



جامعة المستقبل  
AL MUSTAQBAL UNIVERSITY

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# Molecular Biology

Lecture: (5)

First Stage



## Post- transcriptional Regulation (Modification)

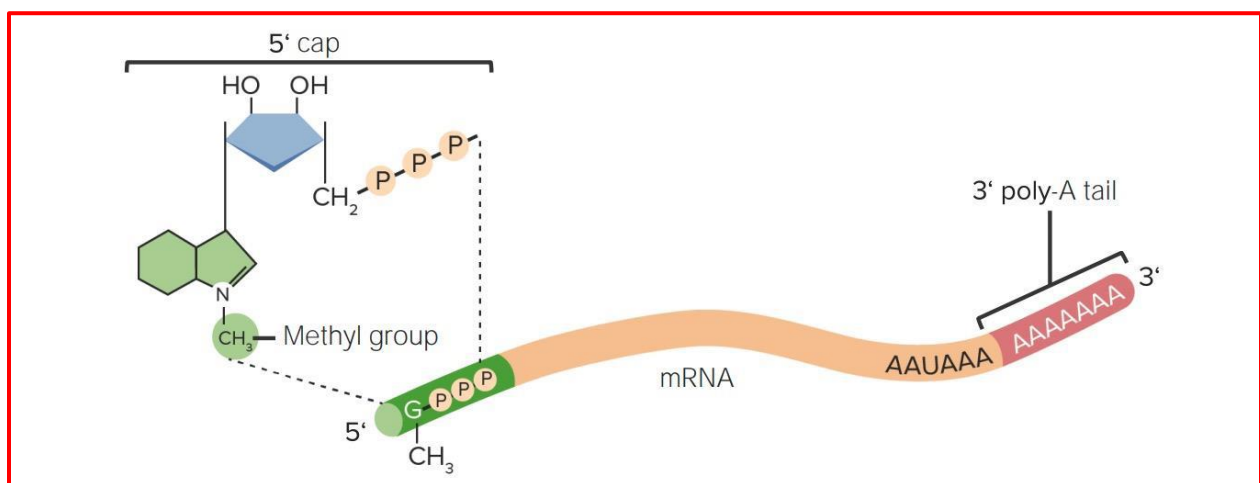
Post-transcriptional regulation can be used to regulate the active amount of RNA by modification . It occurs between the transcription phase and the translation phase of gene expression.

In prokaryotic cell, RNA transcripts are ready to act as mRNA s and get translated into proteins right away, but in Eukaryotic cell pre-RNA needs to go through a few more steps to become an actual mRNA (mature mRNA).

processing includes Additions of **5' cap** and **poly-A tail**. Both the cap and the tail **protect the transcript** and help it get exported from the nucleus and translated on the ribosomes (protein-making "machines") found in the cytosol.

**A-**Adding cap structure:

**B-**Polyadenylation (poly Adenine residue):



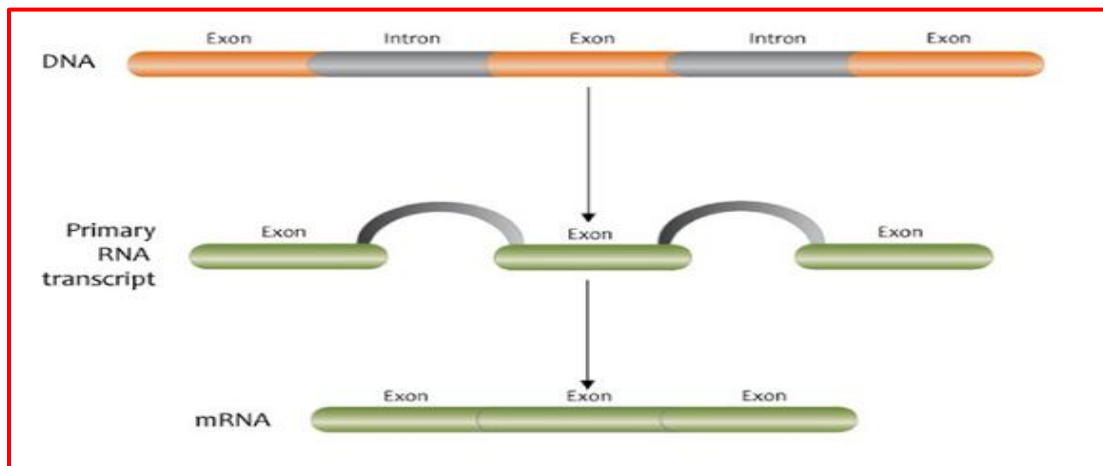


## 2- Splicing:

Eukaryotic genes are composed of **exons**, which correspond to protein-coding sequences, and intervening sequences called **introns** (sequences in mRNA do not encode functional proteins).

