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Master in Photonics – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”

MASTER THESIS PROPOSAL

Dates: April - September 2020

Laboratory : Single Molecule Biophotonics

Institution: ICFO-The Institute of Photonic Sciences

City, Country : Castelldefels, Spain

Title of the master thesis: Multicolor Single Molecule Localization Microscopy to Monitor the Organization of the Golgi Complex

Name of the master thesis supervisor: Felix Campelo

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Keywords : Super-resolution Microscopy, Single Molecule Localization, Golgi complex, Endoplasmic Reticulum

Summary of the subject (maximum 1 page) :

The Golgi complex is the central cellular organelle where secretory proteins (such as insulin, collagens, or neurotransmitters) mature to their final fully-functional form after which they are exported in membrane-bound transport carriers for secretion outside the cells. What is the mechanism that ensures that only fully matured proteins are secreted?

The answer to this question is yet unknown, but indirect evidence from several groups, including ours, suggests that the Golgi membranes need to be laterally compartmentalized into nanoscopic, highly-dynamic regions that present the optimal microenvironment for the timely organization of protein maturation and export. In particular, export domains set the grounds for transport carrier formation for secretion, whereas protein maturation occurs in enzymatic domains. However, due to their intrinsic dynamic character and small size (intra-Golgi transport carriers have sizes of 60-90 nm, and enzymatic domains are probably even smaller), experimental accessibility to such functional membrane domains has been challenging.



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The goal of this Master Project is to apply advanced microscopy techniques, such as Single Molecule Localization Microscopy (SMLM), to visualize the lateral organization of different proteins that constitute either export or enzymatic domains at the Golgi membranes with unprecedented spatial resolution. In particular, the Master student will perform two-color SMLM to determine the relative localization of each of the known molecular players involved in the process. Altogether, the student will be able to actively participate in a joint effort that brings together molecular cell biologists, experimental and theoretical biophysicists, and advance bionanophotonic tools to make ground-breaking discoveries in the field of membrane trafficking and intracellular organization and to push the frontiers of advanced optical instrumentation, data analysis algorithms and biophysical modeling.

Additional information:

- * Required skills : No prior knowledge or experience in biology is required, but the student is expected to be keen on understanding cell biological processes and learning new techniques.
- * Miscellaneous :