

# University of Prince Edward Island

Faculty of Veterinary Medicine  
Summary of Dissertation

Submitted in Partial Fulfilment  
of the Requirements for the

## DEGREE OF MASTER OF SCIENCE

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## **Natural Product Discovery from Marine-Derived Microorganisms and the Investigation of Metabolomic Changes from In-situ Fermentations of Marine-Derived Actinomycetota**

Marine organisms have a history of containing medically relevant natural products with unique chemistry and are thought to be the “true” source of molecules that inspired many marine-derived drugs. However, it is thought that these compounds are locked behind transcriptional and translational regulation. This thesis describes two studies that use untargeted metabolomics as an approach for natural products discovery. The first study describes natural product discovery from 20 marine-derived bacteria with prior observed bioactivity and the second study investigated the application of a marine in-situ fermentation model to investigate the environment’s impact on the metabolome of marine-derived Actinomycetota. The aims of the first study were to replicate the original fermentation conditions and conduct metabolomics and antimicrobial analysis on the extracts. After observing limited antimicrobial “hits”, a media study was conducted with six broths and the metabolomics and bioactivity results were compared to the previous study. Then, based on data reproducibility, presence of putative new compounds, and biological activity, *Streptomyces* sp. RKBH-B7 was selected for large-scale fermentation and spectrometry-guided fractionation. Resulting in the discovery of guanahanolide A using NMR spectroscopy and Mosher’s analysis. Guanahanolide A represents a new meroterpene (with a novel sesterterpene) which showed 70–80% growth inhibition at 10  $\mu$ M in NCI-H226, NCI-H322M, HCC-2998, M14 and >85% in OVCAR-5 cell lines from the National Cancer Institute cell screen. This study highlights the importance’s of using a combination of metabolomics and biological assay results for natural product discovery, since guanahanolide A did not demonstrate antimicrobial activity. The second study aimed to use diffusion chambers for an extractable fermentation that could be “incubated” in a marine ecosystem. Four marine-derived Actinomycetota fermentations (original isolated from San Salvador Island, Bahamas) and media blanks (controls) were successfully “incubated” in seawater, marine sediment, and a *Xestospongia muta* for 3–5 days. Sediment-derived strains “incubated” in mangroves were found to increase natural product production when “incubated” in seawater,

compared to sediment. Whereas the sponge-derived strain tentatively increased production of the main natural product when “incubated” in a sponge when compared to seawater and sediment. In conclusion, this thesis provides evidence that further supports the notion that marine microorganisms remain an underexplored source of new chemistry and accentuates the gap in knowledge in the chemical ecology of marine microorganisms.

## Publications

†Marchbank, D.H., †Ptycia-Lamky, V.C., Decken, A., Haltli, B.A., & Kerr, R.G. (2020). Guanahanolide A, a Meroterpenoid with a Sesterterpene Skeleton from Coral-Derived *Streptomyces* sp. *Organic Letters*, 22(16), 6399–6403.  
<https://doi.org/10.1021/acs.orglett.0c02208> †co-first author

## Presentations

**Ptycia-Lamky, V.C.\*** Haltli, B., D., Marchbank, & Kerr, R.G. (2018). In-situ Fermentations of Bacteria in Marine Habitats from San Salvador, Bahamas. 10th Annual Atlantic Maritimes Natural Product Conference. Halifax, Nova Scotia. (Institutional).

**Ptycia-Lamky, V.C.\***, Haltli, B., Marchbank, D., Lantelgne, M. & Kerr, R.G. (2018). Discovery of New Antimicrobial Natural Products from a Marine Bacterial Library. First Annual Graduate Research Days Conference. Charlottetown, Prince Edward Island. (Institutional).

**Ptycia-Lamky, V.C.\***, Haltli, B., Lantelgne, M. & Kerr, R.G. (2017). Use of Metabolomics and Antimicrobial Screening to Identify Putatively New Natural Products. Poster presentation at the 9th Annual Atlantic Marine Natural Product Conference, Charlottetown, Prince Edward Island. (Institutional).

**Ptycia-Lamky, V.C.\***, Hurta, R. & Quijon, P. (2016). Exploring Green Crab Extracts and Their Potential Use as Inhibitors of Cancer Cell Growth. Oral presentation at the University of Prince Edward Island Undergraduate Research Conference, Charlottetown, Prince Edward Island. (Institutional).

**Ptycia-Lamky, V.C.\***. (2016). Exploring Green Crab Extracts and Their Potential Use as Inhibitors of Cancer Cell Growth. Poster presentation at the Summer Program for Undergraduate Research Poster Presentation, Charlottetown, Prince Edward Island. (Institutional).

## Biographical Data

Born in Port Alberni, BC, Canada

## Awards

2nd Place Oral Presentation. UPEI Graduate Studies and Research Days, Charlottetown, PE, Canada, 2018.

NSERC Experience Award. Canada, 2017.

Geoff Hogan Honours Research Grant. UPEI, 2016.

UPEI Science Undergraduate Research Award. Summer of 2016.