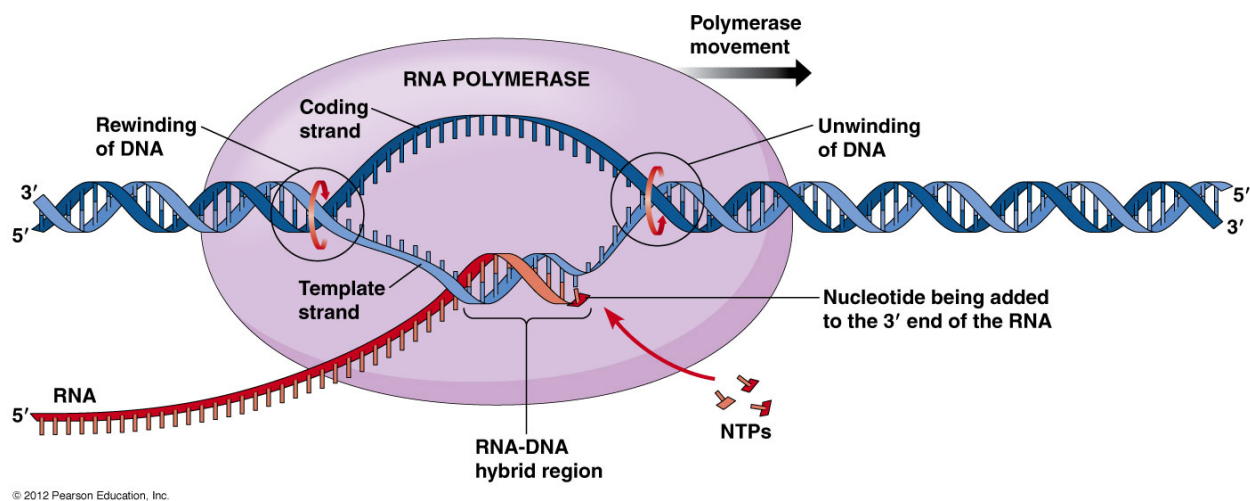


Transcription

Initiation

- General
 - **RNA polymerase** attaches to promoter region of gene on the DNA molecule with the aid of **protein factors**
 - RNA polymerase unzips and separates the 2 DNA strands by breaking hydrogen bonds between complementary base pairs
 - **Non-coding strand** is used as the **template** strand for the synthesis of a complementary mRNA strand



- Prokaryotes
 - **Sigma factor** associates with RNA core polymerase forming **holoenzyme** which scans along the DNA strand and binds to the promoter
- Eukaryotes
 - **General transcription factors** bind to TATA box in promoter and recruit RNA polymerase forming the **transcription initiation complex**, positioning the RNA polymerase correctly at the promoter

Elongation

- Free ribonucleotides from nucleoplasm matched up with DNA template strand by **complementary base pairing**
 - Adenine forms 2 hydrogen bonds with Uracil
 - Thymine forms 2 hydrogen bonds with Adenine
 - Guanine forms 3 hydrogen bonds with Cytosine
 - Cytosine forms 3 hydrogen bonds with Guanine
- **RNA polymerase** catalyses the formation of phosphodiester bonds between free ribonucleotides, forming the sugar-phosphate backbone
- RNA strand synthesised in **5' to 3' direction**

Termination

- General
 - When RNA polymerase transcribes through **termination sequences**, the RNA chain is released, RNA polymerase dissociates and transcription is terminated
- Prokaryotes
 - After transcribing through termination sequence of DNA strand, transcribed terminator of synthesised RNA strand folds back to form a **hairpin loop**
 - **Hairpin loop** acts as termination signal, causing RNA chain and RNA polymerase to be released
- Eukaryotes
 - **Polyadenylation signal** (AAUAAA) in pre-mRNA
 - Endonucleases recognise polyadenylation signal and cleaves pre-mRNA from RNA polymerase, causing it to be released

Post-Transcriptional Modification (only in eukaryotes)

- Pre-mRNA processed to produce mature RNA
- Addition of 5' 7-Methylguanosine Cap to 5' end of pre-mRNA
 - Function
 - Protects mRNA from degradation by ribonucleases
 - Longer half-life
 - Serves as recognition **signal** for small ribosomal subunit to assemble to initiate translation
 - Distinguishes mRNAs from other RNA molecules
 - Recognised by eukaryotic initiation factors which facilitate the binding of small ribosomal subunit during translation
 - Promotes initiation of translation
 - Facilitates export of mature mRNA from nucleus into cytoplasm
- RNA splicing to remove introns
 - Introns are excised and exons are joined together to form mature mRNA
 - Carried out with high accuracy by **spliceosome** and requires ATP
- Synthesis of 3' poly-A tail by poly-A polymerase
 - Adenine nucleotides added to pre-mRNA downstream of polyadenylation signal (AAUAAA)
 - Functions
 - Protects mRNA from degradation by ribonucleases
 - Longer half-life
 - More stable template
 - Directs export of mRNA through nuclear pores into cytoplasm

Extra

- RNA polymerase is a multimeric complex
- As each nucleoside triphosphate is brought in, 2 of its terminal phosphates are

- removed and 5' end is added to 3' end of growing RNA chain
 - mRNA/tRNA/rRNA synthesised and elongated in 5' to 3' direction
- Region of DNA that has just been transcribed reanneals