**University of Nebraska-Lincoln**

**Facilities, Equipment, and Other Resources**

[This document provides easily accessible and up-to-date information on UNL’s institutional environment, biomedical research centers, and research core facilities. Principal Investigators are encouraged to copy and paste relevant information into the Facilities, Equipment, and Other Resources section of their proposals. UNL faculty, staff, and administrators are welcome to contact the [Office of Proposal Development](mailto:%20tgilreathmullen2@unl.edu) with requests for the inclusion of additional facilities or with updates to existing information.]

**Institutional Environment**

The University of Nebraska-Lincoln (UNL), Nebraska’s comprehensive research institution, is recognized by the Carnegie Foundation within its “Research Universities (very high research activity)” category and is a member of the Big Ten Academic Alliance. As a land-grant university, a wide array of academic, research, and outreach programs are available at UNL, including those in agriculture, architecture, business, education, engineering, fine and performing arts, humanities, human resources and family sciences, journalism and mass communications, law, life and physical sciences, and natural resources. UNL offers 44 doctoral majors, 70 master’s majors, and 183 undergraduate majors. In 2016-2017, UNL granted 299 doctoral degrees, 914 master’s degrees, and 3,958 bachelor’s degrees. In fall 2016, UNL’s total enrollment was 25,897 students, including 20,833 undergraduate students, 4,567 graduate students, and 497 professional students.

UNL’s externally funded research, education, and training programs include a number of interdisciplinary research centers supported by multi-million dollar awards from major federal agencies. These include the Materials Research Science and Engineering Center and Center for Root and Rhizobiome Innovation funded by the National Science Foundation, the Nebraska Center for the Prevention of Obesity Diseases through Dietary Molecules and Nebraska Center for Integrated Biomolecular Communication funded by the National Institutes of Health, and the National Drought Mitigation Center funded by the U.S. Department of Agriculture.

In FY2016, UNL’s research expenditures exceeded $294 million and UNL faculty are managing an impressive number of large grants, including a multi-institutional grant from the Department of Energy to improve sorghum productivity and advance sustainable ethanol production; the Early Learning Network, a multi-institutional research and policy effort to improve children’s learning outcomes, funded by the U.S. Department of Education’s Institute of Education Sciences; a research program investigating *E. coli* in beef cattle funded by the U.S. Department of Agriculture; and large-scale biodefense and virology initiatives. In addition, UNL is a participant in the National Strategic Research Institute (NSRI) – a long-term collaboration between the University of Nebraska and U.S. Strategic Command (USSTRATCOM) – and the Robert B. Daugherty Water for Food Global Institute. NSRI’s overarching goal is to support USSTRATCOM missions related to national security, particularly in the areas of nuclear detection and forensics; detection of chemical and biological weapons; passive defense against weapons of mass destruction; consequence management; and space, cyber and telecommunications law. The Robert B. Daugherty Water for Food Global Institute is working to address the most urgent political, environmental, social, and economic challenges of the 21st century related to food and water security.

As a complement to education and research projects, UNL faculty collaborate with K-12 schools; museums; Public Broadcasting Service (PBS) and National Public Radio (NPR) affiliates; the national 4-H network and individual 4-H clubs in more than 20 states; and other individuals from around the world to reach the most diverse audiences possible, making UNL a global leader in broadening knowledge in the sciences and humanities.

**Major Biomedical Research Centers**

**Center for Brain, Biology and Behavior**

The Center for Brain, Biology and Behavior (CB3) is an interdisciplinary research center that brings together distinguished University of Nebraska faculty in the social, biological, and behavioral sciences and engineering who are studying the biological mechanisms underlying social dynamics and human behavior. CB3’s state-of-the-art facilities support research on biological, neural, and cognitive mechanisms of behavior and include high-density electroencephalography brain recording systems, a functional magnetic resonance imaging laboratory, high-density near infrared spectroscopy, behavioral genetics equipment, eye tracking devices, and a salivary bioscience laboratory. These facilities, coupled with the Center’s highly multidisciplinary environment, enable diverse studies to expand understanding of brain function and its effects on human behavior.

**Minority Health Disparities Initiative**

The Minority Health Disparities Initiative (MHDI) links scientific research with policy, practice, and training to improve the health and well-being of Nebraskans. The MHDI’s objectives are to identify and strengthen the research infrastructure and the network of investigators and practitioners addressing critical health issues in the state and the nation. In addition to recruiting and supporting researchers in minority health at UNL, the MHDI administers the National Science Foundation-funded Minority Health Disparities summer research program, which aims to conduct and transform cutting-edge social and behavioral research into understanding, reduce health disparities, and diversify minority health researchers.

**Nebraska Center for Integrated Biomolecular Communication**

The Nebraska Center for Integrated Biomolecular Communication (CIBC) promotes and coordinates interdisciplinary research focused on filling fundamental gaps in understanding spatial and temporal aspects of biomolecular communication. By embracing approaches that span from the molecular and tissue levels to computational modeling, the CIBC fosters the development of integrated, interdisciplinary research teams with broad disciplinary representation to interrogate complex disease pathways from a wide range of perspectives.

**Nebraska Center for the Prevention of Obesity Diseases through Dietary Molecules**

Research at the Nebraska Center for the Prevention of Obesity Diseases through Dietary Molecules (NPOD) centers around developing innovative approaches to combating obesity and related diseases such as cardiovascular disease, type 2 diabetes, and non-alcoholic fatty liver disease. A collaboration between UNL and the University of Nebraska Medical Center, NPOD serves as a hub for researchers focused on leveraging and manipulating nutrient-dependent cell signals to devise consumer-friendly strategies to combat obesity and related diseases. NPOD’s Biomedical and Obesity Research Core provides Center researchers and external users with services in biostatistics, bioinformatics, large-capacity and high-speed computation, animal imaging and phenotyping, molecular biology, and metabolomics.

**Nebraska Center for Virology**

The Nebraska Center for Virology (NCV) is a world-renowned center supporting virology research and education. Combining the expertise and facilities of Nebraska’s leading biomedical research institutions – UNL, the University of Nebraska Medical Center, and Creighton University – the NCV’s research programs focus on important viral diseases of humans, including HIV-1, Kaposi’s sarcoma, and herpes, as well as viruses within plants and animals. The NCV’s impact stretches across the globe as is evidenced by established research, training, and outreach programs in China and Zambia. Training in virology is provided at all levels and includes mechanisms for formal and informal education.

**Redox Biology Center**

The internationally recognized Redox Biology Center (RBC) is a broad-based interdisciplinary and multi-institutional entity involving researchers from UNL and the University of Nebraska Medical Center. The RBC aims to support and expand Nebraska’s existing strengths in redox biology by mentoring junior faculty to success, recruiting new faculty with complementary research interests, and strategically enhancing biomedical research structure. Affiliated programs include undergraduate summer research opportunities, an international graduate-level course with the Karolinska Institute in Sweden, and collaborative pilot projects.

**Research Core Facilities**

**Biological Process Development Facility**

The Biological Process Development Facility (BPDF) provides biopharmaceutical process development and manufacturing to successfully transition research discoveries from the bench to Phase I/II clinical trials and large-scale Good Manufacturing Practice (GMP) manufacturing. Process development and manufacturing of non-pharmaceutical peptides and proteins or microbial cell mass are also performed to support research in other areas.

The BPDF upstream process development strategy is to optimize and control high cell‑density fermentations of *Pichia pastoris* or *Escherichia coli* to achieve maximal yield of recombinant proteins. Approximately 13,000 ft2 of laboratory space is available, with about half of this space devoted to the GMP manufacturing suite that houses 150-L and 60-L working volume fermentors. The development labs and GMP suite are fully equipped for downstream processing of both secreted and intracellular products, and the BPDF features in-house water-for-injection (WFI) production with a pure steam generator, a WFI condenser, a 1,100-gallon WFI storage tank, and ambient and hot WFI distribution loops.

At the BPDF, clients gain access to highly skilled and experienced biopharmaceutical process research and development scientists and engineers, process development capabilities, and GMP manufacturing facilities. Projects range from the preparation of Master Cell Banks to single one-off fermentations to full upstream (fermentation) and downstream (purification) production of recombinant molecules under GMP. The BPDF team is comprised of 22 members with an average of eight years at the BPDF (ranging 1-18 years). The Quality Assurance and Scientific staff have an average of >18 years of experience in their respective fields (ranging 7-30 years).

