UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE

Center For Innovative Biomedical Resources

Fall 2022

CENTER FOR INNOVATIVE BIOMEDICAL RESOURCES

TABLE OF CONTENTS

*Resource Labs included in this booklet are in alphabetical order.

In addition to those listed, information on additional resource labs may be found at www.medschool.umaryland.edu/CIBR

CENTER FOR INNOVATIVE BIOMEDICAL RESOURCES

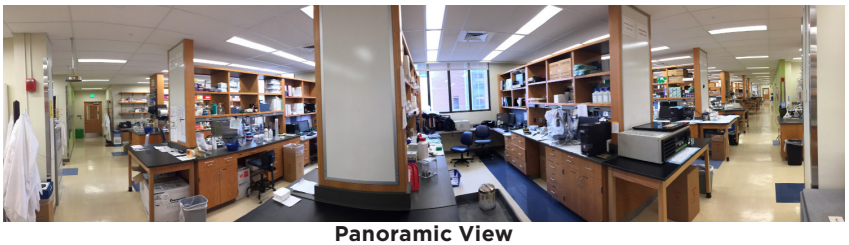
Services • Instrumentation • Supplies • Expertise

MISSION

To provide specialized expertise, cutting-edge technologies and sophisticated scientific resources that support a robust basic, clinical, translational, and population science biomedical research environment.

ABOUT CIBR

The University of Maryland School of Medicine's (UMSOM) Center for Innovative Biomedical Resources (CIBR) is the organizational framework for all UMSOM biomedical core resources. CIBR serves as a center of excellence for state-of-the-art technologies, high-tech instrumentation, and expertise that supports biomedical research, clinical practice and health care. Physical consolidation of many core facilities in common space creates a dynamic environment that will enhance and stimulate high impact research through a trans-disciplinary approach.



Panoramic View
Bressler 7 Open Lab

CIBR's Mission

- Provide the broadest array of core services to support a successful biomedical research environment
- Facilitate access to state-of-the-art technologies necessary to catalyze high-impact science and support new research grants
- Provide a centralized management structure to optimize quality control, efficiencies and cost-effectiveness, marketing, customer support and financial management
- Operate core laboratories with directors and staff who are experts in these disciplines
- Foster a collaborative, interdisciplinary research environment

CORES

STRUCTURAL BIOLOGY FACILITIES
- Biosensor Facility
- NMR Facility

NUCLEIC ACID AND GENOMIC FACILITIES
- Genomics Core Facility
- Cytogenetics Facility
- Maryland Genomics
- Translational Genomics Lab
- Pediatric Biochemical Genetics Lab

IMAGING TECHNOLOGIES
- Center for Translational Research in Imaging (CTRIM)
- Confocal Microscopy Facility
- Electron Microscopy Facility

CYTOMETRIC AND BIOASSAY FACILITIES
- Cytokine Laboratory
- Flow Cytometry Facility
  - Center for Vaccine Development Laboratory
  - Greenebaum Comprehensive Cancer Center Shared Service
- µQUANT Facility

CLINICAL RESOURCE FACILITIES
- NICHD Brain and Tissue Bank for Developmental Disorders
- Pathology Biorepository Shared Service
- UMM Biorepository

ANIMAL MODEL RESOURCE FACILITIES
- Translational Core Laboratory
- Veterinary Services

BIOINFORMATICS AND STATISTICS RESOURCE FACILITIES
- Biostatistics
- Center for Health-Related Informatics and Bioimaging (CHIB)
- Clinical & Translational Research Informatics Centers
- Informatics Resource Center

BIOMEDICAL RESEARCH SUPPLY STORE (BIORESCO)

CENTER FOR INNOVATIVE BIOMEDICAL RESOURCES

BIOMEDICAL TECHNOLOGY SUPPORTING RESEARCH, HEALTHCARE AND EDUCATION

LOCATION

Many of the CIBR resources are located on the 7th floor of the Bressler Research Tower and on the 6th floor of Howard Hall and Health Sciences Facility I. Owing to their specific space and research requirements, some cores are located in other areas on campus.

Our main administrative office is located at:
Room 7-037, Bressler Research Building
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Baltimore, MD 21201
410-706-3339

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UMB BIOMEDICAL RESEARCH SUPPLY CORE (BIORESCO)

CIBR: Center for Innovative Biomedical Resources

Contact information:
freezer@som.umaryland.edu
410-706-0322
www.BIORESCO.org

For Participating Vendors, visit www.BIORESCO.org

Location and hours of operation:
Room 166, MSTF Atrium
9:00 am - 5:00 pm (Mon-Fri)
Closed on UMB holidays

MISSION

To conserve time, money, space and effort for the UMB, VA and BIOPARK researchers, by maintaining a central supply core facility, e-commerce web site and expediting service. BIORESCO operates as a non-profit, re-charge Service Center. BIORESCO enables scientists to "do science" instead of procurement and accounting. We endeavor to become a "one-stop shop" for researchers and their staff.

CORE SERVICES

All products purchased through BIORESCO are at the lowest possible prices and researchers pay no Shipping or Handling charges. BIORESCO web site hosts catalogs from over 40 Vendors. Customers can search and order from over 3.5 million discounted products.

In addition to our Core purpose as stated above, we also:

- Organize two large annual vendor shows with over 50 vendors and 1200 members from the research community
- Share data related to dangerous goods purchases with EHS, who can then track these products on campus to increase safety
- Create PUNCHOUT Portals for designing custom and configurable products to include Peptides, Oligos, CRISPRs etc.
- Free packing and shipping materials for all temperatures
- Dry ice for sale

BIOMEDICAL RESEARCH SUPPLY CORE (BIORESCO)

CIBR: Center for Innovative Biomedical Resources

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HIGHLIGHTS

Based on a 10 year analysis:

- **40 vendors; 3.5 Million** Products
- Average **savings from List — 27%**
- Savings in shipping and handling charges — **$16.1 million**
- Over **900 Grants served**
- Administrative Cost per purchase is approximately $4, far below the national average for a procurement purchase ($60) or P-card purchase ($20)
- We take the hassle out of replacements, backorders substitutions, cancellations and facilitate returns

Top Vendors:

- VWR
- Fisher Scientific
- Life Technologies
- Sigma
- Biorad
- Qiagen
- Cell Signaling
- R&D Systems
- Biolegend
- Promega
- Eppendorf

BIOSENSOR CORE FACILITY

CORE INSTRUMENTATION

Image courtesy of GE Healthcare

Biacore 3000

The Biacore 3000 is designed to study binding of macromolecules to each other, with the possibility of examining molecules as small as ~2 kDa. The instrument accepts a chip with 4 flow cells that can be used in pairs, to compare flow cell 2 with flow cell 1 and flow cell 4 with flow cell 3, or in a single set of 4, to compare flow cells 2, 3 and 4 each with flow cell 1. Software is designed to optimize curve fitting and calculation of kinetic and binding constants.

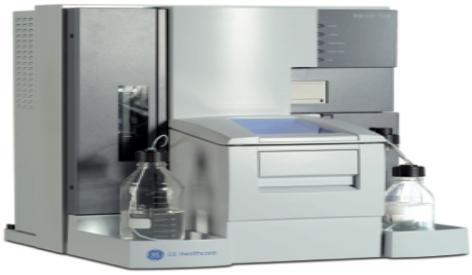


Image courtesy of GE Healthcare

Biacore T200

The Biacore T200 operates very similarly to the 3000 but it has a very stable baseline signal which allows it to be used to study the binding of small molecules as well as macromolecules. The instrument accepts a chip with 4 flow cells that can be used in pairs, to compare flow cell 2 with flow cell 1, or flow cell 4 with flow cell 3. The software has been adapted to facilitate kinetics studies in a single cycle, by introducing low to high concentrations over the surface of the chip without intervening wash or regeneration steps.

MISSION

The Biosensor Core Facility's objective is to provide the faculty, staff and students on the University of Maryland, Baltimore, with the latest technology for the quantitative study of binding reactions in real time, specifically with an approach that is versatile, highly sensitive, and "user friendly," with molecules that are label-free. The instruments we use for this purpose are from Biacore® (GE Healthcare).

CORE SERVICES

Biacore® instruments utilize the optical method of "surface plasmon resonance" (SPR), small changes in the interaction of monochromatic light with a metallic surface that occur when a protein or other molecule binds to that surface. Using the T200 or 3000, the core and its staff can provide accurate determinations of "on" and "off" rates for binding reactions, as well as determine affinity constants for binding. Because our instruments use SPR, many different kinds of binding reactions can be studied, often robotically, and a wide range of biological molecules can be examined, including proteins, nucleic acids, carbohydrates and lipids, as well as small molecules. Typical studies can:

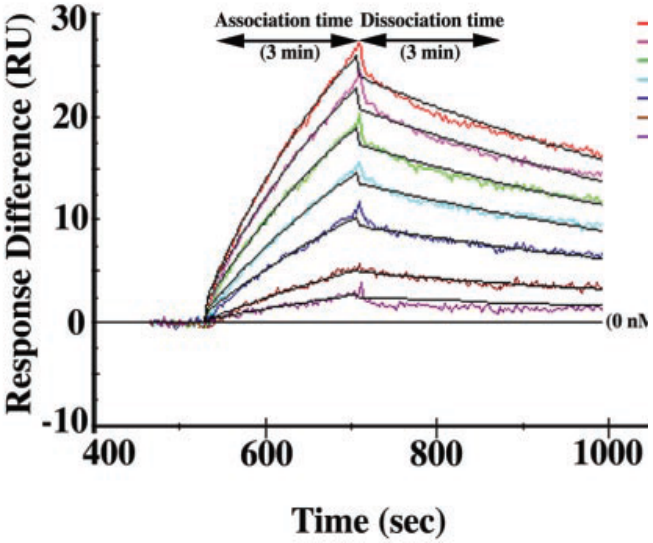
i. Determine if pairs of molecules bind to each other.

ii. Determine kinetic constants, binding constants, and specificity of binding.

iii. Determine if several molecules can bind simultaneously to the same ligand or if they compete for binding.

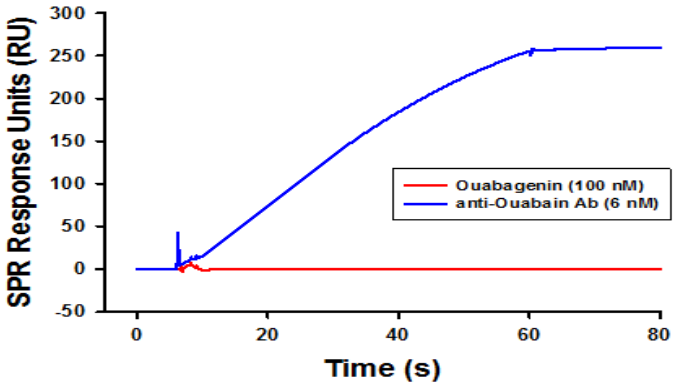
BIOSENSOR CORE FACILITY

Biacore 3000: Binding of Bacterially Expressed Fusion Proteins



Kontrogianni-Konstantopoulos A, Jones EM, Van Rossum DB, Bloch RJ. 2003. Obscurin is a ligand for small ankyrin 1 in skeletal muscle. Mol. Biol. Cell 14(3): 1138-1148.

Biacore T200: Binding of Antibody and of Small Molecule



Song H, Karashima E, Hamlyn JM, Blaustein MP. 2014. Ouabain-digoxin antagonism in rat arteries and neurones. J Physiol. 592(5): 941-69.

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Web Address
medschool.umaryland.edu/CIBR/biosensor

BIOSTATISTICS AND BIOINFORMATICS SHARED SERVICE

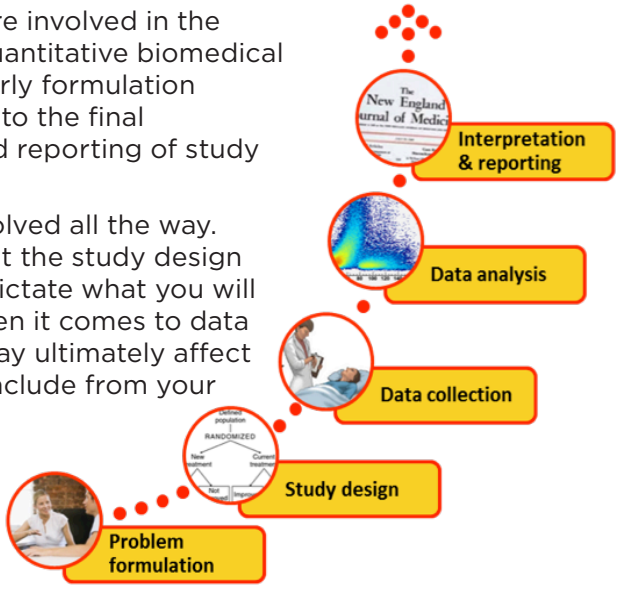
CIBR: Center for Innovative Biomedical Resources

Faculty and staff of the Biostatisctics and Bioinformatics Shared Service have expertise in many fields of 'traditional' biostatistics, including study/trial design and multivariable statistical modeling, but also in bioinformatics, high-dimensionality data sets, machine learning, supervised and unsupervised data analysis, mathematical modeling, simulations and much more! We perform statistical programming as needed. Major statistical software available includes SAS, R, Splus, SPSS, Stata, StatXact and PASS. We also develop customized computer programs for complex statistical problems.

HOW CAN WE HELP?

Biostatisticians are involved in the whole chain of quantitative biomedical research: from early formulation of research aims, to the final interpretation and reporting of study outcomes.

We like to be involved all the way. Decisions made at the study design stage will often dictate what you will be able to do when it comes to data analysis — and may ultimately affect what you can conclude from your study.



MISSION

Quantitative biomedical research is a team sport. The biostatistician brings a strong foundation in statistics, mathematics and computational methods, augmented by knowledge of the field of application and familiarity with biomedical concepts and terminology.

