



Week 0-1

BIO230H Fall 2021 week 0~1

1. Types of Cells

- Eukaryotes

↳ 真核細胞

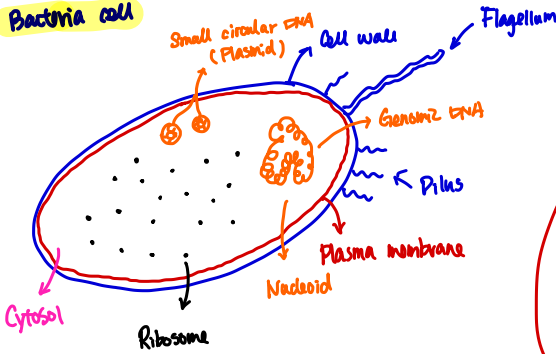
- Do have nucleus
- Single-celled. Multicellular
- Ex. Animals, plants, fungi.

- Prokaryotes

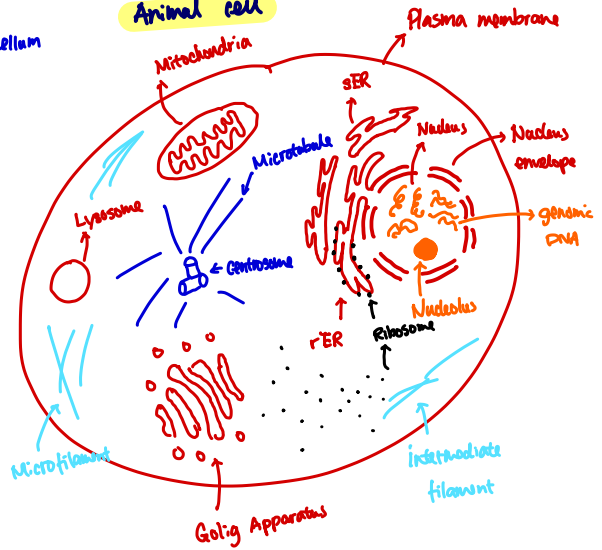
↳ 原核細胞

- Don't have nucleus
- Single cell
- Eg. Bacteria, archaea.

