Live Cell Microscopy: A Physical Chemistry Approach

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A live cell is an extremely complex assembly of various organelles. There is a long standing interest to understand the physical chemistry of a live cell, in terms of dynamics and spectra at a selected intracellular location of a cell (organelle). Recently, we have made significant progress in this direction, using time resolved confocal microscopy. The smallest size of the focused spot in a confocal microscope is 0.2 μm (200 nm). This is nearly one hundred times smaller than the size of a live cell. Thus, one can selectively study different regions/organelles in a live cell. In this talk, we discuss how one can image different intracellular organelles, record fluorescence spectra and decay, ascertain local polarity and viscosity, and monitor the dynamics of solvation, proton transfer, red-ox and other phenomena at specified locations inside a cell. We will highlight how this knowledge enriched us in differentiating between cancer and non-cancer cells, 3D tumor spheroids and drug delivery [1-2] and in DNA dynamics [3].

1) S. Nandi, S. Ghosh, K. Bhattacharyya, "Live Cell Microscopy: A Physical Chemistry Approach," Feature article, J Phys Chem B 122 (2018) 3023-3036.

2) M A Amin, S Nandi, P Mondal, T Mahata, S Ghosh, K Bhattacharyya, “Physical Chemistry in a single Live cell: Confocal Microscopy,” PCCP 19 (2017) 12620-12627.

3) M. Debnath, S. Ghosh, A. Chauhan, R. Paul, K. Bhattacharyya, J. Dash, “Preferential targeting of I-motifs and G-quadruplexes by small molecules,” Chemical Science 8 (2017) 7448-7456.