CORE SERVICES

We collaborate on all aspects of design, analysis, interpretation, and reporting of quantitative biomedical research, see left.

A FEW PRACTICAL NOTES

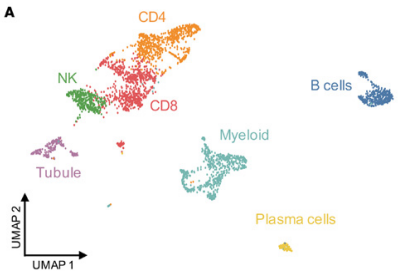
- Services are by appointment only; however, we do offer free office hours for quick questions (10-20 minutes on Tuesdays at Noon.
- We will try to link you up with a biostatistician who has domain expertise and/or relevant methodology expertise AND available time.
- It takes time to set up an appointment, to provide advice and to act on the advice — last-minute consultations may not produce optimal service and are discouraged.
- We do not provide individual tutoring as a substitute for proper biostatistics education (e.g., as part of a degree program).
- For input to a grant proposal and for significant input to a research project or a data analysis, the biostatistician should be included as a co-investigator.

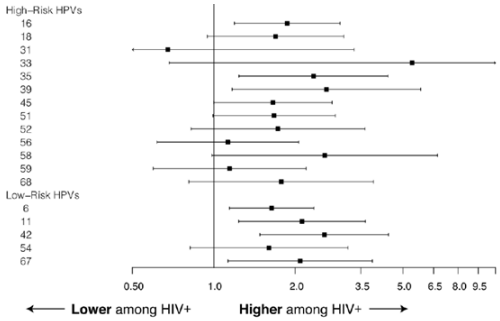
BIOSTATISTICS AND BIOINFORMATICS SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

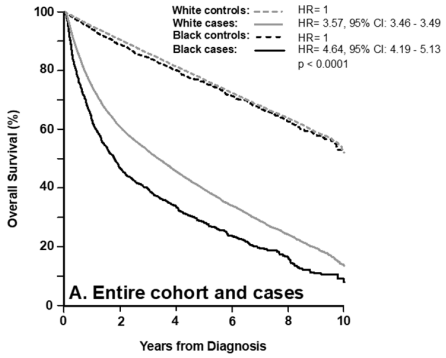
RESEARCH

Example 1. Uniform Manifold Approximation and projection (UMAP) plot of single-cell RNA-Seq of 24 renal biopsies of patients with active lupus nephritis. JCI Insight. 2020; 5(12): e138345.





Example 2. Prevalence Ratio (with 95% confidence interval) of Low-Risk and High-Risk HPV infection stratified by HIV status in men who have sex with men engaged in anal cancer screening in Abuja, Nigeria. Papillomavirus Res. 2020 Dec;10:100200. doi: 10.1016/j.pvr.2020.100200.



Example 3. Overall survival in 13,756 head and neck cancer survivors stratified by race with 27,512 matched-population controls from the SEER-Medicare linked database. Oncologist. 2021 Jul;26(7):579-587.

CONTACT

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CLINICAL & TRANSLATIONAL RESEARCH INFORMATICS CENTER (CTRIC)

CIBR: Center for Innovative Biomedical Resources

CORE SERVICES

Research Design: CTRIC staff is trained to make recommendations on appropriate study design, selection of suitable measures and variables, and data analytic strategies. CTRIC can also give assistance with power and sample size calculations.

Data Management: CTRIC maintains each project's relational database throughout the study including an IRB approved audit log of any data changes. Data can be prepared in tables in a readable format upon request, either at intervals during the study or at the end. Data reports, detailing enrollment, missing values, or other specifications can be created as needed.

Quality Assurance/Control: CTRIC staff can design a quality assurance plan specific to a researcher's study database and run regular reports to indicate improbable and impossible values in the database.

Data Analysis: CTRIC staff is available to provide a wide range of data analysis services, from *t*-tests and analysis of variance with repeated measures to complex regression analysis. CTRIC provides annotated documentation of the analysis results, ensuring clear understanding of both the statistical tests used and proper interpretation of the results; CTRIC can also prepare graphs and tables, as well as draft appropriate portions of the Results section for a manuscript or scientific poster.

MISSION

The purpose is to accelerate the translation of scientific discoveries from the basic science bench to clinical studies, bedside practice, and community intervention, through use of information technologies (IT) and informatics. CTRIC enables and advances research through various services which support clinical and translational research. CTRIC offers a variety of services to assist University of Maryland Baltimore faculty with their research needs at any stage in the process.

ABOUT CTRIC

CTRIC is a service center within the Department of Epidemiology and Public Health (EPH) in the University of Maryland's School of Medicine (UMSOM).

CTRIC supports clinical and translational researchers at all stages of project development. These services include: data capture; data management; custom database creation and data storage; quality assurance/control; data analysis; and research design.

COMMON TOOLS USED BY CTRIC

- REDCap®
- Microsoft Access®
- SQL Server®
- Manual keying of data is also an option

CLINICAL & TRANSLATIONAL RESEARCH INFORMATICS CENTER (CTRIC)

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

Data Capture

CTRIC employs a secure, web-based application for data capture which allows for real time data entry and validation, and audit trails. In addition, CRF's can be printed in order to allow for offline data collection. Any data collected on paper in offline mode will require manual entry with double keying to ensure data accuracy.

Database Creation and Data Storage

CTRIC can organize study data from across various locations and software packages into a cohesive, easy to use database, allowing the researcher to have ready access to any collected data. CTRIC can construct databases in a variety of different formats (SQL server, MySQL, Microsoft Access, etc.) based on the needs of the researcher. Databases can be created to accept ongoing data entry or for extraction of datasets from pre-existing databases. CTRIC offers secure, HIPAA compliant data storage.

Recent Publications

TYVAC Study Team. Safety and immunogenicity of a typhoid conjugate vaccine among children aged 9 months through 12 years in Malawi: results from a randomised, double-blind, controlled trial, (2022), The Lancet Global Health.

Lagos, RM, Ferreccio, C, Hormazábal, JC, Sikorski, M, Duarte, S, Higginson, E, Tennant, SM, Pasetti, M, Sztein, MB, Nkeze, J, Kasumba, IN, Blackwelder, WC, Cook, P, Fernandez, A, Dougan, G, Simon, R, and Lees, A, Tracy, JK, Daza, P, Mena, P, Yarmuch, J, Valenzuela, D, Thonet, G, Palacios, LG, Aguayo, G, Viñuela, E, and Levine, MM., Multisite Study of the Prevalence of Salmonella Typhi Carriers Among 2,307 Persons of Two Different Age Groups (≥55 and 18-34 Years) Undergoing Cholecystectomy in Santiago, Chile, 2017-2019. The Lancet. Available at SSRN: https://ssrn.com/abstract=4051455 or http://dx.doi.org/10.2139/ssrn.4051455

Swanberg JE, Vanderpool RC, Tracy JK (2020). Cancer-work management during active treatment: towards a conceptual framework. Cancer Causes Control. 2020 May;31(5):463-472. doi:10.1007/s10552-020-01285-1. Epub 2020 Mar 3. PMID: 32125547

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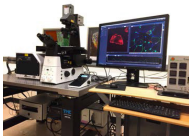
To Request Services or Consultation
research@som.umaryland.edu

CONFOCAL MICROSCOPY CORE FACILITY
DEPARTMENT OF PHYSIOLOGY

CORE INSTRUMENTATION

Nikon W1 Spinning Disk

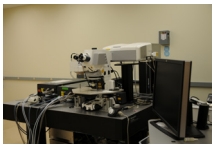


- Spinning disk confocal
- 7 laser lines for most dyes and fluorescent proteins
- Incubation chamber for live samples
- High speed acquisition, tiling, stitching, reconstructions
- TIRF Imaging
- DMD for photoactivation
- Live SR for super-resolution imaging
- FRET Imaging

Nikon A1 Laser Scanning Confocal

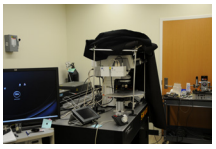
- Point scanning laser confocal
- 4 laser lines for blue, green, red, far red fluorophores
- 2 PMT, 2GaAsp PMT high sensitivity detectors
- Advanced tiling and stitching capabilities
- Automatic z focus tracking

Zeiss 710 NLO & Zeiss 7MP



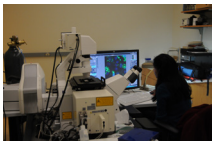
- Upright confocal microscope with single photon and multiphoton excitation capabilities for imaging live cells, slices and whole animals
- Excitation wavelengths 730 to 1300 nm; 2 PMT and 2 sensitive GaAsP detectors
- Provide ability to combine with other measurements (electrophysiology, etc.)

Zeiss 5Live



- Point-scanning and slit-scanning confocal microscope
- Fast acquisition frame rates for studying dynamic cellular processes at physiological temperatures
- Dual scan heads (5Live) allow simultaneous imaging and optical manipulation
- Excitation (488, 543, 560, 633)

Olympus LCV Incubated Microscope



- Widefield inverted microscope allowing continuous imaging of cells for hours or days
- Fluorescence and DIC imaging on multiple positions
- Cell migration, cell division, wounding and repair processes, phagocytosis

Zeiss LS7 Lightsheet Microscopy

- Lightsheet microscope for visualization of large 2d and 3d samples
- Six laser lines: 405, 445, 488, 514, 561, 638
- Illumination optics; 5x/0.1 foc, 10x/0.2 foc
- Detection objectives for clearing and water-based samples (2.5x, 5x, 10x, 20x)
- Water chamber with temperature control
- Mesoscale chamber (Translucence Biosystems)
- 2 PCO Edge sCMOS cameras
- Zeiss, Arivis, Imaris Bitplane analysis software

Imaris Bitplane

Bitplane is an advanced image analysis software for processing images. 3D renditions, display and quantification are readily executed. Some imaging suites are specialized for certain applications, e.g. neurofilament tracing. Other common processing routines are available. The confocal core operates a floating license server which allows easy operation of the software from the investigator's own computers.

MISSION

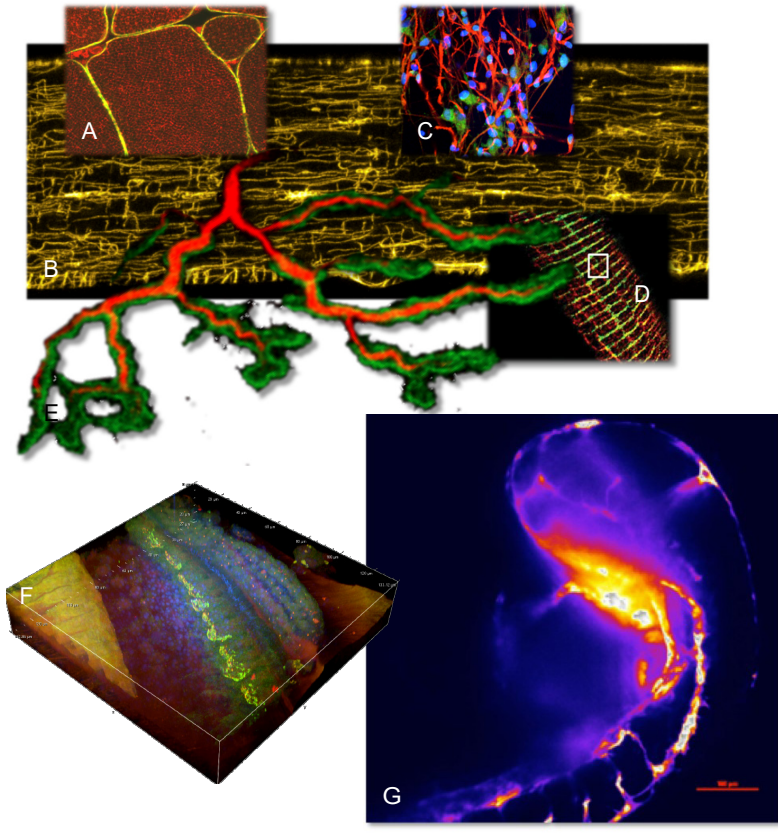
The Confocal Core's mission is to provide researchers with a wide array of state-of-the-art confocal imaging equipment to enable acquisition of high resolution images (both *in vivo* and *in vitro*). The Confocal Core offers training and assistance in the use of multiple confocal microscopes housed in our facility. Optimization of data acquisition and image processing are both part of the training, thus enabling researchers to efficiently design studies, acquire image data and extract relevant data features. The confocal facility is available to all UMB researchers and extramural users on a fee-for-service basis.

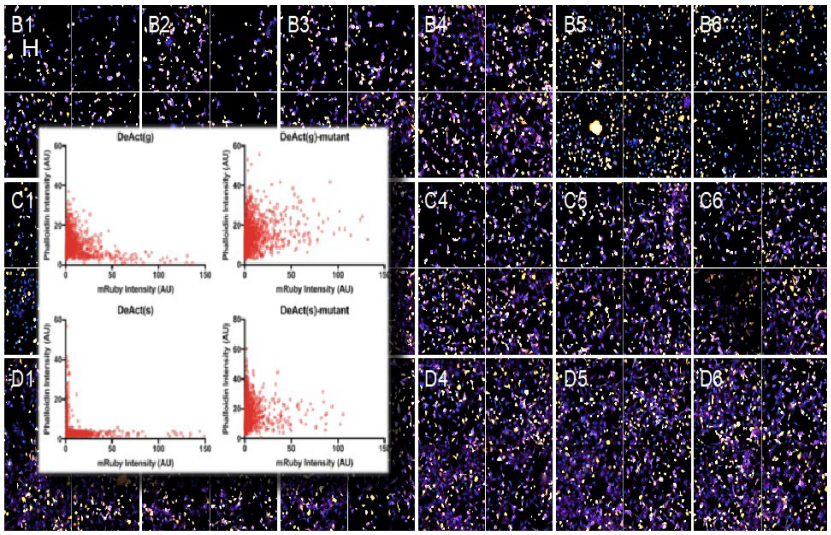
CORE SERVICES

The facility provides individual instruction on an array of confocal microscopes. The needs of the researcher are considered in choosing which microscope will best suit the experimental design. In general, imaging of fixed samples, cultured cells, organ slices and small animals can be accommodated. Imaging techniques including FRET, FRAP, photoactivation and uncaging are readily implemented. The microscopes have excitation sources that cover most fluorophores with excitation ranging from 355-633 nm. Multiphoton excitation of fluorophores is also available on select instruments. An image analysis workstation is available to users.

