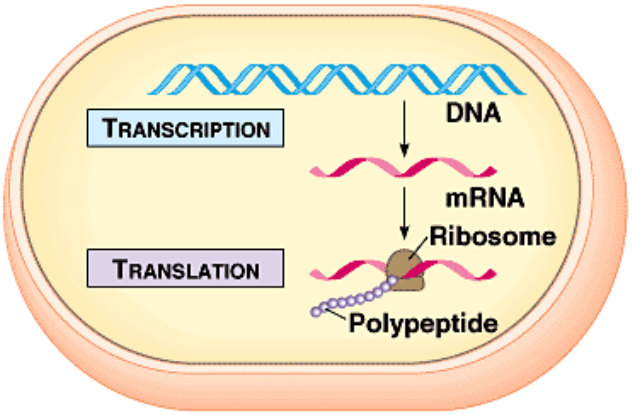
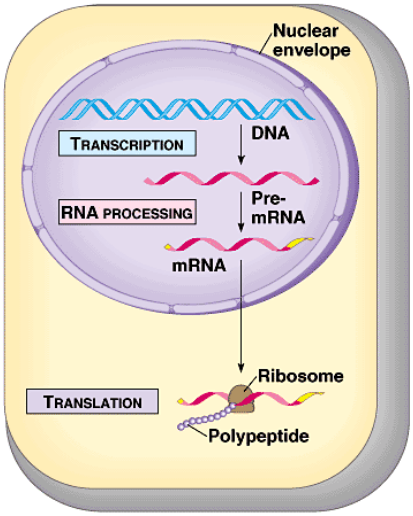
Central Dogma



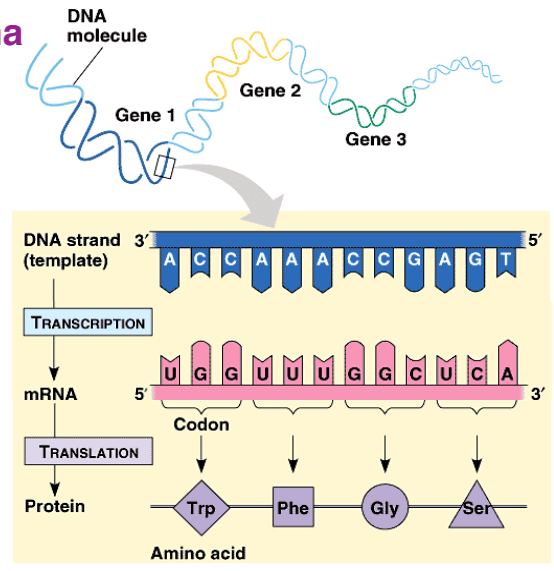
Prokaryotic cell

Central Dogma



Eukaryotic cell

Central Dogma



RNA Transcription

1. Initiation

RNA polymerase binds to specific sequence in the promoter of the gene, and starts to unwind the dsDNA.

2. Elongation:

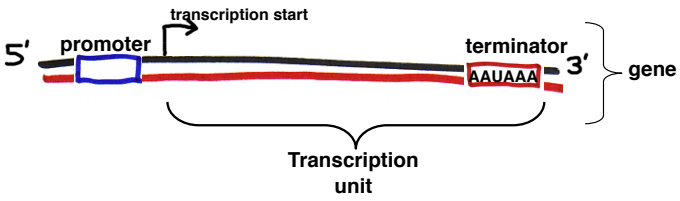
The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5' to 3' direction.

3. Termination:

RNA polymerase transcribes a specific sequence of the terminator at the 3' end of the gene, causing the RNA polymerase to fall off the dsDNA and stop transcription

4. RNA processing and Protein Translation

Transcription



Transcription

Transcription

1. Initiation

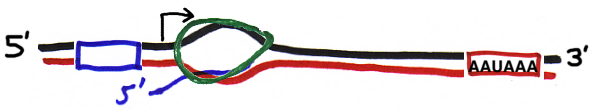
RNA polymerase binds to specific sequence in the promoter of the gene, and starts to unwind the dsDNA.

