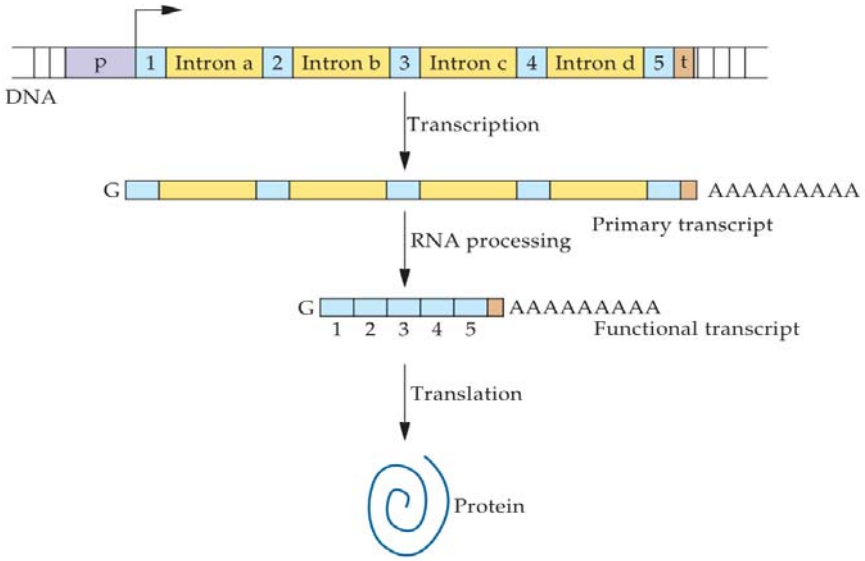
### *Eukaryotic gene structure:*

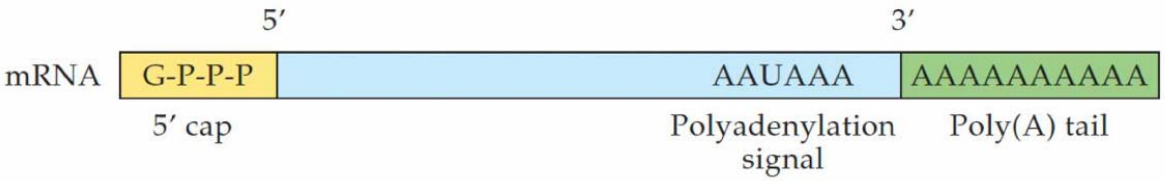
- The promoter is the site of transcription initiation and direction.
- The termination sequence is to stop RNA polymerase.
- Introns (in-trash) are non coding sequences.
- Exons are coding sequences.
- The DNA sequence gets transcribed into primary transcript, with introns, but not with the promoter because the promoter initiates the transcription process but isn't included. The 5' end gets capped with a guanine nucleotide and the 3' end gets poladenylated (addition of 50-250 adenine nucleotides forming a polyA tail).
- The primary transcript sequence gets modified into functional transcript, which only contains exons (no more introns).
- Then the Functional transcript is translated into protein.




- The modification process of the primary RNA occurs in the nucleus.
- Function of modified ends (Guanine cap and polyA tail):

1. aid in the transport of the mature mRNA from the nucleus
2. aid in ribosomes binding to mRNA
3. increase the stability of the mRNA

- The **polyadenylation signal** is a short sequence of nucleotides in mRNA that tells the cell where to cut the RNA and add a poly-A tail at the end.



