

Felicidades al nuevo graduado de doctorado del ICFO

El Dr. Roger Pons Lanau se ha doctorado con una tesis titulada "Single-Molecule Spatiotemporal Dynamics of Protein Export from the Endoplasmic Reticulumi¿½

November 12, 2026

Felicitamos al Dr. Roger Pons Lanau que ha defendido su tesis esta tarde en el Auditorio de ICFO

El Dr. Pons Lanau obtuvo su Master en Fotonica por el Universitat Politecnica de Catalunya antes de unirse al equipo deSingle Molecule Biophotonics dirigido por la profesora ICREA en ICFO Dra. Maria Garcia-Parajo. Su tesis titulada "Single-Molecule Spatiotemporal Dynamics of Protein Export from the Endoplasmic Reticulum" ha sido supervisada por la Dra. Maria Garcia-Parajo y el Dr. Felix Campelo Aubarell.

RESUMEN:

The secretory pathway is a crucial process for cellular homeostasis, responsible for the synthesis, processing, and trafficking of approximately a third of all proteins to their final

destinations. Newly synthesized secretory proteins enter the endoplasmic reticulum (ER) and, after proper folding, are sorted into and exported from specific ER subdomains named ER exit sites (ERES). As the first trafficking step, ER protein export plays a crucial role in ensuring the correct flow of proteins to downstream compartments, and defects result in a variety of pathological conditions. Unraveling its organization in space and time is essential to understanding its mechanisms. Despite the origins of this research field dating to the late 1960s, it was not until the widespread adoption of fluorescence microscopy techniques in the past three decades that rapid progress was made in how we conceptualize ER protein export in living cells. Yet, up until now, researchers have mostly relied on population-averaged measurements, which provide limited information on the molecular heterogeneity inherent in biology. Insights into molecular dynamics, transient interactions, short-lived states, or nanoscale distribution of secretory pathway proteins in living cells have largely remained veiled. Developing a complete view requires characterizing the process at the single-molecule level.

In this thesis, we develop and apply a quantitative framework based on single-molecule fluorescence microscopy to dissect the dynamic organization of the early secretory pathway at the molecular level. By leveraging recent technological advances in fluorescent dyes, functional assays, gene editing, and machine learning tools, our approach enables the detection, monitoring, and analysis of individual cargo protein molecules as they are exported from ERES with high spatial precision (~20-30 nm) and temporal resolution (~10 ms). Our characterization provides novel insights into the orchestration of the early secretory pathway, allowing us to revisit conflicting ideas in the field. Overall, this thesis provides a generalizable methodology and an updated, more accurate view of a fundamental intracellular trafficking process.

Tribunal de Tesis:

Prof. Dr. Franck Perez, Universite de Paris?

Prof. Dr. Nicolas Mateos Estevez, ICFO?

Prof. Dr. Jonathon Nixon-Abell, University of Cambridge



Thesis Committee