Biomedical Sciences Research Facilities Funding Program

2026 Report to the Minnesota State Legislature

January 1, 2026

University of Minnesota

OVERVIEW

The University of Minnesota has set its sights on becoming one of the top public research institutions in the world. Achieving this goal requires state-of-the-art biomedical research facilities that can support leading edge research and attract and retain top-tier research faculty.

To catalyze this effort, the University asked the State of Minnesota to create the Biomedical Facilities Authority as the mechanism to provide a predictable funding source for planning and building research facilities that, in turn, would allow the University to attract and retain the nation's top biomedical research talent.

The State established the $292 million Minnesota Biomedical Research Facilities Funding Program in 2008. This dedicated funding program provided appropriations by the State to the University for up to 75% of the costs to design and construct four new and expanded research buildings on the University's Twin Cities Campus, in the area known as the Biomedical Discovery District (BDD). The State's portion of this funding program is $219 million, while the University's portion is $73 million.

Per the requirements set forth in Minnesota Statute 3.197, the cost to prepare this report was ~$500.

PROGRESS TO DATE

Project #1 – Expansion of the Center for Magnetic Resonance Research – Completed July 2010
Project #2 & #3 – Cancer Cardiovascular Research Facility - Completed July 2013
Project #4 – Microbiology Research Facility – Completed October 2015

These four projects comprise 422,000 gross square feet of new research space housing 131 faculty and 922 research support staff.

The Cancer-Cardiovascular research facility also includes 35,000 square feet of shared research commons and support spaces. These areas house common instrumentation and research processing and support facilities, which are available to researchers throughout the district and broader University community, including:

- University Imaging Center
- University Genomics Center
- Mouse Genetics
- Flow Cytometry
- Chronic, long term testing laboratories

In addition, several of the planning principles for the Biomedical Discovery District provided for connectivity and the development of a cohesive research community. This interconnected, collaborative

research environment can leverage common shared support spaces and resources while allowing for unique opportunities to collaborate across fields and disciplines of research.

The district has now been connected end-to-end by skyway to further enhance and support the principle of cohesiveness and opportunities for collaboration.

Current Occupancy

	Principal Investigators	Research Associates / Staff / Post Doc / Students	Minnesota Biomedical Research Program Total
Cancer & Cardiovascular Research Building	69	624	693
Center for Magnetic Resonance Research	42	120	162
Microbiology Research Facility	20	148	168
District Support Staff		30	30
TOTAL	131	922	1,053

Summary Research Programs

Project #1 – Center for Magnetic Resonance Research (CMRR)

The Center for Magnetic Resonance Research (CMRR) is dedicated to advancing methodologies and instrumentation for biomedical imaging using ultrahigh field magnetic resonance imaging (MRI) and spectroscopy (7 Tesla and above), a focus pioneered by the Biomedical Technology Resource Center (BTRC). This specialization is predicated on the belief that ultrahigh magnetic fields offer significant advantages for extracting biomedical information, provided the corresponding high-frequency technical challenges can be overcome through innovative methodological and engineering solutions. The State of Minnesota's investments in infrastructure and resources have enabled the CMRR to experience steady growth over the past seven years.

Unique Resources and Interdisciplinary Impact

The CMRR houses some of the most advanced MR instrumentation globally, supported by a team with unique expertise in imaging physics, engineering, and signal processing. Recognizing the interdisciplinary nature of this research, the CMRR acts as a central umbrella to synergistically combine these multi-disciplinary capabilities. By facilitating these interactions and providing centralized support, the CMRR significantly amplifies the contributions of individual scientific groups to basic and clinical biomedical research.

Current large-scale research projects include:

- Technological developments for the next generation of magnetic resonance (MR) instrumentation, data acquisition, and image reconstruction.
- The application of these advanced technologies in biomedical research and clinical practice.
- Development of new biomedical applications, ranging from basic neuroscience (e.g., studies on Deep Brain Stimulation (DBS) and ataxias) to translational clinical studies in the human torso and musculoskeletal systems.

The CMRR provides essential resources and synergistic activities to numerous UMN centers (e.g., Institute of Engineering in Medicine, Masonic Cancer Center) and departments both within and outside the Medical School (e.g., Radiology, Neurology, Biomedical Engineering, Physics). The center currently supports more than 300 collaborators across the University. The State of Minnesota's investments in infrastructure and resources have enabled the CMRR to experience steady growth over the past five years.

CMRR investigators leverage these instruments to advance understanding of brain function, cognition, and behavior, bridging basic neuroscience with studies of neurodevelopmental and psychiatric concerns.