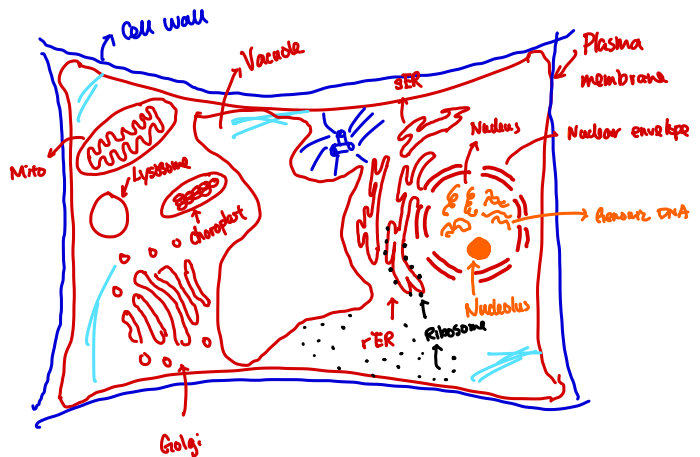
Bacteria cell



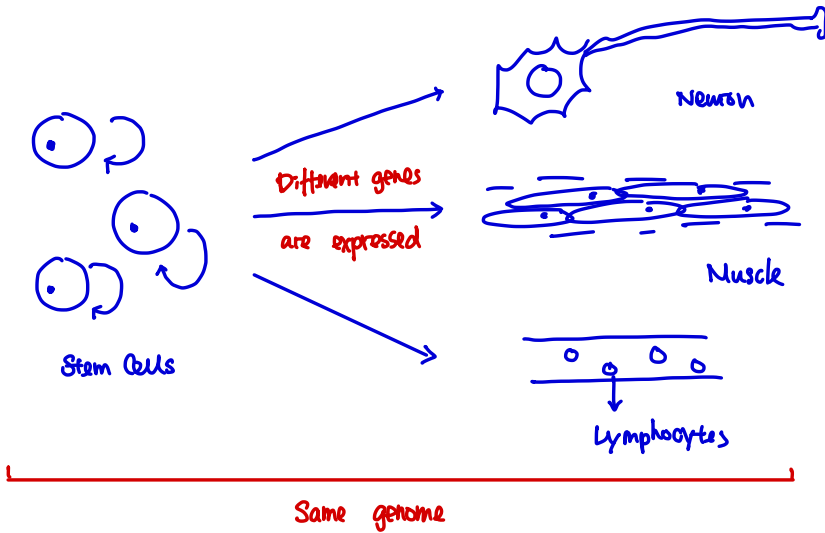
Animal cell



Plant cell



2. Gene Expression



- Human genome : ~ 25,000 genes

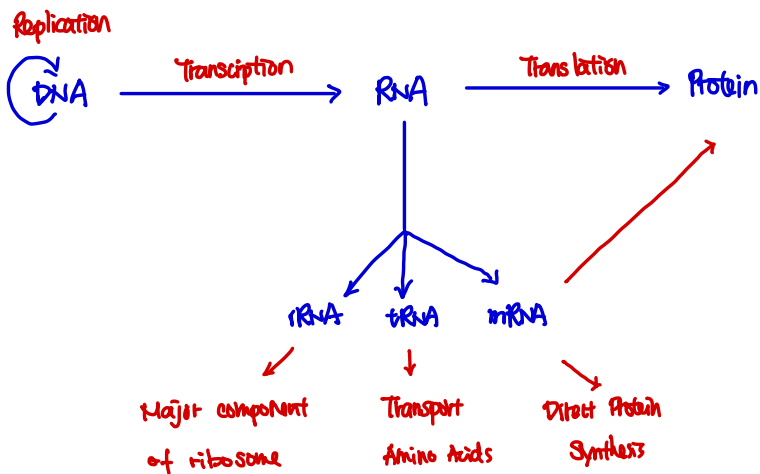
↳ 30% ~ 60% Genes are expressed

- Purpose of gene expression :

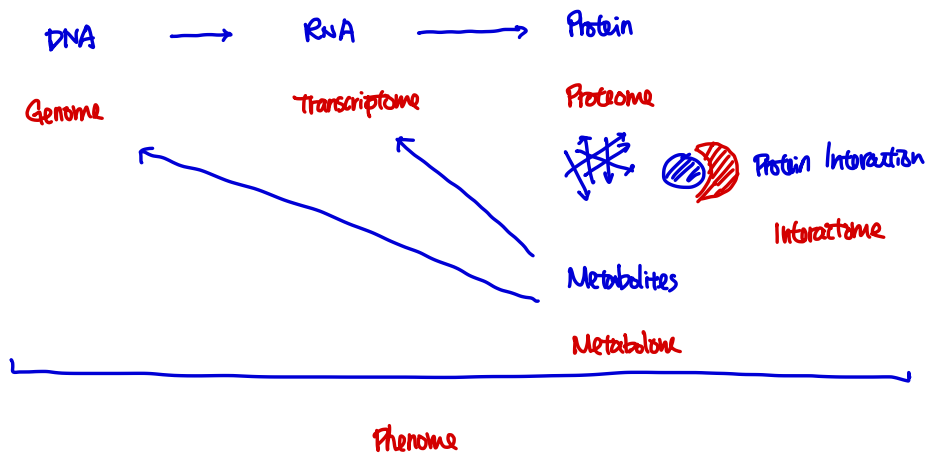
↳ Define different cell types (Multicellular organism)

↳ Respond to extracellular stimuli.

