Internship Proposal – Master 2

Understanding the role of self-assembled carotenoids in chromoplasts

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Project:

The LBMS team is interested in understanding the role that self-assembled carotenoids play in chromoplast. Carotenoids are key components in the mechanisms underlying the function of photosynthetic membrane proteins. In these proteins, carotenoids have a paradoxical role acting as antennae (harvesting light) or dissipating excess of energy damaging for the organisms (photoprotection). The LBMS team is recognized for their contribution in understanding the molecular mechanisms controlling the ultrafast steps in photosynthesis by using vibrational spectroscopies like resonance Raman. Carotenoids are also found as self-assembled structures in chromoplast, with different organizational parameters depending on the species. Carotenoids assemblies are capable to undergo singlet fission to dissipate quickly energy, however, their role or the reason for carotenoid aggregation in plastids are unclear.

This project combine the use of biochemical techniques with advanced spectroscopic methods to understand the properties and function of the carotenoids in chromoplast. The student will learn to purify chromoplasts (from tomato, daffodils, and red peppers) and to extract and isolate the carotenoids from the plastid. Then, the student will use vibrational techniques like resonance Raman to characterize the conformation, configuration, and aggregation state of carotenoids. Finally, the student will carry out studies of photo-resistance (photobleaching) of isolated carotenoids against chromoplasts. To this end, the student will use a continuous LED with control of intensity and emission in UV and Vis.

For this internship, the student is expected to be rapidly autonomous in mastering some current lab techniques, such as sample preparation, Raman spectroscopy. Thus, previous experience in a laboratory environment would be desirable.

References:

Llansola-Portoles, M. J., K. Redeckas, S. Streckaité, C. Ilioaia, A. A. Pascal, A. Telfer, M. Vengris, L. Valkunas and B. Robert (2018). "Lycopene crystalloids exhibit singlet exciton fission in tomatoes." Physical Chemistry Chemical Physics **20**(13): 8640 - 8646.