The Nano/Bio Interface Center

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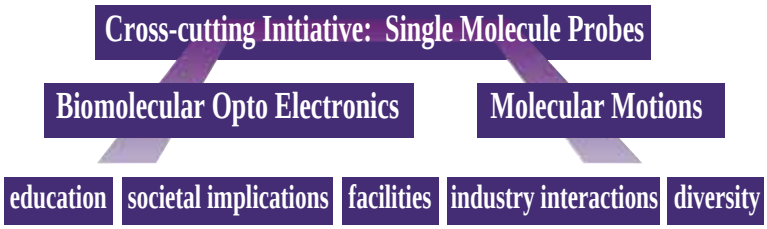
Director: Dawn Bonnell, Associate Director: Yale Goldman

The University of Pennsylvania

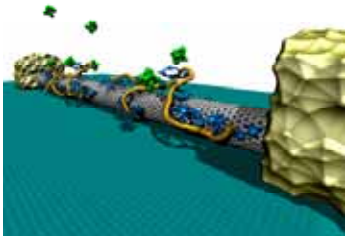
The Nano/Bio Interface Center develops the *next generation probes of nanoscale phenomena enabling fundamental advances controlling optoelectronic function and mechanical motions of biomolecular systems and devices*. These physical measurement advances are part of the NBIC probe portfolio in metrology, which is a prerequisite not only to advancing new frontiers in science but in reliable manufacturing at the nanoscale.

This research informs the development of new Nano Probe Facility, as well as a portfolio of educational and outreach activities aimed at K-12 education in the Philadelphia School System.



Recent exciting advances characterize the activity of the NBIC research. The Bio-optoelectronics team made the first measurement of optically excited dielectric polarization on engineered protein complexes. Graphene nanopores engineered to sequence DNA demonstrated high sensitivity. An emergent phenomenon in which surface plasmons are transduced to molecular electrical conduction was discovered with implications to energy harvesting devices. And protein/nanotube hybrid devices have be developed into sensitive sensor for cancer biomarkers.

The Molecular Motion team invented the 'Nano Aquarium' which enables dynamic studies of particles in liquid by transmission electron microscopy. High accuracy 3-D single molecule tracking based on parallax was developed and demonstrated on flucose-transporter-4. A low cost, high throughput process to fabricate zero mode waveguides enables single molecules to be interrogated one at a time. A new experimental approach to 3-D optical tomography was suggested by inverse scattering theory.



ADVANCED DIAMOND TECHNOLOGIES, INC. www.thindiamond.com

Anima CELL METROLOGY

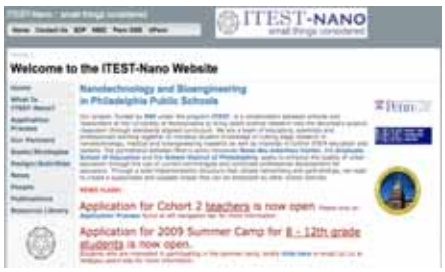
Evolved Machines

From Science to Application

Several NBIC supported concepts are on the way to commercialization. Anima Cell Metrology, Evolved Machines and Advanced Diamond Technologies are start-up companies at various stages of development with probes imaging protein synthesis in living cells, chemical sensors based on nanotubes and neural net arrays, and carbon based probe tips, respectively.

Education, Outreach, and Internationalization

The NIBC engages the local community in several forums. Professional development activities for teachers are held at high schools that serve under represented populations, 87 RET teachers impact over 9000 students in the Philadelphia school system, 10 classroom kits were developed. NanoDay@Penn has engaged over 750 student visitors, 170 science fair projects, 43 exhibits designed by grad students, with multimedia nanotechnology presentations and a new Nanotechnology Film Festival.



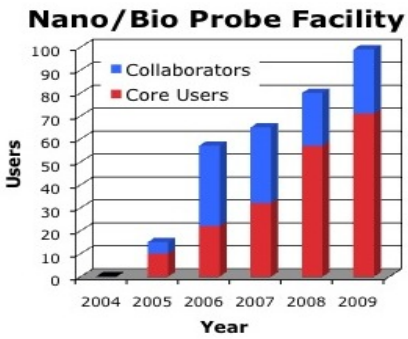
A summer academy course on Nanotechnology for high school students has graduated over 143 students. A partnership with the graduate school of education and School District of Philadelphia , ITEST-Nano, brings the latest scientific and technologic tools to the classroom in standards aligned curriculum. In 2009, the NBIC began hosting an American Chemical Society's Project SEED, which has supported 8 students from Philadelphia.

An undergraduate minor, graduate certificate and, new in 2009, a masters degree in nanotechnology have been established. May 2009 saw the first graduates of undergraduate minor program. The NBIC faculty continue to lead in curriculum development.

The NBIC established an International Nano/Bio Network which is an electronic venue with forums, monthly live e-discussions, blogs by experts in the field, management tools. countries and the site collaboration and project Members reside in 72 has facilitated EU/NSF joint commission and DoE strategic planning workshops.

Infrastructure Development

The Nano/Bio Probe Innovation Facility implements new probes of local phenomena, making these available to the research community long before they become commercialized and works with industry to transition discoveries to products to allow wider dissemination. The facility is developed within the framework of a 3-phase plan. The third phase involves consolidating this facility to one location in the new Krishna P. Singh Nanotechnology Building. The continued increase in the number of users attests to the value of the facility to the research community.



www.nanotech.upenn.edu
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