For more information, contact Jill Hereth (jhereth2@unl.edu, 402-472-1983).

**Biomedical and Obesity Research Core**

The Biomedical and Obesity Research Core (BORC) provides research services for internal and external users. BORC has approximately 2,000 ft2 of laboratory space, access to a videoconference room, and a collaboration zone in Leverton Hall as well as designated space in the Life Sciences Annex for animal studies. BORC offers services in molecular and cell biology, nanoparticle tracking, clinical chemistry, metabolite flux analysis, small animal imaging, neurocognitive phenotyping, and metabolic cages. Consultation regarding experimental design and bioinformatics and biostatistics is available. Members of the Nebraska Center for the Prevention of Obesity Diseases through Dietary Molecules (NPOD) have access to high-speed, large-capacity data computation. BORC also offers training sessions and a research tool development program, with priority being given to NPOD members. Key equipment includes: a Branson S-450D digital ultrasonic sonifier, FreeZone® 4.5-liter freeze dry systems, a New BrunswickTM Innova® 40, Bio-Rad CFX Connect Real-time Polymerase Chain Reaction (PCR), a QX200™ Droplet Digital™ PCR System, a Malvern NanoSight NS300, an XFe-24 Extracellular Flux Analyzer (Seahorse Bioscience), a Vitros-250 Chemistry Analyzer, a Bio Tech Synergy™ H1m, a Licor Odyssey® CLx, an iBox® Scientia™ Small Animal Imaging System, a Pearl® Impulse Small Animal Imaging System, metabolic cages (TSE Systems), and phenotyping equipment for animal behavior studies.

For more information, contact BORC@unl.edu, Emily Barber (emily.barber@unl.edu, 402-472-4243), or Mengna Xia (mxia2@unl.edu, 402-472-4243).

**Bureau of Sociological Research**

Established in 1964, the Bureau of Sociological Research (BOSR) is a one-stop survey research shop that collects data to help answer important questions facing society. BOSR has conducted national, regional, and local surveys using a variety of survey research methods and has experience working with a number of contemporary data collection methodologies, including mail surveys, web surveys, telephone interviewing, in-person interviews, and focus groups.

BOSR actively works with University of Nebraska-Lincoln (UNL) investigators on the design, implementation, and completion of survey research projects and provides research services for state, government, and local organizations outside UNL. Information collected by BOSR is helpful for program evaluation, budget justifications, and planning purposes.

BOSR supports all aspects of social science research applications. Staff can provide support for research design and implementation and will, as determined in consultation with the client, assume responsibility for data collection, processing, analyses, and presentation. BOSR staff also provide training and demonstrations of survey research methods and human subject protection for undergraduate and graduate classes in sociology.

For more information, contact Jolene Smyth (jsmyth2@unl.edu, 402-472-0662).

**Cell Development Facility**

The Cell Development Facility creates cell lines of all types – including mammalian, yeast, and bacterial – for recombinant proteins and metabolites. The facility specializes in biomedical proteins. Other areas of assistance include: cell line development; fermentation process development; protein purification development (e.g., chromatography resins with single or multiple chemistries, protein sequencing by liquid chromatography-tandem mass spectrometry [LC-MS/MS] analysis, and crystallography); antibody-based services (e.g., qualitative and quantitative western blot, enzyme-linked immunosorbent assay [ELISA], antigen immunopreciptation for protein complex analysis or chromatin immunoprecipitation sequencing [ChIP-Seq], and other methodologies); cell biology services (e.g., protein stability, protein potency, protein toxicity, and protein localization); and microscopy (e.g., epi-fluorescence, confocal fluorescence, Nomarski light, transmission electron [TEM], and scanning electron microscopy [SEM]).

For more information, contact Paul Blum (pblum1@unl.edu, 402-472-8969).

**Center for Biotechnology**

The University of Nebraska-Lincoln (UNL) Center for Biotechnology promotes research on all aspects of molecular life sciences by providing state-of-the-art technologies for research through core facilities; enriching the research environment at UNL through a weekly seminar series; providing training to faculty, students, and staff through workshops and short courses; and awarding student fellowships and scholarships. The Center currently offers core facilities for bioinformatics, genomics, flow cytometry, microscopy, plant transformation, and proteomics and metabolomics.

The ***Bioinformatics Core Research Facility (BCRF)*** offers education, analysis, and computational services in the areas of bioinformatics and computational biology. The BCRF provides various standard bioinformatics services for fees (e.g., transcriptome or genome assembly, gene prediction and annotation, differential gene expression analysis, ortholog/homolog detection, phylogenetic analysis, etc.). The BCRF also helps to prepare and write grant proposals that include life sciences-related computation or analyses; collaborates on larger projects and grants; provides custom-program solutions (e.g., Java, Perl, VBA) ranging from simple (e.g., conversion or integration of data files) to complex (e.g., developing and programming solutions for large-scale analyses); gives lectures and workshops on bioinformatics topics; installs and maintains, in collaboration with the Holland Computing Center, up-to-date software and databases in the life sciences (specifically bioinformatics) domain; provides support for bioinformatics software and analyses on the Holland Computing Cluster; and hosts servers and research database-driven websites (e.g., species-specific genome browsers).

BCRF instruments and facilities include a high-performance Linux compute cluster dedicated to life sciences research (approximately 250 CPU cores, 1 TB of RAM, and 150 TB of central SAS RAID six-disk storage), which contains: compute worker nodes, most of which have at least 8GB of RAM and are capable of running MPI jobs; a dedicated four-CPU, six-core large-memory server (320 GB RAM) suitable for larger transcriptome and genome assembly jobs; and two web servers and database backend machines for hosting several database-driven research websites.

For more information, contact Jean-Jack Riethoven (jeanjack@unl.edu, 402-472-7949).

The ***Flow Cytometry Service Center*** provides comprehensive data collection, consultation, instrument training, and data analysis assistance as well as training and education in flow cytometry. The Center is capable of running a wide variety of flow cytometry-based assays, including but not limited to: 1-16 color immunophenotyping studies, cell cycle analysis, plant ploidy, apoptosis, bead-based assays, and cell sorting.

Instruments include: two BD FACSCalibur cytometers (two laser platforms, 488 and 635 nm) capable of detecting forward-scattered light (FSC), side-scattered light (SSC), and four fluorescence parameters (both systems operate under CellQuest Pro software); a BD FACSArray cytometer (a two-laser system, 532 and 635 nm) designed for screening applications using cellular or bead-based assays and capable of four-color analysis operating under FCAP and BD FACSArray System Software in a 96-well format; a Cytek DxP10 flow cytometer (a four-laser system: 407, 488, 561, and 637 nm) capable of detecting FSC, SSC, and ten fluorescence parameters (operating under FlowJo CE software); and a BD FACSAria II cell sorter (a four-laser platform with 405, 488, 561, and 642 nm). This latter system is housed in a Biosafety Level 2 cabinet and is capable of detecting FSC, SSC, and 16 fluorescence parameters. It can also sort up to four separate populations from the same sample at a rate of up to 30,000 events/second and utilizes BD FACSDiva software.

For more information, contact Dirk Anderson (dirk.anderson@unl.edu, 402-472-3129).

The ***Genomics Core Facility*** provides access to high-throughput DNA sequencing and genotyping and Illumina next-generation sequencing (NGS) through regional partners. The University of Nebraska Medical Center (UNMC) provides a full range of Illumina NGS services. The core operates three sequencers, including a HiSeq2500, NextSeq500, and MiSeq, and has an experienced staff of six full-time technologists. The core provides NGS library creation, gene expression, and DNA sequencing at a cost-effective price point with a rapid turnaround time. Recent additions include a SciClone robot for high-throughput rapid NGS library construction and a NextSeq500. Routine applications include RNAseq (mRNA, total RNA, and miRNA), eukaryotic DNA sequencing, and 16s and whole-genome metagenomics sequencing. In addition, the UNMC Core offers single-cell genomics technology. The facility also provides routine Sanger sequencing of polymerase chain reaction fragments and plasmid inserts. In addition, Illumina NGS is available through the University of Minnesota Genomics Center. Services include NGS, NGS library creation, gene expression, genotyping, epigenomics, Sanger sequencing, nucleic acid services, and quality control.

For more information, contact James Eudy (jdeudy@unmc.edu, 402-559-3940) for Illumina next-generation DNA sequencing and traditional Sanger sequencing or Kenneth Beckman (kbeckman@umn.edu, 612-626-2985) for Illumina next-generation sequencing.

