411 Lecture Outline (13 Feb ‘09)

1. Strategies of regulation
2. Overview of RNA pol & Transcription Initiation
3. Repressors vs. Activators of transcription
4. What about CRP-cAMP?

Opportunities in regulation

1. Initiation of transcription
2. What else?
Transcription regulation

1. Initiation of transcription
   ➤ change in $\sigma$ factors
   ➤ direct stimulation by DNA sequence or structure
   ➤ use of repressors
   ➤ use of activators

A little review of transcription in Bacteria…

The Bacterial RNA pol has several subunits.
Stereotypical bacterial promoter

![Diagram of bacterial promoter structure]

**Figure 2.6**

Promoter with this structure/sequence binds RNA pol holoenzyme with $\sigma^{70}$ with high affinity. Different holoenzymes bind to distinct promoters.

**Sequences recognized by different holoenzymes**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Use</th>
<th>-35 Sequence (Upstream)</th>
<th>Spacing</th>
<th>-10 Sequence (Downstream)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma^{70}$</td>
<td>normal</td>
<td>TTGACA</td>
<td>16-18 bp</td>
<td>TATAAT</td>
</tr>
<tr>
<td>$\sigma^{28}$</td>
<td>Motility Chemo-</td>
<td>TAAA</td>
<td>16-17 bp</td>
<td>CCGATAT</td>
</tr>
<tr>
<td></td>
<td>taxis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma^{54}$</td>
<td>Nitrogen Reg.</td>
<td>TTGGCA (-24)</td>
<td>6 bp</td>
<td>TTGCA (-12)</td>
</tr>
</tbody>
</table>
Figure 2.7

RNA pol/DNA/RNA complex

Figure 2.16

Focusing on initiation...

Figure 2.8
RNA pol contacts in the promoter and beyond

B: When you absolutely, positively want to transcribe lots of RNA...

Focusing on initiation...
Many opportunities to affect initiation of transcription…

A different model of regulation: *ara*

Three loci revealed in mutational analysis. (The two not shown here needed for L-Ara transport.)
Analysis of Ara mutants

At least 4 complementation groups/genes (araA, araB, araC and araD) are defined by the Ara- mutants.

What about araC?
AraC mutants can grow on xylulose, so it’s not further downstream.
Is AraC a regulator?

araC- Mutants Are “Super-suppressed”

No L-arabinose

Plus L-arabinose

What could be the function of araC? (Remember: AraC is not the L-Ara permease)
Action of AraC

A Absence of L-arabinose

B Presence of L-arabinose

C Excess of AraC

Figure 12.20

cAMP-CRP and AraC

Figure 13.4