



COLLEGE of
BIOLOGICAL SCIENCE

DEPARTMENT OF MOLECULAR
AND CELLULAR BIOLOGY

Announcement:

All interested members of the university community are invited to attend
the Final Oral Examination for the degree of **Master of Science** of

MACKENZIE VERHOEF

On Monday, April 24, 2023 at 1:30 p.m. (SSC 3317)

Thesis Title: Teichoic acid-associated surface charge impacts *Staphylococcus aureus* host adhesion

Examination Committee:

Dr. Matthew Kimber, Dept. of Molecular and Cellular Biology (Exam Chair)

Dr. Georgina Cox, Dept. of Molecular and Cellular Biology

Dr. Marc Habash, School of Environmental Sciences

Dr. Priyanka Pundir, Dept. of Molecular and Cellular Biology

Advisory Committee:

Dr. Georgina Cox (Advisor)

Dr. Chris Whitfield

Dr. Marc Habash

Abstract: *Staphylococcus aureus* is a highly adaptive pathobiont capable of colonizing and infecting many sites within the human body, resulting in different clinical outcomes. An early and important step in bacterial colonization and infection is adhesion to the host, which is essential for *S. aureus* pathogenesis. The research in this thesis explores the role of FmtA in *S. aureus* host adhesion. The teichoic acid (TA) D-alanine (D-Ala) esterase, FmtA, was previously found to have an uncharacterized role in *S. aureus* adhesion by the Cox Lab. TAs are cell wall polysaccharides decorated with D-Ala moieties that alter the overall and intrinsic negative charge associated with the TA backbone. FmtA hydrolyses the ester bond between positively charged D-Ala residues and the TA backbone. Modification of TA charge impacts overall cell surface charge, influencing many cellular processes. Using cell surface charge and adhesion assays, the importance of surface charge in *S. aureus* host adhesion was uncovered. Further investigation revealed that TA charge also plays a role in the spatial regulation of the cell wall-anchored (CWA) Staphylococcal protein A (SpA) adhesin. Overall, I propose that *S. aureus* can dynamically regulate cell surface charge in response to different environments to enable optimal adhesion, promoting infection and colonization. The FmtA-associated adhesion phenotype is likely due to two factors: increased electronegativity and reduced surface display of CWA adhesins.

Curriculum Vitae: Mackenzie completed her Bachelor of Science (Hons.) in Microbiology (Co-op) at the University of Guelph in April 2021. In May of the same year, she began her Master of Science program in Molecular and Cellular Biology at the University of Guelph in the lab of Dr. Georgina Cox.

Awards: Best Graduate Poster Award at University of Guelph Graduate Student Symposium (2022).

Publications: Berry, Verhoef, M. T. A., Leonard, A. C., & Cox, G. (2022). *Staphylococcus aureus* adhesion to the host. *Annals of the New York Academy of Sciences*, 1515(1), 75-96.