

Difference Between Enhancer and Promoter

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Key Difference - Enhancer vs Promoter

Genes are the basic units of the heredity that consist of specific sequences of DNA. They contain information for the synthesis of functional proteins that are necessary for all the functions occurring in living organisms. The conversion of the information stored in the gene into a protein is known as gene expression, and it is a complex process. Gene expression occurs in main two steps; transcription and translation. A gene has different sequences such as coding sequence, non-coding sequences and regulatory sequences. Gene expression is regulated by the regulatory sequences located near the gene and a little far away from the gene. The promoter is one type of regulatory sequence located next to the site of the transcription initiation of the gene. The promoter is located at the 5' end of the transcriptional unit (upstream on the sense strand), and it is the region where RNA polymerase enzyme binds. The enhancer is another type of regulatory sequence that increases the activity of the promoter of the gene. The **key difference** between enhancer and promoter is **a promoter should locate upstream and near the site of the transcription initiation while an enhancer can locate either upstream or downstream and anywhere in the vicinity of the gene.**

What is an Enhancer?

The enhancer is a short DNA sequence that influences the transcription of particular genes. The enhancer can change the rate of the transcription. It can locate in the vicinity of the gene. It is not necessary for it to locate near to the transcriptional unit of the gene. Enhancers mainly influence the activity of promoters of the genes. They always interact with the promoters in gene regulation.

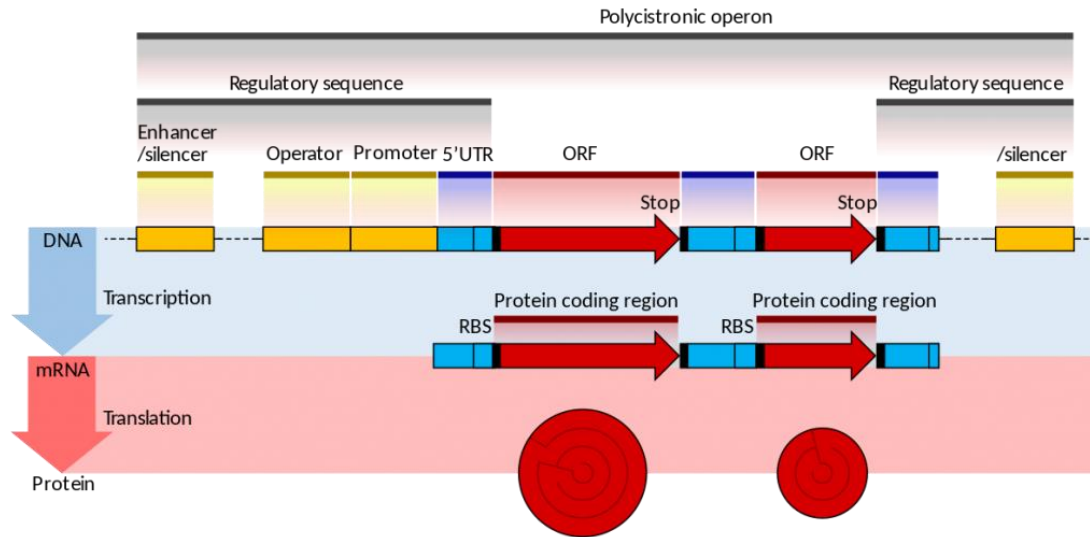


Figure 01: Enhancer

Enhancers and promoters cannot regulate the transcription of the genes that are located on other [chromosomes](#). Enhancers can either be decreased or increased the transcription of the target genes. They work as position-independent manner. They either locate upstream or downstream in the gene. Enhancers can locate even within the introns of the genes.

What is a Promoter?

Promoter is a sequence of DNA that is located near the site of the transcription initiation of the gene. It serves as the binding site for the RNA polymerase enzyme. RNA polymerase is the enzyme that catalyses the transcription of the gene. Promoter is always located near to the transcriptional unit of the gene. Promoter contains special DNA sequences that ensure the specific binding of RNA polymerase at the correct binding site for the correct transcription of the transcriptional unit. Main elements of the promoter region are core promoter element and regulatory elements. Transcriptional factors do the recruiting of the RNA polymerase. These factors have activator and repressor sequences to attach into the promoter region and regulate the transcription.