The ***Morrison Microscopy Core Research Facility*** provides state-of-the-art imaging instrumentation and services to support multidisciplinary research in the state of Nebraska. The facility also provides services and training for Nebraska academic and industrial communities. *Confocal microscopes* include: a Nikon A1R-TiE (inverted) confocal live-cell imaging system (temp/CO2 chamber) with a hybrid resonant dual scanner, automated stage, and integrated six solid-state lasers (405/ 445/488/514/561/640 nm); and a Nikon A1si-90i (upright) confocal spectral imaging system with six laser lines (405/445/488/514/561/640 nm). *Electron microscopes* include: a Hitachi H7500 transmission electron microscope (TEM) with an upgraded high-resolution digital camera for ultrastructural analysis, assay of nano-particles/fibers, and examination of negative stained microbial samples; and a Hitachi S4700 field-emission scanning electron microscope (SEM) for topographic analysis from 25x to 500,000x magnification at nanoscale levels. *Epifluorescence/light imaging systems* include: an EVOS® FL Auto cell imaging system with an automated microscopic stage, dual cameras, selectable excitation/emission filters from five LED light cubes, and 2x to 100x objective lenses; a Nikon Ti-S inverted epifluorescence microscope with a digital camera and 4x to 60x objective lenses; an Olympus AX70 upright epifluorescence microscope with a digital camera and different filter sets; and a Nikon SMZ800 stereo/dissecting epifluorescence microscope with a digital camera.

*Other instrumentation and services* available through the facility include: a Leica cryostat for frozen sectioning; a Leica rotary microtome for paraffin sectioning; a critical-point-dryer and sputter coaters for SEM sample preparation (sample preparation service from fixation to sputter coating for SEM); and a Leica UC7 ultra-microtome for semi-thin and ultrathin sectioning for TEM (sample preparation services from fixation, dehydration, embedding, and ultrathin sectioning, and staining [including negative staining] for TEM).

For more information, contact You (Joe) Zhou (yzhou2@unl.edu, 402-472-5935 [office], 402-472-5942 [laboratory]).

The ***Plant Transformation Core Research Facility*** provides services for vector constructions, plant transformations, and characterizations of the derived transformants. The facility has the capacity to conduct transformations for major commodity crops, including maize, soybeans, sorghum, and wheat, and can provide full service transformations for tobacco (*Nicotiana tabacum* and *Nicotiana benthamiana*) and tomato (*Solanum lycopersicum*) upon request. All transformations are conducted using *Agrobacterium*-mediated protocols. Transformations with commodities are carried out on a project agreement basis, and custom quotes are provided for each project.

For more information, contact Tom Clemente (tclemente1@unl.edu, 402-472-1428).

The ***Proteomics and Metabolomics Facility*** offers a range of technical services using mass spectrometry, including identification and relative quantification of proteins and several advanced methods for profiling and quantitation of small molecules. With highly specialized technology capabilities and proficiency and expertise of personnel in the field of mass spectrometry, the facility serves as a regional, national, and international resource and fosters collaboration in the quickly developing field of proteomics and metabolomics.

Proteomics services include: protein identification from gel bands, protein identification from solution or bead samples, quantitative proteomic analysis using labeling or label-free approaches, identification and quantification of post‐translational modifications, phosphopeptide enrichment followed by identification and quantification of phosphorylation sites, and targeted quantification of peptides using data independent acquisition. Proteomics instrumentation includes: one ThermoFisher Scientific Q ExactiveTM High Field (QE-HF) mass spectrometer coupled to Dionex U3000 nano-rapid separation liquid chromatography (RSLC) and Mascot 2.5.1 technical support (Matrix Science Ltd.) systems for protein identification from tandem mass spectrometry (MS/MS) spectra; one Proteome Discoverer 2.1 search engine (Thermo) for metabolic, isotope labeling, and label-free quantitative proteomics; Scaffold 4.4.7 (proteome software) for protein identification, reporting, and label-free quantitative proteomics; and PEAKS 7.5 (Bioinformatics Solutions Inc.) for de novo sequencing and post-translational modification (PTM) characterization.

In the area of metabolomics, services include: free amino acid analysis; hydrolyzed amino acid analysis; free sugars assay; stress plant hormone assay; growth plant hormone assay; targeted quantification of small molecules using either high-performance liquid chromatography (HPLC) separation, gas chromatography-mass spectrometry (GC-MS), or multiple-reaction monitoring (MRM)-based assay; and untargeted metabolomics using liquid chromatography-MS/MS (LC-MS/MS) and/or GC-MS. Instrumentation includes: a Sciex QTRAP 6500+ mass spectrometer with SelexION+ ion mobility coupled to a Shimadzu Nexera II ultra-high performance liquid chromatography (UHPLC); a Progenesis QI (Nonlinear Dynamics) for qualitative and quantitative comparison of small molecules and identification using various databases; a Thermo Q-Exactive-HF mass spectrometer coupled to a Thermo Vanquish H UHPLC; an Agilent 1290 Infinity II UPLC; and an Agilent GC-MS 5977A.

For more information, contact Sophie Alvarez (salvarez@unl.edu, 402-472-4575).

**Center for Brain, Biology and Behavior**

The Center for Brain, Biology and Behavior (CB3) is an interdisciplinary research center that brings together distinguished University of Nebraska faculty in the social, biological, and behavioral sciences and engineering who are studying the biological mechanisms underlying social dynamics and human behavior. CB3’s state-of-the-art facilities support research on biological, neural, and cognitive mechanisms of behavior and include high-density electroencephalography (EEG) brain recording systems, a functional magnetic resonance imaging (fMRI) laboratory, high-density near infrared spectroscopy, behavioral genetics equipment, eye tracking devices, and a salivary bioscience laboratory. These facilities, coupled with the Center’s highly multidisciplinary environment, enable diverse studies to expand understanding of brain function and its effects on human behavior.

The ***Magnetic Resonance Imaging (MRI) Facility*** features a research-dedicated Siemens 3 Tesla Skyra MRI scanner and optional capabilities for concurrent 256-channel high-density electroencephalography (EEG) and eye tracking. The MRI scanner includes multiple head and body coils that allow for conducting functional brain MRI (fMRI), as well as orthopedic, cardiac, and other MRI. The MRI scanner is equipped with all standard sequences for functional and structural neuroimaging and for sequences enabling multiband imaging for faster and higher-resolution fMRI data acquisition. A full-time MRI technologist is on site during normal working hours; additional MRI technologists are available to conduct scans in the evenings and on weekends as needed. In addition, neuroradiologists from the University of Nebraska Medical Center review scans from all research participants for incidental findings.

Research use of the MRI scanner is charged at a per-hour rate, including MRI technologist time to run the scanner. Researchers who have undergone appropriate safety training and received Institutional Review Board approval are eligible to reserve the scanner. A highly realistic mock MRI scanner is also available in an adjoining room for familiarizing research subjects (such as children) with the MRI environment and cognitive testing protocols. Instruments include a Siemens 3 Tesla Skyra MRI scanner, an EGI Net Amps 400 EEG amplifier, an EyeLink 1000 eye tracker, and a Psychology Software Tools Hyperion MRI digital projection system.

For more information, contact Jennifer Nelson (jnelson18@unl.edu, 402-472-0321).

The ***Salivary Bioscience Laboratory (SBL)*** is a Biosafety Level 2 laboratory equipped to assay biospecimens – specifically saliva – for biomarkers of stress response and immune function, and can also inventory and archive biospecimens. The SBL collaborates with researchers from a variety of academic disciplines (including the social, behavioral, educational, and health sciences) in their pursuits to incorporate salivary biomarkers into scholarly work. SBL staff and faculty advisors provide consultation in research design, human subjects protection, saliva sample collection, statistical analysis, and grant/publication writing.

SBL staff currently conduct assay analyses for 19 salivary biomarkers of immune function and stress response, including alpha-amylase (sAA), androstenedione, blood contamination/transferrin, cortisol, cotinine, C-reactive protein (CRP), dehydroepiandrosterone (DHEA), DHEA-sulfate (DHEA-S), estradiol, estriol, estrone, interleukin-1 beta (IL-1β), interleukin-6 (IL-6), melatonin, progesterone, 17-hydroxyprogesterone (17-OHP), secretory immunoglobulin A (SIgA), testosterone, and uric acid. The SBL conducts annual proficiency testing through its affiliations with the Institute for Interdisciplinary Salivary Bioscience Research at the University of California, Irvine and with Salimetrics, Inc., to ensure quality control of results generated.

