



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

VICTORIA SANDERSON

on Tuesday, June 2, 2020 at 1:30 p.m. (online)

Thesis Title: Improving Lyme disease direct detection: Identification of a novel method to enrich for *Borrelia* in blood, and comparing surveys and serology in a chronically ill patient cohort.

Examination Committee:

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

Dr. M. Wills, G. Magnotta Lyme Disease Research Lab, MCB

Dr. N. Jones, Dept. of Molecular and Cellular Biology

Dr. G. Harauz, Dept. of Molecular and Cellular Biology

Advisory Committee:

Dr. M. Wills (Co-Adv)

Dr. C. Khursigara (Co-Adv.)

Dr. N. Jones

Abstract: Lyme disease is a growing public health threat impacting hundreds of thousands of individuals each year. This multi-system disease is caused by the spirochetal bacterium, *Borrelia*, an obligate parasite transmitted to humans by *Ixodes* ticks. The laboratory test for Lyme disease is serological, meaning it is reliant on the adaptive immune response which limits early diagnosis and is unable to distinguish between active and resolved infection. As a result, there is interest in tools that can directly detect the microorganism and its associated biomarkers. However, there is no consensus or validation regarding the methodologies used to process blood for this purpose. The overarching goal of this research is to determine how Lyme disease diagnostics can be improved, with a focus on direct detection techniques. Our findings show that the most commonly used anticoagulant, EDTA, severely limits *Borrelia* culture growth but sodium citrate provides a viable alternative. Additionally, a mock-infected blood model demonstrates that serum and plasma, the typical test sources in the literature, lose the majority of *Borrelia* during processing, while isolation of the platelet fraction provides an enriched source of detectable *Borrelia*. Existing diagnostic techniques were analyzed on a 70-participant cohort of chronically ill patients and healthy controls by comparing serological status and clinical diagnostic survey results. Collectively, this research questions unfounded assumptions that have persisted in the field of Lyme disease diagnostics and provides foundational work informing future avenues of direct detection research.

Curriculum Vitae: Victoria completed her Bachelor of Science (Hons.) at UBC Okanagan in April 2018 and then began her MSc in the G. Magnotta Lyme Disease Research Lab with Dr. Melanie Wills in May 2018.

Publications: (from MSc) Bamm, V. V., Ko, J.T., Mainprize, I.L., Sanderson, V.P., and Wills, M.K.B. (2019). Lyme disease frontiers: Reconciling borrelia biology and clinical conundrums. *Pathogens* 8: 299.

(from BSc) Sanderson, V., Bamber, N., and Pelletier, N. (2019). Cradle-to-market life cycle assessment of Okanagan (Canada) cherries: Helicopters, seasonal migrant labour and flying fruit. *J. Clean. Prod.* 229, 1283–1293