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# Energy conservation on the basis of structure of bacterial genome

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## I. Introduction:

It is evident that genes manifest themselves by the production of proteins. Different cells have different types of proteins. These proteins are responsible for the phenotypic expression of a cell . Not only the morphology, histology but there are functional differences in the cell both interms of physiology and biochemistry differs among cells and there by each cell .This implies that all genes of a cell do not express at a same time .so it can be concluded that the expression of genes are being regulated by the phenomenon of gene regulation .

## II. Conceptual highlights on structure :

- Prokaryotes do not have an efficient mechanism to gather energy and there by they ration their energy for different metabolic activities and there comes the concept of gene regulation. This genes are expressed at certain periods of time and others do not express simultaneously.
- These genes whose expression are regulated are called structural genes, that are transcribed to mRNA that are translated to polypeptides .on the other hand, the genes that are transcribed into rRNA and tRNA is known as constitutive genes .These genes are not regulated and are constantly being exposed.
- Prokaryotic genome is circular in nature due to poor efficiency of food gathering and subdevided into several parts. These each specific part is called operon, which also assigned for a specific metabolic activity .
- During proteins synthesis, the prokaryotic mRNA contains the code of more than one polypeptide chain and are there by reffered to as polysistronic mRNA .In contrast ,in eukaryotes a single mRNA consists of a single polypeptide chain, is reffered as a monocistronic mRNA .In prokaryotic system the genome is subdevided into operon region ,such as Lac operon, Ara operon, Trp operon etc .
- Operon is the unit of the prokaryotic genome that consists of a promoter , an operator and structural genes. Each operon is assigned to perform a definite physiological and biochemical activity of metabolism. They may include the synthesis of an Amino acid by anabolism such as trp operon and the breakdown of a sugar by catabolism such as lac operon . The segment consists of regulator gene, which produces a protein called the repressor that bind with operator and acts as a switch to turn on or turn off the operon. Promoter, it is the binding site for RNA polymerase that is required for transcription of the structural genes. Operator, is the binding site of the repressor protein . Structural genes, where z – codes for an enzyme called beta galactosidase. That breaks down lactose to glucose and galactose and also isomerizes lactose to allolactose .y-codes for an enzyme beta galactoside permease which help the lactose molecule to enter inside the bacterial cell by increasing the permeability of the cell .A- codes for beta galactoside transacetylase whose function is still unknown .
- In presence of lactose , the cell always have a storage of two to ten molecule of enzymes inside them.permease allows the lactose to enter inside the cell ,it converts lactose to its isomeric form called allolactose. This allolactose is an inducer and binds with the active repressor to convert it into an inactive repressor. This inactive repressor can no longer remain bound with the operator and is released to make the operator site free . This allows the RNA polymerase to bind with the promoter, the RNA polymerase then moves along the operon and reaches the structural genes .They are then transcribed and translated to produce the lactose utilizing enzymes

Within 10 minutes , about 3000 such enzyme are produced.

- Positive control of the lac operon, in presence of both glucose and lactose, the bacterial cell will prefer glucose over lactose. Lactose enter the bacterial cell with the help of the enzyme permease. Beta – galactosidase isomerizes lactose to allolactose, which in inactives the active repressor and finally the operator site is free for the RNA polymerase to bind and transcribe the lac genes. Now the promoter site is not available instantly, the promoter site actually can be divided into two regions, the first one is RNA polymerase binding

site and another is the CAP site allows the CAP-cAMP complex to bind . Only if the CAP – cAMP complex binds with the CAP site then the RNA polymerase is allow to bind with the RNA polymerase binding site of the promoter. Here glucose is first to generate ATP. This ATP is converted to ADP to AMP and finally to cyclic AMP or cAMP by the enzyme adenylyl cyclase. The production of cAMP is therefore dependent upon the utilization of glucose.so, initially the level of glucose is high and the level of cAMP is low but more and more glucose is utilized , the amount of cAMP increases, the level of cAMP will increase only when all the glucose is being utilized. The high level of cAMP enzymes the formation of CAP – cAMP complex. CAP or the catabolite activator protein is always present inside the bacterial cell but CAP – cAMP complex is formed only when glucose has been utilized. Now it is the turn for lactose utilization. So , the CAP cAMP complex binds with the cap site of the lac promoter and allows the RNA polymerase to bind with the polymerase binding site of the lac promoter. Then the transcription of the lac genes will takes place and lactose will be utilized. This phenomenon is called glucose effect or catabolite repression. Since the presence of a protein called CAP turns on the system, hence the system is a positive control system.

## III. Conclusion:

It is concluded that lac operon is not essential for the viability of the cell, because lactose is a sugar which is broken down to yield energy. If lac operon does not function due to mutation, the bacterial cell gathers it energy from other sources of sugar like glucose, arabinose and galactose. On the other hand trp operon is invisible for the viability of the cell. In case of trp operon which synthesis an amino acid , it is essential for its to be present for different polypeptides of the cell. So in absence of a single amino acid, several polypeptides are simultaneously affected and there by affecting the viability of the cell making these operon to be essential than the lac operon . So it is the basis that bacteria conserve it's energy depending on the structure of its genome.

## References:

[1]. Molecular cell biology by Harvey Lodish, 7th Edition, W.H. Freeman.
[2]. I Genetics: A molecular Approach by Peter . J. Russell.3rd Edition. Pearsen Benjamin Cummings.
[3]. Principal and techniques of Biochemistry and molecular Biology by Keith Wilson and John Walker.
[4]. Compbell's Biology,11th Edition by Lisa and A.Urry , Michael L. Cain, Steven A . Wasserman, Jane B. Reece, published by Pearson copyright 2017.
[5]. Molecular Biology of the Gene by Watson. 7th Edition Pearson.
[6]. Russell , P.J.(2009). Genetics – A molecular Approach 3rd Edition , Benjamin Cummings.

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