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ICFO Colloquium Series: Super-resolution imaging of the human genome in health and disease

MELIKE LAKADAMYALI

March 09, 2026
10:00 to 11:00
ICFO Auditorium

PROFILE:

The overarching goal of the Lakadamyali lab is to understand the molecular mechanisms that regulate sub-cellular organization and the significance of this organization on cell function. Cells are highly compartmentalized: the sub-cellular positioning of organelles, nucleic acids and proteins are spatially and temporally coordinated to ensure that biochemical reactions take place at the right place and time. Lakadamyali lab's research program has three major focus areas that seek to advance our understanding of sub-cellular organization. In the context of the cytosol, we seek to determine how the microtubule cytoskeleton and motors regulate the transport and positioning of organelles within the cytoplasm and the functional consequences of disrupting proper organelle organization. In addition, we are interested in understanding how the molecular identity of organelles is linked to their spatial positioning and function. In the context of the nucleus, we seek to understand how the spatial organization of chromatin regulates gene activity in health and disease. To address these key biological questions, the Lakadamyali lab takes an innovative approach of combining cell biological tools with advanced and highly quantitative microscopy tools including single-molecule tracking and super-resolution microscopy.
Dr. Lakadamyali received several honors including the European Molecular Biology Organization (EMBO) Young Investigator award, ERC-Starting grant, Technical University of Munich-Institute for Advanced Study Hans Fischer Fellowship and the Linda Pechenik Montague Investigator award. Her research has been funded by the ERC, NIH and NSF.

ABSTRACT:

Super-resolution microscopy has opened new possibilities for visualizing the folding and spatial organization of the human genome in situ at nanoscale resolution. Leveraging quantitative super-resolution imaging, we revealed the heterogeneous nature of nucleosome folding and demonstrated that DNA organization at both nano- and meso-scales is highly plastic, dynamically remodeling in response to chemical and mechanical cues in health and disease. By combining biologically interpretable feature extraction with machine learning, we further showed that cells can be accurately classified into distinct states based solely on their

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multi-scale genome organization, while also identifying the specific features that drive classification, thus offering mechanistic insight into cell-state and gene regulation.

Hosted by: Maria Garcia-Parajo