For more information, contact Jessica Calvi (sbl@unl.edu, 402-472-0027).

**Central Plains Research Data Center**

The Central Plains Research Data Center (CPRDC) is part of a network of research data centers operated in conjunction with the U.S. Census Bureau that provides researchers with access to restricted-use federal datasets, including Census and health data (through the National Center for Health Statistics and the Agency for Healthcare Research Quality), as well as other federal agencies. These are micro-level, less processed data that provide finer geographic coverage than comparable public-use data sets.

By providing access to these data in a secure facility, the CPRDC aims to bolster research that expands basic knowledge and provides benefits to the federal statistical system with a secure computing laboratory where qualified researchers with approved projects can conduct research using restricted-access versions of important datasets maintained by the U.S. Census Bureau and other federal agencies.

The CPRDC has four primary areas of expertise: Great Plains data, survey research methodology, statistical modeling, and research on health and social disparities. The CPRDC also seeks to facilitate broader access to a range of existing ecological and climatological data sets, including those pertaining to water and food security, and sustainability in urban and rural settings. Researchers with approved projects may access establishment-level business data and/or unreleased household data. In many cases, linked economic data are available.

For more information, contact John Anderson (janderson4@unl.edu, 402-472-1190).

**Extreme Light Core Facility**

The Extreme Light Core Facility (ELCF) provides scientists access to specialized laser equipment to carry out a broad range of experiments. The goal of ELCF is to create a research environment that will stimulate research innovation and further the development of high-power laser applications – in areas such as molecular, optical, plasma, and nuclear physics; materials science; biomedicine; and chemistry – to solve emerging challenges nationally and internationally. ELCF can offer researchers access to the novel capabilities of ultra-short pulses of high-peak power laser light. Available beam lines include: Oscillator (5 nJ, 85 MHz, 15 fs), FemtoPower (1.6 mJ, 1 kHz, 25 fs), Hollow Fiber 0.7 mJ, 1 kHz, 7 fs), Amplifier 1 (30 mJ, 50 Hz, 200 ps), Amplifier 1 (compressed) (15 mJ, 50 Hz, 30 fs), and Amplifier 2 (compressed) (100 mJ 10 Hz, 30fs).

For more information, contact Shouyuan Chen (schen6@unl.edu, 402-472-6038).

**The Food Processing Center**

The Food Processing Center (FPC) is a multi-disciplinary resource for the food industry, providing a combination of consulting, educational, technical, and business development services. Through the integration of applied research with state-of-the-art pilot plants, laboratory services, a team of product developers, and a team that supports food entrepreneurship, the FPC is equipped to work with products in every major food group including grains and oilseeds, fruits, vegetables, dairy products, meat, and poultry. The FPC provides a wide range of customizable services, all delivered in a confidential, price-competitive, and timely manner.

FPC services include: applied research and engineering, pilot plant processing, product and process development, labeling and regulatory compliance, laboratory services, validation studies (thermal and non-thermal), sensory analysis labs, educational internship in food processing, experiential hands-on learning in food preservation and transformation for graduate and undergraduate students; professional development opportunities, small business development seminars, workshops (e.g., extrusion, microbiology, etc.), and distance training opportunities for industry. Facilities include: teaching laboratories, classrooms, an auditorium with distance learning capabilities, product development modules; clinical subject and lab space, innovation training space, expanded sensory prep and evaluation space, and a pilot plant (capabilities for extrusion, milling, brewing and fermenting, high-pressure processing, drying, etc.).

For more information, contact Curtis Weller (cweller1@unl.edu, 402-472-9337).

**Holland Computing Center**

The Holland Computing Center (HCC) boasts the fastest resources in the state of Nebraska at two locations: the Peter Kiewit Institute at Omaha and the Schorr Center at the University of Nebraska-Lincoln. Personnel based in each location engage students and researchers, assist users, and maintain systems. HCC provides such services to researchers associated with any campus of the University of Nebraska system. Many are available in a shared manner for free, but dedicated (reserved) arrangements are also available for a modest price.

Resources include Crane, Tusker, Red, Anvil, and Attic. *Crane* debuted on the Top500 Supercomputer list. Intel Xeon chips (8-core, 2.6 GHz) provide the processing with a total of 7,232 cores. 3,456 core (18-core, 2.3GHz) chips were recently added in servers with at least 256 GB RAM each. The cluster shares 1.5 PetaBytes of lustre storage and GPU-equipped servers. *Tusker* offers 6,784 cores interconnected with Mellanox QDR Infiniband along with 523TB of Lustre storage. Each compute node is an R815 server with at least 256 GB RAM and 4 Opteron 6272 (2.1 GHz) processors. *Red* has 6,960 job slots interconnected by a mixture of 1 Gb and 10 Gb ethernet. It also has over 8 PB of storage, is integrated with the Open Science Grid, and serves as a major site for storage and analysis in the international high energy physics project known as Compact Muon Solenoid. *Anvil* is an OpenStack cloud machine that provides an alternative to standard Linux batch systems when needed. *Attic* is an array of disks built for reliability that is completely replicated between Lincoln and Omaha. It currently costs $25/TB/year for medium-term storage of project data.

For more information, contact David Swanson (david.swanson@unl.edu, 402-472-5006).

**Life Sciences Annex and Manter Hall**

The University of Nebraska-Lincoln Institutional Animal Care Program (IACP) manages the Life Sciences Annex located on East Campus and Manter Hall located on City Campus. Daily care of animals at both facilities is provided by staff in the IACP. Health care is provided by the IACP veterinarians and technician staff.

The Life Sciences Annex accommodates rodent, laboratory animal, and agricultural animal research and offers strict bio-containment conditions for experimentation involving infectious agents and genetically engineered micro-organisms. Facilities include: an animal holding facility, per diem-based animal husbandry, Biosafety Level (BSL)-1 and BSL-2 space, and surgery and procedure rooms. Technical support is also available, including: tissue collection for genotyping, blood draws, fecal collection, anesthesia machine assistance, research staff training, animal ordering and delivery, and a dedicated vehicle for transport. Manter Hall is designed to accommodate traditional laboratory animals at a BSL-1 level.

For more information, contact Kelly Heath (kheath3@unl.edu, 402-440-6577).

**Nano-Engineering Research Core Facility**

Located within the College of Engineering, the goal of the Nano-Engineering Research Core Facility (NERCF) is to create a centralized, shared-user core facility that houses the state-of-the-art research instrumentation necessary to position University of Nebraska-Lincoln (UNL) researchers at the forefront of global research efforts focused on advanced manufacturing of materials, nanostructures, and nanodevices. The NERCF enhances research capacity and quality by providing in-house nanofabrication and nanocharacterization facilities open to use by faculty across the University of Nebraska system. Further, it is the intent of this facility to become a regional hub for nano-engineering. The equipment and operations are funded in part by the Nebraska Research Initiative and the UNL Office of Research and Economic Development. The mission of the NERCF is to advance materials manufacturing efforts within the University and the state of Nebraska.

Equipment for characterization work includes: a Lake Shore cryogenic probe station, an FEI Quanta 200 environmental scanning electron microscope (SEM), a Hysitron TI 950 TriboIndenter, an Asylum Research MFP-3D-BIO™ atomic force microscope (AFM), an Ansays Instruments AFM+, a Keyence VK-X200K series laser SEM, a VersaLab 3 Tesla cryogen-free vibrating sample magnetometer, and Ansays Instruments nanoscale infrared absorption spectroscopy (nanoIR2). Equipment for manufacturing work includes: an FEI Helios NanoLab™ 660 DualBeam™ system, a Stratasys Objet 500 Connex3 3D printer, an Astrella ultrafast amplifier laser system, a Spark plasma sintering system, an ATC Flagship Series sputtering coating system RF/DC, and a LENS 3D metal hybrid vertical milling center inert system.

For more information, contact Director Joseph Turner (jaturner@unl.edu, 402-472-8856) or Manager Wen Qian (wqian2@unl.edu, 402-472-1668).

