THE NANO/BIO INTERFACE CENTER (DMR – 0832802)

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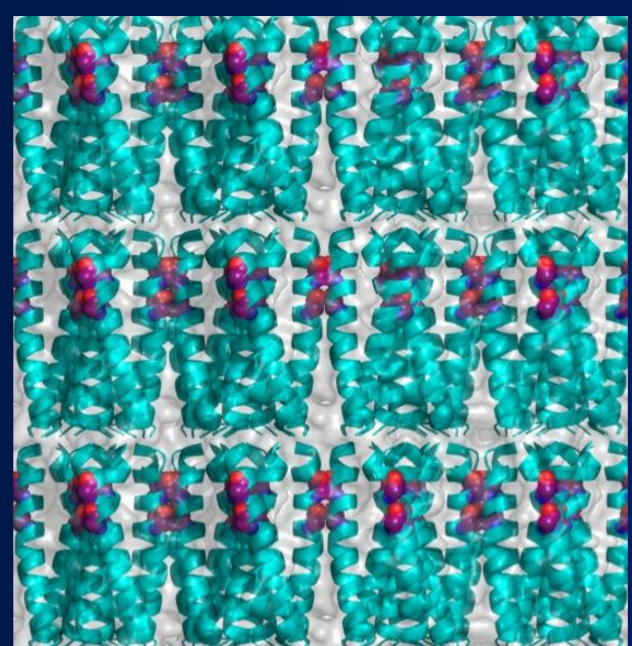
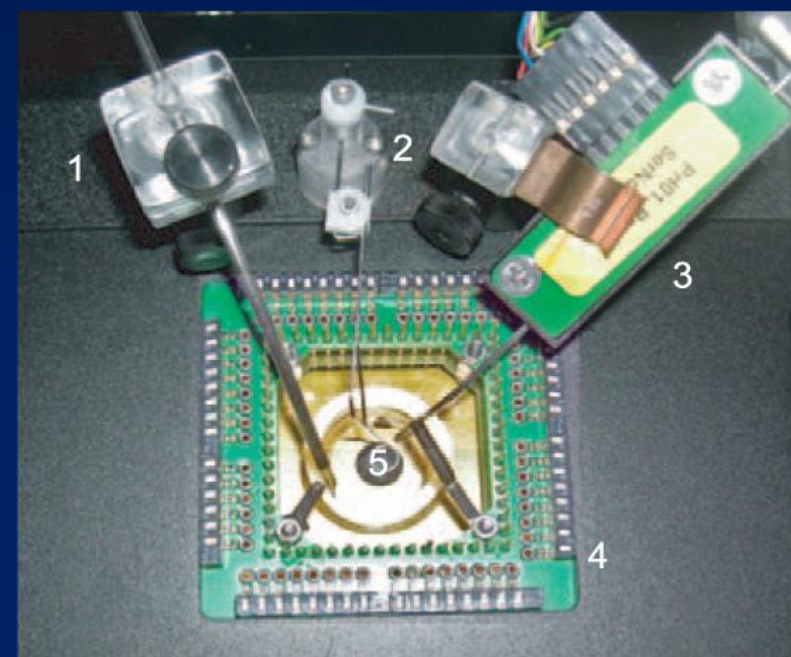


