

Mechano-chemical characterization of dynamin-mediated membrane fission

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The dynamin family of proteins are unique GTPases involved in membrane fission and fusion events throughout the cell. Dynamin is necessary for internalizing essential nutrients, is tightly coupled to cell signalling events, and has been linked to neuropathies and myopathies. As a vesicle invaginates, dynamin oligomerizes as a spiral around the neck of the vesicle generating dynamin-lipid tubes that constrict upon GTP hydrolysis, causing the fission of the neck and release of the vesicle. The ability of dynamin to constrict mechanically the underlying lipid bilayer makes it unique among GTPases as a mechano-chemical enzyme. However, the mechano-chemical processes governing the operation of dynamins at the molecular level are still under debate. Using optical tweezers, we have developed an experimental assay to measure the real-time activities of Dynamin 1 and Dynamin 2 proteins as they constrict individual membrane nanotubes and the effect of GTP analogues on their reactions. Our results shed light into the mechanical operation of these enzymes and reveal significant differences between their mechano-chemical cycles.