



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

RYAN, PATRICK, on Wednesday, December 20, 2017 at 9:30 a.m. in SSC 3317
(Advisor: Dr. M. Kimber)

Thesis Title: A molecular investigation of the interaction between Rubisco and beta-carboxysome interior organizer CcmM.

Examination Committee:

Dr. F. Brauer, Dept. of Molecular and Cellular Biology (Chair)
Dr. M. Kimber, Dept. of Molecular and Cellular Biology
Dr. T. Akhtar, Dept. of Molecular and Cellular Biology
Dr. S. Seah, Dept. of Molecular and Cellular Biology

Abstract: Cyanobacteria and some chemoautotrophs sequester Ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) in close proximity to CO₂ using large proteinaceous microcompartments called carboxysomes, to improve carbon fixation efficiency. Carboxysomes are built from tens of thousands of protein subunits with a closed icosahedral shell that is selectively permeable for certain substrates and metabolites. This shell encases functional enzymes, including Rubisco, within. CcmM is an interior β -carboxysome protein that has been implicated in organizing the carboxysome interior. The C-terminal domain of CcmM is built of three to five subunits that closely resemble the small subunit of Rubisco, and have been implicated in organizing Rubisco into a core that the carboxysomal shell forms around. This thesis reports the first known X-ray crystallographic structure of the first C-terminal domain in the chain, "SS1", from *T. elongatus* BP-1. Förster Resonance Energy Transfer, Surface Plasmon Resonance and Native mass spectrometry experiments show CcmM binds Rubisco with micromolar affinities. Six SS1 domains can bind to Rubisco with no indication of RbcS release, suggesting that binding does not fully displace RbcS. A novel molecular binding model for the CcmM-Rubisco complex is proposed.

Curriculum Vitae: Patrick obtained his B.Sc. (Hons.) in Biochemistry at McMaster University in June 2015. Later that fall, he began his M.Sc. graduate studies in the laboratory of Dr. Matthew Kimber.