FACILITIES AND OTHER RESOURCES (last edited 01/08/2024)

Biostatistics Center. The Biostatistics Center is the primary biostatistical resource for biomedical researchers throughout UConn Health. The Center, part of the Laurencin Institute of Regenerative Engineering, 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
Faculty Director: Gordon Carmichael
Core Staff: Genome Editing, iPSC reprogramming – Christopher Stoddard
Stem Cell Banking and Distribution, iPSC reprogramming – Yaling Liu

Description:
Facility Location: Rooms R1240 and R1223/R1224, 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. We can arrange for quality control measures on iPSCs, such as mycoplasma testing and verification of pluripotency by immunocytochemistry. We also offer biobanking services to ensure secure storage and distribution of custom iPSC lines. We can provide researchers with an expanding suite of cell subtypes to study genetics, developmental biology and human disease states. We serve as a major biobank for iPSCs deposited by the Foundation for Prader-Willi Research and the Angelman Foundation. If you have iPSC lines, we can bank them and arrange distribution to others upon request. We provide integration-free reprogramming services using the Sendai virus method. Tissue samples accepted include skin fibroblasts, peripheral blood, cord blood, PBMCs, and cells cultured from urine. Reprogramming can be done under feeder containing conditions or feeder independent conditions.

The Genome Editing arm of the Core uses cutting-edge genome-engineering technologies to develop cellular models. Work involves not only cell engineering using state-of-the art technologies, but also intellectual help with planning and execution of projects. We also offer targeting of many different inducible systems to offer researchers a wide range of genome modifications as well as direct conversion to cell types of interest using safe-harbor loci in the genome. 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. We provide scarless genome editing using single strand oligo (ssODN) templates that allow for editing without the use of integrated selection cassettes. We continue our role at UConn as a place for project discussion, design, and implementation that provides all levels of researchers an environment to achieve their research goals regardless of their expertise in these areas. We offer complete "start-to-finish" genome editing services for nearly any murine or human cell line or can work with investigators to fill gaps in there engineering workflow.

The facility shares wet lab space (400 square feet) within the Department of Genetics and Genome Sciences. It provides the lab staff with access to a cold room, tissue culture rooms, a secured biobanking storage room, microscopes, picking hoods, and all departmental common equipment.

Services:
Human Pluripotent Stem Cell Services:
-Distribution of iPSC lines and hESC lines
-Cell banking and distribution of custom iPSC lines

-iPSC reprogramming services

Genome Editing Services:
-Correction of gene mutations in patient-specific iPSCs or 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

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 (x1), MiSeq (x2), Illumina NextSeq 550 (x1), Oxford Nanopore MinION (x5) and PromethION-24 (x1), and PacBio Sequel IIe (x1) and Revio (x1). The Illumina NextSeq 550 sequencer on the Storrs campus (main lab) has the ability to scan Infinium CytoSNP 850K and Infinium EPIC Methylation arrays for human only. 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 biological equipment, including thermal cyclers for standard and quantitative PCR (CFX96 Real Time, x2), standard and automated gel electrophoresis systems, centrifuges, single and multichannel micropipettors, water baths, incubators, refrigerators and freezers for sample and reagent storage. Specific (major) equipment available for use include the: Beckman Allegra X-12R Refrigerated Centrifuge, Agilent TapeStation 4200 (x2), Qubit 3.0, two PCR hoods, chemical and biosafety hoods, ABI SeqStudio DNA Analyzer, Pippin Prep (including Pippin Prep, Blue Pippin and Pippin HT systems), 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 CGI has a BioRad QX200 Droplet Digital PCR instrument which can be used for absolute copy number, mutation and gene expression detection.