The Core also has a culture room with an incubator, culture hood and a widefield fluorescence microscope for use in preparation of cultured and live samples. Preparation of live animals for imaging experiments can also be performed in this newly renovated space.

CONFOCAL MICROSCOPY CORE FACILITY
DEPARTMENT OF PHYSIOLOGY





A-Bloch, B-Ward, C-Feldman, D-Bloch,
E-Lovering, F-Ahmed, G-Martin, H-Blanpied

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CORE FOR TRANSLATIONAL RESEARCH IN IMAGING @MARYLAND (C-TRIM)
PRE-CLINICAL IMAGING

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

Bruker BiospecAvance III 7 Tesla and 9.4 T Small Animal MRI Scanners

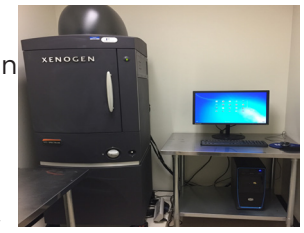
- High-resolution qualitative and quantitative assessment of structure and function for CNS and various body applications
- Multi-nuclear spectroscopy (H-1, C-13, Na-23, P-31, F-19 etc)
- High-resolution Diffusion Tensor Imaging for detecting microstructural and cellular changes
- Vascular studies, cerebral blood flow, cardiac function analysis
- H-1 MRI CryProbeTM 2 Element Array kit for mice on 9.4 T scanner which provides a remarkable SNR gain compared to regular MRI coils operating at room temperature

Siemens Inveon Small Animal PET- CT Imaging System

- Dockable PET-CT for combined anatomic and functional imaging
- High specificity radionuclide uptake
- Metabolic imaging
- High resolution system, (50 µm for CT and 1.2 mm for PET) with extended FOV

Xenogen IVIS Spectrum Optical *in vivo* imaging System

- Rapid whole-body optical images of mice, rats or rabbits
- Wide range of fluorescence excitation and emission filters
- Wide array of molecular biology assays including GFP and luciferase
- Measures proteasome activity, monitor tumor growth, drug efficacy



MISSION

To foster a collaborative environment that facilitates novel innovations in imaging and image guided therapeutics that can be translated to the clinic.

CORE SERVICES

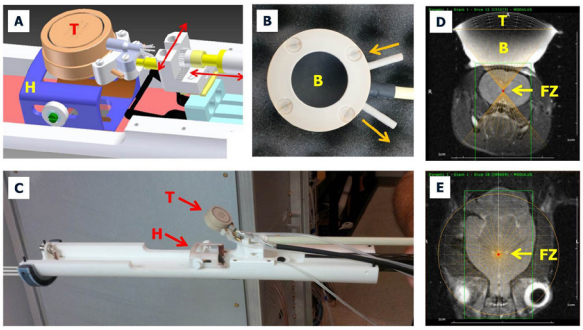
The staff of C-TRIM provides consultation on all imaging related research. Assistance is available for the design of experiments and to optimize imaging techniques. Image processing and analysis expertise is available within the core and training is provided upon request. The core also conducts an annual retreat where specific areas of research are highlighted. One aspect of the core is to develop new diagnostic imaging technologies and to develop image guided therapeutic interventions to remain at the state-of-the-art.

CORE FOR TRANSLATIONAL RESEARCH IN IMAGING @MARYLAND (C-TRIM)
PRE-CLINICAL IMAGING

CIBR: Center for Innovative Biomedical Resources

MRI-guided Focused Ultrasound (MRgFUS) System

- Integrated with MR for image guidance
- Tumor ablation studies, blood brain barrier disruption and neuromodulation



CORE APPLICATIONS INCLUDE

- High-resolution anatomic imaging for CNS and body applications (MR/CT)
- Tumor kinetics using receptor specific exogenous agents (MR/PET)
- Multi-nuclear MR spectroscopy (H-1, C-13, Na-23, P-31, F-19 etc.)
- Metabolomic studies (MR/PET)
- High-resolution Diffusion Tensor Imaging for detecting microstructural and cellular changes (MR)
- Vascular studies (CT/MRI)
- Cerebral blood flow studies using endogenous contrast (MR)
- Cardiac functional analysis (MR/PET/CT)
- Investigation of Blood-Brain Barrier disruption for various particle delivery (MR/MRgFUS)
- Neuromodulation using low energy ultrasound (MRgFUS)
- Ablative image guided surgery
- Focal image guided body and neuro thermal therapy applications. (MRgFUS)
- Bone density measurements (CT)
- Cardiac metabolism (MR/PET)
- Musculoskeletal studies (MR/CT)
- Detection of novel fluorophores (Xenogen)
- GFP and Luciferase imaging (Xenogen)
- Monitoring tumor growth (CT/MR/PET/Xenogen)

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CORE FOR TRANSLATIONAL RESEARCH IN IMAGING @MARYLAND (C-TRIM)

HUMAN IMAGING

CIBR: Center for Innovative Biomedical Resources

CORE EQUIPMENT

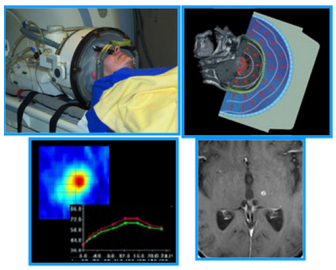
Siemens Prisma 3 Tesla Whole Body MRI System and Siemens PET/MRI 3 Tesla Biograph System

- Siemens Prisma^{fit} 3 Tesla whole body MRI System with high-speed gradients (XR 80/200)
- Siemens PET/MRI mMR Biograph system with MQ 44/200 gradients
- High-resolution anatomic imaging (~70-µm resolution) for CNS and body applications
- Tumor kinetics
- Metabolomic studies
- Fat/Water imaging and quantification
- High-resolution Diffusion Tensor and Diffusion Kurtosis Imaging for detecting microstructural and cellular changes
- Cardiac Functional Analysis and Vascular studies
- Cerebral blood flow studies using endogenous contrast
- Functional MRI and Resting state brain networks
- Interventional Imaging
- Metabolic studies using long half-life isotopes F-18 such as Fluoro deoxyglucose (FDG)
- Myocardial perfusion imaging using Rubidium-82 PET

GE SpinLab Dynamic Nuclear Polarizer

- Hyperpolarization of C-13 substrates (pyruvate, fumarate, glutamine etc) for detection *in vivo*
- Four sterile sample sizes up to 100 mL of 250 mM C-13 substrates for human applications
- Detection of downstream metabolic products *in vivo* in real-time
- Ability to determine metabolic fluxes, for example to determine aggressiveness of tumor
- Metabolic response to therapeutic drugs

MR guided Focused Ultrasound (MRgFUS)



- Insightec Neuro ExAblate system for neuro-interventions
- 1024 element high-intensity focused ultrasound (HIFU) system
- Ability to focus ultrasound beam within 2 mm radius
- MR temperature mapping to facilitate brain interventions
- Neuromodulation Studies
- Blood brain barrier opening for delivery of nanoparticles
- Translational studies

MISSION

To provide full-fledged access to research using Magnetic Resonance Imaging for humans and large animals to discover new imaging markers, understand brain function, and to translate basic science to the clinic.

Objective: To provide a collaborative environment to imaging researchers, that leads to innovation that can be rapidly translated to the clinic.

CORE SERVICES

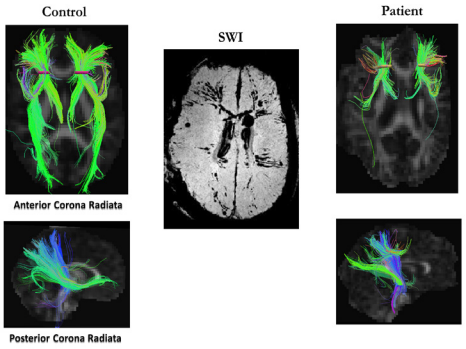
The staff of C-TRIM provides consultation on all imaging related research. Assistance is available for the design of experiments and to optimize imaging techniques. The staff also provides assistance in image processing and image analysis. Training is provided to users upon request. The core conducts an annual retreat where specific areas of imaging research are highlighted.

One aspect of the core is to develop new technologies with the goal of making available state-of-the-art techniques to investigators. Through this core, investigators have access to facilities at the Center for Metabolic Imaging & Therapeutics (CMIT).

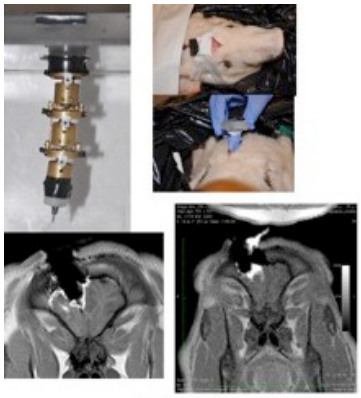
CORE FOR TRANSLATIONAL RESEARCH IN IMAGING @MARYLAND (C-TRIM)

HUMAN IMAGING

CIBR: Center for Innovative Biomedical Resources

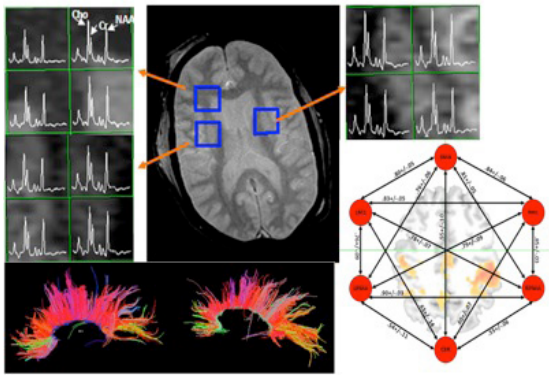


Significant disruption of anterior-posterior white matter tracts due to extensive micro-hemorrhage along the tracts



Ho et al., IEEE Trans Robot, 2011
Yang et al., Int J Rob Res, 2014

Minimally invasive neurosurgical intervention robot performing neurosurgery under image guidance



Anatomic, Biophysical, Biochemical & Functional Changes following TBI

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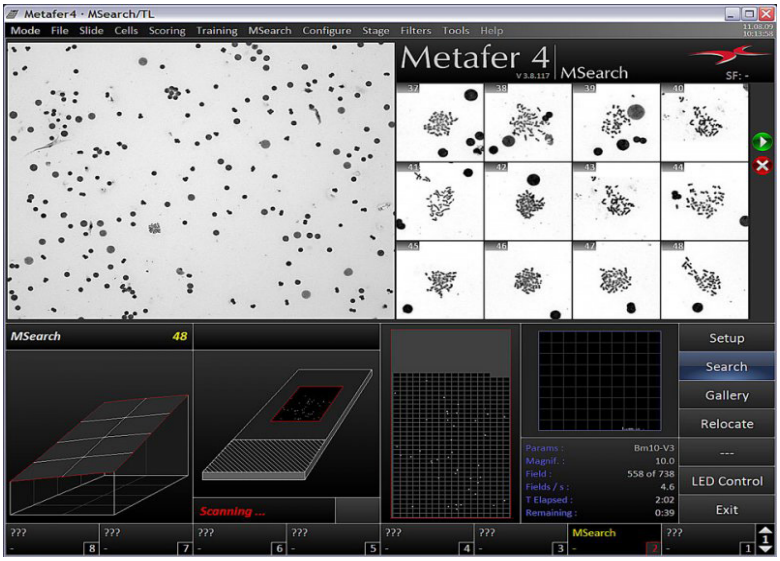
CYTOGENETICS LABORATORY

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

Automatic Interphase and Metaphase Finder

Metasystems Metafer Slide Scanner and Ikaros/Isis Analysis Software are powerful tools.



- Automatic export of high resolution images for analysis

Major equipment available:

- Metasystems Metafer Slide Scanner and Ikaros/ Isis Analysis Software
- Nikon TMS microscope w/Fluorescence
- Olympus AX-70 microscope
- Olympus BHSM microscope
- Olympus BX-41 microscope
- Olympus BX-41 w/Fluorescence
- Zeiss Axiophot microscope
- Zeiss Axioskop microscope

MISSION

Our laboratory offers cytogenetic and genomic diagnosis for both constitutional and acquired chromosome abnormalities. We focus on the detection and characterization of chromosome abnormalities in hematological malignancies.

CORE SERVICES

Our laboratory is a CLIA-certified and CAP-accredited facility that provides comprehensive cytogenetic diagnosis on multiple sample types including peripheral blood, bone marrow, fibroblasts and tissues. We also participate in clinical trial studies. The techniques used in the laboratory included karyotyping, fluorescence in situ hybridization (FISH), and SNP-microarray analyses. Our dedicated team includes an American Board of Medical Genetics and Genomics-certified clinical cytogeneticist and highly-experienced supervisors and technologists.