**Nebraska Center for Integrated Biomolecular Communication**

The Nebraska Center for Integrated Biomolecular Communication (CIBC) promotes and coordinates interdisciplinary research focused on filling fundamental gaps in understanding spatial and temporal aspects of biomolecular communication. By embracing approaches that span from the molecular and tissue levels to computational modeling, the CIBC fosters the development of integrated, interdisciplinary research teams with broad disciplinary representation to interrogate complex disease pathways from a wide range of perspectives.

Within CIBC, the ***Data Management and Analysis Core (DMAC) facility*** develops and supports the data management and analysis needs of faculty and students involved in biomolecular communication research. CIBC researchers are embracing the challenges and promise of large-scale, high-throughput data, and the DMAC facility is designed to serve as an integral partner in such research. As such, the DMAC facility: provides expertise in data management, data preprocessing, statistical analyses, data mining and machine learning, functional and predictive analyses, querying of existing databases, and computational modeling; and educates CIBC members about the role of ‘omics data in research and successful approaches to collaboration with faculty and staff in bioinformatics.

The DMAC facility’s computational platform consists of a web portal that enables data access, processing, and interpretation within the Center and also facilitates the sharing of research data with stakeholders, the general public, members of other Centers of Biomedical Research Excellence, and CIBC’s Systems Biology Core facility.

For more information, contact Jennifer Clarke (jclarke3@unl.edu, 402-472-2512) or Jean-Jack Riethoven (jeanjack@unl.edu, 402-472-7949).

Another of CIBC’s research cores is the ***Systems Biology Core (SBC) facility***, which incorporates existing systems biology instrumentation, methodologies, and expertise at the University of Nebraska-Lincoln – including the Microscopy Core Research Facility, Nebraska Center for Mass Spectrometry, and Research Instrumentation-NMR Facility – under a single organizational structure. SBC facility personnel have expertise in nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry (MS)-based metabolomics, MS proteomics (e.g., qualitative protein identification, protein quantitation, posttranslational modifications), microscopy (confocal, digital fluorescence, transmission electron microscopy [TEM], scanning electron microscopy [SEM], etc.), and biostatistics and bioinformatics.

Within the SBC facility, the *Microscopy Core Research Facility* includes: a Hitachi H7500 TEM with a Microsoft Window-based computerized operating system for ultrastructural analysis on sections of samples; a Hitachi S4700 field SEM with a Microsoft Window-based computerized operating system for topographic analysis; a Nikon A1 confocal system on a Nikon 90i upright fluorescence microscope, which can provide six different excitation laser lines; a Nikon A1R-TiE confocal live-cell imaging system, which has a hybrid resonant dual scanner unit for ultrafast photo-activation imaging and six solid-state lasers (405, 440, 488, 514, 561, and 640 nm excitation lines); an EVOS® FL Auto Cell Imaging System (Life Technologies, Inc.); an Olympus AX70 upright fluorescence microscope with high-sensitivity digital camera; a Nikon Eclipse Ti inverted fluorescence microscope with digital/video camera; a Nikon SMZ-800 fluorescence stereo-scope with filters for GFP and RFP and digital camera with 1-6 optical zoom; a Leica EM UC7 ultramicrotome for ultrathin sections for TEM; a Leica CM-1900 cryostat microtome for frozen sections; a Leica RM 2025 microtome for paraffin sectioning; and a Tousimis Samdri ® -795 semi-automatic Critical Point Dryer for preparation of biological samples for SEM and two sputter coating instruments for SEM.

Equipment within the *Nebraska Center for Mass Spectrometry* includes: a Waters Synapt G2 S high-resolution quadrupole time-of-flight (Q-TOF) mass spectrometer with ion mobility and electron transfer dissociation (ETD); a Waters Xevo G2 XS high resolution Q-TOF mass spectrometer; a Micromass Q-TOF Ultima high resolution mass spectrometer; a Micromass GCT high-resolution GC-MS system (with electron ionization, chemical ionization, and positive and negative ion modes); an applied Biosystems Voyager-DE PRO MALDI-TOF mass spectrometer; a Finnigan LC-Q ion trap mass spectrometer; two Waters NanoAcquity HPLC systems with flow rates from 200 nl to 100 uL (normal or reverse phase, each of which is equipped with 96 sample auto-injection systems); a MASCOT (four copy site license) database search engine from Matrix Science resident on two dual processors set up as a server; and Progenesis QI for proteomics and quantitative and identification software (comparative analysis across sample sets for expression levels of proteins).

*Research Instrumentation – NMR Facility (RIF)* equipment includes: a Bruker Avance III-HD 300 MHz NMR system (jointly shared between the RIF and the Undergraduate Instrumentation Center) equipped with a BBOF probe; a Bruker Avance III-HD 400 MHz NMR system; a Bruker Avance 600 MHz NMR system; and a Bruker Avance III-HD 700 MHz NMR system.

For more information, contact Robert Powers ([rpowers3@unl.edu](mailto:rpowers3@unl.edu), 402-472-3039).

**Nebraska Center for Materials and Nanoscience**

The Nebraska Center for Materials and Nanoscience (NCMN) was founded by the Board of Regents in 1988 to serve as the focal point of interdisciplinary research in materials in the College of Arts and Sciences and College of Engineering. The overall goal of NCMN is to provide for the state of Nebraska and the University of Nebraska a nationally recognized center of excellence in materials research science and engineering, nanoscience, and nanotechnology.

The NCMN has six facilities that are available to all University of Nebraska-Lincoln (UNL) faculty, companies in Nebraska, and outside interests: the Cryogenics Instrumentation Facility, the Electron Nanoscopy Instrumentation Facility, the Nanofabrication Cleanroom Facility, the Central Facility for Nanomaterials and Thin Films, the Surface and Materials Characterization Facility, and the X-Ray Structural Characterization Facility.

The ***Cryogenics Instrumentation Facility*** provides the means for obtaining liquid nitrogen (LN2) and liquid helium (He) for low-temperature research, cold traps, and other forms of research. Available resources include: (1) a 230-L supply of LN2 which is maintained at the facility and from which researchers can transfer LN2 to their own dewars (typically 1-30 L) as needed; liquid He, which can be ordered in 60- or 100-L containers; and a Quantum Design MPMS-XL superconducting quantum interference device (SQUID) magnetometer, which offers advanced performance in all areas of magnetometry.

The SQUID magnetometer monitors very small changes in magnetic flux and the magnetic properties of samples and offers user-friendly automated software, dynamic range in temperature, and sensitivity of 1x10-8 emu. Data can be collected as magnetic moment vs. temperature measurement (ZFC-FC, susceptibility) or moment vs. magnetic field (hysteresis loops). The 4.5 T magnetic annealing system combines high temperature annealing with a high magnetic field to potentially modify the magnetic properties of thin film and alloys. The system makes use of exchange interactions at high temperature to form new magnetic phases and/or control the crystal growth.

For more information, contact Steve Michalski (smichalski@unl.edu, 402-472-7096).

The ***Electron Nanoscopy Instrumentation Facility*** provides hands-on access to electron microscopes, sample preparation equipment, data collection and data reduction instrumentation, as well as advice, training, and research collaboration. The scope of the facility is materials characterization of the topography, morphology, elemental composition, crystalline microstructure, crystal defects, and atomic arrangements of materials, mainly on a scale from 10 micrometers down to the near-atomic level.

The *FEI Tecnai Osiris (scanning) transmission electron microscope (S/TEM)* is a fully digital 200 kV TEM and STEM system with a high-angle annular dark-field imaging (HAADF) detector and extreme field emission gun (X-FEG) high-brightness Schottky FEG, Super-X windowless EDX detector and electron energy loss spectroscopy (EELS) system, and biprism for a holography and tomographic holder. The *FEI Nova NanoSEM450* is a field emission SEM with an ultra-stable, high-current Schottky gun. The system has advanced optics and detection, including immersion mode, beam deceleration, Everhart Thornley Detector for secondary electrons (ETD-SE), and “through-the-lens” detector for secondary electrons (TLD-SE) and backscattered electrons (BSE) for best selection of the information and image optimization. The *JEOL JEM 2010 TEM* system is 200kV and has an analytical mode, LaB6 filament, single-tilting and double-tilting sample holders, Gatan Erlangshen CCD camera, and TSL texture analysis system. The facility also offers *TEM and SEM specimen preparation equipment*, including a slow-speed diamond/wire saw, ultrasonic/rotation disc cutter, dimpling grinder, metallurgical polishing wheel, precision ion polishing system (PIPS)/PIPS II, plasma nanoclean, and Au/C sputter coater.

