Regulation of Gene Expression:

- All the genes are not needed constantly some genes are needed only sometimes (regulatory genes) and are made to function (switched 'on' or 'off') only when required.
- Expression of gene to form polypeptides can be regulated at different levels in eukaryotes. At the time of-
    - Transcription
    - Processing (splicing)
    - Transportation of mRNA from the nucleus to cytoplasm
    - Translation.
- The metabolic, physiological or environmental conditions regulate the expression of genes.
- In a transcription unit, the activity of RNA polymerase at a given promoter is in turn regulated by interaction with accessory proteins (act as activator or repressor), which affect its ability to recognise start sites.
- The development and differentiation of an embryo is a result of coordinated regulation and expression of several sets of genes.
- **Operon**: A unit made up of (polycistronic) structural genes which is regulate other genes (promoter & regulatory gene) responsible for protein synthesis in prokaryotes.
- **Ex**: trp operon- Tryptophan Synthesis
  ara operon- Arabinose synthesis- that catalyse 5-c sugar
  his operon – Histidine Synthesis
  val operon – Valine Synthesis

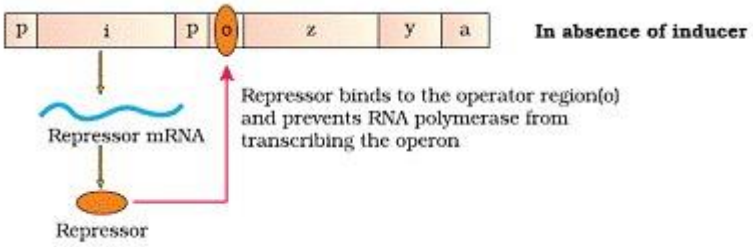
The Lac Operon

Lac operon is the operon controlling lactose metabolism proposed by Francois Jacob & Jacque Monod.
Promotor: Binding site for RNA polymerase.
Regulatory or Inhibitor Gene (i) : Code for the Repressor
Operator: Binding site for Repressor Protein
Inducer (Lactose)- The substrate for enzyme beta-galactosidase and it regulates switching on and off of the operon.
Structural Genes-

1.) **z-gene-** code for enzyme beta-galactosidase (responsible for hydrolysis of Lactose into galactose and glucose)
2.) **y-gene-** code for enzyme permease (increases permeability of enzyme beta-galactosidase into the cell)
3.) **a- gene-** code for enzyme transacetylase (transfer an acetyl group from acetyl CoA to beta-galactosidase)

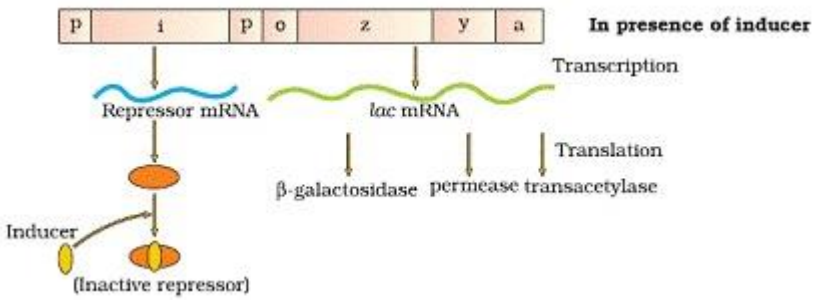
Negative regulation- Regulation by repressor in absence of Inducer (lactose).

- Regulatory /inhibitory gene synthesise mRNA to produce Repressor protein.
- In absence of inducer, Repressor Protein bind to Operator and blocks RNA polymerase.
- Lac operon remain Switched off- structural gene are not expressed.



Positive regulation- Presence of inducer (Lactose) Switch On Lac operon.

- Regulatory gene (i) synthesise mRNA to produce Repressor protein.
- In presence of inducer (Lactose) Repressor protein binds to Inducer.
- Operator region remain free that induces RNA polymerase to bind wit promoter gene.
- Transcription starts and lac mRNA formed which further form enzymes by Translation that helps in Lactose metabolism.



- Glucose can't act as inducer but low concentration of intracellular glucose activate lac operon.