Networks

Examples of regulatory networks

Outline

- The *E. coli* regulatory network
- An example subnetwork: the *lac* operon

Part of the E. coli Regulatory Network

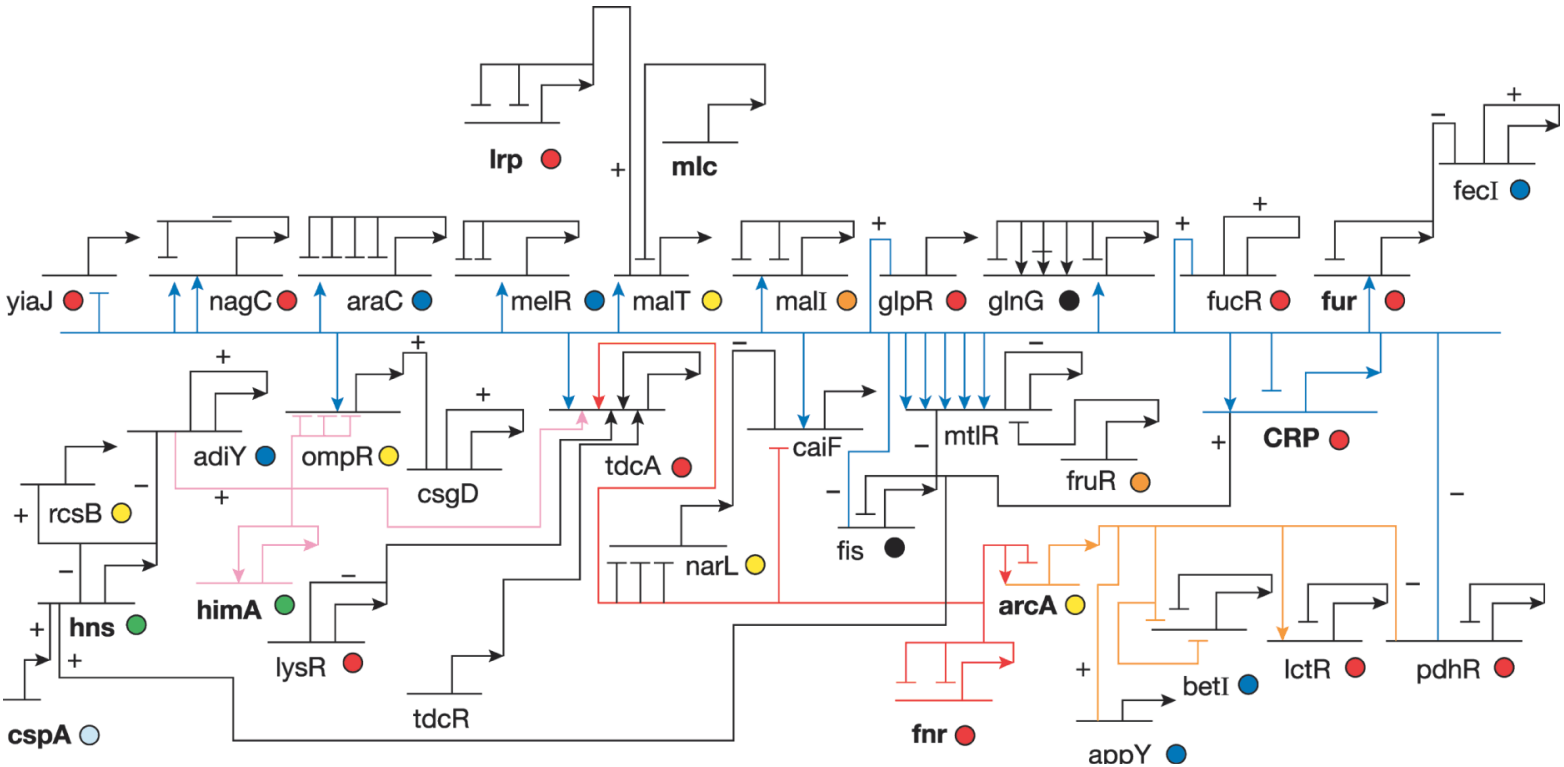
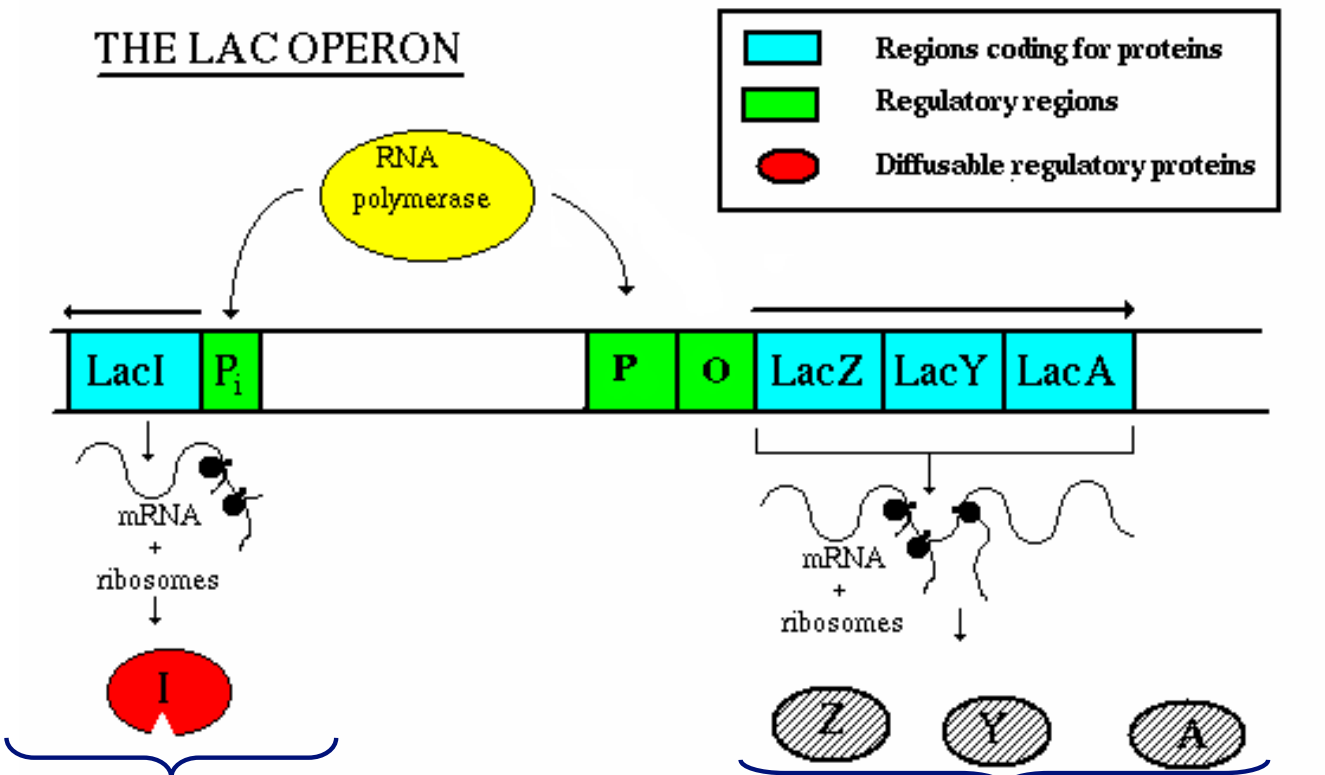


