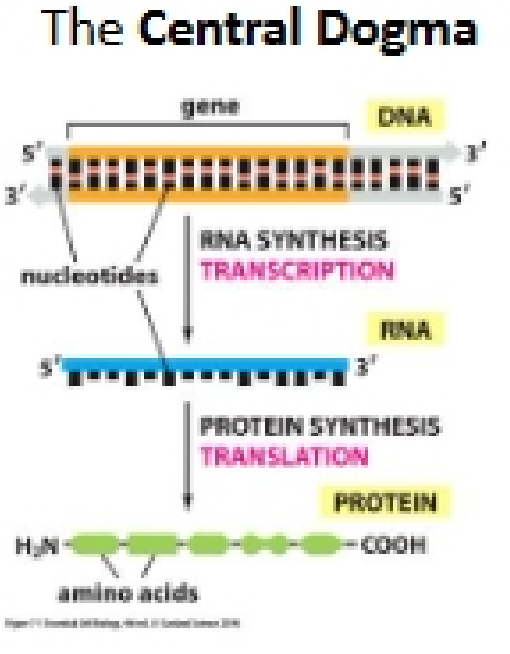
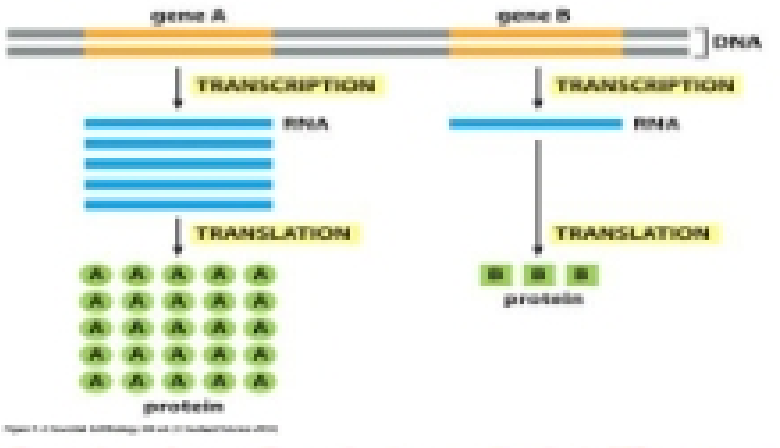
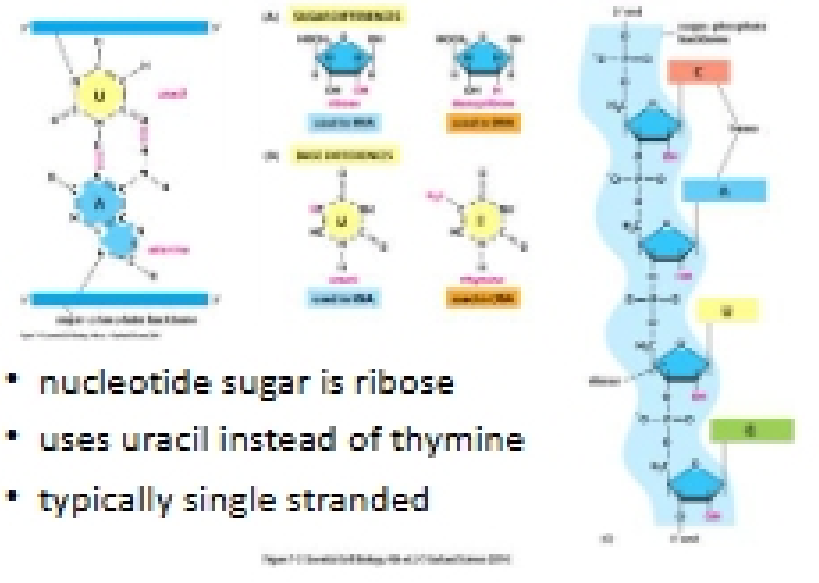
Central Dogma





