**FACILITIES AND OTHER RESOURCES**

The UMB offers faculty an environment that includes an array of facilities, centers, equipment, programs, and other resources. Research laboratories are typically 600 to 1500 square feet in size and include necessary equipment for modern biomedical and behavioral research.

**University of Maryland School of Medicine**

**A. University of Maryland School of Medicine and the University of Maryland, Baltimore Campus**

The University of Maryland School of Medicine (SOM) was established in 1807 as the founding school of the University of Maryland System and is the fifth oldest and first public medical school in the United States. UMSOM includes 25 academic departments, 2 institutes, 10 organized research centers, and 8 training programs. The SOM has grown to include more than 7,000 personnel, including nearly 3,000 faculty, of which 1,431 are full-time faculty, 11% of whom are underrepresented minorities and 40% of whom are women. We also house more than ~3,000 administrative, research, and clinical staff; 1,000 students and approximately 500 postdoctoral fellows.

The SOM, regarded as a leader in biomedical and public health research, was awarded research grants and contracts totaling $555 million in FY21. According to the Association of American Medical Colleges in FY21 the SOM ranked 8th among all 93 public U.S. medical schools, 25th in all 155 US medical schools, and 18th in research grant and contract expenditures per full-time faculty member among U.S. medical schools. The SOM received more than $210M in NIH funding in FY20, ranking 32nd in the country for all medical schools. The SOM, which has more than 1 million sq. ft. of net assignable space, includes more than 500,000 sq. ft. of research laboratory space for the more than 300 graduate students and 300 postdoctoral trainees within the school. This includes the brand new, state of the art Health Sciences Research Facility 3 which opened in 2018 and included almost 300,000 sq. ft of laboratory and laboratory support space.

The SOM is located in a rich research environment on the University of Maryland Baltimore (UMB) campus that includes other Schools and Centers, including Schools of Dentistry (SOD), Pharmacy, Nursing, Social Work, and Law. The SOD ranks ninth in the nation among all dental schools in total NIH funding ($8 million in FY19), and performs research in pain and neuroscience, oncology, infectious disease, biomaterials, and health promotion and disparities. The School of Pharmacy (SOP), applies an integrative approach to drug discovery and development, innovative patient care, and drug outcomes and their economic impact. In 2020, the SOP was ranked 14th out of more than 130 schools by US News & World Report ranking of best graduate schools and had more than $32 million in grants and contracts in FY19. The SOP ranks 24th in the nation among pharmacy schools in total NIH funding ($5.8 million in FY19) In 2019 the SON was ranked 19th nationwide in total NIH funding (more than $5 million) and has four top10 nationally ranked programs for all of its DNP and master’s specialties. The SON performs significant research in the areas of chronic pain, health outcomes, and disease management. The SOM works closely with these schools and shares some resources to enhance our research enterprise.

The Baltimore Veterans Affairs Medical Center (BVAMC) is located across the street from the SOM and is connected through a ramp to the SOM complex. The VA Maryland Health Care System (VAMHCS) Research & Development (R&D) Program is a very active research program which has been ranked in the top five of all VA centers nationwide for several years. The program has 55,000 sq. ft of research space more than 65 funded investigators conducting over 300 projects with total annual research funding of $23 million. The program conducts investigations in biomedical research, health services research, clinical trials, cooperative studies, and rehabilitation research. The Baltimore VAMC is also home to several centers of excellence and special programs including: [Geriatric Research, Education and Clinical Center (GRECC)](http://www.maryland.va.gov/services/Geriatric_Research_Education_and_Clinical_Center.asp); [Mental Illness Research, Education and Clinical Center (MIRECC)](http://www.mirecc.va.gov/visn5/); Multiple Sclerosis Center of Excellence, Research Enhancement Award Program (REAP) on Stroke, Research Enhancement Award Program (REAP) on ALS and VA Maryland Exercise and Robotics Center of Excellence.

**B. Research Environment at UMSOM – Departments**

The UMSOM contains 25 basic science, clinical, and allied health departments.

*Anatomy & Neurobiology* – The department of Anatomy & Neurobiology is a basic science research powerhouse. Although small in size, the department received more than $10M in NIH funding in the last fiscal year. Research expertise in the department focuses on addiction and motivated behaviors, sensory systems and pain, and aging and neurodegeneration. The department has a commitment to diversity and inclusion and is a proud sponsor of Black in Neuro, an organization celebrating black excellence in neuro-related fields. The department also contains the Center for Substance Use in Pregnancy, which will conduct pre-clinical and clinical neuroscience research, focusing on the prenatal use of marijuana, opioids, nicotine, and alcohol.

*Anesthesiology* – The department of Anesthesiology delivers start of the art anesthesia services in perioperative care, pain management, and critical care; educates students and residents and fellows, and conducts cutting edge research. In FY21, the department received nearly $10 million in extramural grant funding, including ~$7M in NIH funding and was ranked 11th by the Blue Ridge Institute for Medical Research. Research in the department focuses on traumatic brain injury, shock, and sepsis.

*Biochemistry & Molecular Biology* – The department of Biochemistry & Molecular Biology has a two-part mission: 1) to develop fundamental new scientific knowledge that leads to insights into the functioning of biological systems with a goal of advancing the diagnosis and treatment of human disease, and 2) to train the scientific leaders of tomorrow by preparing students to function as independent investigators. The department provides state of the art facilities and does cutting edge research in the areas of molecular cancer biology; structural biology and technology development; heart, muscle, and blood biology; phage and bacterial biology; and surface epithelial biology. Annually, the department receives ~$8-10 million in extramural research funding.

*Dermatology* – The Department of Dermatology is dedicated to improving the quality of life for patients afflicted with skin disease through state-of-the-art patient care, education, and research. Research in the department focuses on the mechanism of disease in order to better understand and combat disorders of the skin, including cancerous and non-cancerous skin conditions and drug reactions to combat disease and improve treatment options.

*Diagnostic Radiology & Nuclear Medicine* – The Department of Diagnostic Radiology & Nuclear Medicine is a national leader in research on state-of-the-art technologies including spiral CT, MR imaging, SPECT imaging, teleradiology, and picture-archiving and communications systems. The department was amongst the first in the nation to obtain CT fluoroscopy and portable CT. The department contains research centers on Magnetic Resonance Research and the Center for Advanced Imaging Research, as well as a newly formed center on AI and imaging. The Department of Diagnostic Radiology and Nuclear Medicine at UMSOM is a research site for the NIH-funded Adolescent Brain Cognitive Development Study, the largest long-term study of child and adolescent brain development in the United States.

*Emergency Medicine* – The Department of Emergency Medicine consists of 75 full-time, board-certified faculty and covers a wide range of clinical expertise and interest, including clinical toxicology, disaster preparedness and response and prehospital care. The department offers outstanding clinical education and research opportunities to medical and graduate students at the UMSOM and other emergency medical departments in downtown Baltimore, including the Baltimore VA Medical Hospital, UMMC Midtown Medical Campus, and Mercy Medical Center.

*Epidemiology & Public Health* – In 2021 the Department of Epidemiology and Public Health ranked 5th out of all public institutions in the Blue Ridge National Ranking of EPH departments. Research-focused graduate degrees in the department are offered in epidemiology, molecular epidemiology, clinical research, gerontology, and public health. This department is closely integrated with the NCI-funded Marlene and Stewart Greenebaum Comprehensive Cancer Center on campus and have a mission of patient-centered outreach and education within the greater Baltimore community to ensure equity in cancer treatments. Faculty in the department were recently awarded $4 million in federal funds to expand and refine the pool of genetic information to make polygenic risk scores more predictive and reliable for clinical use in underrepresented populations.

