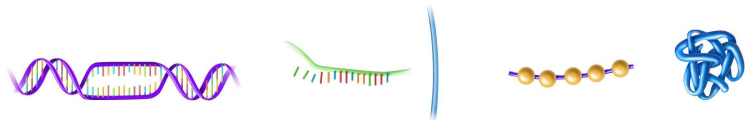

II) Gene Expression

A) The Central Dogma



II) Gene Expression

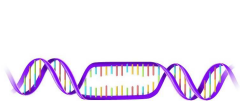
Genes

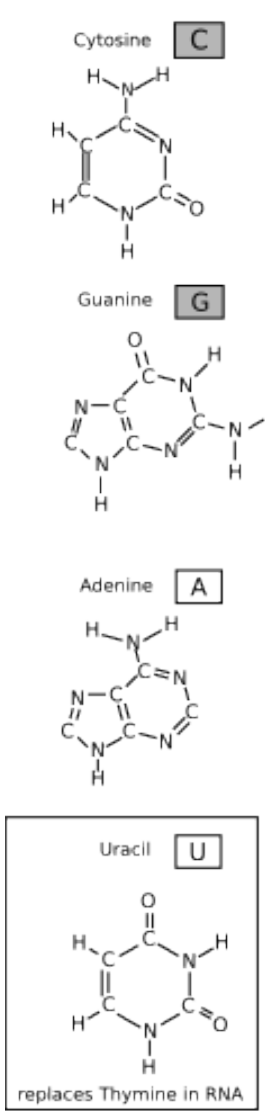
- gene expression
 - the conversion of a gene into a specific trait through the production of a particular polypeptide
 - a polypeptide is a chain of amino acids.
 - proteins are made of polypeptides.
 - the products of all genes are polypeptides.



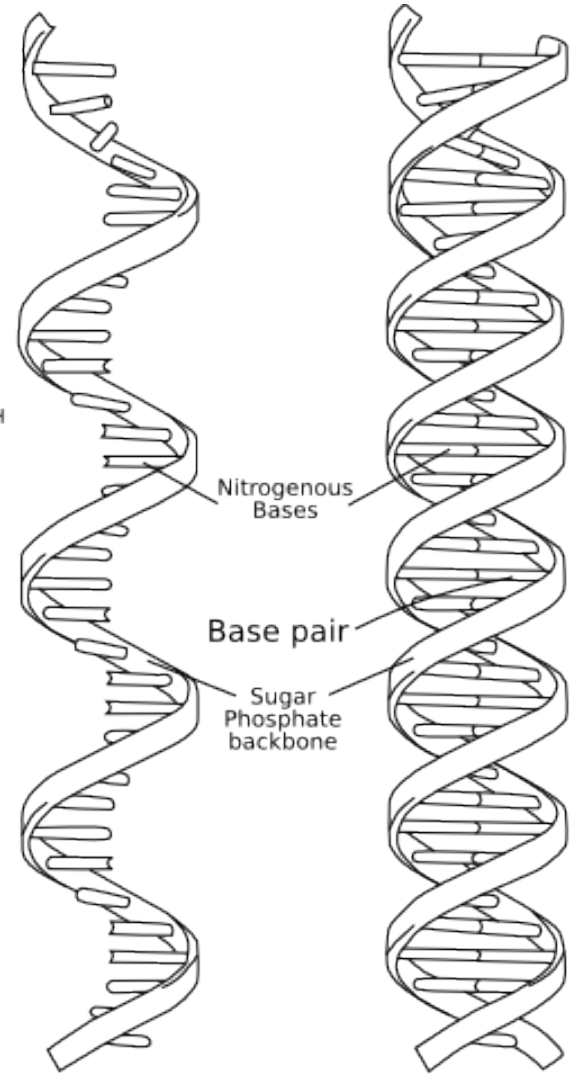
A) The Central Dogma

-
- *a polypeptide is a chain of amino acids.*
 - *proteins are made of polypeptides.*
 - *the products of all genes are polypeptides.*
 - the conversion of genes to polypeptides involves a second type of nucleic acid called Ribonucleic acid (RNA)
 - RNA is a polymer of nucleotides similar to DNA
 - RNA is different from DNA because:
 - RNA has an extra hydroxyl group and is called ribose rather than deoxyribose
 - RNA does not have the base thymine (T) instead it has the base uracil (U)
A-T in DNA A-U in RNA
 - RNA is single stranded not double stranded.





