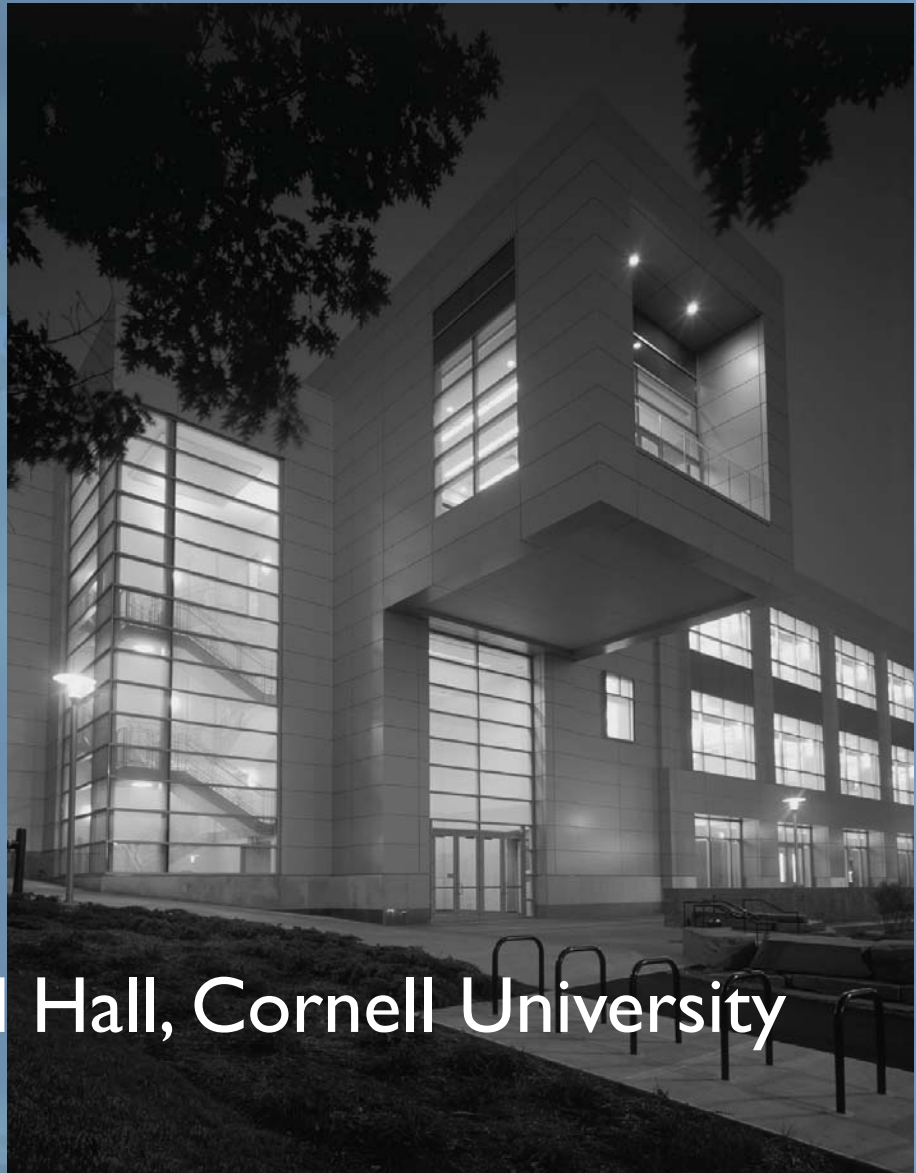


# Nanobiotechnology Center

## Shared Research Facilities



Duffield Hall, Cornell University

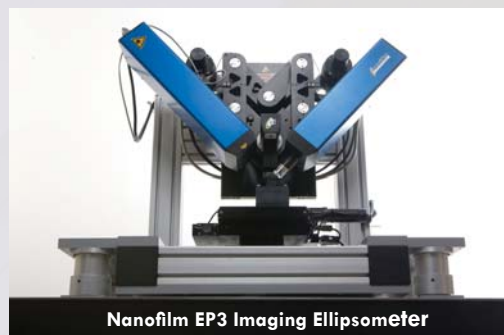
“Instrumentation and capabilities for integrated nanobiotechnology research”

# Imaging Ellipsometer

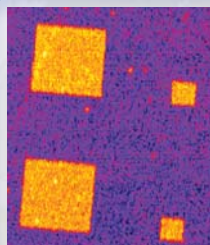
## Spectroscopic Imaging Ellipsometry (S-IE)

A powerful non-destructive technique for measuring dielectric properties or thickness of thin films of almost any material adsorbed/deposited on a reflective substrate.