*Family and Community Medicine* – The Department of Family and Community Medicine was established in 1970 and is nationally recognized for its emphasis on the care of the urban population, prevention and management of adolescent pregnancy, and the training of new minority academic family physicians. Department faculty, medical and graduate student trainees are diverse in background and expertise, and committed to providing comprehensive care that integrates biological, psychological and social aspects of health while responding to the health needs of a diverse population in a changing environment.

*Medicine* – The Department of Medicine is the largest department in the SOM, with 340 full-time faculty, and has trained physicians since 1807. The department has an extensive research base in basic, translational and clinical research, with over $180 million in active research funding. The UMSOM Department of Medicine ranked 14th in the AAMC list of General Research Expenditures, with $51.9 million in expenditures, compared to the national average of $21.9 million. The Department of Medicine supports and conducts research internationally, with considerable infrastructure in geographically diverse areas such as South America and Africa.

*Microbiology & Immunology* – The Department of Microbiology and Immunology was founded in 1919 and includes more than 50 primary faculty members. Research in this department covers molecular pathogenesis of bacterial, viral, and parasitic pathogens, innate immune responses to bacteria and viruses, microbial genomics and metagenomics, evolution of the immune system and microbial pathogens, pathogenesis of autoimmune disease, stem cell biology, vaccine development, and the development of novel cancer immunotherapies, and is supported by more than $80 million in funding. Faculty are allied with many of the SOM Institutes and Organized Research Centers, such as the Center for Vaccine Development, the Institute for Human Virology, the Institute for Genome Sciences, and the Greenebaum Cancer Center. The most recent Blue Ridge Institute rankings placed the Dept. of Microbiology & Immunology 5th in NIH funding for all departments of microbiology and second among all microbiology departments in public medical schools.

*Neurology* – The Department of Neurology is one of the top ten Neurology programs in the country in terms of research funding, garnering more than $10 million in research funds annually. The department conducts research in the treatment and management of [Parkinson's disease and movement disorders](https://www.medschool.umaryland.edu/neurology/Divisions/University-of-Maryland-Parkinsons-Disease--Movement-Disorder-Center/), [multiple sclerosis](https://www.medschool.umaryland.edu/neurology/Divisions/Division-of-Multiple-Sclerosis-and-Neuroimmunology/), [stroke](https://www.medschool.umaryland.edu/neurology/Divisions/Division-of-Stroke-and-Cerebrovascular-Diseases/), [epilepsy](https://www.medschool.umaryland.edu/neurology/Divisions/Maryland-Epilepsy-Center/), [Alzheimer's disease](https://www.umms.org/ummc/health-services/neurology/services/alzheimers-disease), spasticity and [neuromuscular disease](https://www.medschool.umaryland.edu/neurology/Divisions/Center-for-Neuromuscular-Disease/). The Department also provides state-of-the-art [rehabilitation services](https://www.medschool.umaryland.edu/neurology/Divisions/Rehabilitation-Medicine/), and faculty conduct free seminars to the public for those considering deep-brain stimulation, MR-guided focused ultrasound, or other treatments for movement disorders.

*Neurosurgery* – The Department of Neurosurgery is comprised of 20 faculty researchers, medical and graduate trainees in this department collaborates closely with the departments of Neurology, Diagnostic Imaging and Radiology, and other basic science research groups at the SOM to promote discovery and translation of new treatments for movement disorders, seizures, neurodegeneration, spine injury, neuropathic pain, and brain tumors. Within the department, the Translational Therapeutics Research Group is a multi-disciplinary team of clinicians, engineers,​ and cancer biologists actively working together to solve life-limiting treatment challenges in the neuroscience and cancer fields.

*Obstetrics, Gynecology, & Reproductive Sciences –* The Department of Obstetrics, Gynecology and Reproductive Sciences provides training and clinical research opportunities in high-risk and complicated pregnancy, gynocological cancer, and family planning, and serves a diverse population in the Baltimore area. Research is supported by over $5 million in research funds.

*Ophthalmology and Visual Sciences* – The Department of Opthalmology and Visual Sciences has been a leader in the advancement of vision sciences since the 19th century. The department conducts collaborative, fully funded research in the visual sciences, and leverages the clinical and research strengths of department faculty to quickly bring new knowledge to patient care settings. The department currently receives over $3 million annually in federal research support.

*Orthopaedics* – The Department of Orthopaedics is comprised of a diverse group of 45 faculty clinicians and researchers. Basic research, clinical and surgical training is available in collaboration with several Organized Research Centers or Programs at the SOM, including the Shock Trauma Center, and pediatric orthopedics at the University of Maryland Rehabilitation and Orthopedic Institute. The department offers ACGME-accredited fellowships in spine and trauma clinical research, and jointly houses the Center for Sports Medicine and Human Performance along with the University of Maryland, College Park campus. Departmental research support is more than $11 million in funds.

*Otorhinolaryngology-Head & Neck Surgery* – The Department of Otorhinolaryngology is comprised of a diverse group of physicians who actively participate in patient care and translational research. Research areas focus on discovering new treatments, novel drug therapies and diagnostic tools in the areas of hearing loss, cranio-facial surgery, audiology laryngology in adult and pediatric populations. Faculty research endeavors are closely integrated with basic science departments at the SOM, and research is supported by nearly $3 million in research funds.

*Pathology* – The Department of Pathology’s mission is to increase the knowledge and understanding of disease process mechanisms. Through our focus in the key areas of cancer, infectious disease, neuropathology, new prognostic and diagnostic tools, immunology, genomics, tumor biology, animal models, biomarkers, and biodefense, we maximize our research efforts by encouraging both independent and collaborative research opportunities. Due to the translational nature of the science, the study of pathology allows us to bridge the gap between pure research and clinical application.

*Pediatrics* – The Department of Pediatrics’ goal is to assure that every child in Maryland receives the very best medical care. That includes a strong history of laboratory and clinical research, in areas including infectious disease, vaccine development and evaluation, stem cell research, child nutrition & obesity, and neurodevelopment, totaling more than $30M in extramural funding in FY20. The department also houses the NIH-funded NeuroBioBank Brain and Tissue Repository, which supports neuroscience research across UMSOM, UMB, Maryland, and the nation.

*Pharmacology* – The Department of Pharmacology focuses on research in the areas of neuropharmacology, oncopharmacology, and toxicology. The department is closely allied with UM Greenebaum Comprehensive Cancer Center, the Institute for Genome Science, the Maryland Psychiatric Research Center, and is home to the Center for Epigenetic Research in Child Health and Brain Development. Faculty in the Department of Pharmacology hold a number of patents for novel drug therapies for breast and prostate cancer, and collaborate extensively with clinical researchers in the areas of cancer treatments and therapies for movement and psychiatric disorders. Research in the department of Pharmacology is supported by over $5 million in funds.

*Physical Therapy & Rehabilitation Sciences* – The Department of Physical Therapy & Rehabilitation Sciences (PTRS) is an allied health department that is dedicated to contributing and advancing health care through research. Particular areas of research focus include neuromotor performance & rehabilitation, musculoskeletal performance & rehabilitation, cardiovascular & pulmonary rehabilitation, rehabilitation engineering & robotics, and rehabilitation epidemiology. PTRS is an active collaborator on the Department of Epidemiology’s NIH-funded University of Maryland Claude D. Pepper Older Americans Independence Center, and also houses a DHHS-funded center on rehabilitation.

*Physiology* – Research in the Department of Physiology works to integrate molecular, cellular, and systems biology approaches to discover how life works. The department has especially strong traditions in cardiovascular-renal biology, neuroscience, and reproductive biology. They are helping to uncover the causes and mechanisms of human disease, including Alzheimer’s, cancer, heart failure, hypertension, muscular dystrophy, and depression.

*Psychiatry* – The Department of Psychiatry’s research portfolio reflects a wide range of diverse clinical and basic science programs that span translational, educational, and psychiatric services, making significant contributions to scientific knowledge and the delivery of evidence-based care. With more than $45 million in external research funding, and nearly $16 million in NIH funding in FY20, the department has particular research strengths in basic science and clinical work in schizophrenia, substance use, and affective disorders.

