Braxton Hawkins
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Draw and describe the regulation of the *Escherichia coli* lac operon in the following situations:

1. **In the absence of lactose (disregard presence or absence of glucose).**

The *lac* repressor binds tightly to the operator, this prevents the RNA polymerase enzyme from going through transcription.

2. **In the presence of lactose (disregard presence or absence of glucose).**

The *lac* repressor will lose its ability to bind DNA. It detaches from the operator to clear the way for RNA polymerase which continues transcribing the operon. This change in lac repressor happens because of the formation of allolactose. The binding of allolactose to the lac repressor changes its shape, this makes it so that it can no longer bind to DNA.

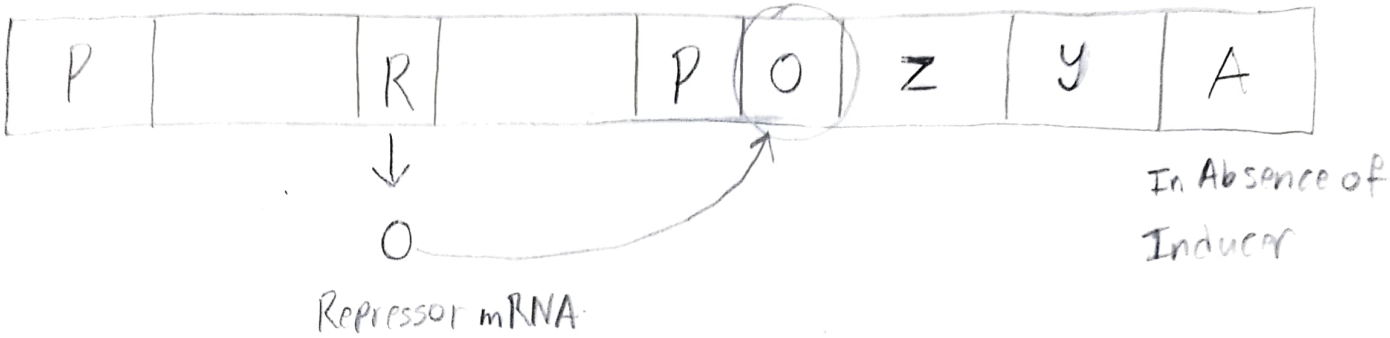
3. **In the absence of glucose (disregard presence or absence of lactose).**

The Catabolite Activator Protein (CAP) acts as a sensor for glucose. The CAP binds to an area of DNA just before the *lac* operon promoter. Then the RNA polymerase will attach to the promoter which will lead to the transcription process.

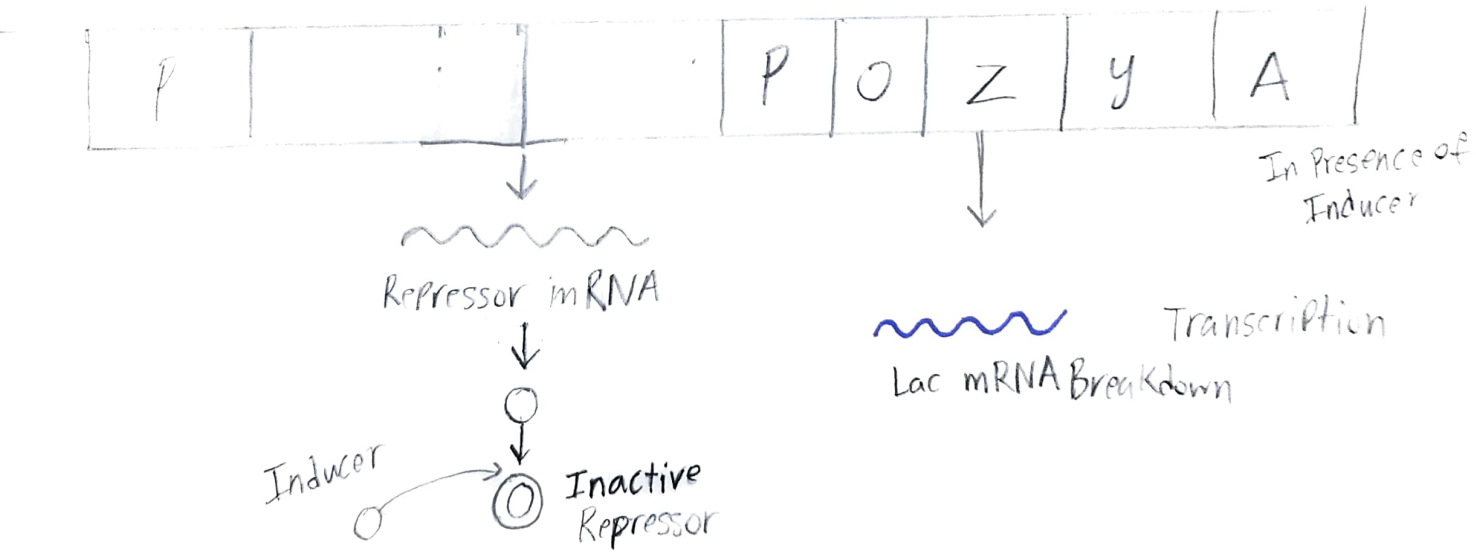
4. **In the absence of glucose AND the presence of lactose.**

The CAP binds to the CAP binding site and the repression of the lac operon by Lac I is relieved as the Lac Repressor molecule is bound by the Allolactose. The binding prevents the Lac Repressor from binding to the lac operon, which allows for transcription of the lac operon.

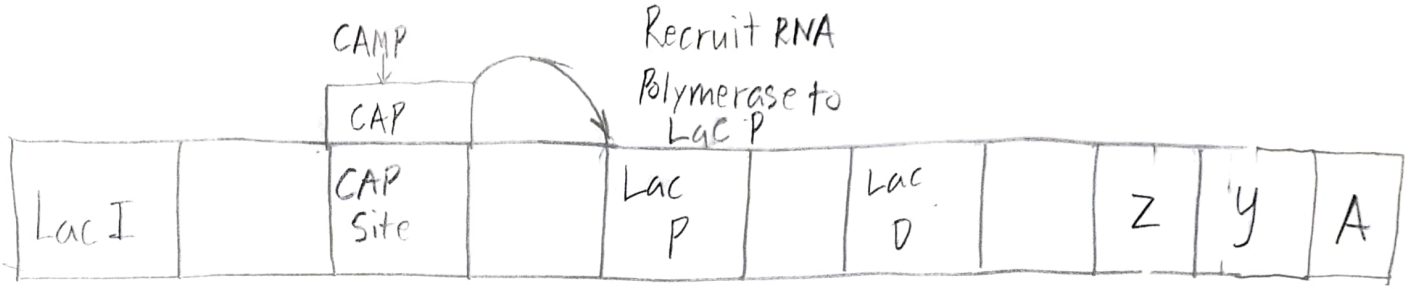
Absence of Lactose



Presence of Lactose



Absence of Glucose



Absence of Glucose & Presence of Lactose.