



School of Medicine Core Facilities and Services

To assist researchers in the creation of standard proposal material The Office of Clinical Award Administration created templates for information commonly required in the submission process.

The School of Medicine offers 18 different fee for service Core Facilities. Below are short descriptions of each that can be included in your facilities statements:

BioBank* (Richard Kew)

The Stony Brook Medicine Biobank is a core facility within the School of Medicine. The Biobank provides human biological specimens, and associated clinical data, collected under informed consent to Stony Brook researchers and their collaborators. Banking of biospecimens is performed in a state-of-the-art, dedicated laboratory to ensure complete molecular and morphological integrity.

The Biobank stores normal and malignant specimens including tissue samples, bodily fluids, and other biomaterial under liquid nitrogen vapor phase at -185°C . This method of cryogenic storage allows for better cell preservation than -80°C freezing. In addition, the Biobank controls access to the entire archival collection of H&E slides and formalin fixed paraffin embedded (FFPE) tissue blocks from all pathology diagnostic cases done at Stony Brook University Hospital. This collection of clinical specimens (more than half a million cases) is a valuable resource for investigators to determine protein and/or RNA expression in diseased tissue and correlate those findings with morphological and clinical data.

Biological Mass Spectrometry (John Haley)

John Haley PhD, Daniel Canals PhD, Bo Chen PhD & Robert Rieger

The Biological Mass Spectrometry Shared Resource provides expertise in discovery and quantitative proteomics, metabolomics, and lipidomics.

Proteomics: Global and targeted analyses

- Identification and quantitation of post-translational modifications (phospho, acetyl, ubi, etc)
- Protein/peptide quantitation approaches using iTRAQ/TMT, SILAC, and cl-ICAT
- Immunoprecipitation, CLICK, Turbo/BioID, iPOND, Cys coupling
- Full service proteomics from sample preparation through biological interpretation

Instrumentation for Proteomics

- Thermo Q-Exactive HF – orbital trap with Nano1200 HPLC
- Sciex 5600Plus – quadrupole time-of-flight (QqTOF) with Eksigent nanoHPLC
- Bruker rapiFlex MALDI TOF/TOF

Lipidomics: targeted, quantitative lipid analysis

- Analysis of multiple lipid classes: sphingolipids, ceramides, PC, PE
- Absolute quantitation in large-cohort analysis using multiple internal ¹³C labeled standards
- Tissue-scanning MALDI

Instrumentation for Lipidomics

- Thermo TSQ Quantiva - triple quadrupole with Vanquish uHPLC
- Thermo TSQ Quantum Ultra – triple quadrupole with Dionex HPLC
- Agilent 6490 - triple quadrupole with 1290 uHPLC
- Bruker timsTof flex (tissue scanning)

Metabolomics: Eicosanoids, TCA cycle, glycolytic, lipid/fatty acid and DNA synthesis

- Targeted GC-MS and LC-MS/MS TQ and untargeted LC-MS/MS QqTOF
- Analysis of both steady-state levels and stable isotope metabolic reaction rates
- Tissue-scanning MALDI

Instrumentation for Metabolomic analysis

- Agilent 6490 - triple quadrupole with 1290 dual pump uHPLC (RP and HILIC)
- Thermo TSQ Quantum Access MAX – triple quadrupole with Dionex HPLC
- Agilent GC-MS
- Sciex 5600+ QqTOF with Dionex HPLC (RP and HILIC)
- Bruker timsTof flex (tissue scanning)

Pharmacokinetics, small molecule and nucleic acid analysis

Thermo TSQ Quantum Access MAX – triple quadrupole with HPLC

Bruker rapiFlex MALDI TOF/TOF

Biostatistical Consulting Core (Jie Yang)

The Biostatistical Consulting Core (BCC) aims to meet the increasing demand and serve the biostatistical needs in Stony Brook Medicine by providing biostatistical consultation, collaboration, education and support for all aspects of a research endeavor. The BCC is one of many core facilities under Office of Scientific Affairs at the School of Medicine. It is located in the Department of Family, Population and Preventive Medicine, School of Medicine. The core has one faculty member with PhD in Statistics, two fulltime and two part-time master level biostatisticians.

The services provided by our core include:

1. General biostatistical consultation ranging from clinical trial/experiment design to statistical data analysis;
2. Biostatistical assistance in grant preparation from formulating the study hypotheses to writing the statistical analysis plan;
3. Statistical short courses or workshops.

Our core continuously gets grant support from NIH PPG, NIH R01, NIH R21, DoD and other internal grants. Since 2016, our core members co-authored approximately 20 published peer-reviewed articles and 20 presented meeting abstracts every year. Our core has six working desktops (Dell Precision T1700 mini Tower with Intel® Xeon® Processor E3-1220 v3 (Quad Core, 3.10GHz Turbo, 8MB) and 16GB memory. The statistical software installed on these computers includes SAS 9.4, JMP, R, SPSS 19, STATA 13, PASS 12, and StatXact.

There is more statistical/computational software available in Virtual Sinc Site supported by Division of Information Technology, Stony Brook University (for example, MATLAB and GraphPad Prism).

Central Microscopy Imaging Center (Guowei Tian & Yunming Hu)

Central MIC is staffed with experience technical staff who can consult on experimental design and provide training on the instruments.

