



**Weill Cornell
Medicine**

Core Laboratories Center

Imaging Core Facility

Optical & Electron Microscopy, High Content Screening, and Image Analysis Services

ABSTRACT

The Imaging Core Facility is part of the WCM Core Laboratories Center and provides state-of-the-art instruments and services, and expertise in their applications, to the Weill Cornell Medicine (WCM) community and to outside investigators. Resources and services include confocal microscopy, wide field fluorescence microscopy, multiphoton microscopy, high content screening, electron microscopy, histology services (paraffin and cryo sample preparation), phosphorimaging, and X-ray film processing. The facility provides consultation on project design and image visualization and analysis, and offers seminars, training and educational workshops.

OVERVIEW

History: The WCM CLC Imaging Core Facility is the result of an ongoing collaborative process of integration of five previously separate core facilities: Optical Microscopy Core, Multiphoton Microscopy Core, Electron Microscopy and Histology Core, CLC Screening Core, and X-ray Processing Core. These services are now being offered to the WCM research community by a unified and integrated core facility.

Location: The core is located on the 1st floor of the "A" building, sub-basement of the "E" building, and 2nd floor of the "L" building at 1300 York Avenue, New York, NY, and on the 9th floor of the Belter Research Building, 413 East 69th Street, New York, NY.

WCM Core Laboratories Center (CLC): The WCM CLC was established in 2015. In addition to the Imaging Core, the CLC includes core facilities that offer resources and services in genomics and epigenomics, proteomics and metabolomics, synthetic and analytical chemistry, NMR, flow cytometry, CBIC (MRI, PET/CT and ultrasound), biorepository, bioinformatics, and advanced technology assessment.

Wide Field Fluorescence Microscopy: Upright Zeiss AxioPlan and inverted AxioObserver stands with CCD cameras, multiple objectives (5-63x), wide range of filter cubes for fluorescence, transmitted light imaging supported.

Confocal Microscopy: Two Zeiss LSM880s, one with Airyscan, spectral detection and incubation chamber, both with 7 laser lines, "filter-less detection," multiple high NA objectives.

Multiphoton Microscopy: Olympus FV1000MPE with Mai Tai DeepSee Laser (tunable 690-1020 nm); upright microscope; intravital imaging support includes inhalation anesthesia and access to dissection microscope.

High Content Screening: ImageXpress MICRO Automated High Content Analysis System designed for rapid and automated imaging and analysis of cells in multi-well plates.

Electron Microscopy: JEOL JSM1400 TEM with two CCD cameras; full sample processing for TEM and SEM.

Histology Services: TissueTek VIP 150 for automated paraffin processing; microtomy for paraffin and frozen sections.

X-ray Film Processing & Phosphorimaging: Two Konica X-Ray film processors; one Typhoon Trio PhosphorImager.

Administration: The Imaging Core Facility is part of the Weill Cornell Medicine (WCM) Core Laboratories Center (CLC).

Open to all: The resources and services of the core facility are open to all investigators at Weill Cornell Medicine, Cornell University and Cornell-affiliated institutions. The facility also provides services to external investigators at both academic institutions and commercial enterprises.

RESOURCES

Optical microscopy: two confocal microscopes (Zeiss LSM 880 and Zeiss LSM 880 + Airy Scan with 32-channel GaSP array for spectral imaging) and incubation chamber for long-term live cell imaging; multiphoton microscope (Olympus FV1000MPE, with auxiliary mouse pulse oximeter, anesthesia and euthanasia equipment), Zeiss AxioObserver inverted microscope, Zeiss AxioPlan upright microscope, dissection stereomicroscope (Olympus SZX10).

High content screening: ImageXpress MICRO High Content Analysis Imager, Thermo Catalyst Express Robotic Plate Loader, two MultiDrop384 Dispensers, BioTek ELx405 Microplate Washer.

Electron microscopy: electron microscope (JEOL JEM 1400 TEM with 2 cooled Olympus-SIS CCD cameras, 2K x 2K Teletra and 11 Megapixel Quemesa), 2 ultramicrotomes (Leica Ultracut S, Leica UltracutT), Electron Microscopy Science Vacuum Evaporator, Pella EasiGlow glow discharge unit, Electron Microscopy Sciences Critical Point Dryer, Pelco 9100S Sputtering Unit.

Histology: TissueTek VIP paraffin tissue processor & embedding station, Leica RM2155 rotary microtome, Hacker-Bright OTC cryostat.

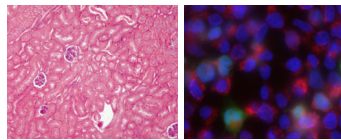
X-ray film developing: two Konica SRX-101 X-ray film processors.

Phosphorimaging: GE Triad Typhoon laser scanner.

Image analysis: 4 image analysis workstations, all have Zeiss Zen, MetaMorph, ImageJ/Fiji; one also has Imaparis and Autoquant; another one also has MetaExpress.

Wide Field Fluorescence Microscopy

Zeiss AxioObserver (inverted)
Zeiss AxioPlan (upright)

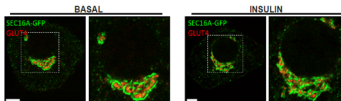


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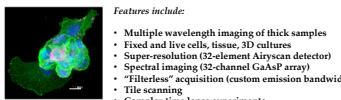
- Multiple wavelength fluorescence and transmitted light imaging
- Cell cultures and tissue sections
- AxioObserver allows tile scanning
- Basic filter cubes (blue, cyan, green, red, far red)
- Objectives 5x - 63x
- CCD camera

Confocal Microscopy

Zeiss LSM 880
Zeiss LSM 880 + AiryScan



Real and multicolorized adjuvanted influenza expressing H2N1-GFP (green) were stained for endogenous CD31 (red). 3D/2D-GFP images (CD31) and the corresponding image of real and multicolorized adjuvanted influenza. Scale bar: 5 μm. (Luo, Swanson, Nishida, Choudhury and Liu, 2012)



Neurotrophin-3 (NT-3) staining of hippocampal neurons. Scale bar: 10 μm. (Luo, Swanson, Nishida, Choudhury and Liu, 2012)

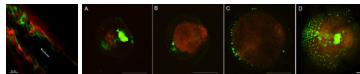
Features include:

- Multiple wavelength imaging of thick samples
- Fixed and live cells, tissue, 3D cultures
- Super-resolution (32-element Airyscan detector)
- Spectral imaging (32-channel GaSP array)
- "Filterless" acquisition (custom emission bandwidths)
- Tile scanning
- Complex time-lapse experiments
- Laser excitations: 405, 488, 488, 514, 561, 594, 633 nm
- Objectives: 10x, 25x, 40x, 63x, 100x (all but 10x are oil immersion); all DIC for simultaneous transmitted light imaging)

Multiphoton Microscopy

Olympus FV1000MPE
with Mai Tai DeepSee laser

3D resolved excitation and deeper penetration

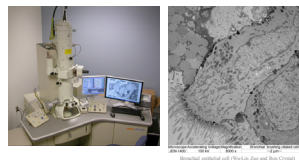


Features include:

- Fluorescence, Autofluorescence and Second Harmonic Imaging of cells, 3D cultures and thick tissues
- Intravital imaging (mice/rats)
- Inhalation anesthesia equipment
- Oxygen supply
- Heated stage and circulating-water heating blankets
- Excitation laser tunable between 690 - 1040 nm.
- Simultaneous detection of up to 4 signals
- Additional 405 nm laser (for uncaging and photoactivation)
- Objectives include standard ones, plus
- Low-power large field-of-view macro lenses: 2x and 4x
- IR-transmitting, high NA water-immersion objectives: 10x/0.6NA and 25x/1.0NA
- Small tip diameter Microprobe objectives: 6x and 20x; tip diameter: 1.3 mm; water-immersion

Electron Microscopy

JEOL JEM 1400 TEM



Features include:

- JEOL JEM 1400 Transmission Electron Microscope
- Accelerating voltage up to 120 Kv
- EM equipped with two digital CCD cameras for rapid (2K x 2K) or high-resolution (11 Megapixel) imaging
- Two ultramicrotomes for sectioning EM samples
- Vacuum evaporator for carbon coating
- Glow discharger
- Critical Point Dryer and Sputter Coater for SEM sample prep

Histology Services

TissueTek VIP

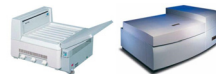


Features include:

- Hacker-Bright OTC cryostat
- Leica RM2155 rotary microtome
- TissueTek VIP150 paraffin tissue processor
- Tissue embedding and staining

X-ray Film Processing & Phosphorimaging

Konica SRX101 X-Ray Film Processors
GE Typhoon Trio PhosphorImager



High Content Screening

ImageXpress Micro Imager

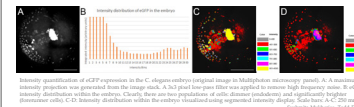


Features include:

- Inverted wide-field fluorescence microscope designed for rapidly imaging cells in multi-well plates.
- Compatible with 6, 24, 96, 384 and 1536-well plates.
- High-speed laser autofocus allows for imaging of up to 100 plates/day.
- Imaging of up to 8 different wavelengths from UV to near IR.
- Long working-distance objectives from 2X to 60X.
- Thermo Catalyst Express allows unattended screening of up to 45 plates/run.
- MetaXpress software and MDCStore integrated database with >8TB of ITS supported server space for images.

The ImageXpress MICRO High Content Analysis Imager is capable of automated fluorescence imaging of fixed- or live-cells. Together with a Thermo Catalyst Express Robotic Plate Loader, this system provides speed, flexibility, and high quality data with a large field-of-view, stage and autofocus control, broad range of objective lenses, and multiple filter options. Automated sample prep is facilitated by two MultiDrop384 Dispensers and a BioTek Plate Washer.

Image Visualization and Image Analysis



Relative quantification of GFP expression in the C. elegans vulva region using multiphoton microscopy (panel A). A histogram showing the distribution of the relative intensity of GFP expression in the vulva region. A 3D plot shows the relative intensity of GFP expression in the vulva region. A 2D plot shows the relative intensity of GFP expression in the vulva region. A 1D plot shows the relative intensity of GFP expression in the vulva region. A 0D plot shows the relative intensity of GFP expression in the vulva region. Scale bars: A-C, 200 nm. (Hoshino, Matsumoto, and Tani, 2012)

Available software:

- MetaMorph
- ImageJ/Fiji
- Zeiss Zen
- Imaparis
- Autoquant Image Deconvolution
- MetaXpress

Consultation, Workshops and Training

Consultation: on project design and image visualization & analysis (including automated batch analysis of images).

Educational workshops and hands-on training on equipment use and image analysis.

Seminars on emerging imaging technologies and applications.

Coordinated project design consultation and image analysis support available with the CLC genomics and epigenomics, proteomics and metabolomics, flow cytometry, CBIC (including MRI, PET/CT, and ultrasound), synthetic and analytical chemistry, NMR, biorepository, bioinformatics, and advanced technology assessment core facilities.

Contact Information

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http://corefacilities.weill.cornell.edu/elec_microscopy
http://corefacilities.weill.cornell.edu/ot_scr

For questions about the WCM Core Laboratories Center please contact George Grells at grells@med.cornell.edu