For more information, contact Xingzhong “Jim” Li (xzli@unl.edu, 402-472-8762).

The ***Nanofabrication Cleanroom Facility*** provides state-of-the-art instrumentation for designing, fabricating, characterizing, and testing complex nano/micro-scale structures and devices. These advanced toolsets are housed within the 4,000-sq.-ft. cleanroom at the Voelte-Keegan Nanoscience Research Center. The facility is open to all UNL researchers as well as external (including private sector) researchers for carrying out research projects in physics, chemistry, nano/microelectronics, microelectromechanical and nanoelectromechanical systems, nano-bio, and other related and interdisciplinary areas. Staff support is also available for training, process consultation, and collaboration on new process development.

In addition to the certified class 10,000 (ISO-7) cleanroom, which spans over 4,000 sq. ft. and includes 2,500 sq. ft. for work space, the facility provides the following instrumentation: electron beam lithography (EBL), optic lithography (SUSS MJB-4 Mask Aligner), and a laser lithography system (Heidelberg DWL66); reactive ion etching (Trion Minilock), deep RIE (Oxford Plasmalab 100), ionic milling/Sputtering (Intlvac Nanoquest-I), and a wet etching bench; a Stylus profilometer (Dektak XT), a reflective film thickness measurement system (Filmetrics F40), an optic microscope with camera (Nikon Eclipse L200N), and a four-probe resistivity measurement stand (Lucas 302); a focused ion beam (FEI Strata 201); e-beam evaporation (AJA ATC-ORION 8000); and a Spinner (Laurell WS-400-6NPP), hot plate (Super Nuova 120), oven (Thermo Scientific 3492M), and UltraSonic cleaner (Brason 2510) for water processing.

For more information, contact Jiong Hua (jhua2@unl.edu, 402-472-3773).

The ***Central Facility for Nanomaterials and Thin Films*** provides state-of-the-art instruments for fabricating material samples and devices. The primary focus of the facility is on nanostructuring by using thin film deposition and multi-layering. The facility has three thin film deposition systems which can deposit sub-nanometer-thick films in which two or more materials can be layered together in different orders to form a multilayer structure. The facility also provides systems to alloy materials together to study the bulk material properties.

Available equipment includes: two thin film systems for thin film deposition (an AJA International, Inc. sputtering system [ATC-2000F] and PVD Products laser deposition system [PLD-MBE 2500] with HEX from Mantis Deposition Inc.); gold and platinum target for use in facility deposition systems; two tube furnaces for heat treatment, including a Lindberg 55322 oven (Split-Hinge Single Zone Furnace, Tmax = 1200 °C, working tube diameter = 2.5 inches) and Lindberg 54233 tube oven (Tmax = 1500 °C, working tube diameter = 2 inches); systems for bulk sample preparation (Materials Research Furnaces, Inc. Arc Melt Furnace ABJ-338, Edmund Bühler GmbH Melt Spinner SC, and Fritsch Pulverisette 7 ball mill system); and a Micromeritics ASAP 2460 Surface Area and Porosimetry Analyzer.

For more information, contact Steve Michalski (smichalski@unl.edu, 402-472-7096).

The ***Surface and Materials Characterization Facility (SMCF)*** provides state-of-the-art instruments for nanometer-scale surface measurement, thermal analysis, and mechanical characterization of a variety of materials. The SMCF provides services in three areas (bays): scanning probe microscopy, thermal and optical analysis, and mechanical characterization and sample preparation. The *scanning probe microscopy (SPM) bay* contains three SPM microscopes, including a Bruker ICON SPM, an EnviroScope Atomic Force Microscope, and a Dimension 3100 SPM system. The SPM bay offers simultaneous high-magnification observation of 3D images and related physical properties, such as magnetic, electrical, and nanomechanical properties by using Atomic Force Microscopy (AFM), Magnetic Force Microscopy (MFM), PeakForce Tunneling AFM (PF-TUNA), and Quantitative Nanomechanical Property Mapping (PF-QNM), etc.

The *thermal and optical analysis* *bay* contains two thermal analysis systems: a differential scanning calorimeter (DSC 204 F1 Phoenix) and a thermogravimetry analysis system (TGA 209 F1 Libra) allow users to study and measure various thermal properties of materials such as glass-transition, melting, and crystallization temperatures. Also available is an Olympus BX51 polarizing optical microscope, which includes differential interference contrast capabilities for sample viewing and image analysis. In addition, the thermal behavior of a sample can be observed under the microscope using a Mettler Toledo FP900 thermal system equipped with a FP 82 hot stage with a temperature range from room temperature to 375 °C. The *mechanical characterization and sample preparation* *bay* houses: a Tukon 2500 Knoop/Vickers Hardness tester, a Buehler ISOMet 1000 precision saw, a Buehler MiniMet 1000 grinder-polisher, a Sartorius Cubis MSU2.7S-000-DM microbalance, and a new annealing system with high magnetic field of 4.5 T (available soon).

For more information, contact Lanping Yue (lyue2@unl.edu, 402-472-2742).

The ***X-Ray Structural Characterization Facility*** is dedicated to materials identification and characterization through non-destructive X-Ray Diffraction (XRD). Specific applications of this technique include powder diffraction, x-ray reflectometry, small angle scattering, pole figures, reciprocal space mapping, grazing incidence in-plane diffraction, x-ray crystallography, etc. Non-ambient powder and single crystal diffraction is also available at a selected temperature range. Instrumentationincludes: a Rigaku SmartLab diffractometer, a Bruker-AXS D8 Discover diffractometer, a PANalytical Empyrean diffractometer, a Rigaku D-Max/B diffractometer, a Rigaku Multiflex diffractometer, and a Bruker Photon 100 single crystal diffractometer.

In addition to providing access to instrumentation, the facility also makes available various XRD data reduction and analysis software from Rigaku, Bruker, and PANalytical as well as molecular graphical visualization and analysis tools to users of the facility.

For more information, contact Shah Valloppilly (svalloppilly2@unl.edu, 402-472-3693).

**Nebraska Center for Research on Children, Youth, Families and Schools**

The mission of the Nebraska Center for Research on Children, Youth, Families and Schools (CYFS) is to impact lives through research that advances learning and development. CYFS conducts, supports, and shares research in the following areas: academic intervention and learning, early education and development, psychosocial development and behavioral health, research and evaluation methods, and rural education.

CYFS provides comprehensive grant support for faculty as they conceptualize, develop, submit, and manage their grants. This support includes complimentary pre- and post-award services. Grant support is available in the following areas: research development and coordination (e.g., content reviews and line edits); statistics and research methodology (e.g., collaboration, design, and analyses); administrative services (e.g., pre- and post-award budgeting and event planning); and web, technology, and communications (e.g., database development, media presence, and dissemination). To learn more about CYFS grant support, visit: cyfsgrant.unl.edu.

For more information, contact Susan Sheridan (ssheridan2@unl.edu, 402-472-6941).

**Nebraska Innovation Studio**

Nebraska Innovation Studio (NIS) – the University of Nebraska-Lincoln (UNL) makerspace – is a community-oriented makerspace that serves as a hub for innovators, artists, and entrepreneurs. As the creative and collaborative hub of Nebraska Innovation Campus, NIS makers and builders team up to conceptualize, prototype, and iterate projects that solve problems and influence change. NIS membership is open to all UNL staff, faculty, and students as well as the surrounding Nebraska community. NIS is a do-it-yourself membership-based workshop that offers access to tools in a variety of areas. Within the area of *Computer Numerical Control (CNC) and rapid prototyping*, major equipment includes: an Epilog 50 watt Fusion laser cutter, an Epilog 60 watt laser cutter, Ultimaker 2 and 2+ 3D printers, a Stratasys Mojo 3D printer, a NextEngine 3D scanner, a ShopBot Alpha CNC router, and a Graphtec 24” vinyl cutter. Major equipment in the NIS *woodshop* includes: sanders (a Jet 10” disc sander; a Jet 6” belt sander; a Jet oscillating spindle sander; a Woodmaster 38” drum sander; and FesTool orbital, eccentric, delta, profile, and rotary sanders); saws (a Festool compound miter saw, a Festool track saw, a Laguna 18” band saw, a SawStop table saw, a panel saw, and a scroll saw); a table router; a Powermatic 36” wood lathe; a Clausing drill press; a Felder 19” planer; a Powermatic 8” jointer; a Festool Domino jointer; and a Festool manual router.

