

Control of Gene Expression

I. Overview

- A. Cell types
 - 1. housekeeping proteins
- B. External signals
- C. Control steps
- D. Constitutive expression

II. Transcriptional Switches

- A. Background
 - 1. regulatory DNA sequences
 - 2. transcription regulators
 - a. DNA-binding motifs
 - b. dimerization
- B. Repression
 - 1. Tryptophan operon
 - a. operator
 - b. tryptophan repressor
- C. Activators
- D. *Lac* operon
 - 1. genes & enzymes
 - a. β -galactosidase - *lacZ*
 - b. galactoside permease - *lac Y*
 - c. galactoside acetyltransferase - *lacA*
 - 2. negative control
 - a. *lac* repressor
 - 1) allolactose
 - b. leaky
 - 3. positive control
 - a. cyclic-AMP
 - b. catabolite activator protein
 - 1) activator-binding site
- E. Sigma factor switches
 - 1. heat shock proteins
- F. Eukaryotic regulators
 - a. enhancers
 - 1. loop
 - 2. mediator
 - 3. euk. repressors

III. Cell type control

- A. 1 gene - many regulators
 - 1. combinatorial control
- B. 1 regulator - many genes
- C. Cell types
 - 1. ex. MyoD
- D. Daughter cell transmission
 - 1. epigenetic inheritance
 - 2. positive feedback loop
 - 3. chromatin structure
 - a. heterochromatin
 - b. euchromatin
 - 4. DNA methylation
 - a. methyltransferase

IV. Post-transcriptional Controls

A. Alternate splicing

B. Riboswitches

C. Untranslated regions of mRNA

1. 5'

2. 3'