复旦大学物理系物质科学报告

Physics Department Colloquium

How to find their partners: single-molecule approaches to understand biospecificity

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Specificity is a premise of life, and highly specific interactions are ubiquitous in biological interactions between protein-DNA, protein-protein, protein-metabolites, etc. The lock-and-key model was proposed to explain the high specificity of molecular recognition by a precise structural fit of interacting molecules. In most specific interactions, however, the formation of molecular complexes is coupled to small- or large-scale structural rearrangements. Two representative mechanisms have been envisioned for the achievement of the final precise fit: in the “induced fit” model, initial binding actively starts the development of the structural change, and in the “conformational selection” model, a pre-existing precise fit becomes a dominant structure through a passive but selective stabilization process. Even though it has been a fundamental question of molecular biology which pathway is actually used in achieving a final match of many specific molecular interactions, experimental evidences are rare and controversies are still going on.

Single-molecule spectroscopy is a powerful tool for studying dynamic interactions of biological molecules. Using its superior spatial and temporal resolution under biologically relevant conditions, scientists have determined the detailed kinetics and mechanisms of a variety of biological processes. To demonstrate the interplay of conformational dynamics and molecular recognition, our research group has utilized a unique capability of single-molecule measurements to simultaneously observe the binding/dissociation of a ligand and the conformational dynamics of a receptor in real time. Specifically, substrate recognition mechanisms of Z-DNA binding proteins, TPP riboswitch, maltose binding proteins, type II topoisomerases, and RISC will be discussed. As an introduction, I will also review the recent progress of single-molecule techniques developed in my laboratory.

Time： 2:00 pm, Tuesday, 2014.01.14

Location： Physics Building, Room 221B

(Cookies and coffee are served from 1:30 pm)