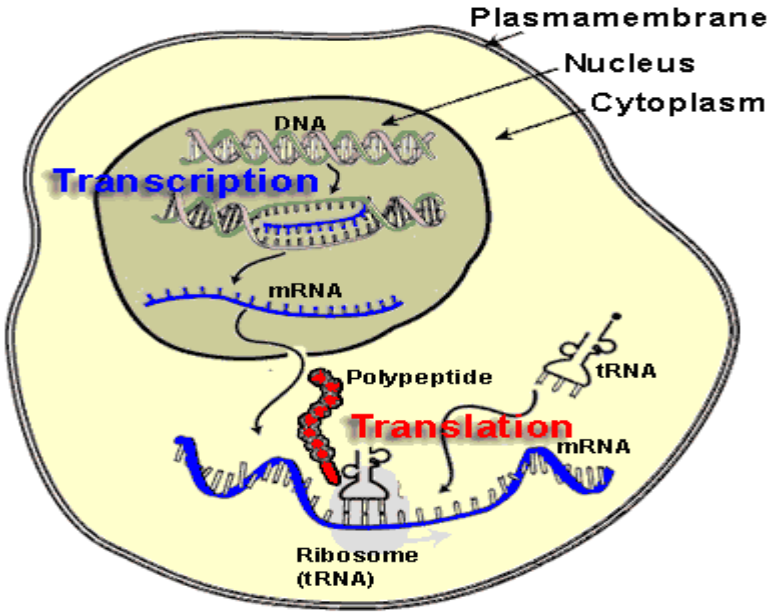
FACULTY OF ENGINEERING &TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Flow of genetic information



- The genetic information flows from DNA to mRNA and then to the protein synthesizing machinery.

DNA Transcription-Introduction

- The synthesis of an RNA molecule from DNA is called **Transcription.**
- All eukaryotic cells have five major classes of RNA: ribosomal RNA (rRNA), messenger RNA (mRNA), transfer RNA (tRNA), small nuclear RNA and microRNA (snRNA and miRNA).
- The first three are involved in protein synthesis, while the small RNAs are involved in mRNA splicing and regulation of gene expression.

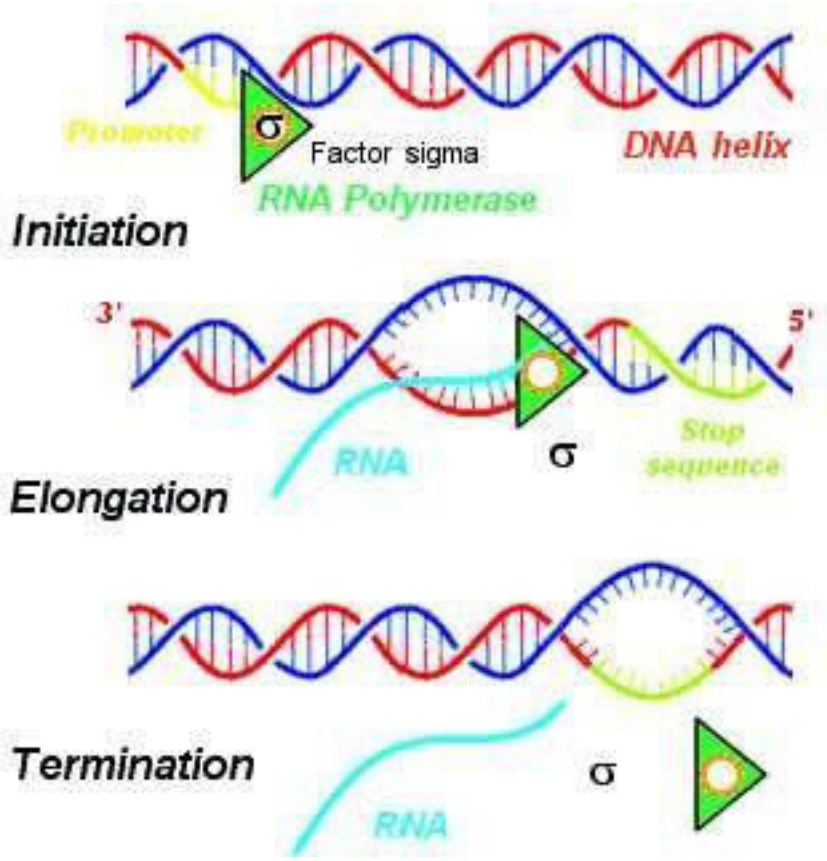
Similarities between Replication and Transcription

The processes of DNA and RNA synthesis are similar in that they involve-

(1) the general steps of initiation, elongation, and termination with 5' to 3' polarity;

(2) large, multicomponent initiation complexes; and

(3) adherence to Watson-Crick base-pairing rules.



