



Master in Photonics – “PHOTONICS BCN” Master ERASMUS Mundus “EuroPhotonics”

MASTER THESIS PROPOSAL

Starting full time from April 2024

Presentation at the end of July or beginning of September 2024

Laboratory: Single Molecule Biophotonics

Institution: ICFO

City, Country: Castelldefels, Spain

Title of the master thesis: Using state-of-the-art fluorescence microscopy techniques to study the mechanobiology of the secretory pathway

Name of the master thesis supervisor and co-supervisor: Fèlix Campelo and Javier Vera

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Keywords: Mechanobiology, Golgi apparatus, stretching, fluorescence microscopy, protein secretion.

Summary of the subject (maximum 1 page):

Cells interact with their environment through focal adhesions (FAs), molecular platforms that bridge the extracellular matrix (ECM) and the cytoplasm. These adhesion complexes serve as sensors of a wide variety of mechanical forces, including tensile forces or the rigidity of the ECM. These physical forces are converted into biochemical signals, acting as initiators of different signaling cascades that regulate cellular processes such as differentiation, proliferation, adhesion and migration. Despite the knowledge earned in the past decades about the role of the cell surface in mechanosensing, little is known about whether the endomembrane system inside the cells also takes part in mechanotransduction.

Recent studies have shown that mechanical forces regulate transport carrier formation in the Golgi apparatus, the central cellular organelle responsible for protein maturation, trafficking, and secretion. Moreover, those carriers are delivered near or at FAs, suggesting that there might be a bidirectional communication between the plasma membrane and the Golgi. The study of the mechanobiology of the endomembrane system has gained increasing attention in recent years, making it in one of current hot topics in cell biology. Because the field is still in its infancy, there are many questions in the need for answers, such as which are the mechanisms governing the communication between the extracellular milieu and different organelles, or how cells respond and adapt to changes in their environment. Answering these questions is crucial to understand cell behavior in physio- and pathological conditions, such as cancer. This could help opening up new venues in cancer research and treatment.



Objectives:

The goal of this Master Project will be to apply advanced fluorescence microscopy techniques, together with mechanical stretching devices, and molecular and cell biology tools to study how mechanical signals affect cellular trafficking, the mechanisms of communication behind such processes, and how cells adapt to changes in their environment. Altogether, the student will join an interdisciplinary group aimed at tackling still mysterious fundamental topics in cell biology with a clear pathophysiological relevance, and will have the opportunity to work in a collaborative project that joins several groups of scientific excellence at national and international level.

Additional information (if needed):

- * 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: