BioSystems Science and Engineering

SEMINAR

4:00 pm, September 11, 2017
MRDG Seminar Hall

Kinesin: A machine or an animal. A single molecule force spectroscopy approach

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The kinesins motor proteins move cellular cargo on microtubule tracks. They are best known for their role in cell division and in axonal transport in neurons. A defect in kinesin function leads to diseases, typically involving defective transport of cell components or pathogens, or defects in cell division. The mechanics of kinesin motor motion has been studied extensively in the last decades. Because of the identical subunits, the motor has been proposed to rotate during stepping. For each step the motor is expected to rotate by 180-degree and a torque transferred from the motor head, through the stalk, onto the motor bound cargo should then be visible as angular steps for every translational step. Yet, experiments mostly done at low ATP concentrations only revealed occasional motor stalk reversals and an asymmetry of consecutive steps, so-called limping, which was attributed to loads perpendicular to the microtubule axis. The stepping rate of kinesin motors is slower at low ATP concentrations and faster at higher ATP concentrations. At high, physiological ATP concentration, rotations have not been detected because of long response times of rotational probes. Recent work on intermediate states during stepping indicate continuous, however, direct evidence for such rotational motion is lacking. Here, we used high-resolution optical tweezers combined with a sensitive optical micro-protractor and torsion balance employing highly birefringent, liquid crystalline probes to directly and simultaneously measure the translocation, rotation, and generation of force and torque of single kinesin-1 motors.Our results and many other interesting experiments from the field prove that single molecule force experiments are indeed going to be a mainstay in any modern biology laboratory. To this end it is essential to develop highly efficient and stable Force spectroscopes which are easy to use and provide a seamless workflow with other biological techniques. I will be discussing my present work with Lumicks BV, towards creating correlative STED optical tweezers and a low cost high throughput acoustic force spectroscope.

About the Speaker

Dr. Avin Ramaiya did his Master's from TIFR, Bombay where he studied the motility and force production of the motor protein dynein. He obtained his PhD from the University of Tubingen/TU Dresden, working on the single-molecule force and torque production of kinesin motors. He is currently a Technology & Application Development professional at Lumicks, Amsterdam.