

University of North Carolina at Charlotte –Bioinformatics and Genomics (Facilities)

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Laboratories: The laboratories of the Bioinformatics and Genomics Department at the University of North Carolina at Charlotte include both wet-lab and computational resources. The department is currently housed in the Bioinformatics Building, comprising 3 floors, 12 experimental research labs, and equal number of rooms for shared equipment, and a large server room. The building has offices for the 12 B&G faculty as well as space for an additional 20 faculty, shared office space for post-doctoral fellows and technical support staff, a large cubicle-farm space for 18 PhD students, and a similar space for Professional Science Masters students, several large classrooms, a video-conference room and four smaller meeting rooms (2 on each floor). There are currently 18 PhD students, 26 PSM and Certificate students, 3 post-doctoral fellows, and 3 Research Specialists or Technicians in the department.

The department operates on the philosophy of sharing resources for much of the more expensive or only occasionally-used equipment. Individual labs have standard molecular biology equipment and any highly specialized equipment required only for specific research projects. The department has access to a walk-in cold room and a generator-backed up and monitored freezer room containing one Isotemp 4C double-door deli cooler, one Thermo, one VWR and two Fisher Isotemp -20 freezers, one Thermo -80 and two Revco Ultima II -80 freezers, and one Thermo 4C Incubator 815. The department has clean rooms for tissue culture work with two Labconco Class II Biosafety cabinets in lab vestibules, and has two Fisher PCR workstations. A VWR Vistavision Fluorescent upright compound epifluorescent microscope is housed in a small room of its own. The department has 4 glassware washers, 2 ice machines, and two autoclaves, one a Getinge pass-through that serves the BSL3 lab. Outside of the BSL3 lab, the department has a culture room containing a VWR Symphony plate incubator (2' x 3' interior) and two Fisher Scientific Isotemp Incubators for plates (2'x 3' interior), as well as one VWR CO₂ incubator (dry heated, 2' x 3' interior) and a New Brunswick 12400 shaker incubator, and two roller incubator ovens (Thermo MaxQ and Hybaid Maxi) and a BioRad shelf style mini-incubator oven. The same lab houses a Molecular Dynamics Spectramax 384 Plus Plate reader and Beckman Coulter DU800 UV spectrophotometer with thermal sample control. In a centrifuge room the department has a Beckman Coulter Avanti J-E high speed centrifuge and a Beckman Coulter L-80 XP Ultracentrifuge, a Sorvall Legend room temperature plate centrifuge, a Thermo Centra GP8R refrigerated plate centrifuge. For visualization of electrophoresis results the department has two Gel Logic 200 Imaging systems, two UVP GelDoc-It systems and a Fisher UV transilluminator with a Spectroline Image capture system. The Sequencing Core suite is housed in a 700 ft² lab and the adjacent 500ft² lab – we have separated sample purification and library preparation from library QC, dilution and sequencing – available equipment includes an Agilent 2100 Bioanalyzer, a Nanodrop ND1000 spectrophotometer and a ND 3300 Fluorometer, a Tecan LS Scanner (3-laser), and an Eppendorf Vacufuge. Individual labs have PCR instruments, but the department also has several PCR machines in the Sequencing Core suite that have been tested for sequencing library yield, including two Eppendorf MasterCycler ep Gradient instruments, a Thermo Arktik, A BioRad T100, a NYX Technik; for qPCR there is a BioRad iQ5 and an BioRad MyiQ cycler. In research labs we have sample disruption devices, including a Pressure Biosciences Barocycler NEP3229, Fisher Sonic Dismembrator 500, Fisher sonicator FS20, Qiagen TissueLyzer LT, and VWR DMS2500 (high speed), Covaris

Ultrasonicator and Diagenode Bioruptor. Equipment currently mothballed but available as needed includes a Matrix PlateMate 2 x 2 robotic re-arranging station, a BioRad CHEF Mapper system, a Tecan HS 4800 Pro, a BioOdyssey Calligrapher microarraying robot. Liquid nitrogen tanks are filled weekly or as needed for sample processing. Two plant growth chambers are on the second floor as part of the Schlueter lab.

