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Myosin-Driven Movement of Nanoparticles – An Approach to High-Speed Tracking

Authors : Sneha Kumari, Ravi Krishnan Elangovan

Abstract : This abstract describes the development of a high-speed tracking method by modification in motor components for nanoparticle attachment. Myosin motors are nano-sized protein machines powering movement that defines life. These miniature molecular devices serve as engines utilizing chemical energy stored in ATP to produce useful mechanical energy in the form of a few nanometre displacement events leading to force generation that is required for cargo transport, cell division, cell locomotion, translated to macroscopic movements like running etc. With the advent of in vitro motility assay (IVMA), detailed functional studies of the actomyosin system could be performed. The major challenge with the currently available IVMA for tracking actin filaments is a resolution limitation of ± 50nm. To overcome this, we are trying to develop Single Molecule IVMA in which nanoparticle (GNP/QD) will be attached along or on the barbed end of actin filaments using CapZ protein and visualization by a compact TIRF module called 'cTIRF'. The waveguide-based illumination by cTIRF offers a unique separation of excitation and collection optics, enabling imaging by scattering without emission filters. So, this technology is well equipped to perform tracking with high precision in temporal resolution of 2ms with significantly improved SNR by 100-fold as compared to conventional TIRF. Also, the nanoparticles (QD/GNP) attached to actin filament act as a point source of light coffering ease in filament tracking compared to conventional manual tracking. Moreover, the attachment of cargo (QD/GNP) to the thin filament paves the way for various nano-technological applications through their transportation to different predetermined locations on the chip

Keywords : actin, cargo, IVMA, myosin motors and single-molecule system
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