*Radiation Oncology* - The Department of Radiation Oncology is a national leader in translational research in radiation therapy and is one of the top 10 radiation oncology departments in the country for amount of federal funding received for cutting-edge research. More than $13 million in extramural awards funds research in medical physics, clinical trials, and translational radiation sciences. The Division of Translational Radiation Sciences within the department uses a multidisciplinary approach to address the knowledge gaps in radiation oncology, biology, and physics to facilitate discovery and innovation.

*Surgery* – The Department of Surgery instills a culture of research within their clinical faculty from the moment they join the department. Research occurs in divisions including Cardiac, General & Oncologic, Pediatric, Plastic, Thoracic, Transplant, and Vascular Surgery, and Urology and Surgical Sciences. In FY21, the department was ranked 9th by the Blue Ridge Institute for Medical Research, with more than $13 million in NIH funding.

**C. Research Environment at UMSOM - Institutes and Organized Research Centers**

The critical path to successful translation of laboratory discoveries and clinical observations to new cures is at the center of our research enterprise. To best achieve these goals SOM has established a group of multi-disciplinary Institutes and Organized Research Centers (ORCs) that create teams comprised of diverse but complementary investigators that focus on critical issues of health and disease. The overall investment of the SOM in these Centers has been substantial. A list of these organizations is found in Table below.

*Biomedical Engineering and Technology (BioMET)* - BioMET is an ORC that is composed of biomedical scientists with expertise in medicine, molecular and cell biology, optics, applied physics, engineering, and biochemistry that develop new strategies and new devices to enhance our ability to treat diseases. Faculty address fundamental questions in bioengineering, optical biology, sensing, neurobiology, genetics, cardiovascular diseases, cellular signaling, and protein structure. Scientific effort centers on biophotonics, molecular controls and cell signaling with current research foci that includes cellular signal transduction, genes and proteins contributing to Alzheimer's disease, cellular and molecular defects that lead to heart failure and arrhythmia, calcium signaling in nerve and muscle, and time-release drugs for stroke prevention. Other major areas of research involve imaging and fluorescence spectroscopy, development of novel contrast media for magnetic resonance imaging (MRI), creation of a new generation of biomedical devices that detect real-time changes in medically important biochemicals.

*Center for Biomolecular Therapeutics (CBT)*- The mission of this ORC is to facilitate the identification and development of new diagnostics and therapeutics. To accomplish this goal, the CBT (i) collaborates with research and clinical faculty to identify important biological targets; (ii) interacts with the biotechnology and pharmaceutical industries to help maintain CBT’s focus on the most biomedically and commercially important targets, diagnostics, and therapeutics, and (iv) manages state-of-the-art scientific discipline-based programs necessary for the discovery and regulation of disease targets including: Genomics & Bioinformatics (in conjunction with the Institute of Genome Sciences, IGS), Target Validation & Screening, Protein Production & Characterization, Structural Biology, Computer-Aided Drug Design, Medicinal Chemistry, and In vivo Biology & Drug Testing. The state-of-art laboratory space contains all of the equipment and supplies needed to develop recombinant protein expression vectors as well as express (bioreactors/fermenters), purify (HPLC/FPLC), crystallize, and characterize (X-ray and NMR) proteins, protein complexes, nucleic acid complexes, as well as complexes involving small molecule inhibitors (i.e. drugs) and biological therapeutics. The Center also has high-throughput screening and target validation at the biochemical and cellular levels (robots, plate readers, tissue culture suites).

*Maryland Psychiatric Research Center (MPRC)* – This internationally recognized research center is dedicated to providing treatment to patients with schizophrenia and related disorders, educating professionals and consumers about schizophrenia, and conducting basic and translational research into the manifestations, causes, and treatment of schizophrenia and other mental illnesses. Neuroscience Program is an integral part of the institute, providing cutting edge scientific concepts and state-of-the-art laboratory expertise to complement the clinical Programs. The wide-ranging research programs include studies on molecular and cellular studies to the examination of normal and abnormal brain function and behavioral genetic in whole animals. The Maryland Brain Collection (MBC), a resource of the MPRC, is dedicated to promoting research with brain tissue obtained post-mortem from individuals with schizophrenia or related disorders. The primary goal of the MBC is to provide high-quality tissue, along with comprehensive clinical information, for hypothesis-driven research. MPRC scientists collaborate with scientists from around the world to understand how abnormalities in brain tissue relate to mental illness in disorders such as schizophrenia, bipolar disorder, depression, teen suicide, and substance abuse. The Neuroimaging Research Program (NRP) is a clinical program at the MPRC whose primary mission is to use cutting-edge multimodal imaging in conjunction with pharmacology, genetics, neurophysiology, and behavioral techniques to find the cause of and better treatment for severe mental illnesses. Faculty maintain a strong technical expertise in a wide range of imaging techniques in fMRI, spectroscopy, DTI, and others. We emphasize applications of imaging techniques in genetic imaging, pharmacological imaging, functional, structural and network imaging modeling.

*Research on Aging* - The mission of the ORC in Gerontology is to create, facilitate and expand interdisciplinary collaborations among investigators to further the development of academic excellence in key areas of clinical, epidemiological, basic-biomedical, mental health, legal-ethical, health services and population-based research in aging. The center emphasizes several specific research areas in aging at the University where there are existing funded initiatives. This approach optimizes the use of resources and builds on the existing strengths in aging research at UMB, including the long running, NIH-funded University of Maryland Claude D. Pepper Older Americans Independence Center P30 grant. These areas include: conducts exercise rehabilitation research in functionally limited older patients; hip fracture recovery; the secondary prevention of coronary artery disease through exercise, nutrition and smoking cessation in high risk older patients who have suffered a stroke; epidemiologic research in residential, long-term care and assisted-living sites; rehabilitation research in frail older hospitalized VA patients to prevent the need for institutionalization in nursing homes; risk factors for hip fracture in older women, research training programs in exercise physiology and metabolism research and the epidemiology of aging.

*Shock, Trauma, & Anesthesiology Research (STAR)* - Founded in 2008, this ORC (STAR-ORC) encompasses the Congressionally mandated, [National Study Center for Trauma and Emergency Medical Systems](http://medschool.umaryland.edu/NSCforTRauma/); the [clinical research activities](http://www.umm.edu/shocktrauma/research/index.htm) of the [R Adams Cowley Shock Trauma Center](http://www.umm.edu/shocktrauma/); the clinical research programs of the [Program in Trauma](http://medschool.umaryland.edu/trauma/default.asp); and the pre-clinical and clinical research programs of the [Department of Anesthesiology](http://medschool.umaryland.edu/anesthesiology/). The STAR Center's mission is to facilitate translational research in areas related to trauma, tissue injury, critical care and anesthesiology.  Areas of research include: examination of the pathobiology of experimental brain and spinal cord injury and their treatment through cellular biology, animal modeling, behavior, imaging and drug discovery; the molecular mechanisms underlying ischemic and traumatic brain injury; understand how oxidative stress and mitochondrial dysfunction contribute to adult and pediatric brain injury; injury epidemiology focusing on occupational and vehicle related traumatic injury ; studies on correlating hypoxia, normoxia and hyperoxia with outcome in patients with severe TBI; outcome in patients with severe TBI and long bone fractures.

*Stem Cell Biology & Regenerative Medicine* – The mission of the Center is to discover new treatments and preventive approaches, based on stem cell technology, for important, currently intractable human maladies. The Center is driven by an imperative to work quickly from bench science to the actual use of discoveries to transform clinical medicine. The cardiovascular group is developing durable therapies for heart disease. The Cancer Stem Cell group works on hematopoietic stem cell transplantations and novel methods to kill cancer stem cells. The mesenchymal stem cell group focuses on the regenerating new bone and cartilage. The neural stem cell group studies 3-D models of brain, neural injury and repair, and stem cell reprograming to form new brain cells.

