

Difference Between Inducible and Repressible Operon

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Key Difference – Inducible vs Repressible Operon

An operon is a functioning unit of [genomic DNA](#) containing a cluster of genes under the control of a single promoter. [Gene regulation](#) is achieved by the control of an operon through induction or repression. Operons are of two types: inducible operons and repressible operons. **Inducible operon is a type of operon which gets switched on by a substrate chemical, i.e., an inducer. In a repressible operon, the regulation is done by a chemical substance known as a co-repressor which is normally the end product of that particular metabolic pathway.** This is the key difference between inducible and repressible operons.

What are Operons?

Operon is a cluster of structural genes that is expressed or controlled by a single promoter and is considered as the functional unit of genomic DNA. There are three components in an operon. They are promoter, operator, and the genes. The genetic codes of the genes are converted into [mRNA](#) sequences by the process called [transcription](#). An operon produces a single unit of mRNA sequences, which are later translated into separate proteins, mostly enzymes involved in metabolic pathways. Initially, operons were discovered in [prokaryotes](#), but later they were found in eukaryotes as well. Prokaryotic and eukaryotic operons lead to the genesis of polycistronic mRNAs and monocistronic mRNAs, respectively. Operons can also be found on [bacteriophages](#) (bacteria infecting viruses).

What are Inducible Operons?

An inducible operon is a gene system that encodes an equivalent amount of [enzymes](#) associated with a catabolic pathway. It is inducible when a [metabolite](#)/ substrate in this pathway activates transcription of the genes which encode the particular enzymes. This activation may be caused by a repressor when it is inactivated or cooperated. An inducible operon is switched on by an inducer. An inducible operon consists of components such as structural genes,

operator gene, promoter gene, regulator gene, repressor, and inducer. Inducible operons consist of one or more structural genes. The [lac operon](#) is the best example for inducible operon.

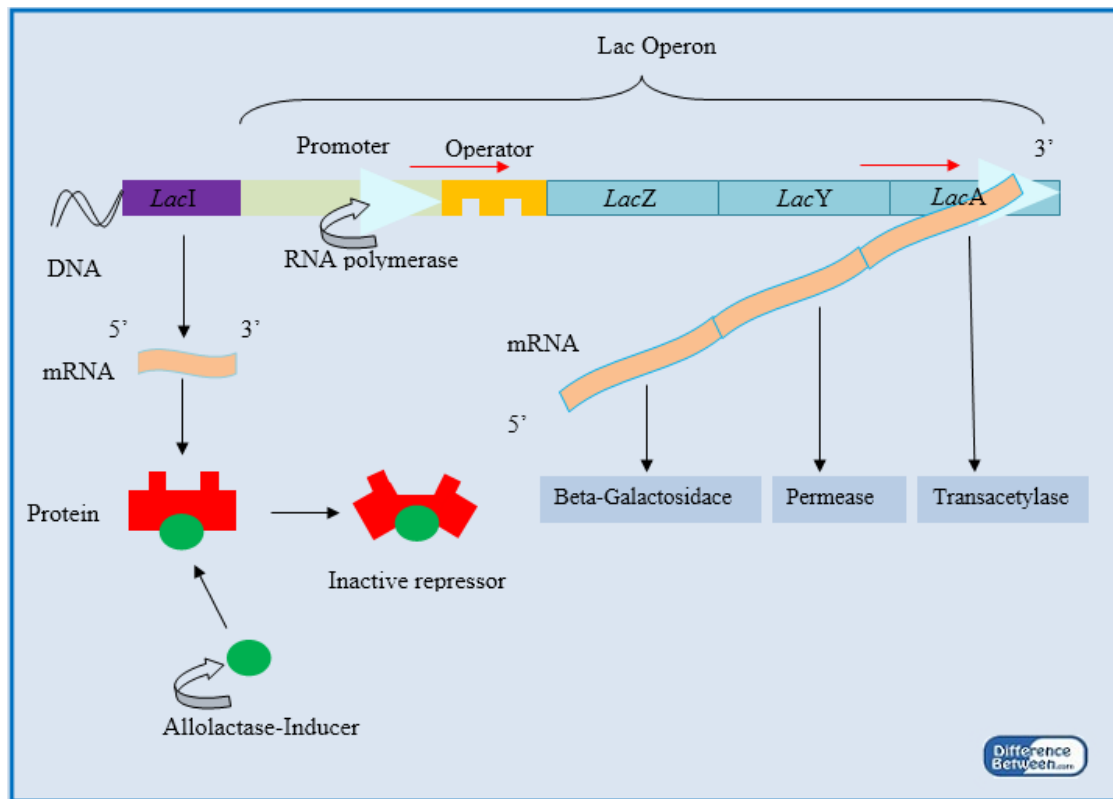


Figure 01: Inducible operon – Lac Operon

It contains three structural genes; Z, Y and A which transcribe an mRNA and translate the mRNA to three enzymes galactosidase, lactose permease and transacetylase, respectively. The operator gene is situated adjacent to structural genes while controlling the functioning them.

What are Repressible Operons?

