

8.6 Gene Expression and Regulation

KEY CONCEPT

Gene expression is carefully regulated in both prokaryotic and eukaryotic cells.



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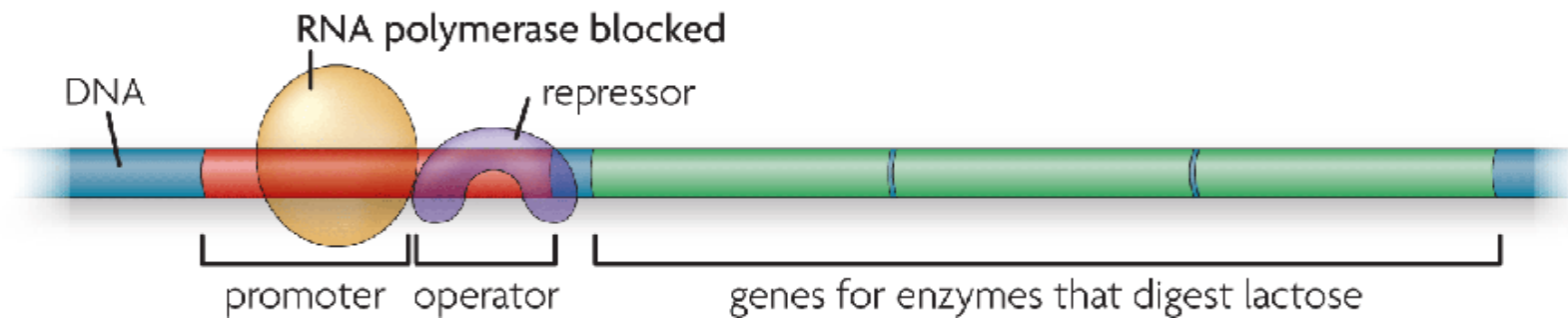
▶ Prokaryotic cells turn genes on and off by controlling transcription.

- A promoter 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.

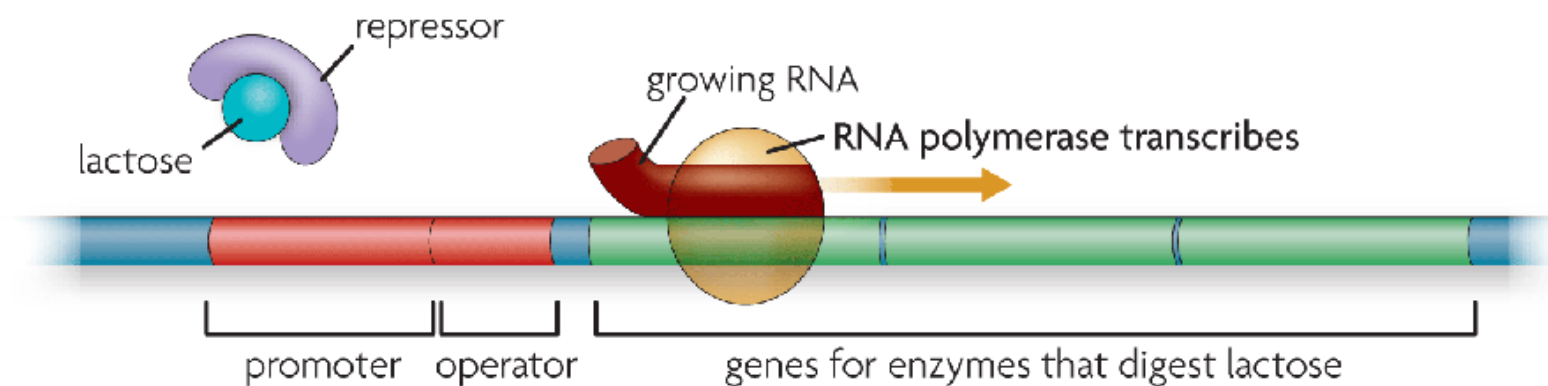
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- The *lac* operon acts like a switch.
 - The *lac* operon is “off” when lactose is not present.
 - The *lac* operon is “on” when lactose is present.

Without lactose (switched off)

