

## PROJECT FACT SHEET

# Paying for Robustness with Efficiency—Understanding Biological Trade-Offs

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The relationship between structure and function in biological networks is important when studying the complex interactions in biological systems. The research of Joseph Bielawski, an assistant professor in the Biology Department at Dalhousie, is focused on quantifying the complex interactions of bacterial metabolism. The research group models the metabolism of a species of bacteria as a network where the metabolites are represented as nodes and enzymes as the links between the nodes. Given such a model, they have begun to explore the trade off between the robustness and efficiency of metabolism. Based on their survey of 105 species of bacteria they have found that ecological characteristics of bacterial are strong predictors of the structure of bacterial metabolic networks. Species that inhabit complex and dynamic environments tend to have structurally robust metabolic networks, whereas lineages that inhabit narrow and stable environments tend to have structurally efficient networks.

The connection between network structure and ecology led Dr. Bielawski's group to focus on comparisons between pathogenic and non-pathogenic lineages of bacteria. Metabolic networks can be decomposed into elements called "modules" and they have found that functional differences between the enzymes of pathogens and non-pathogens tend to be associated with certain metabolic modules. They are currently exploring possible connections to differences in levels of gene expression between pathogens and non-pathogens.

"There are implications for the development of new anti-microbial drugs," says Dr. Bielawski.

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