

## GRAL PhD PROJECT 2020-2023

**Title of the PhD project:** Multiscale study of the host control on its symbiotic microalgae

**PhD supervisor:** Gilles Curien

**PhD co-supervisor:** Johan Decelle

**Research institute:** IRIG

**Laboratory:** PCV, UMR

**Research team:** Photosymbiosis (J. Decelle) and EDyP (Y. Coûté)

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**Summary of the project:** Microalgae originally acquired photosynthesis through endosymbiosis with a chloroplast-bearing prokaryotic or eukaryotic cell. The establishment of a metabolic connection between the host cell and its captured photosynthetic endosymbionts is recognized to be a fundamental step. However, the underlying mechanisms and molecular players of the metabolic interaction remain uncharacterized. Photosymbioses between single-celled host and intact microalgae represent the best available experimental systems to study the first steps of plastid acquisition. This **PhD project aims at unveiling the mechanisms by which the host accommodates and exploits its microalgae, using a combination of different imaging techniques, proteomics and functional genomics on the *Paramecium-Chlorella* symbiosis.** The structural integration of the microalgae in their host cell will be investigated with 3D electron microscopy. Fluorescence microscopy markers will be used to further characterize the symbiosome, a host-derived vacuole that contains the microalgae. The symbiosome membrane will be then purified and proteins will be revealed with mass spectrometry-based proteomics. The function of some key host proteins will be assessed using RNAi approach and a morpho-functional screening assay combining multimodal imaging. Results will not only improve our knowledge of the metabolic interactions in photosymbiosis, but will also bring new evolutionary insights into plastid acquisition in eukaryotes.

**Keywords:** Photosymbiosis, microalgae, proteomics, high-resolution imaging, fluorescence microscopy

**Applicant profile:** Background in biology and physiology, and basic training in molecular biology and imaging. Knowledge and research experience in microalgae or plants, photosynthesis, plastid physiology, oceanic plankton, would be considered an advantage. The candidate should have good interpersonal skills and ability to work independently, but also to interact well within a research group.

### Three recent publications of the PhD supervisor

Decelle J, Veronesi G, Gallet B, Stryhanyuk H, Benettoni P, Schmidt M, Tucoulou R, Passarelli M, Bohic S, Clode P, Musat N (2020) Subcellular Chemical Imaging: New Perspectives in Cell Biology. Trends in Cell Biology In Press DOI:<https://doi.org/10.1016/j.tcb.2019.12.007>

Decelle J, Stryhanyuk H, Gallet B, Veronesi G, Schmidt M, Balzano S, Marro S, Uwizeye C, Jouhet J, Maréchal E, Lupette J, Schwab Y, Schieber N, Tucoulou R, Richnow H, Finazzi G, Musat N (2019) Algal remodeling in a ubiquitous planktonic photosymbiosis. Current Biology. 29, 968–978 <https://doi.org/10.1016/j.cub.2019.01.073>