3. Information flow



-ome (组,集合)

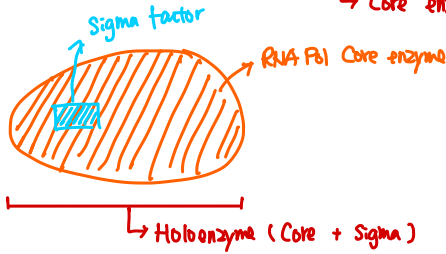


4. Transcriptional Regulation in Prokaryotes

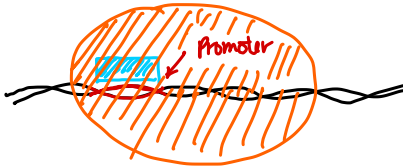
1) Prokaryotic transcription

Step 1. Sigma (σ) factor binds to (RNA Pol)

↳ Core enzyme

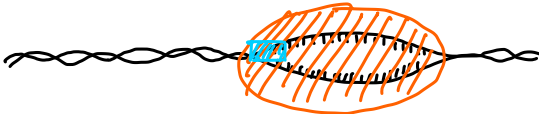


Step 2. RNA Pol Holoenzyme scans DNA and binds promoter on DNA template.

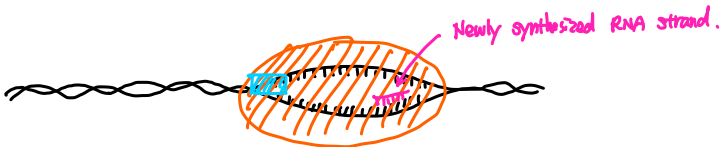


Step 3. Unwind Local DNA sequence

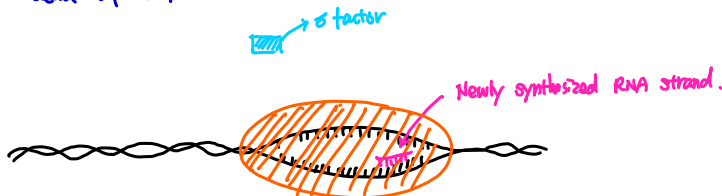
↳ Energy is not required.



