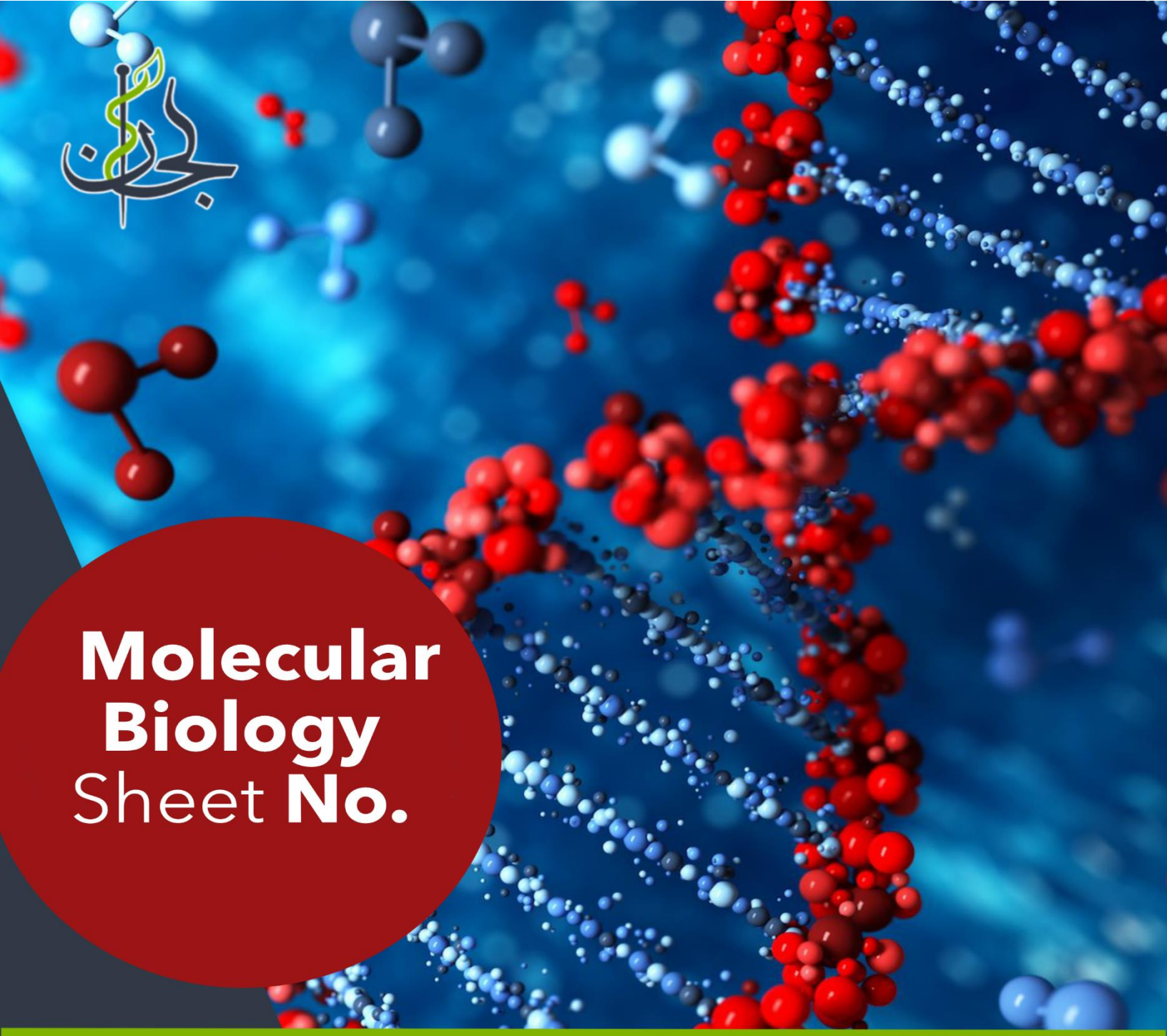


Molecular Biology Sheet No.