Sequencers

The Weller lab has an ABI 3130 (4 capillary) Genetic Analyzer, recently updated to the most recent software – this is primarily used for Sanger sequencing and fragment analysis.

A recently update Genomics Teaching laboratory (room 226) includes the equipment needed to produce and sequence high-throughput sequencing libraries on an Ion Torrent PGM (Life Technologies/Applied Biosystems), and also includes the OneTouch2 preparation stations, and an ES unit for library purification, a Qubit fluorometer and second Nanodrop ND2000 spectrophotometer, a Phippen Prep DNA purification station (Sage Bioscience) and a Bioruptor shearing station (Diagenode, listed above) as well as the necessary PCR machines, microfuges and ancillary equipment such as micropipettor sets for a class of 12 to produce and sequence a library.

The Sequencing Lab suite (332 and 332A) houses the sample and library preparation equipment described above, dedicated micropipettor sets (4) and multichannel pipettor sets (3), the PCR machines described above and a Fisher PCR workstation, a Qubit 2.0 fluorometer, minifuges, the Agilent 2100 Bioanalyzer and a vacufuge, and an Eppendorf 5430 refrigerated centrifuge with plate attachment and 5415D microfuge, and the VWR DMS2500 shaker required for approved protocols. . It includes an ISC SciCool -20 and Fisher under-bench 4C for reagent storage. We have one Illumina MiSeq instrument, with the adjacent library-preparation room containing 4 PCR machines, multi-channel pipettes, refrigerators for the reagents and supplies specific for the Illumina-approved Nextera and Nextera XT protocols.

The Janies lab has been the recipient of lease for an Oxford Nanopore sequencer – inquiries about use of that device should be directed to that lab.

BSL3 Facility: Room 338(vestibule) and 338A have been commissioned to allow carrying out BSL3-level experiments. In addition to a Getinge pass-through autoclave and 2 LabGard Biosafety Cabinets (Class II Type B1). There is a Thermo Fisher freezer-refrigerator and a Fisher Isotemp CO2 pate incubator, an Omni Macro ES tissue disruptor, an Argos EVac system, and Eppendorf 5810R centrifuge for larger volumes and 5418R for microcentrifuge volumes, both with appropriate vapor-shield lids. There are also 2 micropipetter sets, a heating block and het plate with safety shields, temperatier block, minifuges (2) and Fisher digital vortexers (2). There is a -20 freezer, CO2 plate incubator, a Nanodrop 2000 spectrophotometer with its laptop.

B&G Department Computers: The Bioinformatics and Genomics Department has access to four large compute clusters on campus. We maintain a 150 CPU Apple OS X cluster with PowerPC G5 processors (2.3 GHz), gigabit interconnect, and 100TB RAID storage. The average load on this cluster is currently less than 40% of maximum capacity. We maintain a 196 CPU (dual cores) IBM LINUX cluster with 64-bit AMD Opteron processors (2.8 GHz), gigabit interconnect, and 57 TB of RAID storage. The average load on this cluster is currently less than 25% of maximum capacity.

- The Information and Technology Services maintains a 480-core RedHat Linux cluster based on Intel Nehalem quad-core processors with 3 GB RAM per core, Infiniband interconnect and a multi-tiered storage solution that includes 150 GB local storage on each compute node, a 10 TB Lustre parallel file system and 40 TB of network attached RAID. Dr. Charles Price at University Research Computing (ceprice@uncc.edu) is the contact for more information on this cluster.
- A recently installed 720-core RedHat Linux cluster based on the Intel Nehalem hex-core processors with 2 GB RAM per core. The cluster includes 56 TB of usable disc storage, and gigabit Ethernet interconnect with separate paths for data and parallel communication.
- A 384-core RedHat Linux Cluster based on Intel Nehalem six-core processors with 2 GB RAM per core and a total of 96 Nvidia Fermi GPUs is currently being tested. This cluster has a theoretical processing power of over 50 TFlops. The cluster also includes 26 TBs of network-attached storage and an Infiniband interconnect.