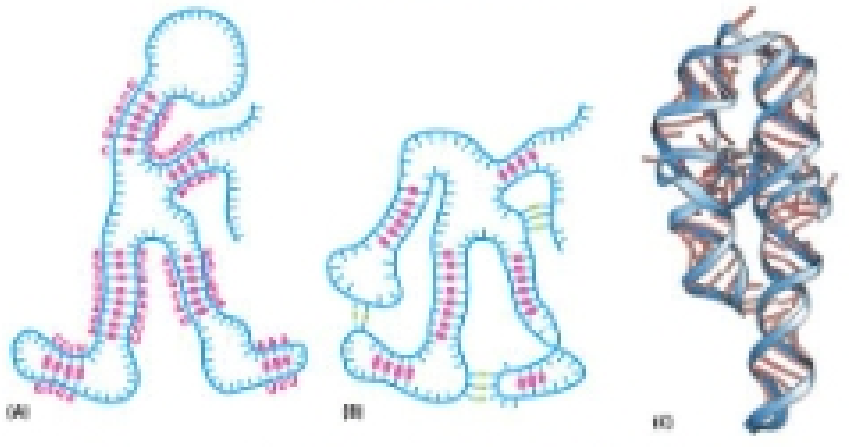
Gene A and gene B can be transcribed at different rates, producing different amounts of RNA within the same cell.

Differences between RNA and DNA



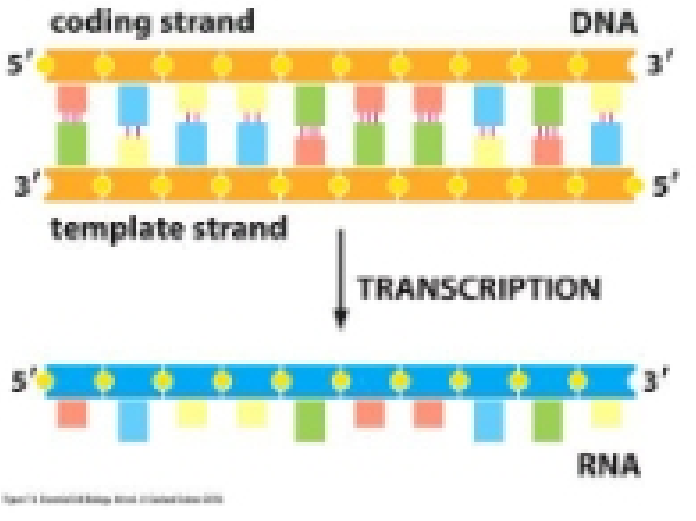
- nucleotide sugar is ribose
- uses uracil instead of thymine
- typically single stranded

RNA molecules can fold into specific 3D shapes.



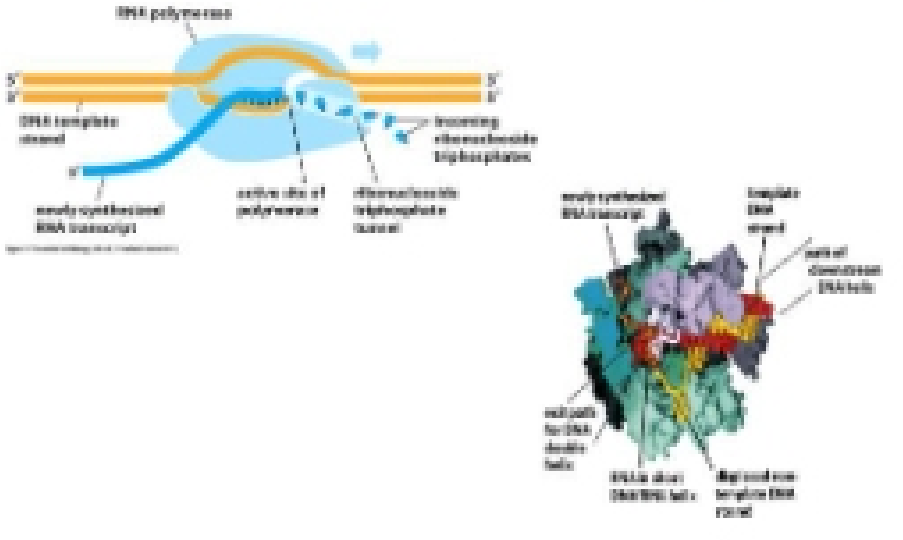
-have catalytic and structural functions

Transcription produces an RNA molecule that is complementary to the template strand of DNA.

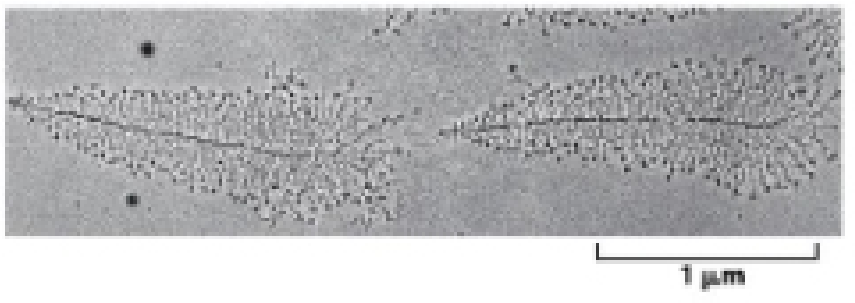


Polymerases catalyze the formation of **phosphodiester bonds.**

RNA polymerases mediate **transcription.**



Genes are transcribed by many RNA polymerases at the same time.