Writer Sham Alsalim & Belal Alhamaideh

Scientific correction Belal AL-hamaideh

Grammatical correction Sham Alsalim

Doctor Mamoun Ahram

TRANSCRIPTION

Dr. Mamoun's GENE: The entire DNA sequence that is necessary for the synthesis of a functional RNA (mRNA, rRNA, tRNA, lncRNA, microRNA, etc.) or a polypeptide, which may become a protein or functional peptides.

DNA sequence

- **Coding region**
  - That makes the protein.
- **Regulatory region**
  - Ex. Promoter, enhancer and introns (non-coding regions).

lncRNA

Long non-coding, which means that it doesn't lead to synthesize protein.

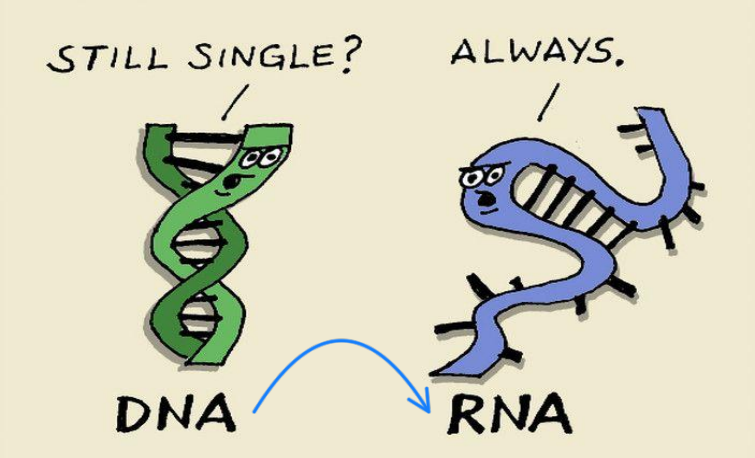
CISTRON = GENE.

1mRNA → 1polypeptide → **MONOCISTRONIC**

1mRNA → Different polypeptides → **POLYCISTRONIC**

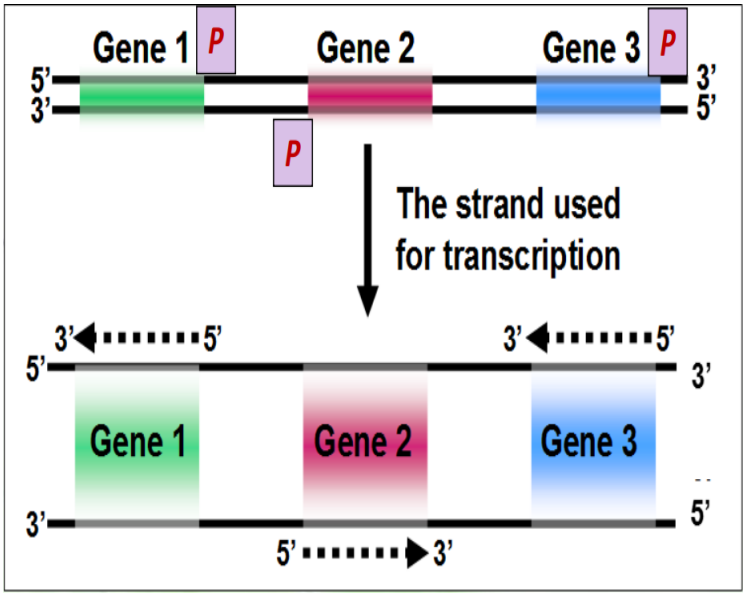
As you remember that Transcription is the process of making RNA from DNA.

One of the two strands of the DNA double helix acts as a template for the synthesis of an RNA molecule.
In **DNA replication**, both strands are the template of the daughter strands



Transcription

Must listen!!



DNA polymerase uses **one strand** for any particular gene in order to make RNA (transcription)

BUT!!!!

What does determine which strand is used for transcription?