*Center for Vaccine Development and Global Health (CVD)* - The CVD has an international reputation as an academic vaccine development enterprise for creating and testing vaccines against cholera, typhoid fever, paratyphoid fever, non-typhoidal Salmonella disease, shigellosis (bacillary dysentery), *Escherichia coli* diarrhea, malaria, and other infectious diseases, including influenza.  Recently the CVD was chosen by the World Health Organization (WHO) to lead the first human Phase 1 Clinical Trials for a novel Ebola Virus vaccine in Mali. In addition to its research and outpatient facilities in Baltimore, Maryland, the CVD has fixed facilities to conduct clinical studies in Mali, West Africa, Malawi, Southern Africa and Santiago, Chile and undertakes time-limited field studies in many other countries in Africa, Asia and Latin America. The Center’s international staff includes molecular biologists, microbiologists, immunologists, internists, pediatricians, epidemiologists, malariologists, biostatisticians and informaticians. The Center has attracted extensive funding from NIH, Bill and Melinda Gates Foundation, WHO, and pharmaceutical companies.

*Center for Vascular & Inflammatory Diseases (CVID)* - The CVID mission is to advance our understanding of vascular biology and the inflammation processes that cause disease. Insults to the vasculature can cause a wide range of life-threatening diseases that include stroke, myocardial infarction, hypertension, diabetes, and chronic kidney disease. Inflammation is emerging as a key contributor to many vascular diseases and further, plays a major role in autoimmune diseases, arthritis, and cancer. Tumor cells can induce the formation of new blood vessels through angiogenesis in concert with inflammation is thought to be critical in the transition from a benign to a malignant disease. Research at the CVID focuses on integrating molecular and cell biology with applied and clinical sciences specifically in the areas of biochemistry, vascular biology, immunology, cancer biology, hematopoiesis, stem cell biology and cardiology. The CVID brings together basic researchers and clinicians to promote the translation of basic discoveries into novel therapeutic applications to promote the health of patients.

*Institute of Human Virology (IHV)* - The Institute of Human Virology, established in 1996, is the first center in the United States to combine the disciplines of basic science, epidemiology and clinical research in a concerted effort to speed the discovery of diagnostics and therapeutics for a wide variety of chronic and deadly viral and immune disorders - most notably HIV, the cause of AIDS. IHV is home to some 70 Faculty who include some of the most globallyrecognized and world-renowned experts in the field of human virology. IHV has a unique and promising HIV/AIDS vaccine candidate designed to neutralize many of the different strains of HIV found around the world from the moment of infection - which IHV believes is a major prerequisite for a successful HIV vaccine. IHV scientists are also aggressively pursuing the mechanisms by which other viral diseases attack human cells and spread throughout the body. Research efforts focus on prevention and biological treatments that are potentially less toxic, less costly and more easily accessible to the world at large. IHV’s extensive global network includes an on-ground presence in 7 African and 2 Caribbean nations allowing it to closely monitor the HIV/AIDS pandemic and associated diseases such as TB in these countries, and numerous research collaborations in countries such as China, Italy and France.

*Institute of Genome Sciences (IGS)* - Members of the IGS team have helped revolutionize genomic discoveries in medicine, agriculture, environmental science and biodefense. By applying genomic tools to clinical research, these investigators are creating new dynamics for understanding individual differences in our susceptibility to disease, for understanding the role of our bodies' microorganisms in health and disease, and for exploring new personalized therapeutics. IGS investigators are also leading the development of the new field of microbial forensics. Through bioinformatics they are applying computational and statistical techniques to interpret, annotate, distribute, and manage biological data. Genomic sequencing of bacteria and viruses by IGS Faculty gives infectious disease researchers the tools to examine a pathogen's genetic blueprint to identify and potentially prevent infectious disease outbreaks. Understanding interactions of microbial communities in healthy and disease states is giving IGS researchers clues about diseases, aging, and our interaction with the environment. IGS is progressing towards a new era of personalized medicine by investigating individual DNA sequence differences for insights about the relationships between genes, physical traits, and disease.

*University of Maryland Marlene and Stewart Greenebaum Cancer Center (UMGCCC)* – A joint program between the University of Maryland School of Medicine and the University of Maryland Medical System, the UMGCCC has been ranked in the top 50 of cancer centers nationwide by US News and World Report for 10 consecutive years. In 2016, the cancer center was named a National Cancer Institute-designated Comprehensive Cancer Center, one of only 49 in the country. The mission of the UMGCCC is to undertake innovative basic, clinical, population, and prevention research that will impact the understanding and treatment of cancer around the world and to provide state of the art clinical care to cancer patients in Maryland and beyond. Established research programs in hormone responsive cancers, molecular & structural biology, experimental therapeutics, population science, and tumor immunology and immunotherapy are, and developing programs in cutaneous malignancies and cancer imaging are performing cutting edge translational research and developing new cancer treatments every day. The newly opened Fannie Angelos Cellular Therapeutics Laboratory is a state-of-the-art, GMP facility that will further facilitate our researchers in creating targeted cell-based immunotherapies for cancer patients.

*Center for Blood Oxygen Transport & Hemostasis (CBOTH)* – The Center for Blood Oxygen Transport & Hemostasis addresses fundamental, challenging questions related to blood oxygen transport and hemostasis from a systems perspective, with attention to human biology, physiology and therapeutics. Innovative study of oxygen transport, hemostasis and key interacting biologic systems crosses traditional disciplines; moreover, efficient therapeutic development bridges typical stages of pharmaceutical & bioengineering advancement. CBOTH surmounts this challenge by integrating effort from leading investigators across disciplines (physicians, biochemists, engineers) and engagement across the translational pipeline. Through these interdisciplinary efforts, CBOTH is advancing the development of an artificial blood product for use in trauma settings without easy access to donated blood for transfusions, such as battlefields or rural areas.

*Center for Epigenetic Research in Child Health & Brain Development (CERCH)* - The Center for Epigenetic Research in Child Health & Brain Development (CERCH) is a centralized resource uniting basic scientists and clinicians across the university, providing them research consultation and grant services, to stimulate collaborative translational relationships in the areas of neuroscience, mental health, obstetrics and pediatrics. Their mission is to raise awareness on the factors important for healthy child development through research, education, and public outreach emphasizing the epigenetic mechanisms that influence development and long-term disease risk. In addition to a strong research core that focuses on parental contributions and early life experiences that shape child health and brain development, the center is committed to partnering with local community leaders and developing outreach programs to raise the awareness of factors that are important for healthy child development.

**D. Other Resources**

**HS/HSL Library**

The UMB Health Sciences and Human Services Library (HSHSL) was the first library established by a medical school in the United States. It provides collections and services for all faculty, staff, and students at the University of Maryland, Baltimore and the University of Maryland Medical Center. Its resources will be available for access to all UM-FIRST faculty recruits, regardless of whether they are based at UMSOM or UMBC. HSHSL also serves as the Regional Medical Library for the Southeastern/Atlantic Region, serving 10 southeastern states, the District of Columbia, Puerto Rico, and the Virgin Islands. The library currently provides access to more than 108 databases, 17,400 ebook titles, and 360,000 print volumes in addition to the numerous subscriptions. The library is staffed by 25 faculty librarians and more than 50 full-time personnel. In addition to the print collection and journal holdings, the library has numerous publicly available computers, fully equipped classrooms, video conference rooms and group study rooms, a Bioinformation and Data Science computer, a presentation practice studio with video recording and editing equipment, a collaborative learning room, and an innovation space with 3D printing equipment, and design software all available for use by faculty, staff, and students. The library staff support the campus research community with specialized knowledge and expertise by performing customized systematic literature reviews, offering detailed consultation and review of clinical study patient consent forms, and providing services for research data management, high performance computing, and data sharing. Staff at the UMB HSHSL conduct numerous training workshops annually in these areas and more, including best strategies for database searches, best practices for large-scale data management, bioinformatics, principles of graphic design, and 3D printing. The 3D printing space at the UMB HSHSL in particular is a valued resource for both basic science and clinical researchers, facilitating the design and prototyping of medical and surgical devices, research equipment, and personal protective equipment.

