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Research Description

In the Enterobacteriaceae, oxygen concentration is an important determinant of habitat and host range. Members of this family are facultative anaerobes and reside in an assortment of hosts, including plants, animals and insects, through mutualistic, commensal or pathogenic interactions. The transcriptional response to changes in oxygen concentration has been extensively studied in the model system Escherichia coli K-12 and is controlled by multiple regulators that direct the expression of a variety of metabolic processes, but little genome-scale expression data is available for other enterobacteria which can aid in the study of regulatory network evolution. Thus far, we have used microarray analysis to study the oxygen-mediated transcriptional response among three enterobacteria, including two plant associated bacteria, Dickeya dadantii and Pectobacterium atrosepticum and E. coli K-12. Several patterns of gene expression among the three species of enterics reveal a strong conservation of gene expression among a core set genes that are responsible for the metabolic shift between aerobic and anaerobic growth. These include the increased expression of genes involved in anaerobic respiration and fermentation, in addition to the repression of genes associated with aerobic respiration. However, divergent patterns of gene expression reveal potential differences in the evolutionary history of gene or regulatory sequences. These genes are involved in pathways associated with ammonia assimilation and glutamate biosynthesis. In the plant associated bacteria, a comparable number of genes are affected and include genes with putative roles in virulence, bacteriaphage expression, transport systems, methyl accepting chemotaxis proteins and putative transcriptional regulators. From these studies, we have identified genes that elicit a conserved transcriptional response, conserved genes that are differentially regulated in a lineage-specific manner and lineage-specific genes acquired through horizontal gene transfer that have been co-opted into global oxygen responsive regulons.

Publications

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Partial List of Posters and Oral Presentations

Comparative genomics of Oxygen Regulation in Enterobacteria. Jennifer Apodaca, Jeremy D. Glasner, Amy Charkowski, Patricia J. Kiley, Nicole T. Perna International Erwinia Workshop, Scottish Crop Research Institute, Dundee, Scotland. July 8-10th, 2006- Invited Speaker

Evolution of the transcriptional response to oxygen limitation in the enterobacteria. Jennifer Apodaca, Jeremy D. Glasner, Amy Charkowski, Patricia J. Kiley, Nicole T. Perna. The 2007 Molecular Genetics of Bacteria and Phages Meeting, University of Wisconsin Madison, Wisconsin. August 7- 12th, 2007 - Speaker