Promoter

Enzyme and substrate

The enzymes that perform transcription are called RNA polymerases.

They catalyze the formation of the phosphodiester bonds between two nucleotides.

The substrates are nucleoside triphosphates **NTPs** (ATP, CTP, UTP, and GTP).

What are the substrates for DNA polymerases?

Deoxyribonucleoside Triphosphates

The energy is derived from the same substrate, HOW?!

Hydrolysis of high-energy bonds in NTPs (Nucleoside Triphosphates) **provides the energy needed to drive the reaction forward**.

1- RNA is complementary to its DNA templet.

2- They extended from 5' to 3' but they are antiparallel to each other.

3- RNA is almost identical to the other strand (that does not make transcription) .

NOTE !! T (DNA) = U (RNA)

Listen!!

DNA Replication	DNA Transcription (Forming RNA)
DNA is **LONGER**. DNA stores genetic info. Each DNA strand forms hydrogen bond with the DNA template strand.	RNA is **SHORTER**. RNA does **NOT** store genetic info . The RNA strand does **NOT** form hydrogen bonds with the DNA template strand.

DNA polymerase Vs. RNA polymerase

Catalyzes the linkage of deoxyribonucleotides.

Start a DNA chain **WITH** a primer.

Make about one mistake for every 10^8 nucleotides.

MORE accurate.

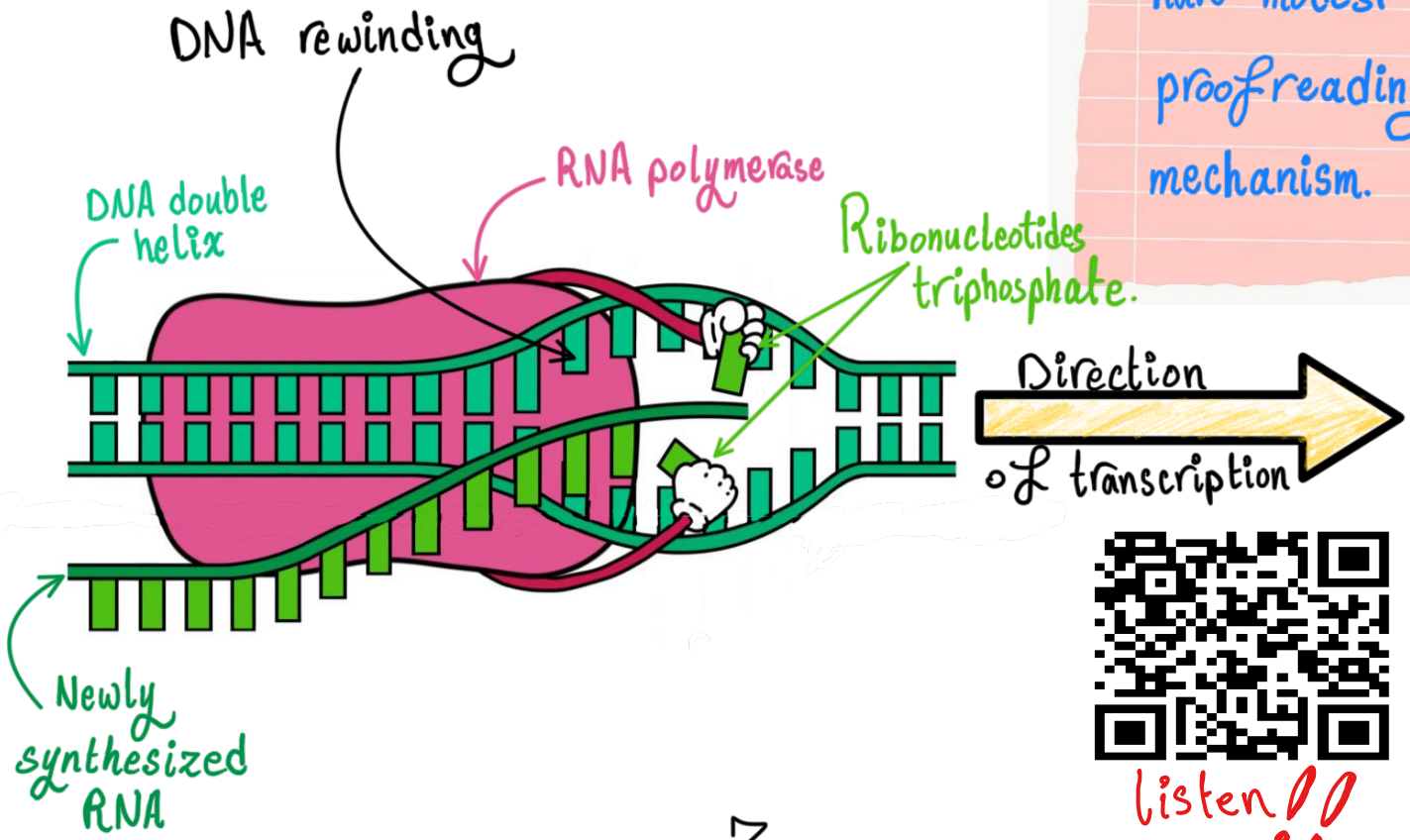
Catalyzes the linkage of ribonucleotides.

