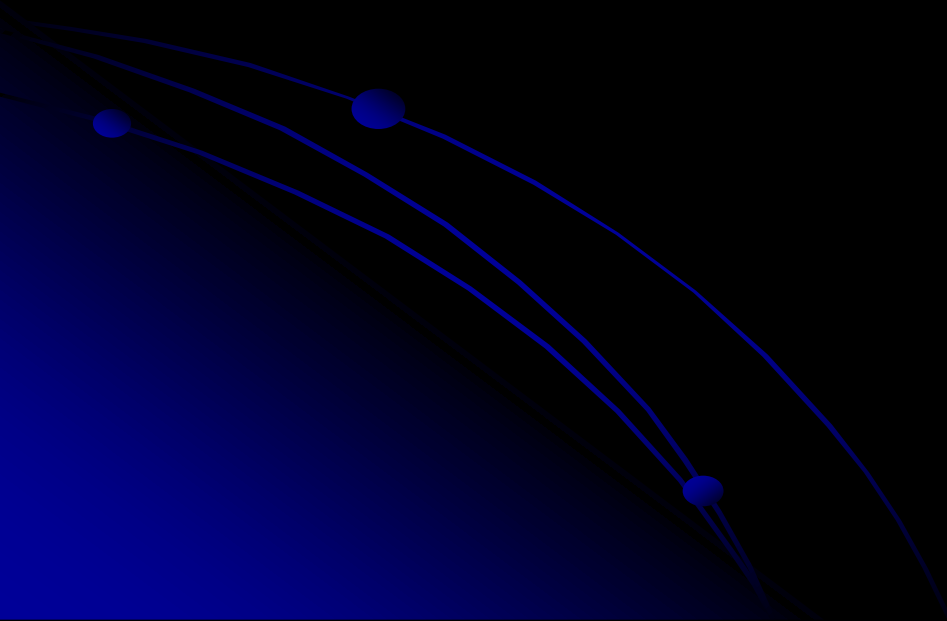


RNA

1. sugar = **ribose**
2. Bases = A, C, G, **U**
3. **single** strand
4. **leaves** nucleus



What are the three main differences
between DNA and RNA?



There are three main differences between RNA and DNA:

- The sugar in RNA is ribose instead of deoxyribose.
- RNA is generally single-stranded.
- RNA contains uracil in place of thymine.

3 Types of RNA are made from DNA

1. mRNA → "messenger"

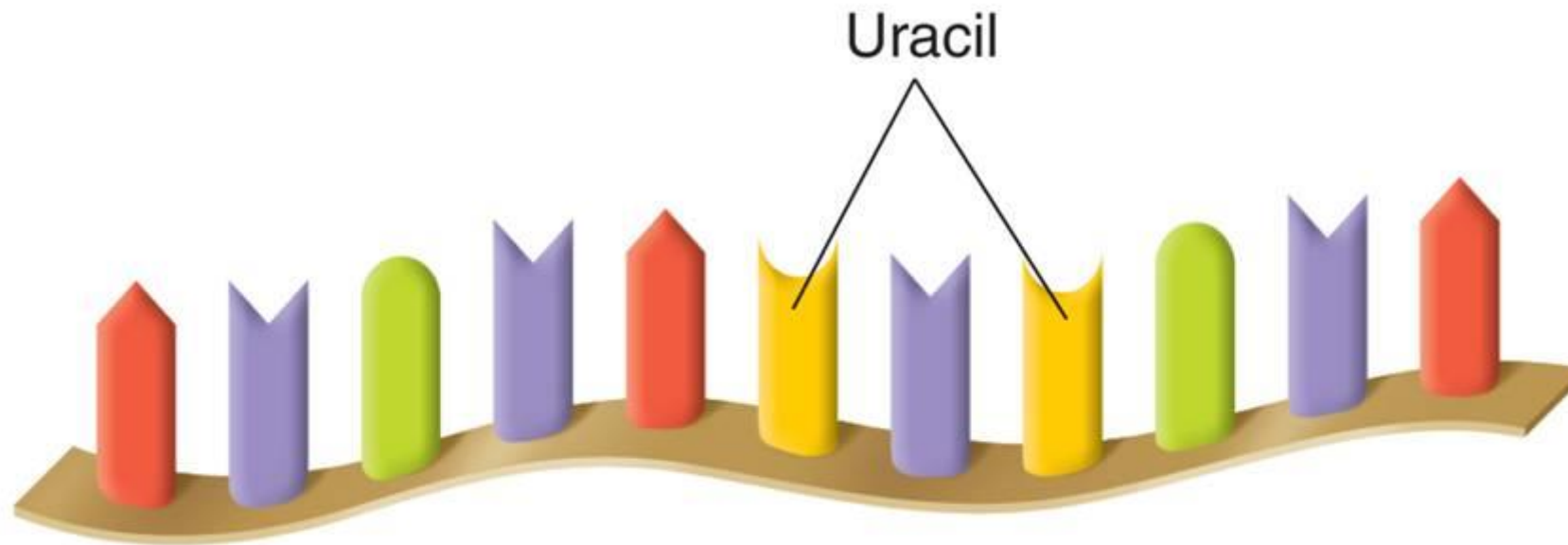
made from DNA in nucleus...travels out of nucleus and finds a ribosome.

2. tRNA → "transfer"

brings amino acids to the ribosomes; found in cytoplasm

3. rRNA → "ribosomal"

part of the ribosome; this is where proteins are made



Messenger RNA

Messenger RNA (mRNA) carries copies of instructions for assembling amino acids into proteins.

Ribosome



Ribosomal RNA

Ribosomes are made up of proteins and **ribosomal RNA (rRNA)**.