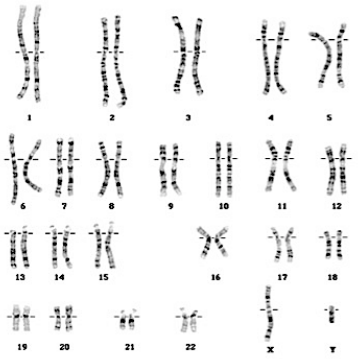
SERVICES OFFERED

- Chromosome Studies on multiple sample types including peripheral blood, bone marrow, fibroblasts and solid tissues (Karyotype).
- FISH testing
- Microarray analyses (Data analyses)

CYTOGENETICS LABORATORY

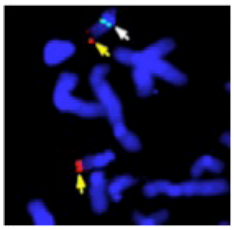
CIBR: Center for Innovative Biomedical Resources

Chromosome Studies (Karyotype)

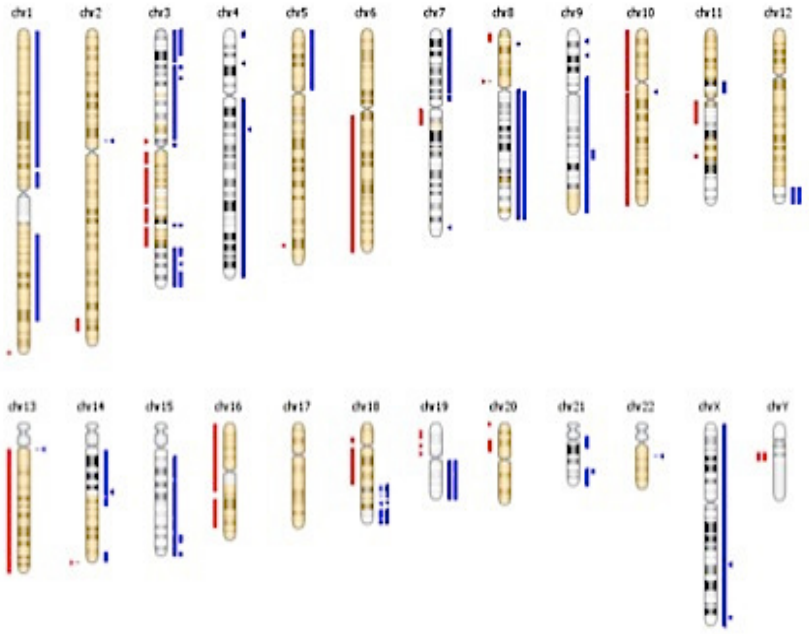


FISH Testing

- Whole chromosome painting
- Centromere probes
- Subtelomere probes
- Microdeletion probes
- Cancer probes
- Other locus-specific probes



Cytogenomic Microarray Analyses



Cytogenomic microarray analyses of a solid tumor revealed duplications (in blue lines), deletions (in red line) and CN-LOH regions (yellow in cytobands)

CONTACT

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CYTOKINE CORE LABORATORY

CIBR: Center for Innovative Biomedical Resources

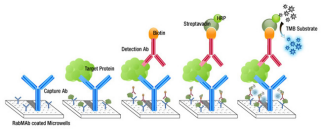
CORE INSTRUMENTATION

Luminex™ MagPix System

This system allows for the simultaneous measurement of up to 50 analytes in a single well using mangetic beads. The MagPix System uses a magnetic force to excite the beads and a CCD camera to detect the beads of each analyte.

Molecular Dynamics Precision Microplate Reader

The reader is used for all ELISA applications. It has 8 filters with the ability to change to others as required to read plates at multiple wavelengths. It reads 96-well plates in a matter of seconds and paired with the SoftMax Pro software it becomes a powerful machine to cover all ELISA needs.



BioTek ELx50 Plate Washer

BioTek's ELx50 Microplate Washer is a fully programmable instrument that allows for full control of plate washing required for ELISA assays. Automated plate washers allows for higher throughput and for lower CV%'s over standard manual washing.

MISSION

The UM SOM Cytokine Core Laboratory (CCL) is an academic-based, fee-for-service laboratory dedicated to providing a high-quality, low-cost cytokine, chemokine and growth factor measurement service for both intramural and extramural investigators.

CORE SERVICES

The CCL offers an extensive list of human, mouse, and rat cytokine, chemokine and growth factor assays. We offer two assay platforms, ELISAs and Multiplex. Both platforms have their own unique advantages and disadvantages.

The lab offers in-house ELISA protocols utilizing validated commercial reagents and have the ability to order commercial kits for those less common biomarkers. Using in-house protocols allows us to greatly reduce costs while still upholding high standards in quality.

We utilize a Luminex™ MagPix System for our multi analyte assays using high quality fully customizable commercial kits from the country's leading vendors in multiplex technology.

The CCL is here for every investigator from beginning to end. We are happy to help with experimental design all the way through to data interpretation.

Our turnaround time is approximately 10 business days, and data are emailed to the investigator in a user-friendly Excel format.

Please contact us for sample volume requirements and pricing, or visit us at www.cytokines.com.

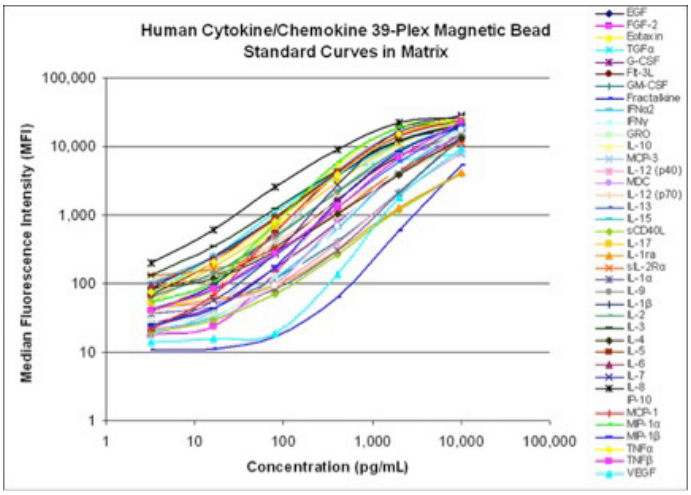
CYTOKINE CORE LABORATORY

CIBR: Center for Innovative Biomedical Resources

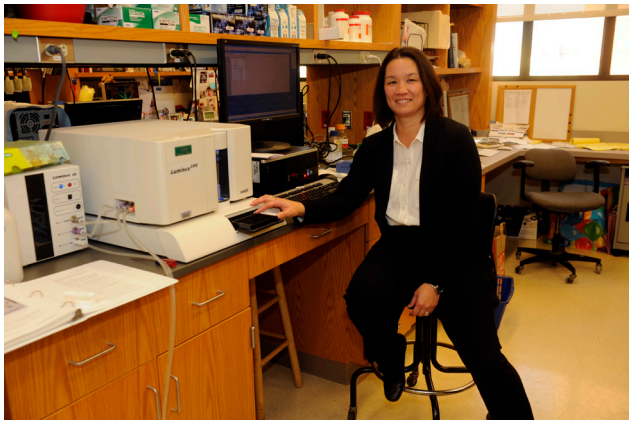
Results for both the ELISA and Multiplex can be customized to your needs. Results can include individual measurement results, means, standard deviations, and coefficient of variation.

If you are generating preliminary data, contact us to discuss our Pilot Development Program which allows for data for a smaller number of samples for one set price.

All of our assays are run with an internal control to ensure optimal assay function and every plate includes a 6- to 7- point standard curve.



Example of Multiplex Standard Curves



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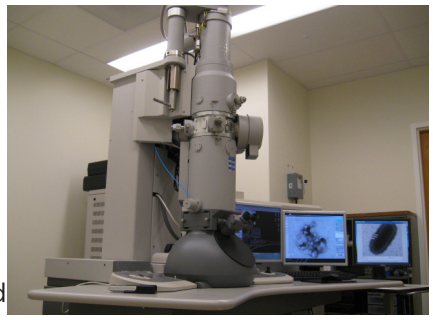
ELECTRON MICROSCOPY CORE IMAGING FACILITY

CIBR: Center for Innovative Biomedical Resources

INSTRUMENTATION

Transmission Electron Microscope

Thermo Fisher (FEI) Tecnai T12 TEM is used for imaging nanoparticles, exosomes, cell culture and tissue resin-sections at room temperature with an AMT camera. A Gatan 626 cryotransfer holder allows for the imaging of frozen hydrated thin sections or plunge-frozen samples at liquid nitrogen temperatures.



Scanning Electron Microscope

Thermo Fisher (FEI) Quanta 200 SEM is used for imaging the surfaces of nanoparticles, cell cultures, tissues and materials samples. It operates in three different vacuum modes to accommodate a wide range of sample types: High vacuum (HV), Low Vacuum (LV) and Environmental Mode (ESEM). A Gatan ALTO2100 cryo-transfer unit and cryostage allows for imaging of frozen samples as well as freeze fracture sample preparation.

- Keyence – All-in-one Fluorescence Microscope
- Zeiss Axioplan Fluorescent Microscope
- Dissection Microscopes
- Sputter Coater
- Critical Point Dryer
- Glow Discharge Unit
- Automated Specimen Processor - ASP01000
- Ultramicrotome
- Vibratome
- Glass Knife Maker
- High Pressure Freezer
- Automated Freeze Substitution Unit
- Plunge Freezer
- Cryo-ultramicrotome

MISSION

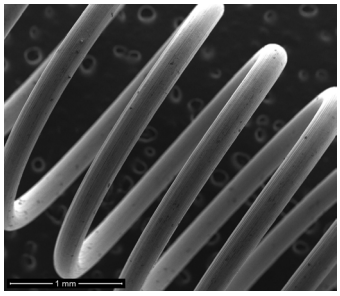
The Electron Microscopy Core Imaging Facility on the University of Maryland Baltimore downtown campus provides electron microscopy services such as experimental consultation, sample preparation and imaging to researchers from the University of Maryland campuses and regional academic and industry partners. We offer TEM and SEM training and imaging services along with sample processing equipment and assistance. Our highly skilled staff will work closely with you to plan and execute your research project.

CORE SERVICES

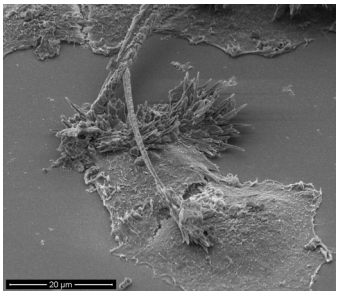
- Conventional TEM sample preparation (fixation through ultrathin sectioning and post-staining)
- Conventional SEM sample preparation (fixation, critical point drying and sputter coating)
- Electron microscope imaging services and training
- Immunogold labeling methods for protein localization
- Negative staining of exosomes, liposomes, bacteria, viruses, macromolecular complexes, nanoparticles and virus like particles (VLP)
- CryoEM
- CLEM – Correlative Light and Electron Microscopy
- Project consultation
- Training and use of EM related instrumentation and protocols

ELECTRON MICROSCOPY CORE IMAGING FACILITY

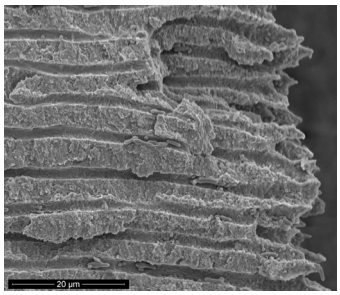
CIBR: Center for Innovative Biomedical Resources



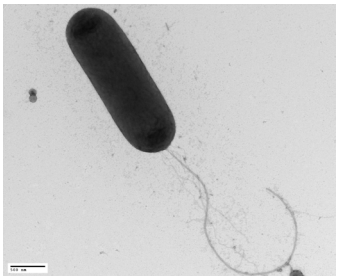
Cigarette Heating Coil



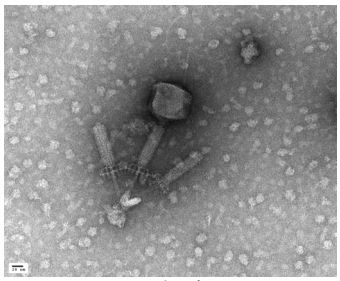
Chemically Induced HeLa Cells



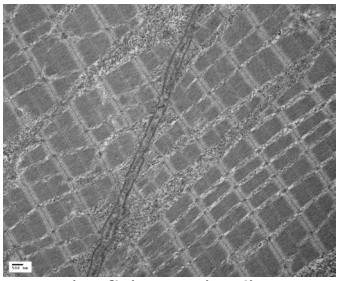
Tooth Apical Dentin Tubule with Bacteria



Bacteria with Flagella



Bacteriophage



Zebrafish Muscle Fibers

References

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Peinado, J. R., Chaplot, K., Jarvela, T. S., Barbieri, E. M., Shorter, J., and Lindberg, I. Sequestration of TDP-43 (216-414) aggregates by cytoplasmic expression of the proSAAS chaperone. ACS Chem Neurosci Jun 1;13(11):1651-1665 (2022).

Scheiber, A. L., Guess, A. J., Kaito, T., Abzug, J. M., Enomoto-Iwamoto, M., Leikin, S., Iwamoto, M., and Otsuru, S. Endoplasmic reticulum stress is induced in growth plate hypertrophic chondrocytes in G610C mouse model of osteogenesis imperfecta. Biochem. Biophys. Res. Commun. 509(1): 235–240 (2019).

Smith, E. M., Grassel, C. L., Papadimas, A., Foulke-Abel, J, and Barry, E. M. PLoS Negl Trop Dis Jul26;16(7):e0010638.

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FLOW CYTOMETRY AND MASS CYTOMETRY CORE (CVD)

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

BD LSR II Flow Cytometer

- **4 lasers**: 407, 488, 552, and 641 nm
- **16 parameters** (14 colors plus forward and side scatter)

Beckman Coulter MoFlo Astrios Cell Sorter

- **4 lasers**: 355, 407, 488, and 641 nm
- **21 parameters** (19 colors plus forward and side scatter)
- **Up to 6-way high speed sorting**
- **CyCLONE single cell sorting**

Fluidigm Helios Mass Cytometers (two instruments)

- **60 parameters** based on mass spectrometry detection of metal isotope-labeled antiboy staining
- No need for single color controls or fluorescence compensation

MISSION

To ensure that University of Maryland investigators have access to flow cytometry and mass cytometry services for their research. A facility with dedicated operators ensures well-performing instruments and optimal results with a minimal outlay of expenses. Established in 1991, this facility has state-of-the art equipment and a highly-trained and experienced staff.

