Core Facility Descriptions

Carver College of Medicine

University of Iowa

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# Biochemistry Stores

[*https://medicine.uiowa.edu/biochemstores/*](https://medicine.uiowa.edu/biochemstores/)

###### Biochemistry Stores is a part of the Biochemistry Department of the Carver College of Medicine at the University of Iowa. As a research supply storeroom that purchases and dispenses nearly $3 million per year in inventory, the Biochemistry Stores services: all University of Iowa research laboratory units, units of the University of Iowa Hospitals and Clinics, University of Iowa students, Veterans Affairs Medical Center, and any other facilities having funding through the University of Iowa. Biochemistry Stores stocks a broad range of research chemicals, labware, glassware, expendables, and other necessary research supplies, and uses high sales volume to negotiate the purchase of the highest quality inventory at the lowest possible prices. Products are dispensed on a walk-in basis in a quick and efficient manner.

# Bioengineering Services

[*https://medicine.uiowa.edu/bioengineeringservices/*](https://medicine.uiowa.edu/bioengineeringservices/)

Bioengineering Services provides professional maintenance of The University of Iowa Hospitals and Clinics' patient-care and the Carver College of Medicine's research equipment. Scheduled preventative maintenance, repair and pre-construction and general technical consultation services are available.

# Biomedical Informatics Core

[*https://icts.uiowa.edu/investigators/biomedical-informatics-core*](https://icts.uiowa.edu/investigators/biomedical-informatics-core)

The University of Iowa Institute for Clinical and Translational Science’s Biomedical Informatics Core (BMI) helps in the capture, management and analysis of human subjects data. BMI maintains a clinical research data warehouse that contains data from electronic medical records linked to a growing number of external data including bio-sample data, genomic data, and cancer registries. Investigators are able to use tools such as TriNetX to explore this data. BMI also provides access to REDCap for collaborative and compliant data capture and management and to UI BioSHARE to manage information about bio-samples. BMI supports multi-instituional medical record data queries via PCORnet and TriNetX. BMI also has a team of developers to assist with custom application development, especially for mobile device applications and to explore new techniques such as Natural Language Processing (NLP).

# Biological Safety Level III Laboratories

The Carver College of Medicine's Biological Safety Level III (BSL3) Laboratory facility provides researchers with state-of-the-art laboratories in which to safely study BSL3 select and non-select agents and toxins regulated by both the Centers for Disease Control and Prevention and the U.S. Department of Agriculture.  The facility has been designed to safely accommodate research, clinical, and diagnostic procedures, including animal housing areas for rodents and other small animals.  In addition to the animal areas, there are additional individual laboraties to accommodate work for tissue culture, virology, microbiology, and molecular biology.  The facility allows up to approximately 10 researchers to work simultaneously.

The BSL3 facility houses a Zeiss Axiovert 200M inverted fluorescence microscope complete with an environmental chamber, allowing researchers to visualize microbe-host cell interactions and responses in real time. This powerful system provides our researchers with the unparalleled ability to perform a range of microscopy experiments that otherwise would not be possible as all BSL3 III samples must be inactivated prior to removal from the laboratory.

# Biomedical Research Store

[*https://webapps1.healthcare.uiowa.edu/biostore/*](https://webapps1.healthcare.uiowa.edu/biostore/)

The Biomedical Research Store provides University of Iowa research investigators easy procurement of common molecular and cell biology enzymes, reagents and kits. Large volume contracts enable the store to negotiate very low prices as well as eliminate all shipping and packaging fees.

# Biostatistics Consulting Center

[*https://www.public-health.uiowa.edu/biostatistics-consulting-center/*](https://www.public-health.uiowa.edu/biostatistics-consulting-center/)

The Biostatistics Consulting Center is a unit within the Biostatistics Department of the College of Public Health. The Consulting Center experts provide statistical consulting for the CCOM researchers, as well as other health science researchers at the University of Iowa Colleges of Dentistry, Nursing, Pharmacy, and Liberal Arts and Sciences. The Consulting Center assists researchers with all phases of basic science, clinical, and epidemiologic research. Specifically, the Consulting Center can assist with grant proposal development, assist with study design, develop efficient data management strategies, perform appropriate statistical analysis, and assist in writing reports for scientific publication.

# Center for Biocatalysis and Bioprocessing

[*http://cbb.research.uiowa.edu*](http://cbb.research.uiowa.edu)

The Center for Biocatalysis and Bioprocessing (CBB) is an interdisciplinary research center dedicated to the advancement of biocatalytic sciences. The center operates a core Microbial Fermentation and Bioprocessing Facility that provides expertise in both upstream and downstream bioprocesses to: a) optimize production of highly-valued biomolecules, b) scale-up these processes, and c) perform pilot-scale manufacturing of products at the highest level of quality control. Examples of targeted products include vaccines, enzymes, binding proteins, growth hormones, DNA, RNA, and bio-transformation products. Conventional academic biomanufacturing is performed in our Research and Process Development (RPD) suite. A distinguishing feature of the CBB core facility is the operation of a second suite that focuses on production under current good manufacturing practices (cGMP) conditions. This GMP suite offers the preparation of high quality biotechnology products produced under regulations mandated by the 2008 FDA guidance for quality manufacturing of compounds designed for Phase 1 clinical trials. The information provided by the GMP manufacturing of putative therapeutics is suitable for Investigational New Drug (IND) applications. Fermentations can be scaled up from shake flasks to 1000 L volumes within our RPD suite and up to 300 L volumes in our GMP suite. All biomanufacturing processes are performed by professional staff trained in laboratory practices and quality control.