Light Microscopy Resources – Instrumentation

Olympus BX61WI InVivo Two-Photon Confocal Microscope

1. **Laser Line**

Central Microscopy Imaging Center (CMIC)

1. **Zeiss LSM 980 with Airyscan 2 NLO Two-Photon Laser Scanning Confocal Microscope System** (Life Sciences building)
 - Inverted Axio Observer 7 with definite focus.3 motorized condenser for AI based automated sample finder and motorized XY stage.
 - Airyscan 2 multiplex high speed, joint deconvolution, super-resolution (90nm).

- 2 MA-PMT+1 GaAsP detectors for regular confocal or 2P lasers, 1 transmitted light T-PMT for widefield imaging.
- Laser lines: 405nm, 445nm, 488nm, 561nm, 639nm, MaiTai HP tunable 2P laser: 680nm – 1040nm.
- Objectives: 10X, 20X, 40X, 63X, 100X.
- Equipped with a dark heated incubator chamber for live imaging.
- Equipped with a LSM Inverter for upright application with 2P system.
- Capable of FRAP, FLIP, FRET, 3D, spectral unmixing, colocalization, ROI measurement, line and spot scan, multiposition assay, time lapse, photo-activation, live cell imaging, and small live animal imaging.

2. Nikon N-SIM Super Resolution Microscope System (Life Sciences building)

- N-SIM (Structured Illumination Microscopy): resolution 100nm, 2x higher resolution than conventional microscopy.
- Inverted Nikon Eclipse Ti research microscope with a motorized stage.
- 100x objective only for N-SIM imaging.
- Laser lines: 405nm, 488nm, 561nm, 640nm.
- 3D capable.

3. Nikon N-STORM Super Resolution Microscope System (Life Sciences building)

- N-STORM (Stochastic Optical Reconstruction Microscopy): resolution 20nm, 10x higher resolution than conventional microscopy.
- Inverted Nikon Eclipse Ti research microscope with a motorized stage.
- Laser lines: 405nm, 488nm, 561nm, 647nm.
- 3D capable, TIRF capable.

[STORM Protocol-Sample Preparation](#)

4. Leica TCS SP8X Laser Scanning Confocal Microscope System (AERTC building, R & D Park)

- Upright Leica DM 6000 microscope with a motorized XY-Stage.
- Laser lines: White Light Laser (WLL) 470-670 nm), UV 405 nm. Detection range: 400-800 nm.
- Internal detection channels: 2xPMT, 2x HyD.
- Equipped with Tokai Hit Stage Incubator providing 37° C and 5% CO2 for live cell imaging.
- Tandem scanner 8 KHz with non-resonant mode and resonant mode.

5. Zeiss LSM 510 META Laser Scanning Confocal Microscope System (Life Sciences building)

- Inverted Zeiss Axiovert 200M microscope with a manual control stage.
- Laser lines: 458nm, 477nm, 488nm, 514nm, 543nm, 633nm.

- Equipped with incubator chamber and a Zeiss CTI-Controller 3700 for CO₂ and temperature control for live cell imaging.
- Capable of FRAP, FLIP, FRET, 3D, time lapse, photo-activation, and spectral imaging.

6. Image Processing Software (Life Sciences building)

- One standalone workstation with Nikon NIS-Element (Ar) software, STORM images, and SIM images off-line analysis licenses.
- One standalone workstation with Zeiss LSM software (version 4.0) off-line image analysis license

TEM Resources

FEI BioTwinG² Transmission Electron Microscope (TEM)

- AMT digital camera for acquiring images as well as film capability
 - accelerating voltage of 120kV with goniometer/stage tilt capability
 - software for serial reconstruction
- Routine sample preparation (embedding, sectioning) as well as:
 - immunohistochemistry using immunogold techniques
 - negative staining
 - serial sectioning
- Leica EM UC7 ultramicrotome for ultrathin sectioning
- Individual tutorial for independent operation as well as assisted TEM support

Sample Preparation (Life Sciences building and AERTC building)

- Leica EM UC7 Ultramicrotome
- Leica EM UC7/FC7 Ultramicrotome and Cryo-ultramicrotome
- Freeze Plunger FEI Vitrobot
- High Vacuum Coater/Freeze Fracture Unit Leica EM ACE 600:
- Equipped with cryo-transfer SEM sample holder (Leica VCT 100) for Cryo-SEM sample prep
- Turbo Freeze Drier EMS 775
- Cryo Transfer TEM Specimen Holder (Gatan Gat-626)

AERTC Building

JEOL JEM 1400 Transmission Electron Microscope

- La B6 filament
- Resolution: 0.2nm/0.38nm(Lattice Image/Point Image)
- Accelerating Voltage up to 120kV
- Magnification(Mag mode/Low Mag mode): x5K-2M/x120-4K
- Specimen Stage: microactive goniometer with piezo drives
- Specimen Chamber(Specimen per Load/specimen Tilt Angle): $1/\pm 25^\circ (\pm 70^\circ \text{ with optional holder})$
- Equipped with Anti-contamination Device and Cryofin
- Bottom-mount Gatan Orius SC1000B CCD camera
- Equipped with energy dispersive X-ray and Oxford X-MAX 80T detector

Zeiss Crossbeam 340 focused Ion Beam-Scanning Electron Microscope (FIB-SEM)

- FE-SEM, High Vacuum or Variable pressure mode available
- Multiple detectors available: InLens Duo(SE and BSE), SE2, VPSE
- Capella FIB column with Ga-Liquid metal ion source
- Resolution at 30kV:3nm ,Voltage range:500V-30kV, Probe Current range: 1pA-100nA
- Equipped with Micromanipulator, capable of TEM lamellas specimen preparation
- Gas Injection System of Platinum precursor
- Oxford EDAX and EBSD detectors
- Equipped with Leica Cryo system
- Equipped with Atlas5, a powerful integrated software, capable of 3D tomography imaging and nano-patterning process

Thermomechanical Characterization Instrumentation (AERTC building, R & D Park)

1. Dynamic Mechanical Analysis (DMA) - TA Q800

- Temperature range: -145~600°C
- Force range: 0.0001~18N
- Frequency range: 0.01~200Hz
- Available clamps: Dual/ Single cantilever, compression, 3-point bending, tension (Film)

2. Thermal Gravimetric Analysis (TGA) - TA Q50

- Monitoring weight changes in a materials as a function of temperature and time
- Temperature range: ambient+5~1000°C
- Sensitivity: 0.1µg

3. Differential Scanning Calorimetry (DSC) - TA Q2000

- Measure temperature and heat flow associated with thermal transitions in a material
- Temperature range: -90~550°C
- Tzero Hermetic pans available for liquid and volatile samples

4. Thermal Conductivity Meter - DTC-300

- Measure thermal conductivity of a material accordance with the ASTM E1530 standard
- Temperature range: -20~300°C
- Thermal conductivity range: 0.1~40W/m.K
- Specimen size: 2" in diameter, ≤1" in thickness

Division of Laboratory Animal Resources (DLAR) (Tom Zimmerman)

The Division of Laboratory Animal Resources (DLAR) at Stony Brook University is fully committed to the judicious, humane use of animals in research and teaching. The Division supports all SBU animal related research through the provision of laboratory animal management and veterinary medical care and assures institutional compliance with all federal, state and local regulations and policies. DLAR is responsible for animal procurement; animal husbandry; veterinary care including health surveillance, preventative medicine programs, animal quarantine, personnel training and special technical support; and maintenance of animal facilities and equipment.

DLAR, with 26 administrative, veterinary and technical personnel, provides quality animal care for over 15 species of laboratory animals located in five facilities on campus. The School of Medicine, and the Departments of Anatomical Sciences, Biochemistry and Cell Biology, Ecology and Evolution, Neurobiology and Behavior, Marine Biology, Molecular Genetics and Microbiology, Physiology and Biophysics, Pharmacological Sciences, and Psychology, receive approximately \$36 million of funding for essential animals research annually.

Description of Animal Facilities: The on-campus DLAR facilities are located in the following four facilities. These facilities are administered centrally through the DLAR and directed and staffed as previously described.

- 1. Health Sciences Center (HSC)** –This is the main and largest DLAR facility and is where the Director and her support staff are based. This 66,285 square foot, ground level facility has the following components: a dedicated loading dock; an animal receiving room; two veterinary treatment areas; four survival surgery suites with associated surgical scrub, animal prep and equipment prep areas; one non-survival surgical suite; a post-operative recovery room; a portable Xray machine and an automatic film processor; a large animal ultrasound machine; a rodent ultrasound machine, a rodent microCT machine, a portable C-arm fluoroscope; stationary fluoroscope and PET/CT/SPECT imagers, and IVIS

bioluminescence imager, a Lietz Ortholuz microscope; a cesium irradiating unit for rodents; two autoclaves dedicated to sterilizing clean supplies; 86 animal rooms for housing multiple vertebrate species facilities; biohazard and quarantine rooms; laboratory areas for experimental procedures; a necropsy suite, with animal and radioactive animal carcass coolers; a walk-in cooler for storage of feed; two tunnel washers; one rack washer; equipment and supply storerooms; one classroom used for staff and investigator didactic training; a laundry area; 2 locker rooms; an employee lunch room and staff offices. In addition, DLAR space has been dedicated for shared mouse phenotyping equipment including a rodent ultrasound unit, GFP imaging unit, indirect calorimetry equipment, MRIs, PET/SPET/CT and a microCT unit.

2. **Medicine and Research Translation Building (MART)** – This is a 6,500 square foot, ground level facility located on the 3rd floor of the MART building, a wing of the hospital. It has a loading dock, 2 rodent housing room, 3 procedure rooms, 1 store room, 1 cagewash containing a rack washer and electric autoclave, a locker room and a tank gas storage room.
3. **Laboratory for Comparative Medicine (LCM)** – This is a 8,500 square foot ground level facility that is equipped to perform biosafety level 3 experiments. It has 3 suites for small animal studies that consist of an anteroom, housing room, and infecting room. There is also a large animal housing room and an insectarium, an autoclave, and a rackwasher. One of the infecting rooms is also equipped with an inhalation unit for aerosol exposures.
4. **Life Sciences Building** – This is a 12,060 square foot, ground level facility located in the basement of the Life Science Building. It has a loading dock, 9 animal rooms, 5 laboratory areas, 1 store room, 1 surgical/experimental procedure room and 1 cagewash room containing a rack washer and a tunnel washer. Mice housed under maximum isolation conditions and conventionally housed mice, rats, and amphibians are located in this facility.
5. **Computer Science Building** – This 9,850 square foot animal facility is located on the ground floor. It is a single corridor facility with a loading dock, 7 animal rooms, 4 investigator laboratory/animal training areas, 1 storeroom, an autoclave and a cage/rack washer.
6. **Psychology A** – This 3,622 square foot, third floor facility has a key-locked, dedicated elevator off of the loading dock. There are investigator offices and laboratories that connect to the animal facility. The facility has 8 animal rooms, 2 rodent surgery suites, 1 necropsy room, 2 laboratories, 1 storeroom and 1 cage/rack washer and multiple vertebrate species houses conventional rodents housing and pigeons.

