Core Equipment Facilities and Shared Resources

Core facilities and resources at South Dakota State University provide an extensive range of services to the research community. The services and resources include many state-of-the art technologies, costly high-end instrumentation, laboratories that provide required security, and venues for interdisciplinary collaborations and training. Many services are also offered to non-SDSU partners from other research institutions or on a fee-for-service basis for the private sector. Please contact the named coordinator for each facility and service. They will be able to provide details on access, scheduling, and costs.

Computational Resources

Beowulf Cluster
Bigjack is built around an IBM IdataPlex platform that is populated with IBM DX360 M3 nodes. BigJack is currently made up of 71 servers with 12 processor cores on each node–dual socket Intel Xeon hex core processors–and 48 GB RAM on each node (6 nodes have been upgraded to 96 GB for large bioinformatics runs). Nine of the nodes have dual Nvidia Tesla 2090 GPU's (Graphics Processing Units).

SMP systems
Pax4 is an IBM x3655 server with a total of 8 processor cores–two quad core AMD 2356, 2.3 GHz processors. The system has 32 GB of RAM and runs a version of OpenSUSE Linux. External hard disks can be attached using SAN (Storage Area Network) connections, to enable several TB storage space.

Silvertip
Silvertip is an IBM x3755 M2 with 24 processor cores–four AMD 8435 hex core 2.6GHz 6MB processors; the RAM is 128 GB and the operating system is Linux OpenSUSE. Silvertip also has SAN connection capability for expanded disk storage space if necessary.

Silvertip2 and Silvertip3
Silvertip2 and Silvertip3 are IBM x3755 M3's, each with 64 processor cores via four AMD Opteron 6282SE 16 core 2.6GHz processors; the RAM is 512 GB and the operating system is Linux OpenSUSE. Silvertip2 and Silvertip3 also have SAN connection capability for expanded disk storage space if necessary.

Yeti and Sasquatch
Yeti and Sasquatch are HP Z820 workstations, each with 16 cores via two Intel Xeon E5-2690 2.90 Ghz processors ; Yeti has 128GB RAM and dual Nvidia Tesla 2050 GPU's while Sasquatch has 256 GB memory and one Nvidia Quadro 4000 video card. The operating system is Linux OpenSUSE. Yeti and Sasquatch also have SAN connection capability for expanded disk storage space if necessary.

Kodiak
Kodiak is an IBM 550 Power 6 system with dual core 4.2 GHz processors; Kodiak has 64 GB RAM and is running AIX 5.3.

Local Area Network (LAN)
South Dakota State University's campus features a high-speed network backbone with 10 Gbps links to campus Data Center functions as well as several research and bandwidth-intense buildings. Currently, most of the buildings on SDSU's campus are connected at 1 Gbps to the network core.

Storage and Backup
Currently SDSU has two Storage Area Networks, providing storage for computational systems. These consist of a 4 Gb SAN Fabric and 2 SAN Storage appliances. The Hitachi Data Systems AMS1000 provides 165 TB of SATA storage. There are two fiber channel controllers is this device and each controller has three 4 Gb fiber channel ports to the fabric. The Hitachi Data Systems AMS2100 consists of 56 TB of SATA storage and 24 TB of SAS storage. There are also two fiber channel controllers on this system with two 4 Gb fiber channel ports to the fabric. Additionally, SDSU maintains a large capacity IBM 3494 robotic tape library with IBM 3592 tape drives connected via a 4 Gb SAN for backup and archive of research data. Tivoli Storage Manager is used to manage the backup and archival activity.

Software

- Engineering
  - ANSYS Computer Based Engineering Simulation
  - COMSOL Multiphysics Simulation Environment
- Bioinformatics
  - BLAST Basic Local Alignment Search Tool
  - CLC Workbench CLC Genomics Workbench
  - MERLIN Pedigree Analysis Package
- Mathematics
  - MATLAB MathSoftware for Engineers and Scientists
  - PETSc Partial Differential Equations Functions
  - R Open Source Statistical Analysis Program
  - SAS Analytics Software
  - SPSS Predictive Analytics Software
- Chemistry
  - Gaussian 09 - Electronic Structure Modeling
  - NAMD Molecular Dynamics (MD) Program
  - NWCHEM High-Performance Computational Chemistry
  - CPMD Density Functional Theory
- Image Analysis, GIS and Visualization
- ESRI GIS Mapping
- ERDAS Image Analysis
- Compilers
  - GCC GNU GCC Compilers
  - PGI Portland Group Compiler
  - IBM XL Compilers IBM XL Fortran and C++ for AIX Compilers

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Chemistry and Life Sciences Research

Core Campus Mass Spectrometry Facility
The core campus mass spectrometry facility (CCMS) provides researchers with advanced mass spectrometers for identification, characterization, and quantification small molecules and large molecules, as well as proteomics analysis in various samples. CCMS also serves as a resource for training users, consultation in techniques, and collaboration on research projects in the area of mass spectrometry and its variety of applications. Currently, the facility is equipped with a Bruker Daltonics electrospray Fourier transform ion cyclotron resonance (ESI-FT-ICR) mass spectrometer (7T), a Bruker Daltonics matrix assisted laser desorption ionization time-of-flight (MALDI-TOF) mass spectrometer, an Eksigent nanoLC - ThermoFisher - linear ion trap (LTQ) mass spectrometer system, a Shimadzu UHPLC - AB Sciex QTRAP system, an AB Sciex QSTAR, a Kratos MS25RFA, a Varian GCMS and several instruments for sample preparation.

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Point of Contact:
Dr. James Rice
Head and Professor, Department of Chemistry and Biochemistry
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NMR Facility
The core Nuclear Magnetic Resonance (NMR) Facility provides access to five NMR systems for structural determination of complex compounds, including proteins. The instruments can address a variety of needs including 1-D, 2-D, and 3-D structural analysis. The choice of NMR instruments include Bruker Avance 600 MHz solutions spectrometer, Bruker Avance 400 MHz solutions spectrometer, Oxford 400 MHz ASX solids spectrometer, Bruker Avance 300 MHz solids spectrometer, and a TecMag 100 MHz Apollo solids spectrometer.

Point of Contact:
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Functional Genomics Core Facility
The Functional Genomics Core Facility (FGCF) was created to facilitate interdisciplinary gene function research and training in viral, bacterial, plant and animal systems. The FGCF Labs and equipment are housed in the Northern Plains Biostress Lab. FGCF components are: Genomics Lab, Automated Genomics Lab, Gel & Microplate Analysis Lab, Microimaging Lab, General Tissue Preparation Lab, and Histological Tissue Preparation Lab.

Point of Contact:
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Microimaging Laboratory
The Microimaging Lab is equipped with three research-grade Olympus microscopes (a SZH10 stereo-microscope, an IX70 inverted-microscope and a AX70 compound microscope), PC computers for image manipulation and analysis, and a copy stand for macro-imaging. These instruments provide fluorescent and white light capability for imaging biological specimens at magnifications from 2.5 to 1000 X. An Olympus Fluoview FV300 Laser Scanning Confocal Microscope System will soon be interfaced with the IX70 Microscope.

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Animal Research

Animal Resource Wing
The Animal Resource Wing (ARW) is a core animal facility managed and coordinated by the onsite University Veterinarian and a support staff with MS and CVT training. The ARW has both BSL-2 and BSL-2+ animal facilities with 19,898 ft^2 of area. There are numerous animal isolation rooms for both large and laboratory animals, including rodents, cervids, swine, cattle, rabbits, and poultry. Separate suites for gnotobiology, animal surgery, and necropsy are available for research use.

Point of Contact: Dr. Michele Mucciante
University Veterinarian
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Engineering Facilities

Lohr Structures Laboratory
The Lohr Laboratory is a 4,000 ft^2 high-bay/strong-floor structural testing facility. The high bay area is 39 ft wide, 90 ft long, and 28 ft high. A control room and a storage room open to the high bay area. The strong floor is a 4 ft thick reinforced concrete slab. The slab is fitted with a matrix of embedded threaded anchors spaced at 1 ft intervals. The pull out force capacity of each anchor is 25 kips. The facility is equipped with a 15-ton overhead traveling bridge crane. The interior space is configured to accommodate load testing of large-scale test specimens and full-scale bridge girders.

Point of Contact: Dr. Nadim Wehbe
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Materials Evaluation and Testing Laboratory (METLAB)
The METLAB provides unique capabilities for research, analysis, and development of materials, testing equipment, and techniques. Nondestructive and destructive evaluation and testing methods are used in a wide spectrum of complex applications. Nondestructive methods include, but are not limited to: high speed video, borescope, metal alloy analyzer, ultrasonic and phased array, acoustic emissions, electromagnetic, magnetic particle, dye penetrant, and radiographic testing. Destructive methods include, but are not limited to: static and dynamic material testing systems, Charpy impact/V-notch tester, Macro and micro/nano hardness testers, and microscopy systems.

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http://www.sd-metlab.org/

Fluid Mechanics Laboratory
The Fluid Mechanics Laboratory serves the departments of Agricultural & Biosystems Engineering, Civil & Environmental Engineering, and Mechanical Engineering. On-site equipment includes an open-channel flume, a three-component laser Doppler anemometer, a stereoscopic particle image velocimetry system, and various apparatus for flow visualizations and fluid mechanics measurements.

Point of Contact: Dr. Francis Ting
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Electrical Engineering Clean Room
The clean room includes over 3,300 ft^2 of class 1000 space and the facilities and equipment used for micro and nanoelectronics materials and devices fabrication. It includes five bays, four fume hoods, and over $3 million of equipment. Bay 1 is for organic electronics and includes a glove box with inert nitrogen gas environment, organic electronics device fabrication equipment, atomic force microscope for materials characterization, diamond and wire saws for wafer dicing, tube furnace, vacuum ovens, and a thick film printer. Bay 2 is a materials characterization bay which includes a Hitachi Scanning Electron Microscope (SEM) with an Energy Dispersive X-ray analysis (EDX) system, Dektak thin film profilometer, and a sputter coater for SEM sample preparation. Bay 3 is for thin film deposition, and includes a Rapid Thermal Processing oven (RTP), plasma cleaner for substrates, ion beam, e-beam, sputtering and evaporation thin film deposition systems, a high-temp chemical vapor deposition (CVD) system for silicon and graphene films, and a large-area plasma-enhanced chemical vapor deposition (CVD) system. Bay 4 contains systems under development including plasma enhanced chemical vapor deposition (CVD), atomic-layer deposition system (ALD), thin-film sputter deposition system with load-lock for rapid sample changing. Bay 5 is a lithography bay that includes yellow and red darkroom lighting for circuit pattern transfer, de-ionized water system for substrate cleaning, substrate spin dryer, photo-reduction stand for integrated circuit masks, contact angle measurement system, wire bonder, spin coater for photoresist deposition, and mask aligner for circuit pattern transfer.

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Statistical and Computational Support Services
Statistical and computational consulting services are provided by six statisticians, one bioinformatician, and two computational scientists. Statistical and computational consulting services available to the university community include assistance with experimental design, data management and preparation, statistical analysis and interpretation of data, computational simulations, and report preparation and dissemination.

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