FACILITIES AND OTHER RESOURCES

The Center for Translational Pediatric Research (CTPR) at the Arkansas Children's Research Institute (ACRI) seeks to investigate how pediatric diseases develop from a systems biology and mechanistic approach, with the ultimate goal of identifying the intersections of disease and development, which will produce targets for therapeutic intervention and the development of new treatments. By applying a systems biology approach to the study of pediatric diseases, the CTPR hopes to expand existing knowledge of pediatric disease development and contribute to new therapeutic targets. The long term goal of the CTPR is to build an innovative, multi-disciplinary pediatric research center that utilizes cutting-edge systems biology technologies and state-of-the-art translational research to study pediatric diseases. The CTPR is a Centers for Biomedical Research Excellence (COBRE) funded through the NIH IDeA program (P20GM121293; 07/11/2017-06/30/2022). The CTPR and ACRI have a partnership with the University of Arkansas for Medical Sciences (UAMS) for components of this center. The CTPR offers three state-of-the-art research core facilities available to center members: Proteomics, Genomics and Bioinformatics Cores.

Proteomics Core

Laboratory: The Proteomics Core is located at the Winthrop P. Rockefeller Cancer Institute at UAMS. The Proteomics Core is contained in 750 ft^2 of enclosed, dedicated laboratory space. The core laboratory has two dedicated air handlers and customized electrical wiring to accommodate numerous mass spectrometers. Additionally, the Proteomics Core has 750 ft^2 of space on the 2nd floor of the ACRI research building that is used for experimental design, sample preparation, and data analysis.

Office: Core directors have 150 ft^2 of office space.

Computer: All personnel have networked desktop personal computers or laptops linked to a docking station. All have at the very least Pentium 4 microprocessors, 30 GB hard drive space, 256MB of RAM, and DVD/CD-RW combination drives. All computers have a minimum of a 15" color monitor. All systems are networked to multiple printers, including a high through-put multifunction device, which provides printing, faxing and scanning capabilities. Many are additionally connected to local laser or inkjet printers. 200 TB of dedicated data storage is available.

Other: The UAMS College of Medicine provides accounting and purchasing support for the core facility. Printing and copying equipment and a conference room with audiovisual and videoconferencing equipment are available on the same floor as the core laboratory and office space.

Genomics Core

Laboratory: The Genomics Core consists of 750 ft^2 on the 2nd floor of the ACRI Research Building and has access to common areas provided by ACRI. There is locked storage space for long-term record storage and locked cabinets for supplies.

Computer: All personnel have networked desktop personal computers or laptops linked to a docking station. All have at the very least Pentium 4 microprocessors, 30 GB hard drive space, 256MB of RAM, and DVD/CD-RW combination drives. All computers have a minimum of a 15" color monitor. All systems are networked to multiple printers, including a high through-put multifunction device, which provides printing, faxing and scanning capabilities. Many are additionally connected to local laser or inkjet printers. 200 TB of dedicated data storage is available.

Office: The director has office space adjacent to the Genomics Core laboratory.

Other: ACRI provides accounting, purchasing and secretarial support for the core facility. Printing and copying equipment and a conference room with audiovisual and videoconferencing equipment are available on the same floor as the core laboratory and office.

Bioinformatics Core

Laboratory: The Bioinformatics Core is housed in an office pod with ~500 ft^2 on the 2nd floor of the ACRI Research Building in immediate proximity to the Proteomics and Genomics Cores. There is desk space for all personnel.