There are two fish/aquatics off campus facilities that houses vertebrate species. The Marine Science Division has a 7,244 square foot facility at Flax Pond that maintains large aquaria housing wild caught fish native to the Long Island Sound. Stony Brook University has also recently purchased the Southampton college campus and they have a Marine Sciences facility, which is under the oversight of the Stony Brook University IACUC.

Freezer Farm (Krista Mauro)

The Freezer Farm is a great option for investigators with large sample collections that are not currently being used as part of an active project. Traditional freezer storage at the laboratory level is notoriously unreliable and takes up a lot of space in a lab. Repairs to freezers are also costly and any loss of power to a freezer often coincides with the loss of valuable work. The Freezer Farm ensures that Investigators will no longer have to worry about faulty freezers or power outages destroying their irreplaceable samples. There are numerous safety measures in place which will ensure that no loss of temperature ever affects the Freezer Farm. Some Investigators have large collections of samples which they are not currently using for research but which are

valuable and may be needed in the future. Usually this would create a space problem for their future projects by limiting the amount of new samples which could be collected. By transferring the samples into the Freezer Farm investigators can free up space while knowing their samples are safe. The Freezer Farm offers peace of mind, increased space and opportunity for future research along with the storage of samples. All samples stored within the Freezer Farm are barcoded and their location in the freezer is documented to make finding the samples in the future quick and easy.

Facilities:

The permanent storage -80oc chambers are situated within a -20oc walk in chamber. Manufactured by Bahnsen Environmental Systems, this system allows for greater storage space at a much lower energy expenditure than the traditional upright and chest freezers commonly used for sample storage. Within the -20oc Walk-in are 8 reach-in chambers at -80oc. This provides the total combined storage potential for over 1.8 million samples.

In addition to this walk-in system the Freezer Farm also has 4 traditional point-of-use -80oc Freezers. Three of these are located within the ambient temperature area of the Freezer Farm. These three Freezers are for incoming and outgoing samples so that they can be added into the database system and barcoded for organizing the permanent storage area. The 4th Freezer is located in the hallway outside of the Freezer Farm and provides 24-hour access to researchers who need to drop-off or pick-up samples outside of the operating hours of the Freezer Farm.

Safety Measures:

Permanent Storage Bahnsen System:

We know that the samples being stored within the Freezer Farm are extremely valuable and irreplaceable so we have taken extensive measures to protect them. To ensure that no loss of temperature will ever affect the samples stored within the Freezer Farm there are measures in place designed to account for equipment failure, power outages, and natural disasters. The temperature of the -20oc walk-in environment and each of the -80oc chambers are monitored 24-hours a day on an Alerton system which will alarm in the event of a loss in temperature or door being left open for an excessive amount of time. In the event of an alarm there are a number of individuals who will be contacted to assess the situation and ensure all samples are safe while the issue is being resolved.

The -80oc chambers are powered from one of two -80oc compressors. These compressors operate on a lead-lag system. Each compressor runs for twenty-four hours before switching over to the other one, this keeps the compressors exercised which will prolong the life of the equipment and ensure that both are in working order in the event that one compressor becomes unusable. In the event one of the compressors malfunctions the other will take over and operate continuously until the damaged compressor can be repaired.

In the event of a power outage the Freezer Farm is hooked up to the hospital's emergency generator with the highest level of priority. In the extremely unlikely event that both the hospital power and generator are non-functional there is a back-up liquid nitrogen infusion system which can keep the -80oc chambers at temperature for about 8 hours per tank. In the event that the liquid nitrogen will be needed for an extended period of time, there is a system in place where a micro bulk truck with liquid nitrogen can be parked in the loading dock and hooked up to our Liquid Nitrogen infusion system to cool the Freezer Farm. In addition, due to the way the chambers are situated within the -20oc walk-in environment, as long as the doors are not opened the chambers will remain at temperature for 8 hours without power.

Point-of-use Freezers:

The temperature of the upright freezers are monitored on a cell based alarm system provided by Rees. Any increase in temperature or loss of power to these freezers results in a phone call to a list of people who can respond to assess the situation and move the samples to a working Freezer. All 4 freezers are also plugged into the hospital's emergency power outlets so that in the event of the building losing power the freezers will be powered by the hospital generator.

Access Control:

In addition to the safety measures against temperature fluctuations, the Freezer Farm is also strictly access controlled. A limited amount of staff have access to the area and the doors are monitored by video to record anyone who enters the -20oc walk-in environment to access the -80oc chambers. The 3 Freezers located inside the ambient temperature area of the Freezer farm are protected by this strict access control.

The 4th Freezer, located in the hallway is protected by an electronic number lock so that all samples are only accessible through prior approval.

