Sunday Afternoon, November 12, 2006

Biomaterials Plenary
Room 2014 - Session BP-SuA

Miniaturization Challenges in Biotechnology
Moderator: D.W. Grainger, University of Utah

3:00pm **BP-SuA1 Invited Paper*, V. Colvin,*** Rice University **INVITED**

3:40pm **BP-SuA3 SERS Nanotags: Colloid and Surface Chemistry Meets Clinical Diagnostics*, M.J. Natan,*** Oxonica, Inc. **INVITED**

A holy grail in point-of-care diagnostics is to develop tests that perform on par with the central laboratory, in terms of robustness, multi-analyte capability, precision, and sensitivity. Oxonica has developed a series of nanoscale optical detection tags based on surface enhanced Raman scattering (SERS) that can potentially meet these criteria. These glass-coated, molecule-loaded gold nanoparticles are excited in the near-infrared, allowing detection in whole blood, and as many as a dozen different types can be simultaneously quantified using a handheld reader. Construction and optimization of these novel nanomaterials comprise classic problems in surface chemistry; the first half of this talk will focus on the techniques and tools we have used to prepare what are arguably the most robust and well-characterized SERS substrates ever made. The second half of the talk will focus on several diagnostic applications. (1) As a proof-of-concept, we have developed a multiplexed, quantitative lateral flow immunoassay (LFI) for Flu A, Flu B, and RSV. (2) We have developed an in-the-tube, no-wash assay for cardiac markers, and evaluated performance in serum, plasma, and whole blood. (3) We have demonstrated in vivo imaging of SERS nanotags in live animals. These applications underscore the range of possibilities opened up by chemical control of optical properties at the nanoscale.

4:20pm **BP-SuA5 Nanostructures for Single Molecule Manipulation and Analysis*, H.G. Craighead,*** Cornell University **INVITED**

We have used simple nanofabricated structures to isolate individual biomolecules in solution in order to observe there activity and identity. We have employed metallic apertures a few tens of nanometers in diameter to confine a region of optical excitation to a volume on the order of 10@super -20@ liters, which allows the observation of single molecule motion and binding activity at meaningful rates and concentrations. This approach also enables detection of motility and binding of individual molecules in lipid layers and cell membranes. Small fluid channels have also been used to isolate individual optically detected molecules for evaluation in flowing systems. The mobility, molecular size and detection of discrete molecular binding events can all be done at the individual molecule level in such fluid systems. Nanofluidic devices with engineered dimensions, smaller than a relevant molecular length scale, can also be used to sort or control the confirmation of long biopolymers such as DNA. The engineered structures have the potential for integration into analytical systems that could exploit these single molecule analytical approaches.

Author Index

Bold page numbers indicate presenter