Introduction

- **The Shared Research Resource at Northeastern University is unlike Core Facilities found at most Universities and other Research Institutions. We do not have a large user base with hundreds of users. Instead, we serve a small group of Faculty Researchers that are working on state of the art developments of Pharmaceutical Formulations primarily using nanotechnology based applications.**

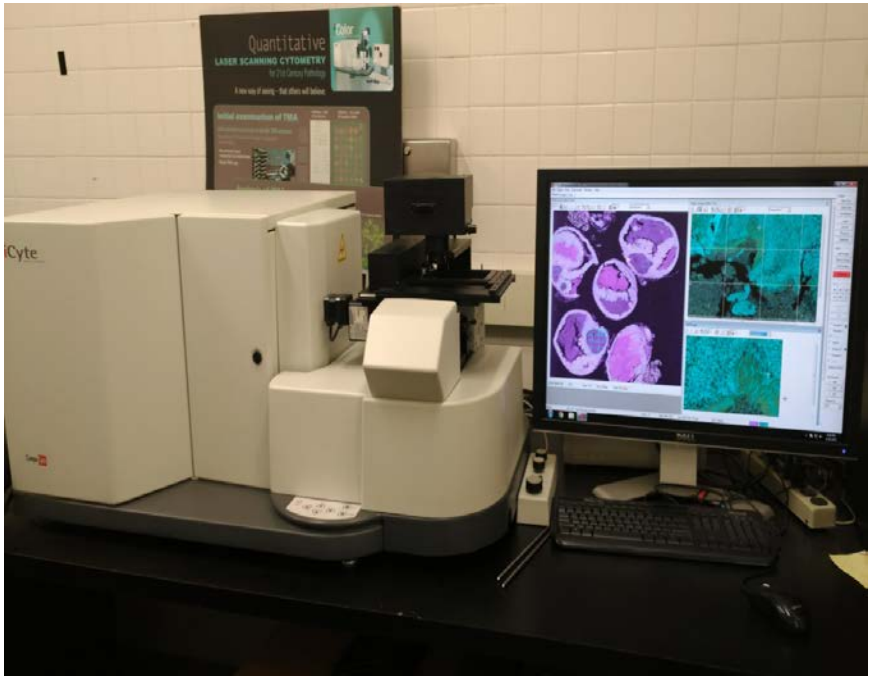
- **To meet their needs, we have more of a boutique facility, with an eclectic assortment of optical instrumentation, including a CompuCyte iCyte Laser Scanning Cytometer, a Keyence All-In-One Fluorescence Microscope.**

- **Label free holographic imaging instruments recently emerged, and we have 3 Phase Holographic Imaging Holomonitor M4®, obtained as part of the Northeastern University – Phase Holographic Imaging Program of Excellence in Holographic Imaging (now in its fifth year).**

- **Super-resolution cellular tomography systems are just beginning to appear on the market, and we have a Nanolive 3D Cell Explorer (Nanolive SA, Ecubens, Switzerland), paired with A stage top temperature control module, and a gas mixer for cellular atmospheric control, including hypoxic and hyperbolic conditions.**

- **We also have a tomography system Tomocube HT-2, (Tomocube, Daeion, South Korea), which combines refractive index and fluorescence imaging.**

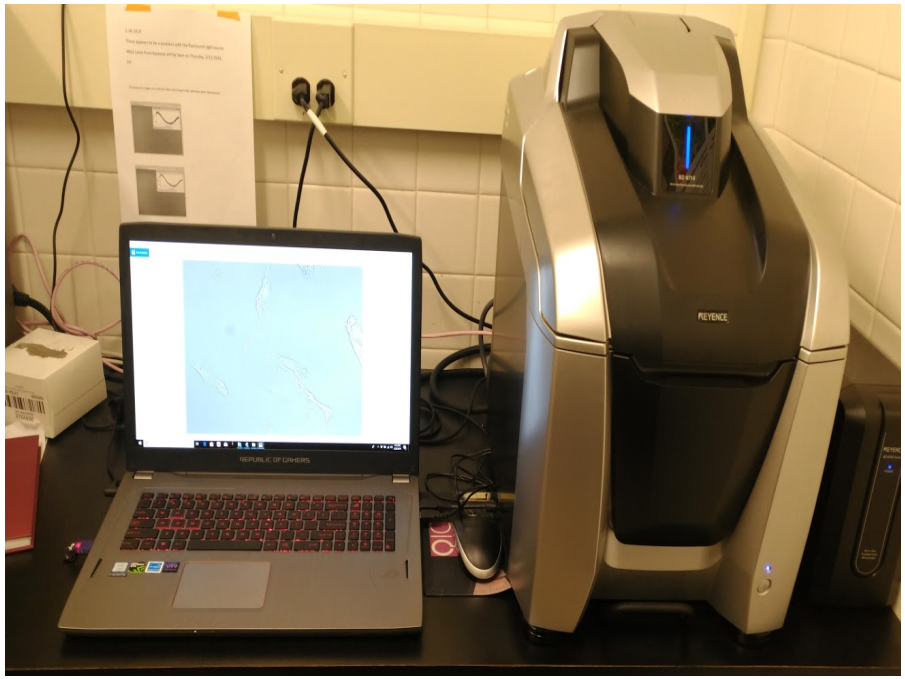
CompuCyte iCyte Laser Scanning Cytometry



- About 50 years ago, flow cytometry emerged as the premier platform for obtain quantitative data on large populations of cells. Using lasers, light scattering and fluorescence.
- The iCyte takes the same instrumentation components and applies them to samples on solid substrate – adherent cells, cells in microtiter plates, and tissue sections.

One or more lasers scan across the substrate surface and photodiode and photodiode measurements are recorded. 2-dimensional arrays are processed to form computational images (no camera is involved), from which multi-parameter quantitative features are extracted and processed by an extensive library of image processing and data analysis routines.

Keyence All in One Fluorescence Microscope BZ-X700



- Keyence Corporation (Tokyo Japan) is a leading producer of optical and engineering systems. Their camera based microscopy system id characterized by extremely high speed image acquisition, very advanced image processing features, and the ability to look at both bright field and fluorescence based modalities.

- Our instrument was purchased to replace the Zeiss confocal microscope we formerly had, and was selected for it's ease of use, robustness, and wide range of options.

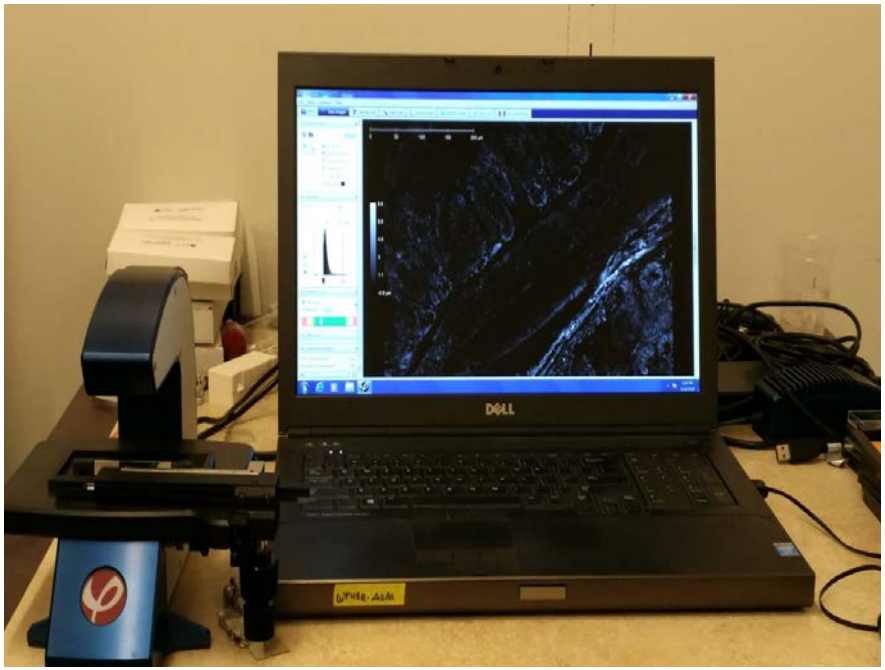
- Most users become competent in its operation after a single training session. Qualified users are allowed autonomous access.

Phase Holographic Imaging Holomonitor M4

- The HoloMonitor M4™ (Phase Holographic Imaging, Lund Sweden) is an incubator adapted, label-free, quantitative time lapse imaging system.
- A laser is used to generate diffraction patterns which are de-convolved to form maps of the sample optical thickness.
- Cellular events are identified and features are calculated.

- The automated stages allows moderate sample throughput rate, with the ability to track cells for time periods ranging up to up to a week.

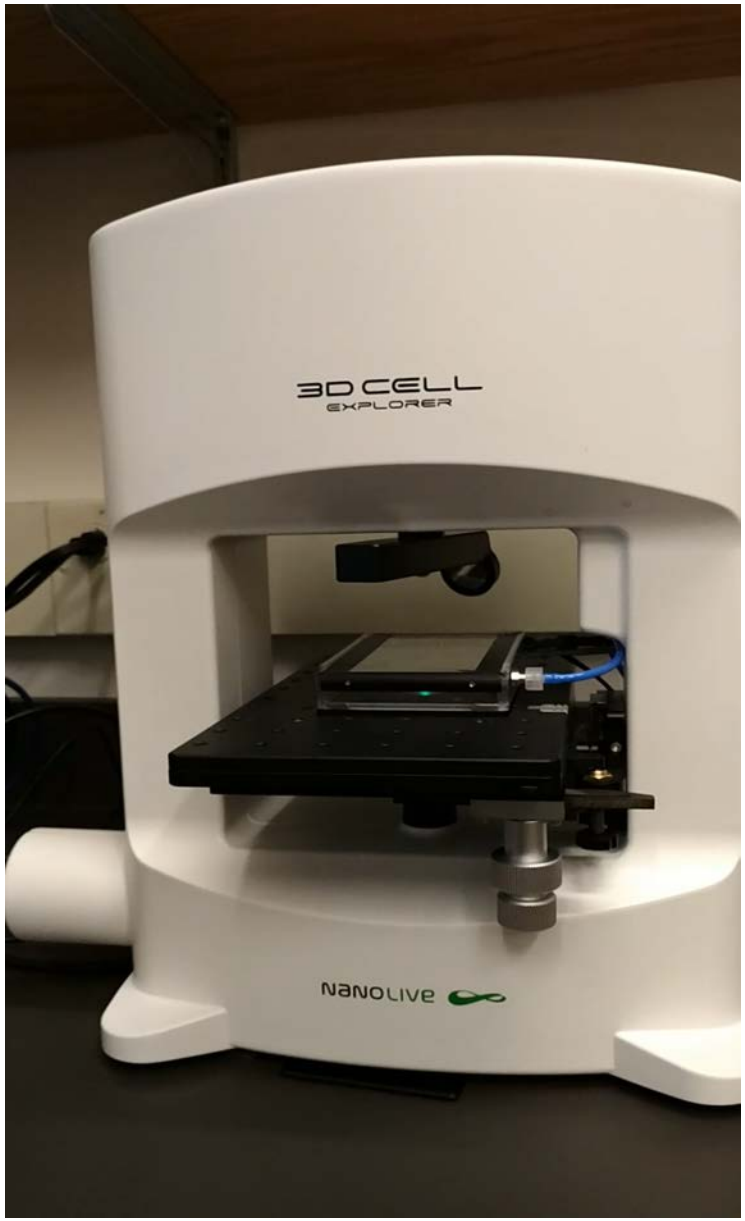
Holomonitor M4 for tissue analysis.



- One of the properties of holographic image generation is that focusing is not required – the algorithm determines the best focus height.
- Here, a M4 with a manual stage is shown with a mechanical stage outside of the incubator environment.

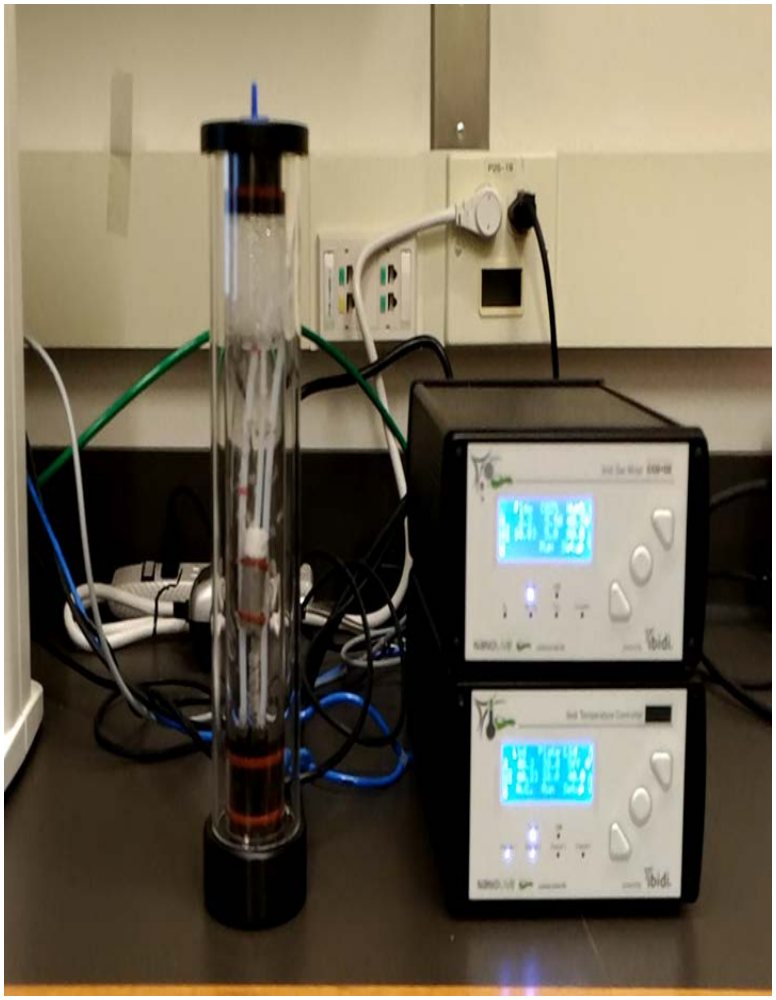
- In practice, we find this useful for doing quick evaluations of tissue sections – either stained, for example with H&E, or unlabeled.
- The purpose is not for diagnostic evaluations, bur as an aid in evaluating and documenting sample preparation.