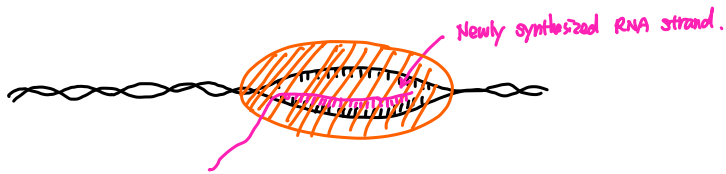
Step 4. Initial RNA synthesis



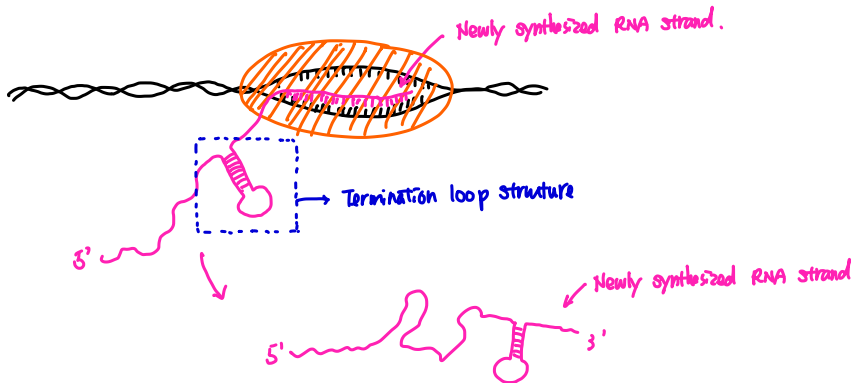
Step 5. Release of σ factor



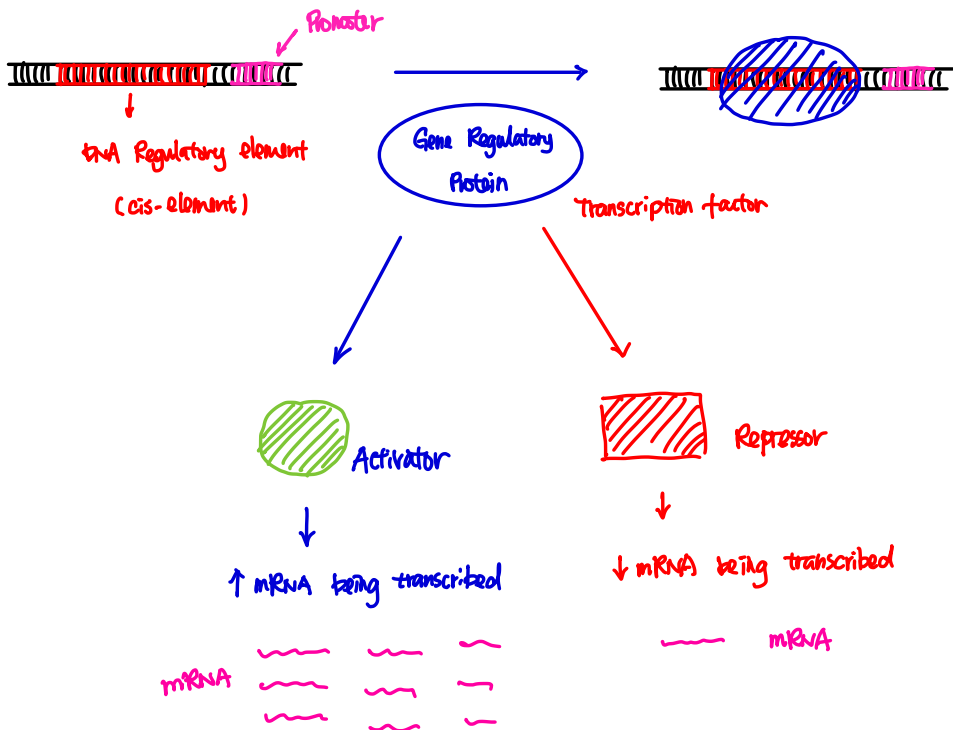
Step 6. RNA Elongation



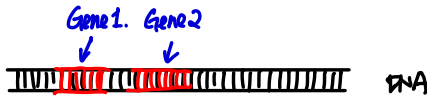
Step 7. Termination of synthesis



2) Transcriptional Regulation



3) Bacteria transcriptional regulation → E.coli

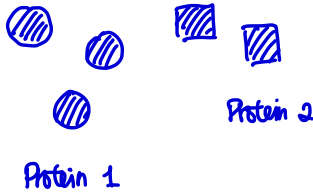


↓ Transcription



→ Multiple genes can be transcribed to a single mRNA.

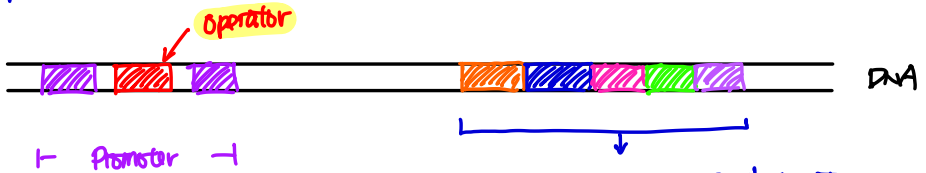
↓ Translation



How gene expression regulation is achieved?

