FACILITIES AND OTHER RESOURCES (last edited 9/7/2021)

Biostatistics Center. The Biostatistics Center is the primary biostatistical resource for biomedical researchers throughout UConn Health. The Center supports grant development, ongoing research collaborations, publications, and translational discoveries. Center staff consult with researchers to identify the most appropriate and robust analysis strategies, study designs, and power analyses, and staff are available in all phases of their research. Medical student and resident research projects are also supported by the Center faculty and staff. Doctoral students in statistics train with Center faculty and work on projects.

A primary function of the Center is to provide support for grant development that leads to ongoing research collaboration. Biostatisticians participate in team research by developing statistical plans, performing power analysis and sample size calculations, and providing an NIH Biosketch if listed as a Co-Investigator on a grant submission. Faculty teach classes in the Public Health Sciences program and the Masters in Clinical and Translational Research program.

Biophysics Core Facility. The Biophysics Core Facility at the University of Connecticut (Storrs) consists of analytical ultracentrifugation, microcalorimetry, and protein X-ray structure determination equipment and services. The Core supports research specializing in the characterization of molecules and proteins and their interactions. Instruments are available on a fee-for-service basis, with or without the help of the facility director, Dr. Heidi Erlandsen.

Equipment:
Microcalorimetry: (1) A Nano-ITC (Isothermal Titration) and (2) a NanoDSC Calorimeter (both from TA Instruments). ITC is a quantitative technique that can directly measure the binding affinity, enthalpy changes, and binding stoichiometry of the interaction between two or more molecules in solution. From these initial measurements, Gibbs energy and entropy changes can be determined. DSC is a thermo-analytical technique that can be used to monitor phase transitions in different systems. The Nano-DSC is specifically designed to determine the thermal stability and heat capacity of proteins and other macromolecules in dilute solution, with versatility to allow the screening of ligands and pressure perturbation measurements. (3) Analytical Ultracentrifugation (AUC) instrumentation. The facility has two Beckman XL-I ultracentrifuges along with associated instruments, hardware, and computers, and a new Optima AUC (Beckman) equipped with absorbance and interference detection systems. Analytical ultracentrifugation (AU) is a rigorous method to characterize the size, shape, and interactions of molecules and macromolecules in solution. The facility's ultracentrifuges are equipped for real-time collection of AU data using absorbance and interference detection. These data are analyzed to provide native molecular weights, association states, homogeneity, and binding constants (associating systems). One of the XL-I centrifuges is also equipped with the Aviv AU-FDS fluorescence detector, which can provide 10,000-fold enhanced sensitivity over absorbance and interference detectors. The Aviv AU-FDS permits investigations of molecules at picomolar concentrations. The fluorescence detector allows the study of labeled biomolecules in complex mixtures, including serum, cell lysates, and pharmaceutical formulations.

In addition, the Biophysics core facility Director, Dr. Erlandsen, runs a Beam time Allocation Grant (BAG) on behalf of UConn towards collecting X-ray data at the Brookhaven National Laboratories synchrotron (NSLS-II), and will aid in determining crystal structures of proteins and protein complexes.

UConn Cell and Genome Engineering Core

Website: https: health.uconn.edu/stem-cell-core
Faculty Director: Stormy Chamberlain
Core Staff: Lab Manager – Noelle Germain
Genome Editing – Chris Stoddard
Stem Cell Reprogramming and Distribution – Yaling Liu

Description:
Facility Location: Room 1240, Cell and Genome Sciences Building, 400 Farmington Avenue

The UConn Cell and Genome Engineering Core supports Stem Cell Research conducted in Connecticut and beyond by providing a central source of technologies and materials for research on human pluripotent stem cells: embryonic stem cells (hESC) and induced pluripotent stem cells (hiPSC). The Core distributes several hESC lines which were generated in-house (CT1, CT2, CT3, CT4) as well as the WiCell lines, H1 and H9. Using a variety of methods, we reprogram patient samples into high-quality iPSC cultures. We perform quality control measures on iPSCs, such as mycoplasma testing and verification of pluripotency by immunocytochemistry and differentiation into embryoid bodies. We also offer biobanking services to ensure secure storage and distribution of custom iPSC lines. The Core can perform differentiation of hESCs/iPSCs into neural progenitor cells (available as cryopreserved cultures) and neurons (provided as cell pellets for downstream analysis). Training in the routine culture of hESCs/iPSCs is also available upon request.

The Genome Editing arm of the Core uses cutting-edge genome-engineering technologies to develop cellular models. Precise gene editing in hESCs/hiPSCs provides a powerful tool for the study of disease models *in vitro*. By using TALENS and CRISPRS, we induce precise double-strand breaks in the genome that will activate the machinery for homologous recombination. The use of these genome cutters along with carefully designed targeting vectors or oligonucleotide repair templates allows for the precise modification of the genome. This approach allows researchers to engineer isogenic cell line pairs by introducing specific mutations into wild-type cells or correcting mutations in patient-derived cell lines. These isogenic cell lines are powerful tools to study human development and disease. Gene editing can also be used to generate reporter cell lines for lineage tracing, isolation of specific cell sub-populations, or drug screening. By using single-stranded oligonucleotide (ssODN) repair templates, we are able to perform scarless genome editing, without the use of integrated selection cassettes. The UConn Cell and Genome Engineering Core provides custom TALEN and CRISPR constructs as well as targeting vectors/repair templates for these studies. We also offer complete "start-to-finish" genome editing services for nearly any murine or human cell line.