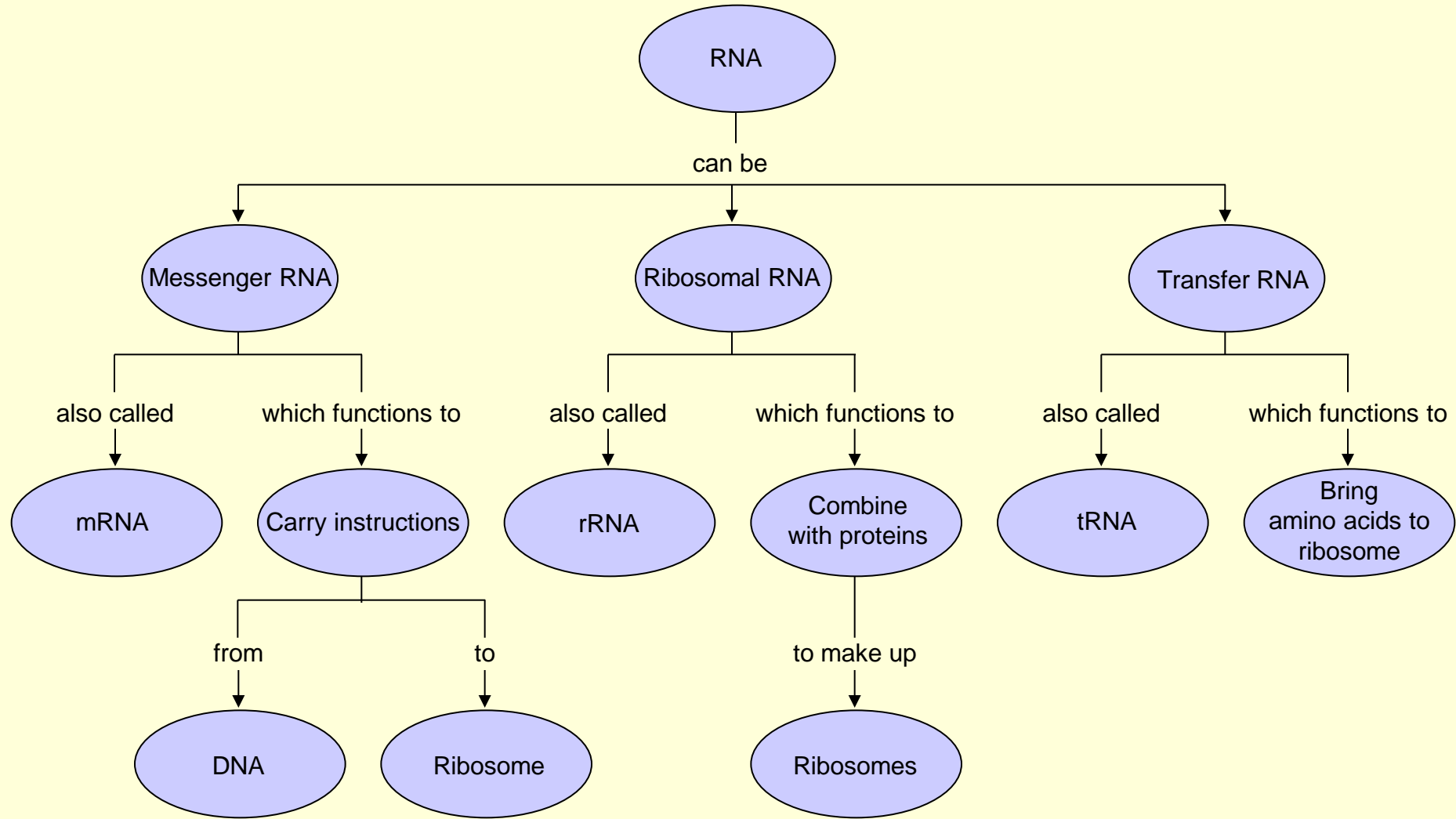
Amino acid



Transfer RNA

During protein construction, **transfer RNA** (tRNA) transfers each amino acid to the ribosome.

Concept Map



Transcription

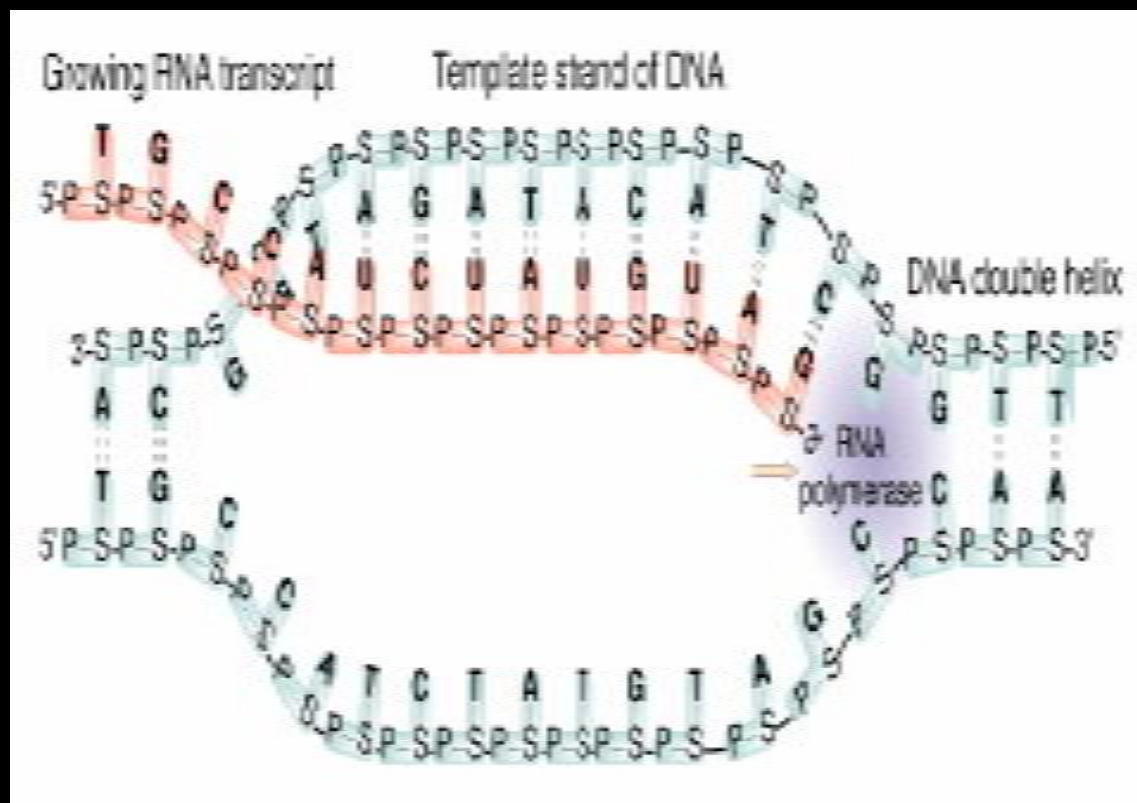
RNA molecules are produced by copying part of a nucleotide sequence of DNA into a complementary sequence in RNA. This process is called **transcription**.

Transcription requires the enzyme **RNA polymerase**.

Have we heard of another polymerase recently??

TRANSCRIPTION

How RNA is made from DNA

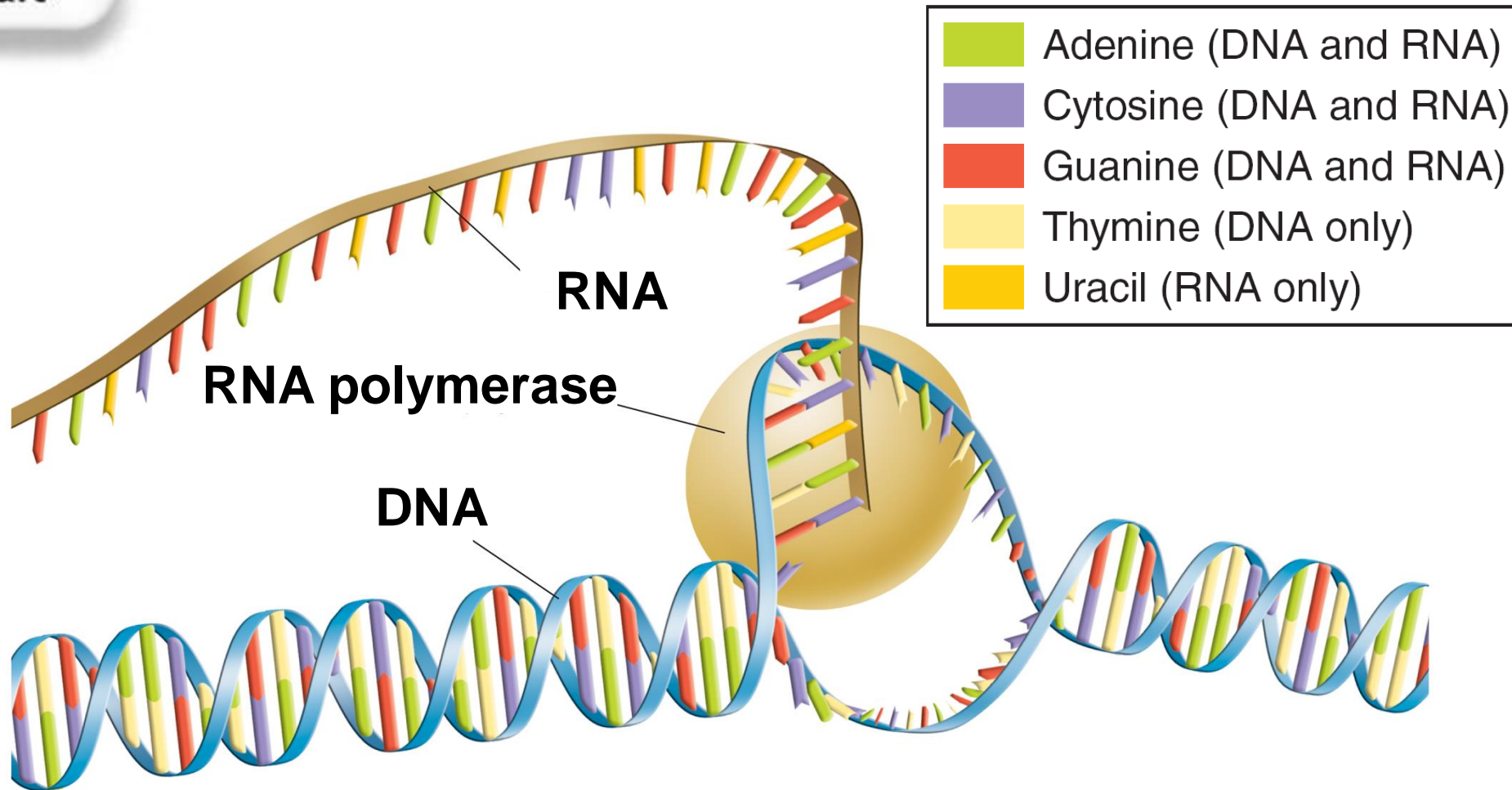


Transcription Steps

1. RNA polymerase binds to the promoter site (TATA box) (start) on the DNA
2. RNA polymerase adds RNA nucleotides complimentary to the DNA strand
3. mRNA building is complete when the RNA polymerase reaches a Termination (stop) site on the DNA
4. This strand of mRNA is **EDITED** before leaving the nucleus & carrying the code into the cytoplasm

✓ ***DNA never leaves the nucleus***

movie
click to start



Don't Confuse Replication with Transcription!

