Facilities and Other Resources-University of North Dakota School of Medicine and Health Sciences (XXX Lab)

The UND School of Medicine and Health Sciences completed construction of a 325,000-square-foot, four-story, state-of-the-art building in August 2016. It is the only medical school in North Dakota and houses eight degree programs, including Athletic Training, Biomedical Sciences, Medicine, Medical Laboratory Sciences, Occupational Therapy, Physical Therapy, Physician Assistants and Public Health. Its entire west wing is devoted to research and includes open labs with office suites for researchers and students nearby.

The Biomedical Sciences Department occupies four floors of the research wing of the new UND School of Medicine and Health Science as well as the Neuroscience Research Facility and the first floor of the Edwin James Research Facility. The space in the newly completed School of Medicine houses open design, state-of-the-art laboratories and offices spanning all 4 floors, occupying approximately 42,000 sq. ft., as well as 5,500 sq. ft. in the Edwin C. James Research Facility, and 14,000 sq. ft. in the adjacent Neuroscience Research Facility. The Biomedical Sciences Department also maintains or has access to the Flow Cytometry Core (see below), the Microscopy Core (see below), Mass Spectrometry Core (see below), Bioinformatics Core (see below), and Behavioral Core (see below). The Biomedical Sciences Research Wing is an extremely interactive environment. With the merging of all of the biomedical departments in the medical school into the combined Biomedical Sciences Department, the environment has become very cross-discipline with shared seminar series, courses, common equipment, research retreats, and multiple journal clubs allowing not only faculty but students, fellows, and staff to interact formally and informally continually. This atmosphere is extremely conducive to free-exchange of ideas and collaborative ideas and projects.

The Biomedical Sciences Department was created from the merging of the Departments of Pharmacology/Physiology/Therapeutics, Microbiology & Immunology, Anatomy & Cell Biology, and Biochemistry & Molecular Biology in 2013. This created a multi-discipline research environment and graduate/fellow training program that spans disciplines. In addition, the merging created an abundance of shared equipment resources now available to faculty, students, fellows, and staff. Combined seminars, journal clubs, laboratory meetings, and coursework have created an integrated research environment with a collective expertise far beyond what was present in any single department. This vibrant atmosphere stimulates a variety of new projects among the faculty, fellows, and students. All computers are connected to the State University Systems mainframe allowing nucleic acid and protein sequence analysis through EMBL, Genebank, and Protein Data Banks, E-mail, library search, electronic journal accession, and statistical analysis. Computers for some major equipment in the Department are networked via the server at the UND School of Medicine & Health Sciences. All Department facilities are available for this proposal.

The Edwin C. James Research Facility houses a portion of the Biomedical Sciences Department and is located adjacent to the Center for Biomedical Research animal facility as well as the Neuroscience Research Facility. It provides all weather connections to the Center for Biomedical Research Facility and spacious, state-of-the-art laboratories and offices. The Facility contains 5 floors of research and office space occupying over 45,000 sq. ft. The building provides recently renovated space for those Departmental faculty whose interests include epigenetics. It is an open lab design conducive to increased collegial interaction.

The Neuroscience Research Facility was established at UND in 2004. The goal of the Facility is to help investigators develop expertise in multidisciplinary approaches toward the understanding of brain function. The Facility is research-oriented involving faculty from the Biomedical Sciences Department. The Facility building is located on the UND campus adjacent to the School of Medicine. This single story building is approximately 14,000 sq. ft. and provides ten laboratories and office space as well as a conference/seminar room, atrium, and dining area for UND researchers engaged in the study of neurological disease and treatment. It is a highly interactive environment with shared space, equipment, combined lab meetings/seminars and very collegial with abundant opportunities for collaborative projects.

