Transcription in prokaryotes

- The process of synthesis of RNA by copying the template strand of DNA is called transcription.
- During replication entire genome is copied but in transcription only the selected portion of genome is copied.
- The enzyme involved in transcription is RNA polymerase. Unlike DNA polymerase it can initiate transcription by itself, it does not require primase. More exactly it is a DNA dependent RNA polymerase.

The steps of transcription

the mechanism of transcription completes in three major steps

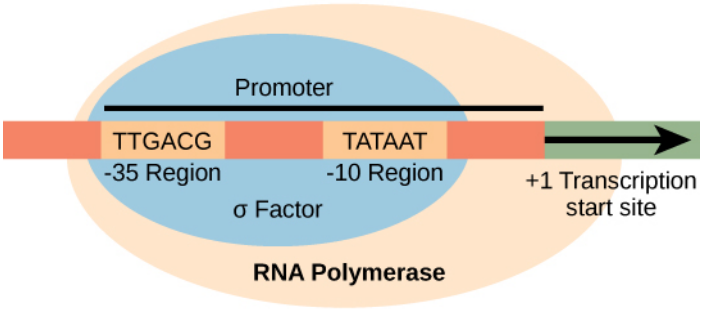
1. Initiation:

2. Elongation

3. Termination:

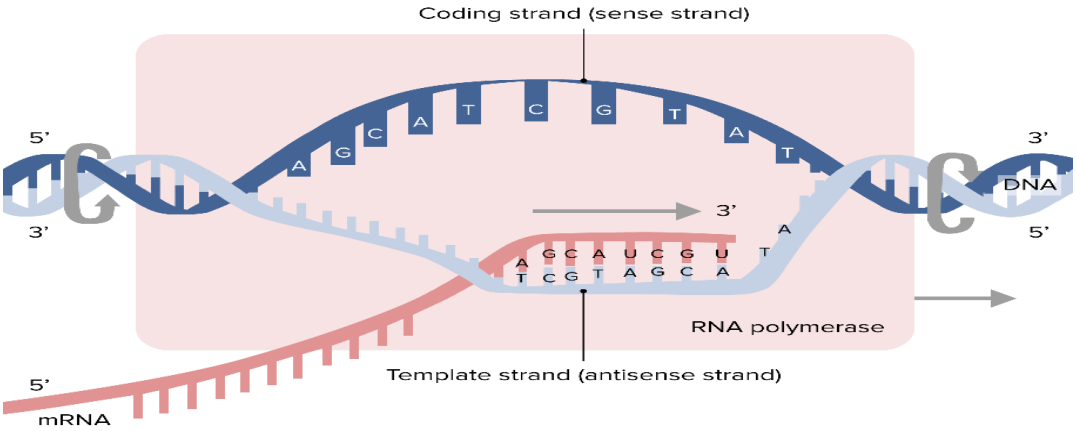
1. Initiation:

- The transcription is initiated by RNA polymerase holoenzyme from a specific point called promotor region.
- Only one RNA polymerase is involve in prokaryotic transcription is called core polymerase it consists of α, β, β' and ω sub units. The core polymerase along with σ-factor is called RNA polymerase holoenzyme.
- In case of e. coli, promotor consists of two conserved sequences the -35 element and -10 element. These sequence are upstream to the site from which transcription begins. RNA polymerase recognizes and binds directly to these sequences
- Binding of RNA polymerase to the promotor sequence form **closed comolex**
- after formation of closed complex, the RNA polymerase holoenzyme separates 10 -14 bases from -11 to +3 is called melting. And form **open complex**
- If the enzyme synthesize short RNA molecules of less than 10 bp, it does not further elongates which is called abortive initiation When the RNA polymerase escape from abortive initiation and synthesize RNA more than 10 bp long. This is the formation of **tertiary complex**.



2. Elongation:

- After synthesis of RNA more than 10 bp long, the σ-factor is ejected and the RNA polymerase move along 5'-3' direction continuously synthesizing RNA.
- The synthesized RNA exit from RNA exit channel.



3. Termination:

There are two mechanism of termination.

