

CORE FACILITIES at UNC

Summer | 2019

Research Cores Newsletter

FROM THE OFFICE OF RESEARCH TECHNOLOGIES

Biomedical Research Cores – Backbone of the Research Enterprise

The complexity of the UNC biomedical research cores environment and infrastructure is important, impressive, and integral to the success of the research enterprise. From small core labs offering one specific analytical service to large cores offering fifty different assays, each core plays its part in helping to make UNC a highly-ranked, research-focused and well-funded institution.

As part of the School of Medicine five-year strategic plan, additional funds have been made available to the Office of Research Technologies to invest in core infrastructure and operations. By focusing on continuous improvement of the “customer experience”, financial stability through operational excellence, cutting-edge technology, hiring the best scientists and rigorous and reproducible research, UNC cores will continue to drive new breakthroughs and exciting science in the coming years.

A new initiative is underway to provide bioinformatics support to our basic science programs. Plans are coming together to stand up a new bioinformatics core to provide personalized service, seamless production, training and data analysis for SOM projects requiring bioinformatics expertise (services to include consultation, analysis of -omics data, interpretation of data sets, and application development).

UNC biomedical research cores will continue to serve as the backbone of the research enterprise through growth, adaptation and acquisition of necessary technologies. We are proud to serve the UNC research community!



UNC
SCHOOL OF MEDICINE

Office of Research Technologies

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For more information on UNC Cores and the Office of Research Technologies, please visit our website:

www.med.unc.edu/corefacilities



- Animal Metabolism Phenotyping
- Animal Models Core
- Animal Histopathology & Lab Medicine
- Animal Studies Core Facility
- Animal Surgery Core Lab
- Biobehavioral Laboratory
- Biomarker Mass Spectrometry
- Biomolecular NMR Lab
- Biospecimen Processing Facility
- BRIC Human Imaging
- BRIC Small Animal Imaging
- Center for Bioinformatics
- CFAR HIV/STD Laboratory
- CGIBD Advanced Analytics
- CH Analytical & Nanofabrication Lab
- Chemistry Mass Spectrometry
- Cryo Electron Microscopy
- Cytokine Analysis Facility
- Flow Cytometry Core Facility
- Functional Genomics Core
- High Throughput Genomic Sequencing
- High Throughput Peptide Synthesis
- Histology Research Core Facility
- Hooker Imaging Core
- Human Pluripotent Stem Cell Fac.
- Macromolecular Crystallography
- Macromolecular Interactions Fac.
- Mammalian Genotyping Core
- Mass Cytometry
- MH Proteomics Center
- Microscopy Services Laboratory
- Mouse Behavioral Phenotyping
- Nanomedicines Characterization
- Neuroscience Ctr Microscopy Core
- RL Juliano Structural Bioinformatics
- Systems Genetics Core
- Tissue Culture Facility
- Tissue Procurement Facility
- Translational Pathology Lab.
- UNC CFAR Clinical Pharmacology
- UNC Microbiome Core Facility
- UNC RNAi Screening Fac
- Vector Core
- Vironomics Core
- Zebrafish Aquaculture Core

Continuous Improvement in UNC Core Facilities

UNC School of Medicine Cores had a banner year. Many continuous improvement initiatives have been put in place to ensure that core directors, staff and customers are successful:

- Quarterly Core Director Meetings with training, policy discussions, and hands-on workshops
- Quarterly Newsletters for core directors and managers
- Strength, Weakness, Opportunity, Threat (SWOT) analysis trainings
- Customer service and communication trainings
- Training on Rigor and Reproducibility in core labs
- 2 day Business Skills Workshop with professional trainers
- Formal orientations for new core directors
- Process mapping workshops
- Visual Control Boards (VCBs)
- New equipment in multiple cores
- Ongoing iLab implementations – 20 cores live on iLab

RIGOR AND REPRODUCIBILITY IN CORE FACILITIES

UNC Core facilities provide rigor and reproducibility content

“Scientific rigor is the strict application of the scientific method to ensure unbiased and well-controlled experimental design, methodology, analysis, interpretation and reporting of results.” (Excerpt from NIH website)

NIH grant and award applications are now required to address the rigor and transparency requirements outlined in the application instructions. Research Performance Progress Reports (RPPR) must also emphasize rigorous approaches to ensure robust and unbiased results.