- Dr. Aaron Kerlin leads a laboratory in the Department of Neuroscience focused on understanding the cellular and circuit mechanisms underlying motor learning. His team investigates how individual dendrites and synapses within the motor cortex are modified as animals acquire new motor skills, using advanced two-photon microscopy to monitor and manipulate subcellular activity. Recent work in the Kerlin Lab identified a distinct loop between the cortex and thalamus that maintains motor plans even in the absence of overt action. By combining precise dendritic imaging with kinematic analysis of behavior, the lab is mapping the critical loci for learning new motor plans and identifying biophysical mechanisms that could inform rehabilitation strategies for cognitive motor disorders.

- Dr. Kamil Uğurbil holds the McKnight Presidential Endowed Chair Professorship and is the founding Director of the Center for Magnetic Resonance Research (CMRR) at the University of Minnesota. His laboratory pioneers the development and application of ultrahigh-field magnetic resonance imaging (≥7 Tesla, including one in clinical use) and advanced MR spectroscopy to study human brain function with unprecedented spatial and temporal resolution. Dr. Uğurbil's research has enabled functional mapping of columnar- and layer-specific responses, highly accelerated brain imaging, and novel insights into metabolism and connectivity in vivo. He was one of the principal investigators of the Human Connectome Project and continues to advance high-resolution neuroimaging to address fundamental questions in neuroscience, physiology, and neurochemistry. His work integrates physics, instrumentation, and computational methods to provide transformative platforms for understanding brain function in health and disease.

- Dr. Kelvin Lim, MD, holds the Drs. T. J. and Ella M. Arneson Land-Grant Chair in Human Behavior and directs the Non-invasive Neuromodulation Laboratories at the University of Minnesota. His research uses advanced neuroimaging to identify specific brain circuit abnormalities underlying disorders such as schizophrenia, traumatic brain injury (TBI), addiction, and Post Traumatic Stress Disorder (PTSD). By targeting these dysfunctional circuits with precision non-invasive neuromodulation techniques, including transcranial magnetic stimulation, transcranial electrical stimulation, and paired associative stimulation, his work aims to correct the underlying neural dysfunction and improve clinical outcomes. This translational approach has immediate relevance for pressing public health concerns, including mental health challenges in military veterans and populations affected by neurological injury, and represents a step toward precision psychiatry, where interventions are tailored to individual neural circuitry.

- Jean-Paul Noel, PhD was recently recruited to the Center for Magnetic Resonance Research (CMRR) as a cognitive and systems neuroscientist with a focus on perception, inference, and the neural computations underlying adaptive behavior. His laboratory investigates how the brain infers hidden causes from sensory inputs, integrating approaches from cognitive neuroscience in humans (EEG, psychophysics, VR/AR), systems neuroscience in awake rodents (large-scale neurophysiology, optogenetics), and computational modeling (Bayesian inference, artificial neural networks). This integrative approach bridges human and animal studies to advance understanding of neurodevelopmental and psychiatric conditions, with a focus on autism spectrum disorders. Dr. Noel's recruitment strengthens CMRR's mission by expanding its expertise into cutting-edge cognitive and computational neuroscience, fostering multidisciplinary collaborations, and enhancing the center's capacity to leverage advanced neuroimaging and computational tools for understanding brain function in health and disease.

- Essa Yacoub, PhD is a leading expert in high-field magnetic resonance imaging (MRI) and functional MRI (fMRI) for human brain applications. His laboratory develops advanced imaging methods that push the spatial and temporal resolution limits of fMRI, enabling non-invasive mapping of intrinsic functional architectures and neuronal interconnections in the human brain. By combining high-field MRI technology with novel pulse sequences, his work has revealed fine-scale functional structures, such as orientation columns, and advanced understanding of macro- and mesoscale connectivity. Dr. Yacoub's research is critical for both basic neuroscience and translational applications, including connectome mapping, brain aging studies, and neuromodulation strategies for neuropsychiatric and movement disorders. His leadership in cross-species connectomics and high-resolution human imaging strengthens CMRR's position at the forefront of neuroimaging innovation and facilitates collaborations that translate cutting-edge imaging technology into improved understanding of brain function in health and disease.

