



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

MARGARET SMITH

on Thursday, August 19, 2021 at 1:30 p.m. (online)

Thesis Title: Probing the potential of a charge-based stabilizing interaction between the
Vitis riparia YSK₂ dehydrin and yeast frataxin

Examination Committee:

Dr. John Vessey, Dept. of Molecular and Cellular Biology (Exam Chair)

Dr. Steffen Graether, Dept. of Molecular and Cellular Biology

Dr. Rod Merrill, Dept. of Molecular and Cellular Biology

Dr. John Dawson, Dept. of Molecular and Cellular Biology

Advisory Committee:

Dr. Steffen Graether (Advisor)

Dr. Rod Merrill

Abstract: Dehydrins are intrinsically disordered proteins expressed ubiquitously throughout the plant kingdom in response to abiotic stresses that cause a loss of intracellular water. It is likely that these proteins serve multiple roles within the cell, including macromolecule stabilization. The impact of the charge distribution of a YSK₂ dehydrin from *Vitis riparia* on the stability of yeast frataxin homologue 1 (Yfh1) at cold temperatures was examined using circular dichroism spectroscopy. Three mutant YSK₂-constructs were created for comparison: one with evenly distributed positive charge (YSK₂-SpaceK), one with locally neutralized charge (YSK₂-Neut), and one with the lysine residues substituted for arginine residues (YSK₂-K→R). The cryoprotective efficiency of these constructs in addition to a fourth, YSK₂-φ→T (specific hydrophobic residues substituted with threonine) were also compared in a lactate dehydrogenase (LDH) activity assay under the assumption that a different cryoprotective mechanism, one that is not charge-based, was taking place. The results showed that clustered positive charge is an important part of the cryoprotective mechanism of dehydrins with respect to Yfh1 but not LDH, where instead, hydrodynamic radius appears to be a more significant factor. This is suggestive of a charge-based interaction between YSK₂ and Yfh1 that should be studied in greater detail in future work.

Curriculum Vitae: Margaret completed her Bachelor of Science (Hons.) at the University of Guelph in the summer of 2019, and then began her MSc in the lab of Dr. Graether in the fall of the same year.