CORE SERVICES

- **Multichromatic flow cytometry**

  Including markers for:
  - Lineage
  - Maturation
  - Activation
  - Homing
  - Intracellular cytokines

- **Cell sorting (up to 6-way)** based on GFP and/or multichromatic staining
- **Mass Cytometry (60 parameters)**
- Serum/supernatant cytokine levels using bead kits (e.g. BD Pharmingen CBA kit)
- Cell cycle analysis (PI, DAPI)
- Cell proliferation (CFSE, PCNA, BrdU and Ki67)
- Apoptosis (Annexin V vs. PI; TUNEL; subG0/G1 peak analysis)
- Green fluorescence protein (GFP) (eukaryotic and prokaryotic)
- **Advice with experimental design and data analysis**

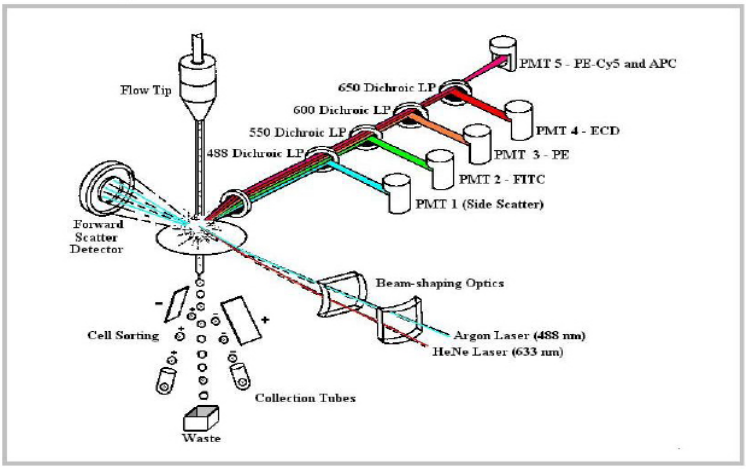
FLOW CYTOMETRY AND MASS CYTOMETRY CORE (CVD)

CIBR: Center for Innovative Biomedical Resources

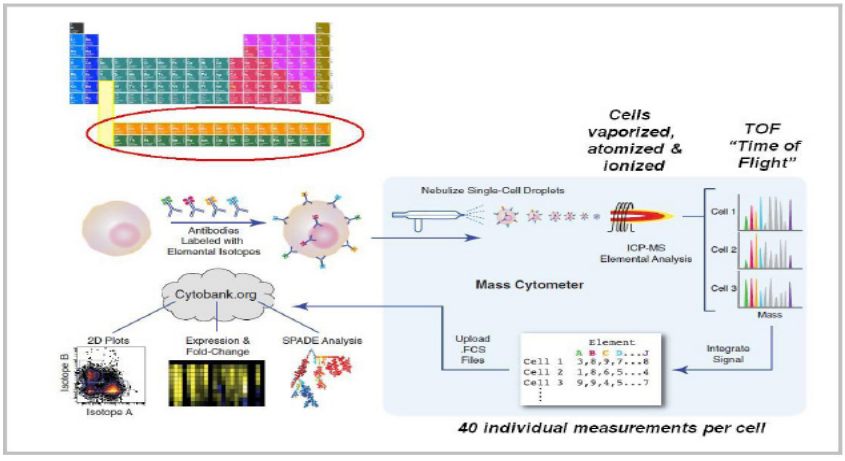
Principles of Flow Cytometry

Fluidics	• Cells in a single-cell suspension • Flow in a single file through
Optics	• An illuminated volume where they • Scatter light and emit fluorescence • That is filtered, collected and
Electronics	• Converted to digital values • That are stored on a computer • And put through software for analysis

Revised from Dr. Robert Murphy, Carnegie Mellon University, Pittsburgh, PA



Principles of Mass Cytometry



Bendall & Simonds *et al., Science* 332, 687 (2011) www.cytobank.org/nolanlab

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Regina Harley, MS
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Laboratory Policies
Experiments should preferably be scheduled one to two weeks in advance.

All sample analysis and cell sorting is done by Core Laboratory personnel.

The "Rules and Regulations" form (Revision March 10, 2015) is available at the CVD Flow Cytometry Core Laboratory.

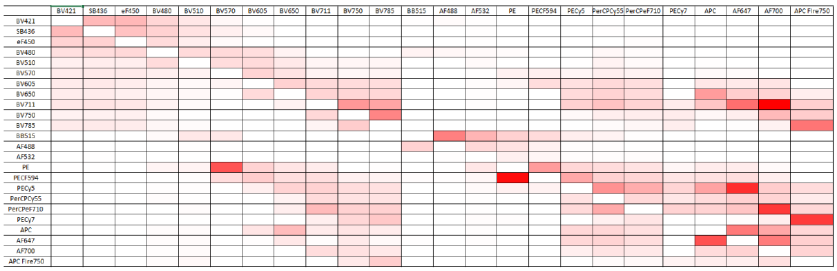
FLOW CYTOMETRY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

2 Cytek Aurora Spectral Cytometers

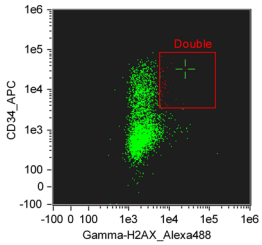
- 3 lasers: 488 nm, 405 nm, 640 nm; 23 colors
- 4 Lasers with 355 nm laser, 30 colors
- Ready to use panels provided
- Removes autofluorescence background
- Small particle detection: 100 nm range



Red represents the spillover from the dye in the row to the dye in column

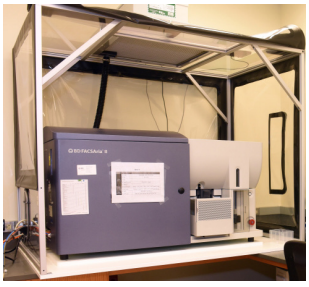
Amnis FlowSight Imaging Cytometer

- 4 lasers: 488 nm, 640 nm, 405 nm, 561 nm
- 10 colors
- 20X magnification
- Autosampler



BD Aria II Cell Sorter

- 4 lasers: 488 nm, 633 nm, 405 nm, 552 nm
- 11 colors
- 96-well single cell sorting, 4-way sorting, index sorting
- BSL-2 enhanced sorting inside of bioBUBBLE enclosure



MISSION

The University of Maryland Greenebaum Comprehensive Cancer Center Flow Cytometry Shared Service (FCSS) offers equipment and technical expertise to the entire campus, as well as outside clients in conducting research in all areas of basic and applied biomedical sciences.

CORE SERVICES

- Experimental design, troubleshooting, consultation and grant application
- Cell sorting performed by staff
- Monthly lecture covers basic knowledge, useful tools, and new development. Free and open to all.
- Hands on training on analyzers (LSR II, Canto II, Accuri C6, and FlowSight) Investigators are encouraged to use the analyzers independently.
- Training on analysis software

ONLINE BOOKING

https://cibr.umaryland.edu

FLOW CYTOMETRY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

Miltenyi MACSQuant Analyzer 10

- Clinical cytometer
- 3 lasers: 488 nm, 405 nm, 640 nm; 8 colors
- Compliance with FDA 21 CFR Part 11
- Express Modes automate the anaylsis

BD LSR II

- 4 lasers: 488 nm, 640 nm, 405 nm, 561 nm
- 13 colors

BD CANTO II

- 2 lasers: 488 nm, 640 nm
- 6 colors

BD Accuri C6

- 2 lasers: 488 nm, 640 nm
- 4 colors

ANALYSIS SOFTWARE

FCS Express 7 Site License
No charge for facility users.

FlowJo Dongles
PC and Mac dongles can be borrowed at no charge.

CONTACT

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UMGCCC Flow Core Staff

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Mikayla Trainor
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LOCATION

Room 7-022, Bressler Research Building
655 West Baltimore Street
Baltimore, MD 21201
410-706-2173
Fax: 410-328-6559

Web Address
medschool.umaryland.edu/CIBR/CORE/umgccc_flow

Email
XiaoxuanFan@som.umaryland.edu

GENERAL CLINICAL RESEARCH CENTER

CIBR: Center for Innovative Biomedical Resources

GCRC FACILITIES

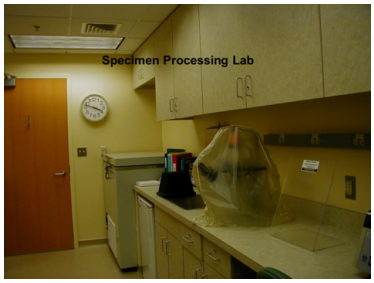
The GCRC is located in the University of Maryland Medical Center, South Hospital, occupying the C&D wings on the tenth floor.

Our flexible Inpatient/Outpatient facility on 10 South, C Wing includes:

- Five patient rooms - available for outpatient or inpatient visits up to double occupancy
- 24-hour nursing care available
- Nurses station with computer workstation/EPIC access
- Pyxis
- Specimen Processing Lab
- Procedure room
- Kitchen/Activities Lounge
- Countertop Refrigerated Centrifuge

Our Outpatient facility on 10 South, D Wing includes:

- Four outpatient exam rooms
- Large outpatient treatment area for up to 5 patients
- Upgraded equipment for monitoring Phase 1 and 2a clinical trials
- Nurses station with computer workstation/EPIC access
- Specimen Processing Lab
- Countertop Refrigerated Centrifuges
- Refrigerator, -20 and -70 freezer for temporary storage
- Reception and Waiting Areas



Other outpatient area assets include:

- DEXA (Duel Energy X-Ray Absorptiometry) Facility
- Countertop Refrigerated Centrifuges
- Temperature monitored refrigerators, -20 and -70 freezers
- Emergency equipment (UMMC crash carts)
- Class 2, Type A1 Biosafety Cabinet
- Microscopes
- Reception and Waiting Areas

MISSION

The General Clinical Research Center (GCRC) is the cornerstone for clinical research within the University of Maryland. The GCRC supports the full spectrum of patient-oriented research.

The GCRC is available to all University of Maryland investigators who have a need for Center resources and who will conduct clinical research of scientific merit. Studies funded by federal sources, foundations, industry and other sources are welcome. The GCRC welcomes pilot studies that may lead to future peer-reviewed clinical research.

The GCRC can provide investigators with the resources they need to conduct clinical research, including nursing support and the facilities for inpatient and outpatient data collection and patient care, as well as a state-of-the-art DEXA Facility.

GCRC Staff

The GCRC Nursing staff have the necessary education, certification and skills to provide quality research participant care. Staff training is an ongoing activity that assures all staff are competent to perform the skills required by GCRC Investigators. The Nursing staff is an integral part of the GCRC's Quality Assurance program to assure the highest standards of research conduct and documentation. All nursing staff are BLS certified, some are ACLS certified.

GENERAL CLINICAL RESEARCH CENTER

CIBR: Center for Innovative Biomedical Resources

CLINICAL SERVICES

Physical Examination and Monitoring
- 24-hour nursing care available
- Vital Signs, Weight, Height
- Serial BP Monitoring
- Intensive Physiologic Monitoring
- Pulse Oximetry
- Psychomotor/Cognitive Testing
- Activity Monitoring
- Intake/Output
- Anthropometry
- Doppler measurement

Subject Teaching
- Glucose Monitoring
- Medication Administration
- Protocol-specific Instructions

Specimen Collection/Processing
- Phlebotomy and IV Placement
- Centrifuge to collect serum, plasma, and buffy coat samples
- Multiple Specimen Aliquots
- Timed Serial Sampling including PK/PD samples
- Urine Pregnancy Tests
- 24-hour Urine Collection
- Blood Glucose Monitoring
- Hemoglobin

Investigational Drug Administration
- Certified Chemotherapy/Biologic Administration

Special Testing/Procedures
- IV and Oral Glucose Tolerance Test
- Blood Donation
- O2 Administration
- GFR Testing
- Skin Testing
- DEXA Scan (on-site)
- Chemotherapy Infusion
- 12 Lead Electrocardiogram
- Assistance with bone to bone marrow
- Anthropometric Measurements
- Bioelectrical Impedance Assessments (BIA)

Other Data Collection
- Questionnaire Administration

CONTACT

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LOCATION

General Clinical Research Center (GCRC)
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Baltimore, MD 21201

Web Addresses

www.medschool.umaryland.edu/gcrc/

www.umaryland.edu/ictr/

The GCRC is part of the UMB Institute for Clinical and Translational Research (ICTR)

INFORMATICS RESOURCE CENTER (IGS)

CIBR: Center for Innovative Biomedical Resources

The Informatics Resource Center (IRC) under the direction of Anup Mahurkar provides high-performance computing, software development, and custom bioinformatics services to the UMB campus. The IRC works under the overall guidance of Owen White, PhD, the Director of Bioinformatics for School of Medicine and the Associate Director of the Institute for Genome Sciences. IRC leadership also includes Michelle Gwinn Giglio, PhD, Associate Director for Analysis.

The IRC includes a staff of over 30 scientists, engineers, systems administrators, and analysts that work together to conduct research and development in bioinformatics and provide analysis services. The IRC staff is organized along scientific platforms and functional areas of expertise. Typically, biologists lead scientific platforms and coordinate the engineering and analysis activities needed for individual projects. The major scientific platforms supported by IRC include prokaryotic, eukaryotic, viral, and mammalian genomics, metagenomics, transcriptomics, epigenomics, informatics, and systems biology.

Custom Programming and Analysis Services
IRC staff can develop custom pipelines and analysis tools to meet the needs of individual projects. The IRC staff has expertise in web development, database development, and statistical programming.