Computer: The core has priority access to a computer cluster housed in the UAMS Bioinformatics Department. The system has a Dell R730 chassis, 1 login/management node and 4 computer nodes. Each node has Twin Intel Xeon 2680 processors, 2.5 GHz 12 core (24 total cores), 128 GB memory, 2133 MT/s, mirrored 200 GB SSD OS drives, 10x 960 GB SSD read intensive with hardware RAID controllers (scratch drives, 7 TB), and quad port Intel X710 10 Gb/s network card. The computer node has 2x NVidia Tesla K40M GPUs each with 2880 stream cores, 12 GB GDDR5 memory, rated for 1.45 Tflops DP or 4.29 Tflops SP floating point. The login/management node has single intel Xeon 2650 2.3 GHz 10 core processor, 64 GB memory 2133 MT/s, mirrored 300 GB 10k RPM SAS system drives, and quad port Intel X710 10 Gb/s network card. In total there are 106 general purpose CPU cores with 576 GB memory, 5760 GPU cores with 24 GB memory, 30 TB raw solid state disk scratch storage, with up to 40 Gb/s interconnects between compute nodes.

The core has full access to a PowerStation GX2, which contains 16 2.0GHz E5-2600 Cloud Ready processor cores, 64GB of memory, 8TB of RAID5 storage and CentOS 64-bit operating system.

The core has remote access to Argon (the University of Arkansas at Little Rock's [UALR] Rocks 5.4 cluster) that consists of 64 Dell PowerEdge machines (each with 8 Xeon processors and 16GB RAM, for a total of 512 cores), 4TB storage, Gigabit Ethernet, 20Gbps DDR Infiniband interconnection among computing nodes for minimal inter-process communication latency as well as between computing nodes and a 40TB LUSTRE parallel file system for fast file access. It includes CentOS 5.5, a free clone of RedHat Enterprise 5 and runs TORQUE resource manager and MOAB scheduler. It has a theoretical peak performance of 5.45Tflops (or 5.45 trillion floating point operations per second). The cluster is built for running large-scale distributed-memory multiprocessing with message passing interface as well as for running large numbers of independent jobs simultaneously. The Argon cluster was bought by UALR Computer Science in 2008 with National Science Foundation Grants CNS-0619069 and EPS-0701890.

The core also has remote access to a shared memory machine by HP (Erbium). It was the most tightly integrated stand-alone computer in the world in November 2012 and is the perfect solution for problems involving very large matrices, databases or datasets. It consists of 80 processors, 4TB memory and 2TB storage. Erbium is equipped with many applications (MATLAB, Maple, R, Bowtie, Tophat, Cufflinks, fastX-toolkit, High-Performance Linpack (HPL), Octave, Gaussian G03 and G09, VASP,COMSOL, FDTD, Hadoop) and useful libraries (Intel MKL, ATLAS, GotoBLAS, Boost, Samtools, TBB, CNC, Armadillo, GSL, GMP, FFTW). Installing new software is possible.

The core also has oversight of 200TB of NAS data storage for the CTPR. The storage system was purchased through Dell and the rack is housed in the IT department.

Desktop computers include: Dell Precision Tower 3500 (Microsoft Windows 7 Enterprise, OS type 64-bit, 12 GB RAM, 1TB storage, Intel Xeon processor), MiniTower (CentOS 6.0, 128 GB RAM, OS type 64-bit, 10TB storage, 24 Intel Xeon processor with hyperthreading enabled [48 cores] in total), and Dell Precision Tower 7810 (Ubuntu 14.04, 64 GB RAM, OS type 64-bit, 2 TB storage, 12 Intel Xeon processor with hyperthreading enabled [24 cores] in total).

Office: The Bioinformatics Core is housed in an office pod with ~500 ft^2 on the 2nd floor of the ACRI Research Building in immediate proximity to the Proteomics and Genomics Cores. There is desk space for all personnel.

Other: ACHRI provides accounting, purchasing and secretarial support for the core facility. Printing and copying equipment and a conference room with audiovisual and videoconferencing equipment are available.