# Central Microscopy Research Facilities

[*https://cmrf.research.uiowa.edu*](https://cmrf.research.uiowa.edu)

The Central Microscopy Research Facilities (CMRF) offers a wide variety of research services, educational/training opportunities, and instrumentation within two campus locations. The main laboratory, located in Eckstein Medical Research Building within the College of Medicine, emphasizes imaging of biological samples by offering epi- and confocal fluorescence microscopy as well as scanning, transmission, and freeze fracture electron microscopy. CMRF instrumentation includes a STED super-resolution microscope, a TIRF microscope, an epifluorescence microscope with motorized X-Y-Z stage and environmental chamber for multi-RO1 time-lapse microscopy. The CMRF has a complete repertoire of instruments and services for electron microscopy including specialized staining and embedding techniques, negative staining, metal coating, and cryo-fixation for analysis with a JEOL JEM 1230 for TEM and Hitachi S-3400N for SEM. A Hitachi S-4800 FESEM is available for high-resolution imaging of sample surfaces. The CMRF also provides all the instruments and materials for routine histological processing, staining, and visualization for both frozen and aldehyde-fixed tissue. In addition, the CMRF maintains licenses and expertise in data analysis with the Bitplane Imaris software and Fiji/ImageJ open-source package. The CMRF supports both the experienced and novice investigator and provides training for independent use of resources. Alternatively, all or parts of a project can be handled by the staff. Major instrumentation within the CMRF is available 24 hours a day and 7 days a week.

# Comparative Pathology Laboratory

[*https://cpl.lab.uiowa.edu*](https://cpl.lab.uiowa.edu)

The Comparative Pathology Laboratory (CPL) works closely with investigators to provide full service pathology, tissue handling, and histology services in order to maximize the impact, relevance and quality of research studies modeling human disease. The CPL is headed by veterinary pathologists, Dr. Katherine N. Gibson-Corley and Dr. David K. Meyerholz, who are trained in comparative pathology and can also provide a variety of consulting services. The facility provides all levels of tissue processing, including necropsy, routine histology, and a large panel of immunohistochemistry markers. The facility has four certified histotechnologists, and two research associates with vast experience in pathology techniques. Additionally, the CPL has the medical resources of over 30 physician pathologists specialized in a wide-range of tissue pathologies.

# Developmental Studies Hybridoma Bank

[*http://dshb.biology.uiowa.edu*](http://dshb.biology.uiowa.edu)

The Developmental Studies Hybridoma Bank (DSHB) is a national resource created by the NIH in 1985 and housed at the University of Iowa. The DSHB stores and distributes hybridomas and the monoclonal antibodies (MAbs) they produce at cost to the general scientific community in order to facilitate scientific research. Our priorities are to 1) allow researchers to test multiple MAbs without commitment of significant funds, and continue to utilize those of interest without worry of expense; 2) relieve scientists of the time and expense of distributing hybridomas and MAbs they develop; 3) assure the scientific community that MAbs with limited demand remain available. The DSHB has over 5,000 hybridomas obtained from a variety of individuals and institutions, including the NIH Protein Capture Reagent Program, the National Cancer Institute, the European Molecular Biology Laboratory and the Muscular Dystrophy Association, and distributes over 65,000 samples per year to investigators around the world.

# Electron Spin Resonance Facility

[*https://www.healthcare.uiowa.edu/CoreFacilities/esr/*](https://www.healthcare.uiowa.edu/CoreFacilities/esr/)

The Electron Spin Resonance Facility provides expertise and instrumentation to pursue research questions dealing with oxygen free radicals, singlet oxygen, nitric oxide, and the array of related oxidants and antioxidants that influence the overall redox environment of cells, tissues, and whole organisms. The facility houses two Bruker EMX ESR Spectrometers and a Varian E-4 ESR.

# Flow Cytometry Facility

[*https://www.healthcare.uiowa.edu/corefacilities/flowcytometry/*](https://www.healthcare.uiowa.edu/corefacilities/flowcytometry/)

The 1,200-square foot Flow Cytometry Facility is located in the Eckstein Medical Research Building (EMRB). The facility has one magnetic-based and ten laser-based instruments whose major purpose is the identification and isolation of cell populations. The two cell sorters are the Becton Dickinson Aria II and the Becton Dickinson FACS Aria Fusion that both operate in a biological safety hood allowing sorting of live human cells and cells exposed to infectious agents. The facility also has three Becton Dickinson LSR II instruments for multi-color flow cytometry analysis, a Becton Dickinson FACScan and FACSCalibur, two BioRad Bioplexes (Luminex 200s), and a Miltenyi autoMACS. The cell sorters are operated by dedicated technicians M-F, 8am-6pm and other instruments are available 24/7 upon suitable training. The facility provides scientific and technical personnel who are available for consultation in designing experimental protocols and training in the use of bench-top instruments and software programs for the interpretation and analysis of data. Cell preparation protocols are available on the facility’s website and publication quality output are available upon request. Offline data analysis using FlowJoTM, DiVaTM, and ModFITTM is accomplished through the facility's system of networked computers equipped with correspondingly maintained licenses. Data are also accessible remotely through the facility's dedicated file servers, which provide data storage for at least ten years.

