A Couple of Examples of
Global Regulation

I. Catabolite repression - CAP regulon

A. misnomer, since the CAP protein is an activator
B. catabolite-sensitive operons

C. cAMP made by adenylate cyclase (*cya* gene) - ATP **ö** cAMP
- decrease energy level - increased cAMP

D. Linked to phosphotransferase system (PTS) Fig. 13.2
- Adenylate cyclase::II^{Glc}~P is active
- if no glucose is available, the higher level of II^{Glc}~P

E. CAP/CRP (*crp* gene) is usually an activator, but can also be a repressor
F. CRP-cAMP is the active form that binds specific DNA sequence
G. CRP-cAMP has affinity for RNA-Pol (alpha subunits)
H. CRP regulon genes have poor upstream elements that usually increase RNA-Pol binding
I. CRP-regulated genes usually are regulate by other regulators, so at least 2 levels of regulation needed (web of regulation)

J. How can you construct constitutive “ON” mutations for catabolite repression? (2)
K. Notice the effects of mutations in the *lac* promoter relative to catabolite repression

II. Heat shock response Fig. 13.13

A. Both a regulon and stimulon with >30 genes
B. Not only induced by heat - other stresses, too.
C. Heat Shock Proteins (HSPs) - highly conserved among most organisms
D. HSPs have normal functions
1. Chaperones - help fold proteins: GroE, DnaK, DnaJ, GrpE
2. Proteases - Lon, Clp

E. Role of sigma-32 ($ó^{32}$) - major; sigma-24/sigma-E ($ó^{24}$/$ó^{E}$) - minor
F. sigma-32 = *rpoH*
G. 15x induced protein after heat shock, but not so much mRNA
H. Role of DnaK (HSP - sigma-32-regulated)
1. binds to misfolded proteins
2. during heat shock is occupied with misfolded proteins
3. during normal growth binds to sigma-32
a. prevents sigma-32 from binding to promoters
b. causes sigma-32 to be degraded

I. Heat shock response is transient - cell will accommodate higher temperature