Nitrogenous Bases

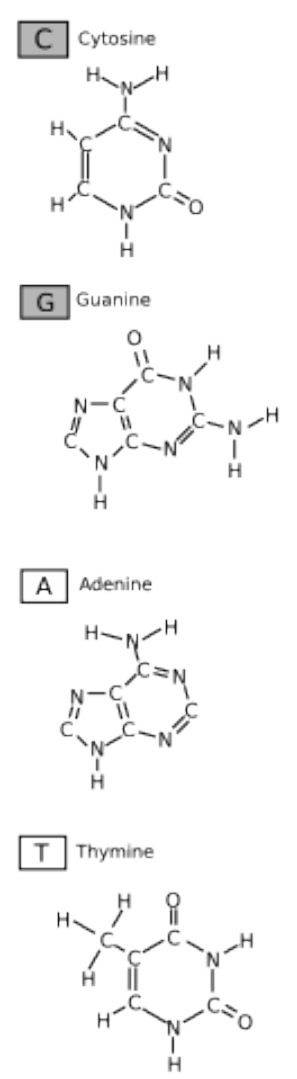


RNA

Ribonucleic acid

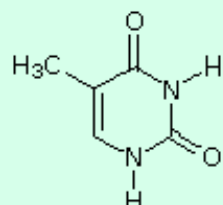
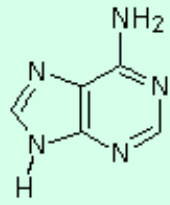
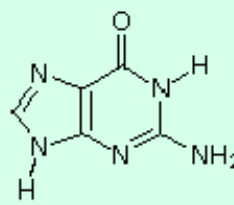
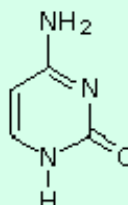
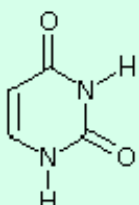
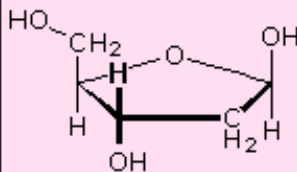
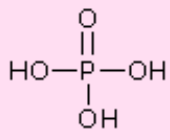
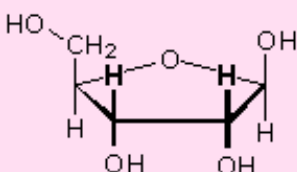
DNA

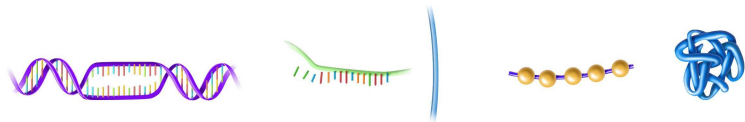
Deoxyribonucleic acid



Nitrogenous Bases

Components of Nucleic Acids

	DNA only	DNA & RNA		RNA only	
Nitrogen Bases	 Thymine	 Adenine	 Guanine	 Cytosine	 Uracil
Sugars & Phosphate	 2-Deoxyribose	 Phosphate		 Ribose	



-
- ❑ *RNA has an extra hydroxyl group and is called ribose rather than deoxyribose*
 - ❑ *RNA does not have the base thymine (T) instead it has the base uracil (U)*

A-T in DNA A-U in RNA
 - ❑ *RNA is single stranded not double stranded.*

- there are three types of RNA

- ❑ messenger RNA

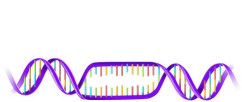
mRNA

- ❑ transfer RNA

tRNA

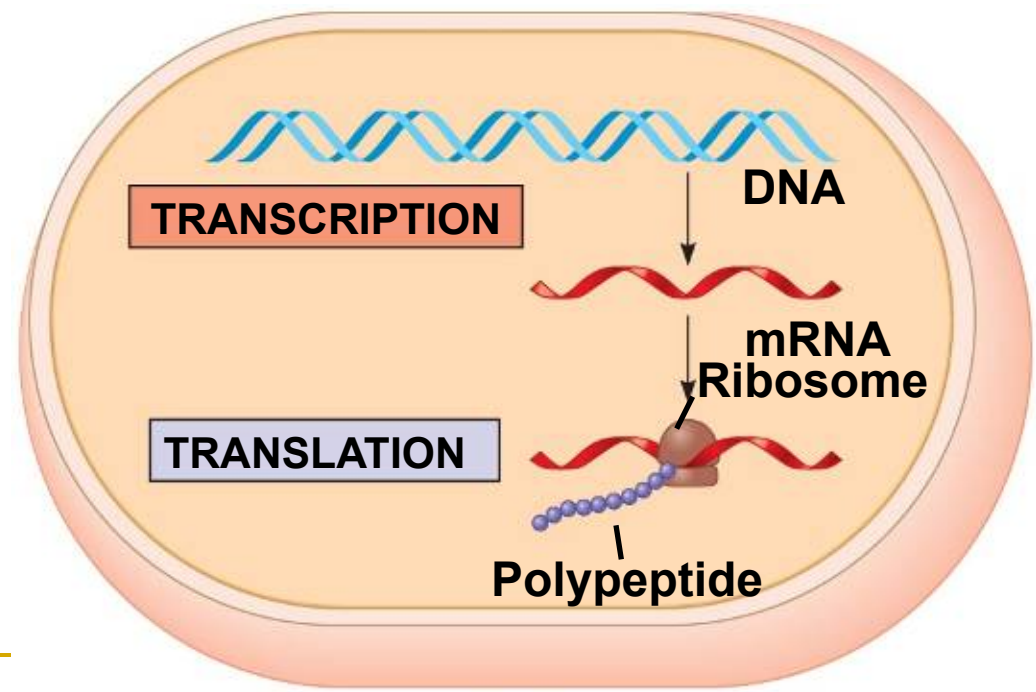
- ❑ ribosomal RNA

rRNA



The Central Dogma

- there are two main stages of gene expression, they are:
 - transcription
 - translation



