

MAR11-2010-001523

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Physical principles of genomic regulation through cellular nanoscale structure and implications for initiation of carcinogenesis

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Although compelling evidence suggests that cellular nanoarchitecture and nanoscale environment where molecular interactions take place would be expected to significantly affect macromolecular processes, biological ramifications of cellular nanoscale organization have been largely unexplored. This understanding has been hampered in part by the diffraction limited resolution of optical microscopy. The talk will discuss a novel optical microscopy technique, partial wave spectroscopic (PWS) microscopy, that is capable of quantifying statistical properties of cell structure at the nanoscale. Animal and human studies demonstrated that an alteration in the statistical properties of the nanoscale mass density distribution in the cell nucleus (e.g. nuclear nanoarchitecture) is one of the earliest and ubiquitous events in carcinogenesis and precedes any other known morphological changes at larger length scales (e.g. microarchitecture). The talk will also discuss the physical principles of how the alteration in nuclear nanoarchitecture may modulate genomic processes and, in particular, gene transcription.

Work done in collaboration with Hariharan Subramanian, Prabhakar Pradhan, Dhwani Damania, Lusik Cherkezyan, Yolanda Stypula, Jun Soo Kim, Igal Szleifer, Northwestern University, Evanston, IL, Hemant K. Roy, Northshore University Health-Systems, Evanston, IL