DNA Replication

DNA-DNA

A – T

C – G

G – C

T – A

Transcription

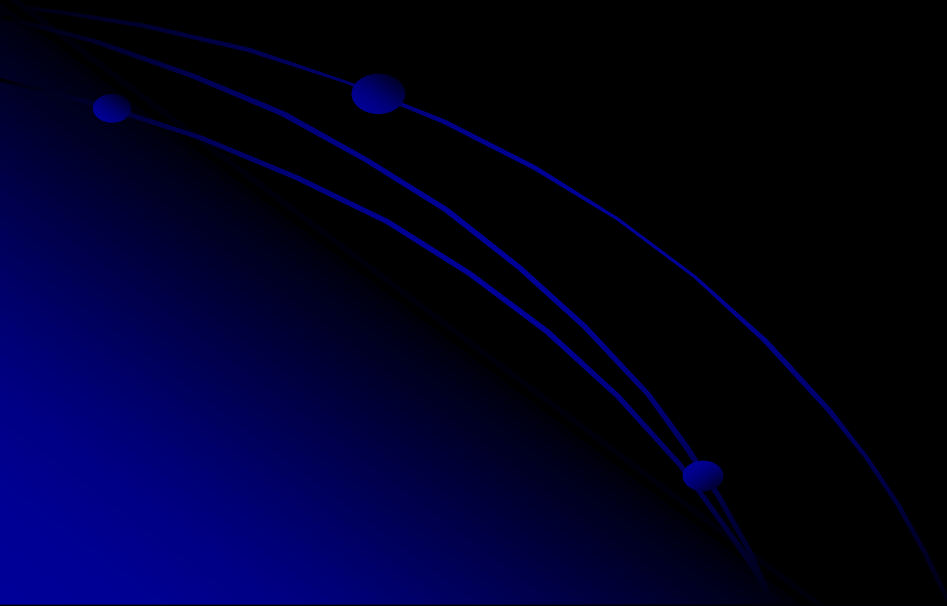
DNA-mRNA

A – U

C – G

G – C

T – A

- Lets watch:
 - <https://www.youtube.com/watch?v=JZXT2uOcD2w>
 - <https://www.youtube.com/watch?v=ztPkv7wc3yU>
- 

Transcribe this.....

TACAGTACCATAATC
| | | | | | | | | |
AUGUCAUGGUAAUAG

Is ALL the DNA transcribed into mRNA?

● NO!!!

- Only certain sections of the DNA are made (transcribed) into message (mRNA)
- AND...only part of the mRNA is actually used and sent out of the nucleus to meet up with a ribosome! This is **EDITING!!**

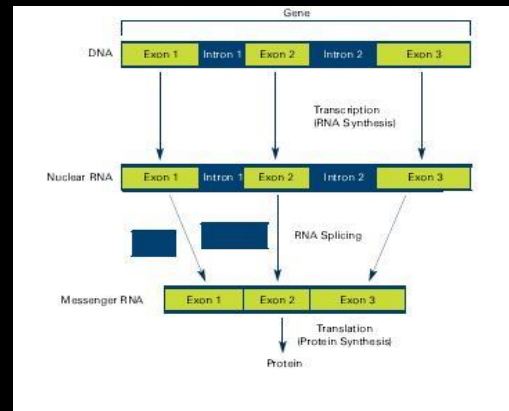
How is mRNA Edited?.

On a mRNA strand there are areas called:

Exons and Introns

Introns are cut out before leaving the nucleus

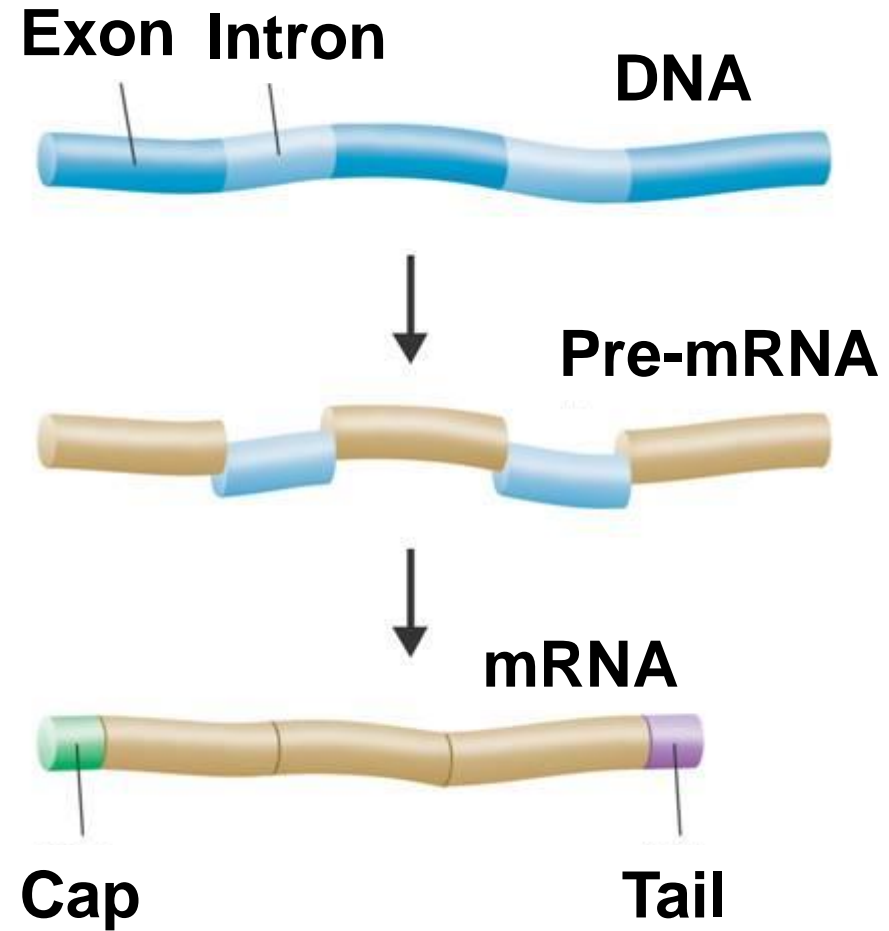
Exons are left, and this shortened piece of mRNA leaves the nucleus and gets Translated into Proteins