To assist investigators complete the rigor and reproducibility (R&R) component of grant applications, the Office of Research Technologies is partnering with core facilities to incorporate R&R information and resources on their websites to provide the necessary data for investigators on best practices to assure rigor and transparency in all research performed in UNC core facilities.

Information will include eight steps to rigorous and reproducible experiments in biomolecular research at UNC, and will also address the areas below that are applicable to that core:

- ⇒ Appropriate core contact for consultation during planning
- ⇒ Listing of important controls and standards to be included in each experiment
- ⇒ Reagent and other relevant materials validation that must be referenced in the resource authentication plan
- ⇒ Core protocols including sample preparation tips
- ⇒ Information on any training programs provided by the core to ensure users are properly trained on core technologies
- ⇒ Equipment service maintenance, calibration and QC schedules,
- ⇒ Links to required acknowledgements

Look for new Rigor and Reproducibility links on core websites this fall.

SELECTED CORE FACILITY ADVOCACY COMMITTEE (CFAC) EQUIPMENT AWARDS FY19

[High Throughput Peptide Synthesis and Array Core Facility](#): Automated microwave peptide synthesizer - fully automated synthesis of long peptides, complex peptides, and peptides having multiple post-translational modifications or unnatural amino acids.

[Michael Hooker Proteomics Center](#): ZipChip capillary electrophoresis - microfluidic technology that prepares and separates a wide range of biological samples from different matrices.

[UNC Microbiome Core Facility](#): Ion Chef System - automated library preparation, template preparation, and chip loading to the GeneStudio system.

CORE HIGHLIGHT

Animal Models Core

The [Animal Models Core](#) (AMC) offers a full range of CRISPR/Cas9 services for genome editing in mice, rats and cell lines. AMC was an early adapter of the CRISPR system in 2013, and has completed over 150 CRISPR projects to date,

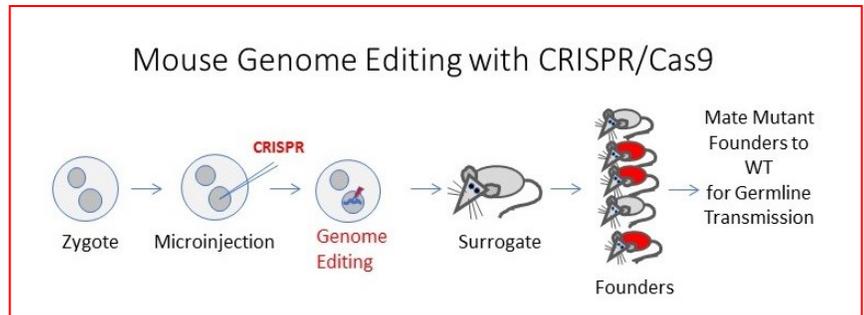
The CRISPR system has revolutionized the production of genetically modified rodent models, having several advantages over previous technologies for genome editing in mice and rats: CRISPR genome editing can be performed by delivering CRISPR reagents directly into embryos, CRISPR-mediated genome editing does not require a selectable marker, and the system is very efficient.

The AMC recently received funding from the Core Facilities Advocacy Committee to obtain a NEPA21 Electro-Kinetic Transfection System for embryo electroporation. CRISPR genome editing has historically been performed by microinjection of CRISPR reagents in mouse and rat embryos. Embryo microinjection is

highly technical and time consuming, requiring tremendous skill to minimize damage to the embryos while delivering the CRISPR reagents. Additionally, embryos from some mouse and rat strains are extremely sensitive to microinjection-induced damage, making genome editing difficult in those strains. The NEPA21 unit allows introduction of CRISPR reagents by electroporation. Multiple embryos can be electroporated simultaneously, dramatically reducing time requirements for reagent delivery. Electroporation is also less damaging than microinjection, allowing better embryo survival rates and facilitating genome editing in sensitive strains. Electroporation technology is currently used for production of knockouts, multiple gene deletions and small insertion mutations. The availability of this technology has increased core throughput and flexibility.