# Genome Editing Facility

[*https://medicine.uiowa.edu/genomeediting/*](https://medicine.uiowa.edu/genomeediting/)

The Genome Editing Facility provides centralized instrumentation and expertise for the generation, breeding and analysis of both transgenic and gene-targeted mice. The facility is comprised of four personnel trained in a variety of mouse embryo manipulations for producing genome-engineered mice. This includes transgenesis and CRISPR/Cas9 HDR approaches using pronuclear microinjection. Additional services include the design and validation of transgenic constructs and CRISPR/Cas9 reagents, screening of founder animals, mouse colony genotyping, and backcrossing strains. The facility also provides services and storage for embryo and sperm cryopreservation, as well embryo and mouse re-derivation and *in vitro* fertilization of cryopreserved sperm. The facility performs mouse embryonic stem cell evaluation, expansion and injection into blastocysts. The facility maintains all animals in strict specific pathogen free (SPF) barrier conditions and has three wet laboratories, a microscopy suite, a tissue culture room, and a molecular biology laboratory. The facility currently has a 100% founder success rate with nearly 300 different constructs.

# High Performance Computing

<https://hpc.uiowa.edu>

The University of Iowa High Performance Computing (HPC) group works to provide high-performance and high-throughput computing resources to members of the campus community. The High Performance Computing group supports the Neon and Argon clusters and is a collaborative initiative currently led by Information Technology Services.

The HPC resource is managed by 11 specialists who provide support and consultation services for our computer clusters.  The Neon and Argon HPC clusters are currently the primary central HPC resources. Collectively the two systems contain approximately 15,000 processor cores and 50 GPU accelerators. Both systems contain high speed internal networks based on Infiniband and Omnipath and are connected to the campus via multiple 10Gb ethernet connections. Soon, the HPC will move to a new model with a single integrated campus cluster extending the latest Argon cluster indefinitely and allowing multiple generations of hardware.

# High Resolution Mass Spectrometry Facility

[*http://hrmsf.research.uiowa.edu/*](http://hrmsf.research.uiowa.edu/)

The High Resolution Mass Spectrometry Facility (HRMSF) provides information pertaining to the molecular weight, elemental composition, and molecular structure of chemical compounds, which allows the identification and quantitative analysis of components of complex mixtures. The HRMSF can also perform tandem mass spectrometry (MS-MS) experiments, which are used to assist in structure determination of unknown molecules.

The HRMSF has four open-access instruments, one GC/MS and three LC/MS that are available to on-campus researchers who have been trained by the HRMSF staff.  Instruments include:

1) A Waters GCT Premier GC mass spectrometer used with either electron ionization (EI) or chemical ionization (CI). 2) A Waters Q-TOF Premier high-resolution hybrid quadrupole time-of-flight mass spectrometer configured with electrospray ionization (ESI) capabilities. This is interfaced with a Waters Acquity ultra-high-pressure liquid chromatography system (UPLC) and an autosampler that holds two plates each with 48 vial positions or two 96-well plates. The Q-TOF premier is used for accurate mass massuerments and is also capable of performing tandem mass spectrometry (MS/MS) experiments. 3) A second Q-TOF Premier is configured for direct infusion analysis. 4) A Waters Acquity triple quadrupole mass spectrometer with an Acquity H Class UPLC used for quantitative analysis of complex mixtures using multiple reactions monitoring (MRM) scanning techniques.

# High Throughput Screening Facility

<https://hts.research.uiowa.edu>

The University of Iowa High Throughput Screening Facility (UIHTS) provides a high-throughput platform that integrates robotics, detection systems, and chemical/biologic libraries to enable highly flexible screening services, project management, grant assistance, and assay/technology development for investigators at the University of Iowa. Instrumentation systems allow for scalable screening approaches for drug discovery and development through screening of large chemical/biologic libraries and also facilitate molecular probe discovery for mechanism of action studies of chemical biology by screening focused and intellectually-designed compound collections.

The UIHTS is equipped to perform high-throughput screening in 96, 384, and 1536-well formats with plate reader detection (Perkin-Elmer EnVision) using absorbance, fluorescence, and luminescence, including advanced FRET and BRET techniques. UIHTS is also equipped to perform high-content screening (HCS, Perkin Elmer Operetta Confocal Imaging System) to detect and quantify phenotypic changes, i.e., cell differentiation, cell migration, neurite outgrowth, and target trafficking; or by fluorescence intensities for target protein expression, transcription factor, or signaling pathway analysis. HTS and HCS systems are integrated with robotics for plate handling and assay execution, suitable for small- or large-scale compound library screens that are fully automated.

UIHTS holds both small molecule drug libraries and biological libraries. Current small molecule libraries include: 1) an FDA-approved drug library containing 1,018 compounds that are all FDA approved. This library is primarily used to identify drugs that can be repurposed. 2) A pathway or target selective collection (PTSC) containing 1,310 compounds for mechanism interrogation. 3) The Spectrum Library from MicroSource (MSSP) containing 2,320 structurally diverse compounds including marketed and experimental drugs as well as natural products. This library is typically the starting point of pilot screenings. 4) ChemBridge, the Diverset, a collection of 50,000 small molecules representing a wide swath of chemical space, optimized to be “drug like,” considering factors such as partition coefficient and Lipinski-like rules. 5) Maybridge Ro3 Diversity Fragment Library containing 1,000 carefully selected fragments for the optimal balance between broad coverage of lead-like diversity space and the number of fragments. 6) NIH NCI NExT collection of 83,536 small molecules, which is a general screening set that was designed to identify lead compounds for drug discovery projects. It is comprised of three non-separable subsets of the Legacy molecular library small molecule repository (MLSMR), 15 privileged scaffolds in two Diversity subsets. Biological libraries cover the cell collections of melanoma cell lines and breast cancer cell lines, and arrayed Kinome-wide CRISPR gRNA library from Integrated DNA Technologies.

