

# Nano/Bio Interface Center

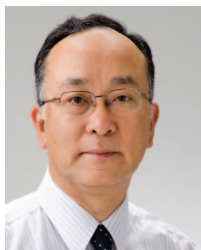


*NBIC Award for*  
Research Excellence in Nanotechnology

**TOSHIO ANDO**

*2012 Recipient*

UNIVERSITY *of* PENNSYLVANIA



Toshio Ando is a biophysicist specializing in the development and use of measurement techniques for understanding the functional mechanism of proteins. In the last two decades he has been developing high-speed atomic force microscopy (HS-AFM) techniques to directly visualize protein molecules in action at high spatiotemporal resolution. His group has made extensive efforts and various improvements to the HS-AFM making it now highly advanced for practical use. The exquisite dynamic images filmed in recent studies have been continuously demonstrating that this new microscopy is a powerful tool capable of revealing the process and structure dynamics of biological molecules in stunning detail. HS-AFM is expected to transform structural biology and biophysics as well as revolutionize our understanding of biological molecules.

Toshio is Professor of Physics and Biophysics and Director of Bio-AFM Frontier Research Center at Kanazawa University. Before joining the faculty at Kanazawa, he worked at UC San Francisco as a postdoctoral fellow and then an Assistant Research Biophysicist from 1980 to 1986. Professor Ando and his colleagues received a number of awards including Nikkei BP Technology Prize (2003), Nanoprobe Technology Prize of JSPS (2004, 2010), Hokkoku Culture Prize (2005), Distinguished Service Award of the President of Science Council of Japan (2007), Sakaki Prize of JSPS (2008), Award of the Surface Science Society of Japan (2010), Yamazaki-Teiichi Prize from Foundation for Promotion of Material Science and Technology of Japan (2010), and Uchida Prize Medal from Foundation for Promotion of Cardiovascular Research (2012).

**Abstract:** Proteins are extraordinary nano-machines. Proteins are essential for life and nearly all vital phenomena are governed and coordinated by the activity of proteins and their networks. They are tiny molecules but perform sophisticated functions infeasible with man-made machines. Understanding how they work is crucial in learning the strategies life has adopted and eventually creating useful nano-machinery. To this end, various approaches have been developed and used. The detailed structure of numerous proteins can now be revealed but their images are limited to static snapshots; the dynamic behavior of individual protein molecules can be studied by observing probes attached to the molecules even though protein molecules themselves are invisible in such observations. This means that we have to infer how proteins operate from data gleaned with significant resolution gaps. Directly observing individual protein molecules in action at high spatiotemporal resolution has therefore been a holy grail for biological science. This dream has now come true by the high-speed atomic force microscopy we developed. This talk will present the fundamentals of this microscopy, recently filmed images of proteins in action, and ongoing and future challenges to expand the scope of its application to biological studies.

*Join the Nano/Bio Interface Center*

NBIC Award for Research Excellence in Nanotechnology

*(2012 Recipient)*

**Toshio Ando**

*High-speed Atomic Force Microscopy:  
Nanoscale Visualization of  
Dynamic Biomolecular Processes*

Wednesday, October 24, 2012

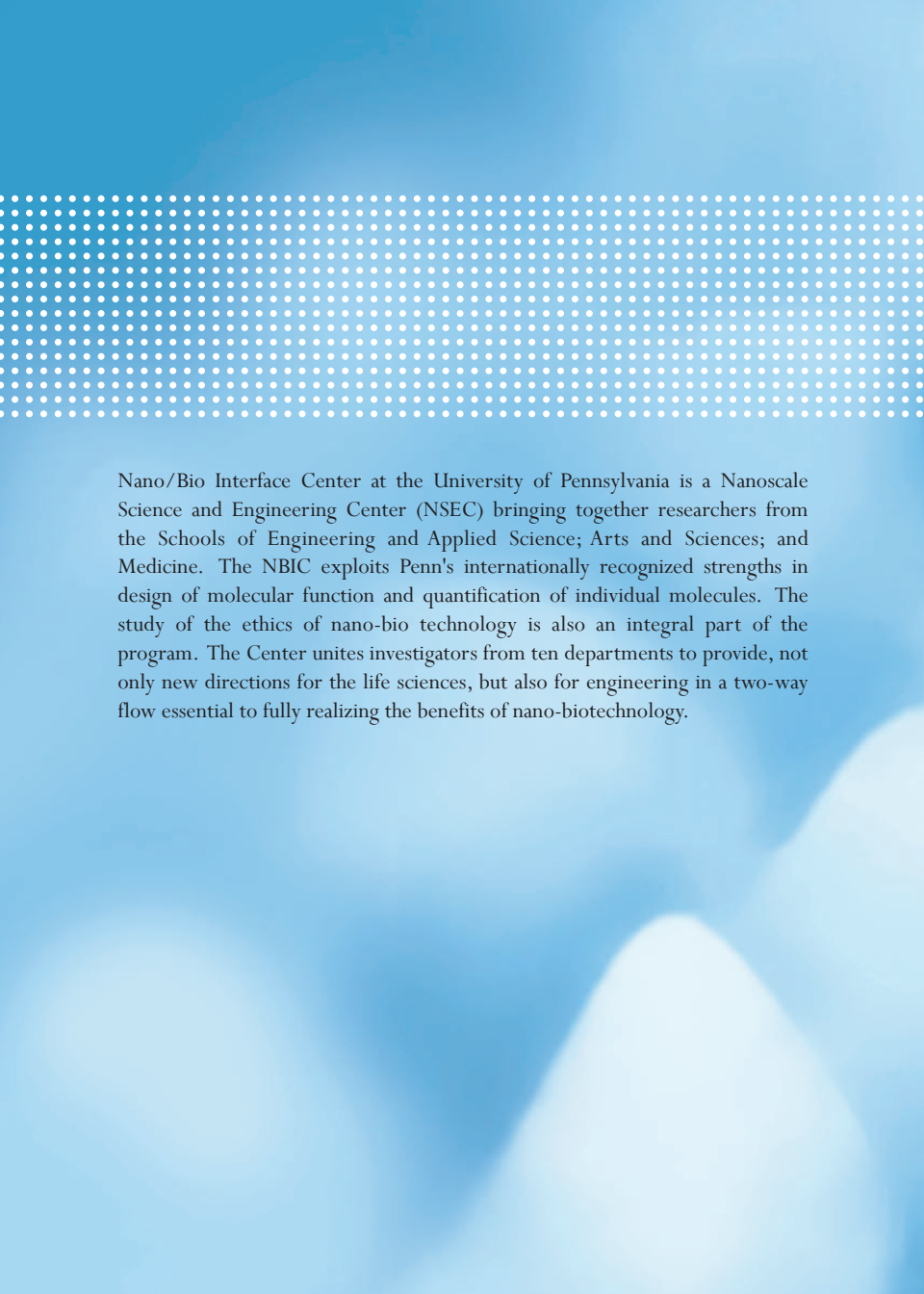
4:00 PM

Wu and Chen Auditorium

Levine Hall

3330 Walnut Street

*Reception to follow*



Nano/Bio Interface Center at the University of Pennsylvania is a Nanoscale Science and Engineering Center (NSEC) bringing together researchers from the Schools of Engineering and Applied Science; Arts and Sciences; and Medicine. The NBIC exploits Penn's internationally recognized strengths in design of molecular function and quantification of individual molecules. The study of the ethics of nano-bio technology is also an integral part of the program. The Center unites investigators from ten departments to provide, not only new directions for the life sciences, but also for engineering in a two-way flow essential to fully realizing the benefits of nano-biotechnology.