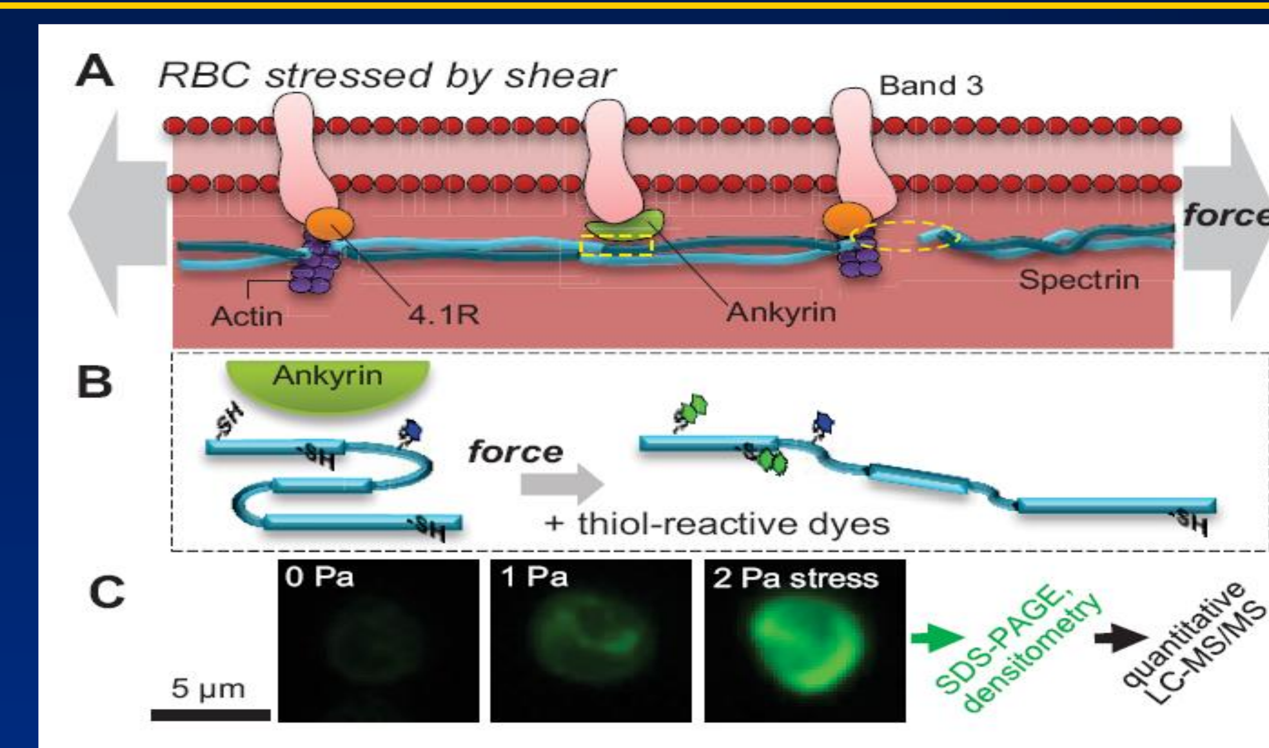
A computational approach has been developed for the design of proteins that self-assemble in three dimensions to yield macroscopic crystals.



Microfabricated electrode arrays can simultaneously 'listen' to the activity of many independent cells in a slice of living neural tissue.

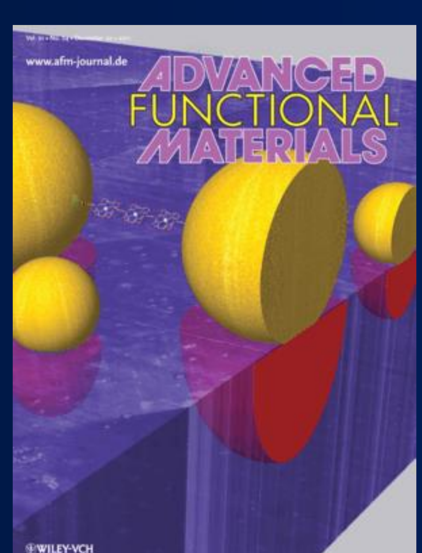
Single Molecule Properties

The ability, or inability, to probe behavior at the nanometer/molecular scale limits almost every endeavor involving nanotechnology. Enabling new scientific discovery, gearing up for manufacturing, determining environmental impact, and evaluating toxicity all rely on manipulating and characterizing structure beyond our current capability. Recent advances have opened a pathway to a new generation of local probes of molecular function that combine optical/electrical/magnetic signals and access dynamic phenomena. This cross-cutting initiative develops tools by combining near field optical probes with mechanical and electronic probes at the single molecule level.

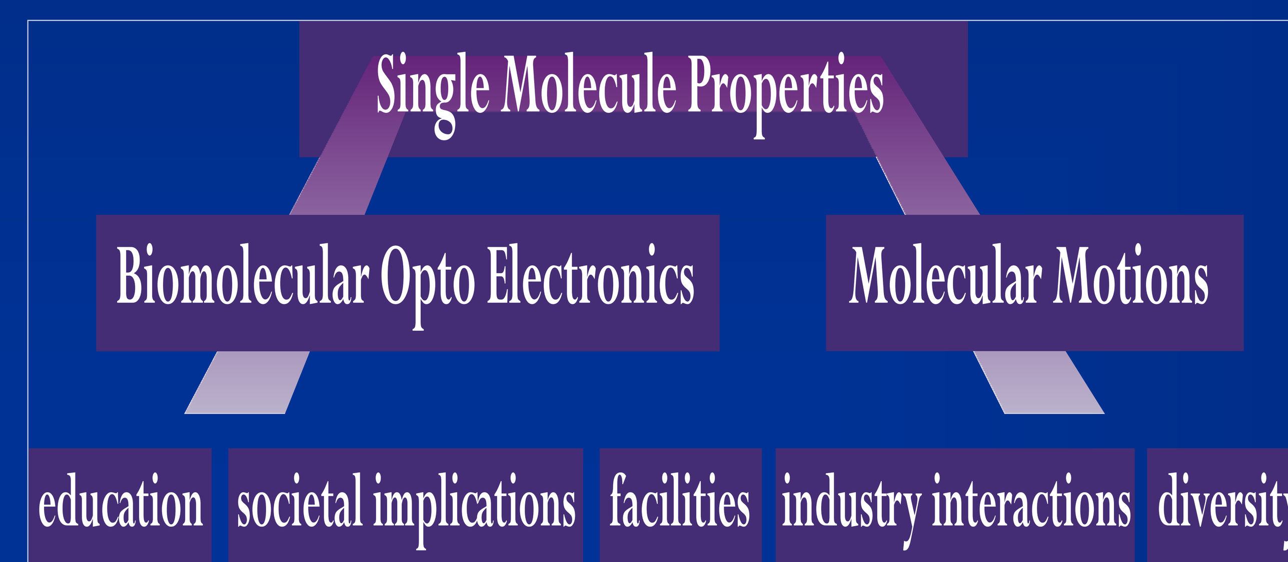


Cysteine shotgun labeling is used here to directly assess the unfolding and dissociation sequences of the spectrin-actin membrane skeleton within sheared red blood cell ghosts from normal and mutant mice. Forced unfolding of protein constructs with AFM proves consistent with in-cell labeling results.