Laboratory/Office:
The investigator has a dedicated laboratory with (To calculate, multiply number of bench sides you control by 156sqft) XXX sq. ft. of space that is more than adequate for the requirements of this study. The laboratory is located in the Biomedical Sciences Research Wing of the School of Medicine and Health Sciences,
Neuroscience Building, or Edwin James Research Facility. The laboratory is modern and well equipped with benches, sinks, cabinets, air and natural gas. The lighting and ventilation are excellent. The laboratory and office spaces are equipped with multiple internet connections and telephones as well as wireless service throughout the building. The P.I. has a private 100 sq. ft. office located separate from the laboratory space. Students, fellows, and staff have individual desk spaces and computers/internet access within the laboratory or within an adjacent office suite.

Animal:
The Center for Biomedical Research Facility at UND is a state-of-the-art research AALAC approved animal facility. This 20,000 sq. ft. facility is equipped with a quarantine room, surgical suite (with separate prep, scrub and surgery rooms), diagnostic laboratory, the North Dakota Behavioral Research Core Facility (see below), barrier rooms, semi-barrier rooms, infectious disease rooms, isotope rooms, behavioral testing rooms, autopsy room, receiving area, two cage cleaning areas and numerous other conventional animal rooms. Each room has an anteroom to prevent cross-contamination. The facility also is equipped with self-watering cages, a water purification system, a water acidification system and water flushing system, as well as a bedding and changing area within a hood in each room. Excellent part-time and 24hr on-call veterinary supervision and care is assured.

Center for Biomedical Research 2:
The Satellite vivarium at the University of North Dakota is designed to act as a complement to the main vivarium on campus. A garage space adjacent to the Satellite vivarium is available for animal transfer between the facilities. All food and water provided to the animals comes from the main vivarium to ensure continuity of care to the animals.

All main doors into the Satellite Vivarium are secure card access only. It consists of two general holding rooms for mice, one general holding room for rats, two procedure rooms, a behavioral suite and an infection suite. Support spaces in the Satellite Vivarium include an office area for records, a rest room, an autoclave, a utility room, and several storage rooms for food, clean supplies, vivarium waste, and dirty cages waiting for pick up. Every sink in the satellite vivarium has an eye wash. There is an eye wash safety shower and fire extinguisher in the common corridor for emergency use.

Each holding room contains a stainless steel sink area, two double sided cage racks of disposable cages and a changing station for moving animals between clean and dirty cages. Changing stations in the infection suite are biosafety cabinets for additional protection for the users. Each procedure room contains a stainless steel sink area, a work surface and a biosafety cabinet. The behavioral suite consists of four individual lab spaces with light tight doors. Two have curtains, a sink, and work area while the other two are without curtains. The infection suite has secured access into an ante chamber and two infectious holding rooms, one bacterial and one viral.

The finishes in the satellite vivarium are selected for durability and cleanliness. The floor is of poured epoxy over solid concrete. The walls are concrete block and finished with epoxy paint. Ceilings are gypsum board with all necessary access panels located in the corridor for easy access. All casework and crash rail is stainless steel.

Computer:
Insert your lab specific computer information here. All computers are connected to the State University Systems mainframe allowing nucleic acid and protein sequence analysis through EMBL, Genebank and Protein Data Banks, E-mail, library search, and electronic journal accession. Computers for some major equipment are networked via the server at the UND School of Medicine & Health Sciences. Data is backed up nightly from all laboratory computers through an in-lab RAID drive as well as through the School of Medicine server.

Other:
North Dakota Edward C. Carlson Imaging and Image Analysis Core Facility
The Core Imaging Center, which is available to all investigators at UND and the region, is housed on the main floor of the School of Medicine and Health Sciences. It is a 3350 sq. ft. facility providing investigators on the UND campus with access to both light and electron microscopy. Instrumentation available for light microscopy includes a Zeiss 510 META confocal microscope with a ConfoCor2 fluorescence correlation spectroscopy (FCS) unit, an Olympus FV1000MPE basic multiphoton/single photon system on an upright microscope, an Olympus cellTIRF microscope on an IX83 fluorescence microscope and two Nikon fluorescence microscopes. The Zeiss 510 META system is a multichannel system capable of imaging a wide variety of fluorochromes in
preserved and live tissues and cells. The Olympus FV1000MPE system is configured for a range of applications that include confocal and multiphoton microscopy of fixed samples and live cells and intravitral multiphoton microscopy using animal models. The Olympus cellITIRF microscope is a four laser system (445, 491, 514, 561 nm) configured for multicolored TIRF microscopy, ratiometric imaging of Fura2 and FRET biosensors, and long term fluorescence imaging of live cells. A Nikon TE300 fluorescence microscope provides additional support for ratiometric imaging while a Nikon i80 upright fluorescence/brightfield microscope is available for standard imaging of fixed samples. Instrumentation in the electron microscopy suite includes a Hitachi 7500 TEM equipped with a high resolution SIA digital camera and a Hitachi 4700 field emission SEM. Additional instrumentation for sample preparation includes two ultramicrotomes, a Leica RM2125 microtome for paraffin microtomy, Denton sputter coaters and a vacuum evaporator for SEM sample preparation. Applications supported by the imaging core include multi-label fluorescence imaging of fixed and live material, FRET, FRAP, FLIP, 3D imaging, multi-label imaging of fluorescent protein variants using spectral fingerprinting, ratiometric fluorescent imaging, TIRF microscopy, FCS, thin section transmission electron microscopy, and scanning electron microscopy of a broad range of biological materials. The Core director, Dr. Bryon Grove, and two technicians maintain the facility and provide training and assistance to users. The facility is listed on both the NICL and ABRF core lab registries.

North Dakota Flow Cytometry and Cell Sorting (ND-FCCS) Core
The North Dakota Flow Cytometry and Cell Sorting (ND-FCCS) core, located in the UND SMHS, is co-operated by the Departments of Pathology and Biomedical Sciences and supported by the North Dakota INBRE grant and the SMHS. The ND-FCCS core is led by Dr. David Bradley (Core Director) who has over 25 years of flow cytometry experience with technical support from Mr. Steven Adkins (Core Technical Advisor) who has over 5 years of flow cytometry experience. The ND-FCCS core contains both a: BD FACSAria II flow cytometer which has 3 lasers (UV (355 nm), Blue (488 nm), and Red (640 nm)) with simultaneous analysis of 9 colors in addition to FSC and SSC, first pass 4-way sorting, aseptic sorting, automated cell deposition, temperature control, and aerosol management capabilities; and a BD LSR II flow cytometer which has 4 lasers (Violet (405 nm), Blue (488 nm), YellowGreen (561 nm), and Red (640 nm)) with simultaneous analysis of 17 colors in addition to FSC and SSC, high throughput sampling, and cell cycle analysis. The ND-FCCS core also maintains both FACSDiva (ver.8) and FlowJo (ver. 10) software for analysis. The ND-FCCS core is open to all users within the state of North Dakota, with the core providing training, initial support and oversight of data analysis, and cell sorting.

UND Epigenetics Bioinformatics Core
The Epigenetics Bioinformatics Core at the University of North Dakota is a shared resource providing state of the art genomics resources to investigators at UND, institutions across the northern Midwest, as well as external commercial clients. The core facility is a COBRE funded operation intended to help regional researchers utilize next generation sequencing technologies in basic and translational genomic research. The core provides services, training and genomics resources to the scientific research community here at UND. Core staff are available to help translate the sequencing and informatics needs of individual investigator research projects into executable tasks performable at our University of North Dakota facility. The Epigenetics Core enables investigators with little experience in modern genomic techniques to design and prepare experiments utilizing these technologies. The Epigenetics Core group has analysts available with experience working with standard analysis pipelines as well as more novel computational experiments. The Core’s primary function is to help researchers analyze, interpret, visualize and store the massive amount of data produced in next generation sequencing experiments.