Start an RNA chain **WITHOUT** a primer.

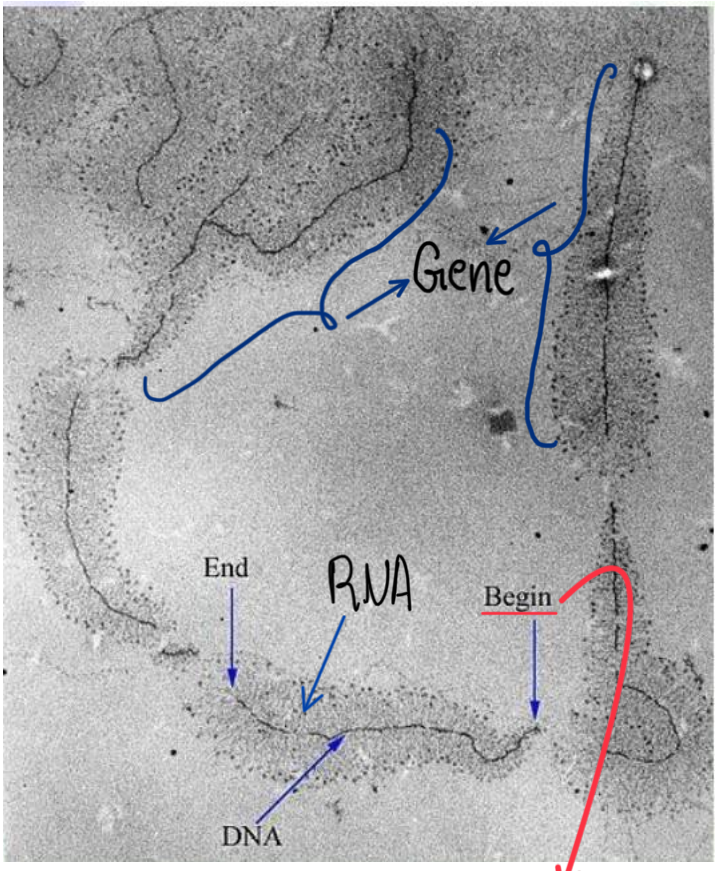
Make about one mistake for every 10^4 nucleotides.

LESS accurate.

RNA polymerase have modest proofreading mechanism.



listen!!



Starting point of transcription.

DON'T PANIC !! هذا مش هستو

More than one RNA are being transcripted in sequence as one system , so it is more efficient .