□ transcription

- the process of converting DNA into messenger RNA (mRNA)
- in all cells the mRNA carries the genetic information from the chromosomes (nucleus) to the site of protein synthesis (cytoplasm)

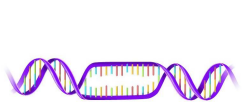
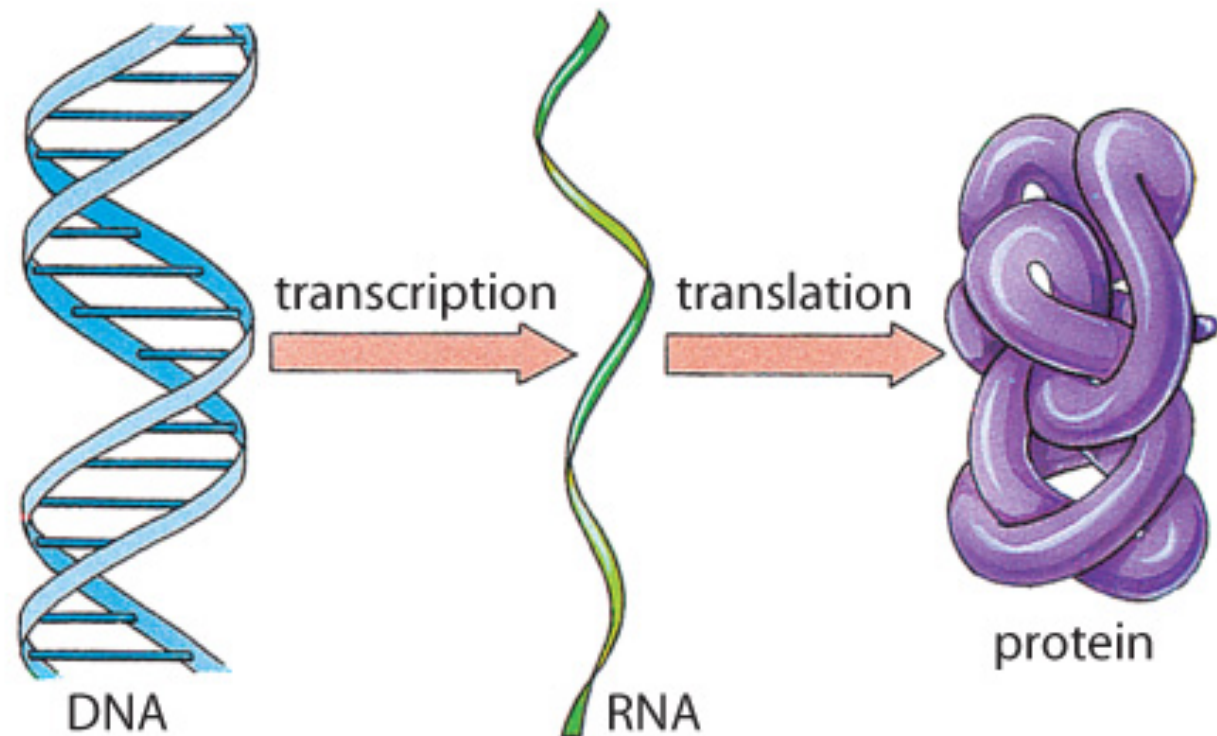
□ translation

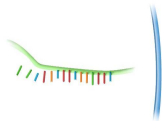
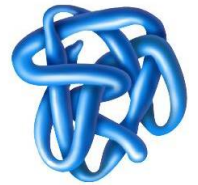
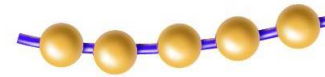
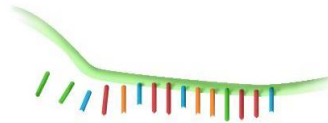
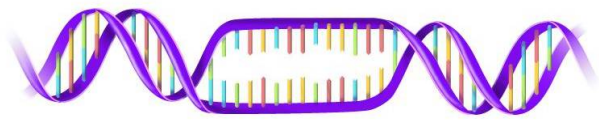
- the process of synthesizing a specific polypeptide as coded for by messenger RNA
- the two step process of DNA to RNA to Protein is known as the Central Dogma of Science.

