



**Weill Cornell
Medicine**

Core Laboratories Center

Citigroup Biomedical Imaging Center

ABSTRACT

The WCM CLC Citigroup Biomedical Imaging Center (CBIC) provides state-of-the-art imaging instruments and expertise in their applications to the Weill Cornell Medicine (WCM) community and to outside investigators. Resources and services include magnetic resonance imaging (MRI), positron emission tomography (PET), single photon emission computed tomography (SPECT), X-ray computed tomography (CT), high resolution ultrasound, and optical imaging and endoscopy. The CBIC provides consultation on project design and image visualization and analysis, and offers seminars, training and educational workshops.

OVERVIEW

History: The Citigroup Biomedical Imaging Center (CBIC) was established in 2003 with the support of Weill Cornell Medicine (WCM), the WCM Departments of Radiology, Psychiatry and Neurology, and NIH high end instrumentation grant awards. In addition, major instrumentation was acquired and continues to be operated with multi-institutional support, including a medical cyclotron with Memorial Sloan Kettering Cancer Center and a MRI instrument with The Rockefeller University. The CBIC became part of the WCM Core Laboratories Center (CLC) in 2015.

Location: The main CBIC facility occupies the "S" building annex at 516 East 72nd Street, New York, NY. A satellite CBIC facility is located in the basement of the Hefter Research Building at 413 East 69th Street. This satellite facility is fully Biosafety Level 2 (BSL-2) compliant and is operated in close collaboration with the Research Animal Resource Center (RARC).

WCM Core Laboratories Center (CLC): The WCM CLC was established in 2015. In addition to the CBIC, the CLC includes core facilities that offer resources and services in genomics and epigenomics, proteomics and metabolomics, synthetic and analytical chemistry, NMR, flow cytometry, imaging (including optical and electron microscopy and high content screening), bioinformatics, and advanced technology assessment.

Resources and services: CBIC major equipment includes two 3 Tesla magnetic resonance imaging and spectroscopy (MRI/MRS) systems for humans and large animals; a 7 Tesla/30cm bore pre-clinical MRI/MRS system; a combined positron emission tomography and computed tomography (PET/CT) system for humans and large animals; a pre-clinical multi-modality PET/SPECT/CT system; two ultra high resolution CT systems; a multispectral optical imaging system including bioluminescence, fluorescence, and X-ray; a medical cyclotron facility for production of radiotracers; and radiochemistry equipment for ligand synthesis. In addition, the CBIC supports a BSL-2 compliant imaging pre-clinical imaging facility that includes a 1.5 Tesla MRI, high resolution ultrasound, optical/CT, PET, and endoscopic imaging systems.

Administration: The CBIC is administered by the Weill Cornell Medicine (WCM) Core Laboratories Center (CLC).

Open to all: The resources and services of the CBIC 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

Magnetic resonance imaging and spectroscopy (MRI/MRS): two 3.0 Tesla systems for whole body human studies (General Electric Discovery 750 3.0 Tesla, Siemens Prisma Fit 3.0 Tesla), Bruker BioSpec 70/30/7.0 Tesla / 30 cm bore for pre-clinical studies, and a small bore 1.0 Tesla 1.0 Tesla ASPECT M3 system for small animal studies.

Positron emission tomography (PET), single photon emission computed tomography (SPECT), and computed tomography (CT): pre-clinical multi-modality PET/SPECT/CT system (Siemens Inveon), pre-clinical PET (Siemens Focus 220, pre-clinical CT (Scanco Viva CT 40), high resolution specimen CT (Scanco microCT 35), whole human body ultra-high resolution PET/CT (Siemens Biograph).

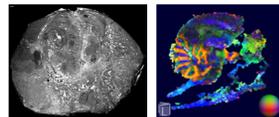
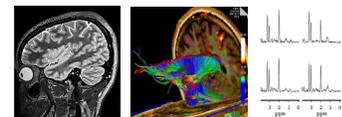
Radiochemistry: medical cyclotron (Eco 19 MeV Dual Beam Cyclotron) for production of radiotracers; radiochemistry equipment for ligand synthesis.

Optical imaging: Bruker Xtreme multispectral optical imaging system (including bioluminescence, fluorescence, and X-ray), optical CT (Perkin Elmer IVIS Spectrum/CT Imaging System).

High resolution ultrasound: VisualSonics Vevo 3100 Imaging System.

Endoscopy: Storz endoscopy system.

Magnetic Resonance Imaging



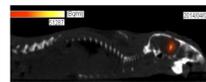
- Applications include angiography, diffusion tensor, functional, perfusion and spectroscopic imaging.
- MRI is used to study a wide range of diseases in patients, from neurological and psychiatric disorders to cancer and vascular disease.
- Additionally, MRI imaging is performed on both large and small live animals to investigate disease-related functional and structural changes.