Figure from Wei et al., *Biochemical Journal* 2004

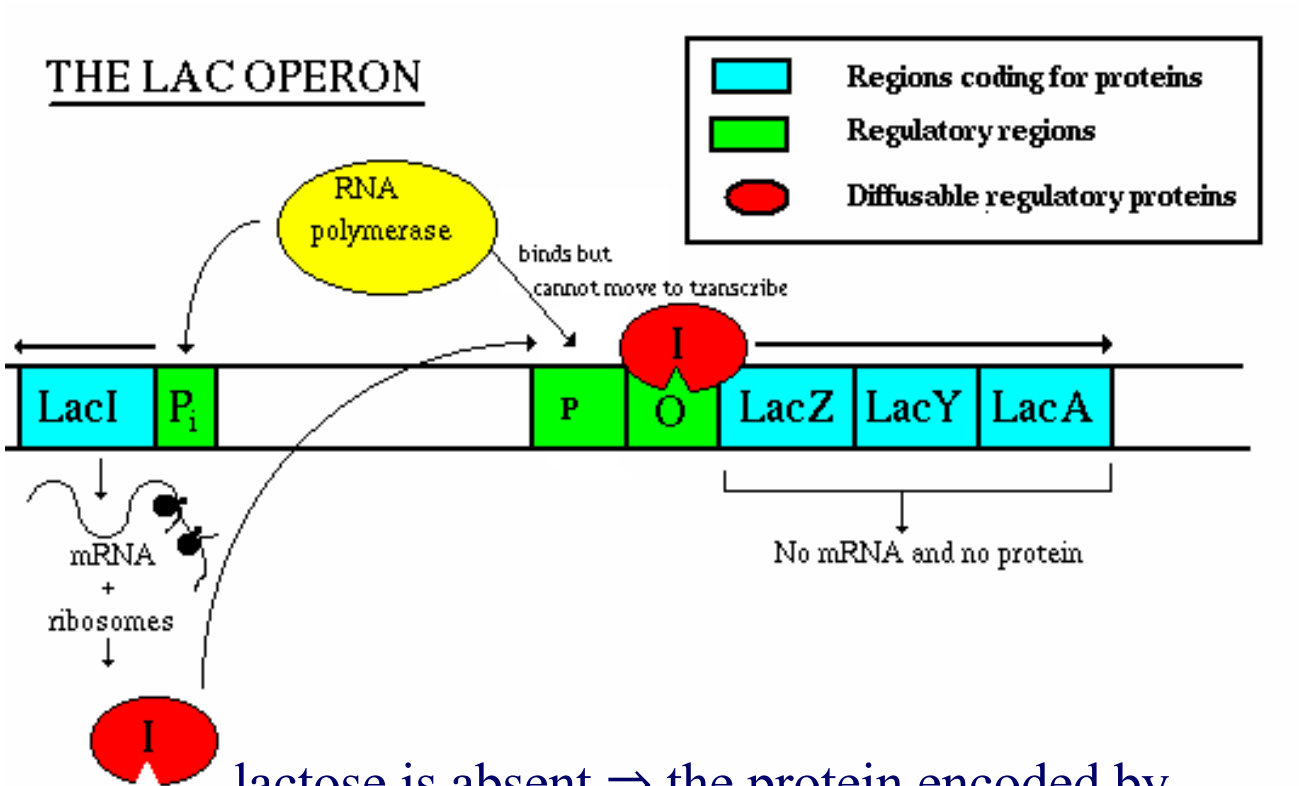
Gene Regulation Example: the lac Operon



this protein regulates the transcription of LacZ, LacY, LacA

these proteins metabolize lactose

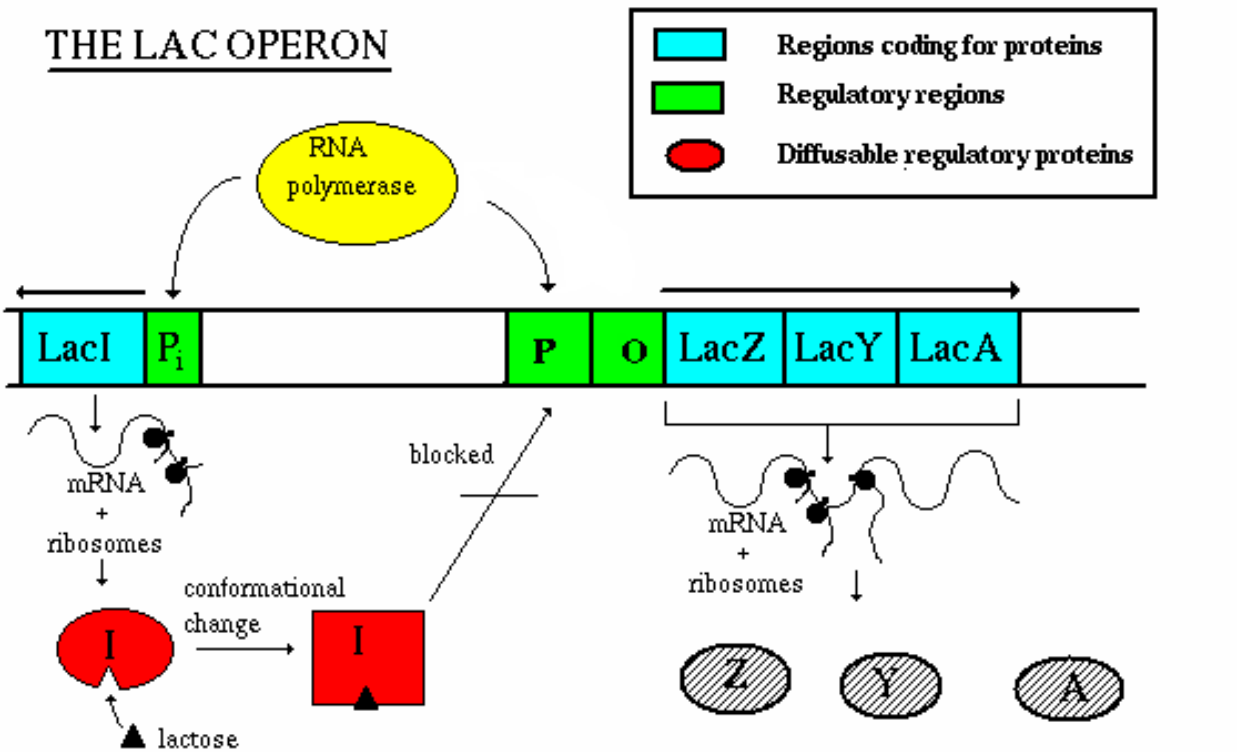
Gene Regulation Example: the lac Operon



lactose is absent ⇒ the protein encoded by

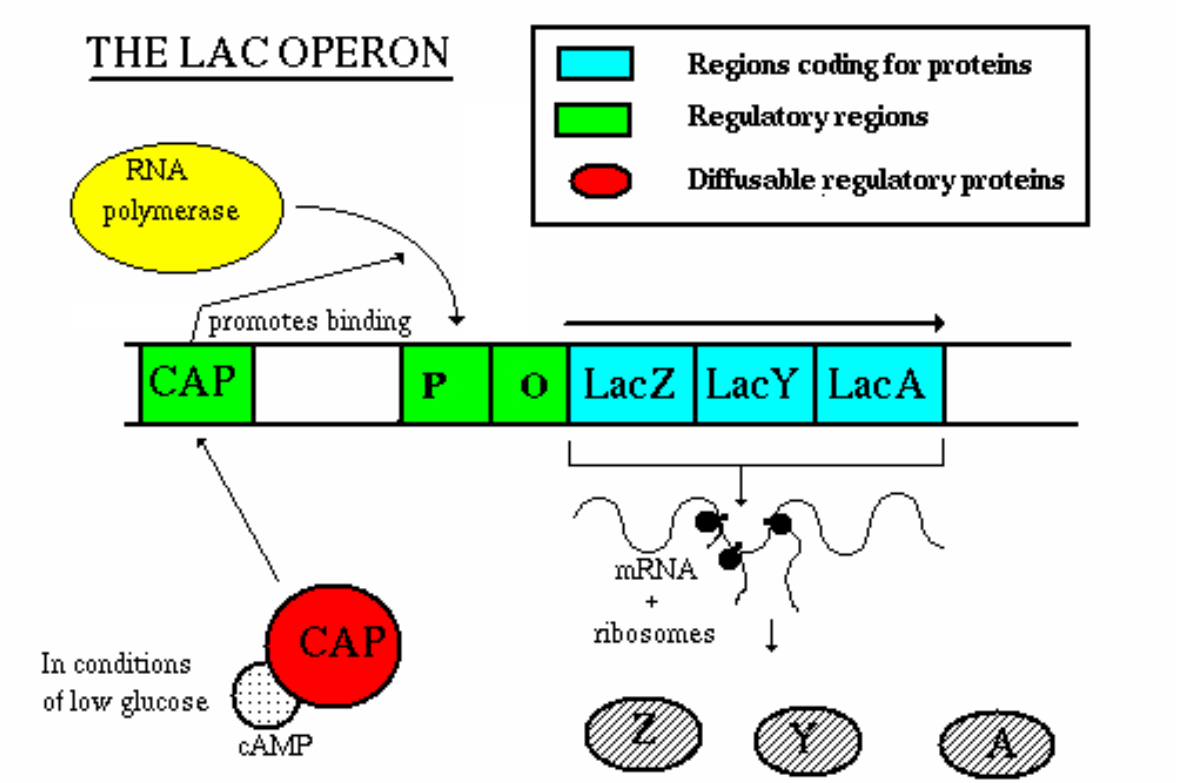
lacI represses transcription of the lac operon

Gene Regulation Example: the lac Operon



lactose is present ⇒ it binds to the protein encoded by lacI changing its shape; in this state, the protein doesn't bind upstream from the lac operon; therefore the lac operon can be transcribed

The lac Operon: Activation by Glucose



glucose absent $\Rightarrow$ CAP protein promotes binding by RNA polymerase; increases transcription

Summary

- Transcription factors (TFs) form complex regulatory networks
- A TF can either activate or repress a target gene (which could be itself)
- Lac operon example
  - a simple illustration of how a cell can regulate (turn on/off) certain genes in response to the state of its environment
  - The regulatory network for the lac operon serves to
    - "turn it on" when lactose is present **or** glucose is absent in the cell
    - "turn it off" when lactose is absent