CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
R1214

Project Title:
Recruitment of First-Time, Tenure-Track Faculty Members

Award Mechanism:
Recruitment of First-Time, Tenure-Track Faculty Members

Principal Investigator:
Finkelstein, Ilya

Entity:
The University of Texas at Austin

Lay Summary:

Dr. Ilya Finkelstein received his B.S. from the University of California at Berkeley and his Ph.D. in Chemistry from Stanford University with Professor Michael D. Fayer. In 2007, he joined the group of Prof. Eric C. Greene at Columbia University Medical Center as an NRSA Postdoctoral Fellow. A unifying theme of his research career is the development and application of biophysical methods that can observe proteins as they undergo their physiological functions in real time. Dr. Finkelstein's future research interests are aimed at understanding the mechanisms of DNA maintenance, including repair, replication and transcription.

Dr. Finkelstein's graduate research tackled the question of how a protein's structural fluctuations are coupled to the solvation environment. To address this question, Dr. Finkelstein designed ultrasensitive spectroscopic (2D-IR) tools and analysis methods based on nonlinear response-function theory and molecular dynamics simulations. Dr. Finkelstein discovered that proteins retain most of their mobility even when surrounded by as few as two aqueous solvation layers. Indeed, protein dynamics persist even when a protein is encapsulated in a glassy matrix at room temperature. This work resulted in twelve peer-reviewed publications.

At Columbia University, Dr. Finkelstein was an NRSA postdoctoral fellow in the group of Eric C. Greene. His research focused on addressing a fundamental and unresolved question in nucleic acid biochemistry: How do DNA-binding motor proteins move on crowded DNA? Understanding how proteins function on a crowded DNA substrate is important because protein-free DNA is unlikely to be found in vivo. Inside living cells, molecular crowding on genomic DNA may profoundly alter the behavior of DNA-binding motor proteins, which are involved in all aspects of DNA maintenance. Dr. Finkelstein's work represents the first study to directly visualize collisions between proteins as they travel along DNA and has revealed numerous mechanistic insights into this process. This work has been published in Nature and PNAS.

Dr. Finkelstein's future research interests at the University of Texas at Austin will focus on understanding how our cells are able to stave off genomic instability and avoid cancer. Genomic instability, which arises from defects in DNA-repair pathways, is a defining feature of most cancers. Dr. Finkelstein's highly interdisciplinary research program combines aspects of single-molecule biophysics, traditional biochemistry and micro-/nano-scale engineering to directly observe the key biochemical steps of DNA repair. His

research will address fundamental questions regarding how cells coordinate multi-protein assemblies to repair DNA, how these biochemical reactions occur on chromatin, a highly condensed DNA-protein substrate, and how defects in these pathways lead to genomic instability. Elucidating the mechanisms of DNA repair is critical to our understanding of both the molecular basis and the therapeutic treatment of devastating human diseases.