THOMPSON RIVERS UNIVERSITY

CHEMISTRY 4480

Please complete and return to the B.Sc. Advisor,
TRU, for approval.

Student Name **Benjamin Sinclair** **Student No.** **T00705900**

Term Fall 2025 & Winter 2026 Prerequisites Completed: Yes

Title of Project: Evaluating the anti-biofilm activity, cytotoxicity, and DNA binding capability of promising macropin1 and indolicidin antimicrobial derivatives.

Start Date September 2025 Completion Date April 2026

TRU supervisor: Dr. Heidi Huttenen-Hennelly[1]
TRU co-supervisor: Dr. Eric Bottos[2]

Department or Affiliation: [1]Physical Sciences (Chemistry) [2]Biological Sciences

Credit Value: Chemistry 4480 credit = 3

one meeting with a supervisor every 2 weeks plus 3 hours laboratory work per week for two terms

Course Description: Please attach a description of the project.

Supervisor Signature: _____ Date: _____

Co-Supervisor Signature:_____ Date: _____

Signature of Student: BS Date: September 3, 2025

Approval

TRU BSc Advisor _____ Date:_____

Description of Project (1 page maximum):

Due to widespread and continuous use of traditional antibiotics, antibiotic resistant bacteria are becoming more common. The use of alternative antimicrobial agents including antimicrobial peptides (AMPs) is a promising solution. AMPs specifically are characterized by their broad-spectrum activity, fast action, and difficult development of resistance. Current research on AMPs focuses on maximizing antimicrobial activity while minimizing hemolysis/cytotoxicity, antibiofilm capabilities, and mechanisms of action including membrane interactions, and nucleic acid or protein binding.

This project will follow previous work done at TRU which established multiple peptides as promising AMPs. These peptides are derivatives from naturally occurring AMPs: indolicidin (found in bovine neutrophils) and macropin1 (found in bee venom). Macropin1 and one derivative (MR) will be tested along with indolicidin and 2-3 of its derivatives.

Biofilms are microbial communities that form on a surface, and can pose unique challenges in medicine and other fields. This is mostly due to a protective matrix covering the biofilm formed by secreted polymers which makes the microbes more resistant to stressors, antibiotics, or immune responses. This research will test the antibiofilm capabilities of these promising new AMPs. Biofilms will be grown in lab and treated with the AMPs at various concentrations to determine the activity of each peptide.

While the hemolytic effects of the AMPs of interest have already been assessed in previous research, cytotoxicity has not. This research will evaluate the cytotoxic effects of these peptides against endothelial cells. Cells will be grown in culture and treated with the peptides. Their viability will then be measured to determine if cytotoxic effects are present.

A DNA binding assay will also be done using these peptides which could provide insights into the mechanisms of antimicrobial action. Low affinity to DNA could suggest that membrane disruption alone is how the peptide kills a microbe while high affinity to DNA could suggest that the peptide must enter the cell and then disrupt cell processes by binding DNA.

This research will help fully establish the capabilities of these novel AMPs which could lead to their eventual use in real world anti-microbe applications.