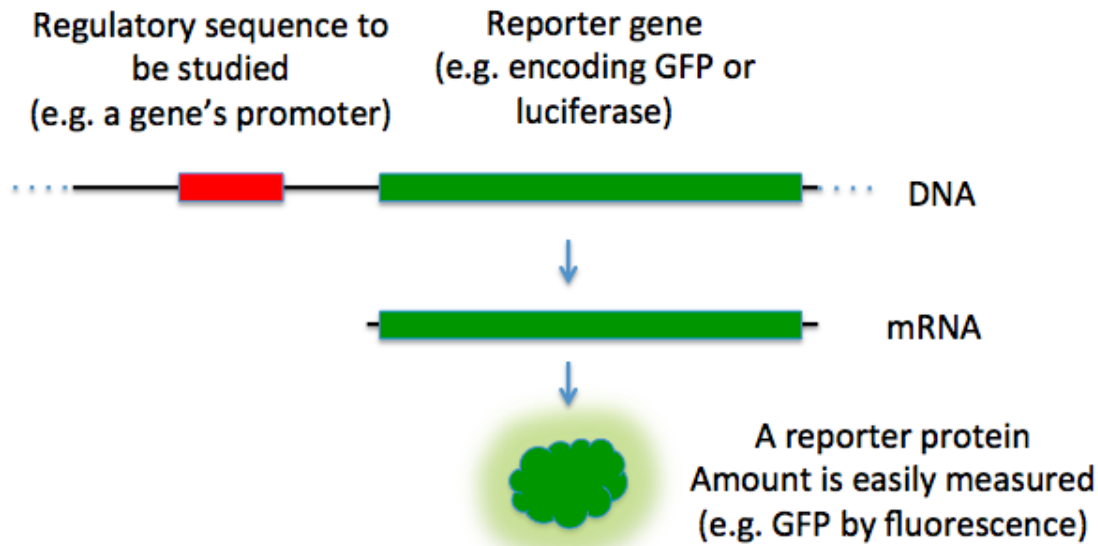


Figure 02: Promoter

Eukaryotic promoters have a conserved sequence known as TATA box that is located 25 to 35 base pairs upstream of the transcription start site. Promoter sequences can contain 100 to 1000 base pairs.

What are the Similarities Between Enhancer and Promoter?

- Enhancer and promoter are regulatory sequences of genes.
- Both contribute in regulating gene expression.
- Both are [nucleotide](#) sequences.
- Both are important in [protein synthesis](#).
- Both enhancer and promoter are cis-acting elements. Both cannot regulate the gene expression of the genes located in other chromosomes.

What is the Difference Between Enhancer and Promoter?

Enhancer vs Promoter	
Enhancer is a short nucleotide sequence of DNA that can influence the rate of the transcription of the gene by interacting with the promoter of the gene.	Promoter is a sequence of DNA located upstream to the transcriptional unit of the gene that facilitates the binding of RNA polymerase and initiating the transcription.
Function	

Enhancer increases the activity of the promoter thereby increases the gene expression.	Promoter initiates the transcription by facilitating the RNA polymerase to bind and catalyse the reaction.
Working Orientation	
Enhancer works regardless of the transcriptional orientation, either in same or opposite orientation.	Promoter works in the same transcriptional orientation.
Location	
Enhancer can be located anywhere in the vicinity of the gene. It can be located several kilo base pairs away from the gene as well.	Promoter should be located near the transcriptional start site.
Gene Expression	
Enhancer can suppress or enhance the gene expression.	Promoter always initiates the gene expression.
Effect of the Position	
Enhancer works as a position independent manner.	Promoter works in a position-dependent.

Summary - Enhancer vs Promoter

Enhancer and promoter are specific DNA sequences associated with the genes and gene expression regulation. They are cis-acting elements. Enhancers can increase or decrease the activity of the promoter region. Promoter is the specific regulatory DNA sequence located at the 5' end of the transcriptional unit which initiates the transcription of the gene. Promoters and enhancers interact with each other during the gene expression. Promoters are always located upstream to the transcriptional unit. Enhancers can locate upstream or downstream to the coding strand. Moreover, enhancers can locate in the vicinity of the gene but not very adjacent to the transcriptional unit. Promoters and enhancers regulate respective genes. They are unable to regulate the genes located on other chromosomes. This is the difference between Enhancer and Promoter.

Reference:

1. "Promoter (Genetics)." Wikipedia, Wikimedia Foundation, 16 Jan. 2018. [Available here](#)
2. "Promoter (Genetics)." Promoter (Genetics) - an overview | ScienceDirect Topics. [Available here](#)

3. "Enhancer (Genetics)." Enhancer (Genetics) - an overview | ScienceDirect Topics. [Available here](#)

Image Courtesy:

1. 'Gene structure prokaryote 2 annotated' By Thomas Shafee - Shafee T, Lowe R (2017). "Eukaryotic and prokaryotic gene structure". WikiJournal of Medicine 4 (1). DOI:10.15347/wjm/2017.002. ISSN 20024436., ([CC BY 4.0](#)) via [Commons Wikimedia](#)
2. 'Reporter gene' By TransControl at en.wikipedia, ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)

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