Microscopy Services Lab

The [Microscopy Services Lab](#) (MSL) will be adding a spinning disk confocal microscope to their instrumentation lineup this fall. The used scope, donated by Dr. Anne Taylor, Department of Biomedical Engineering (BME), will be upgraded with a new workstation and a Tokai Hit stage top incubator. This is a unique opportunity to make available this technology to all UNC researchers. The spinning disk confocal microscope is ideally suited for imaging live cells and small embryos with high speed, low bleaching, low photodamage and optical sectioning. It is also well suited to tiling and stitching images of large, thin (<50um) tissue slices, much faster than a laser scanning confocal. The scope will enable the study of molecular and organelle dynamics in live cells with optical sectioning, higher speed and greater sensitivity than a laser scanning confocal. Many thanks to Dr. Taylor and Dr. Albritton of BME for placing the scope in an open core facility, thereby providing access to all UNC researchers.



Core Facilities Website Updates

The Core Facilities website houses a searchable database of UNC Biomedical Cores, listings of cores by categories, as well as news and updates on the cores.

Recent additions to the site include expanded search functionality of the core facility database, "Cores in the Spotlight" section, and a RSS PubMed feed of publications citing our cores.

Check it all out at:

www.med.unc.edu/corefacilities

WELCOME NEW CORE DIRECTORS

Rachel Lynch, Ph.D, took over leadership of the [Systems Genetics Core Facility](#) on July 1st.



In her previous faculty position at Texas A&M University, Lynch was the inaugural director of their Pre-Clinical Research Core. She earned her PhD at the University of Tennessee and completed post-doctoral training in genetics at North Carolina State University and later at Texas A&M. From her work in the TAMU Pre-Clinical Research Core, she gained extensive experience in mouse colony maintenance, mouse model development and mouse models, including the breeding and utilization of the Collaborative Cross (CC) mouse population.

The Systems Genetics Core Facility (SGCF) maintains and distributes mouse strains and genotype information from the Collaborative Cross (CC) project. The CC is a multi-parent panel of recombinant inbred (RI) mouse strains specifically designed to act as an optimal murine model of heterogeneous human populations.

The SGCF is currently rederiving the CC strains into a cleaner barrier facility and providing updated genetic information. The SGCF also provides customizable services, including recombinant inbred crosses (RIX) and F2 populations from CC strains, and QTL mapping consultations.



Joshua Strauss, Ph.D., Director of the new [Cryo-Electron Microscopy \(cryoEM\) Core Facility](#), has over 10

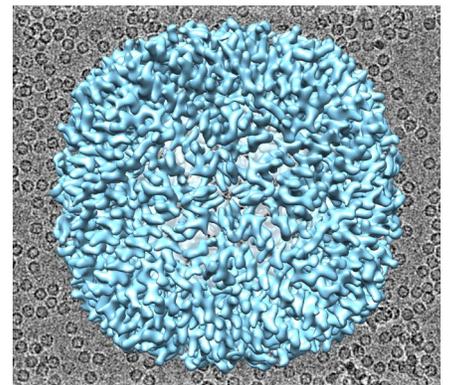


years of research experience in cryo-electron microscopy, and is interested in structural characterization of viruses, cells and dynamic macromolecular complexes using three-dimensional electron microscopy. He earned his Ph.D. in Structural and Cellular Biology at the University of Albany, State University of New York, in the field of single-particle cryoEM, then completed a postdoctoral fellowship at Emory University, School of Medicine, where he used cryo-electron tomography and subvolume averaging to study the structure of human cells and viruses including HIV and Measles.

Before joining UNC, Strauss was a staff scientist at the CryoEM core at the National Institute of Environmental Health Sciences.

“As Director of the CryoEM Facility, I am committed to providing researchers at UNC Chapel Hill with the resources, training, and technical assistance required to do high-resolution cryoEM experiments.”

The centerpiece of the CryoEM Core Facility includes a 200 Kv Thermo Fisher Scientific Talos Arctica G3 TEM and Gatan K3 direct electron detector. The Cryo-EM Core is located on the lower floor of the Glaxo Building, Room 008. Setup of instrumentation, standards, and image pipelines is currently in process. Expect the facility to open later this fall, and the Cryo-EM website coming soon!



structure of apoferritin at 3.5 Angstrom resolution using the microscope