

RESOURCES AND FACILITIES

Georgia Tech Biotechnology Quad

The Biotechnology Quad Complex at Georgia Tech comprises 6 buildings (>1,220,000 ft²) dedicated to biotechnology research and education:

- Petit Biotechnology Building (PTB: 155,241 ft²)
- Engineered Biosystems Building (EBB: 218,914 ft²)
- U.A. Whitaker Building (90,000 ft²)
- Ford Environmental Science & Technology Building (287,000 ft²)
- Molecular Science & Engineering Building (275,000 ft²)
- Marcus Nanotechnology Building (194,850 ft²)

IBB Faculty Laboratory



Petit Institute Core Facilities

The Petit Institute administers core facilities (<https://petit institute.gatech.edu/research/core-facilities>, >\$36M in staffed core facilities) in several buildings across the Georgia Tech campus that are fully staffed by highly qualified personnel (listed) and they are available to support the activities of faculty on the GT campus, other academic investigators, and companies.

Cores in the Petit Biotechnology Building

Systems Mass Spectrometry (David Gaul, Samuel Moore and Ying Lui). This core provides molecular mass analysis and houses six research grade mass spectrometers. The facility provides a unique and complimentary mass spectrometry capability to investigators at Georgia Tech with regard to identification, structure elucidation, and quantitation of widely different molecular species. Some of the instruments include the Thermo Exploris 240, Rapiflex MALDI, and Thermo 7610 GC/MS systems.

Biomechanics (Laxmi Krishnan). The Biomechanics core provides mechanical analysis and testing of biological and engineered materials. Static and dynamic mechanical characterization is performed using various modes of testing that include compressive, tensile, torsional, flexural, and fatigue.

Biomolecular Analysis (Bo Yang and Robert Hughley). The Biomolecular Analysis core supports the analytical characterization of polymeric biomolecules such as DNA, RNA, protein, carbohydrates and lipids as well as small molecules. Available analytical techniques include absorbance spectroscopy, fluorimetry, luminometry, gel electrophoresis, and analytical high-performance chromatography. The core also provides other supporting equipment such as centrifuges (ultra, micro and high speed), scintillation counters, gamma counters, and tissue homogenizers.

Cellular Analysis and Cytometry (Erich Williams, Laxmi Krishnan and Robert Hughley,). Cellular Analysis involves the characterization of cell populations using fluid-based transport systems. In the Coulter Multi-sizer, impedance is used to size and count cells as well as particles as they pass through the orifice of an aperture. Flow cytometry characterizes cell populations based on their scatter and fluorescence properties. The BD Accuri, Fortessa, the Cytex Aurora provides spectral detection, The Beckman Coulter Cytoflex cytometers come with plate loaders provide analysis. The BD FACS Aria Illu and Melody provide FACS. The Amnis Imagestream X

can provide image data for samples with large populations of cells. The core has extended their analysis capabilities with the addition of imaging mass cytometry (Hyperion Tissue imaging system) with the traditional mass cytometry (Helios CyTOF).

High Throughput DNA Sequencing, Oligonucleotide Synthesis and Molecular Evolution (Technical Director-Anton Bryksin and team members Shweta Biliya, Naima Djeddar, and Fang Shi). The High Throughput DNA Sequencing, Oligonucleotide Synthesis and Molecular Evolution Core in Petit provides sequencing services to the GT community using the Illumina NovaSeq 6000 Ultra-High-Throughput Sequencing System. Some of the services include rapid runs with and without reagents, High output, TruSeq DNA, Nextera DNA, Nextera XT, TruSeq RNA sequencing. There are also services for Nextera rapid capture, Nextera library quantification, and Tru Seq quantification. The most recent addition to the core is the NOVA SEQ. The Oligonucleotide synthesis service provides users with high quality, high quantity oligo nucleotides up to 500 base pairs in length with the ability to create over 40 possible base pair modifications.

Histology (Sha'Aqua Asberry). Histology allows the visualization, identification, and the qualitative and quantitative analysis of cellular and tissue morphology. The lab is equipped to perform the following services: cryoprocessing of soft tissue and engineered tissue constructs; processing of soft tissue constructs for paraffin embedding/sectioning; methyl methacrylate embedding of bone and hard tissues and sectioning; H&E and special histological stains; automated immunohistochemical staining.

