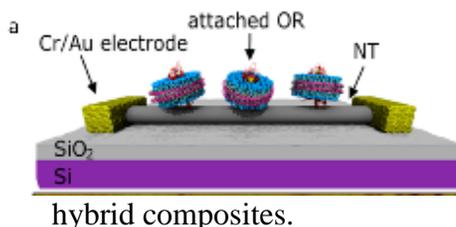


# The Nano/Bio Interface Center

NSEC Grant NSEC DMR08-32802

**Director: Dawn Bonnell, Associate Director: Yale Goldman**  
**The University of Pennsylvania**

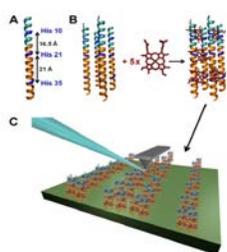
The Nano/Bio Interface Center develops the *next generation probes of nanoscale phenomena enabling fundamental advances controlling optoelectronic function and mechanical motions of biomolecular systems and devices*. These physical measurement advances are part of the NBIC probe portfolio in metrology,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



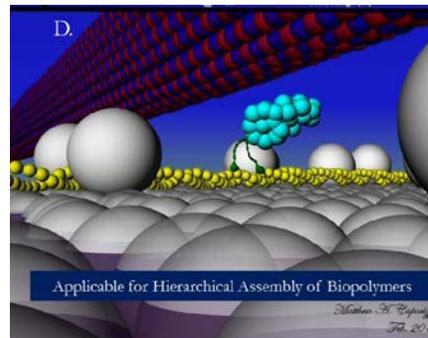
Several advances from 2011 characterize NBIC research. The Bio-optoelectronics team developed a strategy of programmable protein design to produce a family of new materials that enable biochemical sensors as sensitive detectors for cancer biomarkers. Proteins with engineered function are being combined with nanotubes, quantum dots and

hybrid composites.

The Molecular Motion team developed a platform to build biological complexity one molecule at a time using microfluidics and surface functionalization. The platform bridges single molecule observations and complex cellular interactions.



A new technique for probing protein-electrode interface properties was invented, torsionally stabilized nano impedance microscopy, and demonstrated the first measurement of optically excited dielectric polarization on engineered protein devices.



## *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 890 student visitors, 205 science fair projects, 55 exhibits



designed by grad students. 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 11 students from Philadelphia.

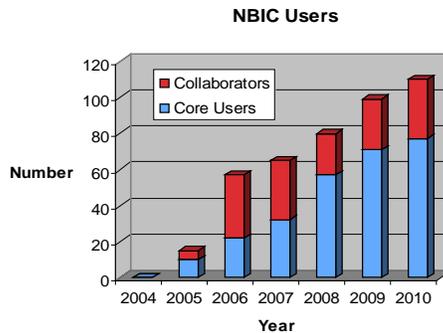
An undergraduate minor, graduate certificate and, a new masters degree in nanotechnology have been established. May 2009 saw the first graduates of undergraduate minor program. NBIC faculty members continue to lead in curriculum development.



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

**Infrastructure Development**

The Nano/Bio Probe Facility implements new probes of local phenomena, making these available to the research community long before they become commercialized. It currently consists of 10 instrumentation platforms serving over 100 users/year. The facility will relocate in the new Krishna P. Singh Nanotechnology Building in early 2013.



[www.nanotech.upenn.edu](http://www.nanotech.upenn.edu)  
[www.nanoprobenetwork.upenn.edu](http://www.nanoprobenetwork.upenn.edu)