# Hybridoma Facility

<http://hybridoma.biotech.iastate.edu>

*This facility is available for use by Carver College of Medicine investigators through a partnership with the Iowa State University Office of Biotechnology in Ames, Iowa.*

The Hybridoma Facility of the Iowa State University Office of Biotechnology provides complete resources for raising monoclonal or polyclonal antibodies. Techniques are provided on an individual charge basis and include animal immunization, cell fusion and hybridoma culture maintenance, cell culture and maintenance of other cell lines used in biotechnology and virology labs, large-scale mammalian cell culture (bioreactor), blood sera collection, antibody purification and isotyping, cryopreservation and cryostorage of cell lines (-140o C), and ELISA tests.

# Iowa Institute of Human Genetics: Bioinformatics Division

<https://medicine.uiowa.edu/humangenetics/research/bioinformatics-division>

The Iowa Institute of Human Genetics (IIHG) Bioinformatics Division provides the expertise and instrumentation to analyze complex DNA and RNA sequence datasets. Routine analysis includes evaluation of large scale sequencing experiments, including variant calling from research and clinical exomes or targeted panels, quantitation and statistical evaluation of RNA-Seq and ChIP-Seq data, and single-cell transcriptomics from the 10x Genomics system. Staff members have diverse training in biological data analysis, and are available to work with investigators on short-term projects, grant applications, and longer-term research collaborations. The Bioinformatics group has preferred access to on-campus, high-performance computer clusters with high-bandwidth dedicated storage attached to the clusters. The Bioinformatics group maintains local installations of Galaxy for the evaluation of NGS data for researchers. The group also maintains licenses for analysis software including Ingenuity Pathway Analysis and Partek Genomic Suite. The Bioinformatics group provides educational services for researchers looking to process and analyze their data with new computational techniques. These include an annual three-day course that provides hands-on tutorial sessions that focus on different topics; a monthly ‘mini-course’ focusing on bioinformatics tools or software covering topics such as the UCSC Genome Browser, Kallisto/Sleuth and R-programming language; and sponsored seminars featuring outside speakers.

# Iowa Institute of Human Genetics: Genomics Division

<https://medicine.uiowa.edu/humangenetics/genomics-division-facilities-and-resources>

The Genomics Division in the Iowa Institute of Human Genetics provides a broad spectrum of technologies and resources to support nucleic acid- and genomics-based initiatives to the research and clinical communities.  These technologies include:

* Genome Sequencing (NGS-based)
* DNA Sequencing (Sanger-based)
* DNA Microarray
* Oligonucleotides
* Nucleic Acid quality assessment
* Real-time and digital PCR

The laboratory occupies a total of ~2950 square feet of space over 6 rooms. The division director (Kevin Knudtson, PhD), the oligonucleotide service, and support staff occupy a total of ~650 square feet of office space over four rooms.

For assessing nucleic acid quality and quantity, the Genomics group maintains two Agilent Bioanalyzers, a Trinean DropSense 16, two Nanodrop spectrophotometers, two Qubit fluorometers, and an Advanced Analytical Fragment analyzer. Sanger sequencing services are provided with an Applied Biosystems Model 3730 (48-capillary) DNA sequencer and a Model 3730xl (96-capillary) DNA Sequencer, and sequence data are accessed by investigators via a custom online web system. Next-generation sequence data are provided with a HiSeq 4000 that features dual-flow cells (delivering the highest throughput and lowest price-per-sample across multiple applications) and a MiSeq benchtop sequencer permits low throughput genome sequencing.These sequencing platforms are complemented by a Covaris E220 96-well plate sonicator, SciClone robots that facilitate high-throughput sample preparation, and a 10X Genomics Chromium drop-seq based technology system used for single-cell RNA-Seq applications.

The Genomics group houses an Illumina iScan BeadArray system for array-based genotyping and methylation profiling projects. For real-time PCR analysis, the facility has an ABI QuantiStudio Flex 7 and two ABI Model 7900 instruments, all configured to support array card, 96- and 384-well formats. For high-throughput genotyping, the facility provides Fluidigm EP1 and BioMark systems with controllers to run the 48x48, 96x96, and 192x24 (target x sample) BioMark Dynamic arrays. Digital PCR is provided with a BioRad QX200 droplet digital PCR system, enabling ultrasensitive and absolute quantification of nucleic acid targets. The system uses the same hydrolysis probe (Taqman)- or EvaGreen (SYBR-like)-based assays and provides the ability to quantify template molecules that may be undetectable using the traditional real-time PCR techniques.

# Magnetic Resonance Research Facility

<https://medicine.uiowa.edu/mri/>

The Magnetic Resonance Research Facility (MRRF) at the University of Iowa is dedicated to providing MR imaging equipment and expertise to any researcher. Two field strengths are available (1.5T, 3T, and 7T). Oversight is provided by both internal and external research advisory committees. The internal research committee reviews new project proposals and equipment acquisitions. The MRRF currently supports more than 60 research imaging projects from fourteen different departments representing five colleges within the University of Iowa

The MRRF currently has two research-dedicated whole-body MR scanners (3.0T GE Discovery, 7.0T GE MR950) for human and large-animal imaging, and one small-animal MR scanner (7.0T GE 901 Discovery) available for research purposes. The whole body scanners are fully outfitted for fMRI imaging, including stimulus presentation software (E-Prime, Presentation, Matlab), auditory and visual stimulus hardware (Avotec), and physiological monitoring (Biopac). A shared clinical/research 3T scanner (3T Siemens Skyra ) is available in the clinical imaging suite. Additionally, an MRI Simulator is available to all researchers.

The MRRF utilizes the XNAT system for data archiving and for distribution of images to the various research projects. In addition, the facility is outfitted with a number of image analysis tools, including FSL, AFNI, Slicer3, ImageJ and BRAINS. The facility also has the ability to develop custom MR pulse sequences and reconstructions using the GE Epic and orchestra tools, respectively.