The department has site licenses to a number of specialized commercial software products including the CLC Genomics Workbench, JMP Genomics and a number of statistical packages (SAS, SPSS), as well as software that accompanies instruments (Genetic Analysis software from ABI/Life Technologies, BaseSpace from Illumina). Specialized software is used by the Bioinformatics Services group and is available to researchers through them (see below).

NCRC Bioinformatics Services Resources

At the North Carolina Research Campus in Kannapolis, the Bioinformatics Services group maintains a 624-core Debian Linux cluster with Intel Xeon processors. Compared to most clusters, ours is designed with more memory per node making our cluster ideally suited to the high-memory demands of biological data. The general-purpose queue contains a mixture of 12- and 16-core nodes with eight gigabytes of memory per core (totaling 96 GB or 128 GB per node). The cluster also has a high-memory queue containing four servers that each contain either 24- or 32-cores and 512GB or 1TB of memory. For storage, the cluster has access to 750 TB via a shared file system. For connectivity, the cluster has both a gigabit Ethernet interconnect for communication as well as a 10Gb interconnect for storage. We also have access to three additional Red Hat Linux clusters that are located on our main University campus.

Software

We utilize many excellent open-source bioinformatics software tools which are installed in our Linux, MAC OS and Windows environments. Tools include a local instance of the Galaxy workflow system, numerous next generation DNA sequencing platforms, gene annotation software, transcriptome analysis tools and many more. If desired, the Bioinformatics Services Division is able to develop custom software scripts and programs where necessary.

- Ingenuity I2E and GeneGo metacore, an integrated knowledge database and software suite for pathway analysis of experimental data and gene lists.
- Linguamatics i2e, text mining software that enables the extraction of relevant facts and relationships from Medline.
- CLC Bio, which provides some of the newest algorithms and analyses available for analyses of genomic, transcriptomic and epigenomic NGS data.
- Geneious Pro, a software platform that is able to search, organize and analyze genomic and protein information.

- Partek Genomics Suite, a single analysis solution for integrated genomics, which provides comprehensive support for microarrays and next generation sequencing.
- JMP Genomics, a product from SAS for genetic and genomic analysis
- DNASTAR's Lasergene Core Suite, a comprehensive DNA and protein sequence analysis software suite comprised of eight applications, which include functions ranging from sequence assembly and SNP detection.
- Umetrics SIMCA-P+, software is used for the process of designing experiments and also for multivariate data analysis.
- SAS program package for statistical analyses.

In addition to the commercial software services,

Weller Lab – Jennifer Weller lab is responsible for labs in two adjacent rooms (343 and 345) each containing a vestibule. One of the department Biosafety cabinets (Labconco Class II) is in 345A and the VWR Vistavision Fluorescent upright compound epifluorescent microscope in 345A. There is a chemical hood in each lab. The ABI 3130 sequencer and Barocycler, UVP Gel DocIt are also housed in 343 and are available for use by any properly trained department personnel. The lab has standard molecular biology small instruments, including 4 micropipetter sets, 2 Fisher Genie 2 vortexers, an ABI 9700 thermocycler and an Techne 512 gradient thermocycler with exchangeable blocks, water baths (2), rocking platforms (2), heating blocks (4) and hot plates (2), balances and microbalances, microfuges (3, one refrigerated), a VWR -20 freezer and two VWR 4C under-counter refrigerators, electrophoresis and electro-blotting platforms, minifuges (3), a Fisher sonicator FS20 and BioLogics ultrasonic Model 3 disruptor, and a New Brunswick 12400 shaker incubator. Dr. Weller carries out monthly BSL3 facilities review and carried out monthly departmental safety inspections (submitted to the Institutional Biosafety Committee) prior to the arrival of the University Biosafety Officer.