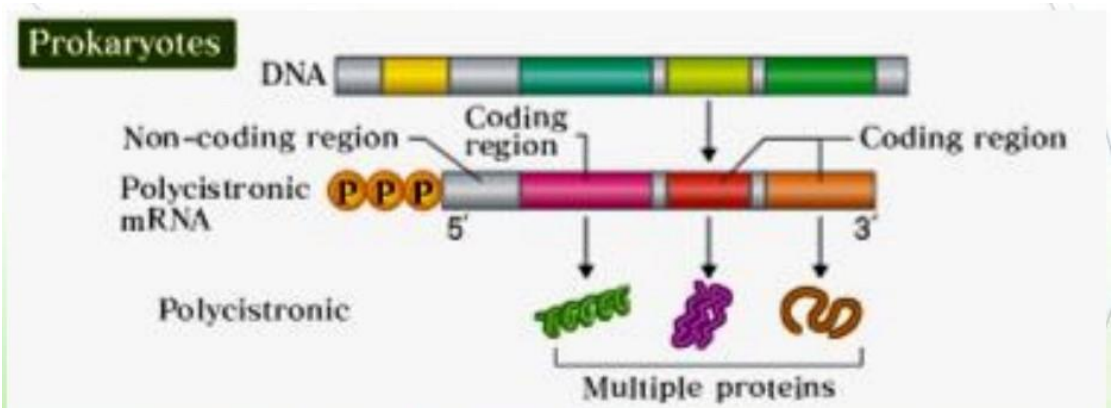
We can determine the:

- Beginning of the gene by observing **SHORT** RNA .
- End of the gene by observing **LONG** RNA .

Transcription in prokaryotes

Genes in bacteria can be monocistronic or polycistronic **(Operons) .**

Back to page 1



Operon

Polycistronic in prokaryotes , it gives 1 mRNA , and each coding region gives different polypeptides (different proteins) but they are involved in related functions.

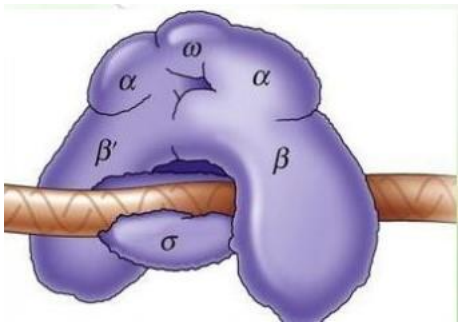
Ex. The genes encoding the enzymes required to synthesize the amino acid tryptophan are contiguous.

Lactose ← واحد عالماشي

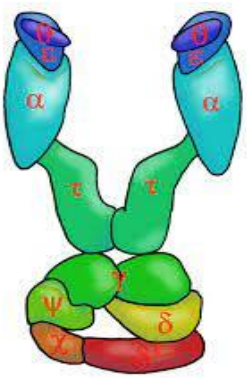
listen

RNA polymerase

- E. coli RNA polymerase is made up of multiple polypeptide chains or subunits.
- The core polymerase consists of two α, one β, one β', one ω and one σ subunits (The σ subunit is not required for the basic catalytic activity of the enzyme) look to page 6.
- The core polymerase is fully capable of catalyzing the polymerization of NTPs into RNA.



-RNA polymerase-



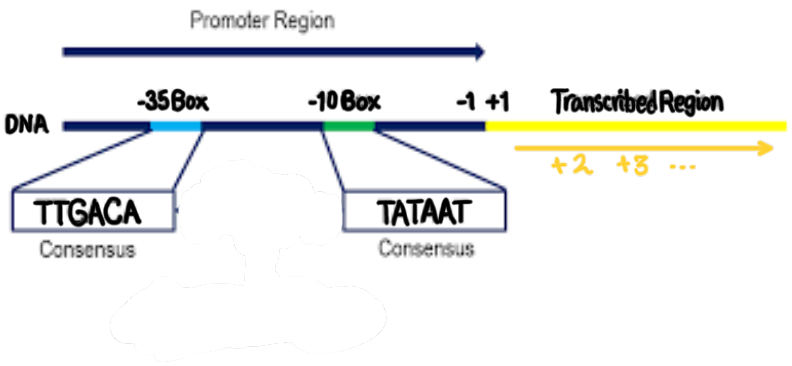
-DNA polymerase-

REMEMBER

Promoter region: (RNA polymerase binding site) it is located upstream to transcription start region.

