

The operon model

The operon model describes how gene expression can be regulated at the level of transcription in prokaryotic cells. In contrast to eukaryotes, the regulation often does not apply to only a single gene, but there is a joint regulation of several genes, which may for example code for enzymes of one metabolic pathway (these genes are present in clusters on the chromosome). By operon we mean this cluster of tandemly arranged genes, the transcription of which into a common mRNA (thanks to a single promoter) and subsequent expression usually results in the activation of a certain metabolic pathway. We distinguish two types of operons, catabolic (inductive) and anabolic (repressive) type.

Inductive type

An example of the former is the **lactose operon**. This is formed by a sequence of repressor, promoter and operator sequences and three genes Z, Y and A. These genes code for three enzymes of lactose metabolism. If the repressor protein binds to the operator, it blocks the transcription of the Z, Y, and A genes from their promoter. However, the repressor can be inactivated by binding lactose, which acts as an inducer here. The repressor can no longer prevent transcription and the genes are expressed. The presence of lactose in the cell supports the production of enzymes for lactose metabolism and enables the use of this substance as an energy source.

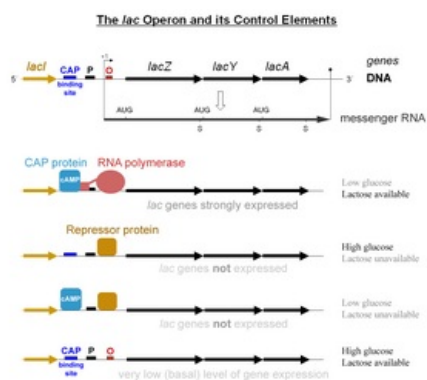
Repressive type

The second type is represented by the **tryptophan operon**. Here, the mode of repression is essentially reversed compared to the lactose operon. The promoter and operator are followed by the 5 genes for the synthesis of tryptophan E, D, C, B and A. However, the product of the regulator gene (i.e. the repressor) does not bind to the promoter under normal conditions and transcription takes place. Only when there is an excess of tryptophan, its molecule as a co-repressor is bound to the repressor and further gene expression is stopped.

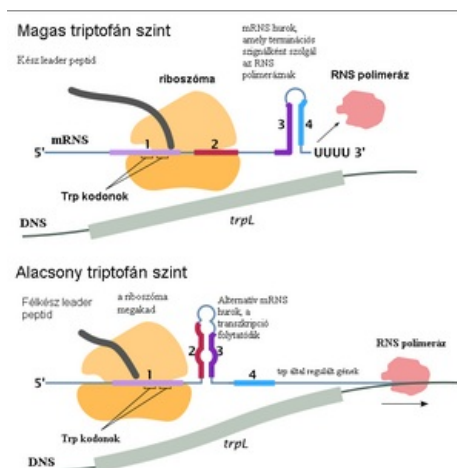
Regulation of gene expression

In eukaryotes, it is much more complicated also because there must be a **complex coordination** of the development and function of individual cell populations and entire organs. A large number of transcription factors, hormones and factors of the external environment take part in it. Nor does regulation occur only at the level of transcription.

Schemes



Scheme of the function of the lactose operon
The *Lac operon* reaches its highest level of expression at a low level of glucose (and thus a small amount of energy) and a high supply of lactose.



Schematic diagram of tryptophan operon function

Links

Related Articles

- Regulation of gene expression in prokaryotes

References

- GOETZ, Petr, et al. *Chapters in Medical Biology : Volume 1*. 2nd Edition. Jinočany: H+H, 1995. 176 pp. ISBN 80-85787-98-9 .