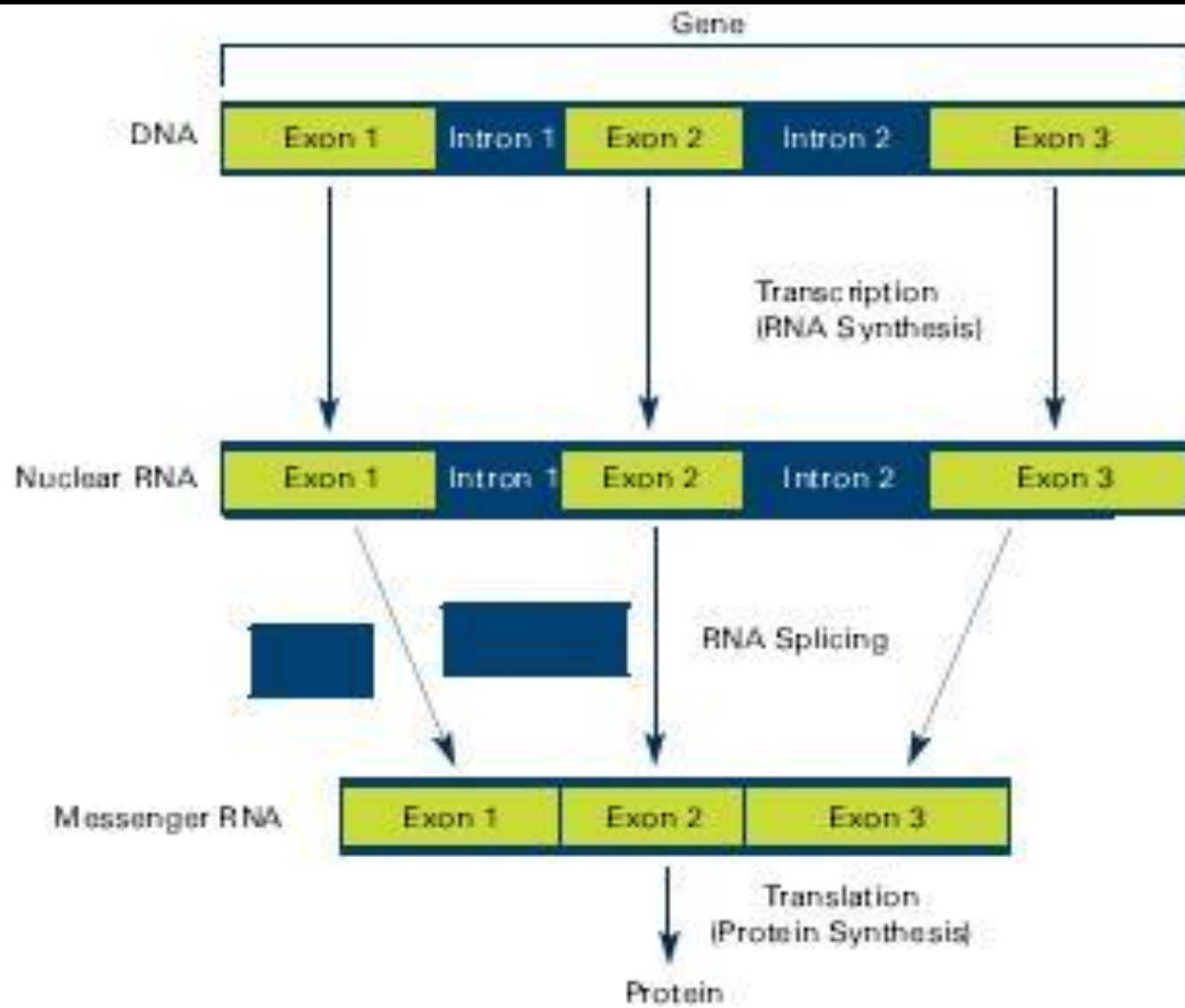


mRNA is EDITED

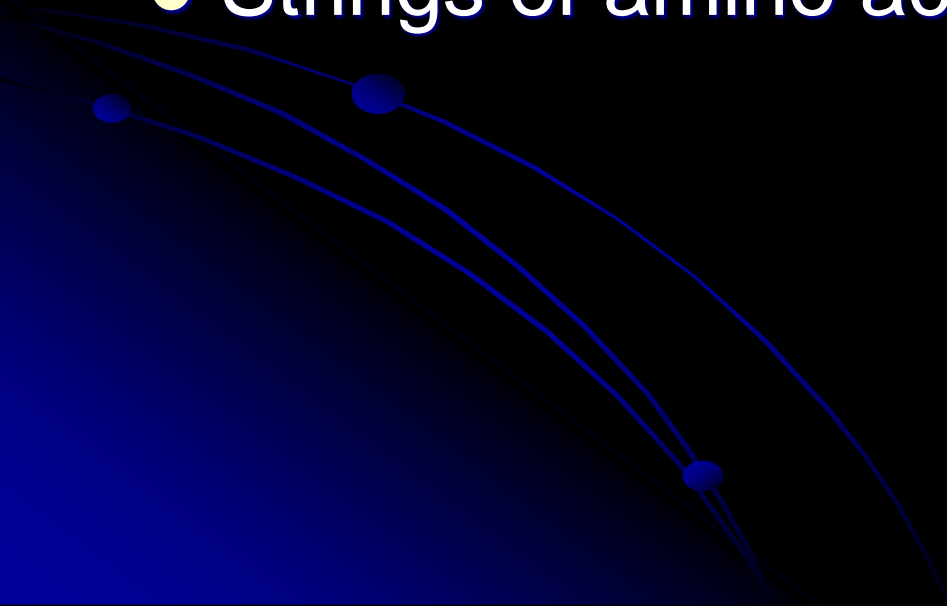
The introns are cut out of RNA molecules.

The exons are the spliced together to form mRNA.





Now...to make proteins from the mRNA

- This is called: **Translation**
 - The mRNA codes for certain amino acids
 - Strings of amino acids are proteins.
- 

Chapter 8.5 pg 243-247

Translation



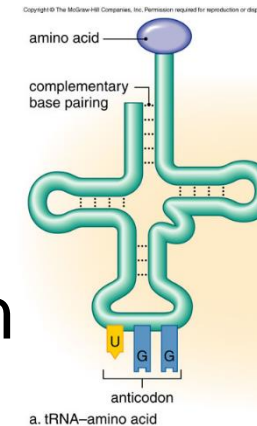
What: Translation is the **decoding** of an mRNA message **into** a polypeptide chain (protein).



WHO: tRNA transfer RNA

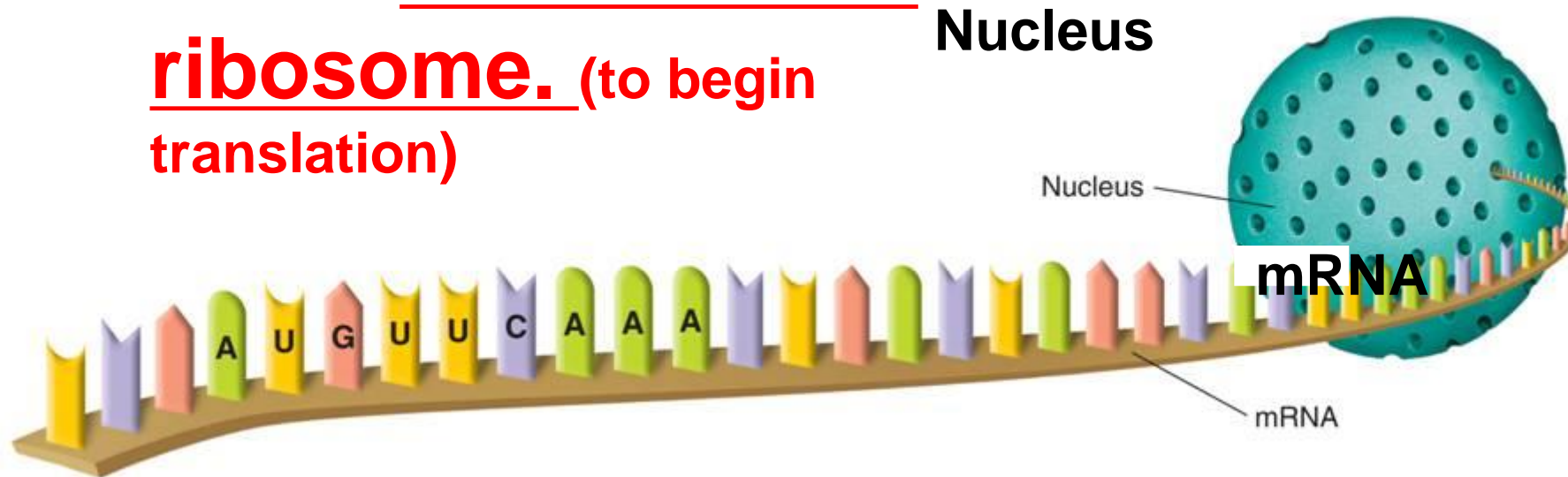
Where: Translation takes place on **ribosomes** in the cytoplasm.