Differences between Replication and Transcription

(1) Ribonucleotides are used in RNA synthesis rather than deoxy ribonucleotides;

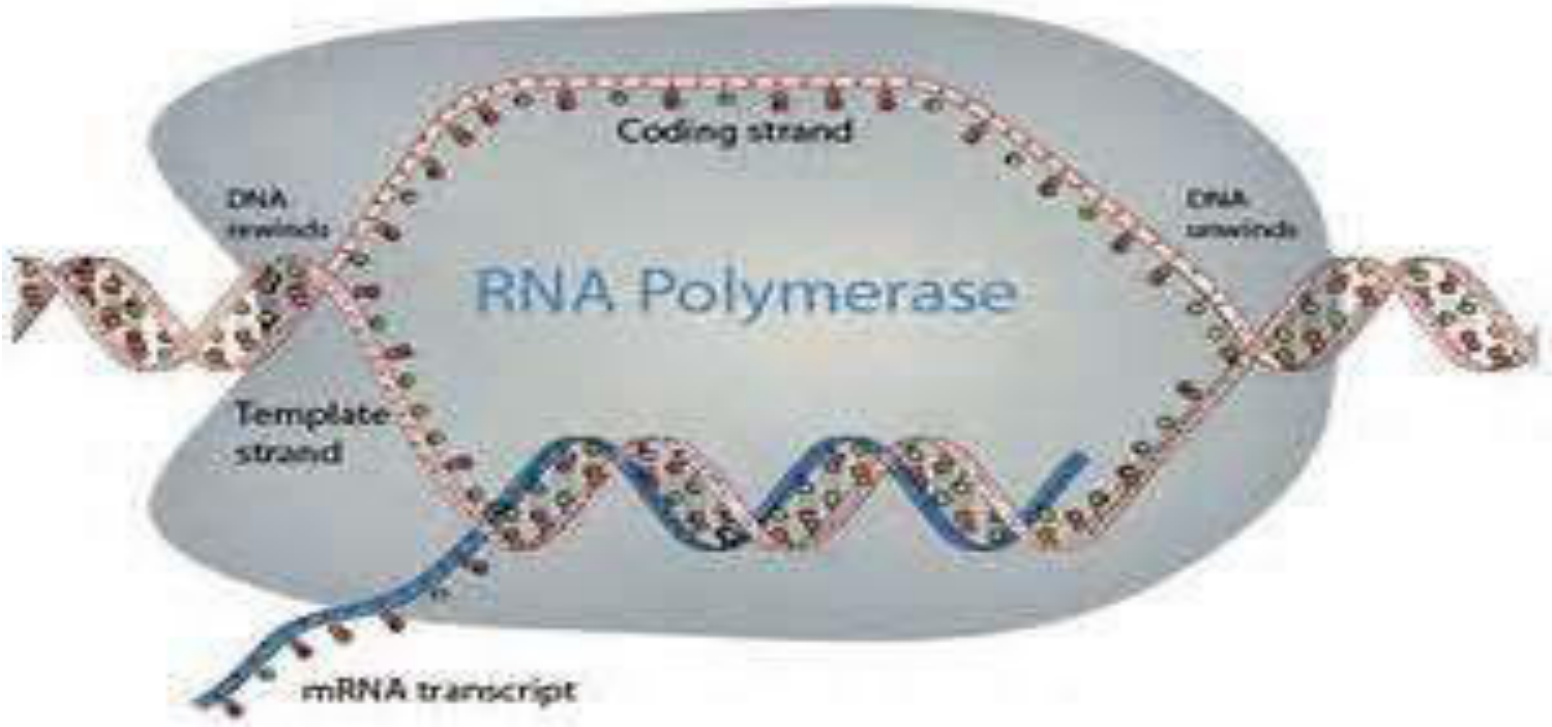
(2) U replaces T as the complementary base pair for A in RNA;

(3) A primer is not involved in RNA synthesis;

(4) Only a portion of the genome is transcribed or copied into RNA, whereas the entire genome must be copied during DNA replication; and

(5) There is no proofreading function during RNA transcription.

