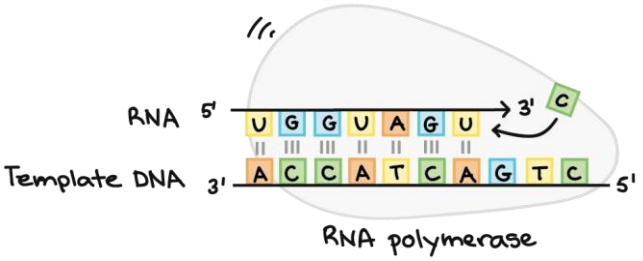
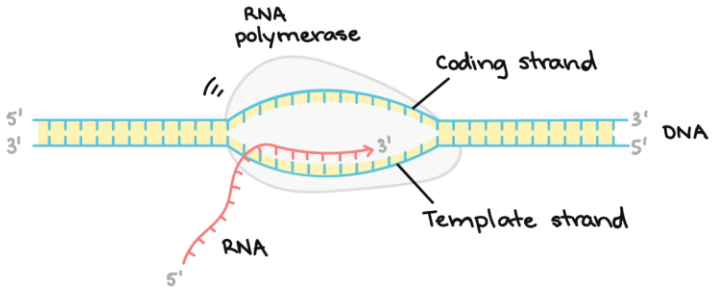
Gene Expression Part I: Transcription

DNA, the fundamental genetic code stored by all cells is safeguarded within the nucleus of the cell and not permitted to exit. Therefore, its expression requires a transitory intermediate to carry the genetic information into the cytoplasm. A complementary mRNA molecule is generated within the nucleus and transported to the cytoplasm where it can be translated. The mechanism for its production is as follows:

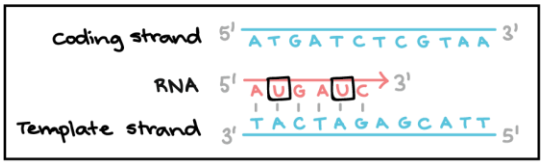
1) The DNA double helix must be separated and unwound at the site particular to the gene of interest. An **RNA polymerase** enzyme binds to a promoter region on DNA and uses one half of the DNA helix, the "template" strand, to match complementary nucleotides of RNA based on the DNA sequence. Aside from the RNA base uracil in place of the DNA's thymine, the resulting RNA is nearly identical to the other half of the DNA molecule, known as the "non-coding" strand.

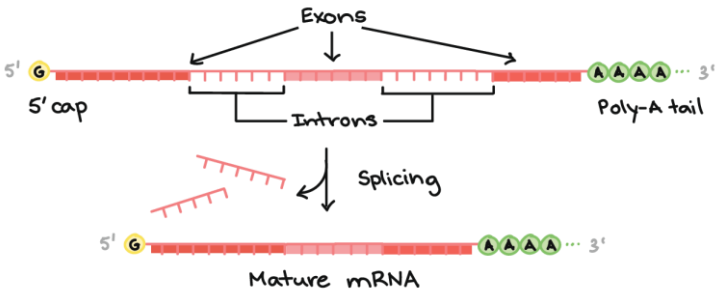


2) Once the "termination" or "stop" sequence of the DNA is recognized by the RNA polymerase, the process is ended and the RNA strand is released and termed **preRNA**



3) In eukaryotes, this preRNA must be processed with three additional steps: addition of a **5' 7-methyl guanosine cap**, addition of a **3' poly-A tail**, and splicing of intron sequences. 7-methyl guanosine capping takes place co-transcriptionally as the RNA is being prepared, but the polyadenylation of the 3' tail must occur post-transcriptionally in order to add it on the terminal end of the RNA product. **RNA splicing** removes intron sequences so that only the exon regions will ultimately be expressed. Because there are alternative splicing arrangements based on the pattern of exon ligation, there is potential for multiple different proteins to be derived from the same original sequence.





4) The mature **mRNA** can then exit the nucleus in order to be translated in the cytoplasm.

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