↳ Answer: Operon

a) Trp Operon

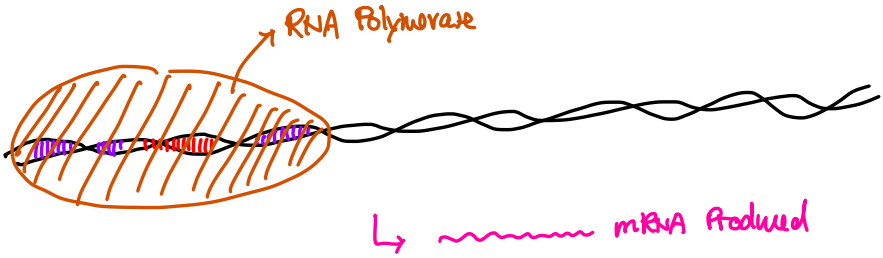


5 Genes → Synthesize Trp



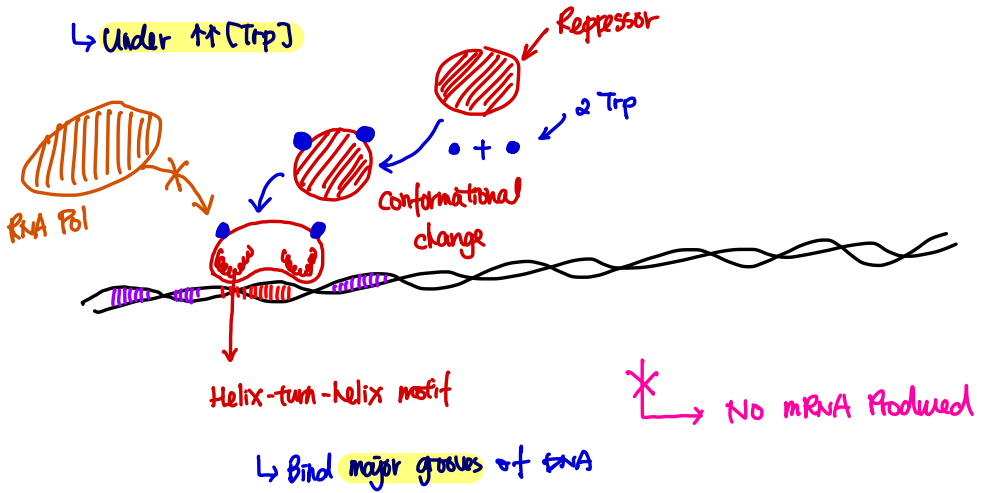
Expression ON:

↳ Under ↓↓ [Trp]

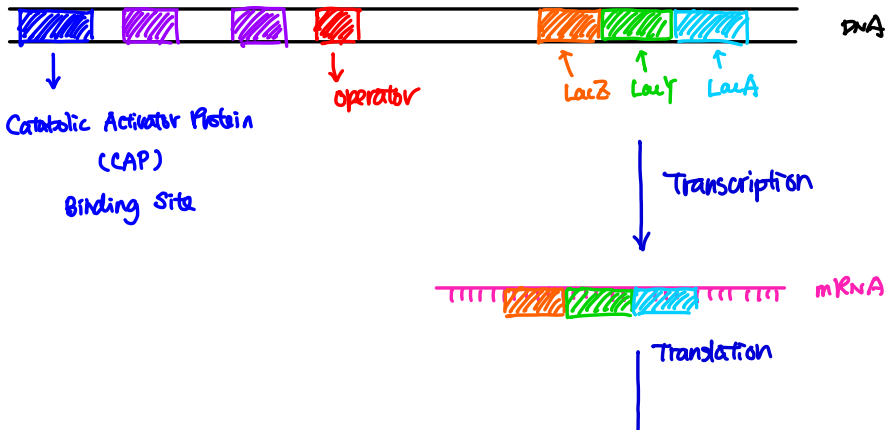


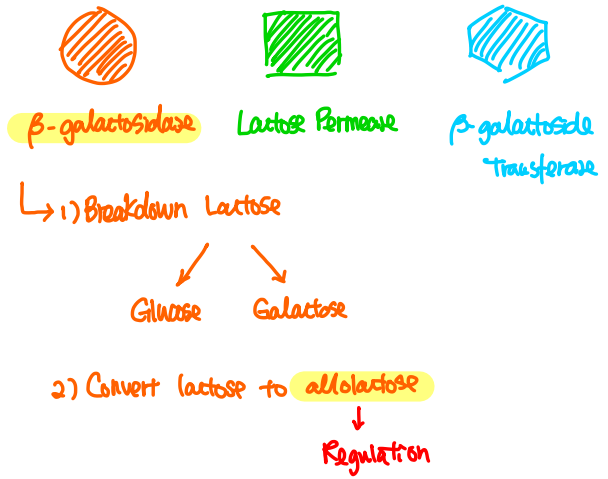
Expression OFF:

↳ Under ↑↑ [Trp]

