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## Homework # 8

The Lac operon is controlled by lac repressor and the CAP activator

The Lac operon encodes proteins required to import & digest lactose. In the absence of Glucose, the bacteria makes cAMP which activates CAP to switch on genes, allowing the cell to use lactose.

In the absence of lactose, it would be useless for CAP to induce expression of the operon.

Thus, in the absence of lactose, the operon is off.  
Thus, lac operon is highly expressed only in the absence of glucose & presence of lactose.

When lactose is present AND glucose is ~~present~~ absent, transcription of genes takes place, utilizing lactose.

- i) Glucose present AND Lactose present - Operon OFF,  
No lactose metabolism
- ii) Glucose absent AND Lactose present - Operon ON, Yes  
lactose metabolism
- iii) Glucose present AND Lactose absent - Operon OFF, no  
lactose metabolism
- iv) Glucose present AND Lactose present - Operon OFF,  
no lactose metabolism

∴ Operon is ON only in case ii)  
i.e. logic of operon expression is

(Glucose absent) AND (Lactose present)

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## Alternative

Using Lac repressor and allolactose as the inducer.

In absence of lactose, Lac repressor binds to the Lac Operator and expression of Operon is off.

Addition of Lactose increases the intra cellular concentration of a related, allolactose. Allolactose binds to the Lac Operator, causing it to undergo a conformational change that releases its grip on the operator by reducing its affinity with the operation site of DNA. Thus the Operon can be expressed in the absence of the repressor.

In absence of glucose, the Lac operon is expressed  $\because$  glucose actively prevents the induction of lactose as the body directly uses glucose instead of breaking lactose. This is  $\because$ , glucose, here, is the preferred form of energy.