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Micro/Nanofluidics and Single Molecular Dynamics for Biomedical Applications

Abstract

Micro/nanofluidics has great potentials for many biomedical applications. In this talk, I will introduce how to regulate the conformations, assembly, and transport of DNA molecules in various microflows driven by hydrodynamic flows, electrokinetics, and their combinations. Examples will be given with the emphasis on applications in single molecule manipulation, drug/gene delivery, and biosensors. A hybrid field microfluidic (HFM) approach is used, in which an electric field is imposed at desired locations and appropriate moments to balance the flow stress on negatively charged DNA molecules, to effectively regulate their initial conformations and deformation dynamics in flows. The same concept is also applied to efficiently pack several types of polyelectrolytes to produce multifunctional nanocarriers. Combined with a serpentine flow-through electroporation (SFE) microsystem, these nanoparticles help enhance gene delivery to mammalian cells with better cellular uptake of molecular probes and reduced adverse effects associated with nonviral delivery approaches.

Bio

Dr. Shengnian Wang, is the Harrelson Family Assistant Professor in Chemical Engineering of Louisiana Tech University. He got his BS, MS, and PhD from Zhejiang University, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, and the Ohio State University, respectively, all in Chemical Engineering. His current research interests focus on polymer micro/nanoengineering, micro/nanofluidics, and their applications in life science, with current research projects supported by NIH, NSF, and Louisiana Board of Regents. He has published more than 20 papers in peer-reviewed journals including Advanced Materials, journal of the American Chemical Society, Analytical Chemistry, Physical Review Letters, Applied Physics Letters, Lab Chip, Biosensors and Bioelectronics, and Biomicrofluidics.