Genomics (John Schwedes)

DNA Sequencing

We offer DNA Sequencing service utilizing the Applied Biosystems 3730 DNA Analyzer using BigDye chemistry. Customer data is downloadable directly from our secure server. We have three sample drop off sites on campus for the convenience of our customers.

Digital PCR

The Applied Biosystems QuantStudio Absolute Q Digital PCR System is a plate based digital PCR (dPCR) platform consisting of just one instrument consolidating all steps required into a one-step qPCR-like workflow. The dPCR workflow is identical to the qPCR workflow you are familiar with. dPCR overcomes variability and low accuracy by eliminating the need for a standard curve.

Real-Time PCR Service

The UDSF is currently equipped with an Applied Biosystems 7300 Real-Time PCR System. This system allows the investigator either use SyBr Green or TaqMan based real-time PCR assays with the advantages of a 96-well format. Data is downloadable directly from our secure server

- Experimental design and data analysis help is available.
- Data analysis software available from the DNA Sequencing Core.
- Results are downloaded from our server.
- One-step or two-step RT-PCR
- A wide variety of technologies requiring dual-dye detection, like TaqMan, Molecular Beacons, Scorpion Probes and others can be run.

PCR Product Purification

The DNA sequencing Core can now save you time and purify your PCR products and setup the sequencing reaction. Once you complete your PCR reactions and run a gel to determine which clones to purify. You simply submit 10 ul of the PCR reaction and your primer. We will purify the PCR product and assemble the sequencing reaction with your provided primer

Instrumentation for DNA Sequencing

- Applied Biosystems 3730 DNA Analyzer
- Applied Biosystems 7300 Real-Time PCR System
- Applied Biosystems Absolute Q dPCR System

Genomics Core Facility

The Genomics Core of the Office of Scientific Affairs of the Renaissance School of Medicine provides scientists with the tools required to maximize their research related to genetics/genomics. The Genomics Core serves researchers at Stony Brook University as well as researchers at other institutions, with a number of genomic technologies and expertise. Using an individual approach to every customer, we consult on experiment design and controls, run the experiment and help with data analysis to meet client's needs.

The Genomics Core offers services that include: various applications of next-generation sequencing (NGS) on our Illumina NextSeq 550, RNA-Seq library preparation, single cell RNA-sequencing and multiomics. Gene expression analysis and microRNA profiling analysis using the Affymetrix Microarray platform; BioPlex 200(X-Map technology) for multiplex cytokine/chemokine assays. In addition, we offer: DNA and RNA isolation services; quality control of DNA and RNA samples and RNA and DNA libraries using an Agilent BioAnalyzer 2100 or Agilent 4200 TapeStation systems; DNA and RNA sample quantitation with a NanoDrop™ OneC or Qubit 3.0. Custom Oligonucleotides can be ordered from Integrated DNA Technologies (IDT) through our web portal. Benefits include lower per base cost and minimal shipping charges.

Single Cell Genomics Facility (Barbara Rosati)

The SOM Single Cell Facility is hosted in a 1,260 sq. ft laboratory located on the 6th floor of the Basic Science Tower, Room 124.

The facility provides researchers with the ability to analyze genetic, epigenetic and surface antigen profiles of individual cells, using state-of-the-art technologies. The facility houses a range of cutting-edge instruments, including microfluidic platforms, robotic automation, and rapid cell counting instruments.

Using the 10X Genomics Chromium platform (Chromium Controller, Chromium iX), we offer several single cell multiomics services:

- [Single cell or single nuclei 3' or 5' RNA library preparation](#) for transcriptome analysis
- Cell-level genome accessibility analysis through [single nuclei ATAC library preparation](#)
- Both approaches above can be combined in the same cells using [multiome library preparation](#)
- Supported options include: [VDJ sequencing](#), [CITE-seq](#) and [cell-](#) or [nuclei hashing](#)

This facility also operates a TapeStation 4200, which allows rapid and automated electrophoresis of up to 96 samples for quality control of RNA and DNA libraries, and determination of RNA- and DNA Integrity Numbers (RIN, DIN).

A Countess 3FL with GFP and RFP fluorescence detection capability supports rapid and automated counting of cell suspensions and dye-based cell viability assays (Trypan Blue, PI/AO).

Additional support provided includes:

- Consultation on experimental design
- Assistance with optimization of sample preparation
- Troubleshooting
- Flexible hours to accommodate clinical or animal sample processing
- Assistance with grant applications (methods, letters of support)

Equipment

- Illumina NextSeq 550
- Affymetrix Microarray platform
- BioRad BioPlex 200
- QuantStudio Absolute Q Digital PCR system
- NanoDrop™ OneC
- Qubit 3.0 fluorometer
- Agilent BioAnalyzer 2100 and Agilent 4200 TapeStation systems
- 10X Genomics Chromium platform (Chromium Controller, Chromium iX),
- Countess 3FL with GFP and RFP fluorescence detection capability
- The SeaWulf high performance computing (HPC) cluster is a computational resource for the Stony Brook research community. It is equipped with more than 14000 CPU cores across more than 300 nodes and several types of GPUs. Standard bioinformatics software and workflows are installed and available for us.

Bioinformatics (Dave Carlson)

Bioinformatics services, including analysis of gene expression, functional enrichment analysis, de novo genome/transcriptome assembly and annotation, germline variant calling, DNA-binding site prediction, single cell sequencing data analysis, and protein structure prediction. Additional custom analyses will be considered upon request.

