

ARMI EXTERNAL SEMINAR SERIES 2023



MONASH
University



Bi-Directional motility of mitotic kinesin-5 biological nano motors

Professor Leah Gheber PhD

Department of Chemistry, Ben-Gurion University of the Negev,
Beer-Sheva, Israel

Abstract

Mitosis is an essential process by which duplicated genetic information is transmitted from mother to daughter cells. Incorrect chromosome segregation during mitosis can lead to genetic diseases, chromosome instability and cancer. This process is mediated by a dynamic microtubule-based intracellular structure, the mitotic spindle. One of the major factors that govern the mitotic spindle dynamics are the kinesin-5 biological nano motors, that were believed to move unidirectionally on the microtubule filaments, using ATP hydrolysis, thus performing essential functions in mitotic spindle dynamics.

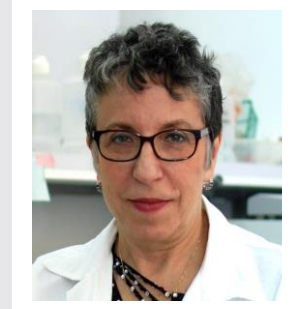
Surprisingly, several reports from our and other laboratories have demonstrated that some kinesin-5 motors are bi-directional: they move in minus-end direction on the microtubules as single-molecules and can switch directionality under a number of conditions. These findings broke a twenty-five-years old dogma regarding kinesin directionality. The mechanism of this bi-directional motility and its physiological significance remain unclear.

To address this unresolved problem, we apply an interdisciplinary approach combining live cell imaging, biophysical single molecule, and structural experiments to examine the activity of these motors and their mutated variants in vivo and in vitro. Our data shows that factors such as protein phosphorylation, motor clustering on the microtubules and structural elements regulate the bi-directional motility of kinesin motors. We also show using Cryo-EM, that bi-directional kinesin motors obtain non-canonical microtubule binding which is essential to their special motile properties and intracellular functions. In the seminar, we will discuss the implication of these findings to the mechanism bi-directional motility and physiological roles in mitosis.

Bio

Leah Gheber is a Professor of Chemistry, Ben-Gurion University (BGU) of the Negev, Beer-Sheva, Israel, working on mechanism and regulation of biological nano-machines (kinesin motors) that are essential for chromosome segregation during mitosis. She received her PhD in Chemistry from Ben-Gurion University of the Negev. Then, as a postdoctoral fellow, she studied Molecular Biology and Genetics at Johns Hopkins University, Baltimore, Maryland.

She joined BGU as a faculty member in 2005. In her research, she applies an interdisciplinary approach, combining biophysics and biochemistry, with cellular and molecular biology, and yeast genetics, to study the function of mitotic kinesin motors in vitro and in cells. Prof. Gheber founded the Israeli Society for Cytoskeleton and Motility and served as the head of this society for nearly ten years. In addition to her research, Prof. Gheber established numerous new graduate and undergraduate courses and she now serves as the head of the teaching committee of the Faculty of Natural Sciences at BGU.



EVENT DETAILS

DATE:

Tuesday 18th April

TIME:

11:00am

VENUE:

Seminar Room
G19
15 Innovation Walk
Monash University
Clayton Campus

HOST:

Dr. Jennifer Zenker



@ARMI_Labs



/AustralianRegenerativeMedicineInstitute



/australian-regenerative-medicine-institute



@regener8au



MONASH
University



ARMI
AUSTRALIAN REGENERATIVE
MEDICINE INSTITUTE

The Australian Regenerative Medicine Institute (ARMI) acknowledges the generous support of Monash University and the Victorian State Government.