The Chinese University of Hong Kong
Department of Biomedical Engineering

Graduate Seminar – PhD Oral Defence

Student	***:***	Mr. SONG Yutong
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Date	***:***	13 June 2024
Time	***:***	8:30 am
Venue	***:***	Room 1118, William M W Mong Engineering Building, CUHK

Title: Optogenetic Mechanostimulation of Intracellular Organelles in Live Cells

Many cellular activities and functions depend on the cell's ability to sense and response to mechanical signals from the surrounding physical environment. Regulation of various cellular processes by mechanical forces is accomplished through cellular mechanotransduction, and different intracellular components have been identified to participate in this process. Recent studies have uncovered the important role of intracellular organelles in constituting the mechanobiological system. To further elucidate the intricate map of cellular transduction, it is crucial to understand how organelles interact with mechanical stimuli. However, study of the mechanosensitivity and mechanoresponding mechanism of organelles like mitochondria and endoplasmic reticulum (ER) has been hampered by a current lack of means to apply direct and precise mechanical force specifically to the organelle of interest. Conventional tools have suffered from non-specificity, unintended perturbation of other cellular components, invasiveness, and low throughput. An organelle-specific mechanostimulation method is thus greatly needed for future study of organelle mechanobiology.

Optogenetic technology has provided a solution to this obstacle and an unprecedented opportunity to construct organelle-specific mechanostimulation methods. This talk will present two newly developed optogenetic systems, namely Opto-defMito and LIMER. Utilizing light-inducible heterodimerization protein pair crytochrome 2 (CRY2) and its binding partner CIBN, and combine with force-generating molecular motors, Opto-defMito and LIMER can deliver light-actuated force directly and specifically to mitochondria and ER respectively. The presentation will also showcase how optogenetic mechanostimulation of intracellular organelles is realized, as well as how the mechanosensitivity of ER via Ca^{2+} signaling is revealed for the first time using these new optogenetic systems.

***** ALL ARE WELCOME *****

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