Magnetic Resonance Imaging (Johannes Leisen): The magnetic resonance imaging core offers high resolution MRI studies with a focus on molecular imaging, cardiac imaging, development of new contrast agents, and imaging specific to biomedical engineering research studies. The facility houses a Bruker Pharmascan 7T MRI scanner for animal research studies.

Optical Microscopy (Sandy Hsieh): The microscopy core houses several instruments used in the imaging and analysis of small samples with an emphasis on confocal microscopy. The facility operates 6 microscope systems: Zeiss Wide field microscope system with cameras, , two LSM 700 systems with incubation, LSM 710 NLO, and LSM 780-Elyra PS1 and two Zeiss LSM 900 w/ Airy Scan. Each system has a variety of lasers from the UV range to the IR range. Wide field microscopes are also used in conjunction with image deconvolution software. In addition, the core houses a BioTek Cytation 7 imaging plate reader with BioSpa 8 robotic incubator, plate handler and washer.

MicroCT (Technical Director-Laxmi Krishnan): Microcomputed tomography (micro CT), provides for the high resolution, nondestructive assessment of materials including musculoskeletal tissues and engineered biomaterials. The facility is equipped with four micro CT scanners of varying capabilities that are used for imaging small live animals and biological samples.

Neuro Design Suite (Bo Yang). The Neuro Design Suite is a state of the art facility for neuroscience research, which consists of three major rigs which allow researchers to perform manual and/or automated *in vitro* and *in vivo* patch clamping and *in vivo* extracellular electrophysiology recording.

Physiological Research Laboratory (Director-Laura O'Farrell, Quality Assurance Manager and Veterinarian-Richard Noel, and Lab Manager-Andrea Gibson). This multi-species animal facility consisting of 8,700 ft² including 10 housing rooms and a room containing 5 one-rack housing cubicles that can be used for isolation or for species that are used in small numbers. There is rack type cage washer with separate clean and dirty sides, a feed and bedding storage room with automatic bedding dispenser, three autoclaves, a 4-room surgical suite, a necropsy room, two procedure rooms, an office, a laundry room and a locker room with a shower. This facility also houses state-of-the-art live animal imaging equipment including IVIS Spectrum CT, and a Laser Doppler Imaging station. Decontamination and Sterilization Resources (Robert Hughley). The Decontamination and Sterilization resources include 3 medium sterilizers, 3 lab glass washers and a lab coat washer/dryer stack.

Cores in the Engineered Biosystems Building

Biopolymer Characterization (Core Director-Andreas Bommarius, Lab Manager- Robert Hughley). The Biopolymer Characterization core facility serves as a one stop shop for all DNA, RNA, and protein/enzyme characterization needs. The facility features a wide range of state-of-the-art instruments for conducting structural, functional, kinetic, and high-throughput analysis of samples. Some of these instruments include multimode plate readers, spectrophotometers (stopped flow and CD), calorimeters (isothermal and differential scanning), biophysical characterization tools such as analytical ultracentrifuge and Malvern OMNISEC REVEAL as well as chromatography instruments (AKTA FPLC and HPLC).

Cellular Analysis and Cytometry (Core Director-Krish Roy, Technical Director-Laxmi Krishnan, and Robert Hughley). The EBB cytometry core mirrors the instruments and activities in the Petit Cellular Analysis and Cytometry core and it also provides enhanced cell analysis and sorting with the addition of forward scatter detectors. The Maestro Pro is used to record signals in electrically active cells. The Isoplexis Isolight is a single cell secreted protein analysis system.

Genome Analysis (Core Director, Greg Gibson, Technical Director- Anton Bryksin). The genome analysis core offers the Biomark Genetic Analysis Platform for the analysis of gene expression, genotyping, mutant detection, and the absolute quantization of nucleic acid sequences utilizing dynamic array integrated fluidic Chip (IFC) technology. The core also provides ddPCR and single cell RNA SEQ services with the ddSEQ and 10X genomics systems. The Taspestri Single cell Multi-omics system is the latest technology in genotyping and phenotyping single cells.

Microscopy (Core Director-Phil Santangelo, Lab Manager-Danielle Scheff). The EBB Microscopy Core compliments the capabilities of the Petit Microscopy Core by offering spinning disk confocal microscopy, light sheet fluorescence microscopy and video rate super resolution microscopy. These capabilities cater to researchers that require high speed imaging as well as high resolution whole organism optical imaging.

Molecular Evolution (Core Director-M.G. Finn, Technical Director-Anton Bryksin, and team members Naima Djeddar, Shweta Biliya, Amina Barkane and Fang Shi). Certain techniques of molecular evolution – the generation and selection of functional molecules using biological mechanisms “in the test tube” – are well established, but still only used by laboratories expert in the art. Principal examples include phage display, SELEX, and yeast hybrid selection methods. These techniques provide access to peptides, proteins, and polynucleotides with an enormous range of properties. The Molecular Evolution Core provides services for any laboratory that needs new molecules to bind selectively to targets from ceramics to spleens. It complements the services of the HT DNA sequencing core by providing researchers different scales of next gen sequencing in the form of the Nova SEQ 6000, NextSeq 500, iSEQ and the MiniSeq. In addition, these methods will serve as the starting point for new ways of inventing catalysts, therapeutic agents, and functional materials. The facility is designed to automate a number of processes using automated sample handlers, colony pickers, gel electrophoresis and ELISA systems. perform molecular evolution projects with trainees from bioscience and bioengineering laboratories on campus. Recently, the Molecular Evolution Core established a CLIA certified lab within the core and started a pipette tip recycling program using the Grenova tip washing and sterilization system.

Systems Mass Spectrometry (Core Directors-Facundo Fernandez and Matt Torres, Technical Director-TBD , and team members TBD, Samuel Moore, Ying Lui and David Gaul). The EBB Systems Mass Spectrometry has existing capabilities in the Proteomics and Metabolomics space as well as planned capabilities in the Bioinformatics space. The full proteomics capabilities include protein identification and/or quantitation, post translational modification analysis (either targeted or untargeted). The full metabolomics capabilities include metabolite quantitation and identification (either targeted or untargeted). The planned Bioinformatics capabilities include the integration of “omics” type of data.

Physiological Research Lab (Director-Laura O’Farrell, Quality Assurance Manager and Veterinarian-Richard Noel, and Manager-Nick Parnell). EBB contains a multi-species animal facility including dedicated suites for zebrafish and other aquatics, a room for large animals and a cat housing suite in addition to rodent and rabbit space. It is composed of 25,000 gross square feet with 8,000 square feet of shell space that has been partially constructed for additional aquatics and large and small animals. An automatic watering system serves all housing rooms. There are two cubicle rooms for flexible use as quarantine, isolation or containment. A dedicated surgery suite for large or small animals contains two operating rooms, a surgeons’ scrub room and animal preparation rooms. There are two autoclaves, a pass-through rack washer designed for removing biofilm from fish tanks, a gas sterilizer and shell spaces for a tunnel washer and a bulk autoclave. There is a small clinical laboratory for processing rodent sentinel and other specimens. Four dedicated procedure rooms contain fume hoods specifically designed for small animal perfusion as well as a biological safety cabinet. An automated bedding removal system delivers dirty bedding directly to a dedicated dumpster on the loading dock. The office suite contains a break room, a laundry room and locker/shower rooms.

Cores in the Technology Enterprise Park (TEP)

TEP Cores (Manager-Rachel Arnold). BME hosts a several types of cores including Histology, Optical Microscopy and Biomolecular Analysis.

Physiological Research Laboratory (Director-Laura O'Farrell, Quality Assurance Manager and Veterinarian-Richard Noel, and Lab Manager-Andrea Gibson). This rat and mouse only animal facility consists of two housing rooms, three procedure rooms, a food and bedding room, an office, a locker room and cage storage area.

Core in the U.A. Whitaker Building

3D Medical Fabrication (Director-Scott Hollister and Manager Sarah Jo Crotts). The Center for 3D Medical Fabrication (3DMedFab) at Georgia Tech has successfully laser sintered resorbable tracheal splints from polycaprolactone (PCL) using an EOS P110 laser sintering system. They also have the capability to produce other medically relevant scaffolds including ear, nose, and larynx scaffolds.