*Textiles* equipment includes: a Juki MO-6700 Serger, a Juki DDL-5550N straight stitch sewing machine, an APQS 14’ Longarm Quilter, two Bernina regular sewing machines, and a Silver Reed LK150 knitting machine. *Electronics* equipment includes: soldering irons, a dual channel function/arbitrary waveform generator, oscilloscopes, a reflow oven, a hot air rework station, a PCB milling machine, and a PCB plating machine (coming soon). *Ceramics* equipment includes: a 22” x 22” Skutt electric kiln (fires up to cone 6), a 10” wide x 12” deep Skutt electric kiln (fires up to cone 6), six VL Whisper & Brent C electric throwing wheels, and a 30” slab roller. *Printmaking* equipment includes: a dark room; screenprinting screens (for rent); a variety of water-based ink colors (for purchase); a dri-cab; a 12-bulb vacuum exposure unit; a four-station color press; an Epson 17” printer; and chemical and finishing room for strong odors, wood finishing, and painting. *Computers and software* equipment includes twelve computer stations with access to design software such as Adobe Illustrator Suite, Solidworks Educational, Fusion 360, AutoCad, Rhino, and Inventor.

For more information, contact Jerry Reif (jreif@unl.edu, 402-472-5114).

**Nebraska Water Sciences Laboratory**

The Nebraska Water Center (NWC) is one of more than 50 Water Resources Research Institutes nationwide and focuses on helping the University of Nebraska solve state water quality and quantity issues. The NWC coordinates faculty research; trains future water researchers; and promotes water research results through publications, research colloquiums and conferences, lectures, and tours. The Water Sciences Laboratory provides advanced methods, technical expertise, and sophisticated analytical instrumentation for environmental and water resources research. Specialized methods and instrumentation are available for measuring traces of organic and inorganic contaminants and a variety of stable isotopes.

Major instrumentation includes: Waters Quattro Micro liquid chromatography-triple quadrupole mass spectrometer (LC-MS/MS) system with electrospray (ESI), atmospheric pressure chemical ionization (APCI), and atmospheric pressure photoionization (APPI) interfaces; Agilent 6410 triple quadrupole LC-MS/MS with ESI and APCI interfaces; Agilent 5972 gas chromatography-mass spectrometry (GC/MS) with an electron ionization (EI) source; Agilent 5973 GC/MS with EI and chemical ionization sources, a Combi-PAL automated extraction system, and OI Analytical Eclipse Purge and Trap Concentrator for volatiles; a Thermo Helix SFT noble gas mass spectrometer with an ultra-low temperature gas extraction purification system and Hiden quadrupole residual gas analyzer; an Isoprime dual inlet isotope ratio mass spectrometer (IRMS) with a Multiprep and Tracegas cryogenic preconcentrator; Isoprime continuous flow IRMS with liquid and solids elemental analyzers; GV2003 continuous flow IRMS with CO2 Multiprep; Optima dual IRMS; Perkin-Elmer AAnalyst 400 and Lambda ultraviolet spectrophotometers; a CEM MARS XPress microwave digester/extraction system; Seal AQ2 and Lachat 8500 Autoanalyzers; an OI Analytical Model 1010 organic carbon analyzer; and aa Trace Analytical reduced gas analyzer (hydrogen GC).

For more information, contact Dan Snow (dsnow1@unl.edu or watersciences@unl.edu, 402-472-7539).

**Plant Phenotyping Facilities**

The University of Nebraska-Lincoln (UNL) Institute of Agriculture and Natural Resources offers cutting-edge instrumentation and supporting infrastructure for plant phenotyping in the plant sciences. These technologies offer the opportunity to integrate proximal remote sensing and imaging measurements of intricate morphological and functional characteristics of plants. This integration is of paramount importance in the quest to link phenomics to genomic expression, optimize yields, achieve crop efficiencies (e.g., water, nutrient, and photosynthetic), understand resistance to biotic and abiotic stresses, and develop biomass for bioenergy and other valuable traits in plants.

Located at the Nebraska Innovation Campus Greenhouse, the *Lemnatec 3D High-throughput Scanalyzer* is an automated, high-throughput plant phenotyping platform system that includes greenhouse bays and an automated conveyor belt with a 672-plant capacity. The system is fully automated and environmentally controlled with automated watering and weighing stations and four chambers equipped with cameras capable of collecting images in the visible, infrared, fluorescent, and hyperspectral range of each plant up to maturity or 2.5 m height.

The *Spidercam Field Phenotyping Facility* is a one-acre field phenotyping site at the Agricultural Research and Development Center. The facility features an automated cable suspended carrier system that holds multiple cameras and sensors for positioning over plots, an advanced automated weather station, and a state-of-the-art subsurface drip irrigation system for water and nutrient delivery and manipulations at the plot level (15 x 20 square feet).

Within the Beadle Center on UNL’s city campus, the *Lemnatec HTS Scanalyzer* specializes in small plants and other organisms and is equipped with four types of sensing and imaging cameras (visible, infra-red, near infra-red. and fluorescent). Various parameters can be derived from the images that can be used to create digital phenotypes and link them to plant morphological and biophysical traits (e.g., leaf area, chlorophyll content, stem diameter, etc.).

For more information, contact Tala Awada (tawada2@unl.edu, 402-472-7088).

**Quantitative Life Sciences Initiative**

The Quantitative Life Sciences Initiative (QLSI) is a University of Nebraska-Lincoln (UNL)-wide faculty-driven program to enable and develop resources for Big Data and data science, with a special emphasis on the life sciences. Supported with funding from the National Science Foundation, U.S. Department of Agriculture, and a UNL Chancellor’s Program of Excellence award, the objective of the QLSI is to establish a cross-campus nexus focused on data science in the life sciences that will conduct research, training, and consulting with cross-sector partners and provide information to the local community about relevant activities in Big Data and data science. The QLSI serves as the primary UNL representative to the Midwest Big Data Hub, ORCiD, and national and international networks in plant phenotyping, including the International Plant Phenotyping Network and the North American Plant Phenotyping Network. The initiative also provides leadership for the Ph.D. program in Complex Biosystems.

For more information, contact Jennifer Clarke (jclarke3@unl.edu, 402-472-2512).

**Redox Biology Center**

The internationally recognized Redox Biology Center (RBC) is a broad-based interdisciplinary and multi-institutional entity involving researchers from the University of Nebraska-Lincoln (UNL) and the University of Nebraska Medical Center (UNMC). The RBC aims to support and expand Nebraska’s existing strengths in redox biology by mentoring junior faculty to success, recruiting new faculty with complementary research interests, and strategically enhancing biomedical research structure. Affiliated programs include undergraduate summer research opportunities, an international graduate-level course with the Karolinska Institutet in Sweden, and collaborative pilot projects.

The ***Spectroscopy and Biophysics Core*** provides instrumentation, training, and support for any type of experimental work involving biophysical and spectroscopic measurements. While most of the facility’s instruments are configured for use in protein and other macromolecule characterization work, the facility’s services can be extended to partially purified proteins, whole cell and media assays, and tissues. Instrumentation includes: an Agilent 7500 cx inductively coupled plasma mass spectrometer (ICP-MS); an Agilent LC1200 high-performance liquid chromatograph with diode array detector; an Elemental Scientific Inc 96-well plate autosampler; a Hi Tech stopped-flow rapid kinetics instrument; a Microcal GE Healthcare differential scanning calorimeter (DSC); a Microcal GE Healthcare isothermal calorimeter; a Varian, Cary Eclipse spectrofluorimeter with multiple adaptors for cell holders and 96-well plates (wavelength range from 190 to 1100 nm); a Beckman XL analytical ultracentrifuge; Open SPR surface plasmon resonance; and a Jasco J-815 circular dichroism equipped with fluorescence and fluorescence polarization accessories.

Core services include: determination of protein stability and thermodynamic parameters for protein conformational changes by DSC; ligand-protein and protein-protein binding studies by means of isothermal microcalorimetry; stopped-flow spectrophotometry and chemical quench (dead time of 25 ms); fluorescence, phosphorescence and chemiluminescence experiments in spectral and kinetic modes; elemental analysis by ICP-MS (all elements except the first row in the periodic table); ligand binding and protein-protein kinetics using SPR technology; and analytical ultracentrifugation.

For more information, contact Javier Seravalli (jseravalli1@unl.edu, 402-472-3124).