The EP3 Imaging Ellipsometer uses analysis optics in combination with a CCD camera to provide spatial resolution down to 2 micrometer and  $<0.1$ nm thickness resolution ( $\text{SiO}_2$  on Si) with a real-time view of the sample, providing the user with unprecedented measurement control and information on sample homogeneity.



Nanofilm EP3 Imaging Ellipsometer



### Thin organic film pattern

Patterned areas of a 1.5nm thick organic monolayer on silicon oxide.

Boxes are 300x300 and 100x100 micrometer

Typical material that can be analyzed include:

- Thin metal films
- Semiconductor, oxides and optical coating materials
- Thin polymer and other organic films
- Self-Assembled Monolayers (SAMs)
- Biological molecule layers (DNA/protein) etc.

The NBTC ellipsometer has a heated stage for temperature ramping and various liquid cells for measuring in solution. An inverted transmission cell allow field-of-view Surface Plasmon Resonance (SPR) measurements

## Microscopy Resources

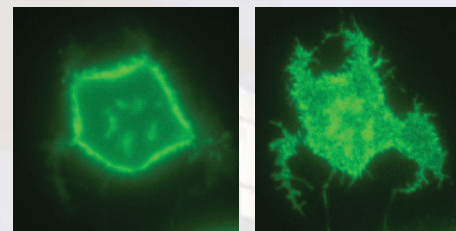
The NBTC shared facilities have a number of high quality optical microscopes with fluorescence, transmitted and reflected light optical configurations. Digital image capture and image analysis software allow measurement and other image processing.



### Total Internal Reflection (TIRF) Microscopy

TIRF is an excellent technique for exciting and imaging fluorophores within  $\sim 100$ nm of a coverslip (for example, labeled membrane proteins). Since excitation of fluorophores in the bulk of the specimen is avoided, a very high signal-to-noise ratio is achieved, making it possible to detect single-molecule fluorescence with TIRF.

The NBTC TIRF microscope is a Nikon Ti-E/B with Andor iXON+ camera, available laser wavelengths of 405, 488, 561, 635 nm, and can also perform FRET, FRAP, or PALM microscopy.



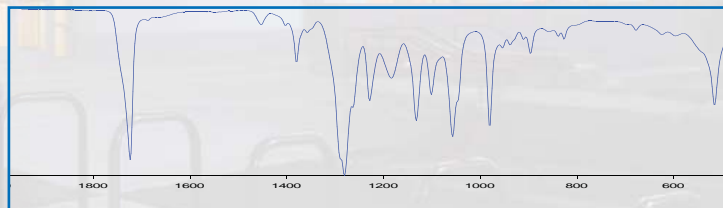
Wide field epifluorescence image (left) and TIRF image (right) of RBL cells labeled with AF488-IgE membrane receptor. Only the lower membrane is visible in the TIRF image. Amit Singhai, Baird-Holowka Group, Cornell

# Infrared Spectroscopy

## Fourier Transform Infrared Spectroscopy

FT-IR is an analytical technique that can be used for identification of chemical functional groups based on their adsorption of infrared radiation.

The NBTC facilities provide access to an advanced, high resolution research Vertex V80v system with a mid-IR source (450-7000 $\text{cm}^{-1}$ ) and vacuum evacuated optics/sample chamber.



Polyhydroxybutyrate film on gold surface

## Available sample accessories

- Diamond ATR
- Germanium ATR (60 deg)
- Transmission sample holder
- Variable grazing angle (IRRS)
- Variable polarization



## Typical samples

- Films of polymers or other organics on various solid substrates
- Monolayers (SAMs of silanes, thiols etc)
- Biomolecules (dry and in aqueous solutions)
- Carbon nanotubes
- Powders and nanoparticles
- Gels
- General organic materials (liquids/solids)

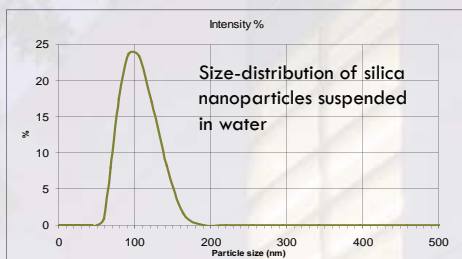
# Dynamic Light Scattering

## Zetasizer Nano-ZS

Dynamic Light Scattering (DLS) provides the ability to measure three important characteristics of particles or molecules (polymers, proteins etc.) over a wide range of concentrations in a liquid medium:

- **Particle size** (hydrodynamic radius: 0.6-6000 nm)
- **Zeta potential** (surface charge)
- **Molecular weight**

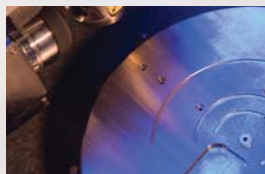
Being able to heat the sample cell from 2 to 90 degrees Celsius, the zetasizer also enables determination of the protein melting point and the ability to perform trend measurements (size vs time, size vs. temp etc.)



# Atomic Force Microscopy

## DI-3100 & MI PicoPlus AFM's

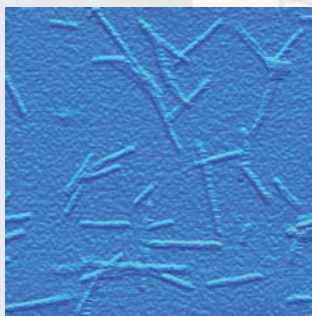
Two versatile atomic force microscopy systems that in combination accommodate all types of samples from large wafers to single strands of DNA. The PicoPlus system is specially designed for biological applications and imaging in liquids. There are a number of accessories for electrochemistry in combination with AFM, as well as integrated software for measuring cantilever force constants.



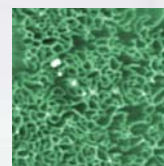
The PicoPlus universal microscope base permits easy integration with an environmental chamber or an inverted optical microscope

### Versatile for many applications:

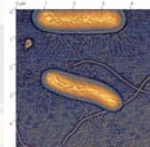
- **Life science**
- **Material science**
- **Polymer science**
- **Electrochemistry**
- **Force spectroscopy**
- **Physics**
- **Chemistry**
- **Nanosciences**



Organic nanowires



DNA plasmids



E.coli bacteria

# BioPlex 200

The Bio-Plex 200 system with high-throughput fluidics is a suspension array system which offers protein and nucleic acid researchers a reliable multiplex assay solution that permits analysis of up to 100 biomolecules in a single sample. This system allows researchers to multiplex:

- Immunoassays
- Enzyme assays
- Receptor-ligand assays
- Nucleic acid hybridization assays



# NBTC shared labspace

## Integrated Research Labs

Provide a versatile biological/chemical laboratory environment to facilitate nanobiotechnology research

- General Chemistry (Acid/Base, Organic)
- Biotechnology
- Microbiology
- Bacterial and Eukaryotic Cell Culture Capabilities
- Analytical Instrumentation
- Micromachining Facilities
- PDMS station for fluidics and mCP/mFP applications etc.
- Walk-in coldroom
- Staff support to assist users in cross-disciplinary research and help with fabrication and analysis

## Training and Research Assistance

In addition to full training which is available on the tools and equipment listed here, the NBTC also provides minicourses on the following topics

- Mammalian Cell Culture
- Cell Staining and Processing
- Electronic Testing
- Fluorescence Microscopy
- Surface Modification
- Microfluidics

NBTC staff can develop workshops tailored to your lab's needs.

## Equipment

Optical/fluorescent microscopy	Critical point dryer
Potentiostat	Gel imaging system
Electronic test equipment	Parylene coating systems
Centrifuge	Spin-coater
Microplate readers	Probe-tip sonicator
Electrophoresis	Profilometer
PCR	Plasma cleaner
Freeze dryer	Drying/vacuum ovens
Nitrogen glovebox	Laminar-flow sterile hoods
Spectrophotometer	Autoclaves
Fluorometer	Profilometry

CHA Mark50 Electron-beam metal evaporation

- Conformal films - 50 wafers capability
- Lift-off - 12 wafers capability
- 6 material pockets
- Materials include:  
Al, Au, Cr, Ti, Pt, Ni, Cu, SiO<sub>2</sub>

PDMS casting station

- Fabrication of MEMS devices
- Stamp making for microcontact printing



**NBTC**  
Nanobiotechnology  
Center



Cornell University  
Center on the  
Microenvironment and Metastasis

Nanobiotechnology Center

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Ithaca, NY 14853

[www.nbtc.cornell.edu/facilities.htm](http://www.nbtc.cornell.edu/facilities.htm)

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