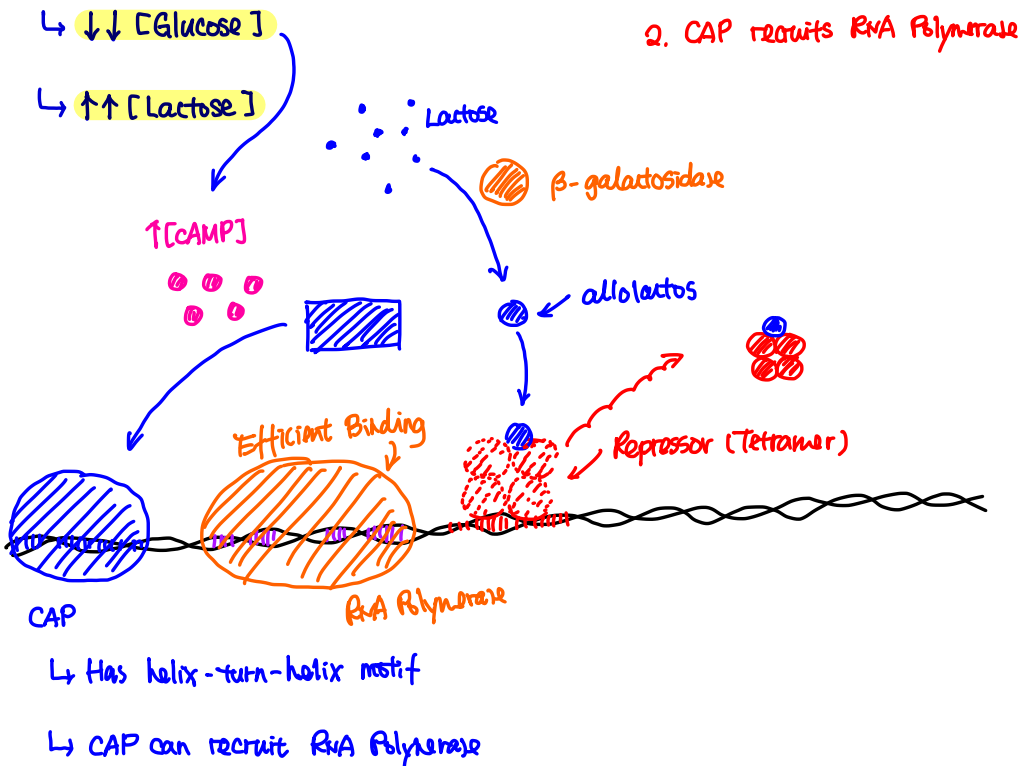


b) Lac operon





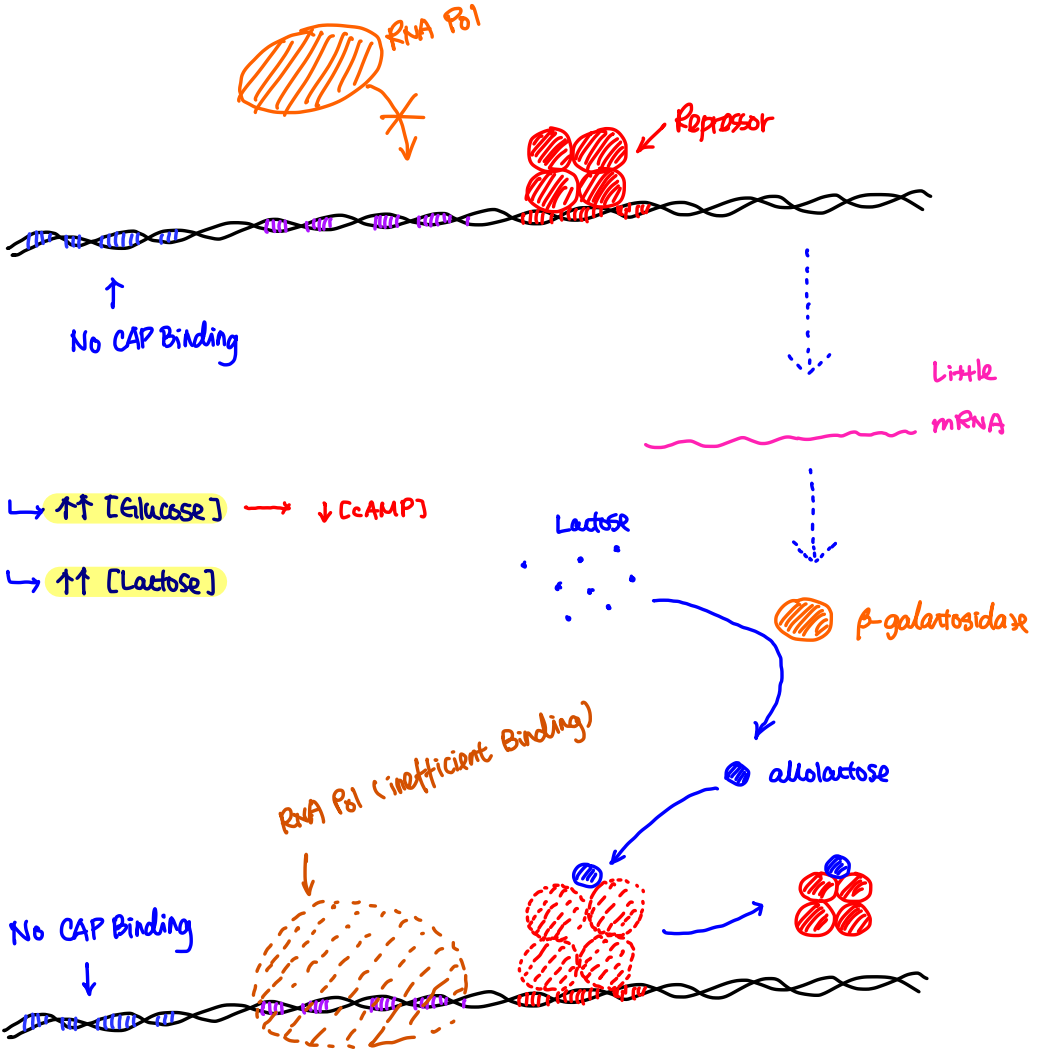
Expression ON :



