PhD Thesis Defense
Department of Microbiology and Cell Biology
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Procrastinator Theater
“Zooming in and out on coral reef microbiomes: molecular patterns over space and time”

ABSTRACT

The observable macro-scale diversity of coral reefs is mirrored in its microbiome. This diversity is exciting but overwhelming. Parsing this complexity to find and understand “important” microbes is a perennial challenge. To cut through this diversity I leveraged ecosystem (e.g. coral mortality, geophysical measures) and community-scale observations (e.g. microbes with high/ cyclic abundance and/ or prevalence) to identify tractable subjects for sequencing-based microbiome investigation. The framework for identifying research subjects is the focus of the Introduction. In the remainder of the dissertation, I will cover multiple angles of the coral reef microbiome using the framework from the introduction. Chapter 2 performs a marker gene survey of microbial taxa across reef microhabitats, identifying several microhabitats and taxa bearing further investigation. The next chapters will focus on microhabitats and microbes characterized in Chapter 2. Chapter 3 uses in situ marker gene surveying and bulk-tissue transcriptomics to zoom in on a high abundant and ubiquitous coral endosymbiont. I uncover gene expression evidence of unexpected, potentially coral parasitizing, metabolisms. Chapter 4 employs quantitative PCR, marker gene surveying, and metagenomics to dig into the reef sediment microbiome, searching for potential taxa and mechanisms that may explain reduced coral mortality after sea cucumber grazing. I find that the metabolites from phototrophs and sulfur reducers bear closer investigation. Collectively, this dissertation identifies several tractable microbial taxa and metabolisms that underlie reef function and follows-up on a couple in detail. The metabolic potential and taxa of interest identified bioinformatically provides clear future directions for research untangling microbial ecology across the coral reef.