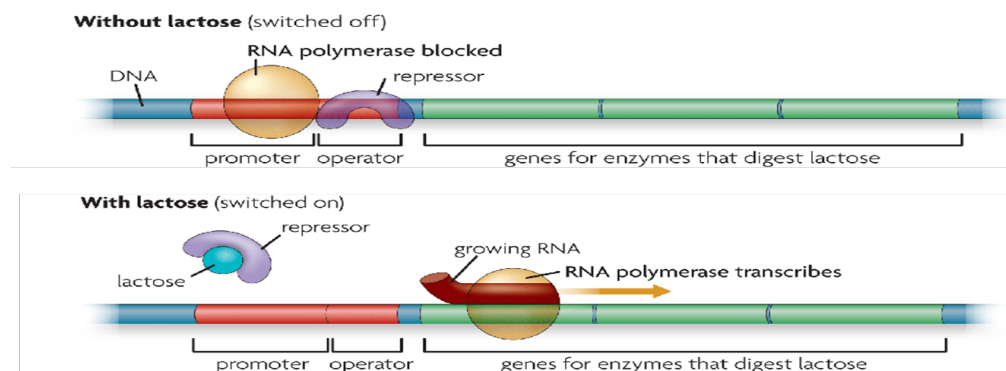


Section 8.6 Gene Expression and Regulation

Prokaryotic cells turn genes on and off by controlling transcription.

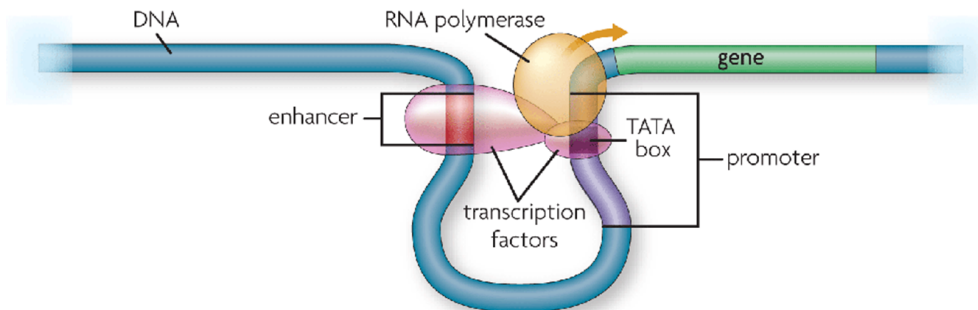
- A **promotor** is a DNA segment that allows a gene to be transcribed.
- An **operator** is a part of DNA that turns a gene “on” or “off.”
- An **operon includes** a promoter, an operator, and one or more structural genes that code for all the proteins needed to do a job.
 - > Operons are most common in **prokaryotes**.
 - > The **lac operon** was one of the first examples of gene regulation to be discovered.
 - > The **lac operon** has three genes that code for enzymes that break down lactose.

- The **lac operon** acts like a switch.
- The **lac operon** is “off” when **lactose is not present** repressor is attached.
- The **lac operon** is “on” when **lactose is present** repressor is removed.

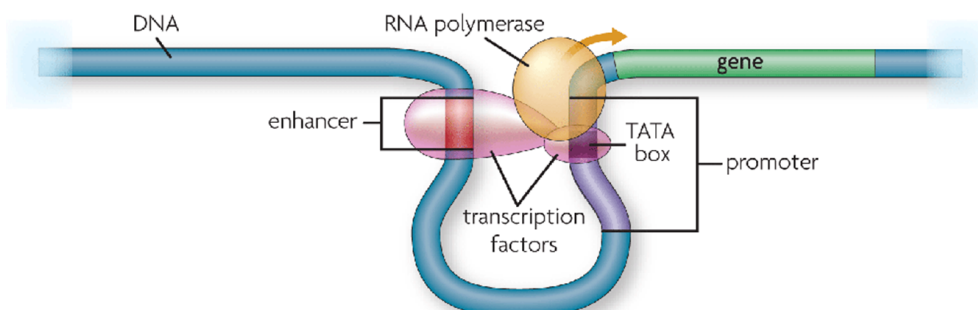


Eukaryotes regulate gene expression at many points.

