NANYANG TECHNOLOGICAL UNIVERSITY

School of Biological Sciences

Seminar Announcement

Sculpting the ring to make a cut: contractile ring structure and mechanism of cell division

Date: 02 March 2017 Thursday

Time: 10:30am to 11:30am

Venue: SBS Classroom 2 (SBS-01n-22)

Host: Associate Professor Thirumaran Thanabalu



Speaker: Dr Mithilesh Mishra, Ph.D
Tata Institute of Fundamental Research

Abstract

Cytokinesis in many eukaryotes involves the contraction of a tension-producing actomyosin-based contractile ring that constricts the membrane to divide the cell. However, the detailed mechanism of contractile ring organisation and contraction is not fully understood. A sliding filament mechanism where myosin pulls actin filaments like those in sarcomere has been proposed decades ago, however, contractile rings are far more disordered and the components of the ring are highly dynamic. We have recently established, for the first time an experimental system to study contraction of the ring to completion in vitro. We show that contractile ring undergo rapid contraction in an adenosine triphosphate (ATP) and myosin-II dependent manner in the absence of other cytoplasmic constituents. Surprisingly, neither actin polymerisation nor its disassembly is required for contraction of the contractile ring although addition of exogenous actin cross-linking proteins blocks ring contraction. Furthermore we use cryosectioning and cryo-focused ion beam milling to gain access to natively-preserved actomyosin rings for direct three-dimensional imaging by electron cryotomography. Our results show that the ring is composed of straight, overlapping actin filaments that “saddle” the septal membrane, but they do not make contact with the membrane or gather at nodes. Correlative cryo-fluorescence light microscopy and electron cryotomography on vitreous cryosections further reveal that myosin does not form thick oligomeric filaments in the ring as it does *in vitro*. Finally by tuning parameters and properties of the ring’s components to match with data from electron cryotomography, we showed that coarse-grained simulations could help reveal the mechanism for the ring constriction.