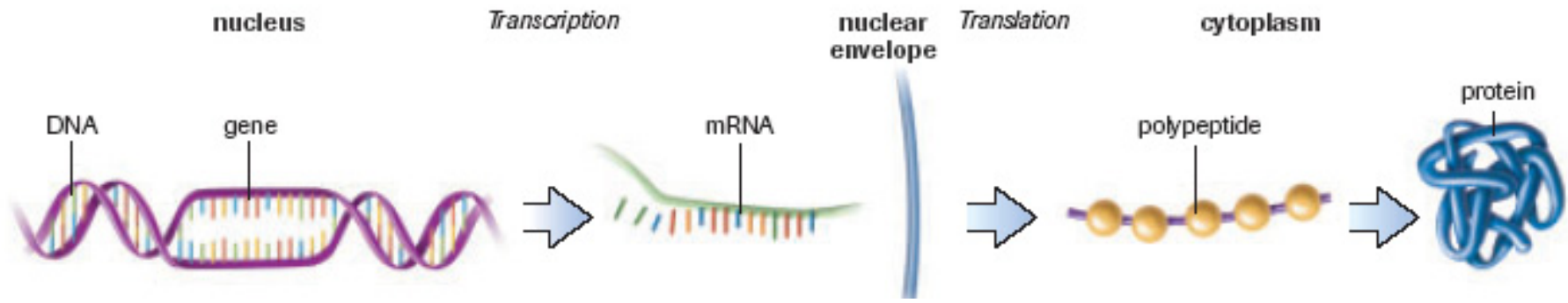


Figure 18.12

The path of gene expression. The “central dogma” proposes that genetic information passes (via transcription) from the genes (DNA) to an RNA copy of the gene, and the RNA copy directs the sequential assembly of a chain of amino acids to produce a protein (via translation).







Transcription

- during transcription the DNA sequence of a gene is copied (transcribed) into the sequence of single stranded mRNA
- it is divided into three processes:
 - initiation
 - elongation
 - termination



- it is divided into three processes:

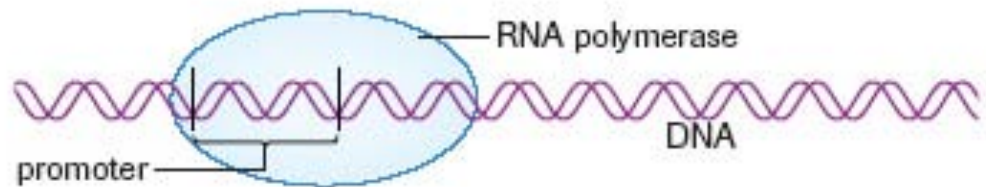
- initiation
- elongation
- termination

- Initiation

- starts when the enzyme RNA polymerase binds to a specific segment of DNA to be transcribed.
 - RNA polymerase binds the DNA molecule in front of the gene to be transcribed in a region called the promoter.
 - in most genes the promoter sequence contains a string of adenine and thymine bases.



- RNA polymerase binds the DNA molecule in front of the gene to be transcribed in a region called the promoter.
 - in most genes the promoter sequence contains a string of adenine and thymine bases.
 - the promoter indicates where the RNA polymerase should start transcribing the DNA.
 - the binding site of RNA polymerase only recognizes the promoter region, therefore it always binds in front of the gene.
- the DNA double helix is unwound, exposing the template strand.



- **Elongation** (after binding and opening the DNA double helix)

- RNA polymerase:

- starts building the single-stranded mRNA in a 5' to 3' direction.

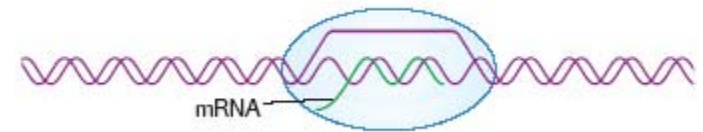
- the promoter is not transcribed

- does not require a primer

- copies only one of the DNA strands

- the transcribed DNA strand is called the template strand.

- the mRNA is complementary to the DNA template except that it contains the base uracil in place of thymine.



■ Termination

- ❑ synthesis of mRNA continues until RNA polymerase reaches the end of the gene.
 - RNA polymerase recognizes the end of gene when it comes to a stop signal called a termination sequence.
- ❑ transcription stops and the new mRNA disconnects from the DNA template.
- ❑ RNA polymerase binds to another promoter region and transcribes another gene.



