Biology Seminar

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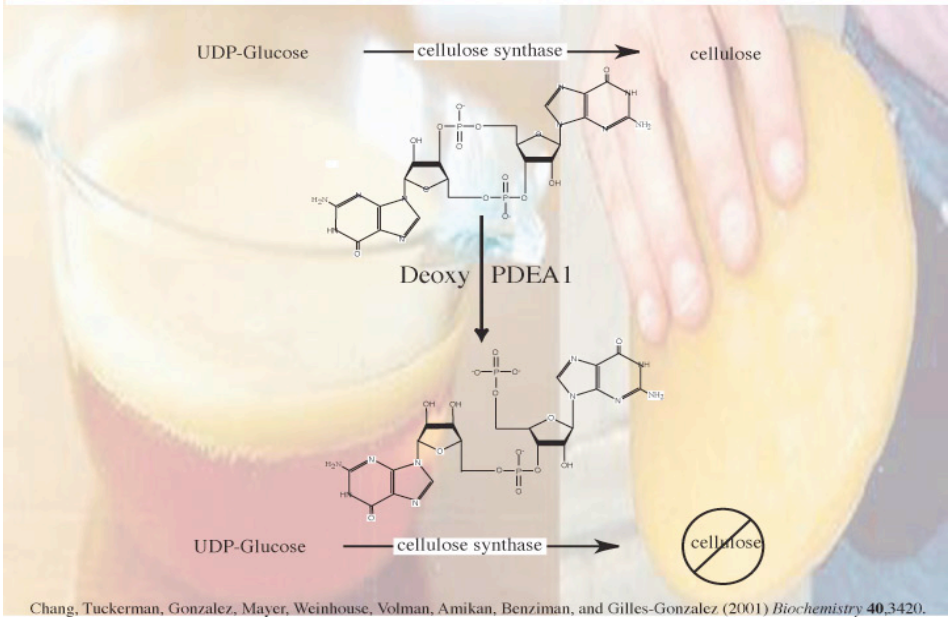
Oxygen Sensing by Bacteria

Abstract: Physiological gases commonly serve as signals for directing major lifestyle changes in bacteria. For example, the scarcity of oxygen gas in the root nodules of legumes triggers symbiotic rhizobia to fix nitrogen for these plant partners. In this case, the oxygen is detected by a heme-binding domain in a histidine-protein kinase called FixL. Under hypoxic conditions, FixL phosphorylates its response-regulator partner FixJ, which then induces the expression of over 20 *nif* and *fix* genes. An analogous system controls the hypoxic expression of the genes required for the transition of *Mycobacterium tuberculosis* (Mtb) from a pathogenic to a dormant state. Prolonged dormancies of Mtb affect one third of the human population; they represent a major reservoir of this pathogen and major health challenge. Bacterial oxygen sensors govern, not only protein kinases, but also other types of signal-transduction modules. For example, we have discovered that *Gluconobacter xylinus* and *Escherichia coli* possess oxygen-sensing cyclases and phosphodiesterases that direct the level of cyclic-di-GMP, a dinucleotide second messenger that is often involved in biofilm production. The biochemical bases for regulation of these systems by oxygen and the biochemical consequences of their actions will be discussed.



Chang, Tuckerman, Gonzalez, Mayer, Weinhouse, Volman, Amikan, Benziman, and Gilles-Gonzalez (2001) *Biochemistry* **40**,3420.

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