- Gülin Öz, PhD is a Professor in the Department of Radiology and a leading researcher at the Center for Magnetic Resonance Research (CMRR). Her laboratory applies high- and ultrahigh-field magnetic resonance spectroscopy (MRS) to map neurochemical and metabolic alterations

in neurodegenerative diseases, including Parkinson, Huntington, Alzheimer diseases, ALS, and spinocerebellar ataxias. Dr. Öz leads multi-site efforts to harmonize advanced MRS methodologies and establish in vivo biomarkers for early disease detection and treatment monitoring. She serves as PI of the COVID-BRAIN Consortium and MPI of the READISCA study, both aimed at validating MRI/MRS biomarkers in early-stage neurodegeneration. Her research has demonstrated that MRS biomarkers can detect neurodegenerative changes before symptoms appear and track disease reversal, providing critical tools for preventive and therapeutic clinical trials. Dr. Öz's work strengthens CMRR's capacity to translate cutting-edge imaging into actionable biomarkers, bridging preclinical and clinical research to accelerate understanding and treatment of neurological disease.

Three-year total research expenditure for investigators in CMRR has been $55.3M.

Projects #2 & #3 – Cancer and Cardiovascular Research Building (CCRB)

- Dr. Emilyn Alejandro's laboratory investigates how metabolic diseases like obesity and type 2 diabetes begin before birth. This research examines how an adverse environment during pregnancy programs an offspring's insulin-producing cells, increasing their risk for disease later in life. This work is critical for understanding how disease risk is passed from one generation to the next, creating new opportunities to prevent this cycle from starting. Current Funding: National Institute of Diabetes and Digestive and Kidney Diseases R21 and R01, National Institute of Child Health and Human Development R21, and Regenerative Medicine Minnesota.

- Dr. Frank Duca was recruited in 2024 to the Department of Integrative Biology and Physiology. This lab investigates how dietary components and environmental exposures, such as pesticides, disrupt metabolic health. The research focuses on the gut-brain axis, examining how the gut microbiome and its metabolites alter nutrient-sensing and vagal nerve signaling. Disruption of these processes can lead to obesity and diabetes.

- Dr. Xavier Revelo's laboratory, in the Department of Integrative Biology and Physiology and Center for Immunology, investigates how the immune system drives the chronic inflammation associated with obesity and metabolic disease. His research focuses on identifying the specific roles of immune cells in promoting fatty liver disease and adverse remodeling in heart failure. This work is critical for developing new diagnostics and therapies to treat the severe, life-threatening complications of metabolic disease. Current Funding: National Institutes of Health R01 awards from the National Institute of Diabetes and Digestive and Kidney Diseases and the National Heart, Lung, and Blood Institute, American Association for the Study of Liver Diseases.

- Dr. Anthony Verkerke's laboratory in the Department of Integrative Biology and Physiology investigates the bioenergetic consequences of mitochondrial metabolic pathways. His research has a primary interest in choline metabolism, specifically examining how the transport of choline

into the mitochondria is rewired during pathophysiology. This work aims to identify metabolic vulnerabilities in this pathway that can be leveraged to provide innovative therapeutic strategies for disease. Current Funding: National Institutes of Health

- Dr. Helen Vuong's laboratory investigates how the gut microbiome influences brain development and behavior by studying microbial-derived molecules. A significant part of her work uses gnotobiotic mouse models to study how the maternal gut microbiome during pregnancy influences fetal brain development. The ultimate goal of this research is to pioneer new microbiome-based diagnostics and therapies for neurodevelopmental disorders. Current Funding: Pew Biomedical Scholars 2023, Sloan Fellowship in Neuroscience 2023.

Masonic Cancer Center (MCC)

In 2023, the National Cancer Institute (NCI) renewed its designation of the Masonic Cancer Center, University of Minnesota (MCC), as a comprehensive cancer center after a highly competitive and rigorous process. In March 2024 it was announced that the funding from this grant, called the Cancer Center Support Grant (CCSG), would provide a total of $20.4 million over the next five years.

This is the sixth consecutive designation awarded to MCC, which is one of only two NCI-designated comprehensive cancer centers in the state of Minnesota—the only one in the Twin Cities—and one of only 53 such centers nationwide.

MCC is excited to announce that internationally recognized immunologist Dr. Carla Rothlin, PhD, will join MCC as co-leader of the Immunology Program in August 2025 and will lead the Center for Immunology located in the Wallin Medical Biosciences Building. This strengthens the interconnectedness of the Biomedical Discovery District and fosters exciting research collaborations

- Dr. Branden Moriarity's laboratory, in the Department of Pediatric Hematology/Oncology and Masonic Cancer Center, develops novel cellular therapeutics for gene therapy and cancer immunotherapy. As Co-Director of the Center for Genome Engineering, his team utilizes advanced genome editing tools like CRISPR/Cas9 to engineer a patient's own immune cells to fight disease. This research is successfully moving from the lab into first-in-human clinical trials. Current Funding: U.S. Department of Defense

- Dr. Kaylee Schwertfeger's laboratory in the Department of Laboratory Medicine and Pathology investigates how tissue resident macrophages contribute to both normal mammary gland development and breast cancer progression. Her research identified the JAK/STAT signaling pathway as critical for macrophage function in both healthy and tumor-associated tissue. A key finding is that these host macrophages can interfere with cancer therapies, causing breast cancer cells to become resistant to JAK-targeted drugs. This work aims to identify new

combinatorial approaches that target both the tumor and the macrophage pathways to overcome this resistance.