The ***Proteomics and Metabolomics Core Facility*** at the RBC supports faculty, scientists, clinicians, and students within the RBC, UNL, UNMC, and other universities and industries. The Facility is equipped with chromatography and mass spectrometry-based state-of-the-art technologies for proteomics and metabolomics (clinical and non-clinical) and offers personalized experimental design consultation and comprehensive, individualized bioinformatics support. General services include: small-molecule exact mass determination or quantitation using positive or negative ion modes; protein identification using liquid chromatography-tandem mass spectrometry (LC/MS/MS) analysis and MASCOT and SEQUEST database search; shotgun proteome analysis of biological samples; biomarker discovery from biological fluid; drug-protein or drug-nucleic acid-protein interaction; protein complex isolation and identification of interacting partners and its quantitation; global post-translational modification (PTM) analysis and quantitation; phosphorylation and oxidation analysis; coomassie blue and silver stained gel analysis; confirmation of mutations in protein; customized sequence search of in-house proteins that are not available in databases; PTMs (phosphorylation, sumoylation, ubiquitination, oxidation, etc.); determination of oxidation state of cysteine (disulfide bonds); and mass determination of intact proteins and peptides.

Instruments and technology include: a SCIEX QTRAP 4000 mass spectrometer integrated with an Agilent 1200 series LC system and a Dionex U3000 nano LC system; a Bruker’s Solarix High resolution FT-ICR mass spectrometer integrated with Agilent’s HPLC system; a ThermoFisher LCQ FleetTM ion trap mass spectrometer integrated with a 2D-nano LC/MS/MS system; a ThermoFisher LTQ Velos Pro ion trap mass spectrometer system with electron transfer dissociation; and Protein bioinformatics software (e.g., Bioworks, Metaboanalyst, SEQUEST).

For more information, contact Jiri Adamec (jadamec2@unl.edu, 402-472-5097).

**Research Instrumentation Facility**

Located within the University of Nebraska-Lincoln Department of Chemistry, the Research Instrumentation Facility (RIF) is equipped with a wide variety of instrumentation for chemical analysis including nuclear magnetic resonance (NMR) spectroscopy, optical spectroscopy, thermal analysis, and gas chromatography-mass spectrometry (GC-MS). Its primary mission is to support research within the Department of Chemistry and the wider University of Nebraska system, but it is additionally available to support the analytical chemistry needs of other academic institutions, research laboratories, businesses, and individuals and can run samples and compile data or reports as necessary. RIF instrumentation includes:

*NMR spectroscopy* instrumentation includes: a Bruker Avance III-HD 700 MHz, a Bruker Avance 600 MHz, a Bruker Avance III-HD 400 MHz, and a Bruker Avance III-HD 300 MHz. *Spectroscopy* instrumentation includes: a Shimadzu UV-2401 ultraviolet-visible (UV-VIS) spectrometer, Jasco 815 circular dichroism spectrometer, Shimadzu RF-5301PC fluorimeter, and Rudolph Autopol III polarimeter for optical spectroscopy; and a Smiths Detection SensIR infrared (IR) microscope, Nicolet AVATAR 380 FT-IR, and Leica optical microscope for infrared spectroscopy (FT-IR). For *GC-MS*, a Thermo Scientific Trace GC/ISQ single quadrupole MS capable of electron impact and chemical impact is available, and a Perkin Elmer STA6000 thermal analyzer and TA Instruments TGA with evolved gas furnace (part of the Thermo iS-50; see below) are available for *thermal analysis*. Other instruments include: a Carl Zeiss scanning electron microscope with an X-ray detection system; a data processing and workstation facility; and a Thermo iS-50, a modular instrument that is capable of Attenuated Reflectance IR, NIR, Raman, and TGA-IR.

For more information, contact Martha Morton (mmorton4@unl.edu, 402-472-6255).

**Social and Behavioral Sciences Research Consortium and Methodology and Evaluation Research Core Facility**

The Social and Behavioral Sciences Research Consortium (SBSRC) is available to all researchers at the University of Nebraska who wish to connect with the social and behavioral sciences. SBSRC helps researchers identify and build new collaborations and provides mentoring for new investigators. Its partner and referral network structure makes it possible for researchers to quickly take advantage of emerging opportunities by allowing them to quickly and efficiently find the best University of Nebraska-Lincoln partners available to meet their research and broader impact needs, and easily identify gaps that may require outside expertise.

The SBSRC houses the *Methodology and Evaluation Research Core Facility (MERC)*, which supports innovative approaches to sample design, data collection, data management, data archiving, and evaluation within a collaborative environment. The MERC Sampling Unit provides assistance with optimal survey sampling design, including complex sampling strategies such as network sampling, and innovative data collection is supported through the MERC Data Acquisition Unit, which provides state-of-the-art data collection services and can help develop new data collection technologies, including mobile device data collection. Database support and consulting on statistical models and analyses are provided through the MERC Database and Analysis Unit. This unit provides expert support for the de-identification and public access archiving of data for funded grant projects and can help researchers navigate the process of obtaining access to restricted data. The MERC Evaluation Unit consults on evaluation designs and conducts evaluations for funded grants. Evaluation services include the design of comprehensive formative and summative evaluations, logic model development, collection of evaluation data, analysis of data, and evaluation reporting. SBSRC staff also have access to state-of-the-art hardware and software (e.g., Qualtrics, REDCap, SPSS, SAS, R, and Nvivo), enabling them to meet needs for advanced research methodologies.

For more information, contact Dan Hoyt (dhoyt2@unl.edu, 402-472-2108).

**University of Nebraska State Museum**

As Nebraska's largest natural history museum, the University of Nebraska State Museum promotes discovery in natural science and natural history through research, scientific collections, learner-centered education, and public exhibitions. Its vast collections of organisms, fossils, and artifacts serve to foster scientific understanding and help us interpret the Earth’s past, present, and future. It also is part of the museum’s mission to enhance stewardship of the natural and cultural heritage of Nebraska, promote scientific literacy, and stimulate curiosity about and discovery of the natural world and heritage of diverse cultures.

The State Museum has three locations: Morrill Hall, the Trailside Museum of Natural History, and Ashfall Fossil Beds State Park. *Morrill Hall* is located on the University of Nebraska-Lincoln City Campus and boasts the world’s premier collection of fossil elephants, including the world’s largest mounted mammoth, on display in Elephant Hall Gallery. Visitors can interact with hands-on exhibits and explore natural wonders in the Marx Science Discovery Center or experience an immersive full-dome show in Mueller Planetarium. *The Trailside Museum of Natural History* is located in northwest Nebraska at Fort Robinson State Park. The Trailside Museum displays fossil remains from The Tertiary deposits near Fort Robinson, and exhibits focus on natural history subjects and objects of the area. Located in the northern part of Nebraska’s Antelope County, *Ashfall Fossil Beds State Park* is a joint project of the Nebraska Game and Parks Commission and the State Museum that offers visitors a chance to step back in time and see what Nebraska wildlife was like long before modern man ventured onto the Great Plains.

The State Museum offers outreach opportunities that are part-day or full-day events (e.g., Sunday with a Scientist, Science Café, Investigate), teacher workshops, professional development in science communication, and virtual field trips that can be delivered across the nation. The State Museum also has substantial research facilities. The Systematics Research Collections of the State Museum house approximately 14 million specimens and artifacts representing nearly 150 years of data gathering in the Great Plains and elsewhere. These collections form the basis of research in the Divisions of Anthropology, Botany, Entomology, Parasitology, Vertebrate and Invertebrate Paleontology, and Zoology that have resulted in thousands of scientific publications and presentations. The collections of Entomology, Parasitology, and Vertebrate Paleontology are of international significance because of the breadth and size of their holdings, and the other collections are of regional significance. The collections and their associated data also form the foundation for the public exhibits and outreach in Morrill Hall, The Trailside Museum, and Ashfall Fossil Beds State Park.

For more information, contact Susan Weller (susan.weller@unl.edu, 402-472-0577).

**University of Nebraska-Lincoln Libraries Data Management Services**

The University of Nebraska-Lincoln Libraries offers data management services for university faculty, staff, and students. This includes workshops and one-on-one consultations on data management and writing data management plans for grant proposals, as well as a data repository for preserving and sharing research data.

For more information, contact Jennifer Thoegersen (jthoegersen2@unl.edu, 402-472-4558).