**UMB Institute for Clinical & Translational Research (ICTR)**

The UMB ICTR is a campus-wide clinical translational research initiative supported by the UMB campus. The UMB ICTR provides financial support as well as infrastructure, environment, training, and workforce to invigorate, facilitate, and accelerate clinical translational research to improve patient and community health. ICTR provides substantial resources in support of clinical and translational support, including core services (outlined below), education and training opportunities and grants, and community engagement with local health providers, community-based organizations, disease advocacy groups, nonprofit or industry entities engaged in translational research, and other local or national communities. UMB’s ICTR is funded by an NIH CTSA grant in collaboration with Johns Hopkins University. ICTR resources will be available to all UM FIRST recruits, whether at UMSOM or UMBC as UMBC is a member of ICTR.

ICTR Cores:

* ICTR Biostatistics Core – provides biostatistical support in the design, implementation, and interpretation of clinical translational research studies and access to Medicare and IQVIA data. Researchers can get up to 25 hours of free services.
* ICTR community and Collaboration Core – provides expert patient- and community-centered services and resources, including the PATIENTS program for help in setting up focus groups, developing participant instructions videos, and more. It also includes access to a research vehicle to transport research staff and supplies into the community. Researchers can access up to 50 hours of services free of charge.
* ICTR Drug Discovery and Development Core - provides services in computer-aided drug design, clinical pharmacology and pharmacometrics, mass spectrometry, and drug formulation. Researchers can access up to 25 hours of services free of charge.
* ICTR Informatics Core – provides support with data management (REDCap, Qualtrics, Teleforms), access to EPIC clinical data, consultation with UMBC’s cybersecurity and artificial intelligence core, and consulting on the use of digital technology in support of health, like mobile apps. Researchers can access up to 25 hours free of charge.
* ICTR Studios Program – offers a series of integrated, dynamic, and interactive “roundtable” discussions to assist the researcher by providing expertise in areas such as hypothesis generation, study design, biostatistics, implementation, analysis, and interpretation, recruitment, and research ethics.

**E. CORE FACILITIES AND SHARED RESOURCES**

**CENTER FOR INNOVATIVE BIOMEDICAL RESOURCES (CIBR)**

CIBR is a novel center that provides infrastructure and oversight of a collection of 35 scientific core facilities that provide state-of-the-art technologies, high-tech instrumentation, and expertise to support biomedical research, clinical practice and health care to principal investigators in the state of Maryland and the region. Renovation of nearly 30,000 square feet of space was accomplished in 2017 with $7.3 M in funding from an NIH award. This newly renovated space allows for the physical consolidation of many core facilities, creating a dynamic environment that facilitates collaboration, maximizes efficiencies and provides our investigators with easy, round-the-clock access to cutting-edge instrumentation.  In addition, each core facility within the CIBR is overseen by a PhD-level director, and offers highly-trained technical staff who support the mission of each instrument core by training users and assisting in experimental design, data analysis and interpretation. CIBR provides training for all graduate and medical students, postdoctoral fellows, and faculty within the University, and to outside collaborators.  Investigators can reserve equipment time and book services from each instrumentation core via an online portal. Each core within the CIBR addresses an critical area of research expertise: Animal Models (phenotyping and transgenic services, veterinary services), Bioinformatics and Statistics, Clinical Resources (clinical histology, cytogenetics, brain and tissue banks, molecular diagnostics), Cytometric and Bioassay services, Drug Development (including GMP and GLP services), Imaging technologies (Xray crystallography EM, confocal microscopy, MR-guided ultrasound, MRI, PET-CT), Nucleic Acid and Genomics Services, Structural Biology (NMR, mass spec, protein analysis), and Clinical and Translational Research Services. Additional information on select cores is below.

# BIOMEDICAL RESEARCH SUPPLY CORE (BIORESCO)

**MISSION**

To conserve time, money, space and effort for the University of Maryland, Baltimore (UMB) and UMB BioPark researchers, by maintaining a central supply core facility, e-commerce web site and expediting service which thrives upon its ability to innovate and re-create itself in accordance with the requirements of the University and its research staff. 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 the researchers pay no Shipping or Handling charges. The BIORESCO web site hosts catalogs from over 45 Vendors. Customers can search and order from over 1.5 million discounted products.

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

* Two large annual vendor shows that bring over 50 vendors and 1200 members from the research community together
* Collaboration with UMB Environmental Health and Safety to minimize the volume and variety of dangerous chemicals on campus by maintaining years of searchable campus purchasing data
* Calibration for pipettors and balances
* Peptide and Oligonucleotide Synthesis
* Emergency Freezer Storage (-20 degrees C, -80 degrees C)
* Free packing and shipping materials for all temperatures
* Dry ice for sale

# HIGHLIGHTS

* Based on a 10 year analysis:
* Average savings from List — 27%
* Savings in shipping and handling charges — $16.1 million
* Administrative Cost per purchase is around $4, which is much below the national average for a procurement purchase ($60) or P-card purchase ($20)
* We take the hassles out of replacements, backorder substitutions, cancellations and returns

# BIOSENSOR CORE FACILITY

**MISSION**

The Biosensor Core Facility’s objective is to provide the faculty, staff and students at UMB 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:

* Determine if pairs of molecules bind to each other.
* Determine kinetic constants, binding constants, and specificity of binding.
* Determine if several molecules can bind simultaneously to the same ligand or if they compete for binding.

# CORE INSTRUMENTS

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.

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.

# BIOSTATISTICS SHARED SERVICE

**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. Our most important resource is our team of enthusiastic and competent biostatisticians, bioinformaticians and administrative staff. We 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 East. We also develop customized computer programs for complex statistical problems.

**CLINICAL AND TRANSLATIONAL RESEARCH INFORMATICS CENTER (CTRIC)**

**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.

# 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 Capture.

CTRIC employs both web-based and scannable paper-based form technologies which minimize manual data entry in order to increase the speed and accuracy of collected data entered in the database.

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 (PostgreSQL, 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.

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.

Access to data in the University of Maryland Medical System (UMMS) Clinical Data Repository. Across various facilities, UMMS has more than 600,000 visits every year, with much of the resulting data stored in the data repository. Researchers who are interested in accessing this vast resource can be provided with guidance through the process of obtaining IRB approval, submitting a data request, and analytic strategies.

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.

**CONFOCAL MICROSCOPY CORE FACILITY**

**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. Facility users can be trained to utilize the machine best matching their respective imaging requirements. 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 equipped with software packages is available to users.

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

# CORE INSTRUMENTATION

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; 2PMT and 2 sensitive GaAsP detectors
* Can be combined with electrophysiology or other measures

Zeiss 5-Live & Zeiss 510

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

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

Olympus FV300/Atomic Force Microscope

* Inverted confocal microscope capable of multicolored imaging
* Equipped with an Atomic Force Microscope accessory (AFM, Bruker)
* Combines the capabilities of confocal imaging with atomic force microscopy to enhance experiments

**CYTOGENETICS LABORATORY**

**MISSION**

Our laboratory offers cytogenetic and molecular genomic diagnosis for both constitutional and acquired chromosome abnormalities. We focus on the detection and characterization of subtle chromosome abnormalities in hematological malignancies/ stem cells, as well as roles of telomere biology in cancer and human aging.