Positron Emission Tomography (PET) Research Core (Ramin Parsey)

The Core provides a full range of PET imaging services for research PET. These include consultation on study design, implementation of established research radiopharmaceuticals, development of novel radiopharmaceuticals, generation of documentation for IND and RDRC applications, scan acquisition, blood input function and metabolite analysis, scan data quantification and kinetic analysis. Core Leadership: Ramin Parsey, MD, PhD (Director of Strategy), Mark Slifstein, PhD (Director of PET Research), Christine DeLorenzo, PhD (Director of CUBIT for data analysis), Wenchao Qu, PhD (Director of Radiochemistry). See our website for more details:

https://renaissance.stonybrookmedicine.edu/PET_research_core

Facilities

Medical and Research Translation (MART) PET Research Facility:

SBU recently constructed (opened December 2019) the 465,000 sq. ft. MART building that houses laboratories for basic and clinical research. The PET Research Core is located on the 4th floor of the MART. Facilities include

- *BAHL Molecular Imaging Laboratory.* A complete facility for radiochemistry production and development.
- *PET Imaging Center.* Two bays housing PET scanners with a common console room are located in the MART
- *Metabolite Analysis Laboratory.* A room completely equipped for analysis of radiometabolite fractions in blood plasma, for kinetic models of tracer uptake
- *Exam Rooms.* Two exam rooms equipped for basic medical examination and arterial and venous catheter placements.
- *Uptake Room.* A dedicated tracer uptake room for participants in studies designed with delays between tracer injection and imaging
- *Office Space, Data Analysis Room.* Offices for faculty and staff in the MART
- *FERM Radiochemistry Laboratory.* Located in the Basic Sciences Tower, the FERM is an additional lab equipped for F-18 radiochemistry production and research.

Equipment

Cyclotron:

- A 16 MeV GE PetTrace 800 series cyclotron, configured for producing [¹³N]NH₃, [¹¹C]CO₂, [¹¹C]HCN, [¹¹C]CH₄, [¹⁸F]fluoride and [⁶⁸Ga]GaCl₃

Research Radiochemistry Laboratory. This laboratory contains:

- 4 Comcer MIP 1100 hot cells
- Chemical fume hood
- ScanSys TracerMaker chemistry systems

- GE Tracerlab FXN pro ¹⁸F chemistry systems
- GE FastLab ⁶⁸Ga chemistry system
- RadioHPLC systems

cGMP Radiosynthesis Laboratory. This ISO class 7 laboratory contains:

- 2 Comecer MIP 1100 hot cells
- 2 Comecer MMP mini hot celss
- ISO Class 5 dispensing hot cell with master/slave manipulators.
- GE Tracerlab FXN pro 18F chemistry systems
- ScanSys TracerMaker chemistry systems
- Direct pass through connecting to the QC laboratory
- Direct pass through connecting to the packaging and dispatch area
- ISO Class 7 ante room

QC Laboratory. This laboratory contains:

Gas chromatography system for residual solvent testing

- Two HPLC systems with autoinjectors and in line UV and gamma detectors for radiochemical/chemical purity testing
- Depyrogenation oven
- Multichannel analyzer
- Endotoxin testing equipment
- Pharmacy 4°C refrigerator,
- -20°C freezer
- 0.01 mg readable balance
- 2 kg capacity, top loading balance
- 22.5°C incubators for assessing fungal contaminants.
- 32.5°C incubators for assessing bacterial contaminants.
- Class 2A biological safety cabinet for aseptic work
- Chemical fume hood
- Direct pass through connecting to the cGMP manufacturing laboratory

Scanners:

MiE Scintronic PET Scanner. This is a dedicated research PET scanner that is a redesigned and updated Siemens HR+. The scanner rings and detection hardware are from an HR+, restored or replaced with new components as appropriate. The digital processing hardware and software have been modernized to acquire list mode data.

United Imaging uMI 550 Digital High-Resolution PET/CT: This is a 100% research-dedicated combined PET/CT scanner. This scanner consists of a high-resolution digital PET with 2.9 mm NEMA resolution and 2.76 mm LYSO detectors. The CT is an 80-slice ultra-low noise CT with 0.55 mm individual elements. The PET/CT has a 24 cm axial field of view (FOV) and can acquire a whole-body scan within 8 minutes. This FOV lends to high system sensitivity to boost data acquisition and enable low dose PET scans. Additionally, this system offers advanced technologies such as time-of-flight, point spread function, HYPER iterative (ROSEM), HYPER focus, deep learning (AI) PET reconstructions, deviceless gating, metal artifact correction, and more.

Stony Brook University has a unique collaboration with United Imaging. We hold biweekly meetings with the company's Physics team to discuss and address the research goals of both our team and the field as a whole.

Metabolite Analysis Laboratory. This laboratory contains a HIDEX gamma counter, additional HPLC systems for radiometabolite analysis and systems for cell culture analysis.

Equipment Available for Pet Research in Other Facilities

Positron Emission Tomography (PET)/Magnetic Resonance Imaging (MRI) Scanner:

In addition to the 100% research-dedicated PET scanners, SBU has a Siemens Biograph mMR (molecular MR), a shared resource that is 50% research dedicated. This scanner consists of MRI-compatible LSO PET detectors that are inserted into the bore of the 3T MRI scanner and that allow simultaneous acquisition of MRI and list-mode PET data. PET axial and transaxial fields of view are 25.8 cm and 59.4 cm, respectively. The diameter of the scanner bore is 60 cm, with a magnet length of 163 cm and system length of 199 cm. The whole-body gradient coil system is actively shielded with a length of 159 cm. The MRI gradient strength is 45 mT/m @ 200 T/m/s (MQ Gradients). The helium capacity of the magnet is 1,500 L. The unique TrueForm RF design provides uniform RF distribution in all body regions, optimized amplitude and phase transmission settings, and homogeneous B1 distribution. The unique mMR block detector architecture includes integrated cooling features to provide optimal PET performance as well as specialized shielding to virtually eliminate magnetic field interference in the PET data processing chain. The optimized design for Biograph mMR and low-attenuation materials in Tim mMR coils and the mMR Tim Table minimize attenuation of the PET signals. This helps to improve the consistency of PET data results. PET detector crystal material is 4 x 4 x 20 mm with 64 crystal elements per block, providing the NEMA 2007 transverse spatial resolution of 4.4 mm in full width at half maximum, with sensitivity of 13.2 cps/kBq and a peak NEC rate of 175 kcps.

Through a Master Research Agreement with Siemens and their Works in Progress program, MRI sequences are available on the mMR that are not available on commercial MRI scanners. Techniques that are available include: high resolution anatomical images (used for anatomical delineation in PET studies), EPI (Echo-planar imaging) for resting state functional MRI, diffusion-weighted MRI (diffusion tensor imaging [DTI] and diffusion spectrum imaging [DSI]), pseudoContinuous Arterial Spin Labeling (pCASL) for cerebral blood flow quantification, Point RESolved Spectroscopy (PRESS) for single-voxel magnetic resonance spectroscopy and spectroscopy images, and a MEGA-PRESS (MEshcher-GARwood PRESS, the authors who first developed the MEGA suppression scheme), spectroscopy sequence for GABA quantification. Any of these sequences can be acquired simultaneously with the PET imaging.

To accommodate task-based functional MRI scans, the PET/MRI suite is equipped with: a projector (Psychology Software Tools' Hyperion, Sharpburg, PA) connected to a PC for visual stimulation using E-Prime (Psychology Software Tools, Sharpburg, PA) and MATLAB (MathWorks, Natick, MA); two 5-button MRI-compatible response pads to accommodate each hand (Celeritas Fiberoptic Response System of PST); an audio stimulation device (Serene Sound from Resonance Technology) with external noise attenuating MRI-compatible headphones; and MRI-compatible corrective lenses.

Research-Dedicated Siemens MAGNETOM 3T MRI Scanner:

A research-dedicated 3T MRI scanner housed in the SCAN (Social, Cognitive, and Affective Neuroscience) Center at SBU, near the MART.

Recent MRI Upgrade: In July 2015, the MR scanner in the SCAN Center was upgraded to a Siemens

MAGNETOM Prisma scanner with 3T PowerPack technology. The 3T PowerPack combines a new, unmatched 3T magnet with 80 mT/m @ 200 T/m/s gradients, the most powerful gradient in clinical MR scanners. For comparison, the scanner specifically designed for the human CONNECTOME project is using a 100 mT/m gradient, and the maximum gradient is 45 mT/m in the Siemens Skyra system. This improvement in gradient has been shown to be advantageous in brain imaging, especially for diffusion and functional MRI. The latest parallel transmit technology in PRISMA, TimTX TrueShape, enables zooming into specific brain regions for enhanced imaging and spectroscopy quality.

The MRI scanner at the SCAN Center has the following techniques available for brain research: anatomical images, EPI for fMRI and resting-state fMRI, diffusion-weighted MRI (DTI, DSI), pseudoContinuous Arterial Spin Labeling (pCASL) for cerebral blood flow quantification, PRESS for single-voxel spectroscopy and spectroscopy image, and an GABA spectroscopy sequence for GABA quantification. Other instruments associated with the SCAN Center include a projector (BrainLogics MR) connected to a PC for visual stimulation using the E-Prime and Experiment builder as the paradigm software, a response pad used to record the participant response during fMRI tasks, an audio stimulation device (SereneSound - Resonance Technology Inc.) with external noise attenuating MRI-compatible headphones, an MRI-compatible eye-tracking system, an MRI-compatible TMS coil for noninvasive transcranial magnetic stimulation of the brain, and BIOPAC physiological monitoring system for pulse, respiration, and galvanic skin response measurements.

Pre-Clinical MRI Scan Center (Zhao (Johnny) Jaing)

Preclinical MRI Center:

The Department of Radiology has a comprehensive state-of-the-art biomedical imaging infrastructure for carrying out clinical and preclinical research. Major infrastructure radiochemistry, related resources, and expertise.

Preclinical MRI:

- A small animal Bruker Biospec 7.0 Tesla MRI scanner with AVANCE III HD hardware with 1H and X nuclide RF amplifiers. The bore size is 20 cm diameter. The gradient capability is 65G/cm with 0.11 ms risetime to maximum and a 12 cm inner diameter (BGA12S). The system has an assortment of vendor and custom-made RF coils for 1H and X nuclide experiments and an assortment of holders with support for rat and mouse experiments. This system is run with Paravision 6 software for structural, physiological, and functional MRI, and spectroscopy.

