Molecular Foundry
Lawrence Berkeley National Laboratory

General description of the facility:

The Molecular Foundry at Lawrence Berkeley National Laboratory is a DOE User Facility charged with providing support to nanoscience researchers in academic, government and industrial laboratories around the world. The Foundry provides users with instruments, techniques and collaborators to enhance their studies of the synthesis, characterization and theory of nanoscale materials. Its six facilities focus on both "soft" (biological and polymeric) and "hard" (inorganic and microfabricated) nanostructured building blocks, and their integration into complex functional assemblies. Additional information about the Molecular Foundry is available on the web at http://foundry.lbl.gov/index.html.

Description of the homeland security expertise and available research areas with a direct relationship to one or more homeland security research areas at the facility:

Homeland security expertise at the Molecular Foundry involves the development of future improved chem/bio sensors based on advancements in nanomaterials research

Research Area # 1:
Functionalization of porous copolymers in microfluidic devices as biological sensors

The Organic Nanostructures Facility of LBNL's new Molecular Foundry has a program on porous copolymers in microfluidic devices using combinations of acrylate- and/or methacrylate-based mono- and divinylic monomers and UV initiated polymerization. Functionalization of these materials is via radiation initiated grafting of reactive monomers. Immobilization of specific antibodies to create units for "fishing out" selected proteins from complex matrices prior to their detection. Ultimate application is seen in detection of biological WMDs.

Molecular Foundry Lead Scientist for this research area: **Frank Svec**
For contact information: http://foundry.lbl.gov/science/organic/organic_staff-svec.html

Research Area #2:
Discovery of selective chemical sensors via combinatorial chemistry

This Molecular Foundry program in the Biological Nanostructures Facility is developing a general approach for the rapid discovery of specific, robust molecular recognition elements (MREs) for chemical and biological sensing. Currently MRE's are typically either highly specific but unstable (proteins or other biomolecules), or highly stable and relatively non-specific (polymers). We have developed a class of bio-inspired polymeric

material (called peptoids) that are ideally suited to serve as robust MREs, and we are screening combinatorial libraries of them for binding to pesticide or chemical WMD molecules.

Molecular Foundry Lead Scientist for this research area: **Ron Zuckermann**
For contact information: http://foundry.lbl.gov/science/bio/bio_staff_zuckermann.html

Research Area # 3:
Scanned-probe based fabrication of nanowires sensors

The Fabrication, Imaging and Manipulation, and Biological Nanostructures Facilities on the Molecular Foundry are developing a scanned-probe based fabrication method for creating integrated circuitry of metallic and semiconductor nanowires to be used as highly-multiplexed arrays of chemical and biological sensors. The method utilizes a discovery and amplification process known as SELEX to discover RNA sequences that mediate the growth of specific semiconductor or metallic nanocrystals from aqueous precursors. These RNA oligos are arrayed in nanoscale patterns using a scaaned probe in which the tip is heated to constrain the surface reaction to a sub-10nm region. By passivating the remainder of the surface with self-assembled monolayers that present a high energy surface to the inorganic materials, we hope to develop a technology for fabricating high-density nanocircuitry. The same approach will then be used to functionalize the semconductor components with RNA oligos specific to the target agents, so that they act as FETs for chem./bio sensing.

Molecular Foundry Lead Scientist for this research area: **Jim De Yoreo**
For contact information: JJDeYoreo@lbl.gov; (510) 486-7343

Other information about postdoctoral appointments at the facility:

Extending a tradition of 65 years of science leadership for America, the Ernest Orlando Lawrence Berkeley National Laboratory performs forefront research to address major national and global challenges. The Berkeley Lab has maintained its institutional distinction based upon our close partnership with the University of California, the size and scale of our research programs, and our accomplishments in computational, energy, life, and general sciences. Our location provides a rich environment, with an outstanding scientific and engineering staff and with joint faculty appointments, graduate students, and postdoctoral fellows. Postdoctoral Fellow positions enable recent graduates with a Ph.D. or its equivalent to acquire further scientific training and to develop professional maturity for independent research. No classified research is performed at LBNL so a clearance is not a requirement for employment here.

Postdoctoral fellows are fully integrated into LBNL's workforce. In FY2007 there were 794 postdoctoral associates, 691 graduate students, 934 undergraduate students and 491 faculty who worked at LBNL out of a total of some 7,000 staff and guest.