Fig. 17-7

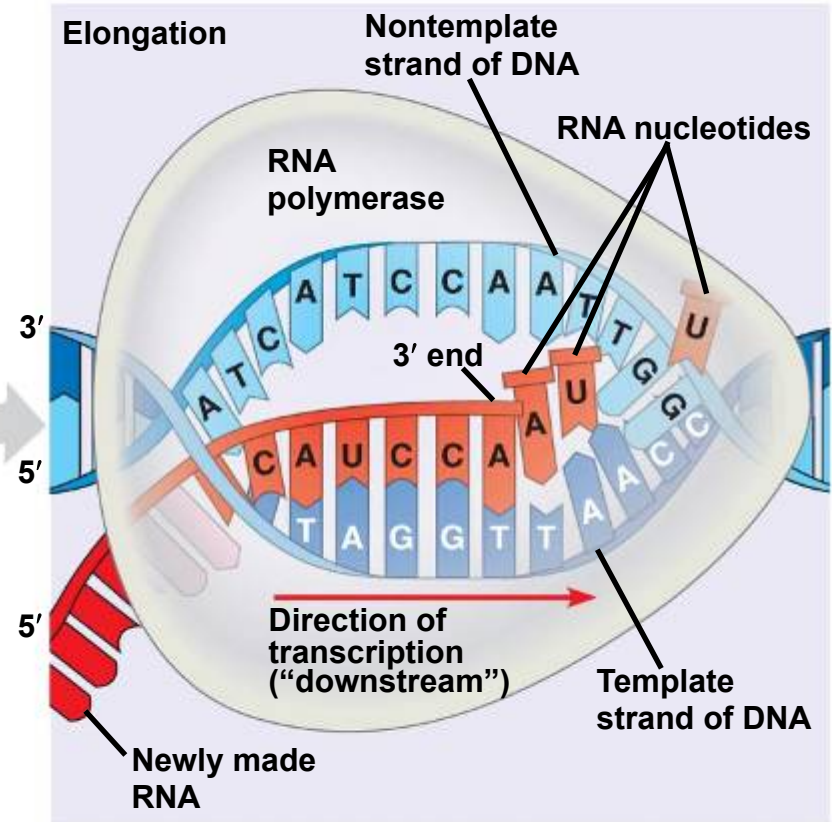
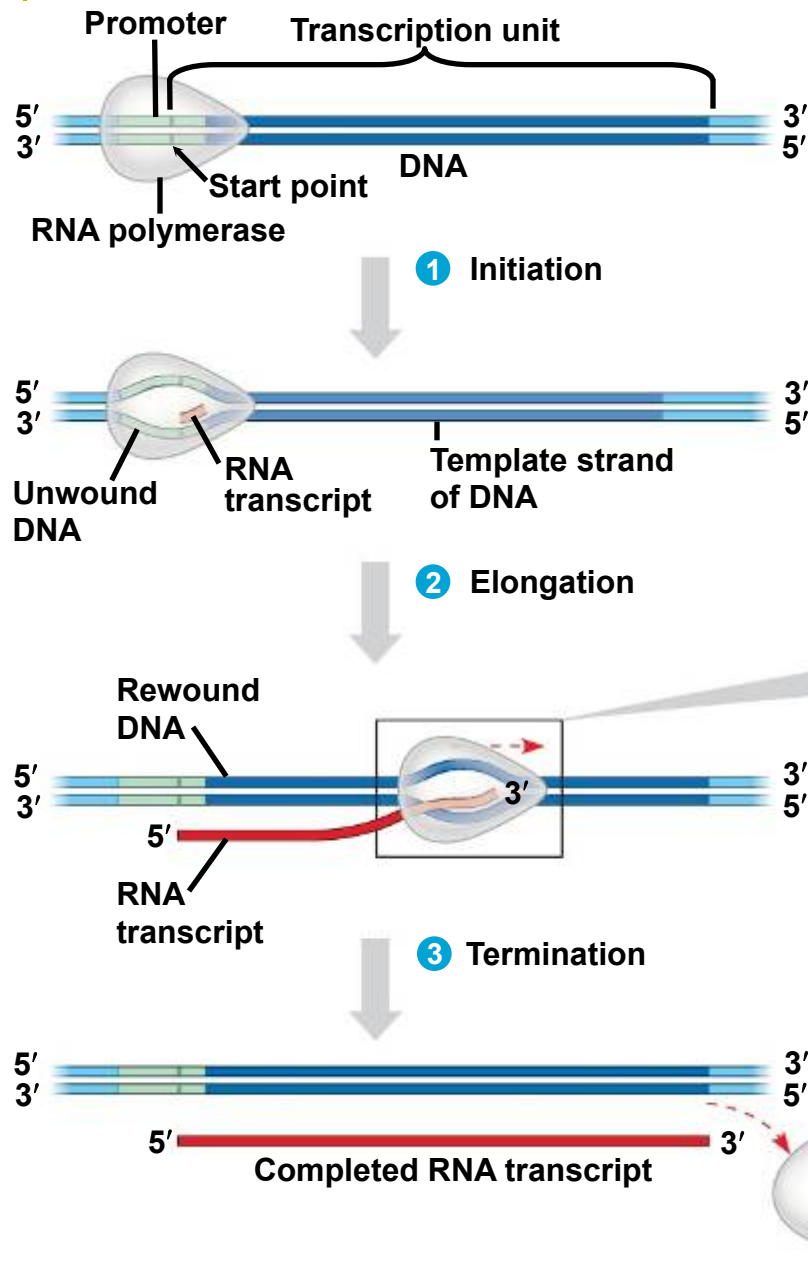