- Micro-imaging gradient insert: A gradient insert with 100G/cm maximum gradient and a 0.1 ms risetime to max with a 6 cm inner diameter (BG06) is available for high resolution mouse imaging.
- Peripheral equipment: All necessary equipment to ensure well-being and normal physiology of the animals under study are available on the preclinical MRI system. Major equipment includes: mechanical ventilators, gas anesthetic equipment, respiratory sensor, capnometers (to monitor inhaled O₂, CO₂ and exhaled CO₂, heart rate and respiration rate), MR-compatible oximeters, EKG electrodes, feedback-regulated warm water pad, rectal temperature probe, tactile stimulation, and PCs for controlling and/or recording. All of these physiological parameters can be monitored, recorded, and used for MRI triggering using PCSam and MouseOx software in real time.

Machine Shop:

The machine shop is well equipped to support the needs of instrumentation. Major machinery includes a drill press, band saw, and surface sander. Smaller hand held power tools and general shop tools complement the equipment available for use.

Electronics Shop:

The electronics shop houses electronics parts and diagnostic equipment to support the needs of instrumentation for coil design, testing, and maintenance. Major equipment includes soldering stations and network analyzer.

Computer:

The animal imaging scanners are connected to expandable RAID storage (currently at 8 Tbytes), with a server of 64 Gb RAM with four 8-core processors. For data analysis, the Department of Radiology which houses the Preclinical imaging cores, has several groups of workstations with software for analysis of MRI data and other modalities accessible via server, including FSL, SPM, Matlab, CONN toolbox, TensorFlow, DSI Studio, and FreeSurfer, among others.

Research Flow Cytometry * (Hong Lin Smith-Jones & Corinne Leombruno)

The Flow Cytometry Research Core Laboratory supports both internal and external investigators and operates within an IFR (Income Fund Reimbursable) account. The Flow Cytometry Research Core was set up in 1996 and is part of the Stony Brook University Hospital Clinical Immunology Laboratory. The flow cytometry research core lab provides high quality, cost-effective, state-of-the art flow cytometry and multiparameter cell sorting instrumentation and associated expertise and services to investigators at Stony Brook University across both west campus and east campus, as well as several biotechnology companies at the nearby Long Island High Tech Incubator.

Equipment/Resources: The Flow Cytometry Research Core Facility is located in University Hospital Level 3-Room 705 and houses four instruments with a range of capabilities:

FACS Aria IIIu Cell Sorter (BD Biosciences) - Five lasers with 15 fluorescent detectors; can sort up to 4 populations simultaneously

LSR Fortessa (BD Biosciences) - 4 lasers with 16 fluorescent detectors, equipped with 96-well plate loader

CytoFLEX (Beckman Coulter) - 6 lasers with 21 repositionable bandpass filters, equipped with plate loader

FACSLyric (BD Biosciences) - 3 lasers with 12 fluorescent detectors

Research Histology Core Laboratory * (Ken Shroyer)

The Stony Brook Research Histology Core Lab (RHCL) provides clinical and basic science investigators with access to a wide range of histological procedures. The facility is managed by the Department of Pathology and offers gross processing of research tissue and cellular specimens, including fixation, paraffin embedding, sectioning and staining. Both routine hematoxylin and eosin (H&E) and advanced immunohistochemical (IHC) staining methods are offered. The Core staff and scientific director are available to assist in the development of research protocols that depend on the processing of tissue or other cellular specimens.

The laboratory is equipped with an embedding station, microtomes, and automated immunostainers. Additional specialized stains may be available upon request. Additional advanced services, including preparation of research tissue microarrays, laser capture microdissection, and other methods to support tissue-based research may be arranged following consultation with the Core Lab Director. Please contact the Core Lab in advance of submitting specimens to discuss methods for sample collection and tissue fixation.

Small-Animal PET Facility (Inveon/microPET) (Paul Vaska)

Stony Brook's small-animal PET imaging facility features the Siemens Inveon trimodality PET/SPECT/CT. The Inveon is a top-tier small-animal imaging platform located in a spacious lab in the main animal facility in the Health Sciences Center. All 3 modalities can be accessed in a sequential manner, without removing the animal from the bed, thus providing a high degree of image registration. The PET component features a large field of view (9.9 cm transaxial x 12.7 cm axial), high spatial resolution (1.5 mm FWHM), and high sensitivity (6.8% coincidence). The CT component provides anatomical information as well as attenuation correction for the PET. It also has fully developed data processing software with all necessary quantitative corrections and multiple image reconstruction options (FBP, OSEM, and MAP) as well as gating functions. Animal handling equipment includes isoflurane anesthesia machine, rectal temperature probe with closed-loop heating pad, respiratory pillow to monitor breathing rat, MouseOX physiological monitoring (real-time display and recording of arterial oxygenation, heart and respiratory rates from a single clip-on probe). For quantitative radioactivity measurements of radiotracers/blood/plasma, the lab includes a Biodex Atomlab 500 dose calibrator integrated with a calibrated well counter as well as standard equipment for handling blood samples (pipettes, centrifuge...). The facility is fully approved for radioactive animal research, and almost any PET radiotracer (F18, C11, or other isotopes) can be synthesized in our PET Core facility.