



ERASMUS MUNDUS



MASTER IN PHOTONICS – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”

MASTER THESIS PROPOSAL

Dates: April - September 2019

Laboratory : Single Molecule Biophotonics
Institution: ICFO-The Institute of Photonic Sciences
City, Country : Castelldefels, Spain

Title of the master thesis: Single Molecule Localization Microscopy to Monitor Collagen Export from the Endoplasmic Reticulum

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Keywords : Super-resolution Microscopy, Single Molecule Localization, Collagen Export, Endoplasmic Reticulum

Summary of the subject (maximum 1 page) :

Over the past four decades, we have witnessed the discovery of molecular machinery of how cells secrete newly synthesized proteins to the extracellular milieu. However, these discoveries do not reveal how bulky cargos such as collagens, which constitute up to 25% of our dry body weight, are exported. Collagens are large, rigid proteins that cannot be accommodated into the canonical (small) transport carriers that export most secretory proteins from the endoplasmic reticulum (ER). A major step towards understanding collagen export was provided by the identification of TANGO1, a fundamental player in export of collagens from the ER. Super-resolution light microscopy approaches showed that TANGO1 assembles at specific ER subdomains into rings of ~200 nm in size. However, these new findings also raise new issues. In particular, the three-dimensional morphology of these collagen-containing transport carriers and the physical mechanisms by which they are formed and cut from the ER membrane to produce a large collagen-filled container still remain elusive. Moreover, the stoichiometry of TANGO1 filaments and temporal organization of their dynamic (dis)assembly are completely unknown.



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The goal of this Master Project will thus be to apply advanced microscopy techniques, such as Single Molecule Localization Microscopy, to visualize the 3D structures of TANGO1-containing collagen export domains with unprecedented spatial resolution. In particular, the Master student will determine the molecular density and relative localization of each of the known molecular players involved in the process; and compare these observations with the predictions of a newly developed biophysical model. 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 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 candidates are expected to be keen on understanding cell biological processes and learning new techniques.

* Miscellaneous :