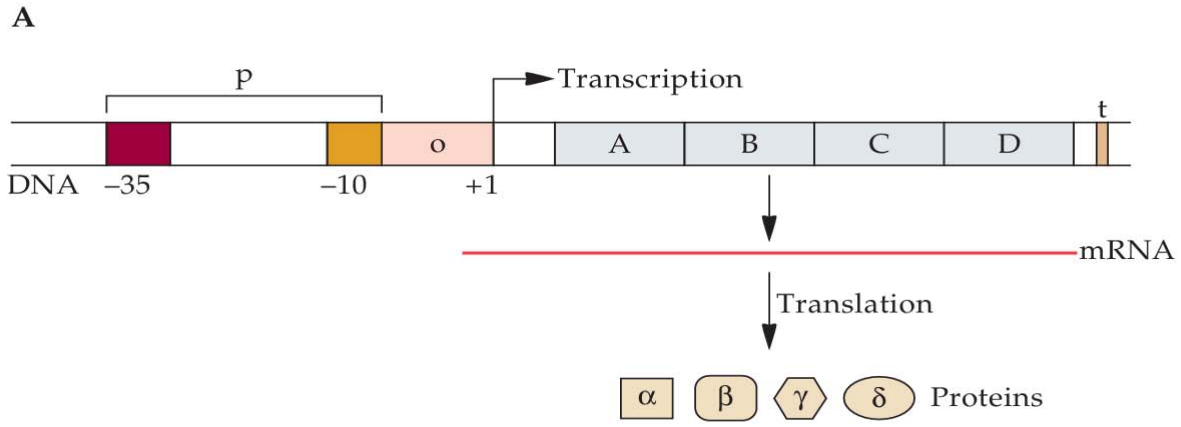

### *Prokaryotic gene structure:*

- The initiation of transcription is +1
- RNA polymerase binds to regions that are 10 (–10) and 35 (–35) bp from the site of initiation of transcription (+1)
- The structural genes are under the transcriptional control of an operon and a promoter region.
- The structural genes are followed by a termination sequence.

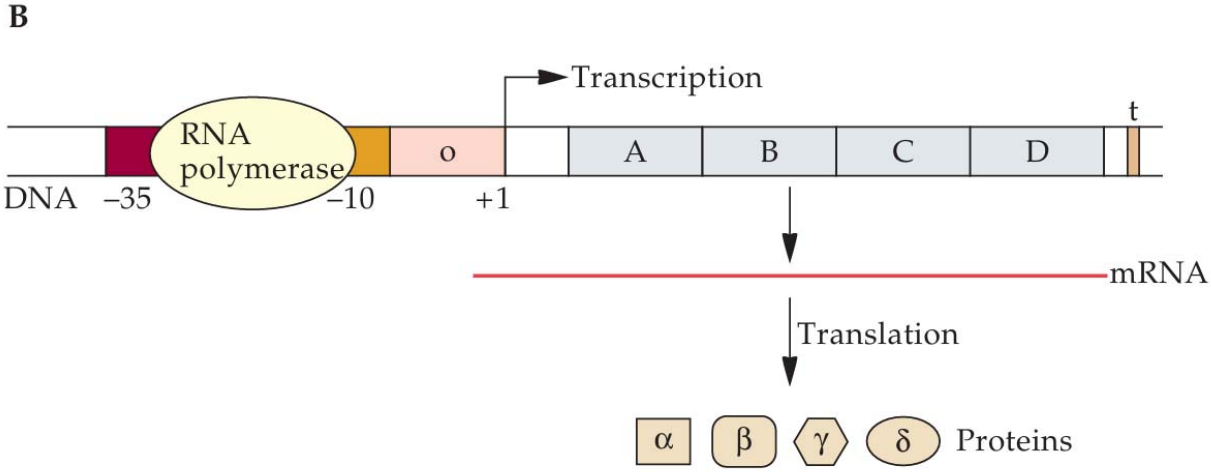
- The promoter is where the RNA polymerase binds
- the operator is a region that can block transcription if a repressor binds to it
- operator vs operon:

The operon is a group of genes regulated together under one promoter, and it's the whole system: (promoter, operator, genes). Meanwhile, the operator is a short DNA segment within the operon where a repressor protein can bind.

- The operator acts as a switch on/off.

