In above experiment the glycerol is substrate and lactose act as Inducer for the synthesis req. The enzyme whose synthesis can be induced adding substrate are called inducible enzymes so, it is known as lac operon.

2. Repression / Repressible System: In repression the activity of genes suppressed and the synthesis of specific protein is stopped / reduced. The substance which stops or suppresses protein called Repressor. For eg, in minimal culture of E.coli can synthesise different amino a

The Lactose System in E.coli: Jacob and Monod (1961) studing catabolism of lactose in E.coli suggested that the action of most genes are regulated at the transcription level by induction and repression. Three enzymes, namely, β-galactosidase, permease and transacetylase are reqd in lactose catabolism. The three enzymes represented by Lac-Z, lac-Y, and lac-A. These are called structural gene. The action of these genes is controlled in a co-ordinated fashion by regulator genes. The Operon model for lactose catabolism is called Lac operon.

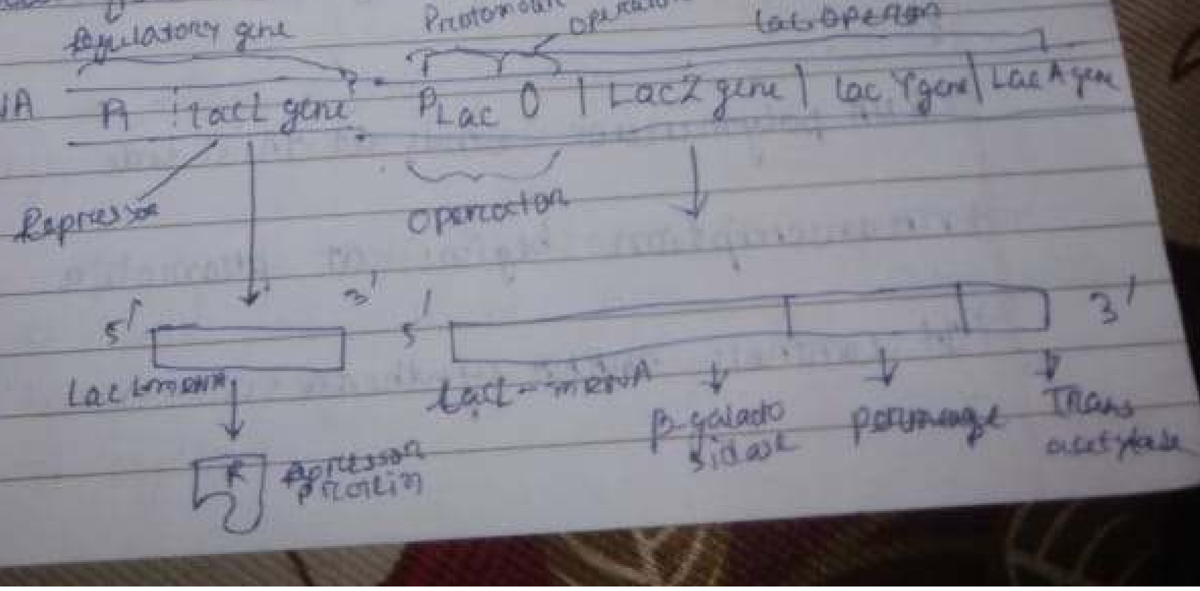

Fig: Genetic map of lac operon E.coli

Date 15/02/20

iii) Repressor / Regulator gene (i)

→ Lies outside operon & produce from repressor substance

→ This binds to operator gene and suppress transcription of structural gene

Functioning of Lac Operon:

Beckwith (1967), Martin (1969), Epstein have described the operation of Lac operon in E.coli

→ In the absence of an inducer lactose, the regulator gene produces a repressor protein which binds strongly to the operator site and prevents its transcription. As a result, the structural genes donot synthesise mRNA and proteins are not formed.

→ When an inducer - lactose is introduced in the medium, it enters the cell and gets modified and binds to the repressor. The repressor now fails to bind the initiation site.

B. Allosteric Regulation of Lac Repressor:

Repressor proteins are allosteric i.e, exist in two confirmational forms. In one form the proteins is active other form is inactive. When effector molecule binds to the protein, the protein undergo change and become inactive.

Role of cyclic AMP in catabolite repression

Small molecule of cAMP are distributed in bacteria, synthesised enzymatically by adenyl cyclase.

1. when bacteria growing in *E. coli*, the cAMP conc. in cells is quite low.

2. In a medium containing glycerol can't enter the biochemical pathways used to metabolise glucose

3. *E. coli* contains protein called Catabolite Activator protein (CAP). It is encoded by gene adenyl cyclase (crp).

4. The CAP and cAMP are needed for lac mRNA synthesis.

5. CAP and cAMP binds together forming cAMP-CAP unit. The complex regulates positive regulator and functions as independent of lac repression system

6. In the absence of cAMP-CAP complex, RNA polymerase binds weakly to promoter.

7. cAMP-CAP complex must bind to a base sequence in DNA in the promoter region to initiate transcription.

Mechanism of Gene regulation in Prokaryotes:

1. Induction
2. Repression

1. Induction: A set of genes will be switched on when there is necessity to metabolise a new substrate. When these switched on enzymes are produced. phenomenon called Induction

I) Induction and inducible system (Inducible Operon): A genetic induction of the gene are induced or 'switched on' to produce mRNA, needed for the synthesis of required enzyme. The substance which induces the gene for protein synthesis or enzyme production is known as Inducer. The phenomenon of induction can be demonstrated by growing E. coli in differentiated media as follows:

1. When E. coli is grown in a cultural medium containing glycerol, it produces all those enzyme needed to breakdown of glycerol

2. When these E. coli are grown in a medium containing lactose (β galactoside), the synthesis of enzyme β galactosidase increases manyfold

3. Intestinal bacteria, E. coli are grown on glucose medium, they contain just ~~ra~~ traces of β galactosidase

1. Structural genes : These genes are segments of DNA that are associated with the syntheses of enzymes are needed for catabolism of lactose.

i) lac Z gene for β-galactosidase enzyme

ii) lac Y gene for galactose permease enzyme

iii) lac A gene for thiogalactoside transacetylase.

2. Control Gene or Regulatory gene :
These genes control the activity of structural gene and lie immediately adjacent to the structural genes. The three control genes —

i) Operator gene (O) : I

→ It lies before first stru structural gene and overlaps the promoter sequence.

→ It controls transcription of mRNA.

→ Operator genes are controlled by repressor / regulator gene.

ii) Promoter gene :

→ It lies immediately adjacent to operator gene.

→ RNA polymerase binds at this side

→ Transcription begins at promoter

→ It controls mRNA synthesis.

Gene Expression :

Gene expression is the molecular mechanism by which a gene produces specific phenotypes or produces an enzymes which control specific metabolic activity

Mechanism of Gene Expression :

Gene is basically a functional segment of DNA. It contains heredity message to form specific sequence of nitrogenous bases. Its encoded information form polypeptide chain, which synthesised through mRNA. The process of copies of mRNA ~~the~~ is called transcription. Messenger RNA comes out of the nucleus, attach ribosome and linking of amino ā. Gene expression involves —

1. Transcription of mRNA from the DNA segment composing the gene

2. Transcription of rRNA and form ribosomal subunit

3. Transcription of tRNA.

4. Translation of codons of mRNA leading to the linking of amino ā to form a polypeptide chain.

5. Termination of polypeptide chain

6. Maturation of protein.

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