Why: During translation, the cell uses information from messenger mRNA **to produce proteins.**



TRANSLATION STEPS:

1. Messenger RNA is transcribed in the nucleus, and then enters the cytoplasm where it **attaches to a ribosome.** (to begin translation)



STEP 1: Initiation

Translation begins when an mRNA molecule **attaches to a ribosome.**

STEP 2: As each codon (group of 3 nucleotides) of the mRNA molecule moves through the ribosome, the proper amino acid is brought into the ribosome by **tRNA.**

STEP 3: Elongation

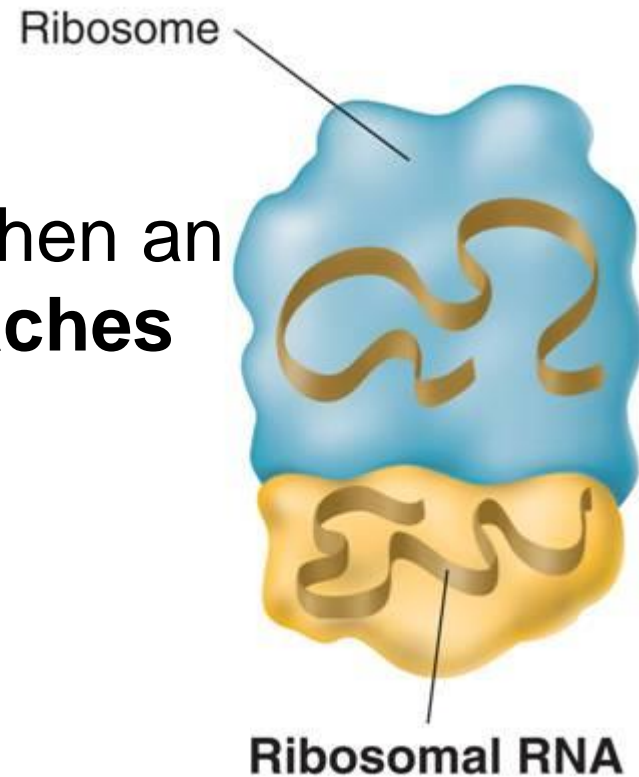
In the ribosome, amino acids are transferred to the growing polypeptide chain by the action of the tRNA (elongation)

STEP 4: TERMINATION

When the “STOP” codon is reached the mRNA uncouples from the ribosome.

STEP 1:

Translation begins when an mRNA molecule **attaches to a ribosome.**



Ribosomes are made up of proteins and **ribosomal RNA (rRNA).**

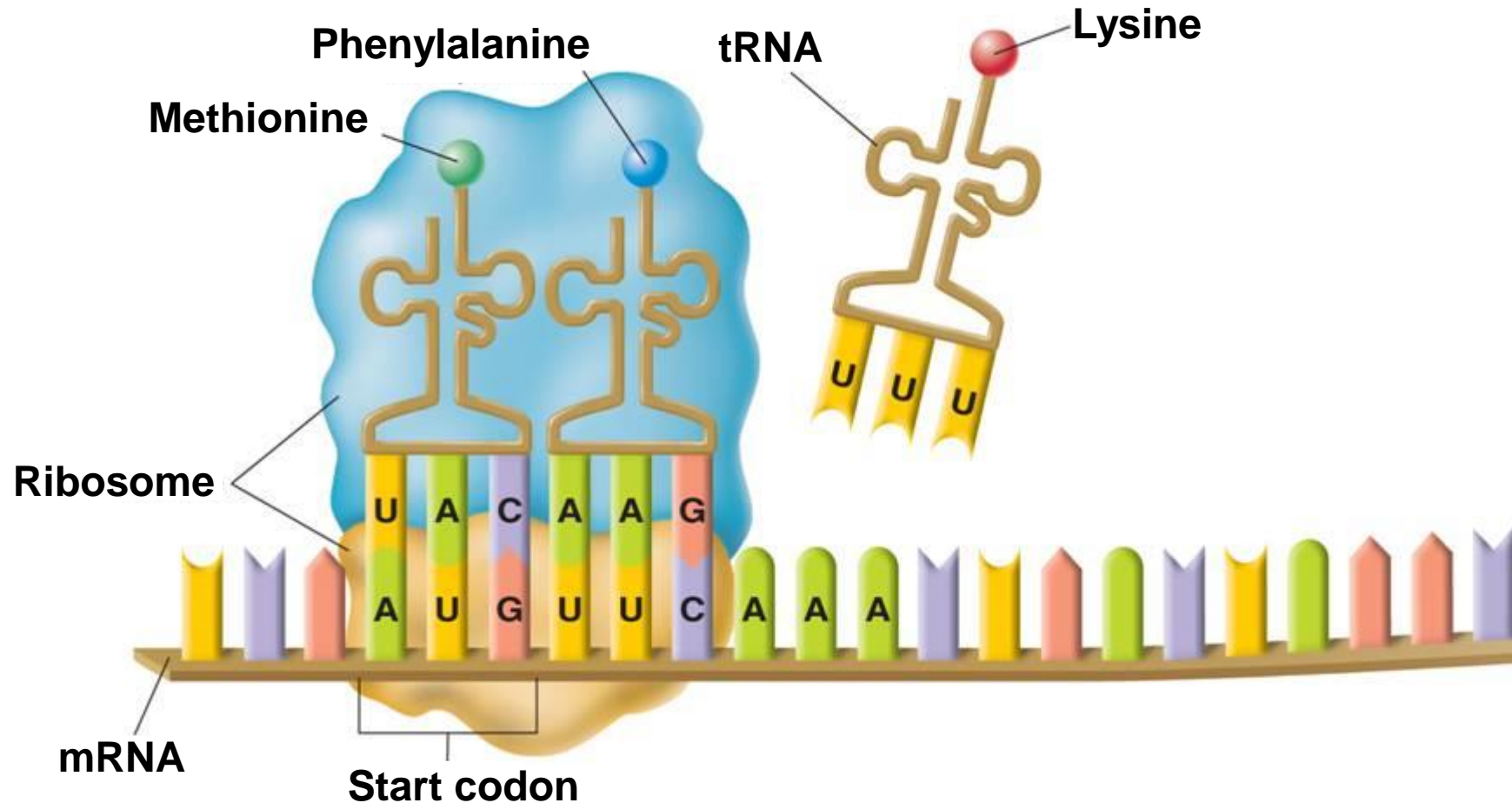
Amino acid



Transfer RNA

During protein construction, **transfer RNA** (tRNA) transfers each amino acid to the ribosome.

STEP 4: The ribosome binds new tRNA molecules and amino acids as it moves along the mRNA.



More about tRNA

Each tRNA molecule carries only one kind of amino acid. (as determined by the anti-codon)

In addition to an amino acid, each tRNA molecule has three unpaired bases.

These bases, called the anticodon, are complementary to one mRNA codon.

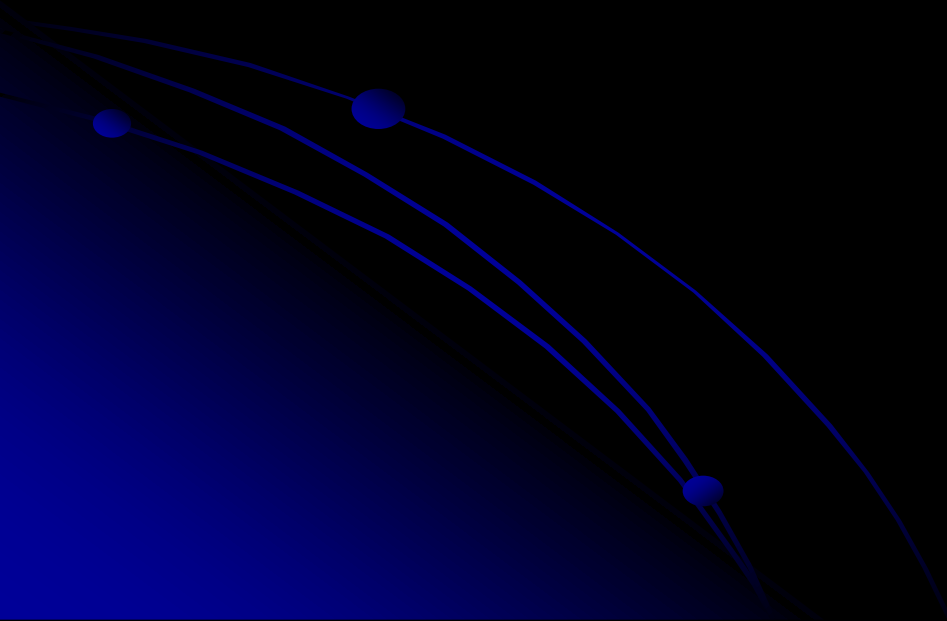
To determine what Amino Acid is coded for you look at the Genetic Code codon chart:

Translation :Decoding the Message

FOR REVIEW

1. mRNA leave nucleus and enters ribosome
2. mRNA codons read & tRNA brings matching amino acid to the ribosome
3. The tRNA anticodon is complimentary to the mRNA codon
4. Amino acids are strung together like beads on a necklace
5. Amino Acids are held together by peptide bonds
6. 1000 or more Amino Acids = protein

- Lets watch!
- <https://www.youtube.com/watch?v=5bLEDd-PSTQ>
- https://www.youtube.com/watch?v=TfYf_rPWUdY



The Genetic Code

The genetic code is the “language” of mRNA instructions.