Transcription start region : (+1)

The first nucleotides that are read by RNA polymerase



NOTES

Upstream means that it is previous

(تقع قبلها او تسبقها مثل منبع النهر الذي يقع قبل مجرى الماء)

NOTE !! We have two consensus sequence (-10 , -35)

They are called the (-10) and (-35) elements because they are located approximately 10 and 35 base pairs upstream of the transcription start site , (-35 is upstream to -10).

σ subunit : it is guide the polymerase to the -35 and -10 sequences .

It makes a **STRONG** (high affinity) and specific interaction.

In the absence of σ , a RNA polymerase binds to DNA with **LOW** affinity and nonspecifically .

listen :

As the DNA replication and RNA translation (**later on**):

Transcription has 3 stages : -INITIATION
-ELONGATION
-TERMINATION

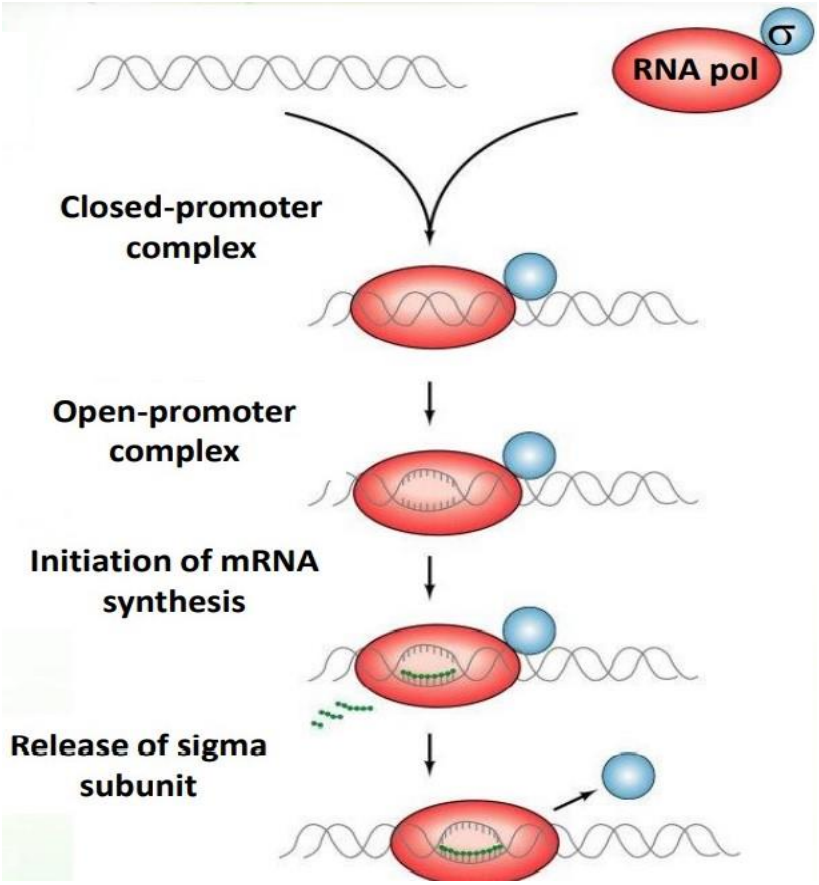
1- Initiation.

Before transcription, RNA polymerase associate with sigma subunit.

DNA promoter connect with the RNA polymerase to form CLOSED PROMOTER COMPLEX.

