Problem Set #2 – *Regulation and such*

*Problem set is due at the beginning of class, Tuesday 19 October 2004*

**Problem 1**

It’s fair to say that in Methanogenesis from methanol, it is impossible for the same molecule of methanol to serve as electron donor and electron acceptor during that respiration. But it is fair to say that Methanogenesis from acetate uses the same molecule of acetate as both an electron donor and an electron acceptor.

Do you agree or disagree with the above statement? Defend your position.

**Problem 2**

Genes responding to DNA damage are regulated by the LexA repressor, which cleaves itself in response to binding to RecA when RecA is bound to ssDNA. This is a good model for general regulation of such repair genes.

Propose an alternative model for sensing and responding to DNA damage. Point out its strengths or weaknesses relative to the existing model. Your model should be plausible (that is based on actual DNA damage of some sort), but of course we don’t expect that it will be perfect. Explain why it is inferior to the RecA/LexA model, thereby illustrating the strengths of the RecA/LexA model.

**Problem 3**

In the context of issues discussed in this course, and using the regulatory models discussed for bacterial sulphur assimilation, devise a model by which assimilatory sulfate reduction is controlled in yeast. For each regulatory interaction you devise, specify what signal is sensed and what outcome results. To demonstrate your model, consider the regulation of genes providing for sulfate reduction and address the following:

1. How, and to what level, would these genes be expressed when growing on sulfate as a sole sulphur source?
2. How, and to what level, would these genes be expressed when growing on methionine as a sole sulphur source?
3. How, and to what level, would these genes be expressed when growing on cysteine as a sole sulphur source?