Computational Infrastructure
Supporting the informatics activities at IGS/IRC is a state-of-the-art computational infrastructure that includes a computational grid, an internal 40-gigabit network, database servers, and a hierarchical storage management system.

The grid is built around 5 high-performance high-memory multi-processor machines (Intel dual-eight processor machines, 512-2048 GB RAM each) for memory and compute intensive applications and over 80 high-throughput servers (256-1024 GB RAM, 4,000 hyper-threaded cores total) for running distributed applications.

To address the ever-expanding data sets generated by next generation genome sequencing technologies at a reasonable cost we have deployed a hierarchical storage infrastructure consisting of four tiers of random-access storage and a fifth tier of serial access tape for archival and data backup. Total storage capacity is over 8 petabytes.

This computational infrastructure is also available for use by the UMB community through the HPC Core.

Outreach and Educational Programs
A vital component of every bioinformatics project at IGS is training and outreach. IGS offers a comprehensive professional development program including multiple workshops each year that provide instruction on genomics, metagenomics, transcriptomics, and programming. More information can be found at http://www.igs.umaryland.edu/ education/workshops.php.

MISSION
To enable basic and translational research by lever¬aging expertise in genome-scale analysis tools and high-performance computing.

CORE SERVICES
The IGS Informatics Resource Center engages in fee-for-service (FFS) and collaborative research projects and proposals. For this purpose, two cores were created: the Genome Informatics Core (GIC) and the High-Performance Computing Core (HPC). The following are some of the major services available through these IRC cores.

SOFTWARE AND TOOL DEVELOPMENT
GIC software engineers are available to develop custom software solutions that include:
- Website Development
- Custom Programming/Scripting
- Research Data Capture Systems
- Database Design

RESEARCH COMPUTING
The HPC computational infrastructure is available to researchers to conduct their own analysis. The following are some of the ways researchers can access this infrastructure.

- Cloud Computing
- Pre-packaged Genome Analysis Pipelines
- Command-line tools

CONTACT
irc-info@som.umaryland.edu
410-706-5682

INFORMATICS RESOURCE CENTER (IGS)

CIBR: Center for Innovative Biomedical Resources

Visualization Tools

The IRC has developed several genome visualization and curation tools that are available to the research community. In addition, we have also deployed third-party open-source tools. Some of these include:

• Gene Expression Analysis Resource (gEAR) – A web-based tool developed in collaboration with Ronna Hertzano, MD, to analyze and visualize functional genomics data including gene expression and epigenomic data.

• Probing Outcomes Data with Visual Analytics (POD-Vis) – A Web-based tool developed in collaboration with Lisa Shulman, MD, for exploration and analysis of clinical outcomes data.

• SYBIL – A browser for comparative genomics results that provides views for ortholog groups, synteny gradients, genomic regions, and more.

• Circelator – A circular genome visualization tool providing compact figures showing diverse types of information that can be used to compare features of multiple genomes.

• Manatee – A genome annotation query and curation tool that allows one to browse annotations by gene location, function, and biological role. Annotations can be revised by users as well as downloaded in a variety of standard formats.

• Integrative Genome Browser (IGV) – A tool that provides simultaneous visualization of multiple types of genome-associated information including gene models, ortholog data, RNA-Seq alignments, and more.

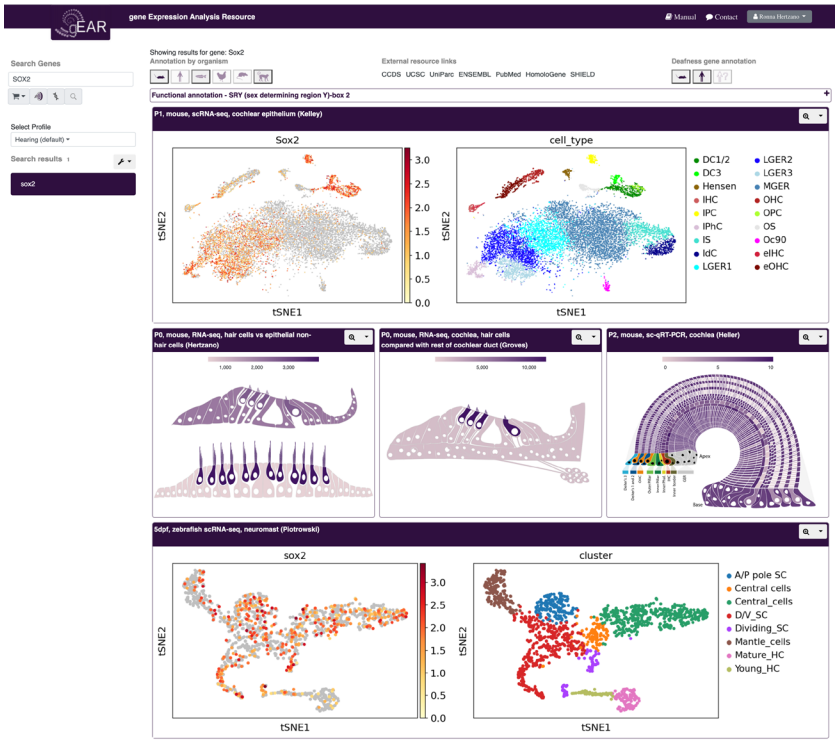

Figure 1: Gene Expression Analysis Resource (gEAR) screen shows a number of experiments with gene expression data for the sox2 gene

LEADERSHIP

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WEBSITE

http://www.igs.umaryland.edu/resources/irc/

LOCATION

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Baltimore, MD 21201

MARYLAND GENOMICS

CIBR: Center for Innovative Biomedical Resources

Maryland Genomics is a high-throughput laboratory and data analysis core offering cost-effective 'omics and bioinformatics services from within the UMSOM Institute for Genome Sciences. As pioneers in the field, our senior scientists apply their extensive experience in genomic technology and bioinformatics to advance your research.

High-throughput Services We provide high-quality, cost-effective sequencing, qPCR, and molecular profiling using a diverse array of platforms. We cultivate long-standing relationships with technology providers to gain early access to new platforms and maintain our position at the forefront of genomic technology. Our extensive experience allows us to provide high-quality data in a nimble and responsive environment.

Microbiome Services We provide high-throughput analysis of microbiome samples. Our custom microbiome services include DNA & RNA extraction, amplicon library preparation, quantitative PCR, sequencing on both Illumina and PacBio platforms, and custom informatics pipelines for microbiome profiling and taxonomic assignment. We process human, animal, and environmental samples from all over the world.

Informatics Our staff of engineers, systems administrators, and analysts work together to conduct bioinformatics research and provide analysis services. We engage in collaborations to develop novel, customized analysis methods. Our team has broad expertise in sequence analysis applied to data from all types of organisms.

Clinical/Diagnostic Services Our Translational Diagnostics Laboratory is a high-complexity CLIA-registered clinical laboratory leveraging our deep genomics and bioinformatics expertise to offer state-of-the-art clinical molecular diagnostic testing, clinical trial support, and novel assay development.

APPLICATIONS AND SERVICES

Laboratory Services:

- DNA/RNA Extraction
- Library Preparation
- Genomes/Metagenomes
- Exomes and Custom Capture
- Transcriptomes
- Epigenomes
- Microbiome Amplicons (16S, 18S, ITS, etc.)
- Single Cell Sequencing
- Custom Amplicons
- Digital Molecular Profiling
- Customized Applications

Analysis & Computational Services:

- Assembly & Annotation
- Comparative Genomics
- Variant Analysis
- Transcriptome Analysis
- Epigenome Analysis
- Microbiome Profiling
- Pathway & Network Analysis
- Microarray Analysis
- Cloud Based Pipelines
- Customized Analysis

Platforms:

- PacBio Sequel II/IIe Systems
- Illumina NovaSeq 6000
- Illumina NextSeq
- Illumina MiSeq/iSeq
- 10x Genomics Chromium X
- NanoString nCounter
- Oxford Nanopore
- Illumina iScan
- Qiagen QIAcuity Digital PCR

MARYLAND GENOMICS

CIBR: Center for Innovative Biomedical Resources

Why Maryland Genomics? High-throughput technologies and applications now permeate both basic and clinical research. Personalized medicine is being driven by 'omics data. However, transforming data into knowledge is the primary challenge facing researchers today. We take pride in the quality of our work. Although many centers offer sequencing and routine analysis services, few offer the depth of experience and quality of analysis that our team provides. Let us help you take your research to the next level.

Who can work with Maryland Genomics? Everyone! We strive to bring the increasing power and decreasing cost of sequencing and analysis to a continually expanding research community. We provide services to a wide range of researchers – from basic scientists to clinicians to computer scientists. Prior experience with high-throughput technologies or sequence data is not required.

What can I expect? We work with researchers from both the public and private sector, and our projects span the globe. No matter your experience or expertise, we can guide you through every phase of the process. Each project begins with a complimentary consultation with our scientists and project managers. We use this consultation to learn more about your project goals, and to advise you on project design, platform selection, cost, and timelines. From there, we conduct regular project status and update meetings to ensure the project completes on time and on budget.

Is my project too small? Too large? No! We routinely work with projects that range from a single sample to multi-year projects with thousands of samples. On average, we have more than 30 active ongoing projects and process more than 50,000 samples per year.

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LOCATION

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670 W Baltimore St, 3rd Floor
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410-706-5672

Email Questions
IGS-services@som.umaryland.edu

Web Address
https://www.igs.umaryland.edu/services

NUCLEAR MAGNETIC RESONANCE CENTER

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

- 600 MHz Bruker Avance III Spectrometer with TCI cryoprobe and ^{19}F capability
- 800 MHz Bruker Avance Spectrometer with TXI cryoprobe and BACS 60 automatic sample changer
- 950 MHz Bruker Avance III Spectrometer with TCI cryoprobe

MISSION

The objective of the UMB NMR Center is to promote the use of nuclear magnetic resonance spectroscopy for use in ongoing and new research projects at the University of Maryland School of Medicine.

CORE SERVICES

We offer assistance and training for:

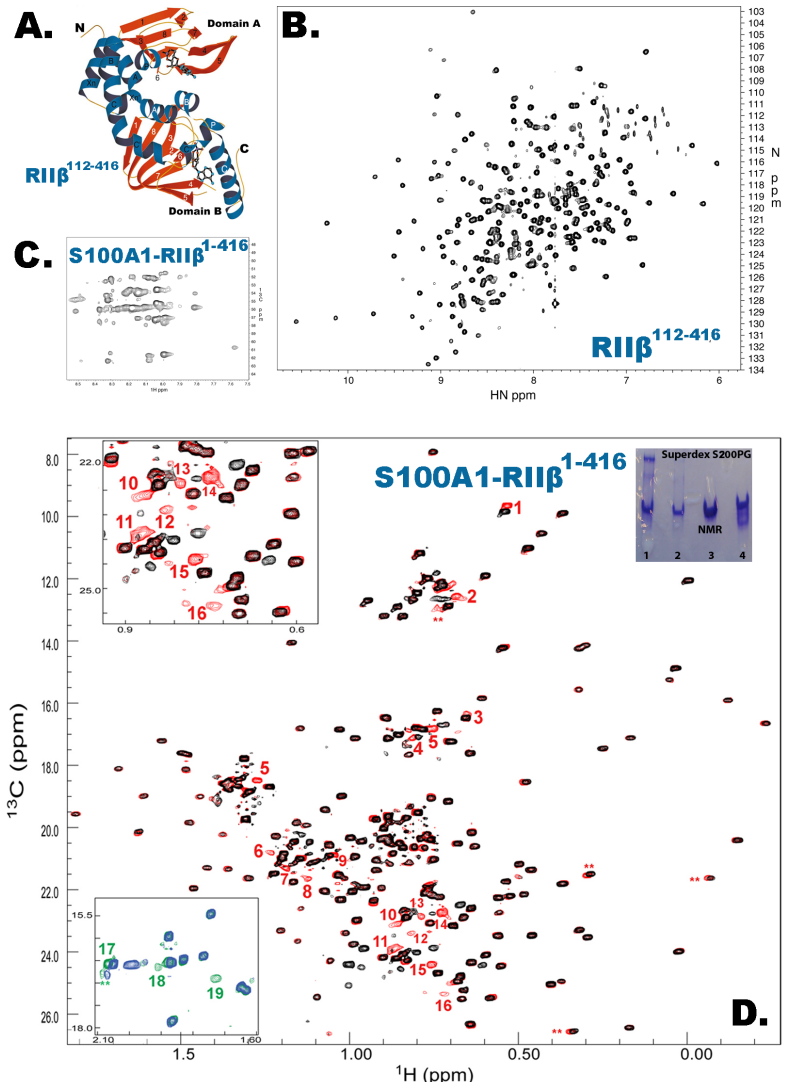
- Collecting NMR data
- Processing NMR data
- Analysis of NMR data

ADDITIONAL CORE SERVICES

- Linux and Apple workstation access for data processing and analysis
- Lab space for sample handling
- Assistance with NMR-related computer software including Bruker Topspin, NMRView, nmrPipe, nmrDraw, xplor-NIH, and several others

NUCLEAR MAGNETIC RESONANCE CENTER

CIBR: Center for Innovative Biomedical Resources



Ribbon diagram of RIIβ$^{112-416}$ (A) and NMR feasibility data for RIIβ$^{112-416}$ (B) and ^{Ca}S100A1-RIIβ$^{1-416}$ (C, D) at 950 MHz. (A) Ribbon diagram of RIIβ$^{112-416}$ (2); (B) ^{15}N-TROSY-HSQC of [^{2}H,^{13}C,^{15}N]-RIIβ$^{112-416}$ at 950 MHz after refolding/back-exchange to give H^{N} protons. (C) 3D-TROSY-HNCA of [^{2}H,^{13}C,^{15}N]-RIIβ$^{1-416}$:^{Ca}S100A1^{unlabeled} with RIIβ$^{1-416}$ back-exchanged. (D) ^{13}C-TROSY-HSQC with selection of A,I,L,V-methyls in uniform [^{2}H,^{13}C,^{15}N]-labeled PKA-RIIβ$^{1-416}$ in the absence (black) and presence of ^{Ca}S100A1 bound (red). The inset in the top left corner illustrates several chemical shift perturbations from S100A1 binding (>19 $\Delta\delta^{CH3}$ perturbations labeled with a number or **). In the lower left-hand corner (inset) is the negative contour region in the absence (blue) and presence of ^{Ca}S100A1 bound (green). In the top right (inset) is a native gel illustrating the high quality of the NMR sample (lane 3).