# Metabolic Phenotyping Core

<https://medicine.uiowa.edu/diabetes/research/metabolic-phenotyping-core>

The Metabolic Phenotyping Core provides investigators specialized and non-invasive metabolic assays that are essential in phenotyping mouse and other animal models with diabetes, its complications, obesity, and related metabolic disorders.

The central services of the core include:

* Determining whole animal energy expenditure using Metabolic Chambers: Promethion (Sable Systems International) and CLAMS (Comprehensive Lab Animal Monitoring System, Columbus Instruments). This is a non-invasive measurement of food intake, energy expenditure, respiratory exchange ratio and physical activity.
* Measuring whole body composition with a Bruker MiniSpec in mice and rats.
* Hyperinsulinemic-euglycemic clamp experiments to assess *in vivo* insulin action, insulin signaling, and glucose metabolism in awake mice.
* Hyperglycemic clamp experiments to assess *in vivo* pancreatic beta-cell function (i.e., glucose-induced insulin secretion) and the effect of hyperglycemia on glucose metabolism (i.e., glucose toxicity).
* Mitochondrial bioenergetics: tissue/cellular/isolated mitochondria oxygen consumption using the XF-24 Extracellular Flux Analyzer; mitochondrial respirometry for tissue (permeabilized mouse heart and soleus) and isolated mitochondria with the O2K from OROBOROS.
* Glucose and insulin tolerance tests.

Specific equipment available at the Metabolic Phenotyping Core includes: a **Seahorse XF-24 analyzer, two O2K from OROBOROS,** two Bruker Minispecs, and Metabolic Chambers.

# Metabolomics Core Facility

The Metabolomics Core Facility provides investigators with metabolite profiling and isotope tracer analyses using high-resolution mass spectrometry interfaced with either gas chromatography (GC) or liquid chromatography (LC). The semi-targeted high resolution GC-MS protocol identifies and measures over 100 metabolites. These include TCA cycle and glycolytic/gluconeogenic intermediates as well as amino acids, sugars, neurotransmitters, and fatty acids. The high-resolution LC-MS analysis focuses on compounds that are not amendable to the high temperatures of gas chromatography such as AMP, ADP, ATP and other redox metabolites, coenzymes, nucleotides, and complex lipids.

The Metabolomics Core Facility currently has three mass spectrometers. The first is a Thermo Q Exactive GC (QE-GC), which is a high resolution/mass accuracy, hybrid quadrupole-Orbitrap mass spectrometer (R=120,000). The second is an ISQ LT GC-MS, which is a low resolution single quadrupole mass spectrometer. Each GC-MS is interfaced with a Trace 1310 gas chromatograph and autosampler. Both GC-MS instruments have electron ionization (EI) and chemical ionization (CI) capabilities utilized for metabolite profiling and isotope tracer studies, respectively. The third instrument is a high resolution LC-MS system, a Thermo Q Exactive LC. It is a hybrid quadrupole-Orbitrap mass spectrometer (R=140,000) interfaced with a Vanquish UHPLC system. The Vanquish is a ultra-high pressure liquid chromatograph (UHPLC), which includes a binary solvent pump, column heater, and autosampler. The QE-LC is capable of performing tandem mass spectrometry (MS/MS) experiments, which provides options for qualitative and quantitative applications.

# Neural Circuits and Behavior Core

[*https://ncbc.medicine.uiowa.edu*](https://ncbc.medicine.uiowa.edu)

The Neural Circuits and Behavior Core (NCBC) provides equipment, facilities, and services to aid investigators in performing behavioral assays of motor and sensory function, learning and memory, anxiety-like behaviors, social interaction, and sleep. The NCBC also provides imaging equipment and services for investigating the neural substrates of these behaviors, including a recently acquired LaVision UltraMicroscope II lightsheet microscope for fast volumetric imaging of brains and Bitplane Imaris software for displaying and analyzing 3D-reconstructed volumes.

# Nuclear Magnetic Resonance Facility

<https://medicine.uiowa.edu/nmr/>

The Carver College of Medicine Nuclear Magnetic Resonance Facility supports the biomedical research community with three instruments, a wide variety of techniques, and the expertise to probe structure and dynamics of a wide range of biomolecules. A full spectroscopic and interpretive service is offered, as well as assistance and training for researchers who wish to perform their own experiments. Instrumentation includes: a Bruker Avance II 800 MHz equipped with a TCI cryoprobe and 60 sample changer with barcode reader, a Bruker Avance NEO 600 MHz with a QCI-P cryoprobe, and a Bruker Avance II 500 MHz with a TXI probe and 60 sample changer with barcode reader.

# Office of Animal Resources

[*https://animal.research.uiowa.edu/office-animal-resources-oar*](https://animal.research.uiowa.edu/office-animal-resources-oar)

The Office of Animal Resources (OAR) provides the expertise, care, and resources necessary for the maintenance of research animals.  The OAR's mission is preservation of the university's animal research privilege and maintenance of a quality animal research environment. The animal research facilities are comprised of approximately 170,000 square feet of housing and support space and accommodate multiple species in multiple campus locations.  The OAR team includes five full-time veterinarians (all are board certified by the American College of Laboratory Animal Medicine, ACLAM), five veterinary technicians and 50+ animal care technicians.  This team of skilled animal care specialists can advise and instruct researchers on appropriate methods for anesthesia/analgesia, surgery, biosampling, and euthanasia.