Transcription

2. Elongation:

The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5' to 3' direction.

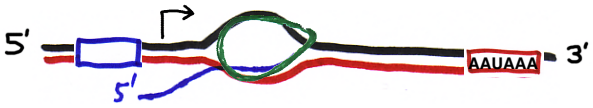
Transcription



2. Elongation:

The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5' to 3' direction.

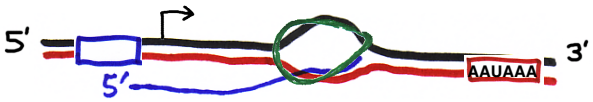
Transcription



2. Elongation:

The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5’ to 3’ direction.

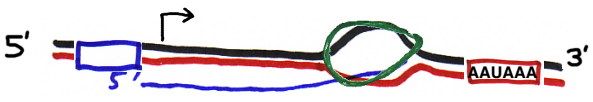
Transcription



2. Elongation:

The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5’ to 3’ direction.

Transcription



2. Elongation:

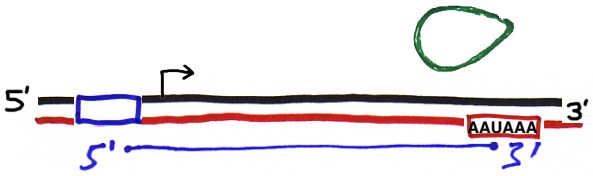
The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5’ to 3’ direction.

Transcription

2. Elongation:

The RNA polymerase moves down the dsDNA, unwinding as it goes, and using template (bottom) strand of dsDNA to synthesize the RNA strand from 5' to 3' direction.

Transcription



3. Termination:

RNA polymerase transcribes a specific sequence of the terminator at the 3' end of the gene, causing the RNA polymerase to fall off the dsDNA and stop transcription

Post-Transcription

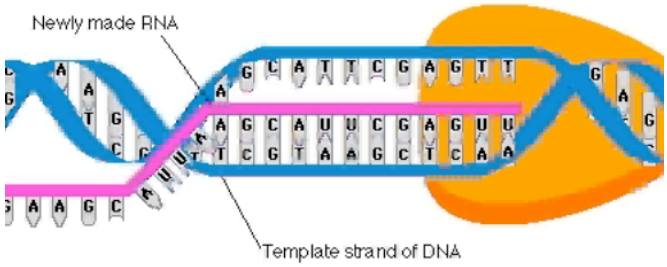
4. RNA processing and Protein Translation

Note: RNA equivalent to DNA sense strand (complimentaryto DNA antisense strand)

Features of RNA transcription

- RNA polymerase has helicase activity
- RNA extended in 5′-> 3′ direction
- Uracil (not Thymine) is used as complement to deoxyAdeonsine
- The bottom (antisense) DNA strand is used as template, but RNA sequence = sequence of top (sense) DNA strand

- The bottom (antisense) DNA strand is used as template, but RNA sequence = sequence of top (sense) DNA strand



Post-Transcriptional Processing

Prokaryotes:

DNA —*transcription*→ **RNA** —*translation*→ **protein**

Eukaryotes:

DNA —*transcription*→ **preRNA** —*processing*→ **mRNA** —*translation*→ **protein**

There are 2 additional steps in RNA synthesis after transcription in eukaryotes, that result in messenger RNA (mRNA):

