Lac Operon
An inducible operon

**OPERON**=cluster or series of related genes

**Lac Operon**=cluster or series of genes responsible for the metabolism of lactose

a. **Promoter**=where RNA polymerase attaches to DNA sequence for transcription

b. **Operator**=where repressor attaches to DNA sequence to block transcription

c. **Inducer**=inactivates the repressor and removes it from the DNA (lactose is the inducer)

d. **Repressor**=attaches to the operator and blocks RNA polymerase from transcribing mRNA

**How Does the Lac Operon Work?**

1. If glucose is not available for cells, they will need to use another source of energy such as lactose

2. If lactose
   a. *is available*, it will remove the repressor from the operator and allow RNA polymerase to transcribe mRNA
   b. *is not available*, the repressor will attach to the operator and block RNA polymerase

3. RNA polymerase will attach to promoter and if it is not blocked will begin transcribing mRNA

4. RNA polymerase first encounters the lacZ gene which is responsible for making *β*-galactosidase
   a. *β*-galactosidase is the enzyme that hydrolyzes (breaks) the bond between glucose and galactose to make the disaccharide lactose

5. RNA polymerase moves on to the next gene, lac Y that makes the enzyme permease
   a. Permease is a transport protein that carries lactose into the cell

6. RNA polymerase finally moves to the lac A gene which is responsible for making transacetylase
   a. Scientists are not sure of transacetylase’s function
7. β-galactosidase, permease, and transacetylase are enzymes in the metabolic pathway used to get energy from lactose.
8. After lactose is used up and levels decrease, the repressor will attach to the operator blocking the production of β-galactosidase, permease, and transacetylase so that lactose levels increase.
9. Once lactose levels increase, the repressor is removed from the operator and RNA polymerase continues making β-galactosidase, permease, and transacetylase, thus enabling the breakdown of lactose.