

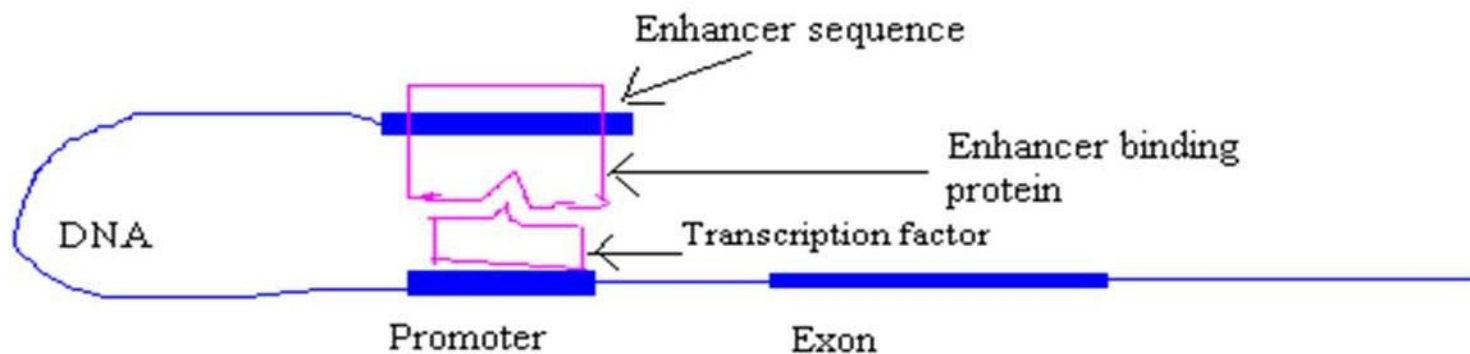


FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

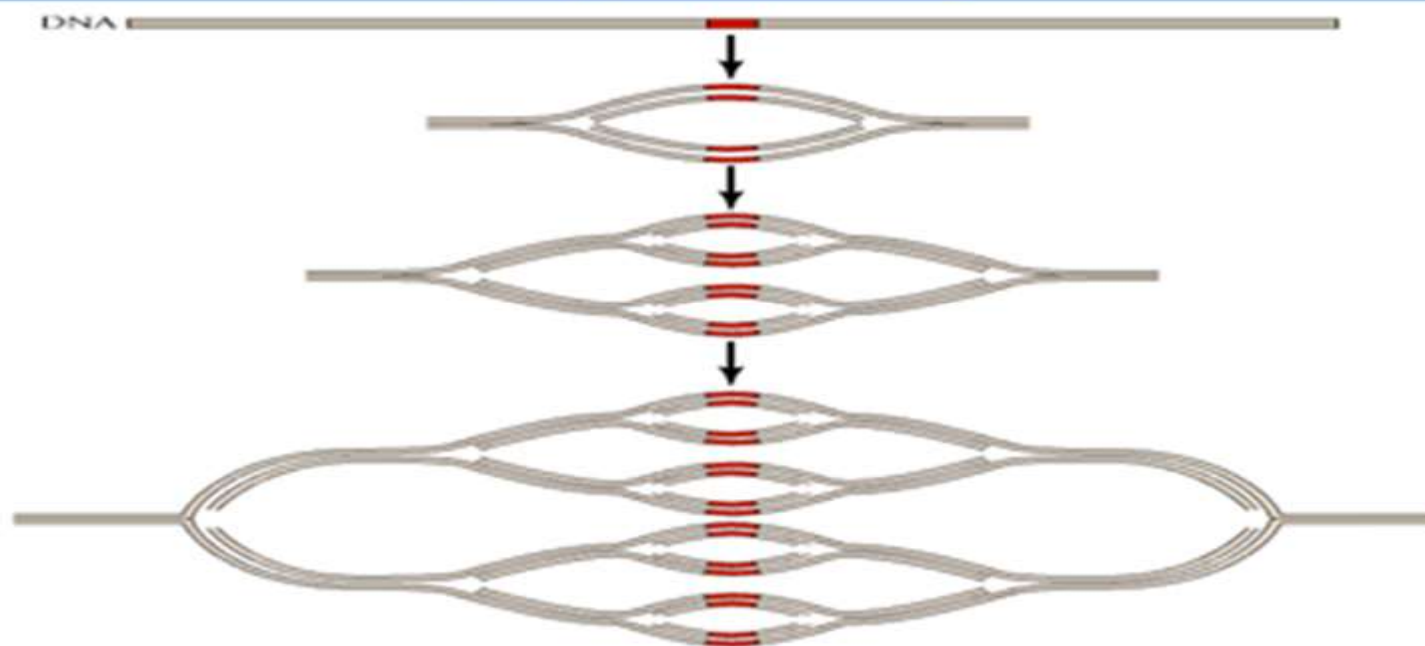
- **Action of an enhancer**

An enhancer binding protein has two binding sites

- Binds DNA
- Binds the transcription factors that are bound to the promoter



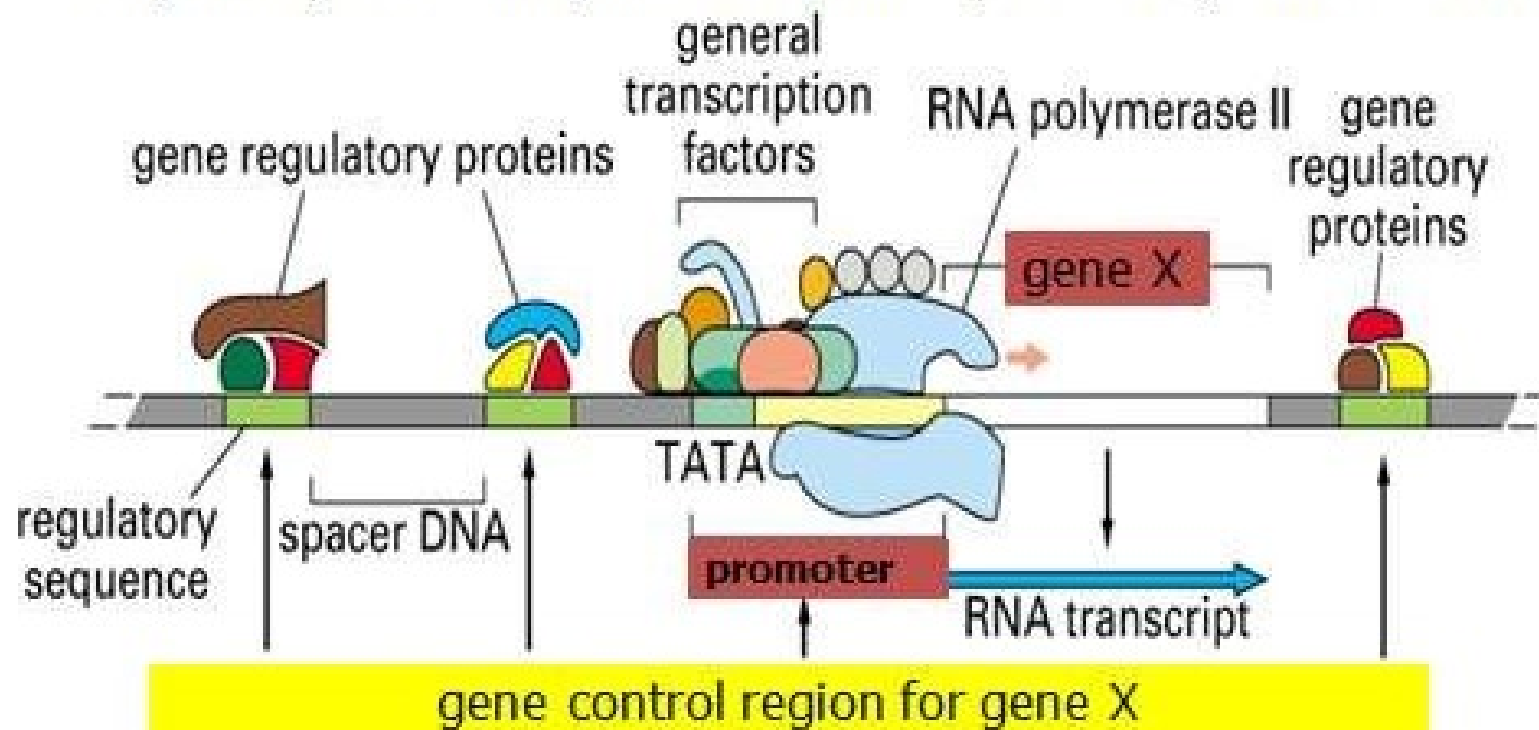
3-Control at DNA level by gene amplification:



Repeated rounds of DNA replication yield multiple copies of a particular chromosomal region.