Center for Comparative Medicine (CCM) at the UConn Health ensures humane and ethical care and use of animals involved in approved research to advance medical, biomedical and veterinary knowledge for the benefit of all. The CCM is an AAALAC International accredited facility, provides quality animal care to meet or exceed the standards and policies of Public Health, Animal Welfare Act PL 89-544 (1966) and subsequent amendments and the documents entitled "Guide for the Care and Use of Laboratory Animals" and "Public Health Service Policy on Humane Care and Use of Laboratory Animals".

The facility is staffed by a full-time veterinarian who also acts as the Attending Veterinarian and Director in the implementation of the Institution's animal care and use program. In addition, CCM consists of Assistant Director, two supervisors, two certified veterinary technicians, 8 animal care staff, 5 sterile facility personnel and 2 administrative staff. The veterinarian also directly participates in monitoring the care and use of laboratory animals through daily interaction with animal care staff, consultations with investigators and direct input through the Institutional Animal Care and Use Committee (IACUC) during animal care and use protocol review.

The CCM are in most part centralized, consists of three main facilities - Animal Tower (B Building), 400 Farmington and Center for Mouse Genome Modification Facility and three additional satellite facilities (MARB, Building 2 and 4). The Animal Tower have seven floors with identical floor plans for housing animals, and are connected to the research laboratories with card entry. The facilities are well equipped to handle variety of species like rodents, guinea pigs, rabbits, ferrets, and aquatic animals (Zebra Fish/Xenopus). All rodents are housed in are housed in individual ventilated cages.

The entry into the facility is maintained through key card access and access to animal rooms is restricted using code-entry locks. Personnel protective equipment is required to enter the facilities, such as disposable gown, hair bonnets, gloves, and shoe covers. All materials going into the facilities are sterilized or decontaminated (i.e., wiped clean with an appropriate disinfectant). Animals are provided with irradiated food, R.O. water in autoclaved water bottles. All cage changes are done under biosafety cabinets with appropriate precautions like gloved hands are disinfected with Clidox® between cage changes. The CCM facility includes dedicated ABSL-2 facility, Chemical Hazard Room, Large & Small animal operating room, behavioral suite, imaging facilities, and procedure rooms in every floor of the animal tower.

Dr. Ramaswamy M. Chidambaram, D.V.M., M.Sc., Ph.D., DACLAM is the director of CCM.

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 and Mantis clusters are housed in secure data centers at the Cell and Genome Sciences Building and the Administrative Services Building on the UCHC Farmington campus. All servers are freely available to members of the UConn research and their research affiliates.

The Xanadu compute cluster is comprised of 75 compute nodes with over 10,000 CPU cores, 65 TB of RAM, and capable of processing at 300 TFLOPs. The Mantis compute cluster is comprised of 32 compute nodes with over 3,000 CPU cores, and 17 TB of RAM. The nodes are a mix of Dell Xeon and Opteron, and Penguin Xeon nodes. Node memory ranges from 128 GB to 2 TB of RAM. Additional resources include 15 NVIDIA A100 GPUs, 10 NVIDIA A10 GPUs, 2 NVIDIA T4 GPUs and 2 NIVIDIA M10 GPUs. All nodes are equipped with ten-gigabit interfaces and connected to a 10/40/100/400 gigabit network infrastructure.

Isilon, Qumulo, Quantum, and Weka Network Attached Storage systems are provided with a capacity of 18 petabytes. An additional 7 petabytes of Scality geo-spread object storage is provided as a long term archival storage solution.

All clusters allow access to over 400 bioinformatic modularized and/or containerized applications. These applications support analysis in phylogenetics, metagenomics, genome assembly, transcriptome assembly, sequence alignment, sequence annotation, variant detection, ChiP/ATAC-Seq, proteomics, and a variety of visualization tools.

Digital Experience Group. The Digital Experience Group (DXG) offers UX Design, Web Development, App Development, Web Design, and other digital innovation in support of Research at UConn. Primarily staffed by student designers, developers, and communications specialists, the DXG also strives to serve as a source of experiential learning, utilizing industry-leading approaches to UX Design, agile software development, and product design.

In addition to providing services to PIs and other research centers at UConn, the DXG contains the specialized Squared Labs team, which provides web development and digital services in support of the University's internal research infrastructure.

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 maintain multiple 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 Zeiss Sigma 360 variable pressure SEM (installed Jan 2024) with secondary and backscatter electron detectors and energy dispersive spectroscopy probe. 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 UConn Health Center Flow Cytometry Facility provides flow cytometry and cell sorting services. The facility consists of a 900 square-foot laboratory, and currently has six instruments available for cellular analysis and two cell sorters. There are two BD FACS Symphony A5 spectral edition cell analyzers as well as a Becton Dickinson (BD) LSR II, a Bio Rad ZE5, an Accuri C6 analyzer, and an Amnis ImageStream Mark II. The facility also houses two BD high speed cell sorters, a FACS ARIA II and a FACS Symphony S6 SE. The FACS Symphony A5 SE cell analyzers have 5 lasers, 50 detectors, and provide the capability of spectral cell analysis while maintaining the ability to perform conventional experiments. Each of these instruments is also equipped with a high throughput plate loader. The Bio Rad ZE5 can also obtain samples from 96-well and 384-well culture plates and can 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 and FACS Symphony S6 SE cell sorters optically match the BD cell analyzers and can perform 4-way or 6-way sorting, respectively. Both have the option for single cell deposition into multi-well plates. The sorters are also equipped with aerosol containment for sorting biohazardous materials and are entirely enclosed in biosafety cabinets. 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), ModFit LT (Verity), and FCAP Array (BD Bioscience).

Fluorescence Imaging Resources at the CCAM Microscopy User Facility. The Microscopy User Facility at CCAM provides access to instrumentation and technical support for light-based microscopy for the research community.
Resources include:

- Zeiss Elyra 7 Lattice SIM2 super-resolution imaging system. The Zeiss Elyra 7 supports several super-resolution imaging modalities, including structured illumination microscopy (SIM), direct stochastic optical reconstruction microscopy (dSTORM), 2D/3D-photoactivated localization microscopy (PALM), and points accumulation in nanoscale topography (PAINT). The microscope is configured with four laser lines (405, 488, 561, and 640) and two high-speed sCMOS cameras (pco.edge 4.2 CLHS) behind a DuoLink coupler that enables fast, simultaneous imaging at two wavelengths.
- Zeiss light sheet Z1 microscope with 4 laser lines (405, 488, 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. A recent upgrade includes a Translucence mesoscale imaging system that allows for high-speed imaging of small live organisms and large intact tissues such as adult mouse brain.
- 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.

- Zeiss AxioObserver inverted microscope with live cell environment control, a 7-color LED illumination system (Lumencor Spectra 7), four laser lines (458, 488, 514, and 561 nm) and TIRF (total internal reflection fluorescence) imaging capability.
- Zeiss Axiovert 200M inverted wide-field fluorescent microscope upgraded with a 7-color LED illumination system (Lumencor Spectra 7) and a 95% QE sCMOS camera (pco.edge 4.2 bi).
- All 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 Zen (Carl Zeiss), ImageJ/Fiji and the legacy Metamorph 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 research community with the necessary support to perform tissue and cellular phenotyping from mouse or human through the use of cryohistological tissue sectioning, high-content imaging including tiled-full section 100x fluorescent imaging of histological slides, live cell long-term (>7 days) time-lapse imaging, confocal imaging and 3D rendering of tissues or cells grown in matrices or scaffolds, in addition to traditional upright and inverted fluorescent microscopes. We have particular expertise with mouse models that utilize fluorescent protein reporters useful for interpreting cell lineage and contribution to 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 a catalog of fluorescent antibody probes specific for certain cell types that can all be utilized on the same tissue section after which chromogenic stains can be 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 from generating histological sections to multiple rounds of staining and imaging. The core can also provide end-to-end services including planning and performing the experiments, providing the fluorescent reporter transgenic mice, assessing the intact animal by TD-NMR and μCT, processing the tissue by X-ray, RNA expression, histological sectioning, imaging, and post-image analysis for interpretation and publication.

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

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 as well providing the UConn research community access to our fully equipped molecular laboratory. We offer both Illumina (MiSeq) and Oxford Nanopore (Gridion) DNA/RNA sequencing platforms. Equipment available for use includes sample preparation robots: Kingfisher Apex, Eppendorf epMotion 5075 TMX and Opentron OT-2 liquid handling robots (single and 8 channel pipetting from 0.1ul 1000ul), Qiagen QiCube and QiAgility. Additional equipment: Synergy HT plate reader (fluorescence, luminescence, and absorbance), Quibit 4.0, QiAxcel nucleic acid fragment analyzer, BioRad 384 well qpcr, Covaris M220 ultra-sonicator, along with standard molecular biological equipment (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. MARS offers training on all instrumentation for users interested in unsupervised use of any equipment as well as fee-for-service sample processing. Fee for service sample processing is both our custom microbiome libraries and most commercially available library kits. MARS offers bioinformatic and statistical support for microbiome analysis as workshops to train users as well as fee-for-service custom analyses.

X-ray microtomography (µCT) Core Facility: The UConn Health µCT core imaging facility has extensive expertise in the assessment of bone microarchitecture, mineral density and functional biomechanics. Directed by Dr. Daniel Youngstrom, the µCT core runs three parallel Scanco instruments (µCT50, µCT40 and VivaCT40) suitable for specimen analysis at 2µm-16µm resolution (10% MTF). The µCT50 can run at a maximum voltage of 100kVp, maximum current of 200µA, and has a 3400×1200-element detector. This equipment is run by a full-time MS-level technician with 14 years of experience in this core (Renata Rydzik), and operates on a dedicated local computing cluster with a GPU graphics accelerator, off-site data backup and options for full-service or self-service segmentation and analysis. The core also maintains micromechanical testing equipment, including a TA Instruments Electroforce 3200 set up for 3-point bending of mouse femurs, as well as a Bose SLM090 high-torque torsion testing instrument optimized for testing fractured mouse femurs. Furthermore, the µCT50 is capable of performing compression/tension experiments inside the scanner using a dedicated stage.

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. New and planned instrumentation will support screening studies, using NMR to identify small molecules that interact with a target protein. This includes a benchtop 80 MHz instrument equipped with a high-capacity sample changer (available now), and a 700 MHz instrument also equipped with a high-capacity sample changer (anticipated delivery summer 2024).

The UConn Proteomics & Metabolomics Facility (PMF) is located on the Storrs academic campus in the Pharmacy/Biology Building (PBB) in adjoining rooms 511 and 513 (69 N. Eagleville Road, Storrs, CT 06269). PMF currently houses 5 advanced and state-of-the-art mass spectrometers for protein, peptide, and small molecule identification and quantification. Room 513 features a multi-functional 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. In early 2023, a brand-new Trapped Ion Mobility Spectrometry (TIMS)-enabled Bruker timsTOF HT mass spectrometer with dual Thermo Scientific Vanquish UPLC systems that provide nanoflow and analytical flow proteomic and metabolomic analyses, respectively, was installed in room 511. This laboratory also houses an ion mobility-enabled Waters Synapt G2Si mass spectrometer with metabolomic and proteomic capabilities: a fully dedicated Waters Acquity UPLC system for small molecule UPLC-MS/MS analysis plus a brand-new (2023) Waters HDX Manager and UPLC system with a Trajan automated robotics system for Hydrogen-Deuterium Exchange-Mass Spectrometry (HDX-MS) on proteins and protein-ligand complexes.

Each room is a temperature- and humidity-controlled laboratory module (~750 sq. ft). Rooms 511 and 513 include generous wet bench space for proteomic and metabolomic sample preparation, a sink, fume hood access, a full-sized sample storage refrigerator and -20ºC freezer, plus a floor-to-ceiling wall-separated workbench area that serves dual purposes: office space for PMF scientists and desk space for several workstations that enable data analysis for PMF users. 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 300 TerFLOPS of compute power, 10,000 processor cores and data storage capabilities of 14 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), Byonic (v3.1.0, Protein Metrics, Inc.), and Spectronaut 17 (Biognosys). Additional analysis software including Scaffold Quant (v5, Proteome Software Inc.), Progenesis QI (Nonlinear Dynamics), MetaboScape (Bruker), and HDX programs ProteinLynx Global Server (PLGS, Waters Corp) and DynamX (Waters Corp) are all 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 mission of the Single Cell Biology Laboratory (SCBL) is to develop, test, compare, validate, and make available state-of-the-art technologies to enable the molecular characterization of individual cells in isolation, in tissue, and in culture. Supported by a staff that is highly experienced in the generation and analysis of single-cell and single-nucleus data, the SCBL carries out single-cell/nucleus workflows that encompass cell and tissue dissociation; cell capture, enrichment, and isolation; molecular characterization; and the computational analysis of single-cell/nucleus data sets. Microfluidic chip-, droplet-, and plate-based single-cell/nucleus transcriptomic methods are all established in the laboratory. The Chromium X™ platform (10x Genomics) has become a key resource

for work with cells/nuclei from fresh and fixed tissues as it enables preparation of sequencing libraries for up to ~20,000 single cells or nuclei, with current applications including single-cell/nucleus RNA-seq (with sample multiplexing capabilities), T- and B-cell immune repertoire sequencing, joint single-cell mRNA and cell surface protein profiling (CITE-seq), single-cell ATAC-seq, and joint single-cell RNA- and ATAC-seq. In addition, the SCBL has established the application of Chromium Single Cell Gene Expression Flex probe-based chemistry (10x Genomics) to paraformaldehyde-fixed cells/nuclei in suspension as well as nuclei isolated from formalin-fixed, paraffin-embedded (FFPE) tissues via the method of single-nuclei pathology sequencing (snPATHO-seq). The SCBL's Chromium Connect platform (10x Genomics) enables automated single-cell/nucleus partitioning, barcoding, and library prep for selected assays. The SCBL also offers several whole-transcriptome spatial profiling assays for frozen and paraformaldehyde-fixed tissues.

These assays include: Visium Spatial Gene Expression slides (10x Genomics), using either manual placement or semi-automated via the CytAssist platform (10x Genomics); and Curio Seeker (Curio Biosciences), which is a commercialization of the SlideSeq (v2) assay. Moreover, the SCBL offers highly multiplexed in situ profiling of gene expression via the Xenium platform (10x Genomics), which enables the subcellular localization of up to 480 mRNAs within tissue sections. Associated SCBL equipment for spatial profiling includes a dedicated RNase-free cryostat and microtome for processing frozen and FFPE tissues, respectively. A NanoZoomer-SQ slide scanner is available for rapid and high-resolution imaging of Visium and Xenium slides (prior to or after molecular processing, respectively).

For the simultaneous localization of >10 cellular proteins at high resolution in a single imaging sample, the SCBL utilizes two platforms: 1) the Hyperion™ Imaging System (Fluidigm®) for Imaging Mass Cytometry™, which couples laser ablation and time-of-flight mass spectrometry to detect up to 37 proteins labeled with metal-tagged antibodies; and 2) the PhenoCycler-Fusion System (Akoya Biosciences), which performs sequential fluorescence-based detection of more than 100 proteins in a single experiment using oligo-tagged antibodies (also known as CO-Detection by indEXing [CODEX]). The SCBL has acquired a complementary platform, the Cell DIVE (Leica), that enables detection of more than 100 proteins through cyclic detection of fluorescently labelled antibodies and is coupled with a BioAssemblyBot 200 (Advanced Solutions) to automate multiple rounds of antibody staining and imaging.

The SCBL 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 an automated incubator and readout capabilities. These capabilities include the SpectraMax® i3x Multi-Mode Microplate Reader (Molecular Devices) and a four-laser, four-camera Opera Phenix™ High-Content Screening System for confocal 3D imaging (Perkin Elmer). In addition, the SCBL is equipped with standard laboratory equipment and workstations dedicated to tissue preparation and cell culture. The facility in Farmington is immediately adjacent to the Flow Cytometry Service and Genome Technologies Service and extensively uses equipment in these labs such as cell sorters (BD FACSAria™, BD Symphony S6™, Sony SH800) and Illumina® sequencers (NovaSeq X Plus, NextSeq 500, MiSeq). The SCBL is based at JAX and is accessible to the UConn/UConn Health community through a Single Cell Genomics Agreement between the two institutions.

Single Cell Biology equipment (Farmington, CT, and Bar Harbor, ME, campuses; number of units in parentheses)

- 10x Genomics Chromium X™ system (2, one unit at the Bar Harbor campus)
- 10x Genomics Chromium Controller™ system (3, one unit at the Bar Harbor campus)

- 10x Genomics Chromium Connect system (1)
- 10x Genomics Xenium Analyzer (1)
- 10x Genomics Visium CytAssist System (1)
- Agilent Tapestation 4200 (2, one unit at the Bar Harbor campus)
- BioRad C1000 Touch Thermal Cyclers (6, one unit at the Bar Harbor campus)
- Cell DIVE Imager (Leica) coupled with a BioAssemblyBot 200 Cell DIVE Automation Workstation (Advanced Solutions)
- Epredia HM 355S Automatic Microtome (2, one unit at the Bar Harbor campus)
- Eppendorf Mastercycler Nexus Thermal Cycler (1, at the Bar Harbor campus)
- Hamamatsu NanoZoomer-SQ digital slide scanner
- GX-Robot (Peak Analysis & Automation)
- Heracell™ 150i CO2 incubators (2)
- Heracell™ Vios 160i CO2 incubators (4)
- Hyperion™ Imaging System (Fluidigm®) consisting of Hyperion™ laser ablation module coupled with a Helios™ CyTOF® mass cytometer
- Incucyte SX5 HD/3CLR live imaging system (Sartorius)
- Invitrogen™ Countess™ II FL Automated Cell Counter (2, one unit at the Bar Harbor campus)
- Invitrogen™ EVOS™ FL Auto Cell Imaging system
- Leica CM3050 S Cryostat (2, one unit at the Bar Harbor campus)
- Logos Biosystem LUNA FX7 Automated Cell Counter (2, one unit at the Bar Harbor campus)
- LUNA-FX7™ Automated Cell Counter (Logos Biosystems) (2, one unit at the Bar Harbor campus)
- Microlab VANTAGE Liquid Handling System (Hamilton Robotics)
- Miltenyi gentleMACS™ Octo Dissociator (2, one unit at the Bar Harbor campus)
- Molecular Devices SpectraMax i3x Multi-Mode Detection Platform (2)
- Nexcelom K2 Image Cytometer (1)
- NuAire 6-foot Class II, Type A2 biosafety cabinet
- Opentrons OT-2 Robotic systems (2, one unit at the Bar Harbor campus)
- Perkin Elmer Opera Phenix™ High-Content Screening System (4 lasers, 4 cameras)
- PhenoCycler-Fusion System (Akoya Biosciences)
- STX44 Automated Incubator (LiCONiC Instruments)
- Thermo Scientific 4-foot Class II, Type A2 biosafety cabinets (4)
- ThermoFisher QuantStudio 7 Flex REAL-TIME PCR System (2, one unit at the Bar Harbor campus)

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..