MRI supports high resolution imaging virtually anywhere in the body. The Siemens 3.0 Tesla Prisma MRI contains 64 high bandwidth receivers providing fast parallel image acquisition with a 80 mT/m gradient amplitude. The GE Discovery 750 MRI has 32 high bandwidth receivers and a 50 mT/m gradient amplitude. Both scanners have a 200 T/m/s slew rate and a 60 cm inner bore diameter.

The Bruker BioSpec 70/30 USR 7.0 Tesla Small Animal MRI provides a 200 mT/m gradient amplitude, a 640 mT/m/s slew rate and a 20 cm inner bore diameter. In-house built RF coils provide additional signal and localization compared with standard imaging coils.

In addition, the CBIC supports a BSL-2 compliant pre-clinical 1.0 Tesla ASPECT M3 MRI scanner for use behind the barrier.

Computed Tomography / Positron Emission Tomography



- PET can be used to scan the entire body or selected organs. PET precisely measures physiologic function, detects metabolic changes in tissue, displays blood flow, tracks alterations in biochemical processes, and more.
- PET can help physicians evaluate patients for coronary artery bypass or angioplasty procedures, diagnose psychiatric and neurological diseases, assess head trauma and movement disorders, and help diagnose and stage tumor malignancies.



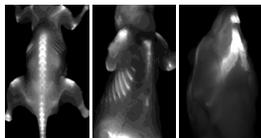
Instruments in the CBIC combine sophisticated computed tomography (CT) and positron emission tomography (PET) to produce images that simultaneously provide anatomic and metabolic information. MicroPET is available for small animal imaging studies.

Cyclotron / Radiochemistry



A medical cyclotron (Eco 19 MeV Dual Beam Cyclotron) is available for production of radiotracers and radiochemistry equipment is available for ligand synthesis. The cyclotron and related equipment are supported as a joint venture between WCM and MSKCC. The cyclotron produces various positron-emitting radiolabeled pharmaceutical drugs that are designed and engineered to complement clinical molecular targets. The preparation of these unique drugs requires a source of radionuclide (such as ¹³C or ¹⁸F) and the tools for subsequent synthesis of the drug incorporating the radionuclide. The cyclotron produces 19.2 MeV protons and 9.5 MeV deuterons in two separate beam lines.

Optical Imaging

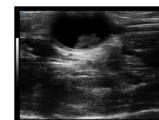


The Bruker In-Vivo XTREME is a powerful and versatile small animal imaging system for preclinical research that includes multispectral fluorescence, luminescence, radioisotopic and high resolution X-ray imaging in one system.

The IVIS SpectrumCT enables simultaneous molecular and anatomical longitudinal studies, providing researchers with essential insights into complex biological systems in small animal models.

High Resolution Ultrasound

Noninvasive measurement of anatomical structures, cardiac motion and blood flow



VisualSonics Vevo 3100

- Transducers with 40 μ m, 50 μ m, and 75 μ m resolution
- 20 mm field of view
- Image-guided needle injection
- *In vivo* anatomical structures
- Bloodflow and perfusion studies
- Abdominal and tumor studies

Image Visualization and Image Analysis

ImageJ
Image Processing and Analysis in Java

IT. pmod
Biomedical Image Quantification

AFNI = Analysis of Functional NeuroImages

SPM
Statistical Parametric Mapping

SYNGO.via

DTI-TRK
Diffusion Tensor Imaging

Available data analysis software includes ImageJ (NIH), Functional MRI (fMRI) analysis may be performed using AFNI or SPM. Diffusion tensor imaging (DTI) may be processed using the Siemens Syngo workstation, DTI Studio or TrackVis. PET pharmacokinetic analysis is performed using PMOD software with multiple toolboxes. Advanced applications programming is performed in MATLAB, IDL, and ImageJ routines. Data processing is performed on PC, Mac, Silicon Graphics and Linux based systems. Dedicated analysis machines include a Linux workstation with an NVIDIA Tesla K20C, SGB, Graphics Processing Unit containing 2496 processor cores for parallel analysis. Online data storage is maintained by ITS via a secure 8.5 TB partition on their research storage system.

Consultation, Workshops and Training

Consultation on project design and image visualization & analysis.

Educational workshops and hands-on training on 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, imaging (including optical microscopy, multiphoton microscopy, electron microscopy, and high content screening), synthetic and analytical chemistry, NMR, bioinformatics, and advanced technology assessment core facilities.

Contact Information

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