Biomolecular Opto Electronics

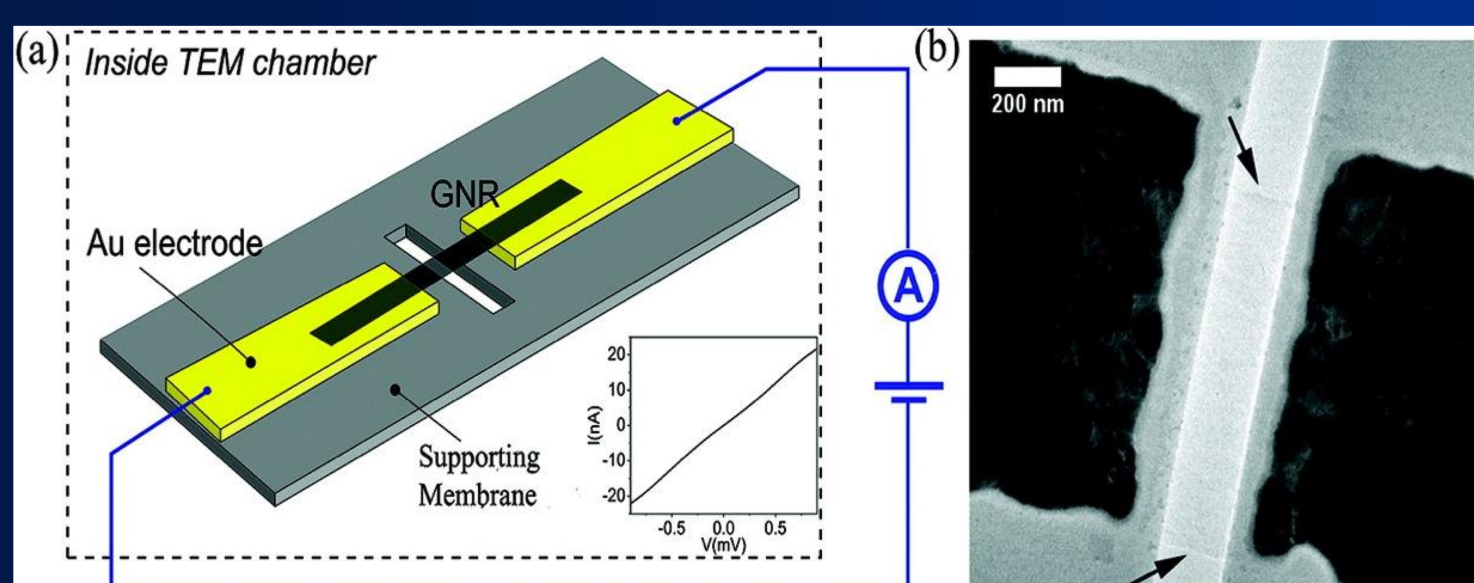


The combination of functional molecules and inorganic nanostructures such as tubes, wires and dots, suggest opportunities to engineer new approaches to energy transfer in, solar cells, sensors, and opto electronics. Biological molecules intrinsically organize complex structural assembly and function. Combining these two powerful strategies leads to new families of functional materials and devices. Inorganic metallic and semiconducting nanostructures are used to interface biological nanosystems with external measurement apparatus, signal processing circuitry, and optical systems.



Molecular Motions

This research develops methods of positioning biological macromolecules and controlling thermal/chemical/ mechanical environment to determine mechanisms associated with protein motion. The studies span biological polymer synthesis, protein folding, supramolecular self-assembly, directed energy transduction, and the theory of statistical fluctuations that dominate nanometer-scale physical behavior. Microfluidic design is a critical tool.



***Suspended graphene devices**. (a) Sample schematic. Few-layer graphene ribbon is suspended over a 1.4 µm × 0.2 µm slit in a 100 nm thick silicon nitride (SiN) membrane (membrane size ≈40 µm × 40 µm). Inset: current–voltage characteristic of an as-fabricated nanoribbon, acquired in situ. (b) TEM image of a suspended graphene nanoribbon. Arrows indicate the edges of the graphene.*

NBIC Scanning and Local Probe User Facility

Instrumentation

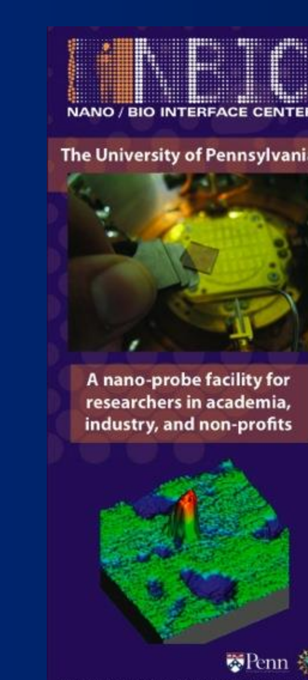
- UHV, environmental, and ambient AFMs and STMs.
- Confocal Raman spectroscopy with AFM.
- Total internal reflection florescence microscope with AFM.
- Microwave frequency probe station.

Capabilities

- On-site expertise for customization on instruments and measurement or techniques.
- In-situ device characterization.
- Fluid cells and heated stages for biological specimens (permitting atmospheric control).
- Optical stimulation via laser and monochromatic light sources.

Applications

- Real-space imaging of nanoscale particles, wires, and structures.
- Characterization of ferroelectric and piezoelectric films.
- Measurement of dopant concentration and leakage current.
- Probing stiffness, friction, and adhesion with nanometer resolution.



Ten instrumentation platforms with advanced probes of local properties that enable fundamental research, proof-of-concept testing, and characterization at the micro- and nanoscale.

Education and Outreach

- Masters Degree in Nanotechnology
- Graduate Certificate in nanotechnology
- Undergraduate minor in nanotechnology
- Summer Undergraduate Research Experience
- New courses/ modified courses with nanotechnology content
- Outreach to local teachers, students and community

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Sandia National Laboratories
A Department of Energy National Laboratory
Graphene Frontiers
ADVANCED DIAMOND TECHNOLOGIES, INC.
Agilent Technologies
Anima Cell Metrology
intel

New University Building

Krishna Singh Center for Nanotechnology
Opened October 2013

- 10,000 sq. ft. micro/nanofab cleanroom
- 10,000 sq. ft. nanocharacterization facility
- 18,000 sq. ft. shared facility and laboratory