Funded PhD project in Integrated Structural & Cell Biology in Grenoble, France

Title of the PhD project: MixCO2 - Exploring the structural and metabolic bases of microalgal mixotrophy for optimum biomass production

PhD supervisors: Giovanni Finazzi & Guillaume Allorent

Host laboratory: Laboratoire de Physiologie Cellulaire & Végétale, Light Photosynthesis & Metabolism (PHOTOSYNTHESIS) team - https://lpm-research.com/

Project summary: Microalgae are extremely versatile photosynthetic machines, optimizing their growth through a balance between light capture, use and dissipation (when light exceeds photosynthetic capacity). Light capture and dissipation are controlled by the light itself, via its color. Harvesting depends on the color of the sun's radiation, as pigments do not harvest all wavelengths with the same efficiency. Light dissipation also depends on its color, because the different protein players involved in excess light dissipation are induced by different photoreceptors, activated by different wavelengths. On the contrary, the use of light depends on the partitioning of reducing power between the different sinks (CO_2, exogenous carbon acceptors) used in the different trophic modes (phototrophy, heterotrophy, mixotrophy).
Is there a relationship between the regulation of light harvesting and dissipation by light itself and the consumption of light by downstream metabolism? Our working hypothesis is that light and trophic modes trigger specific structural changes in the light-harvesting and CO_2-fixing compartment, the chloroplast. These changes modulate the efficiency of these two processes in a coordinated manner.
In this project, we will test this possibility by combining state-of-the-art cell imaging approaches, cell biology, and biochemistry to provide a new interpretation of the link between light capture and utilization and to propose new ideas for implementing carbon assimilation for potential downstream biotechnological applications, in line with the objectives of the DefiCO2 project (https://defico2.univ-grenoble-alpes.fr/en).

Preferred skills:
- Expertise in cell culture. Previous demonstrated expertise in microalgae cultures will be a plus.
- Expertise in biochemistry (isolation and purification of membranes, BN-PAGE, 2D electrophoresis, western blot)
- Basic expertise in molecular biology (DNA extraction, PCR)
- Basic knowledge on microscopy
- Knowledge on the physiology of photosynthesis
- Effective oral and communication skills and strong ability to report and present data
- Excellent collaboration skills, high capacity to take initiatives

Student role: The PhD student will be involved in all the different tasks of this project. She/he will contribute to the decisions regarding the project in agreement with her/his two supervisors. She/he will participate in the design of the experiments, their realization, as well as in the analysis of the results. The candidate will be encouraged to disseminate results of the project at local, national and international conferences and contribute to the redaction of publications related to the project. The recruited candidate will be host in the LPCV lab (https://www.lpcv.fr/en) by the LPM team (https://lpm-research.com/) composed of ~15 researchers, technicians, postdocs and PhD students. She/he will benefit from the strong expertise of the host team in microalgal cultures and photosynthesis measurements as well as the training provided by the imaging platform of the institute and the LPM team for the microscopy part of the project.

Keywords: photosynthesis, microalgae, light, CO2, environmental responses

Relevant publications of the team:

DalBo et al., 2021. *Front Plant Sci*. doi: 10.3389/fpls.2021.628684
Uwizeye et al., 2021. *Nature communications*. doi: 10.1038/s41467-021-21314-0
Flori et al., 2017. *Nature communications*. doi: 10.1038/ncomms15885
Allorent et al., 2016. *PNAS*. doi: 10.1073/pnas.1607695114
Bailleul et al., 2015. *Nature*. doi: 10.1038/nature14599