L4H SEMINAR: Mechanism of shaping membrane nanostructures of Endoplasmic Reticulum

MICHAEL KOZLOV

July 12, 2022
12:00 to 13:00
ICFO Auditorium

ABSTRACT:
Recent advances in super-resolution microscopy revealed the previously unknown nanoscopic level of organization of endoplasmic reticulum (ER), one of the most vital intracellular organelles. Membrane nanostructures of 10-100nm intrinsic length scales, which include ER tubular matrices, ER sheet nanoholes, internal membranes of ER exit sites (ERES) and ER transport intermediates, were discovered and imaged in considerable detail, but the physical factors determining their unique geometrical features remained unknown. Here we proposed and computationally substantiated a common concept for mechanisms of all four ER nanostructures based on the membrane intrinsic curvature as a primary factor shaping the membrane and ultra-low membrane tensions as modulators of the membrane configurations. We predicted computationally the existence of a discrete series of equilibrium configurations of ER tubular matrices and recovered the one corresponding to the observations and favored by ultra-low tensions. We modeled the nanohole formation as resulting from a spontaneou collapse of elements of the ER tubular network adjacent to the ER sheet edge and calculate the nanohole dimensions. We proposed the ERES membrane to have a shape of super-flexible membrane bead-chain, which acquires random-walk configurations unless a ultra-low tension converts it into a straight conformation of a transport intermediate. Th adequacy of the proposed concept is supported by a close qualitative and quantitativ similarity between the predicted and observed configurations of all four ER nanostructures

BIO:
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Hosted by: Maria Garcia-Parajo