The code is written using four “letters” (the bases: A, U, C, and G).

WHEN WE DECODE DNA

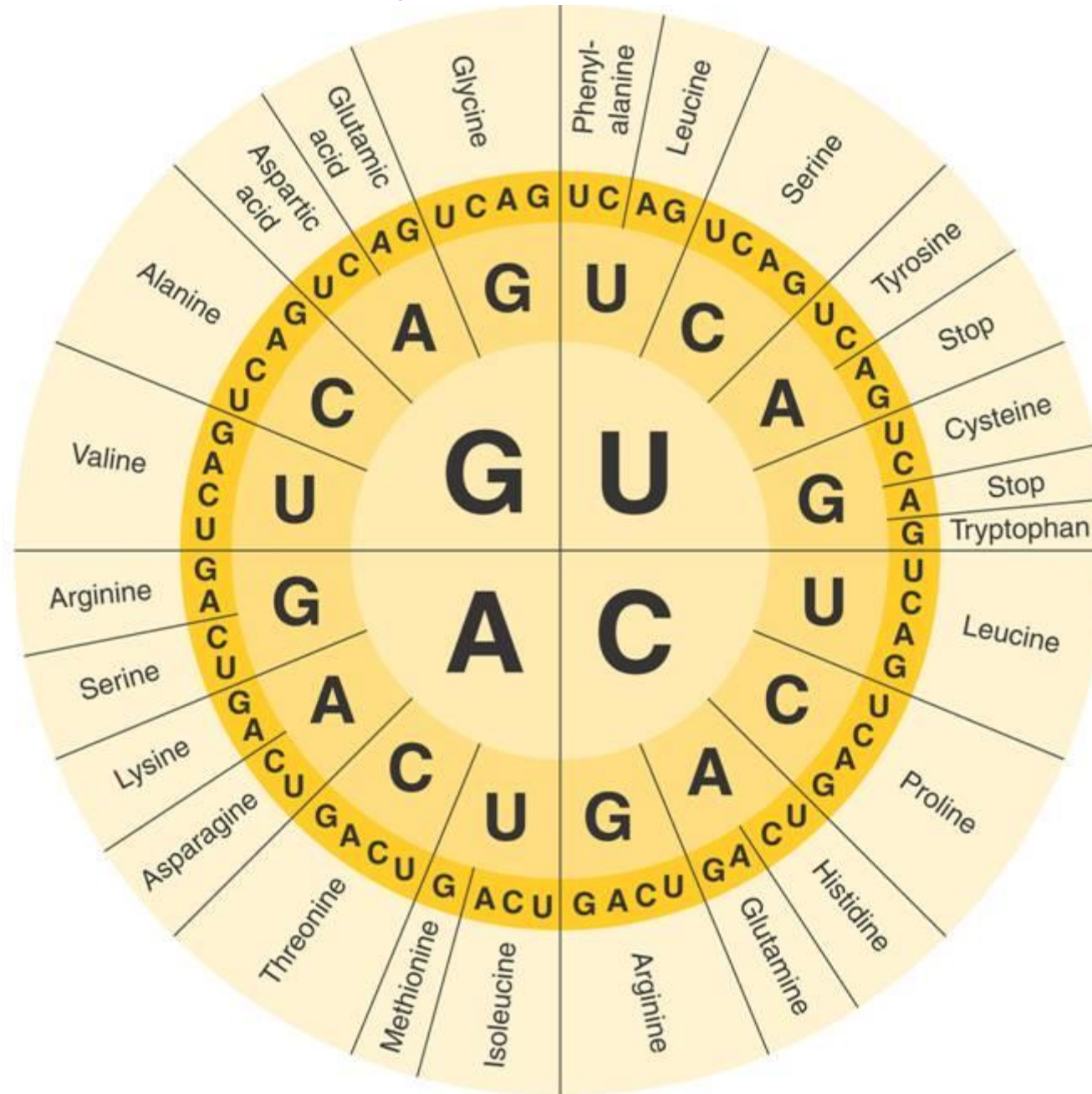
- ✓ Use the "Genetic Code"
→
- ✓ Convert mRNA 3 letter groupings called **codons**

Example:

AUG= Methylamine (Start)

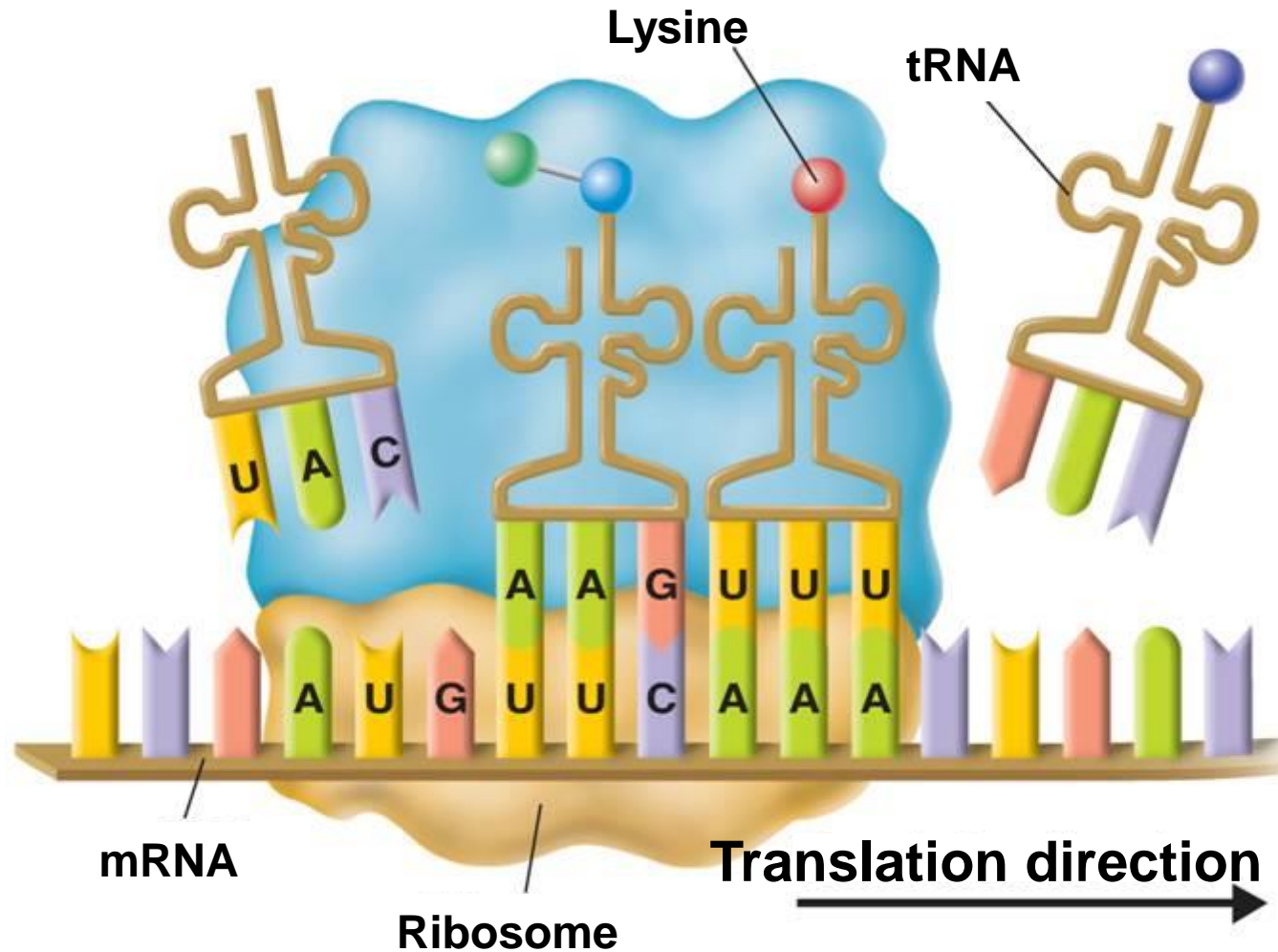
- ✓ The **mRNA** Code tells us what **amino acid** each codon codes for.

