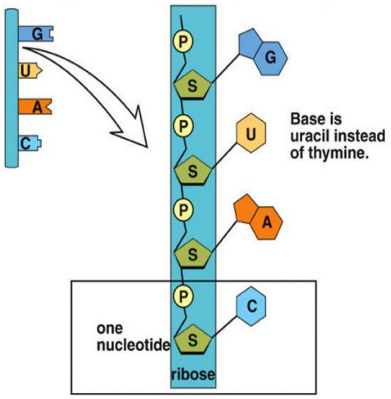
CH 17 Transcription

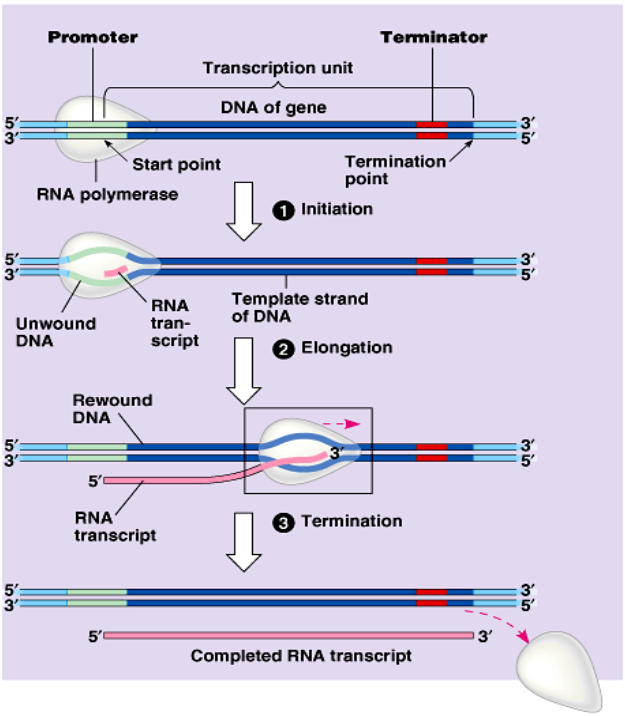
- Messenger RNA is transcribed from the template strand of a gene.
- **RNA polymerase** -
- Like DNA polymerases, RNA polymerases can add nucleotides only to the 3′ end of the growing polymer.
  - Genes are read 3′->5′, creating a 5′->3′ RNA molecule.

RNA STRUCTURE

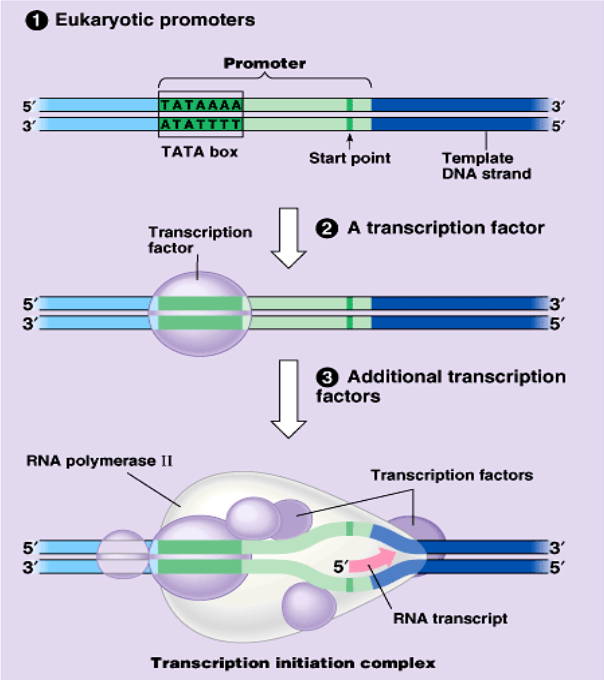
- The structure is single strand
- Nucleotide bases:
  - ✧ Adenine and *Uracil*
  - ✧ Cytosine and Guanine
  - Its sugar is ribose



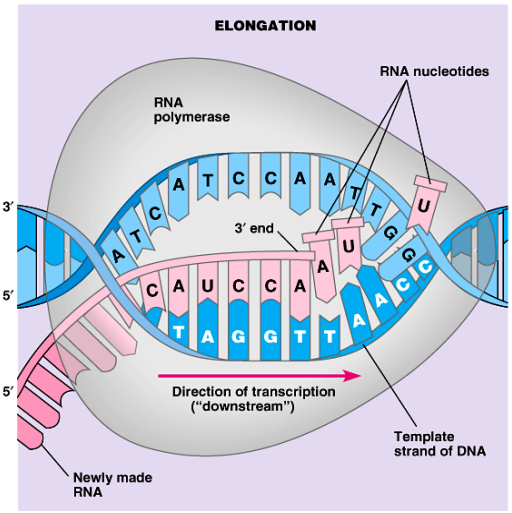
- 3 regions of a Gene to be transcribed:
  - the **promoter** – attachment point
  - Coding region
  - The **terminator** signals the end of transcription.
  - Bacteria have a single type of RNA polymerase. In contrast, eukaryotes have three RNA polymerases (I, II, and III) in their nuclei. RNA polymerase II is used for mRNA synthesis.