Expression OFF : (Not completely OFF)

↳ $\uparrow\uparrow [\text{Glucose}] \rightarrow [\text{cAMP}] \downarrow\downarrow$

↳ $\downarrow\downarrow [\text{Lactose}]$

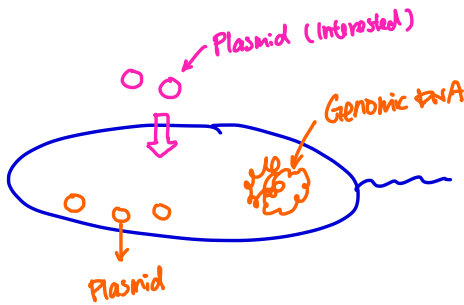


c) Summary :

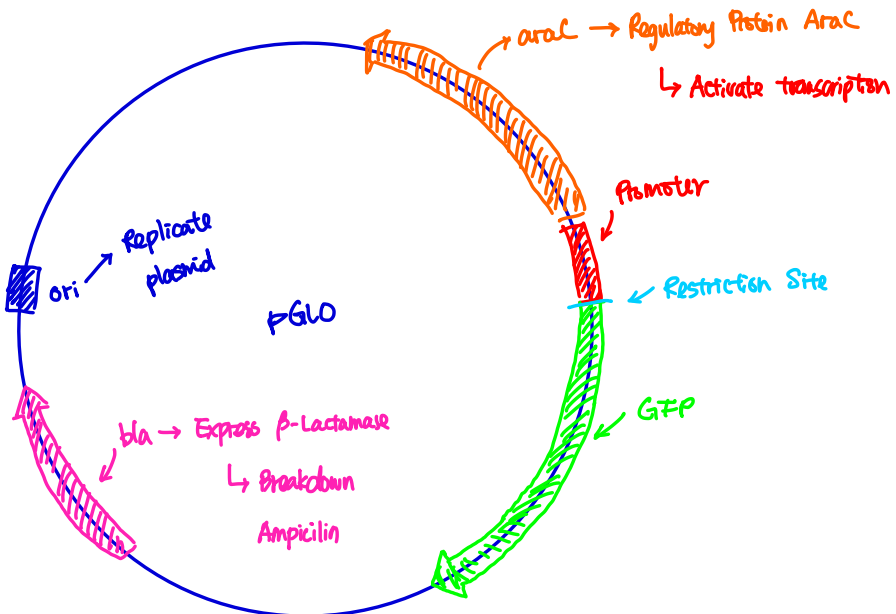
1. Negative regulation : **Repressor** binds DNA , blocking binding of RNA Pol.
2. Positive regulation : **Activator** binds DNA , recruiting RNA Pol.

