



DNA as Both a Genetic and a Generic Nanoscale Material

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Our group has employed DNA as a true polymer utilizing its genetic as well as non-genetic properties. We have rationally designed and successfully created various DNA-based nanostructures and nanomaterials including DNA dendrimers and DNA hydrogels; we have also explored their real-world applications focusing on three main directions: DNA nano-barcodes, DNA gels, and DNA-nanoparticle hybrid systems. In this talk, I will highlight a few examples from these three directions. Examples include 1) using anisotropic, branched, and crosslinkable (ABC) DNA monomers to achieve a novel polymerization scheme where DNA polymers are formed only in the presence of a pathogen. ABC monomers can also serve as a vector for multiplexed drug delivery; 2) using DNA hydrogels for 3D cell culture, where we recently created a DNA gel (termed P-gel) that can produce proteins without any living cells; 3) using DNA as a nano-organizer to fabricate nanoparticle-based 1D nanowires, 2D supralattices, and 3D dry crystals. Synthesis, characterization, engineering, and application of these DNA-based nanostructures and nanomaterials will be presented.

Dr. Dan Luo is Associate Professor of Biological Engineering at Cornell University. He currently is also a faculty member in Nanobiotechnology Center, Cornell Center for Materials Research, Kavli Institute for Nanoscale Science, Biomedical Engineering Program and New Life Science Initiatives at Cornell. Dr. Luo obtained his BS degree from the University of Science and Technology of China (USTC) with an undergraduate thesis on molecular dynamics computer simulation. He received his PhD in 1997 from The Ohio State University in the Molecular, Cellular, and Developmental Biology program, working on topoisomerases and DNA networking. After a postdoctoral training in the School of Chemical Engineering at Cornell focusing on polymers and synthetic DNA delivery systems, he joined Cornell faculty in 2001. The goal of Luo's research is the development of Biological Engineering at the molecular level by integrating molecular biology with engineering. More specifically, his research group is currently concentrating on engineering biomacromolecules, DNA for example, into useful, novel materials for nanotechnological, biological, and biomedical applications with funding from numerous federal and state agencies. Dr. Luo is an Editorial Board Member for "Nanomedicine", "Nano Today", and for "Open Biotechnology". Dr. Luo was awarded National Science Foundation's CAREER award (2006), the NYSTAR Technology Transfer Incentive Program Award (2005) and Faculty Development Program Award (2007), and Cornell Provost's Award for Distinguished Scholarship (2007).

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