# CORE SERVICES

The Cytogenetics Laboratory is a CLIA-certified and CAP accredited facility that offers comprehensive cytogenetic diagnosis for both constitutional and acquired chromosome abnormalities. It provides conventional karyotype analysis and fluorescence *in situ* hybridization (FISH) studies for the detection and characterization of chromosome abnormalities in clinical specimens and in established cell lines. The Cytogenetics Laboratory includes an American Board of Medical Genetics-certified clinical cytogeneticist/clinical molecular geneticist, highly knowledgeable laboratory supervisors, and well-experienced staff.

# SERVICES OFFERED

* Chromosome studies on multiple sample types including peripheral blood, bone marrow, fibroblasts and solid tissues (Karyotype)
* FISH testing
* Microarray data analysis

# CORE INSTRUMENTATION

Automatic Interphase and Metaphase finder

* Metasystems Metafer Slide Scanner and Ikaros/Isis Analysis software
* Automatic export of high resolution images for analysis
* Chromosome Studies (Karyotype)

FISH Testing

* Whole chromosome painting
* Centromere probes
* Subtelomere probes
* Microdeletion probes
* Cancer probes
* Other locus-specific probes
* Cytogenomic Microarray Analysis

# CYTOKINE CORE LABORATORY

**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 LuminexTM 100 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.

# CORE INSTRUMENTATION

Luminex 100 Multi-analyte system

* This system allows for the simultaneous measurement of up to 100 analytes in a single well. The machine utilized two lasers, a reporter laser at 532 nm and a classification laser at 635 nm, to detect and measure fluorescently dyed microspheres. This allows for smaller sample requirements with a larger data output. Bio-Rad’s Bio-Plex Manager software is used for data requisition and analysis.

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 allow for higher throughput and for lower CV% over standard manual washing.

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.

**ELECTRON MICROSCOPY CORE IMAGING FACILITY**

**MISSION**

The Electron Microscopy Core Imaging Facility provides electron microscopy related research, consultation and imaging services to all faculty and staff of the University of Maryland Baltimore campus and the academic and industrial community in the Washington, D.C. and Baltimore areas. The objective of this facility is to provide affordable electron microscopy research services using the modern EM techniques and state-of-the-art instrumentation from sample processing to image acquisition and analysis.

# CORE SERVICES

* Conventional TEM sample preparation, including embedding in various types of resin and ultrathin sectioning
* Conventional SEM sample preparation, including chemical dehydration, critical point drying and sputter coating
* Cryo-sample preparation for both TEM and SEM, including high pressure freezing, freeze substitution cryo-ultramicrotomy, plunge freezing and freeze fracture
* Immuno electron microscopy using pre-embedding, post embedding or Takuyasu methods
* Negative staining of purified macromolecular complexes, bacteria, viruses, liposomes, nanoparticles, or viral like particles (VLP)
* Advanced microscopy techniques, such as cryoEM, correlative LM/EM (CLEM) and 3D EM
* Electron microscopes imaging for trained or novice users
* Advanced consultation and training of electron microscopy related techniques and equipment usage
* Annual Current Electron Microscopy Techniques workshop
* Annual Ultramicrotomy Minicourse
* Instrument demonstration

# CORE INSTRUMENTATION

## Transmission Electron Microscope

FEI Tecnai T12 is a high-performance, high-resolution transmission electron microscope equipped with a tungsten filament. It is well suited to be a general-purpose instrument in a multi-user facility. The Tecnai T12 is also equipped with a Gatan 626 cryo transfer holder for observing frozen hydrated biological sample at liquid nitrogen temperature.

## Scanning Electron Microscope

The FEI Quanta 200 is a versatile high performance, low-vacuum scanning electron microscope with a tungsten electron source. It can be operated in three different vacuum modes, High Vacuum (HV), Low Vacuum (LV) and Environmental Mode (ESEM), thus accommodate a wide range of sample of any SEM system. The Quanta 200 is also equipped with a Gatan Cryo transfer unit (ALTO2100) for cryo SEM imaging and freeze fracture.

## Automated Specimen Processor

ASP01000 is a multifunctional robotic specimen processing platform. The instrument is controlled through a bioreaction automation software, COBRA, and can be programmed to perform specimen fixation, dehydration, embedding, negative staining and immunogold labeling, etc., in automation.

## Cryo Sample Preparation Instruments

* High Pressure Freezer
* Automated Freeze Substitution
* Plunge Freezer
* Cryoultramicrotome
* Gatan TEM Cryotransfer Holder
* Gatan SEM Alto Cryo Chamber

# CVD FLOW CYTOMETRY AND MASS CYTOMETRY CORE

**MISSION**

To ensure that University of Maryland investigators have access to flow cytometry and mass cytometry services for their research. A facility based in the Center for Vaccine Development (CVD) 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**

# 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 CyTOF Mass Cytometer**

* + **>35 parameters** based on mass spectrometry detection of metal isotope-labeled antibody staining
	+ No need for single color controls or fluorescence compensation

## Fluidigm Helios Mass Cytometer

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

**UMGCCC FLOW CYTOMETRY SHARED SERVICES**

**MISSION**

The University of Maryland Greenebaum Comprehensive Cancer Center (UMGCCC) 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. The FCSS provides full-scale, state-of-the-art flow cytometry services from sample acquisition through data analysis to cell sorting.

# CORE SERVICES

The FCSS provides state-of-the-art instrumentation and technical support for sample acquisition and cell sorting, data analysis and interpretation, as well as training and experimental consultation and strategic planning.

* Operator-assisted sample acquisition
* Sample acquisition by user
* High throughput sample acquisition
* Operator-assisted data analysis with FlowJo or FACSDiva
* Data analysis by user on FCSS workstation
* Operator-assisted cell sorting
* Training for sample acquisition on analytical instruments
* Training on FACSDiva operating system
* Experimental planning and consultation

# CORE INSTRUMENTATION

The facility has state-of-the-art analysis instruments used for quantitative analysis.

* **BD LSRII Flow Cytometer with High Throughput Sampler Option**
* **BD FACS CANTO Cytometer**
* **Amnis FlowSight**

The facility is also equipped with a state-of-the-art high speed cell sorter.

* **BD FACSAria II**

# CENTER FOR FLUORESCENCE SPECTROSCOPY

**MISSION**

The Center for Fluorescence Spectroscopy (CFS) provides state-of-the-art fluorescence instrumentation for studies of structure, function, and dynamics of biological macromolecules. CFS also provides the expertise on applications of fluorescence for bioassays and cellular imaging.

# CORE SERVICES

The CFS makes available state-of-the art spectroscopic instrumentation and techniques for fluorometric bioassay development and cellular imaging.

Techniques include:

* Fluorescence energy transfer (FRET)
* Fluorescence polarization (FP)
* Fluorescence correlation spectroscopy (FCS)
* Single molecule detection (SMD)
* Time-resolved spectroscopy
* Fluorescence lifetime imaging microscopy (FLIM)

Facility also provides technical expertise on all aspects of fluorescence techniques used in basic science and biological/medical applications.

Cell imaging and studies of biomolecule interactions of assemble molecules and on single molecule basis are available with fluorescence microscopies.

# CORE INSTRUMENTATION

## Fluorescence Lifetime Imaging Microscope

State-of-the-art imaging system, Alba V (FLIM and FCS) is designed for cellular imaging and bioassay readout and quantitative analysis. The system is equipped with multiple lasers, multiple channels, dual scanners and dual lifetime imaging capability (TD and FD).

## Single Molecule Fluorescence Microscope

* Multiple lasers
* Lifetime capability
* FCS

## Time-Resolved Fluorescence Spectrometer

* Super Continuum Laser
* Automated system

## Atomic Force Microscope and NSOM WITec alpha300S

* Contact Mode
* AC Mode
* Confocal Capabilities

# GENOMICS RESOURCE CENTER (GRC)

**MISSION**

The Genomics Resource Center (GRC) is a high-throughput core laboratory and data analysis group supporting the scientific programs of the Institute for Genome Sciences, University of Maryland Baltimore and its collaborators utilizing state-of-the-art technology to generate high quality genomic data in a cost effective manner.