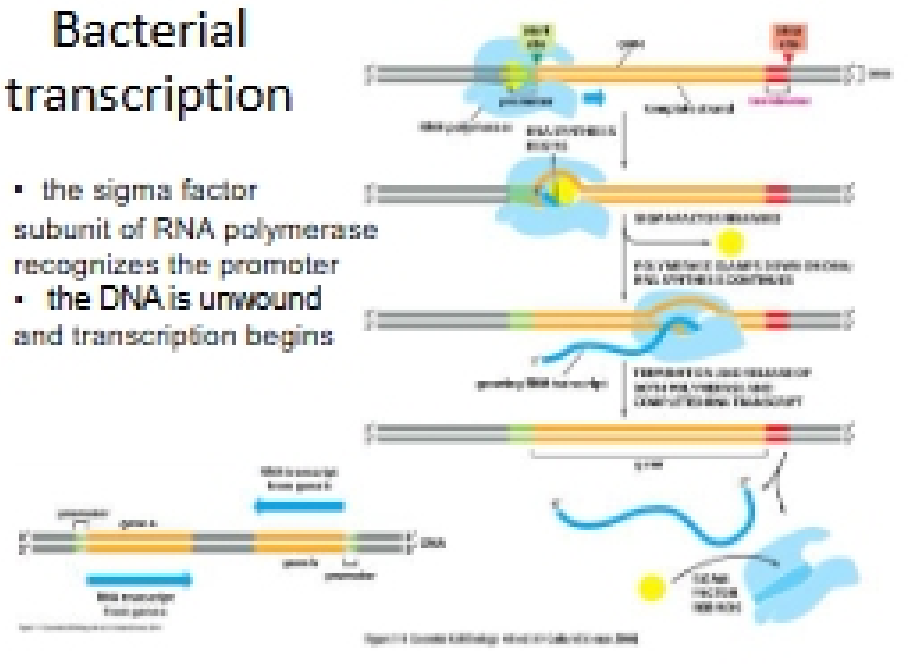
A new RNA molecule can begin to be synthesized from a gene before the previous RNA molecule's synthesis is completed.

TABLE 7–1 TYPES OF RNA PRODUCED IN CELLS

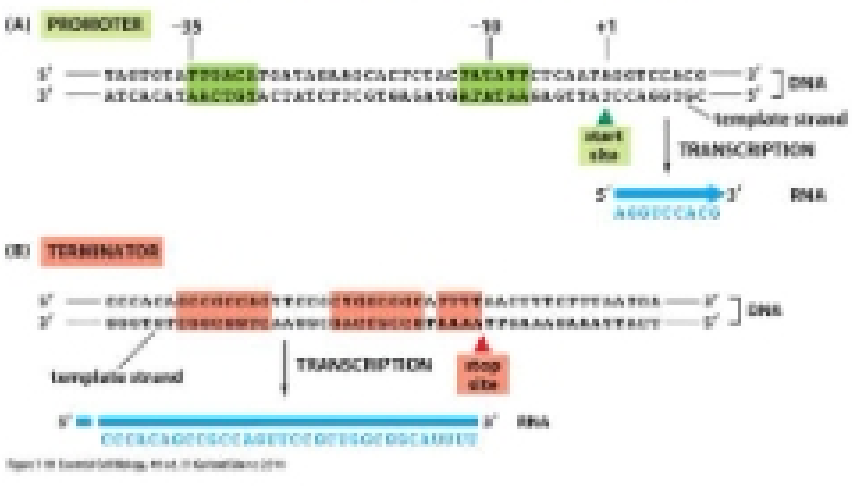
Type of RNA	Function
messenger RNAs (mRNAs)	code for proteins
ribosomal RNAs (rRNAs)	form the core of the ribosome's structure and catalyze protein synthesis
microRNAs (miRNAs)	regulate gene expression
transfer RNAs (tRNAs)	serve as adaptors between mRNA and amino acids during protein synthesis
other noncoding RNAs	used in RNA splicing, gene regulation, telomere maintenance, and many other processes

Bacterial transcription

- the sigma factor subunit of RNA polymerase recognizes the promoter
- the DNA is unwound and transcription begins



Specific sequences tell bacterial RNA polymerase where to start (**promoter**) and stop (**terminator**) transcription.