CONTACT

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Kristen M. Varney, PhD
NMR Center Director
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410-706-2110

Web Address
http://medschool.umaryland.edu/cibr/NMR

PATHOLOGY BIOREPOSITORY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

CORE SERVICES

TISSUE PROCUREMENT AND PROCESSING SERVICES

- Fresh or Frozen tissue
- Bone marrow and peripheral blood mononuclear cell isolation
- Biospecimen storage and retrieval
- Rapid collection and storage methods
- Project/protocol-specific procurement

TRANSLATIONAL RESEARCH SUPPORT

Histology Services

- Tissue processing and embedding
- Sectioning and staining
- Immunohistochemistry (IHC), including antibody work-up and control tissues
- Special Stains
- Tissue Microarray (TMA) Construction
- Laser Capture MIcroscopy (LCM)

Digital Image Analysis Services

- Aperio digital IHC and TMA software
- Quantitative IHC

Data Services

- Association of archived and prospectively collected tissue with clinical data
- Prospectively maintained and queryable database for all collections

Consultation Services

- Pathology consultations
- Interpretation support
- IRB application assistance
- Material Transfer Agreement (MTA) submission support

MISSION

Pathology Biorepository Shared Service (PBSS) provides access to a collection of high quality banked patient samples while maintaining patient confidentiality. PBSS provides pathology, histology, and histotechnology services to assist with procurement, analyses, and clinicopathologic correlations of human tissue specimens. Access to a high-quality bank of patient samples permits UMGCCC investigators to perform studies aimed at understanding the biology of normal and diseased tissues with an ultimate goal of translating this knowledge into diagnostic and clinical applications.

ABOUT PBSS

Pathology Biorepository Shared Service was established by UMGCCC in 2006. PBSS has both the unique advantage of the long-standing expertise gained under the well-established relationship with the NCI as well as the advantage of existing expertise and archives of the Pathology Department.

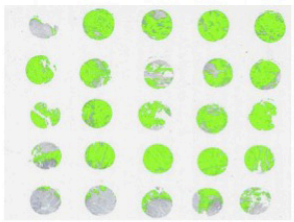
PBSS is the only tissue bank shared service for specimens removed at surgery on the campus.

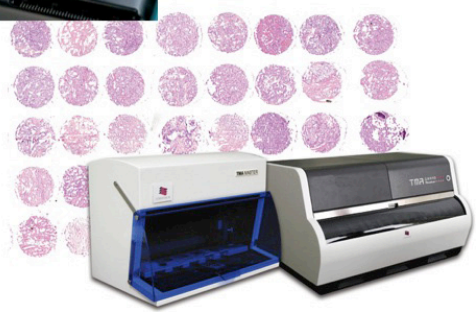
We have an integrated relationship with the Anatomic Pathology Department, which is essential for obtaining well-characterized tissue samples as well as for pathology and histology expertise.

Frozen tissue archived at PBSS consists of more than 13,000 aliquots of matched tumor and normal tissue from the same patient, and more than 25,000 aliquots of mononuclear cell isolates, and plasma.

PATHOLOGY BIOREPOSITORY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources





CONTACT

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Amy Plotkin, MD, PhD
Director
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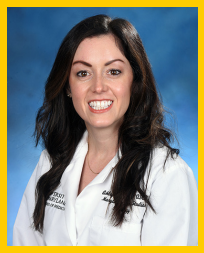

Ashley Cellini, P.A. (ASCP)
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LOCATION

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410-706-2174

Web Address
http://medschool.umaryland.edu/cibr/Path_Biorepository

TRANSLATIONAL GENOMICS LABORATORY

CIBR: Center for Innovative Biomedical Resources

CORE INSTRUMENTATION

- Applied Biosystems 3730XL (Sanger sequencing)
- Affymetrix GeneChip system 3000 7G (chip-based arrays, e.g. CytoScan HD, DMET)
- Applied Biosystems 7900 RT-PCR system (genotyping by Taqman©-based methods)
- Applied Biosystems 9700 thermocycler (PCR amplification)
- Nanodrop single-channel and 8-channel spectrophotometers
- ThermoFisher QuantStudio 5
- Ion Torrent Personal Genome Machine (next generation sequencing panels, e.g. Comprehensive Cancer Panel, and Custom AmpliSeq panels)
- Ion Chef System
- Ion S5 Sequencer

CORE SERVICES (CLINICAL)

- Confirmation of a Research Finding
- *CYP2C19* Genotyping
- *CYP2C19* Sequencing
- Cytogenomic Microarray
- Extract and Hold
- *FLT3* ITD and TKD Analysis
- *IDH1* R132_*IDH2* R140 and R172
- Site-specific Familial variant analysis
- Next Gen Sequencing (NGS) Myeloid Malignancy Targeted Panel

CORE SERVICES (BASIC RESEARCH)

- Cytogenomic Arrays
- Extraction of Nucleic Acid
  - DNA
  - RNA
- Gene Expression Arrays
  - Global Expression Profiling
  - miRNA Expression Profiling
  - Transcriptome Analysis
- Genotyping
  - Taqman Assays
- Next Generation Sequencing (NGS) Gene Panels
- Sanger DNA Sequencing

MISSION

The mission of the Translational Genomics Laboratory is to provide a critical bridge to help accelerate translation from discovery into precision health care, by providing DNA sequencing, genotyping and array-based technologies in both a basic research and clinically-regulated environment.

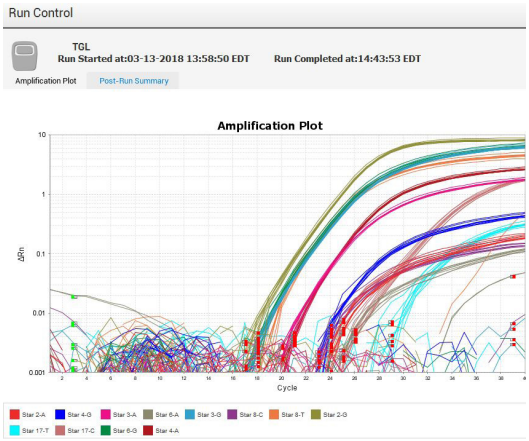
ABOUT

The Translational Genomics Laboratory (TGL) is the result of 35 years of core facility evolution, starting with peptide and oligonucleotide synthesis, to the current CAP (College of American Pathologists) accredited and CLIA (Clinical Laboratory Improvement Amendments) compliant laboratory, capable of providing support to clinical and translational genetic/genomics studies (CAP# 8017554; CLIA# 21D2027356). TGL is part of the University of Maryland School of Medicine's Marlene and Stewart Greenebaum Comprehensive Cancer Center (UMGCC), the Program for Personalized and Genomic Medicine (PPGM), and the Center for Innovative Biomedical Resources (CIBR).

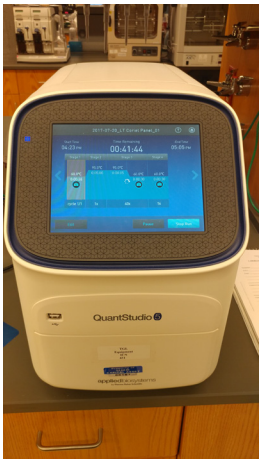
The services offered by the TGL support basic research. The clinical assays offered are similar to those offered to support basic research, except that these assays are validated under CLIA, enabling them to be used in the clinical decision-making process in research protocols and for routine patient care.

TRANSLATIONAL GENOMICS LABORATORY

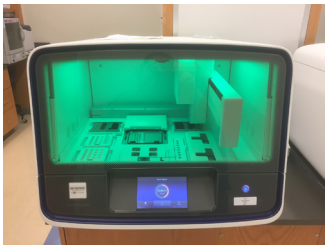
CIBR: Center for Innovative Biomedical Resources



Quant Studio 5 Amplication Plot



Quant Studio 5 Experiment



CONTACT

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Research Lab: 410-706-8553
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Web Addresses

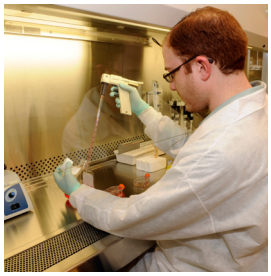
http://medschool.umaryland.edu/cibr/TGL
http://medschool.umaryland.edu/cibr/
Genomics Core (Research Services)

TRANSLATIONAL LABORATORY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

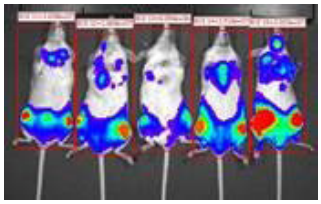
CORE SERVICES

***In Vitro* Assays**



- Mycoplasma testing
- Clonogenic Survival Assays
- IC50 generation
- Cell cycle (propidium iodide)
- Viability (trypan blue exclusion)
- Apoptosis
- Potentiation/Synergy
- ROS
- Western Analysis
- Angiogenesis

***In Vivo* Assays**



- IACUC approved umbrella protocol
- Tolerability
- Tumor Growth
- Patient Derived Xenograft Models
- Pharmacokinetics: generation of plasma
- Efficacy (flank models)
- Efficacy (orthotopic models)
- Pharmacodynamic Endpoints
- Imaging of cells with Xenogen System

Pharmacodynamic (PD) Endpoints

- in-patient samples, tumor or surrogate tissues, preclinical samples
- Endpoint dependent on target (e.g., ELISA, flow cytometry, Western, unique assay)

CORE INSTRUMENTATION

- ACEA Xcelligence
- Agilent SeaHorse
- Biotek Synergy HT

CRISPR SERVICES

https://www.medschool.umaryland.edu/cibr/Core/CRISPR/

- Gene Knock out
- Gene editing single nucleotide polymorphism

MISSION

The University of Maryland Greenebaum Comprehensive Cancer Center Translational Laboratory Shared Service (TLSS) offers pre-clinical and clinical experimental support to basic researchers and physicians in the UMGCCC community. We work in areas across the entire spectrum: cell biology, *in vitro*, *in vivo* and human trials.

CORE RESOURCES

- Access to >120 human/murine cell lines
- Luciferase-expressing breast, head & neck, leukemia, ovarian and prostate cancer cell lines
- IACUC approved umbrella protocol
- Access/Knowledge in Using Xenogen/IVIS Imaging Mice
- Primary Derived Xenograft Models
  - Breast
  - Head and Neck
  - Leukemia
  - Ovarian
  - Pancreatic (under development)

Access to IRB approved protocol for tissue acquisition

Clinical Trial Support

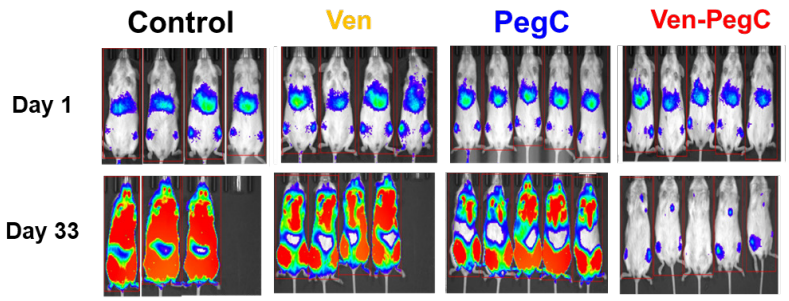
We isolate:

- Plasma
- Serum
- Whole Blood (isolation of PBMC, DNA, RNA, protein)
- Bone Marrow (isolation of marrow cells)
- Staining of isolated lymphocyte cells
  - Coordination with Flow Cytometry Core for analysis
- Exosomes and ct DNA

TRANSLATIONAL LABORATORY SHARED SERVICE

CIBR: Center for Innovative Biomedical Resources

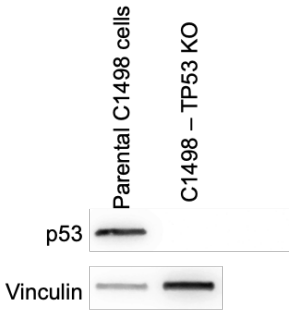
IN VIVO SERVICES

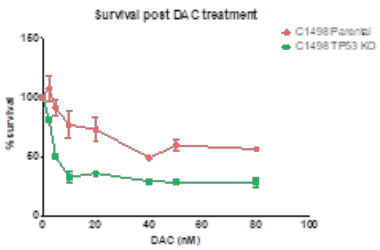


Combination of BCL2 inhibitor Venetoclax (Ven) and long acting Asparaginase (pegcrisantaspase or PegC) inhibits leukemia growth in an orthotopic patient derived xenograft (PDX) model of acute myeloid leukemia. NRG mice were injected with 1x106 AML45-luc-YFP-luc cells (primary cells gift of Drs. Martin Carroll and Alexander Perl, UPENN). After engraftment, mice were treated with vehicle, 75 mg/kg Ven PO 5x/week, 250 IU/kg PegC IV 1x/week or their combination. Mice were imaged weekly on the Xenogen IVIS spectrum in the Imaging Core. Leukemia burden is depicted by color from high to low (red, orange, green, blue). Emadi *et al* Leukemia 35(7): 1907-1924, 2021.

CRISPR SERVICES

Knock-out of p53 gene by CRISPR CAS9 in murine cell line C1498 increased sensitivity to decitabine. Kogan *et al*, 119(27) PNAS June 2021 epub ahead of print.