RNA polymerase separates the DNA strands (as the HELICASE does in DNA replication)

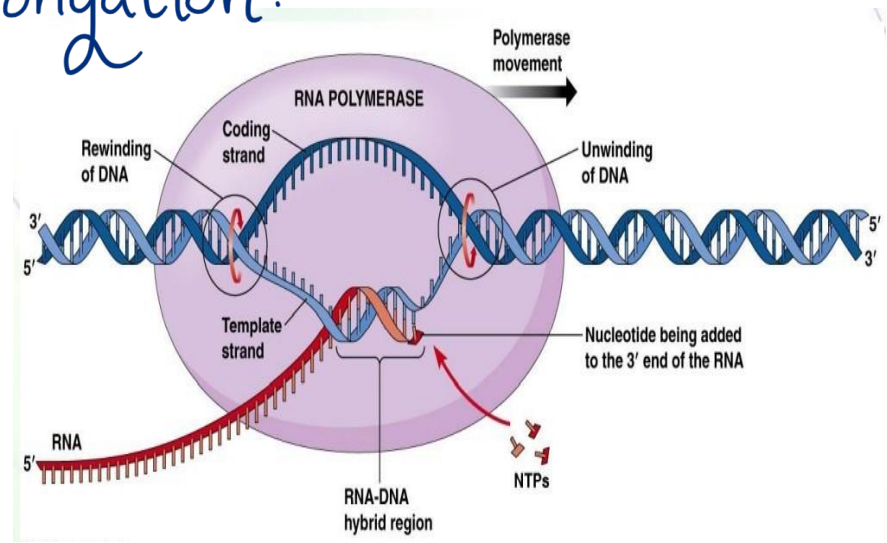
After reading 10 nucleotides, sigma subunit is released and bind with another RNA polymerase to start a new transcription.



2-Elongation.

As the polymerase moves forward :

- It unwinds the template DNA ahead of it
- elongates the RNA
- rewinds the DNA behind it

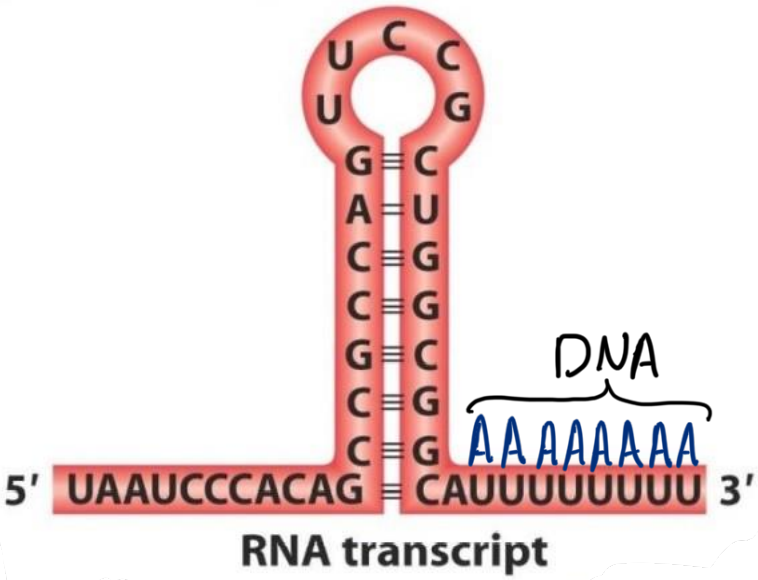


3- Termination.

RNA synthesis continues until the polymerase encounters a termination signal where the RNA is released from the polymerase, and the enzyme dissociates from its DNA template.

How it is alerted to stop ?!

Transcription of the GC-rich (note that it is three strong hydrogen bonds) inverted repeat results in the formation of a stable **stem-loop structure.**
(The formation of this structure breaks RNA association with the DNA template, destabilizes the RNA polymerase binding to DNA, and terminates transcription).



After that, it is followed by a UUUUU… sequence then interact with an AAAAA… sequence to form weak bonds, so the TERMINATION stage is done easily.

last one!

Made with love ♥

♥ دعواتكم