		Second position				
		U	C	A	G	
First position	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/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



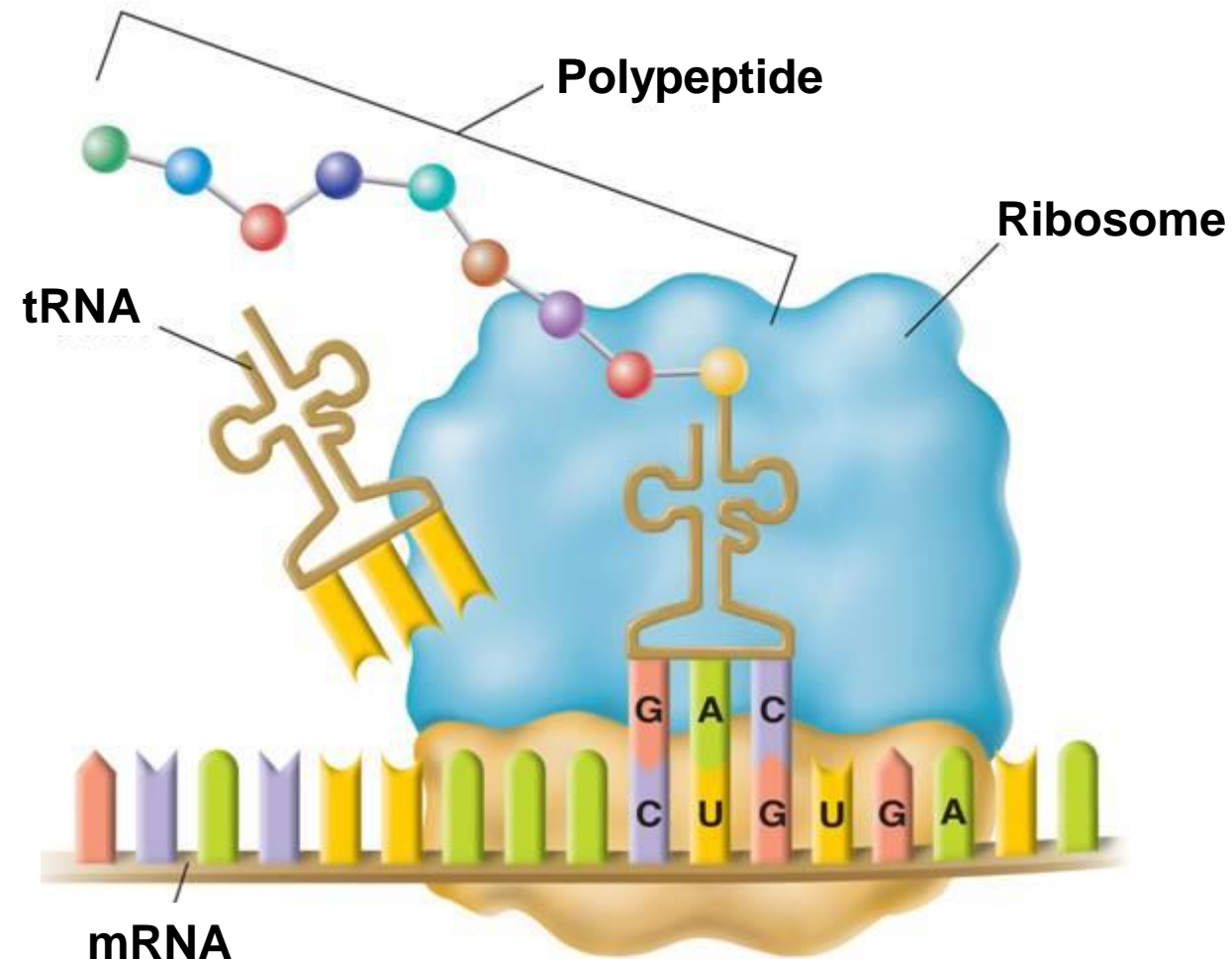
		Second base							
		U	C	A	G				
First base (5' end)	U	UUU	UCU UCC UCA UCG	UAU UAC UAA Stop UAG Stop	UGU UGC UGA Stop UGG Trp	U C A G			
		UUC					Phe	Tyr	Cys
		UUA							
		UUG					Trp	Trp	Trp
	C	CUU	CCU CCC CCA CCG	CAU CAC CAA CAG	CGU CGC CGA CGG	U C A G			
		CUC					Leu	His	Arg
		CUA							
		CUG					Gly	Gly	Gly
	A	AUU	ACU ACC ACA ACG	AAU AAC AAA AAG	AGU AGC AGA AGG	U C A G			
		AUC					Ile	Asn	Ser
		AUA							
		AUG					Met or start	Gly	Gly
	G	GUU	GCU GCC GCA GCG	GAU GAC GAA GAG	GGU GGC GGA GGG	U C A G			
		GUC					Val	Asp	Gly
		GUA							
		GUG					Gly	Gly	Gly
						Third base (3' end)			

