

BIOGRAPHY

Ph.D. Candidate

Rossella Calvaruso

Graduate Academic Unit

Biology

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**December 21, 2022**

**1 p.m. (Atlantic)**

**Virtual Defence**

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Examining Board:

Dr. Aurora Nedelcu (Biology)

Dr. Dion Durnford (Biology)

Dr. Allison Enright (Earth Sciences)

Dr. Adrian Reyes-Prieto (Biology) Supervisor

External Examiner: Dr. Luciana Santoferrara
Biology
Hofstra University

The Oral Examination will be chaired by:

Dr. Kevin Englehart, Associate Dean of Graduate Studies

Universities attended (with dates & degrees obtained):

2013 – present Ph.D. candidate, University of New Brunswick
2012 M.Sc. in Marine Biology and Ecology, University of Messina
2010 B.Sc. in Marine Biology and Ecology, University of Messina

Publications:

Calvaruso, R., Lawrence, J., and Reyes-Prieto, A. 2021. Cytometric Analysis of Diverse Glaucophyte Species Reveals Distinctive Signals Useful for Fluorescence-Based Detection and Sorting. *bioRxiv*.

Lalla, C., **Calvaruso, R.**, Dick, S., and Reyes-Prieto, A. 2021. Winogradsky Columns as a Strategy to Study Typically Rare Microbial Eukaryotes. *European Journal of Protistology* 80:125807.

Brown, J., Hawkes, K., **Calvaruso, R.**, Reyes-Prieto, A., and Lawrence, J. 2021. Seasonality and Distribution of Cyanobacteria and Microcystin Toxin Genes in an Oligotrophic Lake of Atlantic Canada. *Journal of Phycology* 57 (6):1768-1776.

Valadez-Cano, C., Hawkes, K., **Calvaruso, R.**, Reyes-Prieto, A., and Lawrence, J. 2022. Amplicon-based and Metagenomic Approaches Provide Insights into Toxigenic Potential in Understudied Atlantic Canadian lakes. *FACETS* 7 (1): 194-214.

Conference Presentations:

2014, June 25-29. Canadian Institute for Advance Research, Integrated Microbial Biodiversity Program Meeting, Liblice (Prague, Czech Republic). Poster: Using fluorescence-activated cell sorting for identification of Glaucophytes.

2016, April 17-23. Canadian Institute for Advance Research, Integrated Microbial Biodiversity Program Meeting and Sampling Trip, CARMABI Caribbean Research and management of Biodiversity, Willemstad Curacao (Lesser Antilles). Talk: Investigate microbial eukaryotic diversity via progressive filtration with emphasis on glaucophytes.

2017, June 7-9. Canadian Institute for Advance Research, Integrated Microbial Biodiversity Program Meeting and Trainee's Workshop, Whistler BC. Poster: Cytometric analysis of diverse glaucophytes for fluorescence based identification.
Flash Talk (Trainee's Workshop): Using flow cytometry and high-throughput sequencing to investigate microbial diversity: the case study of Glaucophyta.

Use of flow cytometry and metabarcoding approaches to investigate the presence and abundance of the rare Glaucophyta in Nature

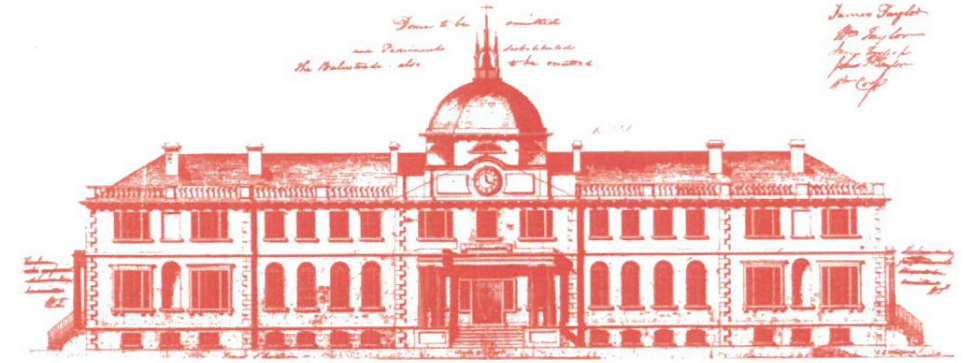
Abstract

Eukaryotic cells acquired their photosynthetic machinery via primary endosymbiosis with cyanobacteria ~1 billion years ago. Various evidence suggests that the Archaeplastida lineage (rhodophytes, rhodophytes, rhodophytes, picozoans, viridiplants and glaucophytes) descended from those first photosynthetic eukaryotes. However, the single origin of the Archaeplastida nucleo-cytoplasm host is still contentious and one of the main approaches for investigating that evolutionary scenario has been the limited data available for the rare Glaucophyta.

The central aim of my dissertation is to establish reliable methods to detect, identify and isolate glaucophyte cells, or their genetic material, from the environment. Glaucophyte cells are characterized by a distinctive green-blue color due to the combination of blue phycobiliproteins (allophycocyanin and C-phycocyanin) with chlorophyll a. I used this set of photopigments in a cytometric investigation of glaucophyte autofluorescence (Chapter 2) to establish that this diagnostic feature can be used to distinguish glaucophyte cells in complex cell mixtures and isolate them to establish subcultures utilizing Fluorescence Activated Cell Sorting. The methodology presented provides a novel protocol to investigate glaucophytes, but also identified important challenges due to the low abundance of glaucophytes in nature. To overcome the challenges associated with such low abundances, it was then important to explore culture-independent methods, such as metabarcoding, which has become routine in surveys of microbial presence, abundance and diversity.

In Chapter 3 of my thesis, I present a DNA metabarcoding survey of four different freshwater environments of southeast New Brunswick (Canada) to investigate microbial eukaryotic diversity, with the central goal of detecting glaucophytes. I detected members of the genus *Glaucocystis* in two of the collection sites at relatively high abundances when compared to the rest of the photosynthetic eukaryotic community.

The presence of glaucophytes in local collection sites, together with some reports in the literature, laid the foundation for the work of Chapter 4, which includes the analysis of novel environmental samples and publicly available metabarcoding datasets. The aim of my last thesis chapter was to corroborate existing glaucophyte records and to present novel findings using a homogeneous bioinformatic workflow for reliably comparing the diverse datasets currently available. The two methodologies explored in my work provide a solid foundation for further investigations into the Glaucophyta and, more broadly, into any other rare microbial taxon.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

The University of New Brunswick recognizes that the university sits on traditional Wolastoqey territory. The river that runs right by our university – the St. John River – is also known as Wolastoq, along which live the Wolastoqiyik -- the people of the beautiful and bountiful river.

UNIVERSITY OF NEW BRUNSWICK SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Rossella Calvaruso

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY