Cell and Molecular Biology

Master of Arts
Doctor of Philosophy

For More Information

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Facilities for Graduate Work at the Center for Biomedical Research Support (CBRS)

CBRS is a group of shared resource core facilities operated under the Vice President for Research and open to all faculty, staff, and students at The University of Texas at Austin. The cutting-edge technology, services, and expert advice offered by CBRS core facilities are valuable to many students in Cell and Molecular Biology research programs. The facilities offer a wide range of services in nucleic acid and protein sequencing, microscopy, mass spectrometry, protein purifications and analysis, next-generation sequencing, high performance computing, bioinformatics, cryo-electron microscopy, biomedical imaging, and transgenic knock-out mice. Additionally, a large variety of supplies are available from the STEM Stockroom and freezer supply core. Keeping the core facilities as comprehensive and accessible as possible increases faculty, staff, and student research productivity.

Microscopy and Imaging Facility. The Microscopy and Imaging Facility provides extensive equipment and services for microscopy and structural analysis. The facility's expert staff offer assisted use and training on instrumentation and consult on microscopy and flow cytometry research. Equipment in the facility includes scanning and transmission electron microscopes; fluorescence-based cell analyzers and cell sorters; super-resolution, TIRF, confocal, spinning disk confocal, multiphoton, and widefield fluorescence microscopes; a cryostat; vibratome and paraffin microtomes; an ultramicrotome; and a laser microdissection system. More information about the facility's services is available on the Microscopy and Imaging Facility website.

Genomic Sequencing and Analysis Facility. The Genomic Sequencing and Analysis Facility provides advanced analytical resources for analysis of DNA and RNA at scales ranging from single cells to whole-genomes. The facility operates two full-service laboratories for nucleic acid sequencing: the Next Generation Sequencing (NGS) Lab and the Sanger DNA Sequencing Lab.

The NGS Sequencing Lab has staff available for consultations to assist with project planning needs. Once research samples are ready, the NGS lab can take DNA or RNA, transform it into sequence ready libraries, and deliver data ready for analysis.

The NGS Sequencing Lab supports one Illumina NovaSeq, which is excellent for large whole genome, RNA-Seq, or single cell sequencing projects. The facility also has two Illumina MiSeq next-generation DNA sequencers that are best for smaller projects or for projects requiring longer read lengths. Additionally, the facility has two Illumina NextSeq sequencers that are ideal for intermediate scale projects, requiring more read depth than is feasible on the MiSeq. One of the NextSeq instruments has scanning capabilities allowing the core to offer the Illumina Infinium EPIC microarray.

The NGS Sequencing Lab includes a fully equipped molecular laboratory, which is outfitted with Agilent Bioanalyzers, NanoDrops, the Tecan Freedom Evo robotic liquid handling station, Hamilton Nimbus liquid handler, two Covaris shearing instruments, a 10X Chromium controller, and two automated Pippin gel electrophoresis systems.

The GSAF also houses the Sanger DNA Sequencing Lab and provides automated DNA sequencing and fragment analysis using capillary-based Applied Biosystems 3730 and 3130 DNA analyzers. These instruments offer high throughput and sensitivity with a capability of handling more than 800 samples per day, with reads greater than 700 base pairs and a success rate of over 90 percent. The AB 3730 and 3730XL are also used for the analysis of microsattelites, AFLP, SNPs, and other fragment applications. Walk-up equipment available for quantitative real-time PCR include three Life Technologies ViiA sytems. More information about the facility's services is available on the Genome Sequencing and Analysis Facility website.

Biological Mass Spectrometry Facility. The Biological Mass Spectrometry Facility provides proteomics and metabolomics services, develops methods for collaborative research projects, and trains users on self-service mass spectrometry instrumentation. Two high-resolution, high-sensitivity Thermo Orbitrap Fusion mass spectrometers with Ultimate 3000 RSLCnano UPLC chromatography systems provide qualitative and quantitative proteomics analyses. Proteome Discoverer database searches using Sequest HT and Scaffold, MaxQuant, Perseus, and Skyline software are provided for data processing, validation and visualization, capable of identifying thousands of proteins in a single run. Techniques for quantitation include stable isotope labeling and tandem mass tags, as well as label free methods. Fractionation enables in-depth proteomics analysis. Protein post-translational modifications including phosphorylation, acetylation, methylation, oxidation, and ubiquitination are identified from the high-resolution data. De novo sequencing of antibodies and glycopeptide searches are conducted with Byonic, and Supernovo software, respectively. The Intavis DigestPro robot automatically digests and desalts samples for analysis. Protein molecular weight determination service provides good quality control for expressed and modified proteins. A self-service Bruker Autoflex maX MALDI-TOF/TOF instrument is available for analyzing proteins, nucleic acids, peptides, polymers and chemicals, with training provided by core staff. A Vanquish Duo UPLC in line with Thermo Q-Exactive is utilized for metabolomics experiments with Compound Discoverer for metabolite identification and quantitation. More information about the facility services and protocols can be found on the Biological Mass Spectrometry website and Wiki pages.

Computational Biology and Bioinformatics. The Computational Biology and Bioinformatics core (https://research.utexas.edu/cbrs/cores/cbb/) provides support for students, postdoctoral fellows, and faculty interested in the use of computational approaches to solving biological problems. This group helps lower the threshold to enter the -omics area of the life sciences. To achieve this goal this core offers an on-demand***Bioinformatics Consulting Group***#that works with researchers on big data analysis projects. Through ***Training Initiatives,*** numerous short courses on diverse topics for learning computational approaches to biological problems; an#Annual Summer School for Big Data in Biology; peer-led working groups, and community events that complement semester-long for-credit courses are available for the community. Finally, the ***Biomedical Research Support Facility*** provides researchers with local computation and managed storage capabilities suitable for research computing workflows not addressed by the Texas Advanced Computing

Center. For more information, visit the Center for Computational Biology and Bioinformatics website.

Mouse Genetic Engineering Facility. The Mouse Genetic Engineering Facility is in the Animal Resource Center and provides services to generate and archive custom-made transgenic mouse models. Services include CRISPR microinjection, DNA pronuclear injection, embryonic stem (ES) cell microinjection, gene targeting in ES cells, expansion of ES cell clones from the International Knockout Mouse Consortium, embryo cryopreservation, and re-derivation of mouse strains to pathogen-free status. The lab also performs sperm cryopreservation and *in vitro* fertilization. More information about the facility's services is available on the Mouse Genetic Engineering Facility website.

STEM Stockroom. The STEM Stockroom is located in the Norman Hackerman Building and provides many lab and office supplies. The STEM Stockroom carries different items ranging from lab consumables, chemicals, office and cleaning supplies, as well as kits from companies such as Qiagen, Sigma, LifeTech and Fisher. Enzymes are also available from New England BioLab and ThermoFisher (Fermentas). The STEM Stockroom also does special orders. For a full inventory list, please check the Center for Biomedical Research Support website.

Biomedical Research Supply Core (BioReSCo). This Core maintains automated refrigerators and freezers from multiple vendors of molecular biology reagents. These units are available 24/7 to registered users. Primers can also be purchased from Sigma or IDT via a customized website for free delivery to the Core. More information about the reagents available at this facility is available at the BioResCo website.

Electronics Repair. This core provides electronics services including maintenance, service, and repair of biomedical/scientific equipment and instrumentation. This is one of the only SMD (surface-mount device) re-work and fabrication services on campus. Additionally, this core offers electrical and mechanical safety consultations related to classrooms and laboratories. More information about the facility's services is available on the Electronics Repair website.

Sauer Structural Biology Laboratory (SSBL). The Sauer Structural Biology Laboratory is a state-of-the-art cryo-electron microscopy facility. The SSBL houses an FEI Titan Krios equipped with a Gatan K2 Summit direct electron detector and an FEI Glacios also equipped with a Gatan K2 Summit direct electron detector. Both instruments are capable of imaging macromolecular machines at atomic or near atomic resolution. The facility also contains all the accessory equipment required for high-resolution structure determination. More information about the facility's services is available on the SSBL website.

Biomedical Imaging Center (BIC). The Biomedical Imaging Center is an interdisciplinary, multi-methods facility specializing in non-invasive neuroimaging. The center supports a Siemens VIDA 3T MRI scanner and a Siemens Skyra 3T MRI scanner. These instruments are used by many researchers for studies of human perception, memory, decision-making, and behavior. Unique emphases at the BIC include a strong connection to supercomputing resources at the Texas Advanced Computing Center (TACC), real-time fMRI, high-resolution / 3D visual presentation, and support for developmental studies. The facility also contains several resources for imaging in model systems, as well as imaging-informed fabrication and machining. More information about the facility's services is available on the BIC website.

Areas of Study

The Interdisciplinary Life Sciences Graduate Programs, a research unit housed in the College of Natural Sciences, provides the support and infrastructure for the Cell and Molecular Biology (CMB) graduate program at The University of Texas at Austin. The CMB graduate program is supported by more than 130 faculty members from four colleges and over 10 academic departments.

The program offers students training in seven different research tracks: bioinformatics and computational biology, biomolecular structure and function, cell and developmental biology, chemical biology and drug discovery, molecular genetics, neurobiology, and plant molecular biology. Each of the tracks provides specialized courses and training for the graduate student beyond the basic core curriculum of genetics, biochemistry, molecular biology, and cell biology.

Graduate Studies Committee

The following faculty members served on the Graduate Studies Committee (GSC) in the spring 2023 semester.

Seema Agarwala
Hal S Alper
Eric V Anslyn
Nigel S Atkinson
Chandrajit L Bajaj
Aaron Blair Baker
Brett J Baker
Jeffrey E Barrick
Brian Belardi
Adela Ben-Yakar
George D Bittner
Amy Brock
Karen S Browning
Xiaolu Cambronne
Frances Anne Champagne
Z Jeffrey Chen
Lydia Maria Contreras
Maria A Croyle
Kevin N Dalby
Bryan William Davies
Arturo De Lozanne
Daniel James Dickinson
John Digiovanni
Jennifer Jane Donegan
Michael Drew
Jaquelin P Dudley
Johann K Eberhart
Gail Eckhardt
Lauren Ilyse richie Ehrlich
Ron Elber
Andrew Ellington
Walter L Fast
Ilya J Finkelstein
Janice A Fischer
Ernst-Ludwig Florin
Laura K Fonken
George Georgiou
Nace L Golding
Vernita Gordon
Andrea C Gore
Ryan S Gray
Jeffrey Martin Gross
Marvin L Hackert
Arbel Harpak
Rasika M Harshey
Justin C Havird
David M Hillis
David W Hoffman
Johann Hofmann
Jon M Huibregtse
Enamul Huq
Brent L Iverson
Vishwanath R Iyer
Robert K Jansen
Andres Jara-Oseguera
Makkuni Jayaram
Arlen W Johnson
Kenneth Johnson
Christopher A Jolly
Thomas E Juenger
Adrian T Keatinge-Clay
Benjamin Keith Keitz
Jonghwan Kim
John S Kuo
Alan Lambowitz
Seongmin Lee
Hung-Wen Liu
Alan M Lloyd
Yi Lu
Dmitrii E Makarov
Edward M Marcotte
Mia K Markey
Stephen F Martin
Andreas Matouschek
William Matsui
Mikhail V Matz
Jennifer A Maynard
Jason McLellan
Mona Mehdy
Robert Messing
Lauren A Meyers
S J Mihic
Kyle M Miller
Daniel P Miranker
Ian J Molineux
Nancy A Moran
Hitoshi Morikawa
Somshuvra Mukhopadhyay
Vagheesh M Narasimhan
Robert W Newberry
Hiroshi Nishiyama
Howard Ochman
Tanya T Paull
Shelley M Payne
Steven M Phelps
Jonathan T Pierce
Martin Poenie
William H Press
Nicholas J Priebe
Hong Qiao
Pengyu Ren
John H Richburg
Rick Russell
Elif Sarinay Cenik
Eric Senning
Jason B Shear
Jeanne Casstevens Stachowiak
David S Stein
Scott W Stevens
Laura J Suggs
Christopher S Sullivan
Sibum Sung
Thibaud Olivier Taillefumier
David William Taylor Jr
Stefano Tiziani
Keiko Torii
Benjamin J Umlauf
Carla L Vandenberg
Karen Marie Vasquez
Steven A Vokes
John B Wallingford
Huiliang Wang
Lauren J Webb
Christian P Whitman
Claus O Wilke
Blerta Xhemalce
Kun Yang
Stephen Yi
Harold H Zakon
Boris Zemelman
Daniel J Leahy
Yan Zhang

Admission Requirements

Applicants must provide evidence of strong accomplishment in the natural sciences, documented by undergraduate grades and a bachelor's degree or the equivalent in an area such as one of the biological sciences, chemistry, or physics. Preparation should include at least one semester each of cell biology and molecular biology, and one year each of calculus, organic chemistry, and general physics. Coursework in genetics and biochemistry is also required. Deficiencies in undergraduate work should be corrected before application to the program.

Because the graduate program is focused on the doctoral degree, students seeking only the master's degree are not admitted.