TIFR Centre for Interdisciplinary Sciences
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Internal Seminar

Insights into the detailed mechanism and conformational dynamics of DNA binding to nanoparticle and protein: studied by single molecule techniques

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Understanding the DNA dynamics is essential to deal with fatal and life-threatening diseases, especially those which are directly linked to its structure and function. Here the dynamics and the confinement have been monitored during hybridization and melting process of DNA double helix at the interface of surface-modified gold nanoparticles using single-molecule FRET in order to perceive the mechanistic and biomechanical aspects of the interaction. It has been observed that tuning the size and hence the charge to approximately 4 nm gold nanoparticles (AuNP) work collectively resulting structural changes, compaction, and stepwise strand separation of the double helix followed by its adsorption onto the AuNP to carry completely unzip the DNA double helix. Additionally, the dynamic binding (sequence specific) and bending (>180°) of dsDNA by IHF, a well-known architectural protein, have been probed using ensemble and smFRET measurements. This work is further extended to realize the impact of IHF binding to the conformational switching of four-way Holliday junction (4WHJ), a crucial intermediate in nucleic acid rearrangement, utilizing single-molecule fluorescence and force tools. An enhanced rigidity and reduced flexibility is observed that the 4WHJ experiences upon binding to IHF, results in slowing down of its isomerization dynamics. Implementation of nonlinear dynamic analysis found to be effective for such data interpretation.

Thursday, Apr 13th 2017

2:00 PM (Tea/Coffee at 1:45 PM)

Seminar Hall, TCIS