Lab

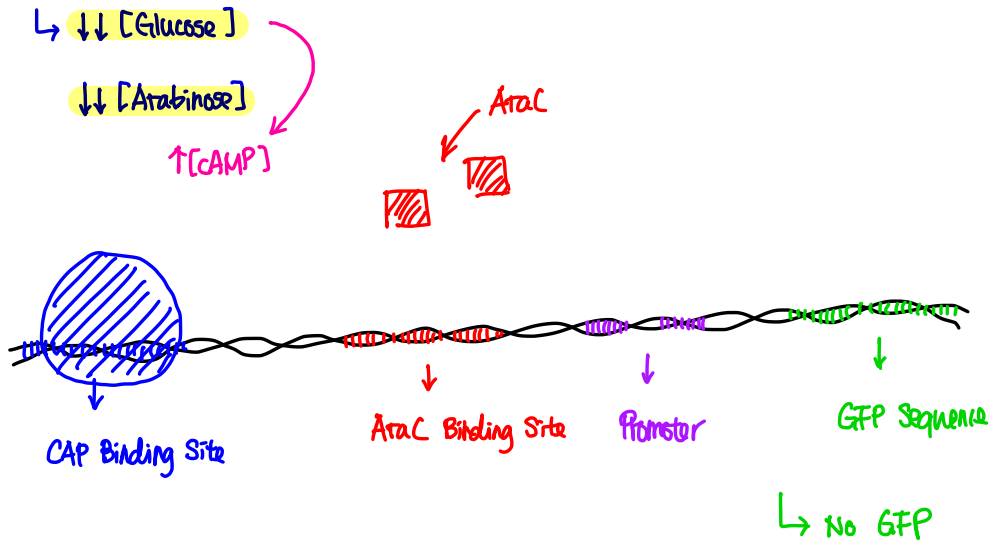
Transformation : Put plasmid into bacteria.



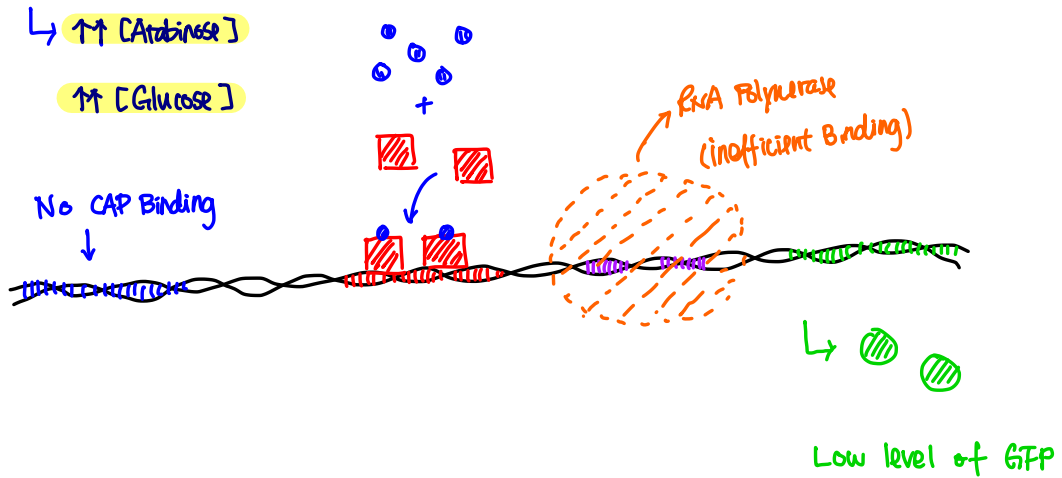
- Bacteria will take plasmids from environment under **stress**
↓
Heat shock



Expression OFF:



Expression Low :



Expression High :