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http://medschool.umaryland.edu/CIBR/CORE/translational_lab

http://medschool.umaryland.edu/cibr/Core/CRISPR

UNIVERSITY OF MARYLAND MEDICINE (UMM) BIOREPOSITORY

CIBR: Center for Innovative Biomedical Resources

MAJOR EQUIPMENT

Hamilton Biorepository (BiOS) Freezer System

- state-of-the-art automated, ultra-low temperature (-80°C) freezer system
- equipped to accommodate over 945,000 biospecimens

MISSION

The objective of the UMM Biorepository is to provide standardized handling and secure storage of biospecimens in a cost-effective manner in order to support high quality research that empowers discoveries in genomics and other 'omics' science and facilitates translation of these discoveries to more effective diagnostics and therapeutics.

ABOUT

The UMM Biorepository is a resource building effort that includes banking of blood samples from UMMS patients as well as collections of various biospecimens from collaborating UM researchers. State-of-the-art robotic freezer and liquid-handling equipment offers a secure and managed environment for biospecimen processing, storage and distribution. Data connected to the samples is obtained through the electronic health record and/or study-specific data collection, allowing for multi-disciplinary research that can impact a range of health issues.

CORE SERVICES

Laboratory

- Sample processing & banking
- DNA/RNA extraction & banking
- Short- and long-term sample storage (room temperature, 4°C, -20°C, -80°C & vapor phase liquid nitrogen)
- Inventory management and sample retrieval
- Shipping to outside laboratories

Clinical Research Support

- IRB protocol preparation assistance

BIOREPOSITORY USER BENEFITS

- "Outsourced" management of biospecimen banking functionalities
- Regulated, secure environment for biospecimen processing, storage & distribution
- 24/7 sample monitoring
- Standard operating procedures for sample processing, storage & distribution
- Detailed biospecimen annotation, tracking & reporting
- Dedicated, expert staff

UNIVERSITY OF MARYLAND MEDICINE (UMM) BIOREPOSITORY

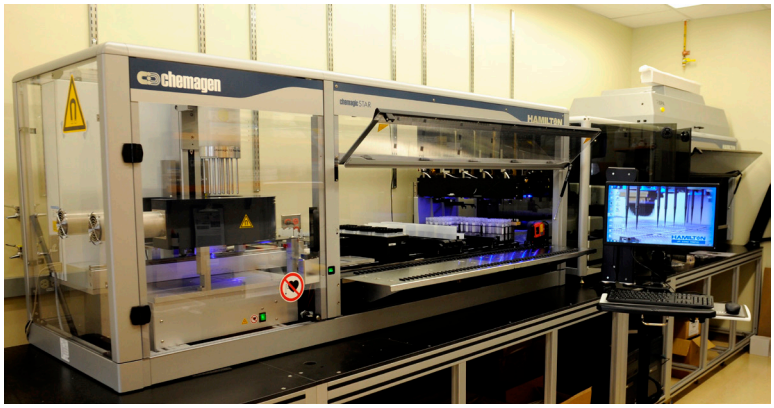
CIBR: Center for Innovative Biomedical Resources

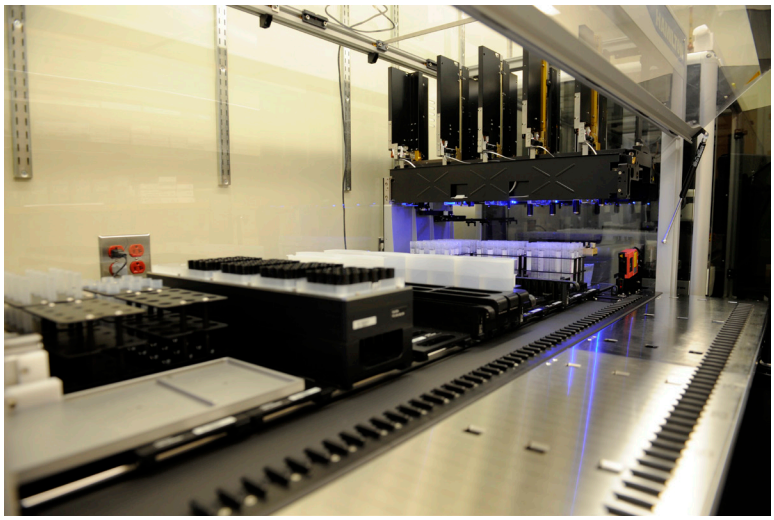
MAJOR EQUIPMENT (CONT.)

Microlab chemagic STAR liquid handling system (Hamilton)
- DNA/RNA extraction

Chemagic 360 (Perkin Elmer)
- DNA/RNA extraction – high throughput, low volume samples

Microlab STAR liquid handling system (Hamilton)
- Sample aliquoting and set up specific assays using retrieved samples





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LOCATION

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http://medschool.umaryland.edu/cibr/UMM_Biorepository

PROGRAM OF COMPARATIVE MEDICINE (VETERINARY RESOURCES)

CIBR: Center for Innovative Biomedical Resources

Comparative Medicine and Veterinary Resources faculty veterinarians direct and oversee the animal resource program for the University of Maryland Baltimore campus. Veterinary faculty provide oversight and supervision for animal care, animal facilities management, and animal health related to diagnosis, treatment, and prevention of intercurrent disease in research animals. They are available for consultation on animal research protocols, technical procedures, laboratory animal management, and development of grant applications proposing the use of animals.

MISSION

Our mission is to provide quality care for all research animals; to facilitate research through our expertise and collaboration on animal models including anesthesia and surgery; maintain compliance with the Federal animal welfare regulations and guidelines; and maintain an AAALAC accredited program for animal care and use.

SPECIAL SERVICES/ COLLABORATIONS

- Housing and care for a range of animal models from mice to non-human primates
- Pre-research consultations with researchers on development of animal models
- Anesthesia and surgical services
- Technical services
- Technical training in research animal procedures
- Support for GLP and GLP-like studies
- Maintain breeding colonies of NSG, NRG, and C57BL/6 mice as a PI resource

PROGRAM OF COMPARATIVE MEDICINE (VETERINARY RESOURCES)

CIBR: Center for Innovative Biomedical Resources

Research & Consultation Services

- Investigators should schedule a consultation with one of our faculty veterinarians as they begin to develop grant & contract applications.
- This will help your application workflow and save time to initiate your study once it has been fully approved.
- Our staff is always available for continued consultation throughout the life cycle of your research.
- We have extensive expertise in providing collaborative support for a broad range of laboratory animal-based research studies, to include GLP and GLP-like studies
- We provide and oversee all Veterinary Services available to University of Maryland School of Medicine and UMB researchers.

Veterinary medical and husbandry services include but are not limited to:

- Daily health monitoring / provision of husbandry medical care 24/7, 365 days a year
- Training in the basics of standard/safe handling procedures for new lab members
- Assisting in ordering materials needed for IACUC approved research (e.g. antibiotics, other pharmaceuticals, medical components or instruments)
    - NOTE for use of Controlled Dangerous Substances (CDS) in IACUC approved research protocols, the PI is required to secure their own CDS/DEA registrations to order and store CDS on campus. State and Federal Law prevents Comparative Medicine from ordering/providing CDS.
- Providing species-specific anesthesia support
- Breeding Colony setup/maintenance plans
- Providing full necropsy service, along with commercial diagnostic lab test submissions, as well as pathology specimen submission as needed
- Providing full necropsy service and diagnostic testing for the purpose of identifying intercurrent disease which may affect animal health and impact on successful research endeavors

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medschool.umaryland.edu/vetmedicine

UMB VIRUS VECTOR CORE

CIBR: Center for Innovative Biomedical Resources

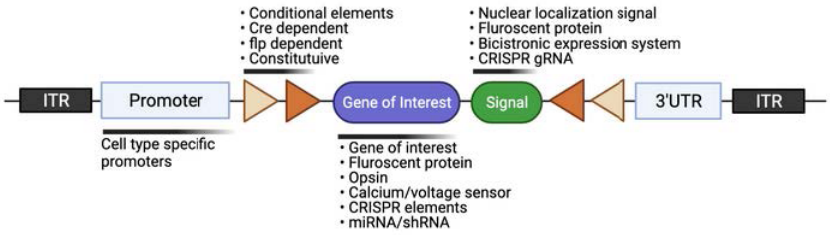
Recombinant adeno-associated virus (rAAV) based gene delivery is the most effective vehicle due to its ability to transduce various mammalian cell types in vitro and in vivo system. Similarly, the lentiviral vector can achieve long-term expression of the gene of interest through integration into the host cell genome. We proudly offer the service for cost-effective and best customer satisfaction for AAV and lentivirus production.

ADENO-ASSOCIATED VIRUS (AAV) SERVICES

- We provide research-grade and ultrapure, high-quality AAV vectors with titers from 1x10E12 to 1x10E13 GC/ml, suitable for in-vivo transduction.
- We provide the service for custom gene cloning for AAV and lentivirus vector systems. We have the inventory of various promoter and fusion genes to design the custom constructs (Fig.1).
- We provide the service for highly purified and endotoxin-free DNA production used for virus production and in vitro transfection.
- We provide the pre-made 'Stock virus' with various AAV serotypes and lentivirus which is ready to use for your experiements.

LENTIVIRUS SERVICES

We offer the service for second and third-generation lentivirus particle production in a highly controlled and sterile environment following BSL2 guidelines. We determine the titers using qPCR using primers specific to the LTRs.The virus titer is guaranteed to be between 1x10E8 to 1x10E9 GC/ml.



MISSION

UMB Virus Vector Core (VVC) offers Adeno Associated Virus (AAV) and lentivirus-based gene delivery systems to be used in gene therapy for targeting a gene of interest (GOI) in in-intro and in-vivo studies. The VVC offers services for custom gene cloning and packaging in Adeno Associated Virus or lentivirus systems. The mission of this Core is to provide high quality viral vectors, reducing the time and cost for the investigators utilizing modern tools and technology. The Core offers free consultancy for gene construct designing strategy, discussing the research project, implementation, and troubleshooting.

CORE SERVICES

Virus Vector Core uses cutting-edge technologies to create and produce a variety of high-quality viral particles.

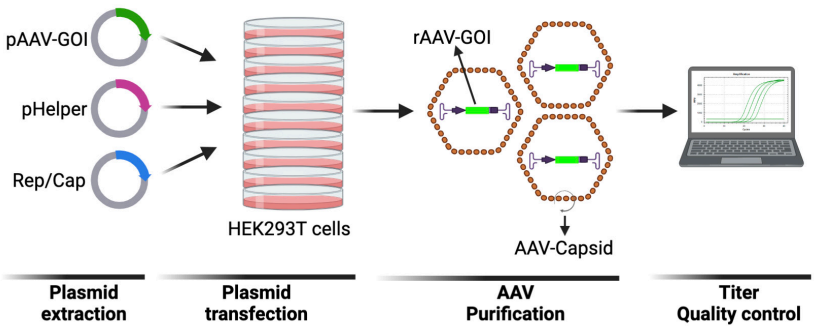
- Custom Gene cloning includes CRISPR elements for targeting gene activation, repression, or knockdown
- Conditional gene expression using tetracycline, inducible Systems, Cre-loxP, or using multiple combination approaches.
- Transfection grade DNA plasmid preparation
- AAV virus production
- Lentivirus production
- Pre-made 'Stock virus' with various range of serotypes
- Core also offers services to validate the virus using target qPCR and immunostaining, or western blot against your target gene or protein.
- Consultation for selection of gene and vector designing and implementation in your research.
- Feel free to contact us for a letter of support for your grant application.

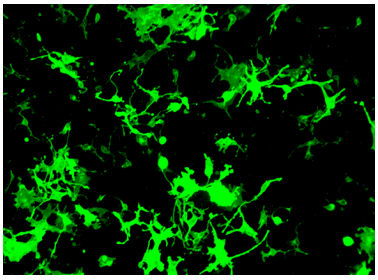
UMB VIRUS VECTOR CORE

CIBR: Center for Innovative Biomedical Resources

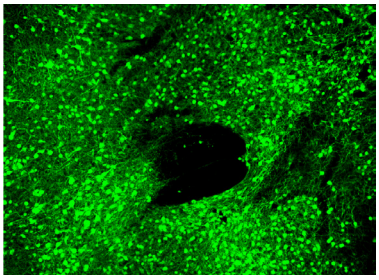
AAV PRODUCTION AND QUALITY CONTROL

- We prepare the AAV virus using triple plasmid transfection in HEK-293 cells (Fig. 2). Before the transfection, custom DNA, serotype-specific plasmids expressing viral Rep/Cap proteins, and pHelper plasmid is produced by endotoxin-free Qiagen kit.
- rAAV particles are purified and concentrated by using Iodixanol (IDX) Gradient Ultracentrifugation.
- Purified virus preparations are subjected to quality control measures, including titer assays using qPCR (primers target the ITRs) and in vitro-transduction in HEK293T cells.

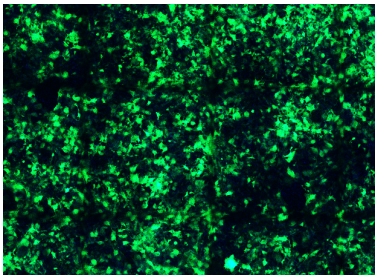




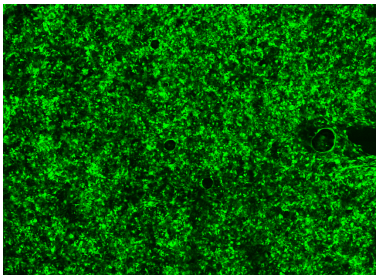
(A) AAV transduction in HEK cells



(B) AAV transduction in mouse brain



(C) Lentivirus transduction in HEK cells



(D) Lentivirus transduction in HEK cells

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