- Dr. Beau Webber's laboratory in the Department of Pediatrics integrates genome engineering and stem cell biology to develop novel treatments. His team engineers cell-based living medicines to treat pediatric cancers like osteosarcoma, while also pioneering gene therapies for inherited disorders like Fanconi anemia. A second major focus is the development of bottom-up cancer models, derived from human pluripotent stem cells, to discover new therapeutic targets. Current Funding: National Institutes of Health from the National Cancer Institute, National Institute of Allergy and Infectious Diseases, and National Institute of Arthritis and Musculoskeletal and Skin Diseases, U.S. Department of Defense, Cure Childhood Cancer, Inc., Fanconi Cancer Foundation, Minnesota Ovarian Cancer Alliance

- Dr. Daniel A. Harki, a highly distinguished figure in Medicinal Chemistry. He holds the Northrop Professorship and the Margaret Harvey Schering Land Grant Chair for Cancer Research at the University of Minnesota. His research is centered on the design and synthesis of novel small molecules for applications in **anticancer and antiviral drug discovery**, specifically targeting nucleic acid-interacting proteins. A high-impact finding on the **targeted degradation of Aurora kinase A to reduce N-Myc in pediatric neuroblastoma**, demonstrating a promising therapeutic approach for a difficult-to-treat cancer.

Lillehei Heart Institute (LHI)

The LHI was established in 1999 through philanthropic support from Kaye Lillehei, wife of the late Dr. C. Walton Lillehei ("Father of Open-Heart Surgery"). The mission of the LHI is to discover novel strategies to improve cardiovascular health and reduce suffering from cardiovascular disease. To accomplish this mission, the LHI actively engages the entire University of Minnesota (UMN) community and fosters interdisciplinary collaborations to compete successfully for large grants, such as large multiple PI R01 grants, P or U series grants.

In the last 5 years, the LHI has witnessed a robust growth in membership and grant funding. Currently, the LHI has 157 members, spanning 10 Medical School Departments and 9 Colleges/Schools. In FY 2022, LHI faculty members held 125 grant awards, including 59 NIH and 5 DOD awards. These awards amounted to a total of >$48.8 mil (>$39.7 mil in direct costs and >$9.1 mil in indirect costs). Overall, the research portfolio of LHI faculty encompasses the entire spectrum of CV research domains: basic, clinical and translational, and population science. Our educational programs, including the LHI Summer Research Scholars program, ensure a pipeline of future physician-scientists and scientists to continue our tradition of excellence and innovation in cardiovascular research.

- Recruited in 2025, Dr. Michael Zhang is a cardiologist and translational scientist whose research is primarily on the pathophysiology of atrial myopathy and its role as a precursor to atrial fibrillation (AF) and other adverse cardiovascular outcomes like heart failure with preserved

ejection fraction (HFpEF) and stroke. His work aims to understand the structural, functional, and molecular changes in the heart's atria, which are collectively termed atrial myopathy. He uses a reverse translational approach, integrating clinical patient data (imaging, epidemiological studies) with pre-clinical and molecular research to identify new mechanisms and potential drug targets. A central component of his current work involves using multi-omics data integration (genomics, proteomics, clinical data) and artificial intelligence to create predictive models for conditions like AF and to identify new, precision-based therapeutic targets for atrial myopathy.

- Dr. Sasha Prisco is a cardiovascular physician-scientist leading a basic and translational research program investigating pulmonary hypertension and associated right ventricular dysfunction. Her laboratory explores novel disease mechanisms, including the role of interstitial macrophages in promoting fibrosis and how the gut microbiome influences inflammation-mediated heart failure. This work aims to identify new druggable targets and therapeutic strategies, such as microbiota transplantation, for this severe cardiopulmonary disease. Current Funding: National Institutes of Health K08, F32, and T32 awards, American Heart Association, University of Minnesota Clinical and Translational Science Institute

Three-year total research expenditures for investigators in CCRB have been $168.5M, including $21.6M for the Lillehei Heart Institute.