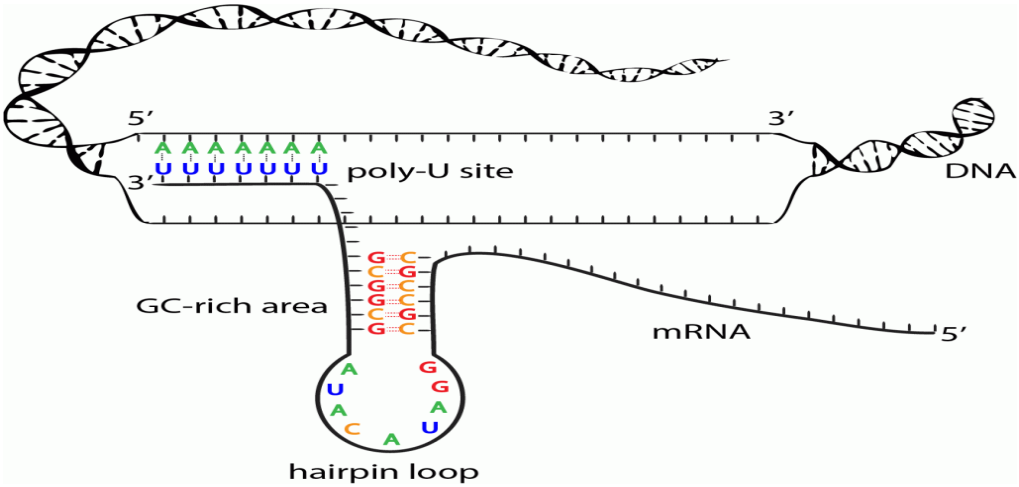
1. Rho independent:

- In this mechanism, transcription is terminated due to specific sequence in terminator DNA.

- The terminator DNA contains GC rich sequence when RNA polymerase transcribe this sequence RNA get GC rich sequence which is complementary this cause RNA transcript to form hair pin like structure

- The GC sequence is followed by larger number of AAAAAAA on template DNA. When RNA polymerase transcribe this sequence The uracil appear in RNA.

- The load of hair pin structure is not tolerated by A=U base pair so the RNA get separated from RNA-DNA hybrid

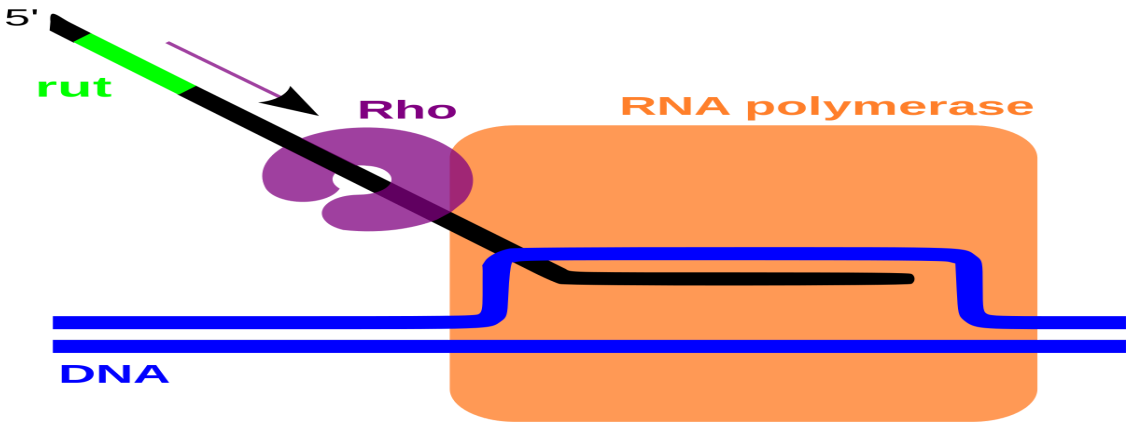


2. Rho dependent:

- In this mechanism, transcription is terminated by rho (ρ) protein, It is ring shaped protein.

- The rho protein bind the single stranded RNA and starts "climbing" up the transcript towards RNA polymerase.

- When it reaches the transcription bubble, Rho pulls the RNA transcript and the template DNA strand apart, releasing the RNA molecule and ending transcription.



TRANSCRIPTION IN EUKARYOTES

- The process of synthesis of RNA by copying the template strand of DNA is called transcription.
- During replication entire genome is copied but in transcription only the selected portion of genome is copied.
- The enzyme involved in transcription is RNA polymerase. Unlike DNA polymerase it can initiate transcription by itself, it does not require primase. More exactly it is a DNA dependent RNA polymerase.

