Single Molecule Studies of the Acto-Myosin Motor Using Optical Tweezers

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Optical tweezers are a form of nanotechnology: They enable the minute forces produced by changes in light momentum to be harnessed in order to manoeuvre micron-sized particles with nanometre precision. Using a tightly focussed laser beam latex particles are captured and then used as handles to manipulate individual protein molecules. An optical detector is used to measure the position of the latex particle and enables the force, movement and stiffness of single biomolecular interactions to be measured with millisecond time resolution.

The NIMR Molecular Motors Group are interested in the molecular mechanism of force production by molecular motors. Our goal is to understand how biochemical change is coupled to mechanical work by these energy transducing enzymes. We use a combination of single molecule technologies to address this problem: Optical tweezers enable us to measure the force produced as a single motor molecule breaks down a single molecule of fuel (ATP) and single fluorophore imaging enables us to observe the chemical reactions directly. The talk will concentrate on single molecule, biophysical studies of the myosin family: myosin II from skeletal muscle, myosin I from brush border, myosin V from brain and the motor action of T7 RNA polymerase as it transcribes a single gene.