The university's animal research program has a PHS Animal Welfare Assurance (A3021-01), is a registered research facility with the United States Department of Agriculture (USDA No. 42-R-0004), and is fully accredited by the Association for Assessment and Accreditation of Laboratory Animal Care, International (AAALAC).  The Institutional Animal Care and Use Committee (IACUC) reviews all research and teaching protocols involving the use of animals and fulfills all other mandated oversight and compliance responsibilities.

## *The Institutional Animal Care and Use Committee (IACUC)*

[*http://animal.research.uiowa.edu*](http://animal.research.uiowa.edu/)

Note: information should be in the “Vertebrate Animals” attachment, not “Facilities & Other Resources” attachment. A Vertebrate Animals attachment should be included if you answered “Yes” to the question “Are Vertebrate Animals Used?” on the R.220 – R&R Other Project Information Form. Information should include the following:

1. **Description of Procedures (Vertebrate Animals Section)**

Provide a concise description of the proposed procedures to be used that involve live vertebrate animals in the work outlined in the Research Strategy section. Identify the species, strains, ages, sex, and total number of animals by species to be used in the proposed work. If dogs or cats are proposed, provide the source of the animals.

1. **Justifications (Vertebrate Animal Section)**

Provide justification that the species are appropriate for the proposed research. Explain why the research goals cannot be accomplished using an alternative model (e.g., computational, human, invertebrate, *in vitro*).

1. **Minimization of Pain and Distress (Vertebrate Animal Section)**

Describe the interventions including analgesia, anesthesia, sedation, palliative care, and humane endpoints to minimize discomfort, distress, pain, and injury.

1. **Method of Euthanasia (Cover Page Supplement / PHS Fellowship Supplemental Form)**

Provide a justification for methods of euthanasia that are not consistent with the American Veterinary Medical Association (AVMA) Guidelines for the Euthanasia of Animals.

Recommended text from UI IACUC: Animals will be euthanized by methods consistent with the recommendations of the American Veterinary Medical Association (AVMA) Guidelines for the Euthanasia of Animals: 2013 Edition.
***Note:  If you need assistance to determine whether or not your method of euthanasia is consistent with the 2013 AVMA Euthanasia Guidelines, please contact the IACUC Office at 319-335-7985, or******iacuc@uiowa.edu(link sends e-mail)******.***

# Protein and Crystallography Facility

[*https://medicine.uiowa.edu/crystallography/*](https://medicine.uiowa.edu/crystallography/)

The Protein and Crystallography Facility provides all necessary support and infrastructure to initiate and complete protein purification, biophysical characterization and structural studies. This includes three BioRad DuoFlow FPLCs for protein purification, a Wyatt NanoStar dynamic and static light scattering instrument for aggregation and protein size determination, a ForteBio Octet RED96 biolayer interferometry system for protein:protein and protein:DNA binding studies, a thermal shift assay workflow to identify protein stabilization conditions using a BioRad CFX96 qPCR instrument, a TTP LabTech Mosquito nano-volume robot for arraying multiple crystallization conditions, a Formulatrix RockImager2 for imaging crystal trays, and a TTP LabTech Dragonfly liquid-handling robot for preparation of custom solution arrays. Diffraction data can be collected locally using two R-AXIS IV++ systems mounted on rotating anode generators or by shipping to our 4.2.2 Molecular Biology Consortium beam line at the Advanced Light Source (Lawrence Berkeley National Laboratory) where data collection is performed remotely from Iowa. The facility also enables analysis by small-angle X-ray scattering (SAXS) in line with size exclusion chromatography (SEC) and multi-angle light scattering (MALS) whereby data are routinely collected in-person at the 18-ID-D Bio-CAT beam line at the Advanced Photon Source (Argonne National Laboratory) or at the 12.3.1 SIBYLS beam line at ALS using their mail-in system. The facility is also set up with several workstations and an SBGrid Consortium membership, which provides updated versions of all necessary structural biology and molecular modeling software.

# Protein Facility

[*http://www.protein.iastate.edu*](http://www.protein.iastate.edu)

*This facility is available for use by Carver College of Medicine investigators through a partnership with the Iowa State University Office of Biotechnology in Ames, Iowa.*

The Protein Facility of the Iowa State University Office of Biotechnology is open to faculty and students from the university, other educational institutions, and industry scientists. The facility offers protein/peptide sequencing, large- and small-scale peptide synthesis (Fmoc), matrix-assisted laser desorption/ionization (MALDI) mass spectrometry, SDS-PAGE/electroblotting, 2-D gel electrophoresis, isoelectric focusing (IEF), in-gel and solution digestion, tandem mass spectrometry (LC-MS/MS), ion mobility mass spectrometry (IM-MS), digital image acquisition and analysis using the Typhoon imaging system and the 2D gel documentation/analysis system, and semi-preparative, analytical and micro-analytical high performance liquid chromatography (HPLC).

# Proteomics Facility

[*https://medicine.uiowa.edu/proteomics/*](https://medicine.uiowa.edu/proteomics/)

The Proteomics Facility houses mass-spectrometers and supporting instrumentation for analysis of proteins and peptides. Services include protein identification, protein expression profiling, accurate weight determination for intact macromolecules and conjugates, characterization of post-translational modifications, and rapid biotyping to determine bacterial strains. Data analysis is provided using MASCOT, SEQUEST and SpectrumMill data analyses with final reporting in Scaffold or Excel format. Instrumentation includes a Bruker Autoflex III MALDI TOF/TOF, Thermo LUMOS Orbitrap, and a Thermo Q-Exactive Orbitrap.

# Radiation and Free Radical Research Facility

[*https://frrbp.medicine.uiowa.edu/research-core*](https://frrbp.medicine.uiowa.edu/research-core)

RFRRC Core Director: Douglas R. Spitz, PhD (Oxidative Stress and Thiol Biochemistry); RFRRC Core Co-Directors: Frederick E. Domann, PhD (Molecular Biology), Prabhat C. Goswami, PhD (Radiation Biology and Cell Cycle), and Garry R. Buettner, PhD (EPR Spectroscopy and Physical Chemistry).

The Radiation and Free Radical Research Core (RFRRC) was established to provide free radical and radiation biology expertise, reagents, technologies, and analysis for investigators doing basic, pre-clinical, and clinical research. The three basic services provided by the core are: 1) Ionizing radiation services and phosphorimaging; 2) Electron paramagnetic resonance spectroscopy to measure oxygen free radicals, singlet oxygen, nitric oxide and the array of related oxidants; and 3) Antioxidant enzyme services to modify and measure molecules responsible for free radical formation and oxidative damage in cells such as anti-oxidant proteins and small molecular weight cellular thiols.

1) IRS – Ionizing Radiation Services:

Ionizing Radiation Services are available under the supervision of Co-Director (Dr Goswami) or Amanda Kalen, the research assistant responsible for the radiation unit. The Radiation Facility is located in B164 Medical Laboratories.  The radiation sources available include a 1 orthovoltage X-ray machine and an 8,148 Curies cesium-137 gamma ray source.  The x-ray unit is a microprocessor-controlled orthovoltage generator.  The unit is a Pantak Therapax DXT 300 (Pantak Inc., East Haven, CT) with maximum x-ray energy of 300 kVp.  The radiation facility housing the new x-ray generator was extensively renovated to contain the new unit and now has the flexibility to accommodate almost any irradiation orientation and device required by the user.  The unit may be adapted for the irradiation of cells in tubes or in culture, as well as of animals in customized devices. The gamma ray source is capable of delivering low or high dose rates of monoenergetic (0.667 MeV) gamma radiation, the range being from 40-3200 cGy/minute.  The x-ray and gamma-ray facilities have been used for total body or partial body irradiation of tumors in experimental mice, rats, dogs, as well as cancer or normal cell cultures grown *in vitro.*

2) EPR – Electron Paramagnetic Resonance Services:

The EPR Facility in the RFRRC supports the basic and clinical research efforts of members of the Holden Comprehensive Cancer Center by providing the tools and expertise to detect and quantify free radicals, small molecular weight dietary antioxidants and pro-oxidants. One of the most valuable services the Facility provides is consultative expertise in the study of free radicals, related oxidants and antioxidants.

*The EPR facility assists users in the detection of:*

1.  Free radicals in systems that range from solids, solutions, cells, tissues and whole animals;

2.  Nitric oxide and related metabolites;

3.  MDA/TBARS, indicators of lipid peroxidation that are detected with our fluorescence spectrometer;

4.  Fluorescent dyes, used as indicators of oxidation;

5.  UV-Vis spectroscopy: Our HP 8453 Diode Array UV-Vis spectrometer;

6.  Oxygen concentration;

7.  Oxidative stress-indicators using HPLC: *e.g*. DNA damage, antioxidants such as vitamins C and E, beta-carotene, *etc*;

8.  Cell volume measurements;

9.  Seahorse Metabolic Profiling Services.

3) AES – Antioxidant Enzyme Services:

The purpose of the Antioxidant Enzyme Services (AES) is to provide free radical biology expertise, reagents, technologies, and analysis for individual investigators doing basic, per-clinical, and clinical research. AES staff will carry out the proposed work or will advise the user and his staff on how to perform and analyze the experiments. Some of this work, particularly transfections of new cDNAs or new cell lines as well as the development of antisense reagents, will be developmental and distributed to investigators as they become available. The AES will aid in vector development and distribution, enzyme activity assays, thiol analysis, western, and quantitative RTPCR analysis. The following enzyme assays will be run: copper-and zinc-containing superoxide dismutase (CuZnSOD), thioredoxin reductase (TrxR), manganese-containing superoxide dismutase (MnSOD), catalase (CAT), glutathione transferases (GSTs), glutamyl transpeptidase (GGT), gamma-glutamylcysteine synthetase (GCS), and glutathione peroxidases (GPx, both cytosolic and phospholipid). Assays for the detection of pro-oxidant production (superoxide, hydrogen peroxide, lipid peroxidation products, etc.) will also be available. Antibodies, cDNA probes, adenoviral, and lentiviral vectors coding for primary antioxidant enzymes as well as stably and transiently transfected cells will be provided. The AES will also aid in transfecting cDNAs into cell lines of interest to investigators. The AES continues to develop and maintain novel reagents for studies in free radical biology including: antibodies, cDNAs, antisense reagents, and expression vectors for antioxidant proteins including thioredoxin, glutaredoxin, thioredoxin reductases, and thioredoxin peroxidases. This core will provide services to measure cellular redox couples including GSH/GSSG, oxidized and reduced thioredoxin, and NADP+/NADPH ratios as well an electron transport chain complex and TCA cycle activities.

# Scientific Editing and Research Communication Core

[*https://medicine.uiowa.edu/sercc/*](https://medicine.uiowa.edu/sercc/)

The Scientific Editing and Research Communication Core helps researchers succeed with their funding efforts and scholarship by providing in-depth advice on how to maximize the clarity of scientific documents.  The core is staffed by PhD-level scientists who offer detailed editorial review of grants, manuscripts, and other writing projects based on extensive experience in both laboratory research and editing of scientific content. Multiple levels of feedback are offered, including:

* Mechanics: proofing for grammar, typographical, and other errors
* Style and clarity: suggestions toward improving text flow
* Presentation: suggestions toward highlighting the significance of the research, and in the case of multi-author documents, achieving a single voice
* Science: pre-review from the perspective of a non-specialist reviewer; on request, feedback on how well scoring criteria for grants are covered.