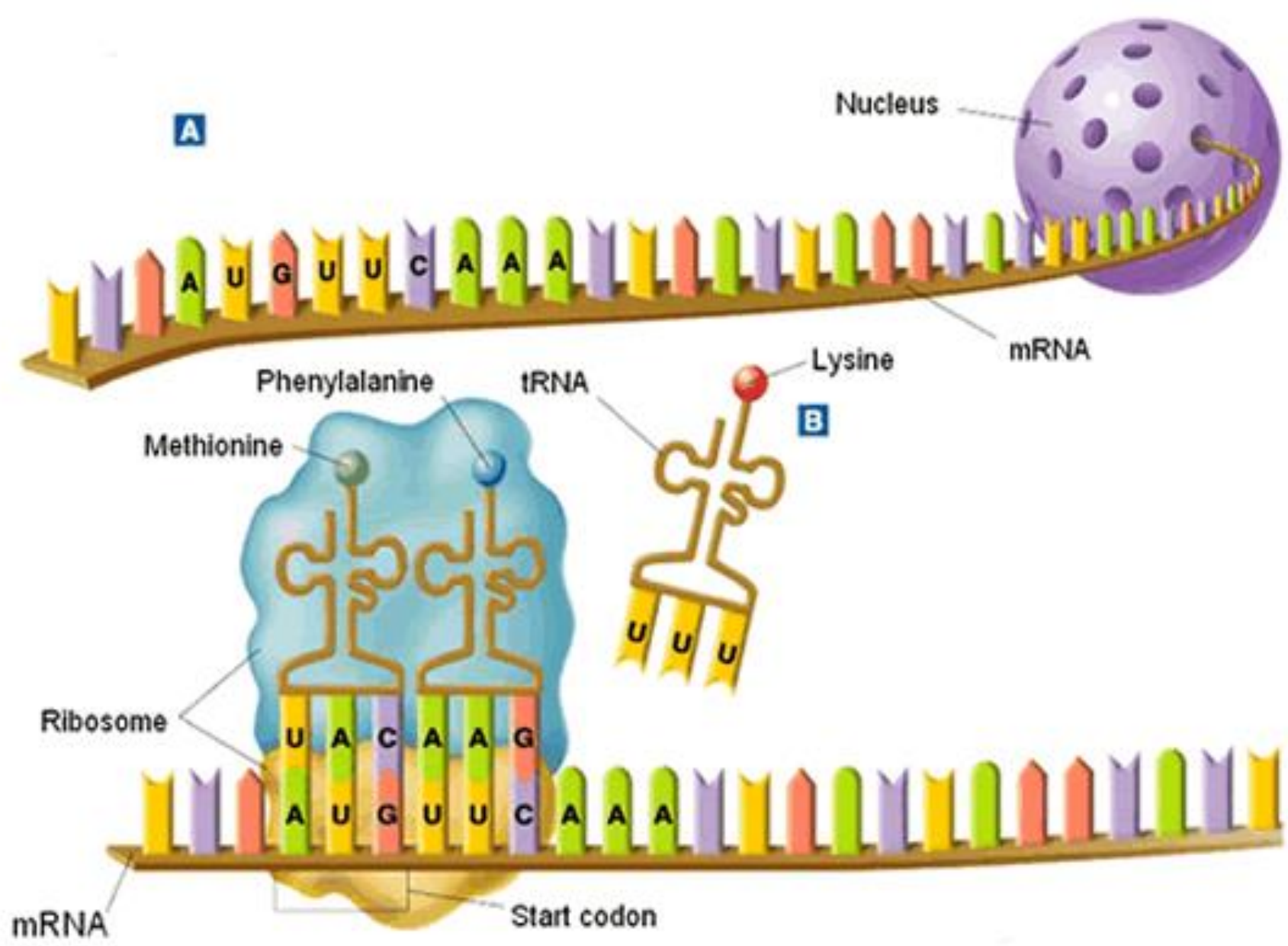
Protein Synthesis



movie
click to start

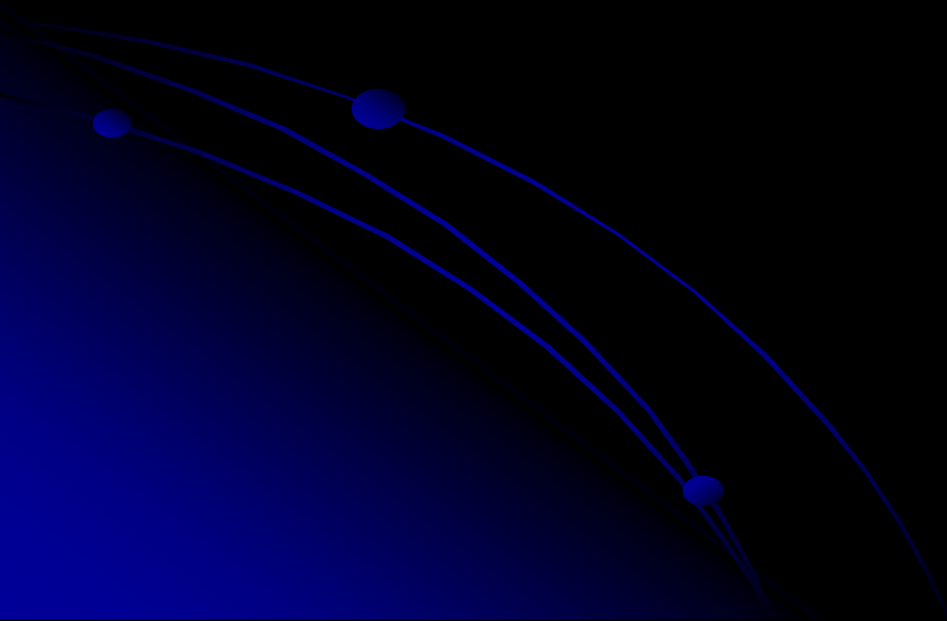
The process continues until the ribosome reaches a stop codon.

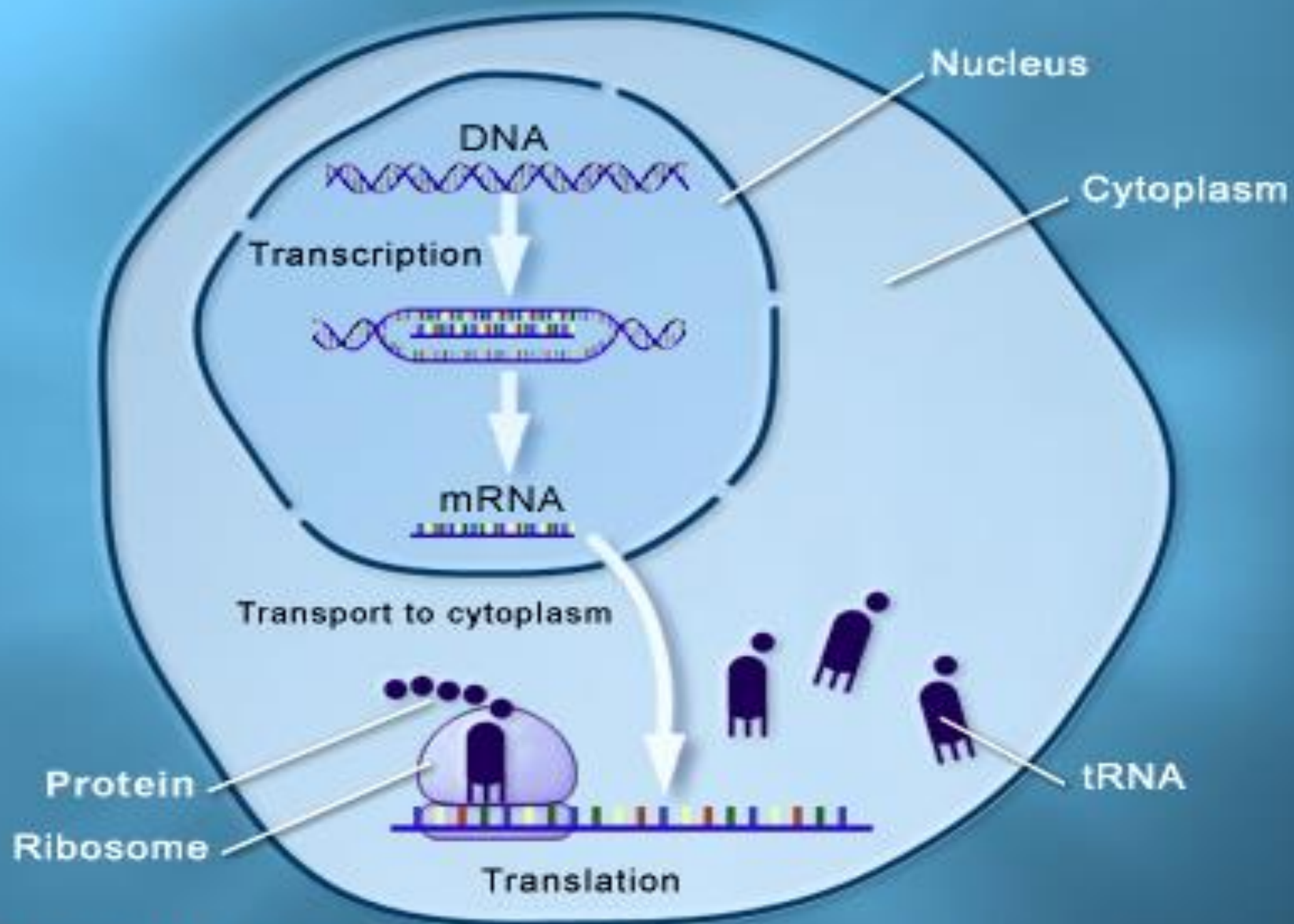




REVIEW!

- Watch these:
- <https://www.youtube.com/watch?v=gG7uCskUOrA>
- <https://www.youtube.com/watch?v=28mgfg8nRT4>





The Roles of RNA and DNA

The cell uses the DNA “master plan” to prepare RNA “blueprints.”
The DNA stays in the nucleus.

The RNA molecules go to the protein building sites in the cytoplasm—the ribosomes.

Transcribe and Translate this DNA Strand

without looking at your notes

TACAGTACCATTAATC

NOW, Label the DNA, mRNA, tRNA, amino acid, codon, anticodon

Which part is *transcription*

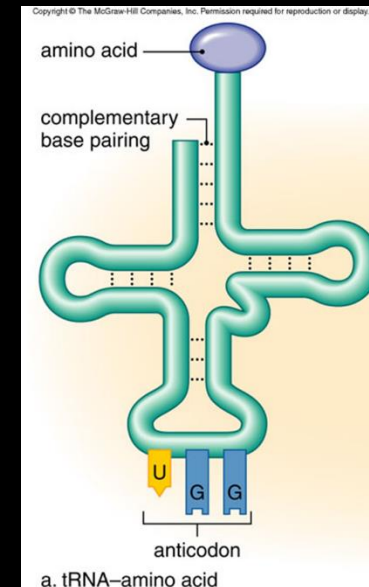
Which is *translation* ?

DNA TACAGTACCATTAATC
mRNA AUGUCAUGGUAUUAG
tRNA UACAGUACCAUAAUC
rRNA MET-SER-TRP-TYR-STOP

Codon

Anticodon

Amino Acid



Vocabulary for ppt 2 Transcription and Translation

Chapter 8.4 and 8.5

- Genes
- DNA
- RNA
- Protein
- mRNA
- tRNA
- rRNA
- Transcription
- RNA Polymerase
- RNA bases
- Exon
- Intron

- Amino Acid
- Ribosome
- Translation
- Codon
- Anticodon
- Genetic Code Chart
- Start codon
- Stop Codons