

Optical trapping force investigation of viable and apoptotic THP-1 monocytes

Ric John Ombid¹, Glenn Oyong², Romeric Pobre¹

¹ Physics Department, De La Salle University, 2401 Taft Avenue, Manila, Philippines

²Molecular Science Unit Laboratory, Center for Natural Sciences and Environmental Research,
De La Salle University, 2401 Taft Avenue, Manila, Philippines

Email: ric_john_ombid@dlsu.edu.ph

Here, we report the utility of optical tweezers in determining the optical force as a profiling factor between viable and apoptotic cells. THP-1 monocytic leukemia cell lines were purchased from ATCC (Manassas, VA, USA). The cells were maintained and cultured in complete Dulbecco's modified Eagle's medium. The trypan blue tested viable THP-1 cells (99% viability) were freshly mounted onto the glass slides, while old culture apoptotic cells (20% viable) were also investigated. The THP-1 monocytes ($\sim 10\ \mu\text{m}$) was at room temperature using a 980 nm laser at 100 mW. Its thermal fluctuations were recorded by the quadrant photodiode in volts and trap stiffness was determined by fitting a Lorentzian to the power spectrum. The optical force was measured through Hooke's Law: $F_x = -\kappa \Delta x$, where F_x is the applied force, κ is the trap stiffness, and Δx is the displacement. Captured images of the trapped viable and apoptotic THP-1 cells are shown (Figure 1A). Viable THP-1 cells, perfectly spherical in shape, were immediately and easily subjected to optical trapping compared to old and apoptotic cells which demonstrated cell membrane blebbing. Trapping force was respectively measured affording values that were higher for viable cells compared to apoptotic cells (Figure 1B).

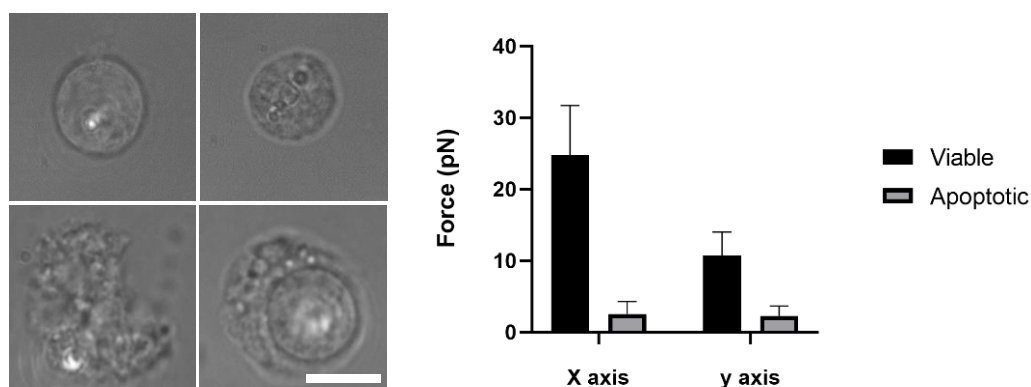


Figure 1: (A) Captured images of optically trapped (Top) viable and (Bottom) apoptotic THP-1 monocytes; (B) Optical forces along the x and y-axes for viable and apoptotic THP-1 cells. (Scale bar, $10\ \mu\text{m}$)