Abstract

"Molecular interactions in biology probed with novel single-molecule techniques"

Biological systems revolve on molecular interactions: microRNAs modulating mRNA, transcription factors regulating DNA, protein kinases altering signaling pathways, to name a few. While conventional biochemical methods in tubes and gels have elucidated essentials of these interactions, some aspects such as distribution of subpopulations, reaction kinetics, and stoichiometry of bindings are difficult to investigate. Single-molecule techniques have provided a wealth of quantitative details and mechanistic picture that is not attainable from measurements on an ensemble of molecules. In this talk, development and application of novel single-molecule approaches designed to study interactions between nucleic acids and proteins will be presented. Particular examples include: (a) capturing molecules in nano-chamber to revisit the mass action law, (b) mechanical sensing of DNA-binding proteins, (c) measurement of interactions between signaling proteins from cancer cells, and (d) fluorescence assay of lipid kinase PI3K activity.