# ABOUT GRC

Led by Dr. Lisa Sadzewicz, Administrative Director, and Mr. Luke Tallon, Scientific Director, who together have more than 40 years’ experience in managing high-throughput sequencing and analysis operations, the multi-disciplinary GRC group includes scientists, bioinformatics software engineers, bioinformatics analysts, project managers, and research specialists who have extensive experience in planning and managing projects, ranging in scope from small-scale amplicon and plasmid sequencing to large-scale comparative genomic and transcriptome sequencing.

The laboratory services offered by the GRC include sample quality assessment, library construction, sequencing and analysis of a broad range of sample types.

# APPLICATIONS AND SERVICES

## Sequencing Applications

* *de novo* Whole Genomes
* Comparative Genomes
* Human Genomes & Exomes
* Transcriptomes
* Custom Capture
* ChIP-Seq
* Methylation & Base Modification Detection
* Ecological and Organismal Metagenomes
* Amplicon Sequencing
* Custom Applications

## Analysis Services

* Genomic and Metagenomic Sequence Assembly
* Comparative Genome Analysis
* Phylogenomic Analysis
* SNP, Indel, and Structural Variant Detection
* Epigenomic Analysis
* Pathway & Network Analysis
* Sequence Data Storage and Distribution
* Custom Data Analysis

## Our Sequencing Platforms

* Illumina HiSeq 2500 & 4000
* Illumina MiSeq and MiSeqDx
* PacBio RS II & Sequel
* Oxford Nanopore MinION
* NanoString nCounter MAX
* 10x Genomics Chromium System

# GENOMICS CORE FACILITY (BASIC AND CLINICAL SERVICES)

**MISSION**

The mission of the Genomics Laboratory is to provide the expertise, state-of-the-art resources and training necessary to promote cutting edge basic, translational and clinical genomic research, as well as clinical molecular testing under Clinical Laboratory Improvement Amendments (CLIA) and College of American Pathologists (CAP).

# ABOUT

The Genomics Laboratory is committed to maintaining technologically advanced methodologies and instrumentation. We also provide an educational environment to instruct faculty, staff, fellows and students on the latest technologies and how they can positively impact on their research. Our staff are available to share their extensive knowledge and expertise in order to successfully support the research being conducted within the institution. Two separate laboratories make up the Genomics Shared Services: RGL and TGL.

# RESEARCH GENOMICS LABORATORY SERVICES (RGL)

* Cytogenomic Arrays
* Extraction of Nucleic Acid
	+ DNA
	+ RNA
* Gene Expression Arrays
	+ Global Expression Profiling
	+ miRNA Expression Profiling
	+ Transcriptome Analysis
* Genotyping
	+ Taqman Assays
	+ SNP Arrays (targeted or GWAS studies)
* Next Generation Sequencing (NGS) Gene Panels
* Sanger DNA Sequencing

# TRANSLATIONAL GENOMICS LABORATORY SERVICES (TGL)

* *BTD* Sequencing
* Confirmation of a Research Finding
* *CYP2C19* Genotyping
* *CYP2C19* Sequencing
* Cytogenomic Microarray
* Extract and Hold
* FLT3
* *IDH1* R132\_*IDH2* R140 and R172
* Site-specific Familial variant analysis

# CORE INSTRUMENTATION

* Affymetrix GeneChip 3000 systems
* Agilent Bioanalyzer model 2100
* Applied Biosystems Model 3730XL DNA Sequencers
* Applied Biosystems Model 7900 rtPCR System
* Ion Torrent Personal Genome Machine (PGM) Sequencers
* Ion Torrent Chef System
* Ion Torrent S5
* Nanodrop single-channel and 8-channel spectrophotometers
	+ ThermoFisher QuantStudio

**INFORMATION RESOURCE CENTER**

**INTRODUCTION**

The Informatics Resource Center (IRC) under the direction of Anup Mahurkar provides genomics and bioinformatics services to the UMB campus. Mr. Mahurkar works closely with Owen White, PhD, the Director of Bioinformatics for School of Medicine and the Associate Director of the Institute for Genome Sciences, and 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. The major scientific platforms supported by IRC include prokaryotic, eukaryotic, viral, and mammalian genomics; metagenomics, informatics, and systems biology.

# ANALYSIS SERVICES

The IRC has developed and maintains several analysis tools and pipelines that facilitate research at the UMSOM. These include:

* **Genome assembly and annotation.** Pipelines for both prokaryotic and eukaryotic organisms are available. These include both reference-based and reference-independent protocols
* **Differential expression analysis**. The IRC has pipelines to conduct gene and isoform level differential expression analysis using microarrays or RNA-Seq
* **Genome variation analysis.** Pipelines for single nucleotide polymorphism (SNP) and copy number variant (CNV) detection and visualization
* **Metagenome/Metatranscriptome Analysis.** Pipelines are available for analysis of microbiome community composition and functional dynamics from 16S, Whole Metagenome Shotgun sequence, and metatranscriptome sequencing
* **Custom Programming and Analysis.** IRC staff have expertise to develop custom pipelines, analysis tools, websites, databases, and custom applications

# OUTREACH AND EDUCATIONAL PROGRAMS

The Institute for Genome Sciences offers regular professional development workshops. Workshop topics include:

* Genomics
* Metagenomics
* Transcriptomics
* Programming

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

**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 EQUIPMENT

## Siemens Prismafit 3 Tesla Whole Body MRI System

* Siemens Prismafit 3 Tesla whole body MRI System with high-speed gradients (XR 80/200)
* 64 receiver channels with head, body array, knee, wrist coils
* High-resolution anatomic imaging (~70-mm 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

## 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

# NUCLEAR MAGNETIC RESONANCE CENTER

**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, mrPipe, nmrDraw, xplor-NIH, and several others

# CORE INSTRUMENTATION

* 600 MHz Bruker Avance III NMR Spectrometer with TCI cryoprobe
* 800 MHz Bruker Avance Spectrometer with TXI cryoprobe and BACS 60 automatic sample changer
* 950 MHz Bruker Advance III Spectrometer with TCI cryoprobe

**PATHOLOGY BIOREPOSITORY SHARED SERVICE**

**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 and Biorepository Shared Service was established by UMGCCC in 2006 as a developing core. 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 archives of PBSS consist of more than 7,000 frozen tumor samples, 5,900 of which are paired with normal tissue from the same patient, and more than 22,000 frozen mononuclear cell isolates, plasma, and serum samples.

# CORE SERVICES

**TISSUE PROCUREMENT AND PROCESSING SERVICES**

* + Fresh or frozen tissue
	+ Plasma and serum collection
	+ 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 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

**PHYSIOLOGICAL PHENOTYPING CORE**

**MISSION**

The Physiological Phenotyping Core (PPC) provides cutting-edge phenotyping services with a focus on cardiovascular and respiratory systems. The core has a 10-year track record of services, including microsurgery, telemetry recordings, high-frequency ultrasound, and pressure-volume loop analysis.