Nanolive 3D Cell Explorer tomographic system



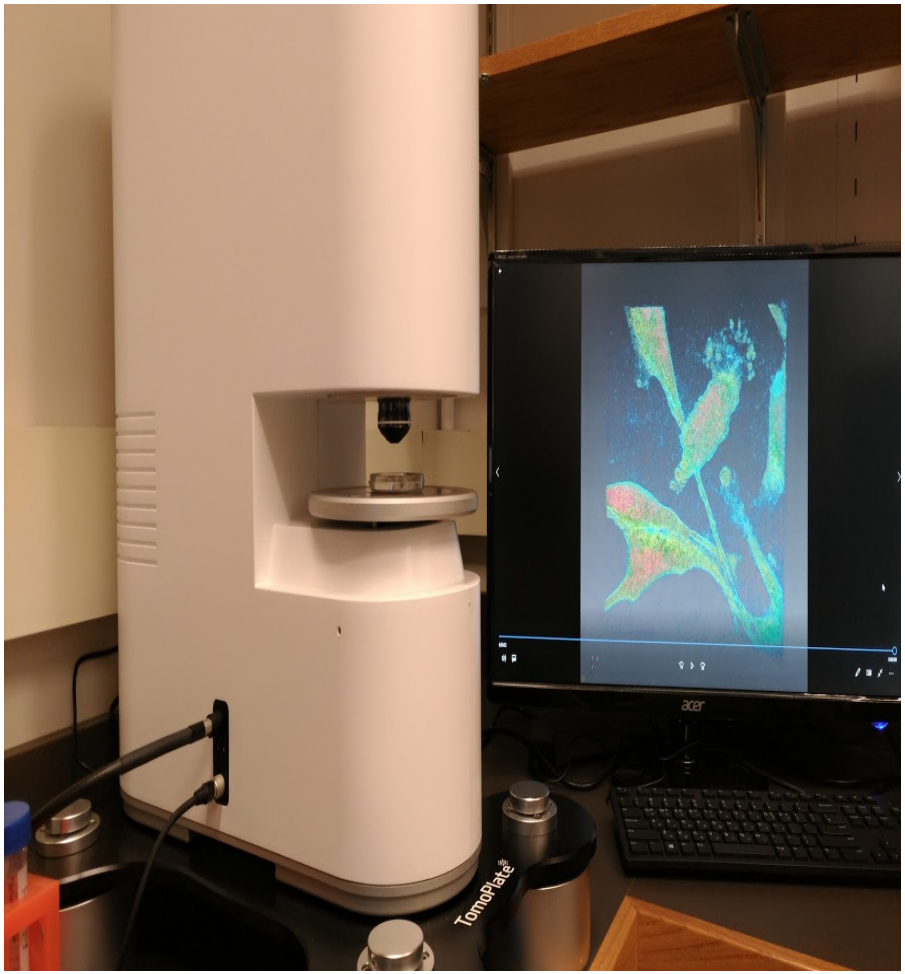
- This instrument has a laser based Mach-Zender holographic system similar to the M4.
- The novelty is the rotating mirror, which integrates the sample over a 360 degree rotation to produce 3 dimensional images.
- This instrument is set up for high resolution, sub micron resolution, with a 60X objective lens.
- The instrument has a manual mechanical stage to aid on searching for target image field.
- However, with the environmental control package, we are able to evaluate sub-cellular components such as mitochondria over time at resolutions previously not possible.

Ibidi Temperature controller, gas mixer and humidifier components.



- These components allow for precise control of the cellular environment over long periods of time.
- Computer interface allows tracking of the parameters over time, and the system is amazingly stable.
- Gas mixtures include CO2 and air, but also inclusion of nitrogen to induce a hypoxic environment, and also the infusion of oxygen for a hyperbolic system.
- The system pairs nicely with IBIDI u-dishes with a membrane bottom, and we routinely image sealed dishes for periods up to 5 days.

HT-2 Tomocube tomographic system



- This instrument uses multi-mirror-arrays to project laser light on the samples from numerous directions to obtain the tomographic images.
- It has a motorized stage, and is able to collect from multiple sample locations, and if desired, produced tiled images.
- The stage also has motion in the z-direction, and fluorescence images can be obtained similar to those by confocal microcopy,