The repressible operon is regulated in the presence of a chemical substance known as co-repressor. A co-repressor is always an end product of a metabolic pathway. In the presence of a co-repressor, the operon is said to be switched off. Tryptophan operon ([trp operon](#)) is an example for repressible operon. Structural genes, regulator gene, operator gene, promoter gene, and co-repressor are included in trp operon. The trp operon consists of five structural genes which transcribe mRNAs which later get translated and coded for proteins that function as enzymes. The structural genes are regulated by a specific operator genes present as a part of the trp operon. The co repressor is produced as an end product through a metabolic pathway that takes place within the cell or may

enter into the cell from outside. The concentration of the co-repressor is directly proportional to the regulation of transcription within the cell. With the increment of the co-repressor concentration, apo-repressor and co-repressor complex is formed. The apo repressor is a protein and is coded by the regulator gene present in the operon. This complex binds to the operator region and stops the transcription of structural genes. During low level of co-repressor concentrations, the joining of apo-repressor and operator gene is prevented. This enables the continuation of the formation of co-repressor. The apo-repressor and co-repressor complex combines with the operator gene and turns off the gene expression. This prevents the process of transcription and thereby stops the synthesis of enzymes.

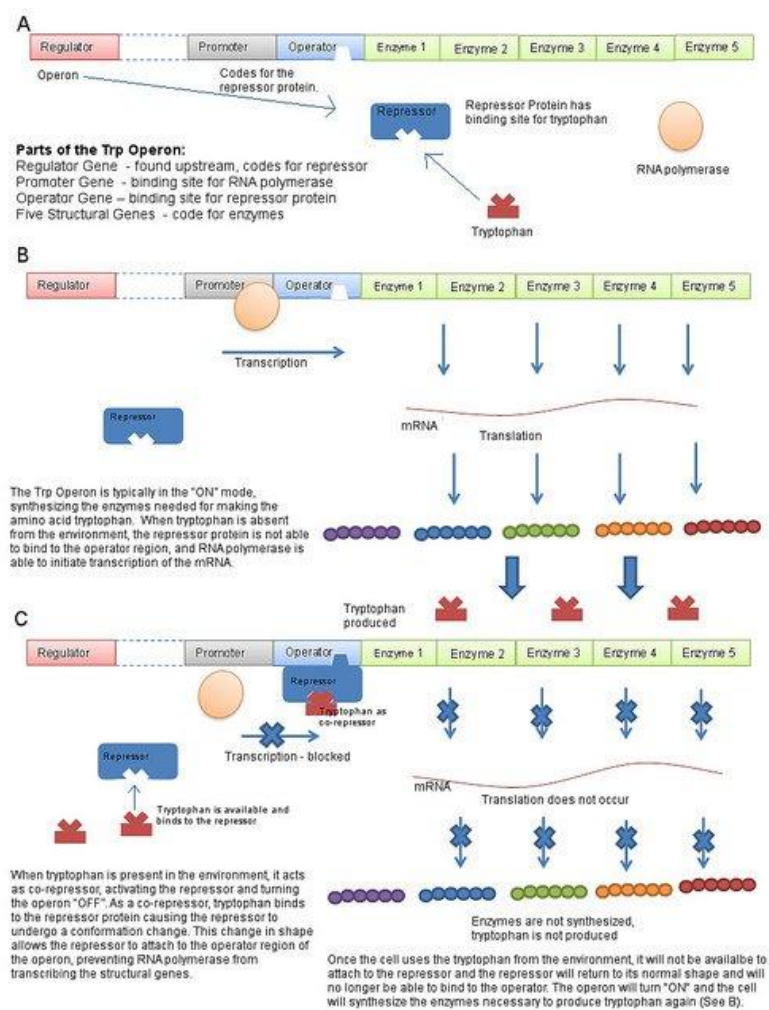


Figure 02: Repressor Operon – Tryptophan Operon

What are the similarities between Inducible and Repressible Operon?

- Inducible and repressible operons contain structural genes with similar functions and are controlled by a single promoter.
- Both types of operons consist of a negative control regulation system which is controlled by a repressor.
- The repressor is coded by the regulatory genes present in the two operons, and once the repressor is attached to the operator, it prevents transcription.

What is the difference between Inducible and Repressible Operon?

Inducible vs Repressible Operon	
In inducible operons, the genes are kept switched off until a specific metabolite inactivates the repressor.	In repressible operons, genes are kept switched on until the repressor is activated by a specific metabolite.
Metabolic Pathway	
The inducible operons function in catabolic pathways.	The repressible operons function in anabolic pathways.
Enzyme Synthesis	
The nutrients utilized in the pathway activate enzyme synthesis.	The production is switched off by the end products of the pathway which repress enzyme synthesis.
Examples	
Lac operon is an inducible operon.	Trp operon is a repressible operon.

Summary – Inducible vs Repressible Operon

An operon is a cluster of genes that is controlled by a single promoter. They are two types of operons according to the functions they perform. They are inducible operons and repressible operons. Inducible operon is regulated by a substrate present in the metabolic pathway while repressible operon is regulated by the presence of a metabolic end product known as a co-repressor. This is the main difference between inducible and repressor operon.

References:

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2. "Inducible Operon." Inducible Operon,operator Gene,promoter Gene | Tutorvista.com. N.p., n.d. Web. [Available here](#).06 Aug. 2017.

Image Courtesy:

1. "Trp Operon" by Becky Boone ([CC BY-SA 2.0](#)) via [Flickr](#)

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APA: Difference Between Inducible and Repressible Operon. (2017, August 10). Retrieved (date), from <http://differencebetween.com/difference-between-inducible-and-vs-repressible-operon/>

MLA: "Difference Between Inducible and Repressible Operon" *Difference Between.Com*. 10 August 2017. Web.

Chicago: "Difference Between Inducible and Repressible Operon." *Difference Between.Com*. <http://differencebetween.com/difference-between-inducible-and-vs-repressible-operon/> accessed (accessed [date]).



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