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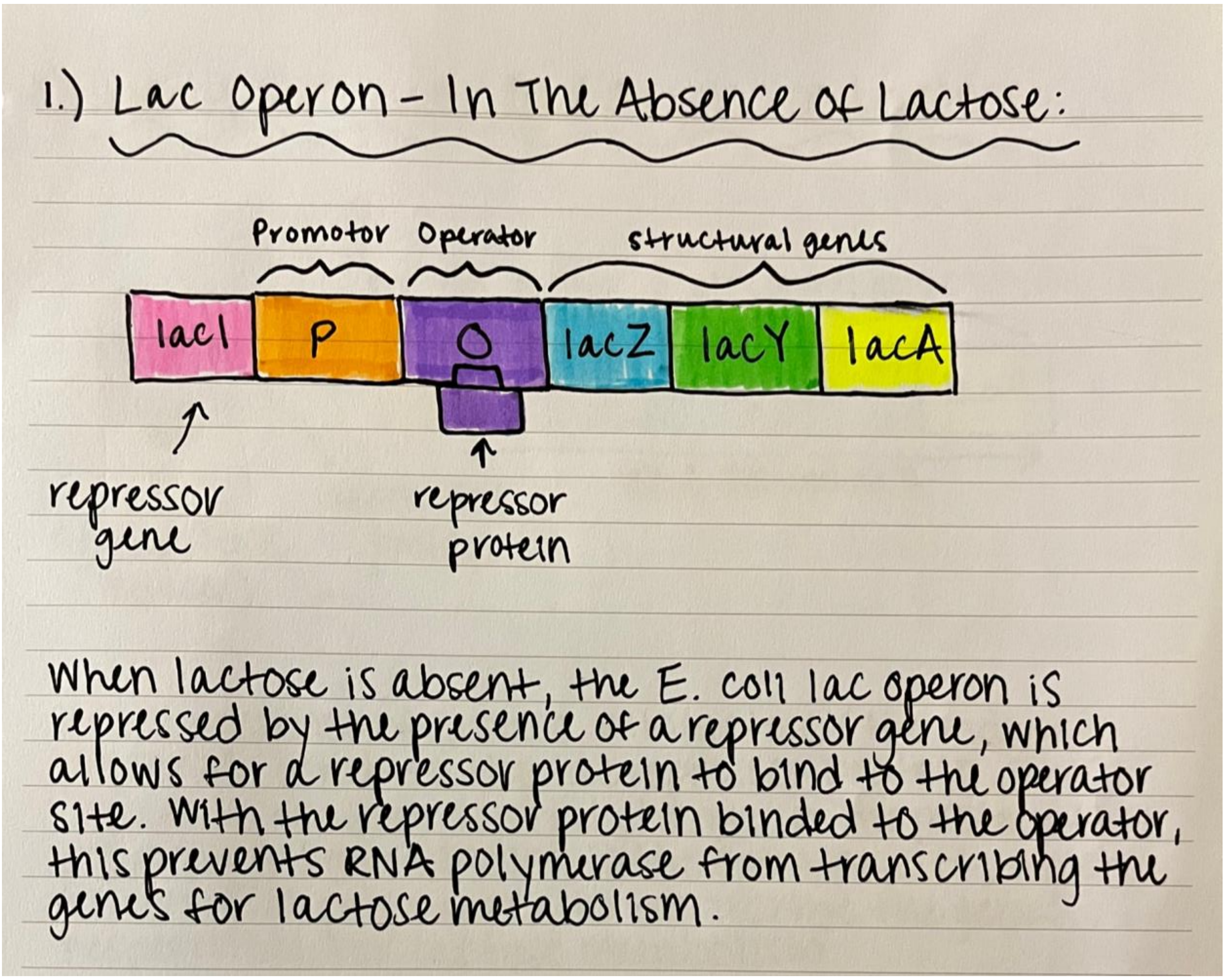
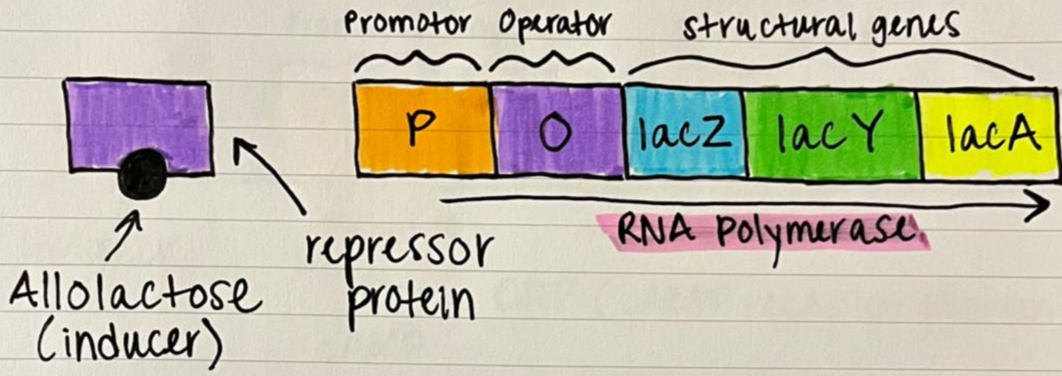
March 25, 2024
BIOL 294
Professor Rinehart-Kim

Lac Operon Assignment:

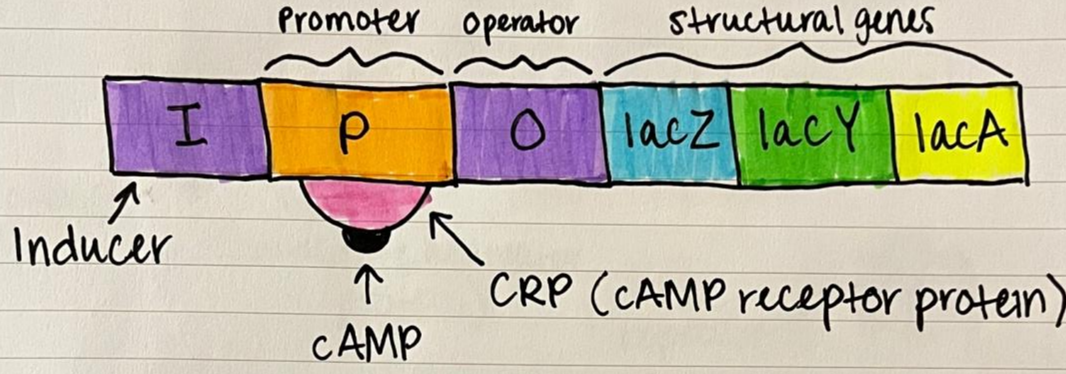


2.) Lac Operon – In The Presence Of Lactose:



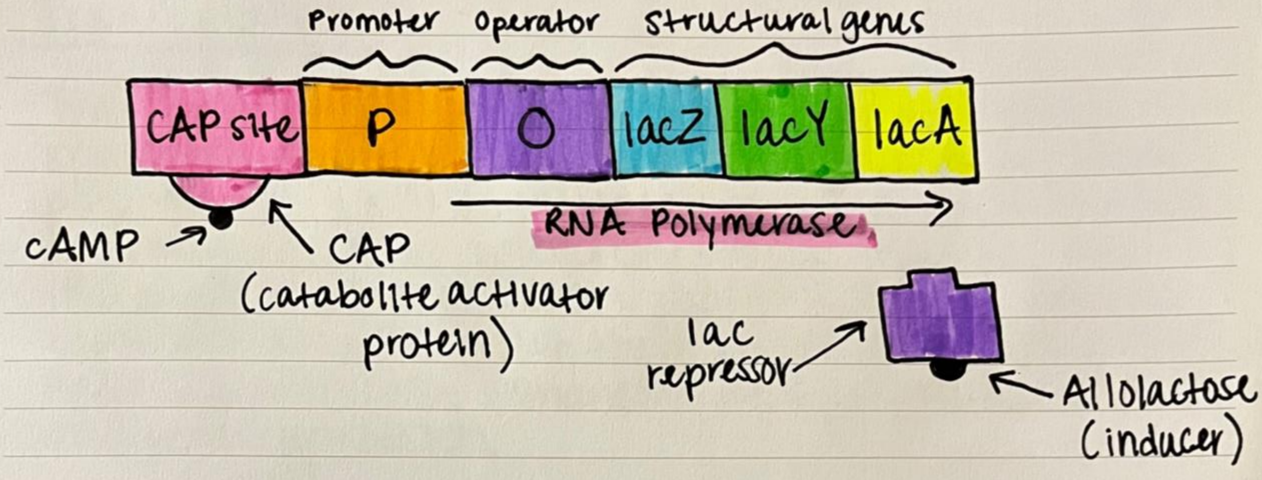
In the presence of lactose, allolactose (the inducer present), binds to the lac repressor protein. This causes a conformational change in the protein that prevents it from binding to the operator site, which allows RNA polymerase to transcribe the genes responsible for lactose metabolism.

3.) Lac Operon - In The Absence of Glucose:



In the absence of glucose, the inducer is bound to the repressor but this does not inhibit expression of the lac genes. Instead, cAMP levels rise due to the low levels of glucose and bind to CRP. Positive regulation occurs and CRP binds to the promoter, enhancing RNA polymerase binding due to catabolite repression, promoting transcription of the lac operon genes.

4.) Lac Operon – In The Absence of Glucose & The Presence of Lactose:



When glucose is absent but lactose is present, the low glucose levels trigger an increase in cAMP levels, which in turn activates the CAP protein when bound to cAMP. Simultaneously, allolactose binds to the lac repressor, releasing its suppression of the lac operon genes. This coordinated response enables RNA polymerase to transcribe the lac operon.

5.) Gene Expression & Regulation:

Transcription:

Transcription initiation occurs in the lac operon specifically at the lac promoter region, where RNA polymerase binds to initiate transcription of the lac operon genes. This regulatory process involves the interaction of regulatory proteins such as the lac repressor and CAP with their respective binding sites near the promoter, enhancing RNA polymerase activity and gene expression.

Post-Transcription:

The regulation of the lac operon primarily occurs post-transcriptionally, where the lac repressor protein binds to the operator region of the DNA, which in turn inhibits RNA polymerase from transcribing the lac operon genes in the absence of lactose. In contrast, when lactose is present, the binding of allolactose to the lac repressor induces a conformational change, releasing the repression and allowing for transcription of the lac operon genes, which gives rise to mRNA molecules.

Translation:

Translation of DNA from the E. coli lac operon occurs after transcription. mRNA molecules transcribed from the lac operon genes are then translated by ribosomes into specific proteins, such as β-galactosidase, permease, and transacetylase, which are involved in lactose metabolism

Post-Translation:

After translation occurs in the lac operon, the proteins synthesized (β-galactosidase, permease, and transacetylase) undergo folding and potential modification processes, such as cleavage, to attain their functional conformation. Once properly folded and modified, these proteins carry out their respective roles in lactose metabolism within the bacterial cell.