# CORE SERVICES

* Microsurgery and animal models: catheter and device implanting; coronary artery ligation; aortic banding; artery wire denudation or ligation; chronic hypoxia
* Biomicroscopy (high-frequency ultrasound) of the hearts, large or small vessels, tumors, or abdominal organs
* Acute *in vivo* measurements: hemodynamics, pressure-volume loop analysis, respiratory mechanics, sympathetic nerve activity
* Long-term recordings: blood pressure, aortic or organ blood flow, sympathetic nerve activity, ECG, EEG, EMG, temperature
* Equipment Rental

# CORE INSTRUMENTATION

* Vevo 2100 High-frequency Ultrasound System (VisualSonics), the most updated system that allows high-resolution imaging under B-, M-, color and pulse-wave Doppler mode, 3-D construct, and Vevo strain.
* Telemetry System (DSI) allows long-term recordings of blood pressure, biopotential (ECG, EEG, EMG), sympathetic nerve activity, and blood glucose concentration. It can be interfaced with flowmeters (Transonic), e.g., for simultaneously long-term recordings of blood pressure and cardiac output
* MP150 Acquisition System (BioPac): 16-channel modular system interfaced with various transduces or amplifiers of pressure, volume, flow, biopotential, and temperature, as well as Mikro-tip catheters (Millar), flowmeters (Transonic), and cardiac output computer (Columbus Instruments)
* Environment System (Kent Scientific) allows customized exposure of hypoxia or hyperoxia
* Pressure-volume loop system (Transonic) for comprehensive analysis of cardiac function *in vivo* or in isolated heart preparation
* Tailcuff Blood Pressure System (SC1000, Hatteras)

# TRANSLATIONAL LABORATORY SHARED SERVICE

**MISSION**

The University of Maryland Greenebaum Comprehensive Cancer Center Translational 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 50+ human cell lines
	+ Luciferase-expressing breast, leukemia, ovarian and prostate cancer cell lines
	+ IACUC approved umbrella protocol
	+ Access/Knowledge in Using Xenogen/IVIS Imaging Mice
	+ Primary Xenograft Models
	+ Breast
		- Leukemia (under development)
		- Ovarian (under development)

Access to IRB approved protocol for tissue acquisition

## Clinical Trial Support

We isolate:

* + Plasma
	+ Serum
	+ Tumor Biopsy
	+ Whole Blood (isolation of PBMC, DNA, RNA, protein)
	+ Bone Marrow (isolation of marrow cells)
	+ Buccal Mucosa

# CORE SERVICES

***In Vitro* Assays**

* + IC50 generation
	+ Cell cycle (propidium iodide)
	+ Viability (trypan blue exclusion)
	+ Apoptosis
	+ Potentiation/Synergy
	+ ROS
	+ Western Analysis
	+ Angiogenesis
	+ Mycoplasma testing

## Xcelligence

Real time proliferation/invasion/migration

***In Vivo* Assays**

* + IACUC approved umbrella protocol
	+ Tolerability
	+ Tumor Growth
	+ 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)

 **UNIVERSITY OF MARYLAND MEDICINE (UMM) BIOREPOSITORY**

**MISSION**

The objective of the UMM Biorepository is to provide the resources and support for large-scale studies to empower basic and clinical researchers to make discoveries in genomics and ‘omics’ science and to translate 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
* Sample storage
* Sample retrieval Clinical Research Support
* IRB protocol preparation assistance
* Consenting
* Phlebotomy/sample collection
* Survey administration

# MAJOR EQUIPMENT AND SERVICES

Hamilton Biorepository (BiOS) Freezer System

* state-of-the-art automated, ultra-low temperature (-80oC) freezer system
* equipped to accommodate over 900,000 biospecimens
* Microlab chemagic STAR liquid handling system (Hamilton)
* DNA/RNA extraction
* Sample aliquoting and set up specific assays using retrieved samples

 **µQUANT CORE FACILITY (IHV)**

# MISSION

The µQUANT Core Facility housed within the Institute of Human Virology provides quality immunological analyses of biological analytes to researchers at the UM SOM, as well as other collaborators locally and nationally. Our aim is to provide consistent service that allows researchers to compare results generated this week with those gathered last month or a year ago.

# CORE SERVICES

Services offered include, but are not limited to:

* + ELISAs
	+ PBMCs
	+ Immunoassay setup & protocol establishment
	+ Luminex assays
	+ Mycoplasma & endotoxin testing
	+ Monoclonal antibody and recombinant protein screening, production, purification, & labeling
	+ HIV, SIV, & SHIV culture
	+ TCID50 and neutralization assays
	+ Quantitative PCR

# CORE INSTRUMENTATION

**SPECTRAMAX M2 6-96 WELL PLATE READER**

* + 6-well to 96-well plate reading capability
	+ Built-in absorbance and fluorescence
	+ Absorbance wavelength between 200 nm and 1000 nm, excitation wavelength between 250 nm and 850 nm, and emission wavelength between 360 nm and 850 nm

# WALLAC VICTOR 2 MULTI-ANALYTE PLATE READER

* + Complete platform for quantitative detection of light-emitting or light absorbing markers
	+ Luminescence, fluorescence, time-resolved fluorescence (DELFIA), and photometer

# VERITAS MICROPLATE LUMINOMETER

* + Read glow and flash luminescent reactions in 96-well plates

# BIO-PLEX 200 SYSTEM

* + Simultaneously quantitate up to 100 analytes per sample from culture media and serum
	+ Automatically analyze up to 96 samples in 30 min
	+ Instantly customize your assay by mixing Bio-Plex assay, or create your own assays
	+ Dramatically increase the amount of useful data obtained from a single sample

## StepOnePlus REAL-TIME PCR SYSTEM

**QuantStudio 3 Real-Time PCR SYSTEM**

* + 96-well Real-Time PCR instrument with sensitive 4-color optical LED recording system

**SimpliAmp PCR THERMAL CYCLER**

# VETERINARY RESOURCES/PROGRAM OF COMPARATIVE MEDICINE

**MISSION**

Our mission is to study the characterization of animal models of human disease; provide accredited services for laboratory animal care through collaborative research, professional development of veterinarians through specialty training with American College of Laboratory Animal Medicine (ACLAM); achieve continuous certification through compliance with The Association for Assessment and Accreditation of Laboratory Animal Care International (AAALACi), the United States Department of Agriculture (USDA); and the Office of Laboratory Animal Welfare (OLAW) (Public Health Service, NIH) and to act as a resource for information and instruction on the use of laboratory animals.

# CORE SERVICES

* + Wide range of animal models from mice to non-human primates
	+ GLP support for FDA/EPA-regulated studies
	+ Generation of polyclonal/monoclonal antibodies and induced pluripotent stem cells
	+ Maintain mouse colonies (SCID-NOD/NSG/NRG, nude, C57BL/6)
	+ Pre-research consultations with researchers on development of animal models
	+ Technical services provided for blood withdrawal, anesthetic support, and weaning
	+ Transgenic Services
	+ Germ-Free Laboratory - gnotobiotic mice

The University School of Medicine Program in Comparative Medicine was established in 1989. All Program faculty members hold joint appointments in other departments; conduct independent and collaborative research; and have expertise in the fields of clinical laboratory animal medicine, surgery, comparative pathology, microbiology, immunology, genetics and infectious diseases.

Comparative Medicine faculty members are available for consultation on animal research protocols, laboratory animal management and development of grant applications proposing the use of animals. Members participate in the teaching of medical students, graduate students, and postdoctoral fellows and provide postdoctoral residency and graduate training programs for veterinarians in the fields of Laboratory Animal Medicine and Veterinary Pathology.

As members of the University of Maryland School of Medicine’s Veterinary Resources, we also provide veterinary supervision for husbandry and health care related to facilities management, diagnosis, treatment and prevention of intercurrent disease in research animals.

# TRANSGENIC RESOURCES

Transgenic Resources and the University of Maryland School of Medicine exists to facilitate all aspects of customized production of genetically engineered rodent models. Transgenic Resources has developed a partnership with Jackson Laboratories (JAX) which is a proven leader in conducting transgenic knockout rodent services. The services offered are extensive and include standard transgenics, nuclease-mediated (CRISPR) knockout and knock-in mouse services, as well as ES cell injections. The mission of Transgenic Resources is to ensure that these established partnerships provide the best pricing, customization and the highest product quality to support UMSOM research