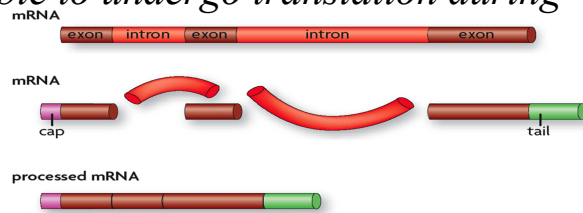
- Different sets of genes are *expressed* in different types of cells.
- Transcription is controlled by *regulatory DNA sequences and protein transcription factors*.



- > Most eukaryotes have a *TATA box promoter*.
- > *Enhancers and silencers* speed up or slow down the rate of transcription.
- > Each gene has a *unique combination* of regulatory sequences.



- RNA processing is also an important part of gene regulation in eukaryotes.
- mRNA processing includes *three major steps*.
 1. *Introns* are removed and *exons* are spliced together.
 2. A *5' cap* is added.
 - A *5' cap* is a specially altered nucleotide on the 5' end of some eukaryotic primary transcripts such as precursor messenger RNA.
 - "**Capping**", the process that creates this nucleotide, is highly regulated and *vital in the creation of stable and mature messenger RNA able to undergo translation during protein synthesis*.

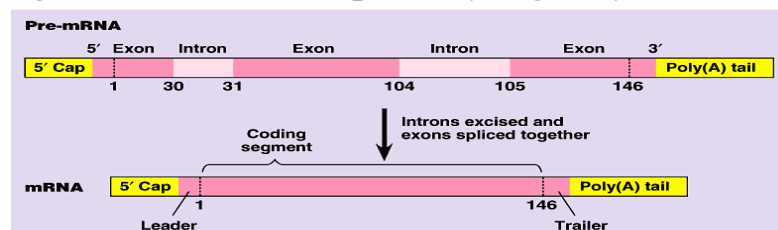


3. A *poly A tail* is added.

A *poly A tail* consists of multiple adenosine monophosphates; in other words, it is a stretch of RNA that has only adenine bases.

In eukaryotes, it is part of the *process that produces mature mRNA for translation*. It, therefore, forms part of the larger process of gene expression.

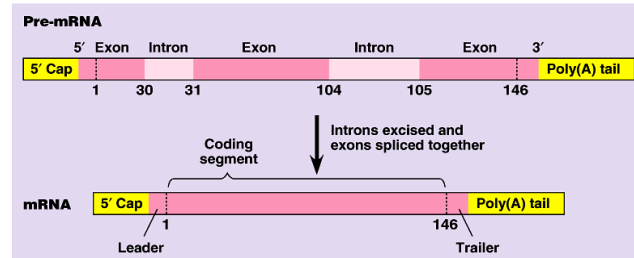
The *process begins as the transcription of a gene finishes, or terminates*.



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In eukaryotes, not all nucleotides carry instructions for making proteins.

- **Exon** = the portions of a gene that get *translated into proteins*.
- **Intron** = the noncoding portions of a gene that *interrupt exons*.
- In humans, less than **10%** of our genes are exons.
- Introns are separated from exons during *transcription*.

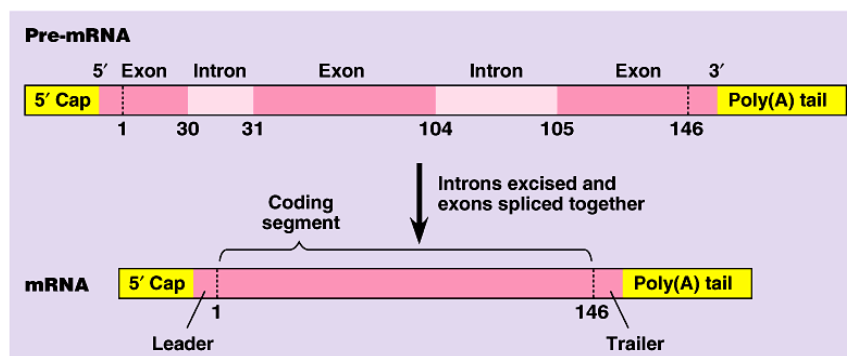


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Exons play a role in evolution.

One exon may influence which molecules an *enzyme is able to recognize*, while another may determine whether a *protein will respond to particular signal molecules*.

By possessing introns and exons, cells can *shuffle exons* between genes and create new combinations. This enables cells to manufacture many *different* proteins by juggling exons between genes.



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