Template strand

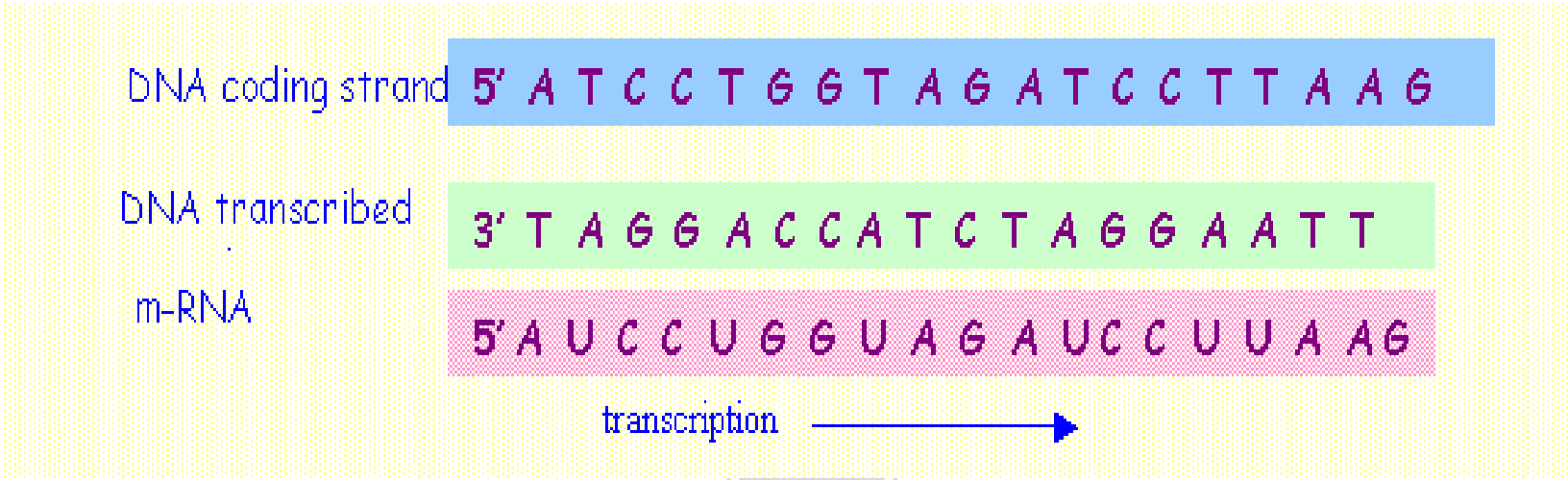


- The strand that is transcribed or copied into an RNA molecule is referred to as the template strand of the DNA.
- The other DNA strand, the non-template strand, is frequently referred to as the coding strand of that gene.

Template strand

- The information in the template strand is read out in the 3' to 5' direction
- The sequence of ribonucleotides in the RNA molecule is complementary to the sequence of deoxy ribonucleotides in template strand of the double-stranded DNA molecule
- In the coding strand (complementary strand) the sequence is same as that of the sequence of nucleotides in the primary transcript.

Template strand



With the exception of T for U changes, coding strand corresponds exactly to the sequence of the RNA primary transcript, which encodes the (protein) product of the gene.

Template strand

- In the case of a double-stranded DNA molecule containing many genes, the template strand for each gene will not necessarily be the same strand of the DNA double helix.
- Thus, a given strand of a double-stranded DNA molecule will serve as the template strand for some genes and the coding strand of other genes.

- **A transcription unit is defined as that region of DNA that includes the signals for transcription initiation, elongation, and termination.**
- **DNA-dependent RNA polymerase** is the enzyme responsible for the polymerization of ribonucleotides into a sequence complementary to the template strand of the gene.
- The enzyme attaches at a specific site—**the promoter**—on the template strand.
- This is followed by initiation of RNA synthesis at the starting point, and the process continues until a termination sequence is reached.