Fig. 17-7a-1

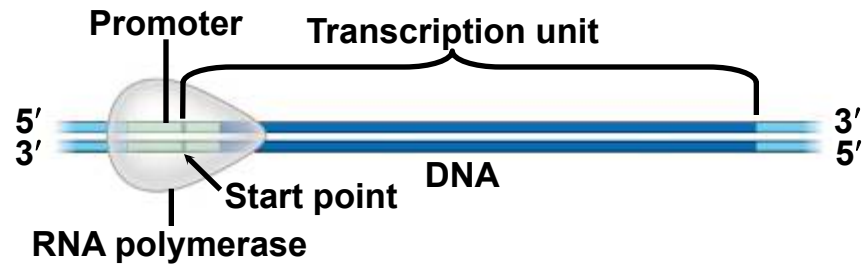


Fig. 17-7a-2

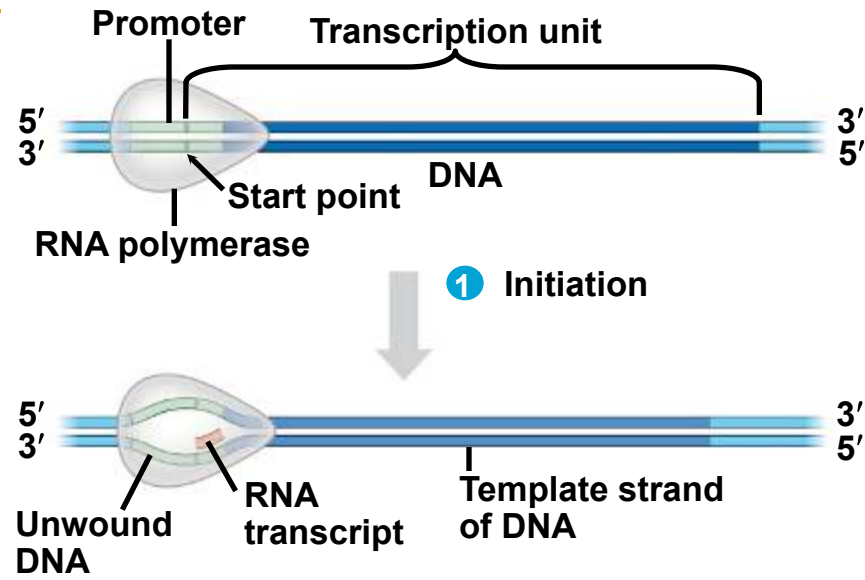


Fig. 17-7a-3

