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 ***Doctor of Philosophy*** *of*

JACOB WILDE

On Thursday, April 20, 2023 at 9:30 a.m. (SSC 2315)

Thesis Title: **Experimental frontiers in the study of human-associated bacteriophages**

Examination Committee:

Dr. Matthew Kimber, Dept. of Molecular and Cellular Biology (Exam Chair)
Dr. Emma Allen-Vercoe, Dept. of Molecular and Cellular Biology
Dr. Rebecca Shapiro, Dept. of Molecular and Cellular Biology
Dr. Marc Habash, School of Environmental Sciences
Dr. Alexander Hynes, Farncombe Family Digestive Health Research Institute, McMaster University (External Examiner)

Advisory Committee:
Dr. Emma Allen-Vercoe (Advisor)
Dr. Cezar Khursigara
Dr. Rebecca Shapiro
Dr. Scott Weese

Abstract: A substantial fraction of the world's bacteriophages can be categorized as 'temperate' or 'lytic.' In mammalian microbiomes, temperate enrichment and lytic reduction are distinguishing features of the viral community. This contrasts aquatic and soil ecosystems where lytic phages tend to dominate. As of 2023, researchers are beginning to understand the ecological factors that give temperate phages a competitive edge in gut microbiomes. There is value in understanding 'why,' but understanding the consequences of temperate enrichment will be just as relevant to human health, if not more. Little evidence exists to suggest how temperate prevalence influences microbiome composition and function. While there is strong indication of a link between temperate enrichment and microbiome features, few studies have had the capability to detect causal influence. To move from correlation to causation, researchers must move away from descriptive metagenomic snapshots and employ experimental manipulation of complex community models. There are several methodological limitations that forestall these studies, including but not limited to: a lack of methods for reducing lytic signals (whilst enriching temperate signals) in complex microbiome models, and a lack of methods for quantifying non-plaque-forming phages. The inability to reduce lytic signals is especially restrictive to studying temperate dynamics, as temperate signals are often subtle and easily washed out by the prominent effects of lytic predation. **The driving goal of this thesis is to innovate new methods and tools for studying temperate dynamics in complex microbiome models.** To create a method for excluding lytic signals whilst enriching temperate signals, I rely on a technique as old as microbiology itself: dilution and plate culture. To quantify prophage reads, I utilize a qPCR assay paired with DNase I treatment to distinguish encapsidated vs. non-encapsidated prophage copies. This work, which utilizes these newly developed tools to provide glimpses of temperate influence,

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opens the door to novel experimental designs and approaches, and ultimately, a deeper understanding of temperate phage influence in mammalian microbiomes.

Curriculum Vitae: Jacob completed his BA Honours in Psychology at Queen's University in April 2018. He then began his PhD in Molecular and Cellular Biology under the supervision of Dr. Emma Allen-Vercoe in May 2018.

Awards: Award for best presentation, Phage Canada Symposium (2020); Award for most promising science, Anaerobe (2021).