Vita

Candidate's name: Alyssa Dawn Seveck

Universities Attended:

University of New Brunswick (2023)
Bachelor of Science

University of New Brunswick (2025)
Masters of Science

Publications/Conference Presentations:

Seveck, A.; Perley, J.;Lian, J,; Gao, D,; Qu,Y. Four Enzymes from Button Bush Enable de Novo Biosynthesis of Spirooxindole Alkaloids in Yeast. BioDesign Research. Submitted.

Hwang, J,; Kirshner, J,; Deschenes, D,; Richardson, M,; Fleck, S,; Guo, J,; Perley, J,; Shahsavarani, M,; Garza-Garcia, J,; Seveck, A,; Doiron, S,; Mai, Z,; Silliphant, S,; Calhoun, L,; Gao, D,; Lian, J,; Deslongchamps, G,; Albert, V,; Qu, Y. Ancient gene clusters intiate monoterpenoid indole alkaloid biosynthesis and C3 stereochemistr inversion. bioRxiv. In revision.

Plant Canada 2024, poster presentation, poster title: Purification, Identification, and Investigation of the Biosynthetic Pathways of Monoterpenoid Indole Alkaloids in Hamelia patens.

Investigation of The Biosynthetic Pathway of Spirooxindoles in *Hamelia patens* and *Cephalanthus occidentalis*

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Alyssa D. Seveck

in the Department of Chemistry

U.N.B., Fredericton, N.B.

Friday, August 22nd, 2025
12:00 p.m.

Toole Hall, Room 303 & via MS TEAMs

Examining Committee

Dr. Yang Qu	Supervisor
Dr. Sara Eisler	Internal Examiner
Dr. Alla Gagarinova	Int-Ext Examiner
Dr. Adam Dyker	Chair of Oral Examination

Abstract

Cytochrome p450 monooxygenases (CYPs) are a vast family of enzymes that play key roles in the biosynthesis and diversification of specialized metabolites in the plant kingdom. They are crucial catalysts involved in numerous biosynthetic reactions such as hydroxylation, isomerization, and oxidations. Monoterpenoid oxindole alkaloids (MOAs) are a subclass of monoterpenoid indole alkaloids (MIAs) and have known medicinal benefits. However, due to their low natural abundance and structural complexity, obtaining them in large quantities for study has been difficult. In this study, I purified and analyzed seven MOAs from *Hamelia patens*, one of which being a new MOA not reported in literature. I also identified and characterized a CYP responsible for catalyzing the oxidation of 3*R* heteroyohimbine-type MIAs to their MOA derivatives in *Cephalanthus occidentalis*. This discovery enables the de novo biosynthesis of major MOAs mitraphylline and isomitraphylline in *C. occidentalis*. The substrate scope of this CYP was examined and kinetic studies suggested similar catalytic efficiencies for 3-epi-ajmalicine and akuammigine. The elucidation of this CYP and MOAs provides valuable insights into the enzymatic biosynthesis of MOAs and can enhance the production of these MOAs for future studies.