Super-resolution Imaging of Cargo Transport

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Abstract

Intracellular transport plays a key role in many cellular processes. Motor-proteins convert the energy of ATP hydrolysis to mechanical motion to transport important cargos along microtubule tracks and deliver them at the right destination. Failure of intracellular transport has been linked to neurodegenerative diseases such as Amyotrophic Lateral Sclerosis (ALS). Over the years, we have learned a lot of information about how motor-proteins function at the single molecule level, thanks to several *in vitro* studies. However, inside the crowded, complex environment of the cell, motor-proteins face additional challenges. Multiple motors must coordinate to transport a given cargo, overcoming road-blocks and traffic jams. Due to the lack of techniques that provide high spatiotemporal resolution, it has been difficult to visualize these processes in living cells in as much detail as we have been able to using *in vitro* single molecule studies. We are overcoming some of these challenges by combining super-resolution microscopy with single particle tracking to study cargo transport in living cells. We have been able to study motor-protein mediated cargo transport dynamics on individual microtubules and decipher the choices that motors make at microtubule intersections. Our results shed important light on how motor-proteins may overcome road-blocks along the microtubule network to effectively transport their cargo.