The process of **removing introns** and **reconnecting exons** is called splicing.

Introns are removed and degraded while the pre-mRNA is still in the **nucleus**.



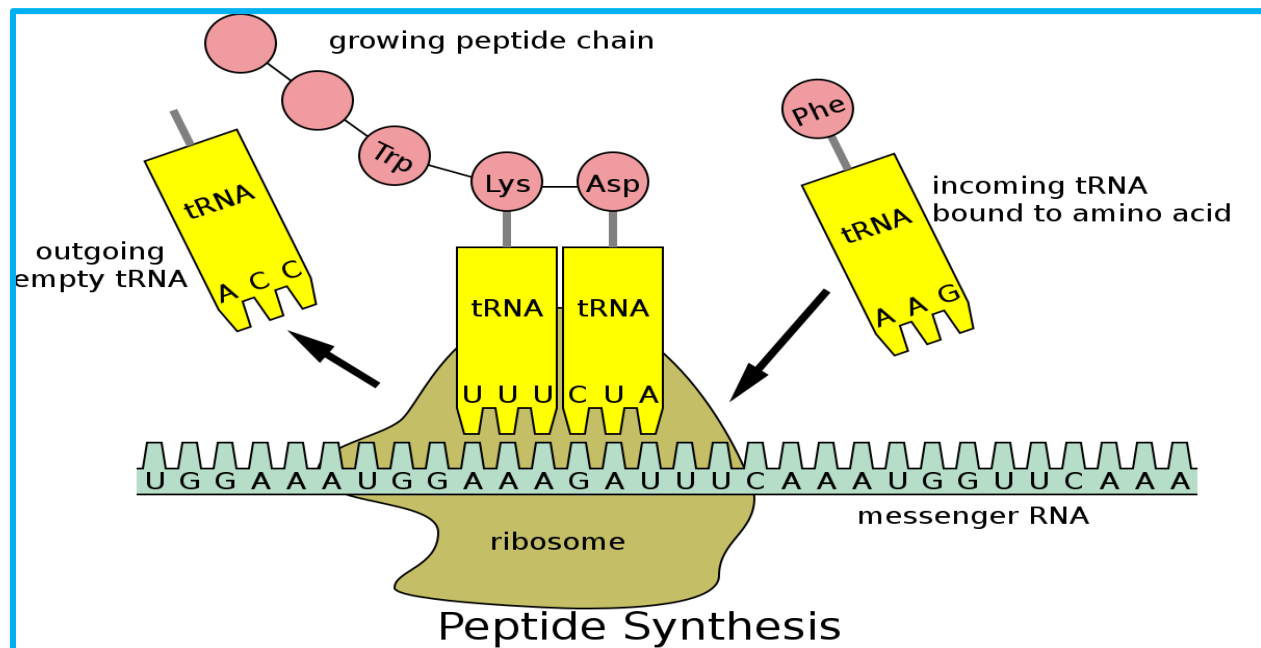
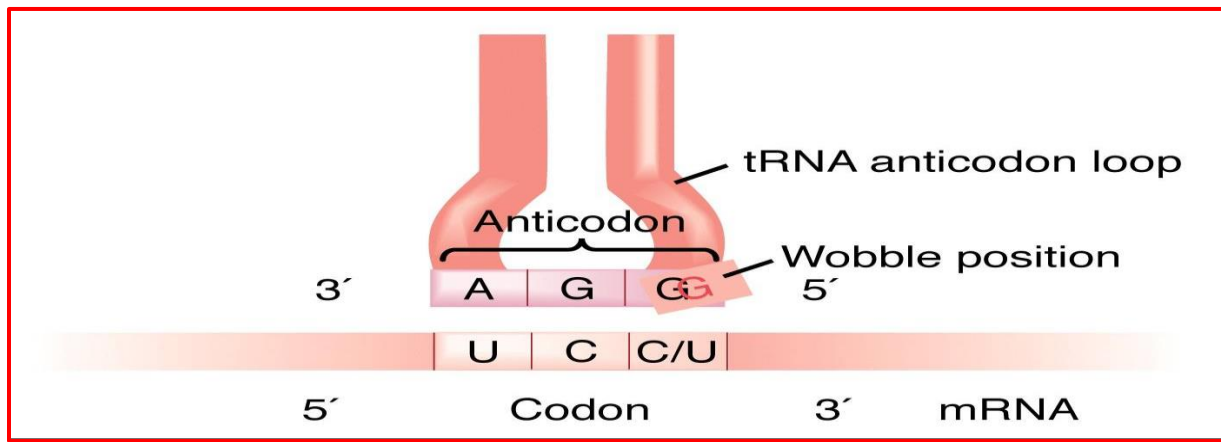
## RNA translation:

Translation is the process by which a protein is synthesized from the information contained in a molecule of messenger RNA (mRNA). During translation, a mRNA sequence is read using the **genetic code**.

- RNA translation is a process that produces a protein from an mRNA template via the **genetic code**.
- The process takes place in the cytoplasm.
- Requires another RNA, called **tRNA** , **rRNA**.
- Protein synthesis is operated by cell organelle called **ribosome**.

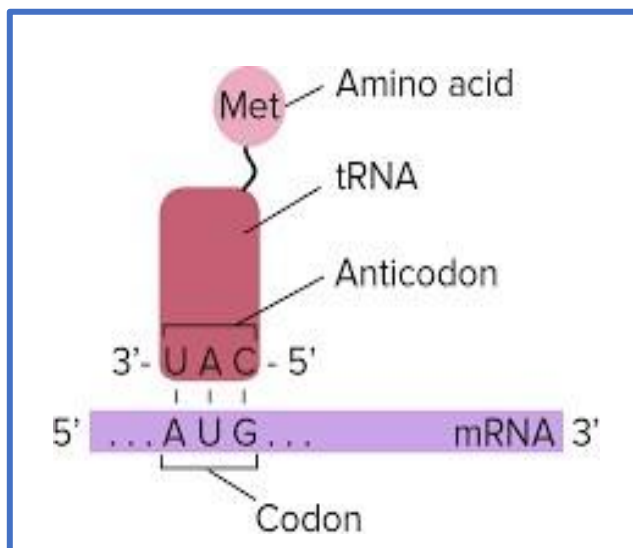


- The genetic code = **triplets of RNA bases** (called **codons**)
- Each codon encodes **1** amino acid.
- mRNA is read from **5' to 3'**.
- The protein is made from the -NH<sub>2</sub> end to the COOH end.





- **For example:**
- mRNA codon 5' AUG 3'
- tRNA anticodon 3' UAC 5'
- After **codon-anticodon** matching, the tRNAs covalently binds the
- Correct amino acid and carries it to the ribosome for the protein synthesis.
- the mRNA codon 5'AUG3' encodes for the amino acid **methionine**



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

1. Read mRNA sequence: 5' AUGAAAACU.....3'
2. Identify codons: 5' AUG/AAA/ACU/.....3'
3. Match codons with amino acids
  - AUG = Met (M)
  - AAA = Lys (K)
  - ACU = Thr (T)
4. Continue until you find the stop codon (UAA or UAG or UGA)
- Note: stop codons **do not code** for any amino acid; they just stop translation



**Question / Complete the following sequence and give the resulting amino acid chain?**

**ATGGGACATCCTTATCCATGA**

|      |  |      |     |     |      |      |      |      |  |
|------|--|------|-----|-----|------|------|------|------|--|
| DNA1 |  | ATG  | GGA | CAT | CCT  | TAT  | CCA  | TGA  |  |
| DNA2 |  | TAC  | CCT | GTA | GGA  | ATA  | GGT  | ACT  |  |
| mRNA |  | AUG  | GGA | CAU | CCU  | UAU  | CCA  | UGA  |  |
| tRNA |  | UAC  | CCU | CUA | GGA  | AUA  | GGU  | ACU  |  |
| A.A  |  | Met. | Gly | His | Pro. | Tyr. | Pro. | Stop |  |

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