The steps of transcription in eukaryotes

the mechanism of transcription completes in three major steps

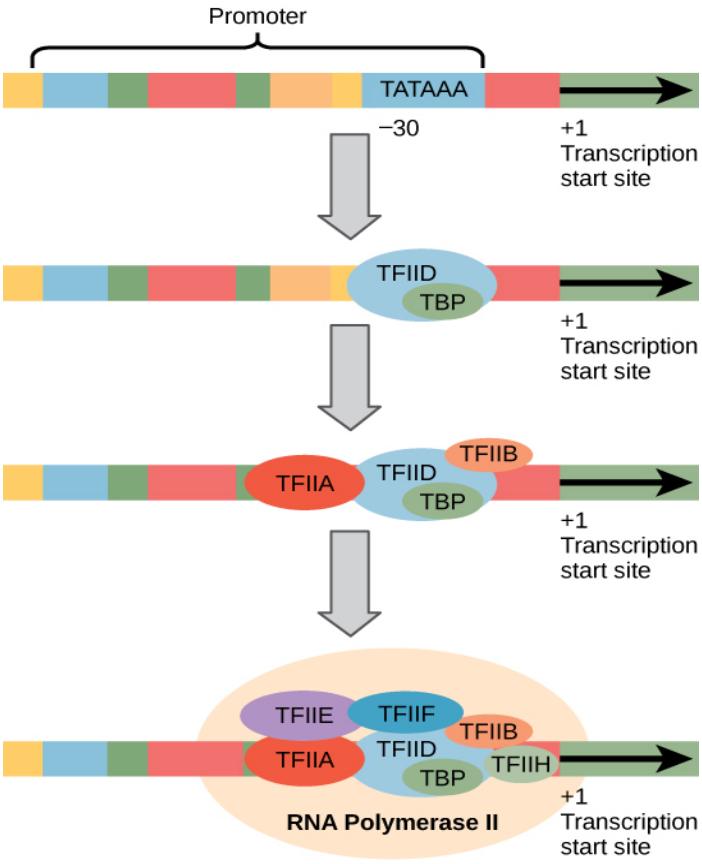
1. Initiation:

2. Elongation

3. Termination:

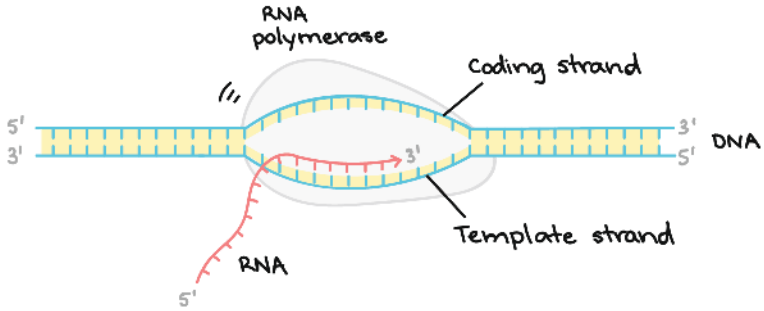
Initiation-

- Eukaryotic RNA polymerase unable to recognize promoter DNA on its own it requires several other proteins, called general transcription factors. These general transcription factors include TFIIB, TFIID, TFIIE, TFIIF and TFIIH.
- promotor consists of two conserved sequences the -35 element and -10 element (TATA element).
    2. TATA element is recognized by the TFIID factor. TFIID contain two domains
        1. TATA-binding protein (TBP) which binds to the TATA element
        2.TAF (TBP-associated factor)
- After binding of TFIID, other transcription factors are sequentially bind to the promoter and form pre-initiation complex.
- TFIIA- it serves to stabilize the binding of TFIID to the DNA
- TFIIB- recruits TFIIE to the promoter region
- TFIIE- recruits TFIIH to the promoter region
- TFIIH- it functions as a helicase that unwinds DNA
- TFIIF- it recruits Polymerase II to the promoter region



Elongation-

- The polymerase is released from the other transcription factors and pre-mRNA is synthesized in the 5'to 3' direction.



Termination-

- As Pol II reaches the end of a gene, two protein complexes carried by the CTD, CPSF (cleavage and polyadenylation specificity factor) and CSTF (cleavage stimulation factor), recognize the poly-A signal in the transcribed RNA.[35] Poly-A-bound CPSF and CSTF recruit other proteins to carry out RNA cleavage and termination takes place.