2011 SURF Summer Seminars and Tours

May 23 First official work day and orientation for SURF Session I students

June 2 Dr. Elizabeth Strychalski
NIST Material Measurement Laboratory, Biochemical Science Division

Nanoslinky: DNA Molecules Descending a Nanofluidic Staircase

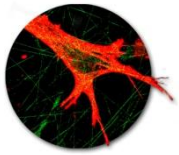
Systems seek to increase their disorder, or entropy. We introduce a method called "entropophoresis" that exploits this tendency to control the otherwise random motion of DNA molecules in a fluid. When squeezed into a nanoscale channel shaped like a staircase, a DNA molecule moved analogously to a Slinky walking down a flight of stairs. While a Slinky is driven by momentum and gravity, the DNA "Nanoslinky" diffused across each step and stepped down to increase its entropy. Entropoporesis enabled an automated and multiplexed study by widefield Epifluorescence microscopy of the change in DNA size between strong and moderate nanofluidic slitlike confinement.

June 2 ***Laser Safety Training***

Josh Hadler from the Optoelectronics Division provided laser safety training for all staff, associates, and students.

June 9 Dr. Kaushik Chatterjee
NIST Material Measurement Laboratory, Polymers Division

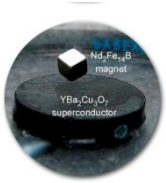
Engineering Tissues at NIST



The field of tissue engineering has the potential to revolutionize healthcare through regeneration and repair of damaged tissues and organs in the human body. Combining engineering principles with fundamental knowledge of biological, chemical and physical sciences, tissues are being engineered from cells seeded in a three-dimensional structure often known as a tissue scaffold. This talk will present an overview of the current strategies in this field. Also described will be the work of the Biomaterials Group at NIST to develop high-throughput screening technologies and reference scaffolds to systematically measure cell-scaffold interactions towards accelerating the pace of tissue engineering research.

June 16 Robert M. Briber
Professor and Chair, Department of Materials Science and Engineering,
University of Maryland, College Park

Materials for the Future



The field of materials science and engineering sits at the boundary between the disciplines of physics, chemistry and engineering. Advances in materials have been the precursors of new technologies and future developments in materials will be the building blocks of continued technological innovation. The talk will provide an introduction to the field and gave examples of many advanced materials through hands-on demonstrations and audience participation.

June 23 Dr. Gretchen Campbell
NIST Physical Measurement Laboratory, Atomic Physics Division

Time Keeping with Ultracold Atoms

Precise timekeeping is important for a number of everyday applications. Precise clocks are used for synchronizing telecom networks and GPS. They are also essential for navigation and for communicating with deep-space probes and rovers. It is predicted that with even higher precision, clocks will lead to new types of gravity sensors, and will allow for the testing of fundamental physical laws. Currently the most precise clocks are made with cesium atoms, where microwave radiation is used to probe and measure an atomic resonance. At NIST researchers are working to develop new atomic clocks, which use optical light to proe ultra-cold alkaline-earth atoms. By using higher frequency optical light instead of microwaves, the clocks divide time into smaller units, offering record precisioin. In these clocks, atoms are held very tightly in optical lattices. The lattice is formed by standing waves of intense laser light. By carefully controlling the environment and interactions between the atoms, optical frequency standards have recently surpassed the accuracy of the best cesium clocks. With their current accuracy, the clocks would neither gain nor loe a second in more than 200 million years.

July 7

The Electronic Kilogram and the Planck Constant and The Next Generation E-Kilogram

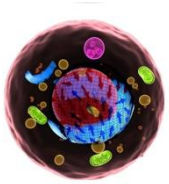
The Electronic Kilogram project uses a mass balance and induction coil in a background magnetic field. The mechanical force of gravity on a mass reference is balanced against an electromagnetic force generated with current in the coil, as in a linear electric

motor. When the same coil is moved to generate voltage, as in an electric generator, the voltage to velocity radio provides an effective calibration of the magnetic field. From these measurements, mechanical power watt units are measured relative to electrical power units, and the result, the fundamental Planck constant, is measured. The electronic standards that go into the measurement are atomic clock time and frequency, laser length, Josephson effect voltage, and quantum Hall resistance. A kilogram mass reference is a standard traceable to the one and only defining artifact in a vault in Paris. Since this measurement involves electronic standards and fundamental physical constants, in the near future the definition of kilogram units of mass will be changed to one using the watt balance method as a new electronic mass standard.

July 14 Vincent Stanford
NIST Information Technology Laboratory, Information Access Division

Distributed Sensor Data Acquisition and Pattern Recognition

July 21 Professor Brian Paegel
Scripps Research Institute



Total Synthesis of a Cell

In pursuit of a total synthesis of the cell, chemical and enzymatic routes to small-molecule metabolites, oligonucleotides, genes, peptides and proteins abound, but there are no elegant synthetic strategies for accessing the lipid bilayer envelope. In fact, among the molecular milieu of the cell, the various membranous structures are uniformly elusive targets. Our laboratory is exploring rational, controlled routes to bilayer synthesis that is driven by microfluidic technology. Our microfluidic phase transfer strategies have proven successful in the synthesis of uniform giant unilamellar vesicles, and set the stage for assembling more complex cellular structures, such as the double bilayers found in the nuclear envelope, or the iconic bilamellar assembly of the eukaryotic cell.

August 2 Final presentations by SURF students moderated by invited guests.

August 2 Lunch: SURF Directors and special invited guests.

August 3 Final presentations by SURF students moderated by invited guests.

August 4 Final presentations by SURF students moderated by invited guests.

August 5 Last day for SURF students and farewell pizza party.