One step at a time: Motor molecules use random walks to make deliveries in living cells

July 21 2009

Cells rely on tiny molecular motors to deliver cargo, such as mRNA and organelles, within the cell. The critical nature of this transport system is evidenced by the fact that disruption of motors by genetic defects leads to fatal diseases in humans. Although investigators have isolated these motor to study their function in a controlled environment outside the cell, it has been difficult for researchers to follow these fascinating molecular transporters in their natural environment, the living cell.

Now, two articles published by Cell Press in Biophysical Journal, make use of incredibly tiny, glowing "quantum dots" to track the miniscule motions of myosin V in living cells. Interestingly, both research groups independently report that myosin V molecules carry their quantum dot cargo either in a straight line or in a manner akin to a drunken walk.

Myosin V is a motor molecule that "walks" in a fashion similar to humans by stepping along actin filament tracks that are assembled in a dense, criss-crossing network inside the cell. A critical feature of these motors is their ability to walk long distances without falling off their tracks. However, this has never been observed within cells. Through the binding of quantum dots directly to a single myosin V molecule, both investigative teams used sophisticated microscopes and sensitive cameras to witness the 72 nanometer strides (equivalent to 1 millionth of an inch) taken by these motors for the first time in cells.

In results published in the May 20th 2009 issue of *Biophysical Journal*, Dr. Giovanni Cappello from the Institut Curie in Paris, France tracked the movement of single myosin V molecules with inside living HeLa cells. Dr. Cappello and colleagues reported that the myosin V can transport cargo for long distances without falling off its track at velocities higher than would be expected based on earlier studies. "Our approach goes beyond conventional experiments on organelles and opens interesting perspectives for studying intracellular transport pathways and how motors behave in complex filament networks," says Dr. Cappello.

Dr. David Warshaw and colleagues from the University of Vermont College of Medicine used quantum dots to follow the activity of myosin V in COS-7 cells. Their findings, published in the July 22nd 2009 issue of the journal, suggested that myosin V's apparent drunken walk is in fact the motor taking turns at almost every intersection it encounters along the dense and randomly oriented intracellular actin highway. "Cargo delivery in cells can't totally be a random process, therefore, using the approach described here we can characterize how motors and cargo link up and understand the engineering design principles Mother Nature uses to guarantee efficient and effective delivery of cargo within cells," offers Dr. Warshaw.

Source: Cell Press (news : web)