4- Control at transcription initiation:

By using different sequences (promoter, enhancer or silencer sequences) and factors, the rate of transcription of a gene is controlled



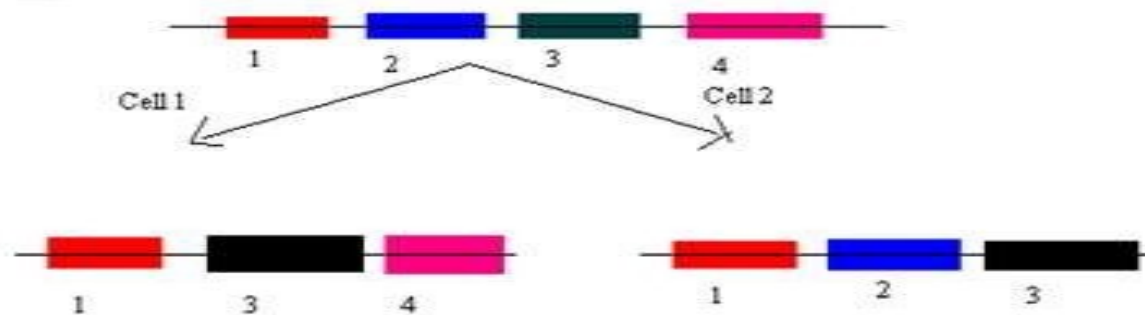
Regulation of RNA Processing



- RNA processing involves
 - Addition of 5' cap
 - Addition of a 3' poly (A) tail
 - Removal of introns
- The RNAs which get translated to proteins are transported out from the nucleus to cytoplasm.
- Depending on the final combination of exons after splicing different kinds of proteins are obtained which can perform different functions in the cell.

Exon Shuffling

- The functions of two proteins synthesized from the same mRNA are different in different cells as different combinations of exons exist in different cells.



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Regulation of RNA Transport

- Only some RNAs function within the nucleus whereas all other RNAs which are meant for protein synthesis have to be transported from the nucleus to the cytoplasm via nuclear pores.

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Regulation of RNA Longevity

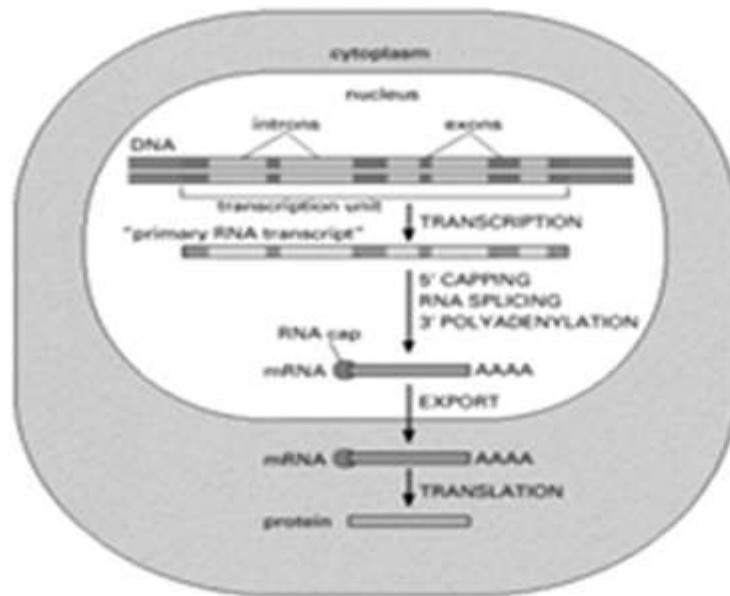


- mRNAs from different genes have different life spans.
- The information of the life span of mRNA is found in the 3' UTR.
- The sequence AUUUA within 3' UTR acts as a signal for early degradation.
- More the number of times the sequence is repeated → Shorter the lifespan of mRNA

RNA-processing control:

Capping, Splicing, Polyadenylation

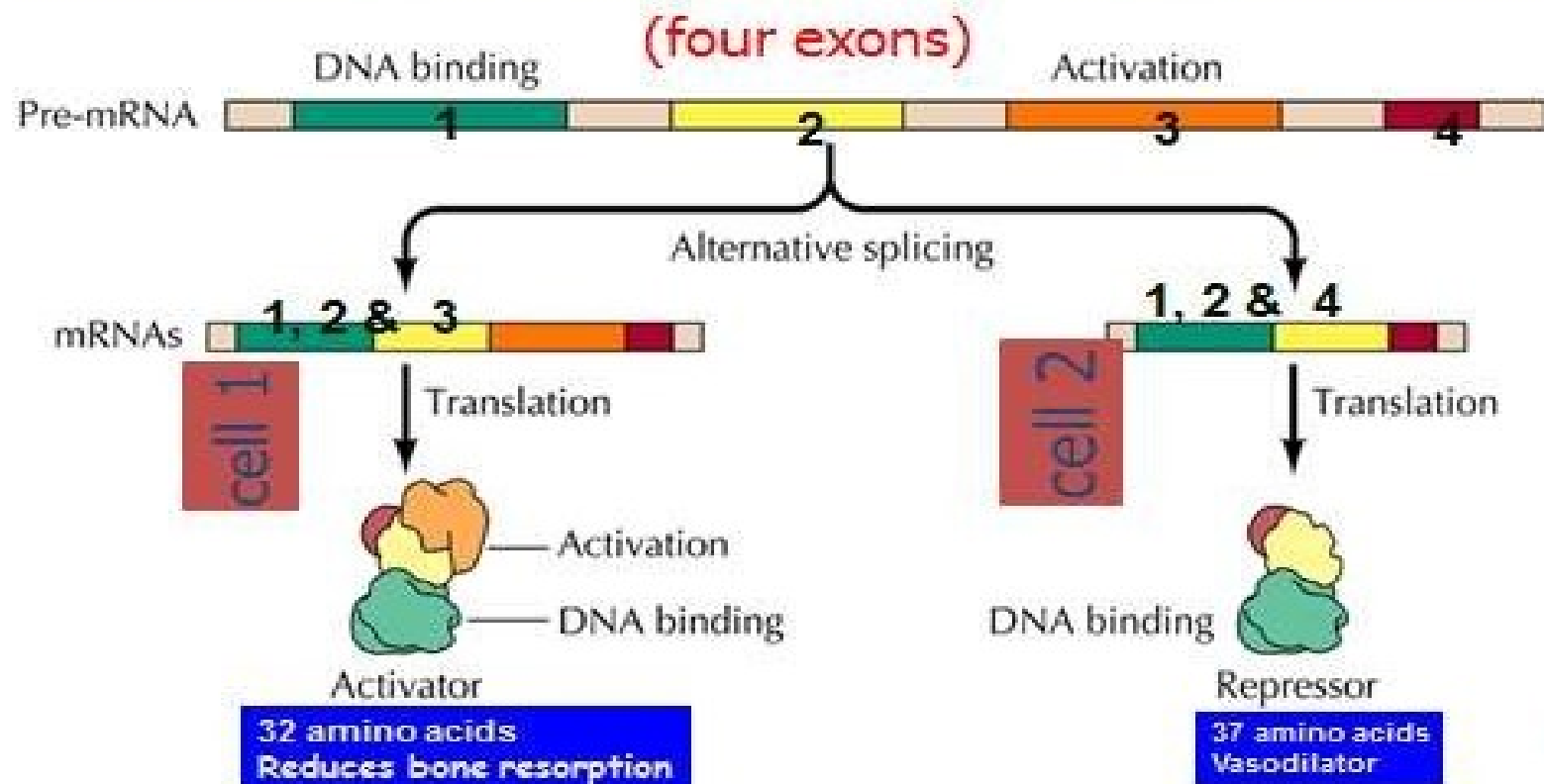
(A) EUKARYOTES



(B) PROCARYOTES



5- Control at mRNA splicing **(alternate splicing) :**

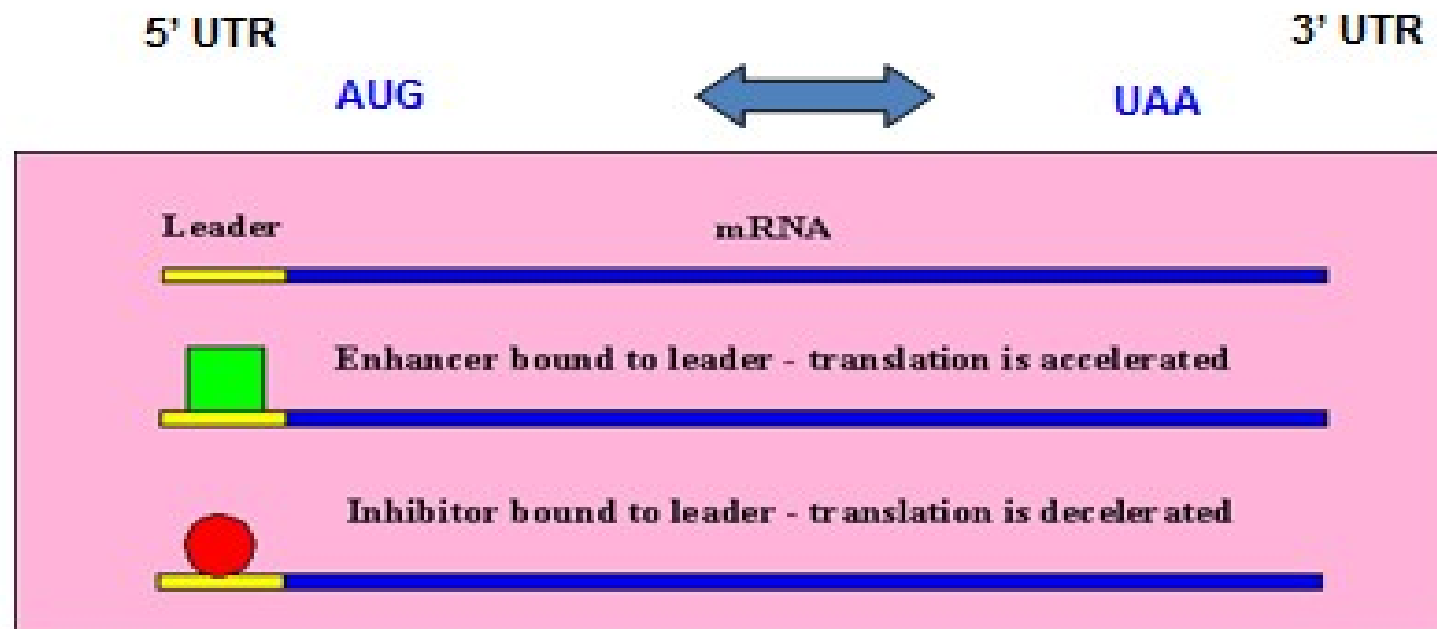


6.Regulation of Translation



- **Translational initiation**
 - The expression of a gene product also depends on the ability of the ribosome to recognize the correct AUG codon out of the multiple methionine codons present in the mRNA.
- **Control of translational process**
 - In many animals large amounts of mRNAs are produced by the eggs but all of them do not get translated until the egg is fertilized.

Control at initiation of translation:



Specific sequences make specific secondary structures

Specific protein factors bind to these secondary structures

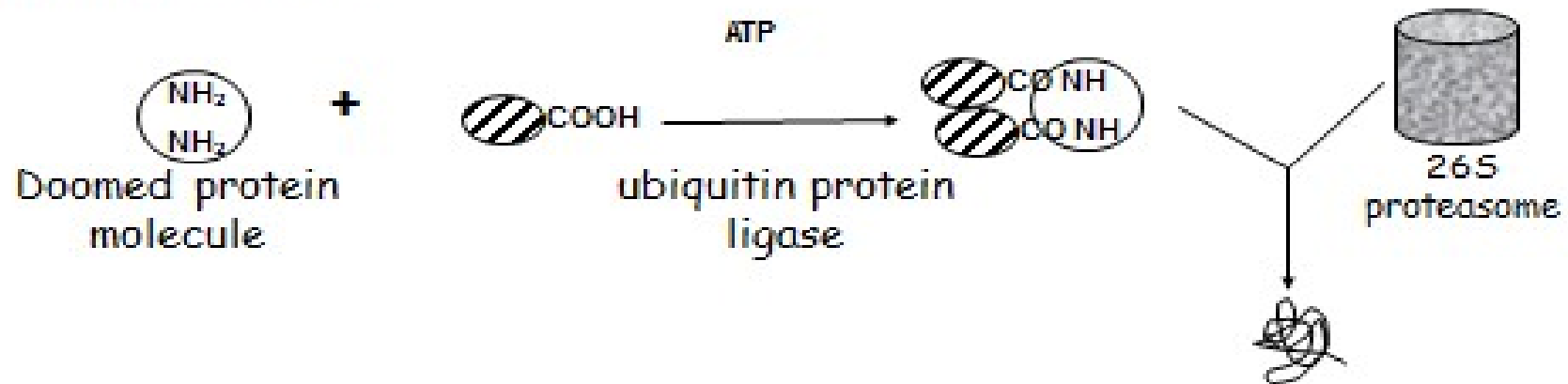
7. Post Translational Control Points

- **Post translational modifications**
 - Functional state of protein depends on modifications like glycosylation, acetylation, fatty acylation, disulfide bond formations.
 - Chaperons
- **Protein transport**
 - Transportation to the site of action
- **Protein stability**
 - The lifespan of a protein depends on the specific amino acid sequence present within them



8-Regulation by protein stability:

- Ubiquitin-dependent proteolysis. Cyclins control of cell cycle.
- Protein molecule is tagged for degradation by attachment of a 20 kDa protein, ubiquitin



- The stability of a protein depends upon its *N*-terminal amino acid (the *N*-end rule).

N-terminal : For example arginine , lysine : protein $t_{1/2} = 3$ min

N-terminal : For example methionine, alanine, : $t_{1/2} > 20$ hrs.

Regulation of gene expression

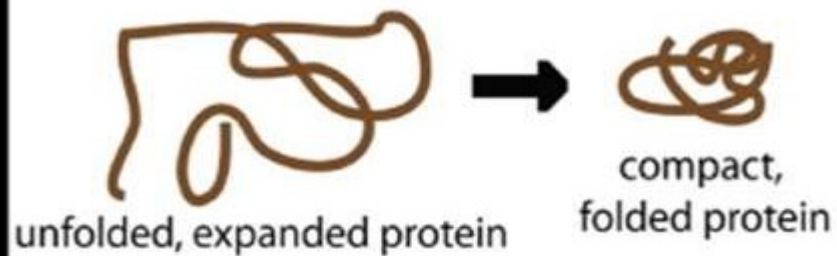
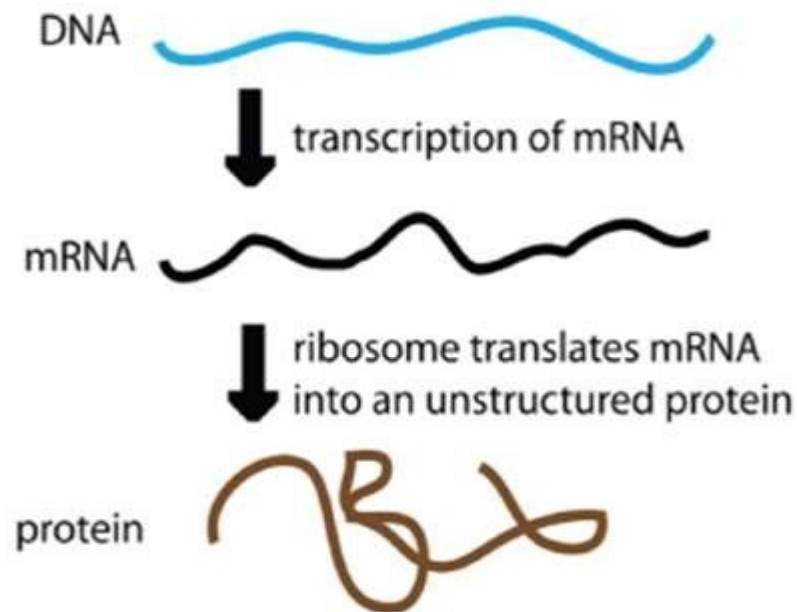
Prokaryotes

- Mainly at transcriptional level
- Sets of genes transcribed together (polycistronic)
- E.g. *lac* operon and *trp* operon in bacteria

Eukaryotes

- Other levels of regulation include posttranscriptional and posttranslational regulation
- Each gene transcribed independently (monocistronic)

(a) Prokaryotic Gene Expression



(b) Eukaryotic Gene Expression