The Core group is equipped with computational hardware capable of handling individual laboratories’ sequencing analysis projects up to moderately sized big data projects. The core has two workstations for handling analysis of large datasets that complement the use of the UND high performance cluster computing resources. Each high performance workstation located in the Core is equipped with an Intel Xeon E5-2687W v2 processor (8HT cores, 3.4GHz), 256 GB 1866MHz DDR3 RAM, an NVIDIA Tesla K20c GPU, and 8TB of local storage. Storage infrastructure is provided in conjunction with the UND Medical School IT department. Data collected by the core and UND investigators is stored redundantly on a high-availability Dell SC4020 storage appliance (146 TB usable space with weekly backups, located at the UND–CEC) and on a set of Dell PowerEdge FC630 server blades located inside multiple Dell FX2 chassis. Each FC630 server node contains two 10 core Intel Xeon processors and 256GB of RAM. Each server node has dual 10GB nics which connect to the Dell SC4020 for extremely fast and reliable access to the storage.
The Epigenetics Core group also operates a fully functional wet sequencing lab. The core lab contains an Illumina MiSeq sequencer along with a variety of instrumentation used to support sequencing activities. Quality control for sequencing is performed primarily on an Agilent Bioanalyzer 2100. The lab utilizes a BioRad QX200 Droplet Digital PCR system for library quantification. The lab also offers a variety of instrumentation for shared use to trained, qualified users within the university. Patrons of the Core may sign up for access to a Covaris S220 Focused-ultrasonicator, a Bio-Rad CFX384 Touch Real-Time PCR Detection System, a Li-Cor Biosciences’ Odyssey Fc Dual-Mode Imaging System, an Aplegen OmegaLum C imaging System, BioRad NGC Quest 10 Chromatography system, Thermo Scientific Sorvall MTX 150 micro-Ultracentrifuge, and a BioRad Personal Molecular Imaging System.

**UND Mass Spectrometry Core**

The Mass Spectrometry Core facility is a state-of-the-art 1,500 sq. ft. facility and very well equipped to perform mass spectral analysis of small molecules and proteins, including accurate mass high resolution analysis and targeted quantification. The high resolution analyzers include Q-TOF G2S (Waters) with UPLC inlet, and QExact orbitrap (Thermo-Electron) with nano-UPLC inlet. A high sensitivity targeted analysis is performed on Xevo triple quad UPLC-MS system (Waters), API 3000 triple quad HPLC-MS system, and a Thermo-Electron PolarisQ GC-MS system. The ion sources include ESI, nano-ESI, APPI, APCI, and solid probe ion sources. Waters UPLC and nano-UPLC, and Agilent and Backman HPLC systems connected to MS analyzers consist of binary pumps, autosamplers, column heaters, and DDA detectors. Processing workstations include MarketLynx, MetaboLynx, Progenesis for small molecules and proteins, Lipid Search, and PLGS processing software. In addition, the MS Core is equipped with Beckman 2-D HPLC system to allow for protein fractionation. The core director, Dr. Golovko, and full time staff are available for help with project design, sample preparation, data analysis and interpretation, as well as data presentation.

**North Dakota Behavioral Research Core Facility**

A new core facility was launched in September 2015 facilitating and strengthening behavioral research in North Dakota. The Behavioral Research Core Facility (BRCF) is designed to 1) promote research productivity; and 2) improve STEM training in behavioral science by providing for the following needs: well-managed and maintained equipment, methodological and technical expertise, training in behavioral testing and analysis, interface for interaction of researchers to facilitate collaborations. The BRCF will be established at UND School of Medicine and Health Sciences (SMHS) and managed and maintained jointly by ND INBRE and the Department of Pathology at UND SMHS. The BRCF will provide the infrastructure and technical expertise essential for behavioral research in order to enhance the productivity of biomedical research programs in IDeA states. The facility will house a variety of equipment and animal monitoring systems that are used for common behavioral tests, including open-field activity monitoring, startle response, rotational behavior, memory performance, motor strength, and anxiety/depression-like behavior. Furthermore, a technologically more advanced, state-of-the-art optogenetics apparatus will also be available for the analysis of animal behavior resulting from precisely controlled activation of targeted neuronal populations. In addition to the infrastructure, the core facility will provide training workshops as well as networking opportunities for IDeA investigators to interact and collaborate with other researchers.