

Regulation of gene expression

I. General information

A. orderly and controlled expression

Ž growth phase, nutritional and stress conditions, environment vs. in host

B. most regulation at initiation of transcription; however, some post-transcriptional - mRNA stability, translational regulation, post-translational

C. operon - region of DNA (genes and required cis-active sites) expressed from same promoter therefore on same mRNA

D. negative regulation - when active regulator turns off expression

E. positive regulation - when active regulator turns on expression

F. regulators - repressor - turn off binding to operators; activators - turn on binding to activator sites

G. effector molecules - inducer - binds to repressor or activator to turn on expression corepressor - binds to repressor turning off expression

H. location of operators and activators sites (Fig. 11.1)

1. operators near or downstream of promoter

2. activator sites - upstream of promoter

I. constitutive mutant - always on - more difficult for positive regulation than repression

J. cistron - operon - regulon - stimulon

II. *lac* operon - repression, utilization

A. Fig. 12.4 - map *lacI..poZYA*

B. LacI repressor binds to operator in absence of inducer (allo-lactose, lactose, IPTG) - prevents initiation of transcription

C. *lacUV5* promoter - not sensitive to catabolite repression

D. *trp-lac* - *tac* stronger; *trc* even stronger

E. catabolite repression - CAP+cAMP required for full expression

F. what are effects of mutations in different elements - constitutive, dominant off, dominant on

III. Arabinose operon - activation - utilization

- A. Fig. 12.18, 12.20
- B. *araC araO2..pC araO1..CAP araI pBAD BAD*
- C. AraC: P1 anti-activator - ara; P2 activator + ara
- D. AraC P2 binds to *araI* activating *pBAD*
- E. AraC P1 binds to *araO2* and *araI* forming bend
- F. AraC represses its own synthesis in the absence of ara (like LacI) at *araO2* and *araA* to loop out *pC*
- G. catabolite repression also

IV. *trp* operon

- A. biosynthesis of Trp
- B. repressor and aporepressor
- C. Fig. 12.15, 12.16 - *ptrp trpL trpE.... ...trpR*
- D. TrpR only binds to and represses *ptrp* in the presence of Trp
- E. TrpR autoregulation - repression
- F. Attenuation - Fig. 12.24, 12.25
 - 1. *trpL* gene
 - 2. 2 Trp codons - rib stalls w/o trp, enables 2:3 pairing, no 3:4
 - 3. +Trp - rib moves to stop codon, preventing 2:3, enabling 3:4, which is a factor-independent terminator