Transcription in bacteria

- The sigma subunit of bacterial RNA polymerase recognizes promoter sites in the DNA.
- RNA polymerase (along with its sigma subunit) can initiate transcription on its own.
- Bacterial cells contain a single RNA polymerase.
- Bacterial cells lack nucleosomes.

Eukaryotic transcription differs from prokaryotic transcription.

- Three types of RNA polymerases transcribe different types of genes

Type of Polymerase	Genes Transcribed
RNA polymerase I	most rRNA genes
RNA polymerase II	all protein-coding genes, miRNA genes, plus genes for other noncoding RNAs (e.g., those in spliceosomes)
RNA polymerase III	tRNA genes 5S rRNA gene genes for many other small RNAs

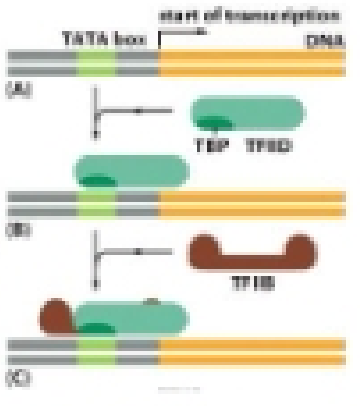
- Transcription factors are needed to initiate transcription
- Initiation requires dealing with nucleosomes

Eukaryotic transcription

General transcription factors are required for RNA pol II initiation

- TFIID = TBP + 11 TAF subunits

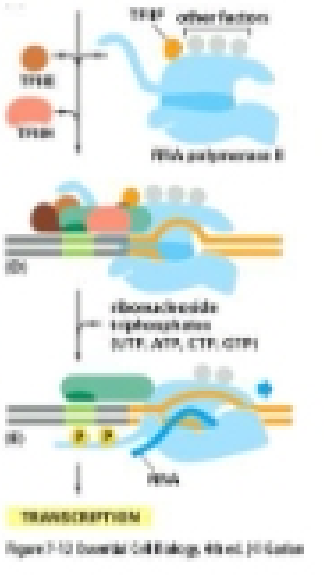
The TBP subunit of TFIID distorts the DNA double helix.



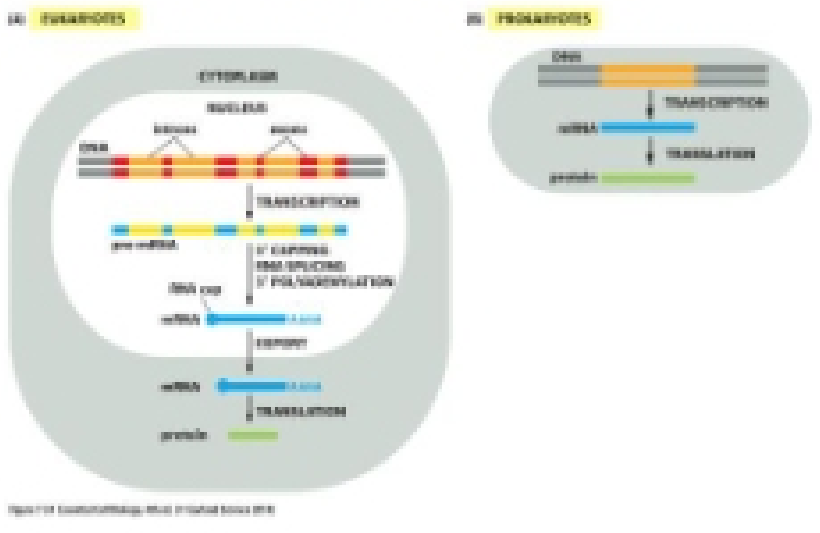
- TFIIB recognizes the distorted DNA

Eukaryotic transcription

- TFIIF – stabilizes interaction between RNA pol II & TFIID/B
- TFIIE – recruits TFIIH
- TFIIH
  - unwinds DNA at start site
  - phosphorylates RNA pol II CTD
- After phosphorylation, RNA pol II disassociates from the TFs and enters elongation phase



Eukaryotic RNAs are processed prior to export from the nucleus.



mRNAs are **capped** and **polyadenylated.**