What is a promoter?

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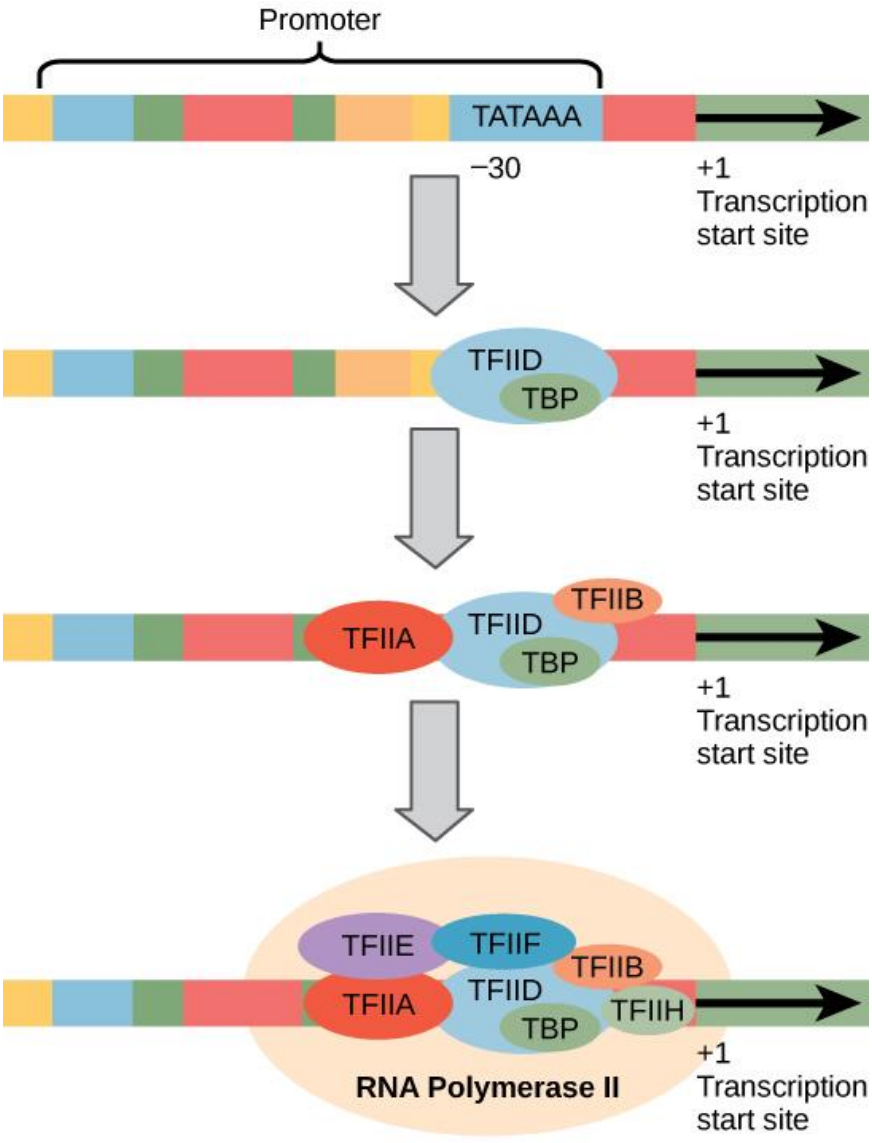
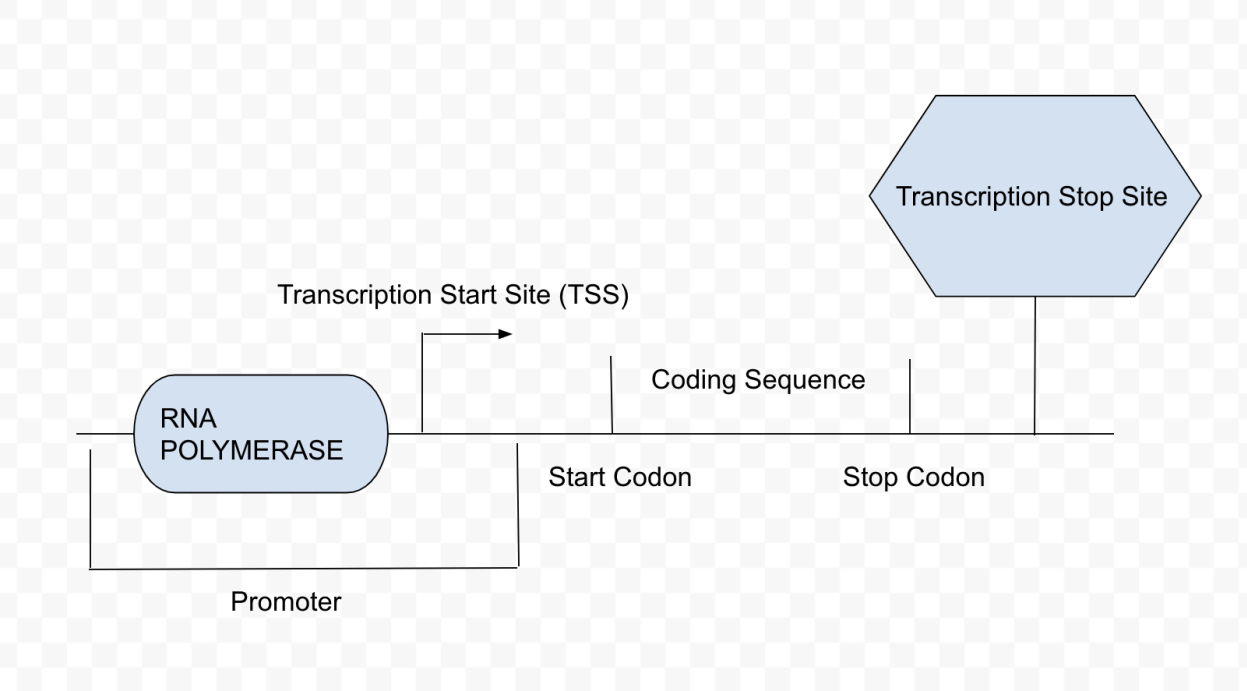
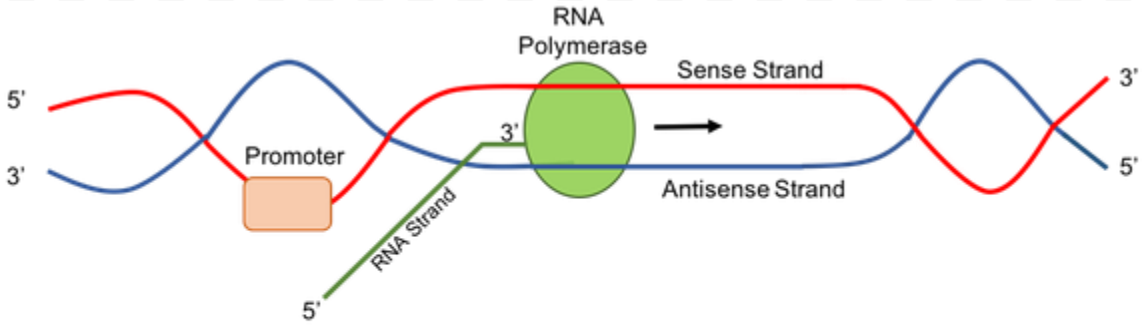
A promoter is a DNA sequence that helps with the initiation of DNA transcription. Promoters are very important parts of expression vectors in which they control the gene expression level and specificity. As soon as RNA polymerase binds to the promoter, it transcribes DNA to mRNA which can translate into a functional protein. The promoter region of the gene can control the expression of the gene when and where in the organism. The length of promoters are about 100 to 1000 base pairs long. They are adjacent and typically upstream (5') of the sense or coding strand of the transcribed gene.The DNA strand that encodes codons and whose sequence corresponds to the mRNA transcript produced is named the coding strand. The antisense strand is also known as the non-coding strand or the template strand as this is the strand that the RNA polymerase transcribes. Response elements are DNA sequences that are located within the promoter regions, they help RNA polymerase and transcription factors stably bind to the promoter region. Proteins that control and regulate the RNA polymerase transcription of DNA into messenger RNA are known as transcription factors.







