PRESENTATIONS

POSTER PRESENTATION

- UT Graduate research forum, March 2015
- Great Lakes Bioinformatics Conference, May 2015, Purdue University
- Midwest Microbial Pathogenesis Conference, August 2015, Indianapolis
- IIT Research Forum, October 2015

PUBLICATION

- Authors:

Yvette Unoarumhi, Robert Blumenthal, Jyl Matson
Title: Evolution of a bacterial global regulator -Lrp in γ Proteobacteria –
In press—BMC Evolutionary Biology journal
(Manuscript in review)

DISSERTATION COMMITTEE

Jyl Matson, Major Advisor

Robert Blumenthal, Ph.D. (co-advisor)

Alexei Federov, Ph.D.

Kandace J. Williams, Ph.D., Graduate School Representative

The University of Toledo College of Medicine and Life Sciences

Infection, Immunity & Transplantation (IIT) Track

Department of Medical Microbiology & Immunology

THE UNIVERSITY OF TOLEDO
1872

DISSERTATION PRESENTATION

Yvette Unoarumhi

April 12, 2016

Evolution of Bacterial Global regulator– Lrp

MSBS in

Bioinformatics, Proteomics and Genomics

Abstract

Global regulators each control hundreds of genes in bacteria, and it is still unclear how these regulators evolve, especially considering that gene regulation changes more rapidly than the regulated genes themselves. Leucine-responsive regulatory protein (Lrp) is a global regulator in enteric bacteria, controlling both metabolic and virulence-associated genes. Lrp orthologs are found among both Bacteria and Archaea. Surprisingly, even within the phylum γ-Proteobacteria, Lrp is a global regulator in some orders and a local regulator in others. This raises important questions about the evolution of Lrp functions. The way global regulators function is crucially important to bacterial physiology. This thesis presents studies on the evolution and regulation pattern of Lrp, carried out with the goal of providing insights into global regulators more generally.

Two independent studies of Lrp were carried out. The first compared Lrp sequences from four bacterial orders within the γ-Proteobacteria: Enterobacteriales, Vibrionales, Pasteurelalles, and Alteromonadales. AsnC was also analyzed in parallel for comparison, as it is a paralog of Lrp that in all known cases is a local regulator controlling a small number of genes. As expected, Lrp and AsnC sequences formed two distinct clusters diverging from a common ancestor. These each divided into subclusters representing the Enterobacteriales, Vibrionales, and Pasteurellales. However, the Alteromonadales did not yield unitary clusters for either Lrp or AsnC, in contrast to the expected order-specific clustering we observed with the control housekeeping genes for 16S rRNA and RNA polymerase subunit RpoB.

Logo analysis was also used to compare Lrp and AsnC in these four orders, and clear sequence signatures were identified. Ultimately, the Logo analysis provided the testable hypotheses that the globally-acting Lrp orthologs have short conserved sequences (particularly at the two ends of the polypeptides), and that Alteromonadales is unique among the orders tested in having member species with global *or* local Lrp orthologs.

The second study focused on the manner in which Lrp protein regulates expression of its own gene (*lrp*). In *E. coli* Lrp represses *lrp*. However, it has been reported that Lrp activates the *lrp* gene in *Vibrio cholerae*. This can have major consequences, since Lrp controls so many genes. To address this question we measured *lrp* expression in a different *V. cholerae* species, in the presence and absence of Lrp using a P*lrp-lacZ* transcriptional fusion. While the *V. cholerae* strain background and growth medium differ from the original study, the results indicate that Lrp represses *lrp* in *V. cholerae*, as in *E. coli*. Our studies of Lrp provide better understanding of global regulators, including testable hypothesis for future studies

Acknowledgments

My sincere gratitude to my advisor (Jyl) and committee members.

I am very grateful to the Bioinformatics Department and Joanne Gray.

Thanks to the Matson Lab; You rock!

Thanks to everyone in the Medical Microbiology & Immunology Department.

Thank you for coming out to support me today.

Future Plans

- Yvette is currently interning at Procter and Gamble, Mason Business Centre, Mason Ohio.
- Establish a career in clinical research.
- Start up an NGO that will actively provide a mentoring platform and adequate resources for the girl child development in Africa.
- Expand my cooking skills and start up chains of restaurants.
- And so many other plans but I choose to take it one step at a time.