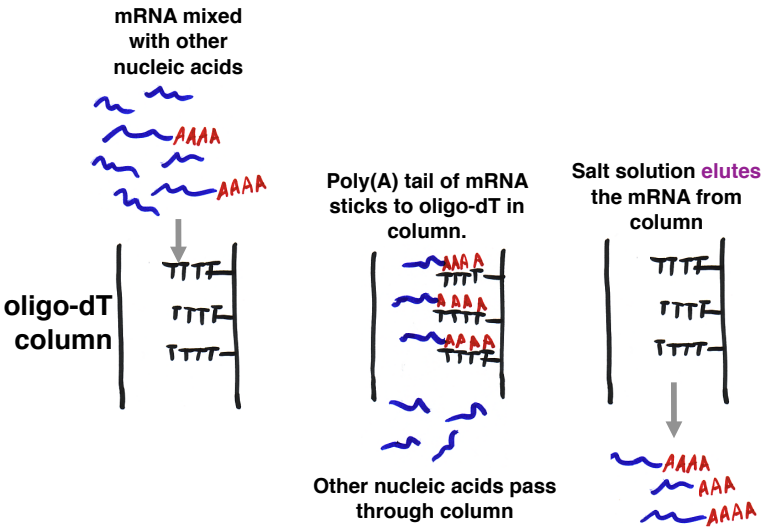
1. **Capping and tailing**
2. **Splicing**

1. Addition of 5’ cap and 3’ poly(A) tail

Cap helps attachment to ribosome for protein translation.

Tail helps stabilize RNA (prevent degradation by RNAses). Length of tail = how long RNA lasts in cell before it is degraded.

Poly(A) tail can separate mRNA from cell contents



2. RNA Splicing

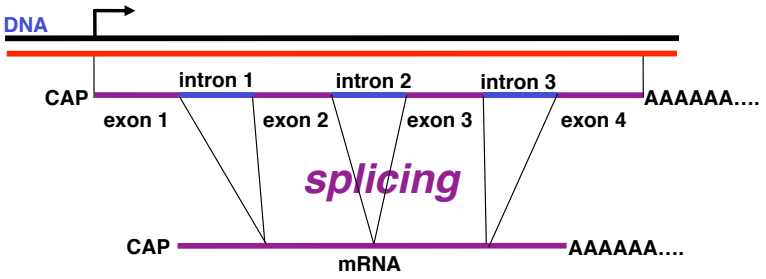
The preRNA gets “cut and pasted” to make a smaller specific mRNA.

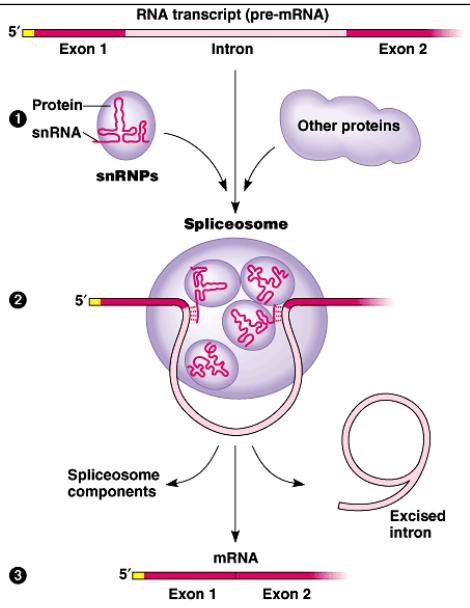
The sequences that get cut out are introns = intervening sequences.

Exons = expressed sequences that get pasted together and expressed in the protein.

Splicing is carried out by spliceosomes, a mixture of protein and snRNPs (small, nuclear ribonucleoproteins).

2. RNA Splicing



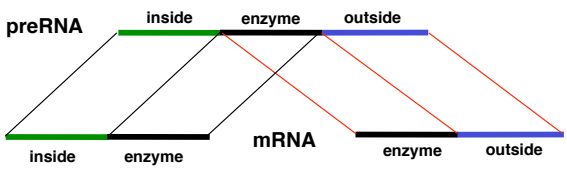


Why splice?

1. Introns may be regulators of gene expression with unknown function (i.e. junk DNA may not be junk.)

2. Allows the cell to mix and match parts of proteins to form different combinations.

e.g. one part = attach to inside, one part = enzyme, one part = attach to outside



Exon -> protein domain