Authors receive an annotated copy of their submission and can request one-on-one meetings at any time to discuss writing strategies, clarify their meaning, or discuss potential problem spots. Core staff also participate in didactic teaching of scientific writing and help to organize grant planning forums for investigators. These forums allow investigators to outline their grant-in-progress to core staff, departmental faculty, and any other suitable experts, and they receive feedback from this group based on a draft of their Specific Aims page and their presentation.

# Small Animal Imaging Core

[*https://medicine.uiowa.edu/saic/*](https://medicine.uiowa.edu/saic/)

The Small Animal Imaging Core (SAIC) is a core facility of the Iowa Institute for Biomedical Imaging (IIBI) housed in the Pappajohn Biomedical Discovery Building. The SAIC occupies 5,500 square feet of space, including 7 imaging suites, 8 support rooms, and is contiguous to the primary barrier housing facility on campus. The purpose of the SAIC is to provide instrumentation and technical services for non-invasive anatomical and physiological imaging of small animals and other biological samples.

The core instrumentation includes:

* Micro-PET (Siemens Inveon DPET)
* Micro-CT (Siemens Inveon CT (10 µm resolution)
* Micro-SPECT (Siemens Inveon SPECT)
* Optical imaging (Carestream MSFX-pro, IVIS)
* Fluorescent imaging (Carestream MSFX-pro)
* 3D X-ray/CT Microscope (Zeiss Xradia 520 Versa, submicron resolution)
* 7T Preclinical MRI (7.0T GE 901 Discovery MRI small animal scanner) separately administered through the Magnetic Resonance Research Facility core
* High-resolution micro-ultrasound imaging (Visualsonics Vevo) - administered separately
* Optical Coherence Tomography

The SAIC operates an image-processing laboratory including four high-end workstations with a suite of multi-modality software available for use, including PMOD, and Inveon Research Workspace. The SAIC administers its own 12 TB archive system, mirrored to offsite research networked storage.

# Tissue Procurement Core

[*https://medicine.uiowa.edu/tissueprocurement/*](https://medicine.uiowa.edu/tissueprocurement/)

The Tissue Procurement Core (TPC) collects, processes and stores well-characterized human biospecimens (normal or tumor tissue, blood, etc.) to researchers for a variety of indications under an existing IRB approved protocol. Fresh, frozen or FFPE specimens can be provided to investigators. Stored biomaterials are suitable for molecular genetic, biochemical, immunohistochemical, cellular, and pathological studies. The TPC also processes blood to PBMCs and to DNA or RNA and prepares DNA from saliva. Additionally, the TPC can assist in isolating, aliquoting, and storing liquid specimens such as CSF or plasma.

# University of Iowa Microfabrication Facility

[*https://ostc.uiowa.edu/uimf/*](https://ostc.uiowa.edu/uimf/)

The University of Iowa Microfabrication Facility (UIMF) is an interdisciplinary central research facility that provides access to state-of-the-art equipment in the areas of micro- and nano-fabrication, metrology, and device characterization, and offers expertise and advanced training courses in the same related areas. The purpose of the UIMF is:

* To provide shared experimental capabilities with advanced equipment, skilled personnel and effective training
* To train and support graduate and undergraduate research in the applications of micro- and nano-fabrication
* To promote and enable high-quality research using a suite of micro- and nano-fabrication tools
* To advance fundamental and technical knowledge in the area of micro- and nano-fabrication technologies
* To promote multidisciplinary research and training through the use of micro- and nano-fabrication tools.

Key research areas enabled by the facility include optics, nanotechnology, sensors, micro- and nano-electronics, plasmonics, photovoltaics, spintronics, and high-resolution spectroscopy.

# UI Pharmaceuticals

[*https://uip.pharmacy.uiowa.edu*](https://uip.pharmacy.uiowa.edu/)

University of Iowa Pharmaceuticals (UIP) provides contract pharmaceutical services including pharmaceutical development, manufacturing, and testing. UIP can support the manufacturing and testing of both clinical and commercial finished products. UIP is a Food and Drug Administration-registered pharmaceutical manufacturing facility, providing expert pharmaceutical development services to clients around the world. Contract pharmaceutical services include:

 •  Preformulation studies

 •  Formulation development (including lyophilization cycle development)

 •  Clinical supply manufacturing and testing

 •  Small scale commercial manufacturing and testing

 •  Analytical method development and validation

 •  Routine quality control analysis

 •  Stability studies

 •  Active pharmaceutical ingredient (API) and excipient release testing

UIP is able to handle controlled substances schedules I - V and most potent and/or cytotoxic substances. UIP is able to manufacture most dosage forms including sterile solutions and lyophilized powders; tablets; capsules; and non-sterile semisolids and liquids. It is the largest and longest running facility of its kind offering this breadth of service in the United States, and has been providing contract pharmaceutical services in compliance with current Good Manufacturing Practices (GMP) for almost 45 years.

# Viral Vector Core

[*https://medicine.uiowa.edu/vectorcore/*](https://medicine.uiowa.edu/vectorcore/)

The Viral Vector Core (VVC) produces and distributes viral vectors for gene expression. The VVC provides all services required in the design and construction of a wide variety of custom viral vectors.  The core also maintains a large catalog of “off the shelf” vectors for expression of common markers (e.g., Cre, GFP) without the need of a material transfer agreement (MTA). The VVC works with Adenovirus, Adeno-associated virus, Helper-dependent Adenovirus, lenti-virus, Vaccinia virus, Baculovirus, and others.