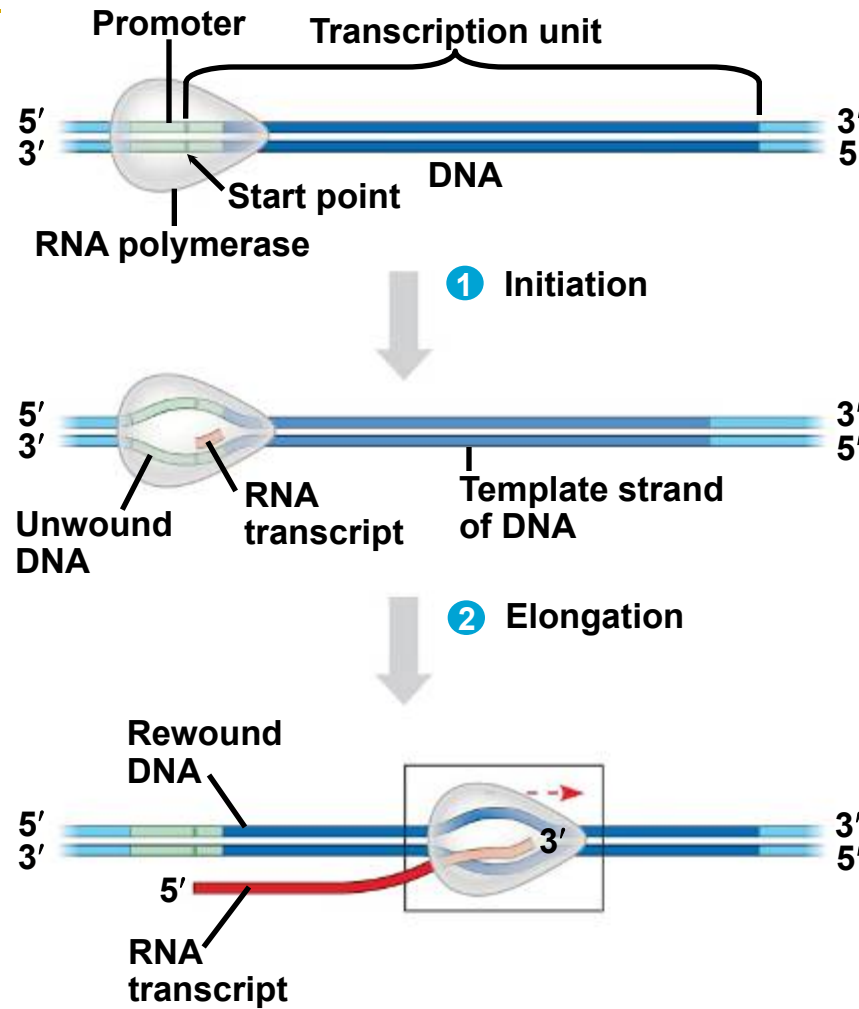


Fig. 17-7a-4

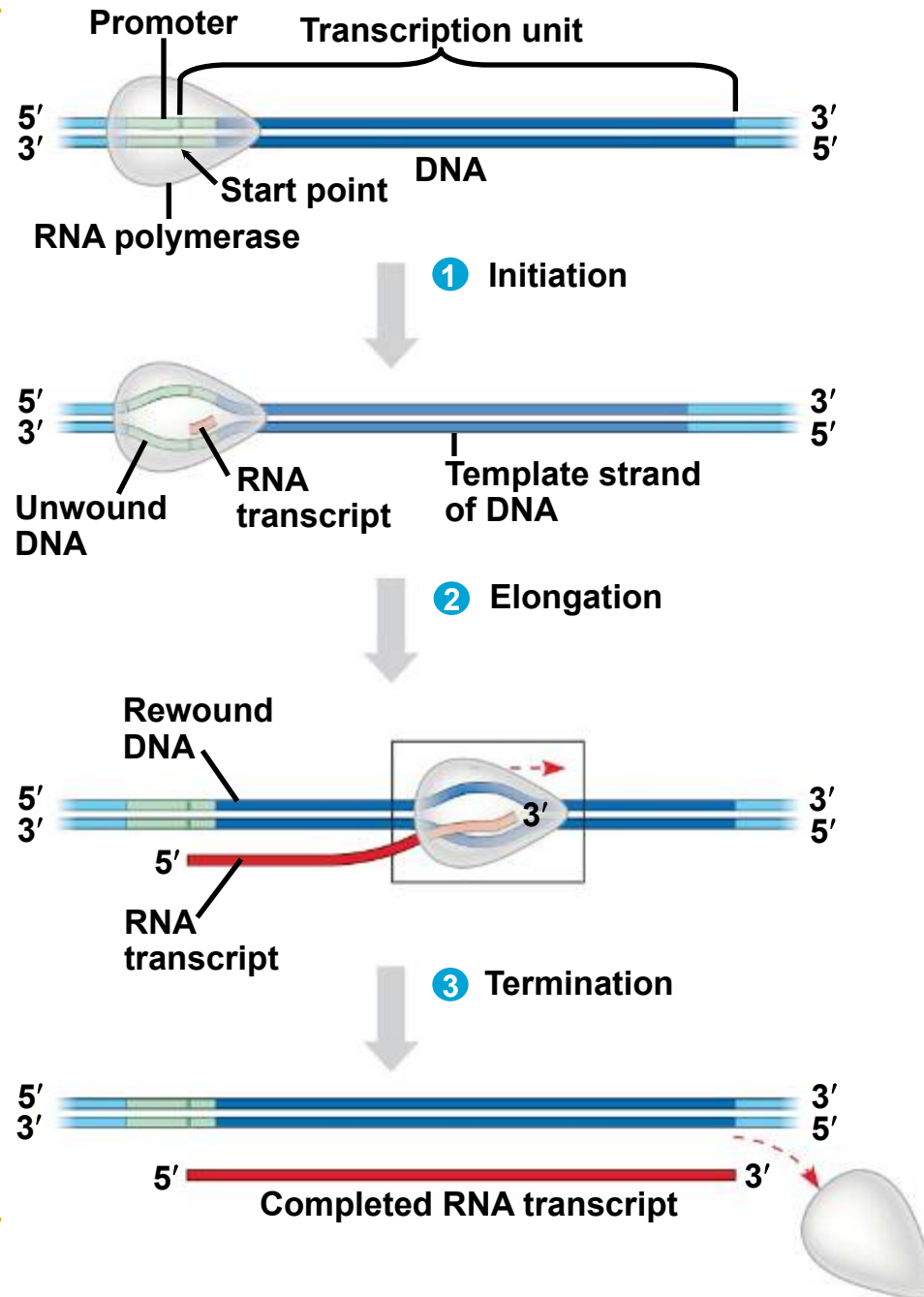
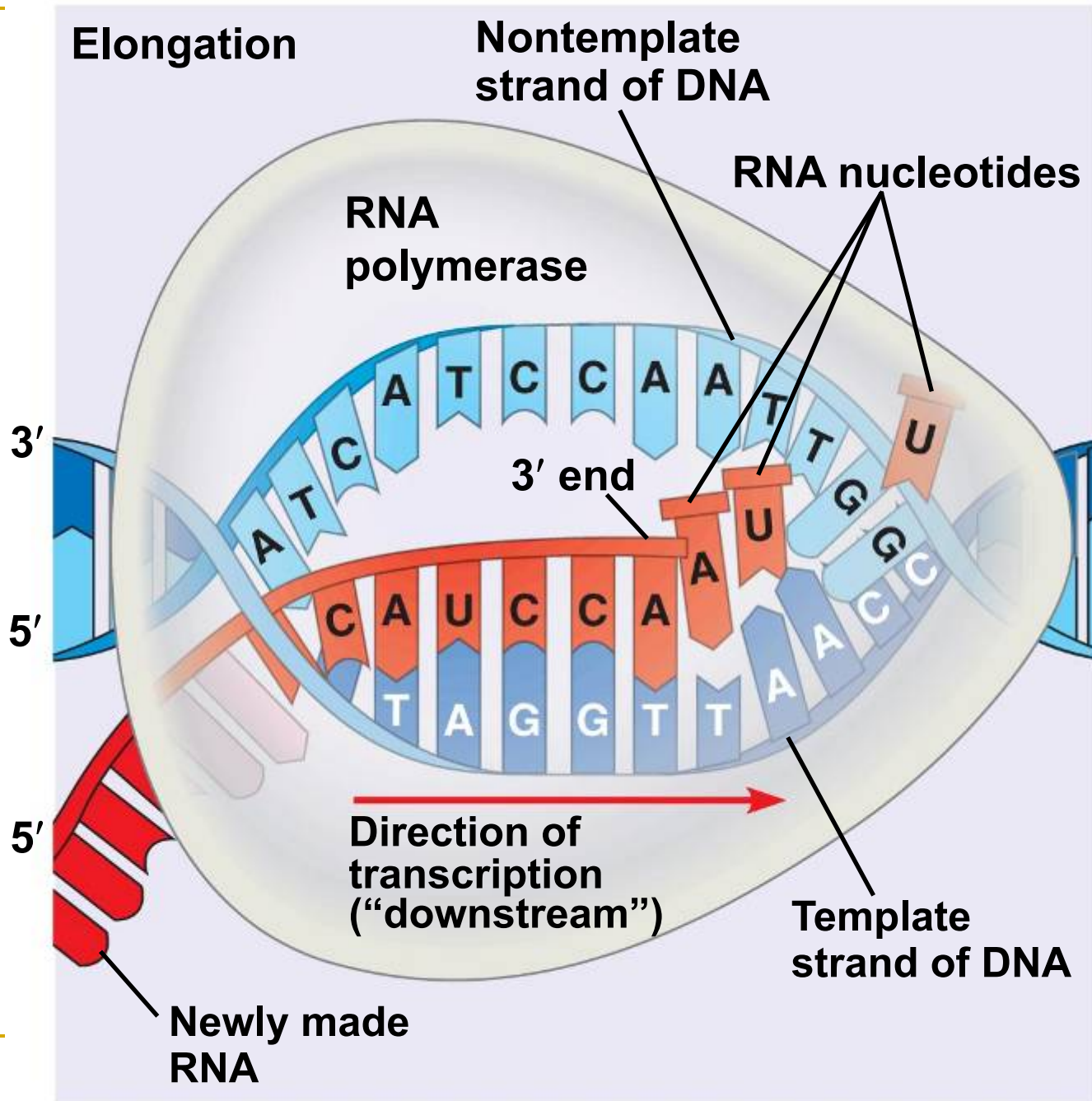
