UNIVERSITY of GUELPH

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*

LAURA SEIDEL

on Thursday, August 20, 2020 at 9:30 a.m. (online)

Thesis Title: **Investigating the structure of the *Escherichia coli* divisome protein FtsK via covariance analysis.**

Examination Committee:

Dr. George van der Merwe, Dept. of Molecular and Cellular Biology (Exam Chair)
Dr. Cezar Khursigara, Dept. of Molecular and Cellular Biology
Dr. Chris Whitfield, Dept. of Molecular and Cellular Biology
Dr. Siavash Vahidi, Dept. of Molecular and Cellular Biology

Advisory Committee:

Dr. C. Khursigara (co-advisor)
Dr. M. Kimber (co-advisor)
Dr. C. Whitfield

Abstract: In bacterial cells, cytokinesis is carried out by the divisome, a highly intricate, multi-protein complex. In *Escherichia coli* the divisome consists of 10 essential proteins, with multiple accessory proteins. It is responsible for septum formation, constriction of membranes, and synthesis of septal peptidoglycan. The *E. coli* divisome protein FtsK is an integral-membrane protein that is implicated cell division and chromosome segregation. The N-terminal portion of FtsK ($FtsK_N$) is the only domain required for cell division and is of unknown structure. This project provides insight into the tertiary structure of $FtsK_N$ using covariance-guided structural modelling in combination with *in vivo* functional assays. The coevolutionary prediction algorithm GREMLIN was used to output predicted amino acids in contact within $FtsK_N$. Contact predictions were tested via temperature-sensitive complementation assays assessing cell morphology and length. *In vivo* testing identified residues believed to be in contact within the tertiary structure of $FtsK_N$, and highlights areas of importance for future studies. The results of the covariance analysis were used to generate preliminary structural models of $FtsK_N$. The work presented in this thesis advances our currently limited knowledge of the structural assembly of the divisome, thereby furthering the understanding of a fundamental cellular process.

Curriculum Vitae: Laura completed her B.Sc. (Hons.), Biochemistry Coop Program, at the University of Guelph in 2017, and then began her MSc that fall, with advisors Dr. Cezar Khursigara and Dr. Matthew Kimber.

Awards: Ontario Graduate Scholarship (OGS) (2018-19); Natural Sciences and Engineering Research Council of Canada (NSERC) CGS-M (2017)

Publications: Berezuk, A.M., Roach, E.J., Seidel, L., Lo, R.Y., and Khursigara, C.M. (2020). FtsA G50E mutant suppresses the essential requirement for FtsK during bacterial cell division in *Escherichia coli*. Can. J. Microbiol. *66*, 313–327.

Roach, E.J., Wroblewski, C., Seidel, L., Berezuk, A.M., Brewer, D., Kimber, M.S., and Khursigara, C.M. (2016). Structure and mutational analyses of *Escherichia coli* ZapD reveal charged residues involved in FtsZ filament bundling. J. Bacteriol. *198*, 1683–93.