The facility shares 400 ft^2 of wet lab space with the Chamberlain laboratory. This space is designed to comfortably accommodate up to 8 research personnel. Lab facilities also include two 220 ft^2 tissue culture rooms and write-up space. The lab houses a shared photo documentation and gel room. Within the facility, lab staff has access to a 150 ft^2 cold room and approximately 200 ft^2 of equipment space. The two tissue culture rooms have 5 standard biosafety cabinets, two stem-cell picking hoods with dissection microscopes, 6 tissue culture incubators, and two standard inverted microscopes.

Services:
Human Pluripotent Stem Cell Services:
-Reprogramming patient samples into iPSCs (fibroblasts, peripheral blood, umbilical cord blood) using Sendai virus, episomal, or lentiviral methods
-Cell banking and distribution of custom iPSC lines
-Mycoplasma testing

-Verification of pluripotency by embryoid body differentiation and gene expression analysis
-Cell culture training
-hPSC-derived neural cells

Genome Editing Services:
-Correction of gene mutations in patient-specific iPSCs
-Engineering mutation of interest into well-characterized wild-type hESCs/iPSCs
-Production of custom targeting vectors and CRISPRs to generate knock-ins
-ssODN targeting for "scarless" genome editing
-Custom services tailored to investigator needs

Center for Genome Innovation. The Center for Genome Innovation (CGI) within the Institute for Systems Genomics on the University of Connecticut, Storrs campus, has established next generation library preparation and sequencing capacity, including all necessary ancillary equipment for the following sequencing platforms: Illumina NovaSeq 6000, MiSeq (x2), Illumina NextSeq 550 system (x1), Oxford Nanopore MinION (x7), and PromethION systems (x1). The Illumina NextSeq 550 sequencer has the ability to scan select Infinium bead arrays as part of the upgrade. The CGI offers both supervised and unsupervised access to instrumentation and training for use and implementation, along with an option to process samples through a fee-for-service structure. The CGI is also capable of assisting with protocol development for various applications and technologies.

The sample processing and teaching laboratory is equipped with standard molecular biology equipment, including thermal cyclers for standard and quantitative PCR, standard and automated gel electrophoresis systems, centrifuges, single and multichannel micropipettors, water baths, incubators, and refrigerators and freezers for sample and reagent storage. Specific (major) equipment available for use include: Beckman Allegra X-12R Refrigerated Centrifuge, Agilent Bioanalyzer 2100, Agilent TapeStation 2200 and 4200, Qubit 3.0, two PCR hoods, chemical and biosafety hoods, ABI SeqStudio DNA Analyzer, Affymetrix GeneAtlas and GeneChip hybridization and scanning systems, DigiLab Hydroshear, Pippin Prep (including Pippin Prep, Blue Pippin, and Pippin HT systems), Fluidigm instruments including the C1, BioMark HD and various Access Arrays, and a Covaris S2.

Genomics projects are further enhanced by the 10x Chromium Genomics System for single-cell applications like mRNA-Seq, ATAC-Seq, and immunology profiling. The BioNano Irys System is also available for use in genome integrity studies looking at structural variation and haplotyping. Lastly, the CGI has a BioRad QX200 Droplet Digital PCR instrument which can be used for absolute copy number, mutation, and gene expression detection.

The Lowell P. Weicker, Jr. Clinical Research Center (CRC) is primarily an outpatient/ambulatory research center, but also supports some inpatient clinical trial studies in the UConn John Dempsey Hospital. The major goal of the CRC is to support and assist in the conduct of NIH and other federal agency-supported clinical research protocols. Many of these projects represent the application of basic science discoveries to address clinical problems (bench to bedside) or to focus on better ways to combat disease and promote health. The CRC also supports many studies funded by foundations, pharmaceutical companies, and companies developing diagnostic tests and devices. Projects conducted in the CRC are led by faculty of the UConn School of Medicine or School of Dental Medicine, located at UConn Health. Several studies are led by faculty located at our major affiliated hospitals including Hartford Hospital, St. Francis Hospital and Medical Center, and the Connecticut Children's Medical Center. The CRC is institutionally supported and operates on a fee-for-service basis.

Facilities: The CRC provides research nursing, phlebotomy, dental, laboratory, and diagnostic services, including administration of urine and blood testing. The available dedicated clinical research space is 6,200 sq. ft., including 1,376 sq. ft. for the core clinical laboratory. The outpatient research clinic is conveniently located near the John Dempsey Hospital main entrance. The CRC is composed of five main research cores: 1) an Administrative Core that provides assistance with grant/contract management; 2) a Clinical Core that includes nine patient exam rooms (including a treatment room and a consultation room) with staffing to provide research nursing support and other study coordination services; 3) a Molecular and Immunoassay Core that is fully equipped for processing tissue samples and performing special molecular biology procedures and immunoassays. In addition, we have a small laboratory space that is used for EZ-screen testing of urine specimens. This CRC laboratory is capable of processing and shipping samples and carcinogens. The CRC lab is CLIA certified. Equipment includes: -80˚C freezers, PCR, tabletop refrigerated centrifuges, Mettler balance, gel electrophoresis and sequencing equipment, and computerized sample tracking system. The lab is fully equipped to carry out immunoassays and analyses of DNA and RNA using molecular biology techniques; 4) a Regulatory Core that assists investigators in the preparation of regulatory documents as may be required by the UConn Health Institutional Review Board (IRB) or a central IRB as well as documents required by the federal Food and Drug Administration (FDA); and 5) an Informatics Core that provides RedCap capabilities for electronic data capture as well as data entry and storage. The Informatics core staff is available on a consultant basis to assist with protocol development, computer systems, electronic data capture (RedCap and other software) services, and data management.

The CRC also has three affiliated research cores including a Dental Clinical Research Core (DCRC) with two dental operatories fully equipped for a wide range of clinical procedures, a dispensing room, a dental lab, as well as an office for study coordinators; a biostatistics core staffed by two doctoral level biostatisticians, with others available as needed; a DEXA (dual energy x-ray absorptiometry) lab to assess bone density; and a research pharmacy core as part of the hospital's pharmacy.

Staff: The CRC currently employs a staff of more than 20 people who provide administrative services, research nursing, and other support to work with clinical investigator faculty in carrying out clinical research protocols.

The **Computational Biology Core (CBC)** within the Institute for Systems Genomics at the University of Connecticut supports bioinformatics research, teaching, and outreach. High Performance Computing (HPC) resources including the Xanadu cluster are housed in a secure data center at the Cell and Genome Sciences Building on the UConn Health, Farmington campus. All servers are freely available to members of UConn research and their research affiliates.

The Xanadu compute cluster comprises 51 compute nodes with 2168 CPU cores, 11 TB of RAM, and is capable of processing at 50 TFLOPs. The nodes are a mix of Dell C6145 chassis with four 12-core AMD Opteron processors and Dell R730 chassis with two, 18-core Intel Xeon E5-2697v4 processors. Node memory ranges from 128 GB to 1 TB of RAM. Additional resources include 2688 NVIDIA M2075 GPU cores. All nodes are equipped with ten-gigabit interfaces and are connected to a 10/40/100 gigabit network infrastructure.

Isilon and Qumulo Network Attached Storage systems are provided with a capacity of 8+ petabytes. An additional 3.8 petabytes of geo-spread object storage is provided via an Avere gateway with 30 gigabit-per-second aggregate throughput.

All clusters allow access to over 300 bioinformatic modularized and/or containerized applications. These applications support analysis in phylogenetics, metagenomics, genome assembly, transcriptome assembly, sequence alignment, sequence annotation, variant detection, Chip-Seq, proteomics, and a variety of visualization tools.

Digital Experience Group. The UConn Digital Experience (DX) Group offers app development, user experience design services, web design and development, and digital product/technology consultation to researchers across the University and partners in the State of Connecticut.

The DX Group uses an Agile approach during the concept, prototype, and full-scale deployment phases of app development, UI/UX design, web design, and new technology ideation, testing, and deployment.

In addition to decades of collective experience and independent research, and as a sibling to UConn's Digital Media & Design Digital Experience Lab, the DX Group and its team members have been recent collaborators, core contributors, and leaders on projects and installations for Boston Children's Hospital, UConn's Greenhouse Studios, UConn Neag School of Education, United Technologies Corporation, UConn's Rudd Center on Food Policy and Obesity, Aldridge Museum of Contemporary Art, and others.

More information about the DX Group is available via their Academic Year-end Update:
https://dx.uconn.edu/2021/04/20/ay-2020-2021-update/

Electrical/Electronics: Technology & Repair. The Electronic/Electrical Technology and Repair Facility has amassed a diverse skillset that ranges from computer/printer repair to repairs of control systems, centrifuges, and spectrometers. This service facility specializes in repairing older, "outdated" machinery and equipment that are no longer under warranty. There is no repair too big or too small for consideration and the Departmental savings (compared to off-campus repair services and costly replacements) are substantial.

Electron Microscopy Facility occupies ~1,800 sq. ft. of space on the B level of the main UConn Health building. The facility currently maintains four electron microscopes (EMs) including a Hitachi H-7650 transmission EM (installed 2010), a Zeiss Sigma Gemini field emission scanning EM (installed 2011), a FEI Verios field emission scanning EM (installed 2015), and a JEOL JSM5900 scanning EM (installed 2011) for routine analysis. Other essential preparative equipment are also available including ultramicrotomes, a vacuum evaporator, a critical point dryer, a sputter coater, a freeze substitution system, etc. The facility performs a wide variety of EM procedures (negative staining, standard chemical fixation, high-pressure freezing, embedding, thin-sectioning, immunogold staining, sample prep for SEM, operator training, etc.) on a fee-for-service basis.

Flow Cytometry Facility. The Flow Cytometry Facility at UConn Health is overseen by the Department of Immunology and is run by an experienced faculty member. The Flow Cytometry Facility provides flow cytometry and cell sorting services. The facility consists of a 900 sq. ft. laboratory, and currently has seven instruments available for cellular analysis and two cell sorters. It operates three Becton Dickinson (BD) LSR II instruments, an automated high-throughput Miltenyi MACSQuant10, a Bio Rad ZE5, an Accuri C6 analyzer, and an Amnis ImageStream Mark II. It also houses two BD FACS ARIA II high speed cell sorters. Two of the BD LSR II instruments are equipped with 5 excitation lasers and are capable of up to 18 parameter analysis. For high-throughput combined with high-parameter analysis, the facility operates a Bio Rad ZE5, which can obtain samples from 96-well and 384-well culture plates and detect up to 27 different parameters. The Amnis ImageStream Mark II imaging flow cytometer has 4 excitation lasers, 12

imaging channels, and 3 objective lenses. It combines the speed, sensitivity, and phenotyping abilities of flow cytometry with the detailed imagery and functional insights of microscopy. This unique combination enables a broad range of applications that would be impossible using either technique alone. The BD FACS ARIA II cell sorters are equipped with 5 excitation lasers, capable of analyzing up to 18 parameters, and can perform up to 4-way sorting or single-cell deposition into multiwell plates. The sorters are also equipped with aerosol containment for sorting biohazardous materials and one sorter is entirely enclosed in a biosafety cabinet. Researchers run their own samples on the analyzers and two experienced operators are available to perform cell sorting or analysis, on a fee for service basis. The core provides several computer workstations with flow cytometry and cytometric bead array analysis software. These include: FlowJo (Treestar Inc.), BD FACS DIVA (BD Bioscience), Cell Quest Pro (BD Bioscience), ModFit LT (Verity), and FCAP Array (BD Bioscience).

Fluorescence Imaging Resources at the CCAM Microscopy User Facility. The Microscopy User Facility at CCAM (https://health.uconn.edu/cell-analysis-modeling/microscopy-facility/) provides access to instrumentation and technical support for light-based microscopy for the research community.
Resources include:

- Zeiss Lightsheet Z1 with 6 laser lines (405, 458, 488, 514, 561, and 633 nm) with dual side illumination multiview optics. The optics are equipped for water-based or cleared specimens and dual sCMOS cooled cameras to provide high sensitivity, rapid, 3D imaging of live or fixed thick specimens.
- Zeiss LSM880 laser scanning confocal microscope with 6 laser lines (405, 458, 488, 514, 561, and 633 nm) and multispectral GAsP detection (~2-fold increased sensitivity over conventional PMTs).
- Zeiss LSM780/NLO confocal microscope with 7 laser lines (405, 440, 458, 488, 514, 561, and 633 nm) and nonlinear excitation from a Coherent Chameleon Ti:Sapphire, and with multispectral GAsP detection. This microscope is also equipped with a Becker-Hinkl Fluorescence Lifetime Imaging Microscopy (FLIM) detector on a nondescanned detection port, particularly useful for detection of fluorescence resonance energy transfer (FRET)-based probes.
- All confocal microscopes have environmental chambers to allow stable control of temperature and CO_2 for live explant or *in vivo* imaging situations.
- Dual channel (488 and 561 nm) TIRF (total internal reflection fluorescence) widefield system on a Zeiss Axio Observer inverted microscope with Photometrics Evolve EM-CCD camera and α-Plan-Fluor 100X/1.45 oil objective.
- Photo-Activated Localization Microscopy (PALM) super-resolution light microscopy is available using a home-built, fully automated PALM imaging system in a CCAM-associated laboratory. This system is built on ASI's custom Rapid Automated Modular Mounting (RAMM) platform, uses 440, 515, and 594 nm (Coherent OBIS) laser lines, and is equipped with Hamamatsu sCMOS cameras for image acquisition.
- diSPIM (dual-view inverted Selective Plane Illumination Microscope) imaging system from ASI imaging Inc is available in the Wu laboratory (a CCAM-associated laboratory) for lightsheet imaging on the cellular as opposed to tissue scale.
- Our microscopes are equipped with DIC optics, a cache of interchangeable objectives, and options for different types of environmental control for *in vivo* or live cell imaging.

We utilize Metamorph image processing software (Universal Imaging) for quantitative image analysis, Imaris software from Bitplane Graphics for volume and surface rendering, and in-house software for specialized applications. A full-time staff microscopist is available to provide technical advice on any of our microscopes, and for training of students and other investigators. In addition, the faculty and staff of CCAM provide a wealth of expertise related to light microscopic imaging and analysis. CCAM is a highly

interdisciplinary center with a research focus of developing quantitative, detailed molecular hypotheses of cellular physiology using advanced optical tools coupled with rigorous mathematical modeling. Bringing together optical engineers, chemists, cell biologists, physicists, and mathematicians in a strongly interactive environment, CCAM has developed and hosts an NIH-designated National Resource in a web-based environment, the Virtual Cell, that provides the tools to create spatially realistic computational models of cellular processes. The broad expertise at CCAM is available to provide help and advice on methods for obtaining, analyzing, and quantifying multi-dimensional data from live or fixed specimens whether obtained *in vitro*, *in situ,* or *in vivo*.

Fluorescence Imaging Core provides the skeletal biology community the use of cryohistological tissue sectioning and tiled-full section 100x fluorescent imaging of mineralized tissues with particular emphasis on mouse models that utilize GFP reporters useful for interpreting the outcome of an injury/repair process. The multimodal fluorescent readouts include: mineralization lines, alkaline phosphate (AP) and tartrate-resistant acid phosphatase (TRAP) for identifying osteoblasts and osteoclasts, EdU and EdU-Tunnel for proliferation and apoptosis, and multiple GFPs and fluorescent antibody probes specific for certain cell types all performed on the same tissue section after which chromogenic stains are performed to provide a familiar context for these signals. Great flexibility of this resource allows the experienced investigator to perform all aspects of the experiment and just supply histological sections for the multiple rounds of staining and imaging. At the other extreme, the core will plan and perform the experiment including providing the experimental GFP transgenic mice; assessing the intact animal by TD-NMR and µCT; processing the tissue by X-ray, RNA expression, histological sectioning, and imaging; and assembling the images for interpretation and publication. The models include bone histomorphometry of the femur and vertebra; cartilage histomorphometry of the growth plate, articular cartilage, and temporal mandibular cartilage; and repair/transplantation models of the calvaria, subcutaneous space, long bone fracture, and joint destabilization. While the mouse is the primary experimental platform, many of the protocols can be used on mineralized or soft tissues from larger animals, including human tissues.

High Performance Computing (HPC) Facility – Equipment and Services. The HPC facility is a core research facility at UConn Health housed in a new state-of-the-art dedicated datacenter with 24/7 physical/environmental monitoring at the Cell and Genome Sciences Building at 400 Farmington Ave, with a separate off-site disaster recovery location for backup and redundant services at 263 Farmington Ave. With the help of an NSF CC-NIE grant, we recently upgraded our separate network for the HPC datacenter, including its own redundant high-performance firewalls and deploying a separate 100 GbE connection to Internet2, and a Science DMZ for large-scale collaborations and Big Data support. We provide HPC resources and support, as well specialized enterprise computing services, to the UConn research community at large. The facility's website (https://health.uconn.edu/high-performance-computing/) offers an up-to-date description of the various services and of the overall resources available. These are also briefly summarized below.

Since 2017, our HPC facility has shared a common private cloud data storage system with the HPC facility hosted by the University Information Technology Services at the main UConn campus in Storrs. UConn has made a strategic decision to invest in HPC, with major hardware refreshes undergoing, and putting an emphasis on supporting compute-intensive work at Storrs and data-intensive work at Farmington (for more information see https://health.uconn.edu/high-performance-computing/ Users from both campuses have access to both facilities and the total resources available across campuses are 15+ PB storage and 10,000+ compute cores. The itemized list below refers only to the UConn Health facility at the Farmington campus.

Additionally, unique to the HPC facility in Farmington is the recent availability of a dedicated research computing environment that is compliant for work with protected health information (PHI) data. This includes redundant VM hosts and 250+ TB of storage co-located in the HIPAA-certified and audited hospital datacenter with logged access and video surveillance at 263 Farmington Ave. These servers are on a separate network connected with dedicated fiber links directly to the firewalls of the HPC facility at the 400 Farmington data center. We provide custom configuration of per-project subnets, VLANs, security groups, firewall rules, logging, implementation of required data retention and destruction policies, and securing a HIPAA binder recorded and maintained by the IT Security department.

Hardware Resources

- Storage (~10 PB):
  - Main shared scale-out NAS clusters, including 2.5 PB EMC^2 Isilon, 2.4 PB Qumulo, 0.8 PB Atavium
  - On-premise cloud object store (3.8 PB Amplistor), geo-dispersed across 3 datacenters
  - High performance NFS/CIFS cloud gateway (Avere FXT)
- Compute (100+ Tflops):
  - Two CPU-only and hybrid CPU/GPGPU compute clusters controlled by a common job manager (SLURM)
  - Two smaller clusters for testing/development and for teaching/student use
- Virtualization Infrastructure:
  - VMWare server and desktop virtualization hosts (34 VM hosts, 1,500 CPU cores, 9.7 TB RAM)
  - Hosting 300+ Linux and Windows customized servers
- Datacenter Infrastructure:
  - UPS generator backed power (160 kW), redundant cooling (50 tons)
  - Dedicated 3x40 GbE dark fiber connection to off-site DR location
- Network (100+ GbE):
  - Fully non-oversubscribed 10/40/100 GbE datacenter network core layer
  - BioScienceCT Research Network – 100 GbE to CEN, Internet2, Storrs
  - New HPC Science DMZ – low latency, 80 Gb-capable firewall

Services (selected list)

- Authentication services for logging into campus computers on the CAM domain
- Globus managed endpoint on dedicated DTN for high-speed data transfers to/from other institutions on Internet2
- Hosted physical systems where rack space, cooling, and network connectivity are provided
- Compute cluster resources including submit nodes for job creation/submission
- More than 350 software packages installed and maintained via modules on the compute cluster
- External access nodes plus free VPN service
- Hosting custom servers/services for individual PIs, grants/research projects, departments, and administration
- Archival and production data storage on our cloud storage system
- Data Center environmental monitoring in rooms R1388/AB012 where we provide alerts or manage the event with ECC on your behalf
- Virtual Desktops (on or off campus) including access to CCAM-purchased installed applications
- MetaMorph for microscopy image analysis that has been provided by CCAM

- MATLAB Distributed Computing Server on the compute cluster
- SMRT Analysis, Galaxy, Genious, and IPA portals for bioinformatics data analysis

Laser Capture Microdissection (LCM) Core. The LCM Core houses two Arcturus XT™ microscopes, each equipped with both infrared (IR) and ultraviolet (UV) lasers, to allow for rapid and precise retrieval of smaller, e.g., 7 – 10 µm diameter, and larger samples from frozen (fresh or fixed) or paraffin-embedded tissue sections. The IR laser performs non-destructive "lifting" of designated tissue areas, while the UV laser executes "cutting" of larger tissue swaths. Bright-field or fluorescence visualization is available, allowing for immunohistochemical or immunofluorescence identification of cell types, as well as routine histochemical staining. Bright-field and fluorescence can also be performed simultaneously, enabling multi-cell labeling. Immediately adjacent to the Core is a fume hood and histology service area were tissue fixations, perfusions, and staining can be performed. One of the XT™ microscopes is maintained within a Biosafety cabinet under negative pressure, to heighten protection against potential pathogens.

The Core operates as a fee-for-service facility, and provides training and instruction for operation of the machines and tissue preparation. All Core patrons can enter anywhere on the pipeline, and perform the steps of LCM they desire.

In addition to performing LCM, the Core also offers services for RNA analysis from LCM samples, such as RNA isolation, reverse transcription, and preparation for qRT-PCR or transcriptomics.

Metabolic Phenotyping Facility. The Metabolic Phenotyping Facility is located in Advanced Technology Lab and Ag Biotechnology Lab on Storrs campus at UConn. The facility is equipped with Oxymax Comprehensive Lab Animal Monitoring Systems (CLAMS) and EchoMRI-100 that measure metabolic rates, energy expenditure, and body composition of mice, respectively. It also has a Seahorse XFe24 analyzer, Luminex MAGPIX, and Cobas Clinical Chemistry Analyzer. In addition, consultation and training are available to assist users with study design, equipment use, and data analysis and interpretation.

The Microbial Analyses, Resources, and Services (MARS) facility within the Center for Open Research Resources and Equipment at the University of Connecticut is a specialized next generation sequencing laboratory. MARS is a service lab focused on microbial community, amplicon, and small genome sequencing and provides the UConn research community access to our fully equipped molecular laboratory. MARS is equipped with standard molecular biological equipment, including thermal cyclers, centrifuges, single and multichannel micropipettors, water baths, incubators, refrigerators and freezers for sample and reagent storage. The sample processing laboratory also contains a dedicated room with a biosafety hood for handling raw samples up to BSL2, which is primarily used to prepare samples for DNA/RNA extraction. Equipment available for use includes Synergy HT plate reader (fluorescence and absorbance), Quibit 4.0, QiAxcel nucleic acid fragment analyzer, BioRad qPCR, Covaris M220 ultra-sonicator, QiAgility liquid handling robot, epMotion 5075 TMX liquid handling robot (single and 8 channel pipetting from 0.1–1000 µl), and an Illumina MiSeq sequencer. MARS offers training on all instrumentation for users interested in unsupervised use of any equipment as well as fee-for-service sample processing. MARS offers bioinformatic and statistical support for microbiome analysis as workshops to train users as well as fee-for-service custom analyses.

MicroCT Imaging Facility. The µCT core facility specializes in comprehensive microarchitectural and densitometric analyses of mineralized biological tissues. The facility consists of three Scanco instruments—µCT50 and µCT40 for excised specimens, and VivaCT40 for *in vivo* applications—capable of imaging down to 2 μm^3 resolution. Full-service sample management and analysis is offered, as well as raw

data export in file types compatible with third-party software or 3D-printing/modeling applications. While the facility specializes in skeletal phenotyping, contrast agents may allow imaging of radiolucent biological and engineering materials. Furthermore, the facility offers self-service utilization of micromechanical testing equipment, including a TA Instruments Electroforce 3200 (3-point bending) and a Bose SLM090 (torsion).

Molecular Core Facility. This Core consolidates orders for oligonucleotides and DNA sequencing, and operates a freezer program with Invitrogen, NEB, Clontech, Biorad, Sigma, Qiagen, and PE, providing onsite access to restriction enzymes and other biological and molecular reagents at a substantial savings with the additional benefit of no shipping costs. The Core also operates a BioRad qPCR machine that is made available to users for a fee; supports a Nanodrop 1000 spectrophotometer, GelDoc station, and Syngene fluorescence and luminescence imaging station; and can process animal tissue samples for genotyping using HotShot methodology and analyze with qPCR and melting curve verification for a fee. Consulting on reagents and equipment is integral to assure investigators and staff can launch new technologies rapidly and effectively.

Center for Mouse Genome Modification. The Center for Mouse Genome Modification (CMGM) at UConn Health provides a comprehensive service to generate and manage novel genetically modified mouse strains. The director, Dr. Siu-Pok Yee, has extensive experience in mouse genetics and the generation of sophisticated mouse models. We will consult with investigators, design strategies, and prepare molecular reagents to ultimately generate novel mouse strains. We use state-of-the-art technologies from CRISPR-mediated gene editing and BAC recombineering to conventional ES cell gene targeting to generate various advanced mouse strains. Furthermore, the CMGM will help investigators manage their mouse colonies inside our SPF mouse facility as well as with rederivation and cryopreservation of novel mouse strains. Our goal is to facilitate investigators using their unique mouse strains as a model for their biomedical studies, and the CMGM is a "go-to" resource for UConn Health, UConn Storrs, and external investigators.

Gregory P Mullen NMR Structural Biology Facility. The NMR Facility provides a state-of-the-art environment for studying the structure, dynamics, folding, and interactions of biological macromolecules. In addition to providing access to advanced NMR instrumentation for experienced users, the facility provides support for new users interested in bio-molecular applications of NMR. The facility supports traditional 1D and 2D NMR for small-molecule (organic synthesis) and metabolomics applications and has multinuclear capabilities including 1H/13C/15N/19F/31P detection.

The **UConn Proteomics & Metabolomics Facility** (PMF) is located on the Storrs academic campus in the Pharmacy/Biology Building, rooms 511 and 513 (69 N. Eagleville Road, Storrs, CT 06269). PMF currently houses 4 advanced and state-of-the-art mass spectrometers for protein, peptide, and small-molecule identification and quantification. Room 513 currently features a brand new (Summer 2021) Thermo Scientific Orbitrap Tribrid Eclipse equipped with FAIMS, ETD, and a fully dedicated Dionex Ultimate 3000 RSLCnano UPLC resulting from a successful NIH S10 High End Instrumentation proposal awarded to Jeremy L. Balsbaugh, Ph.D. (PMF Facility Director). In addition, room 513 includes a Thermo Scientific Q Exactive HF mass spectrometer with a Dionex Ultimate 3000 RSLCnano UPLC system plus a Waters Xevo G2-XS mass spectrometer equipped with SONAR and fully dedicated Acquity UPLC. PMF's ion mobility-enabled Waters Synapt G2Si mass spectrometer and fully dedicated Acquity UPLC system is located in the adjoining room, 511. Each room is a temperature- and humidity-controlled laboratory module (~750 sq. ft). Room 513 includes generous wet bench space for proteomics sample preparation, a sink, fume hood access, full-sized sample storage refrigerator and -20˚C freezer, plus a floor-to-ceiling wall-separated workbench area that serves dual purposes: office space for the PMF Facility Scientist and desk space for multiple

workstations that facilitate data analysis for PMF users. Room 511 includes a shared -80˚C freezer for proteomics sample storage. PBB is centrally located in the UConn Science Quadrangle and houses multiple University departments including the School of Pharmacy, Dept. of Physiology and Neurobiology, and the Dept. of Ecology and Evolutionary Biology.

All data collected in PMF is stored, managed, and analyzed using the state-of-the-art UConn High Performance Computing (HPC) facility that is actively supported and monitored 24/7 by 4 experts: Ion Moraru, M.D., Ph.D. (Director), Stephen King (Senior Systems Administrator), Clarissa Trudell (Technical Analyst), and Michael Wilson (Infrastructure Architect). Individual user space is separate and password-protected. This service is free to UConn and UConn Health researchers and boasts over 60 TeraFLOPS of compute power, 3,000 processor cores and data storage capabilities of >2 PB. The secure data center is monitored 24/7 and backed up daily. The analysis platform housed on UConn HPC space features multiple analysis platforms: MaxQuant (v1.6.0.1 and v1.6.10.43), Proteome Discoverer with XlinkX (v 2.5), and Byonic (v3.1.0, Protein Metrics, Inc.). Additional analysis software including Scaffold Q+S plus PerSPECtives (v4.5, v2.1.0, Proteome Software Inc.) is installed on local PMF PCs.

Research Histology Core. The Research histology core specializes in processing and embedding of paraffin-embedded soft and hard tissues, and sectioning including serial capture and standard or specialized histological stains. Paraffin sample antigen retrieval and immunohistochemistry. Bone sample decalcification prior to embedding. Sectioning and staining of frozen tissue/material blocks including specialized mounting on fast-hold film. Immunofluorescence staining and mounting for investigator analysis. Investigator and staff self-utilization of microtome, cryostats, and standard H&E staining and coverslip stations. Equipment includes: 2 paraffin processing instruments, 2 paraffin microtomes, 3 cryostats, embedding station, dual head upright microscope with color camera, and staining and coverslip stations.

Research Tissue Repository Core. The established 500 square foot facility provides de-identified tissue/blood samples to investigators using the Labware LIMS system for secure documentation. There is a full-time dedicated Research Associate who manages the core. Protocols are based on The National Cancer Institute Best Practices guidance whose key principles ensure state of the art biospecimen resource practices, promote biospecimen and data quality, and adhere to ethical and legal requirements. Equipment includes -80˚C freezers and liquid nitrogen freezers that are monitored and alarmed, as well as a certified Biogard Hood, 4˚C refrigerator, refrigerated centrifuge, oxygen monitor, and water purification system. There are two Dell PC computers used for secure data entry. Both have up to date capabilities including word processing, graphic programs, and access to network and informational resources. Labware LIMS is housed on both computers.

Single Cell Biology. The Single Cell Biology laboratory (SCB) based at The Jackson Laboratory for Genomic Medicine on the UConn Health, Farmington, CT campus, provides single-cell capabilities to the UConn Health and UConn faculty through a single-cell genomics agreement. Supported by a staff highly experienced in single-cell analyses, the SCB carries out single-cell workflows that encompass cell and tissue dissociation; cell capture, enrichment, and isolation; molecular characterization; and the computational analysis of single-cell data sets. Microfluidic chip-, droplet-, and plate-based single-cell transcriptomic methods are all established in the laboratory. The Chromium™ platform (10x Genomics) has become a key enabling resource for single-cell work, preparing sequencing libraries for up to ~6,000 single cells or nuclei, with current applications including single-cell RNA-seq (with cell hashing capabilities), T- and B-cell immune repertoire sequencing, CITE-seq with scRNA-seq, single-nucleus ATAC-seq, a

combined multiome single nucleus RNA-seq/ATAC-seq, and single-cell DNA analysis. SCB also offers spatial transcriptomics capabilities using the Visium spatial gene expression solution (10x Genomics).

SCB houses a Helios™ CyTOF® mass cytometer with a Hyperion™ laser ablation module (Hyperion™ + Helios™ = Imaging Mass Cytometry™; Fluidigm®), leveraging the high-multiplexing capabilities of mass cytometry (using metal-tagged antibodies) to allow simultaneous interrogation of up to 37 protein markers, while preserving the tissue architecture and cell morphology context at subcellular resolution. The SCB also has an established organoid screening platform equipped with robotics for automation of Matrigel®/organoid dispensing, media exchange, and drug delivery (Microlab VANTAGE® Liquid Handling System). This is linked, by a robotic arm, to automated incubator and plate readout capabilities. Readouts include a plate reader (SpectraMax i3x) and a four-laser, four-camera Opera Phenix™ High-Content Screening System for confocal 3D imaging (Perkin Elmer). In addition, SCB is equipped with standard laboratory equipment and dedicated tissue preparation and cell culture space.

Space for the SCB consists of 1,100 ft^2 of laboratory and 500 ft^2 of office space, in addition to a satellite lab with 310 ft^2 of laboratory and 65 ft^2 of office space at the The Jackson Laboratory, Bar Harbor, ME, campus. The laboratory in Farmington is immediately adjacent to the Flow Cytometry Service and Genome Technologies Service groups and extensively uses the associated equipment in these labs such as cell sorters (BD FACSAria™, Sony SH800) and Illumina® sequencers (NovaSeq 6000, NextSeq 500, MiSeq). In addition, computational analysis within the SCBL is aligned with similar efforts within Computational Sciences.

Single Cell Biology Equipment (in Farmington, CT, except where indicated otherwise)

- 10x Genomics Chromium™ system (2, one unit at the Bar Harbor campus)
- Agilent Tapestation 4200
- ClearCell® FX system
- Fluidigm® C1™ Single-Cell Auto Prep system (3, one unit at the Bar Harbor campus)
- Fluidigm® Helios™/CyTOF®3 mass cytometer with Hyperion™ laser ablation module
- Fluidigm® IFC Controller HX
- GX-Robot (Peak Analysis & Automation; PAA)
- Heracell™ 150i CO_2 incubators (2)
- Heracell™ Vios 160i CO_2 incubators (4)
- Invitrogen™ Countess™ II FL Automated Cell Counter (2, one unit at the Bar Harbor campus)
- Invitrogen™ EVOS™ FL Auto Cell Imaging system
- Labcyte Echo® 525 Liquid Handler
- Microlab VANTAGE Liquid Handling System (Hamilton Robotics)
- OT-2 Robot (Opentrons)
- Miltenyi gentleMACS™ Octo Dissociator (2, one unit at the Bar Harbor campus)
- Molecular Devices SpectraMax i3x Multi-Mode Detection Platform
- NuAire 6-foot Class II, Type A2 biosafety cabinet
- Perkin Elmer Opera Phenix™ High-Content Screening System (4 lasers, 4 cameras)
- RainDance™ Technologies sense and source RainDrop dPCR System
- STX44 Automated Incubator (LiCONiC Instruments)
- Thermo Scientific 4-foot Class II, Type A2 biosafety cabinets (4)

Statistical Consulting Service. The University of Connecticut's Statistical Consulting Services (SCS) provides analytical support for research design, data exploration, and statistical analysis. The SCS at

UConn is staffed by late-career Ph.D. students from the University of Connecticut's Department of Statistics. These students are supervised by Dr. Timothy E. Moore, Center for Open Research Resources & Equipment, and Associate Professor Xiaojing Wang, UConn Department of Statistics. The SCS provides statistical support to researchers in the preparation of grant proposals, and in the analysis of data for reports and academic publications. More information can be found at statsconsulting.uconn.edu. Contact timothy.e.moore@uconn.edu for more information.