Project #4 - Microbiology Research Facility (MRF)

The Department of Microbiology and Immunology moved in January of 2016 from the Mayo Memorial Building into the 80,000 sq. ft. Microbiology Research Facility (MRF), the fourth building in the Biomedical Discovery District (BDD), and the first building on campus to be designed and built using new "Smart Lab" technology to reduce energy costs.

The faculty in MRF share with other investigators in the BDD the objective to "pursue discoveries by bringing together talented investigators and encouraging them to work on the new cures and therapies for our most challenging and important health conditions." Department of Microbiology and Immunology faculty are the anchor tenants in MRF, but MRF, since its inception, has been home as well for the Infectious Disease Corridor of Discovery (IDC) whose mission is to understand the microbes and the diseases they cause as the foundations for discovering better ways to prevent, treat and cure infectious diseases with special emphasis on the great killers-HIV/AIDS/TB/influenza/ and other deadly bacterial, fungal and viral infections. That mission and vision is now at the center of the University of Minnesota Institute on Infectious Diseases (UMIID) whose goal is to *create innovative solutions to emerging infections of epidemic or pandemic potential by bringing together University of Minnesota expertise across 20 departments and eight colleges to discover better responses to pandemics, life-threatening infections, and antimicrobial resistance through basic, clinical, and translational research.*

The Microbiology Research Facility continued to advance its mission through the successful recruitment of Michael Gale, Jr., PhD, an internationally recognized leader in innate immunity and viral pathogenesis. As Director of the Institute on Infectious Diseases (UMIID) and Head of the Department of Microbiology and Immunology, Dr. Gale is strengthening the University's capacity to address emerging infectious disease threats. His expertise in RNA virus biology, host–pathogen interactions, and immune-based therapeutic development directly aligns with the facility's goals of building critical talent, expanding translational impact, and accelerating innovation across multidisciplinary research programs.

MRF highlighted accomplishments over the past two years are the continued contributions, advances and commitments of the Department of Microbiology and Immunology and UMIID's shared goal of becoming a center renowned worldwide for its research on pandemics and life-threatening infections.

- Dr. Michael Gale leads a research program that defines the molecular circuitry of the innate immune system and its role in detecting and suppressing pathogenic RNA viruses. His laboratory investigates how antiviral sensing pathways regulate early immune defense, with a focus on the signaling dynamics that shape host responses to viruses such as SARS-CoV-2, Zika, and HIV. By integrating systems biology, molecular virology, and chemical immunology, his team identifies therapeutic targets that can be leveraged to develop broad-spectrum antiviral agents and next-generation vaccine adjuvants. A key emphasis of his current work is building collaborative platforms that link basic discovery to translational development pipelines, supporting rapid therapeutic innovation for high-consequence viral threats.

- Dr. Ryan Langlois leads a mechanistic research program focused on how viruses cross species barriers and adapt to new hosts—a foundational question for predicting and preventing future pandemics. His laboratory develops innovative in vivo transmission models, including co-housing experiments with microbially diverse wild-derived rodents, to map the immunologic and ecological factors that govern cross-species viral transmission. Using these models, his team identifies host restriction factors, entry barriers, and viral adaptations that permit pathogens such as influenza to emerge in new species. This work provides critical insight into the early steps of zoonotic spillover and supports the development of more effective surveillance, vaccination, and risk-assessment strategies.

- Dr. Nichole Klatt directs a highly translational research program in microbiome-host interactions and mucosal immunology, with a focus on how microbial dysbiosis drives disease progression across conditions such as HIV infection, COVID-19, cancer, and sepsis. Her laboratory investigates the molecular pathways through which microbiome disruptions impair mucosal barrier function and alter immune responses, using multi-omic profiling and mechanistic pre-clinical models to define these complex interactions. By identifying how microbial and immune dysfunction reinforce one another, her work aims to uncover new therapeutic strategies—ranging from microbiome-targeted interventions to immune-directed treatments—that can improve outcomes across a wide spectrum of infectious and inflammatory diseases.

- Dr. Anthony Baughn's laboratory focuses on antimicrobial drug discovery for tuberculosis (TB), with an emphasis on understanding how Mycobacterium tuberculosis survives, persists, and becomes resistant to treatment. His team applies molecular microbiology, chemical biology, and metabolomics to uncover vulnerabilities in TB physiology and to revitalize cornerstone therapeutics such as pyrazinamide. A critical component of his research is the identification of agents capable of eliminating non-replicating persister cells, the population largely responsible for prolonged treatment courses and relapses. This work aims to accelerate the development of next-generation TB therapies that are more potent, shorter in duration, and capable of overcoming resistance.

Three-year total research expenditures for investigators in MRF have been $120.1M.