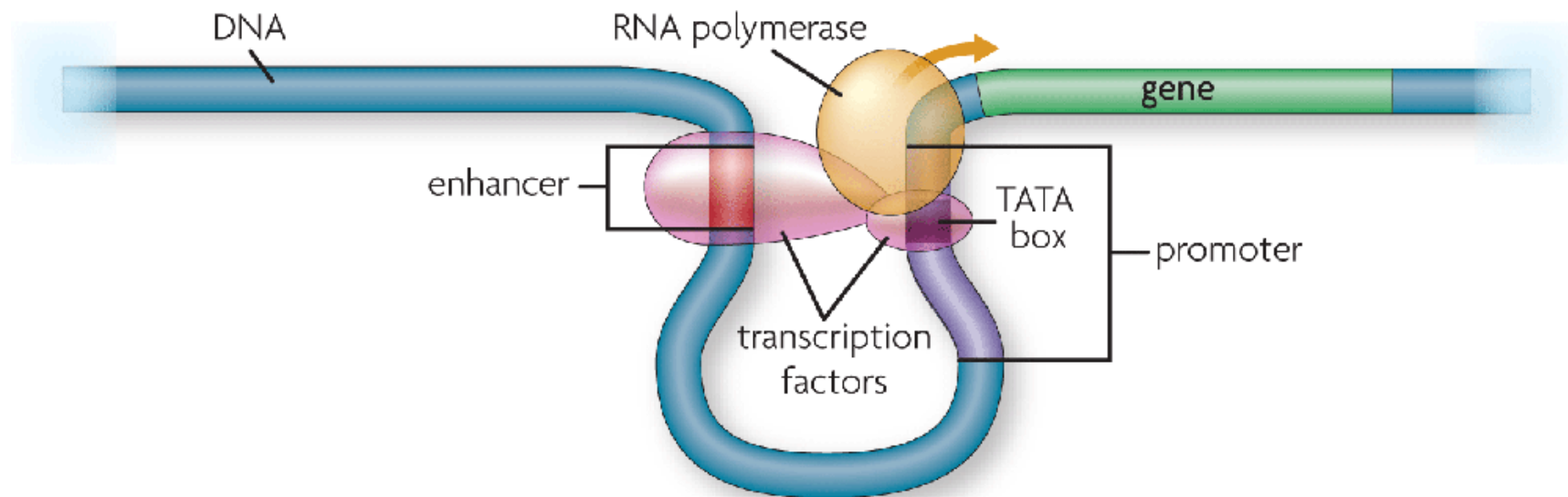


With lactose (switched on)



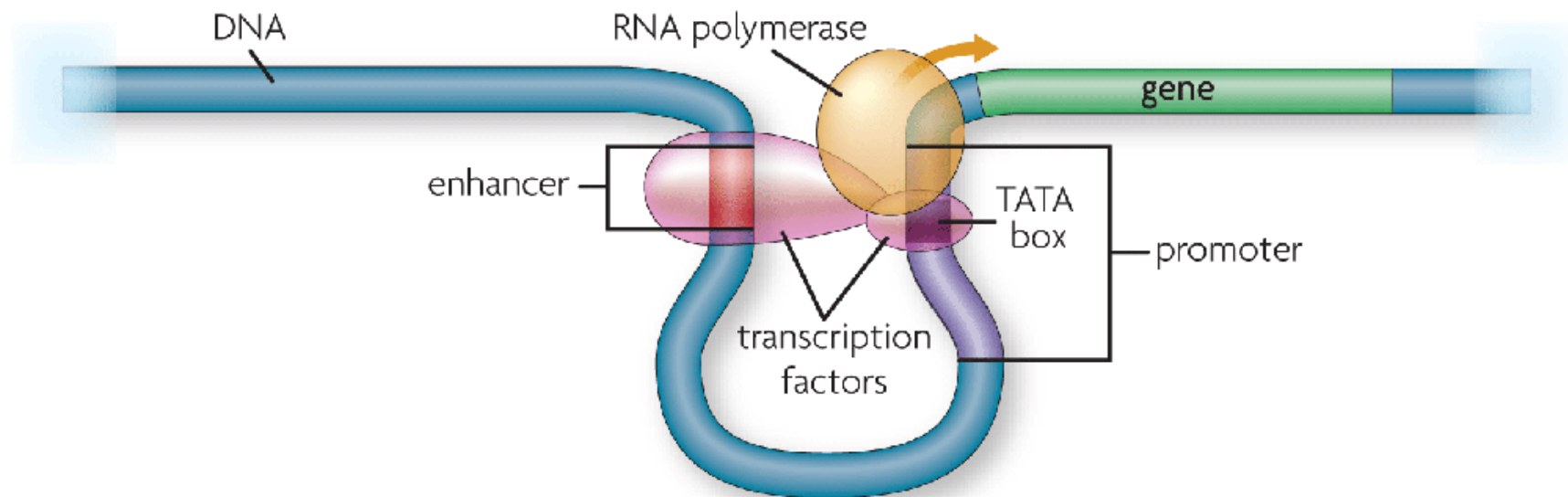
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- ▶ **Eukaryotes regulate gene expression at many points.**
 - Different sets of genes are expressed in different types of cells.
 - Transcription is controlled by regulatory DNA sequences and protein transcription factors.



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- 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.



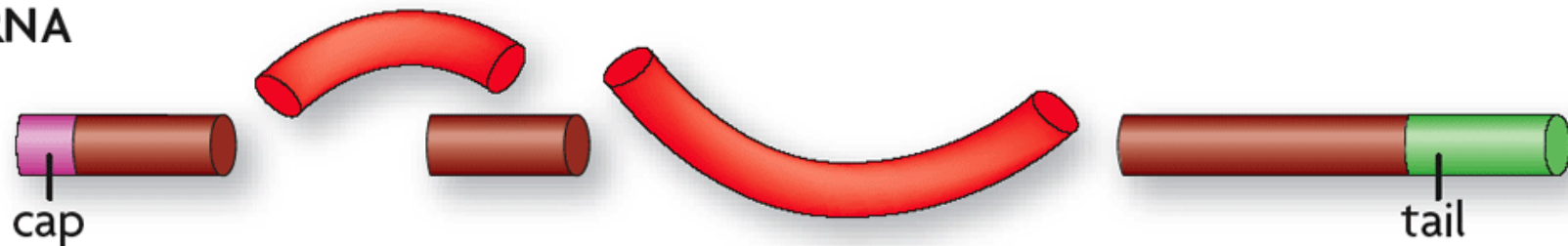
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- RNA processing is also an important part of gene regulation in eukaryotes.
- mRNA processing includes three major steps.

mRNA



mRNA



processed mRNA



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- mRNA processing includes three major steps.
 - Introns are removed and exons are spliced together.
 - A cap is added.
 - A tail is added.