- Transcription can be separated into three stages: initiation, elongation, and termination.
- The presence of a promotor sequence determines which strand of the DNA helix is the template.
  - Within the promotor is the starting point
  - The promotor also includes a binding site for RNA polymerase
  - In prokaryotes, RNA polymerase can recognize and bind directly to the promotor region.
- In eukaryotes, proteins called **transcription factors** recognize the promotor region, especially a **TATA box**, and bind to the promotor.



- After they have bound to the promotor, RNA polymerase binds to transcription factors to create a **transcription initiation complex**.
- RNA polymerase then starts transcription.
- As RNA polymerase moves along the DNA, it untwists the double helix, 10 to 20 bases at time.

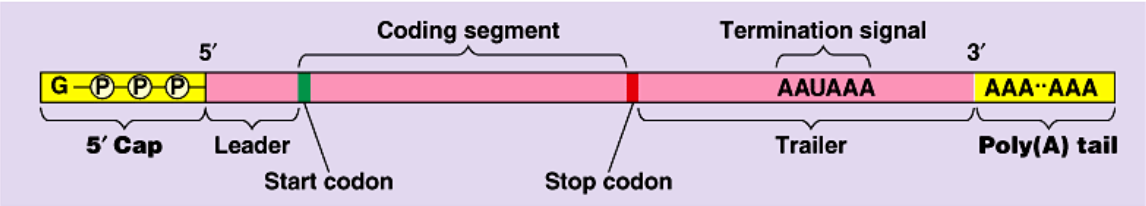


- The enzyme adds nucleotides to the 3′ end of the growing strand.
- Behind the point of RNA synthesis, the double helix re-forms and the RNA molecule peels away.

- A single gene can be transcribed simultaneously by several RNA polymerases at a time.
- Transcription proceeds until after the RNA polymerase transcribes a terminator sequence in the DNA.
  - In prokaryotes, RNA polymerase stops transcription right at the end of the terminator.
    - Both the RNA and DNA is then released.
  - In eukaryotes, the polymerase continues for hundreds of nucleotides past the terminator sequence, AAUAAA.

2. Eukaryotic cells - Splicing

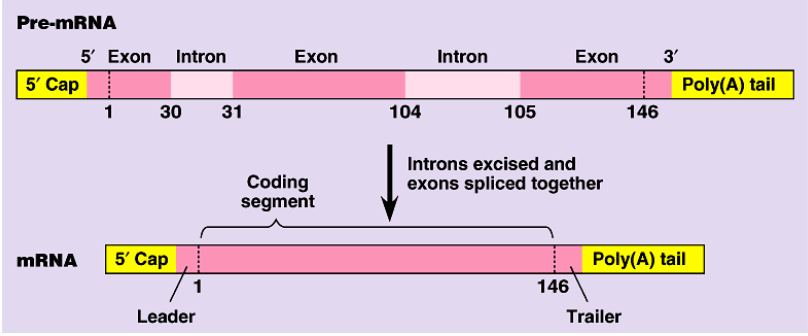
- At the 3′ end, an enzyme adds 50 to 250 adenine nucleotides, the **poly(A) tail**.



- **RNA splicing**.
- Most eukaryotic genes and their RNA transcripts have long noncoding stretches of nucleotides.
  - Noncoding segments, **introns**, lie between coding regions.
  - The final mRNA transcript includes coding regions, **exons**, that are translated into amino acid sequences, plus the leader and trailer sequences.

This splicing is accomplished by a **spliceosome**.

- spliceosomes consist of a variety of proteins and several *small nuclear ribonucleoproteins* (*snRNPs*).



- RNA splicing appears to have several functions.
  - First, at least some introns contain sequences that control gene activity in some way.
  - Splicing itself may regulate the passage of mRNA from the nucleus to the cytoplasm.
  - One clear benefit of split genes is to enable a one gene to encode for more than one polypeptide.