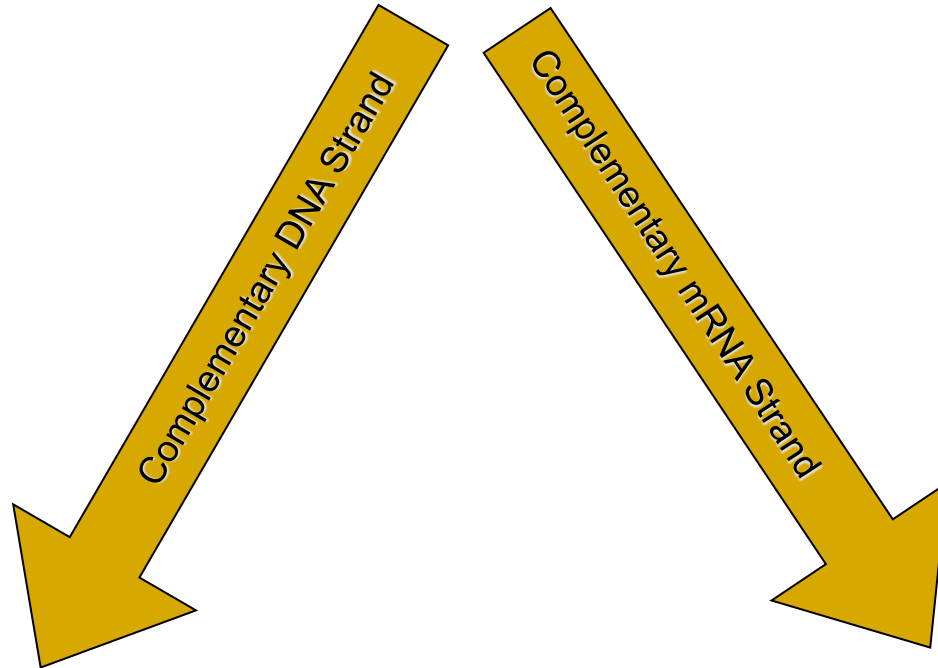


Fig. 17-7b



TACGTATACGTAGCT



ATGCATATGCATCGA

AUGCAUAUGCAUCGA