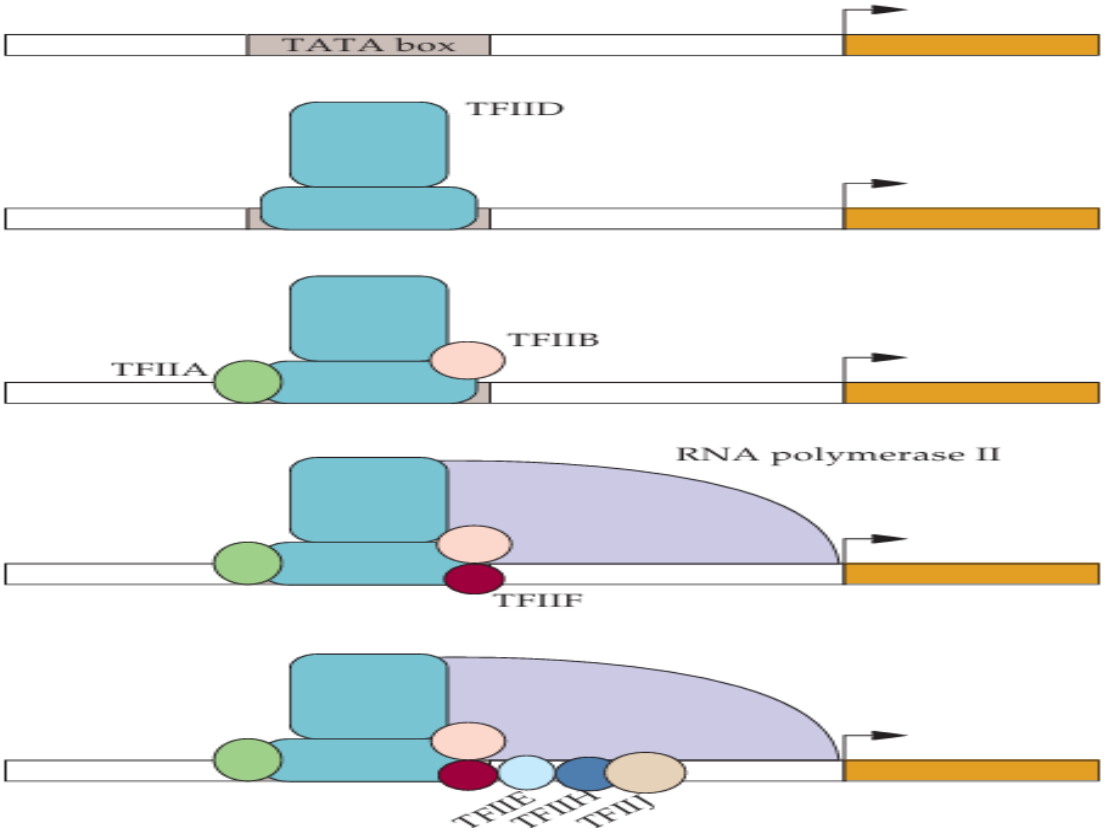



- (α, β, γ, and δ) are proteins produced during translation.




***Formation of an RNA polymerase II transcription initiation complex:***

- The TATA box is a short DNA sequence found in the promoter region of many eukaryotic genes.
- Transcription factor TFIID binds to a TATA box, and in sequence, other transcription factors (TFIIA, TFIIB. TFIIF, TFIIE, TFIIH, TFIIJ) and RNA polymerase II bind to form a protein aggregate that is responsible for initiating transcription.




***Transcription and translation in eukaryoutes:***

- Transcription and translation are spatially separated in eukaryotes. Transcription occurs in the nucleus. Primary transcripts produced by RNA polymerase (yellow ovals) are processed to remove introns (grey lines), and the resulting mRNA (green lines) is exported from the nucleus via nuclear pores. Ribosomes (tan, double-lobed shapes) in the cytoplasm or associated with the endoplasmic reticulum translate the mRNA to produce proteins that remain in the cytoplasm or are translocated into the lumen of the endoplasmic reticulum for further processing.