INSTITUTE FOR CELLULAR ENGINEERING

Enhancing Techniques For Single Biomolecule Studies

Ryan D’souza

PI: Prof. Lori Goldner (Umass Physics)

Collaborators: Mark Arsenault, Peker Milas, and Ben Gamari (Umass Physics)

The study of single biomolecules in crowded, cellular-like environments provide insight into how these molecules actually behave in living cells. In many single-molecule sensitive studies of biomolecular folding and structural transformations, biomolecules are attached to a glass surface. However, this does not mimic a cellular-like environment, since the glass’s polarity and inhomogeneity may affect the biomolecule’s dynamics. An alternative is to form a droplet that has an interior environment that mimics the cell’s cytosol, so that a biomolecule’s behavior is closer to that found in living cells. We are developing techniques for making droplets and studying droplet-confined biomolecules. One scheme for droplet formation uses nonpolar mineral oil as the continuous phase, amphiphllic triton x-100 as a surfactant, and water or aqueous buffer as the droplet phase (figure 1). If fluorinated oil is used instead of mineral oil, its lower index of refraction compared to the interior water environment can allow the droplet to be held in place through the optical trap (figure 2). This “optical tweezer” phenomenon can force a droplet to be stationary, which facilitates the study of the biomolecules within it.

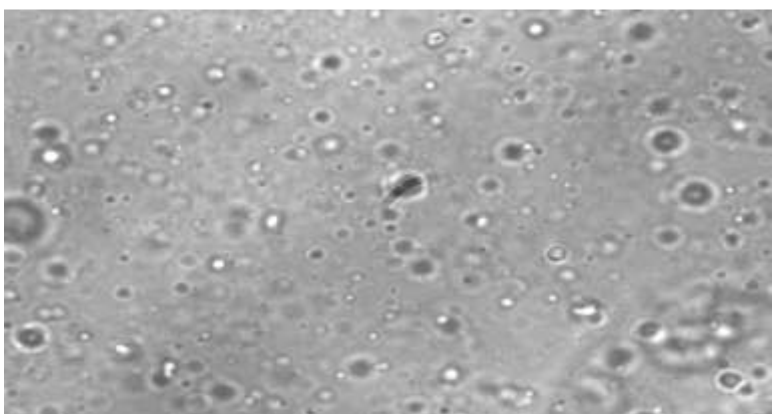

Figure 1. Image of Droplets. The droplets with clear, white interiors are in focus. The rest are on different planes. R. D’souza 2010.

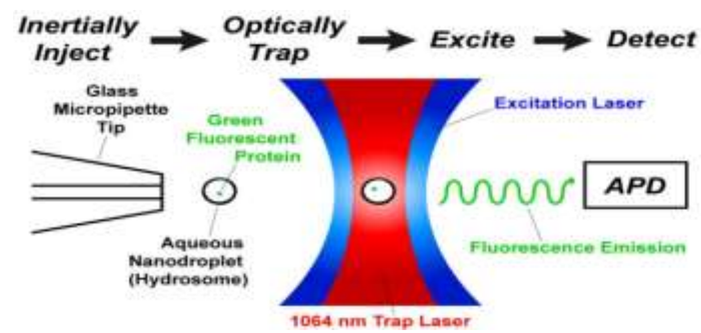

Figure 2. Process of Optical Trapping and Droplet Detection.

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