EQUIPMENT

The Center for Translational Pediatric Research (CTPR) at the Arkansas Children's Research Institute seeks to investigate how pediatric diseases develop from a systems biology and mechanistic approach, with the ultimate goal of identifying the intersections of disease and development, which will produce targets for therapeutic intervention and the development of new treatments. By applying a systems biology approach to the study of pediatric diseases, the CTPR hopes to expand existing knowledge of pediatric disease development and contribute to new therapeutic targets. The long term goal of the CTPR is to build an innovative, multi-disciplinary pediatric research center that utilizes cutting-edge systems biology technologies and state-of-the-art translational research to study pediatric diseases. The CTPR is a Center for Biomedical Research Excellence funded through the NIH IDeA program (P20GM121293; 07/11/2017-06/30/2022). The CTPR and Arkansas Children's Research Institute have a partnership with the University of Arkansas for Medical Sciences for this center. The CTPR offers three state-of-the-art core facilities available to center members: Proteomics, Genomics, and Bioinformatics Cores.

Proteomics Core

Mass Spectrometry and Liquid Chromatography

The Proteomics Core maintains and operates one Thermo Fusion Lumos mass spectrometer with ETD, two Thermo Orbitrap Fusion Tribrid mass spectrometers, and one Thermo LTQ Orbitrap Velos mass spectrometer. Mass spectrometers are interfaced with Waters nanoAcquity Ultra Performance Liquid Chromatography (UPLC) systems and powered by two Toshiba 4200FA uninterruptible power systems. For offline sample fractionation, the core maintains a Thermo UltiMate 3000 binary analytical liquid chromatography system with fraction collector and UV detector.

Sample Preparation and Storage

The Proteomics Core has the equipment necessary to prepare and store protein samples for mass spectrometric analysis, including a sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) apparatus, power supplies, incubators, microcentrifuges, sonicators, speedvac, and −20˚C and −80˚C freezers.

Data Storage and Analysis

The Proteomics Core has exclusive access to 200 TB of NAS data storage. The Proteomics Core lab houses six Dell Precision workstations with 128 GB RAM and solid-state hard drives to run an in-house Mascot Server (Matrix Science), MaxQuant (Max Planck Institute), PEAKS (Bioinformatics Solutions), and Scaffold Q+S, PTM, and perSPECtives (Proteome Software).

Genomics Core

Major equipment located at the Genomics Core includes an Illumina NextSeq 500, HiSeq 3000 (access provided though UAMS Cancer Institute), advanced analytical fragment analyzer, BeadStation 500G Genotyping System with Infinium hardware and software upgrade, Illumina Tecan Freedom Evo Robotic workstation, ABI PRISM 7900HT Fast Real-Time PCR System, ABI 3130xl. Genetic Analyzer, MJR Dual Thermal Cycler, Beckman Allegra centrifuges (2), Eppendorf gradient thermal cycler, Hermle Z400K Centrifuge with microplate holders, Eppendorf Microfuges, Eppendorf spectrophotometer, Level II BSCs (3), Isotemp waterbaths, −80°C freezers (2), −20°C freezers (4), 4 refrigerators, and Pentium 4 computers (x3) and an assortment of small equipment.

Bioinformatics Core

The core houses a PowerStation GX2, which contains 16 2.0GHz E5-2600 Cloud Ready processor cores, 64GB of memory, 8TB of RAID5 storage and CentOS 64-bit operating system.

The core has priority remote access to a computer cluster housed in the UAMS Bioinformatics Department. The system has a Dell R730 chassis, 1 login/management node and 4 computer nodes. Each node has Twin Intel Xeon 2680 processors, 2.5 GHz 12 core (24 total cores), 128 GB memory, 2133 MT/s, mirrored 200 GB SSD OS drives, 10x 960 GB SSD read intensive with hardware RAID controllers (scratch drives, 7 TB), and quad port Intel X710 10 Gb/s network card. The computer node has 2x NVidia Tesla K40M GPUs each with 2880 stream cores, 12 GB GDDR5 memory, rated for 1.45 Tflops DP or 4.29 Tflops SP floating point. The login/management node has single intel Xeon 2650 2.3 GHz 10 core processor, 64 GB memory 2133 MT/s, mirrored 300 GB 10k

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