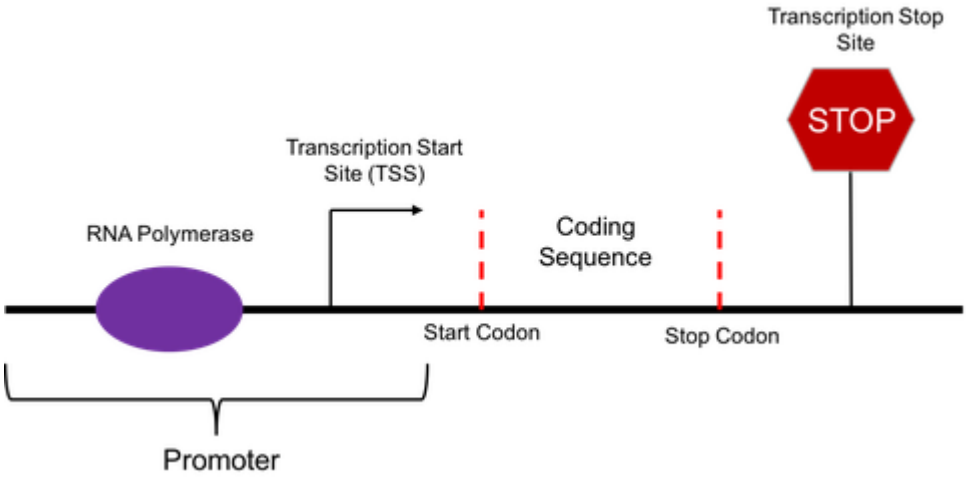
What is the difference between promoters in Prokaryotes and Eukaryotes

DNA sequences called response elements are located within promoter regions, and they provide a stable binding site for RNA polymerase and transcription factors.

Transcription factors are proteins which recruit RNA polymerase and control and regulate the transcription of DNA into mRNA.
Promoter binding is very different in bacteria compared to eukaryotes. In bacteria, the core RNA polymerase requires an associated sigma factor for promoter recognition and binding. On the other hand, the process in eukaryotes is much more complex. A minimum of seven transcription factors are required in order for RNA polymerase II (a eukaryote-specific RNA polymerase) to bind to a promoter. In bacteria and eukaryotes, transcription is firmly controlled. Many DNA regulatory sequences control promoters, including insulators, silencers, boundary elements, and enhancers.

Promoter Regions

.Promoters are made of three main portions; the core promoter, distal promoter, and proximal promoter..



The discretion of specifically explains the regions in the eukaryotic cells

Core Promoter

Eukaryotic cell's core promoter will be binded to the RNA polymerase stably and transcription of the template strand can start. The TATA box is a DNA sequence (5'-TATAAA-3') within the core promoter region where general transcription factor proteins and histones can bind. Histones are proteins found in eukaryotic cells that package DNA into nucleosomes. Histone binding prevents the initiation of transcription whereas transcription factors promote the initiation of transcription. The most 3' portion (closest to the gene's start codon) of the core promoter is the TSS which is where transcription actually begins. Only eukaryotes and archaea, however, contain this TATA box. Most

prokaryotes contain a sequence thought to be functionally equivalent called the Pribnow box which usually consists of the six nucleotides, TATAAT.