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Letter from
the Director

Translational research—that bench-to-bedside work that directly impacts human health—enlists the talents of doctors and designers, programmers and scientists, engineers and entrepreneurs. Their collaborations require state-of-the-art research, lab, and meeting space that can break down traditional scientific research silos and enable pioneering approaches to investigation and implementation.

The North Campus Research Complex has the capacity to support this kind of leading-edge, trans-disciplinary innovation at the University of Michigan. In the past seven years NCRC has created more than 350 new jobs, hosted over 1,000 events, and more than 30 partnerships have co-located here. Meanwhile, we have kept our operating expenses under budget every year.

I wrote in last year’s letter that I looked forward to announcing new groups moving into the NCRC—it gives me great pleasure now to share with you that the U-M Health System’s clinical pathology activities will begin renovating four buildings at NCRC with relocation starting in 2018.

The pathology project will add hundreds more occupants to NCRC, bringing our total to around 3,200 within the next four to five years. It will be terrific to have pathology connected to the other groups here, establishing relationships and developing ideas in the NCRC research community.

As our colleague Jack Hu, Vice President for Research, says, “NCRC has become a vibrant hub of activities that showcase our commitment as a public research university to societal impact.” NCRC is committed to providing the collaborative, innovative and diverse environment that complex research programs need in order to attract world-class investigators, programs, funding, and business support.

In addition to our many U-M research programs, we are home to external partners like Lycera, and the Ann Arbor VA Center for Clinical Management Research. In the next year we will also be welcoming Denso, a private manufacturer of auto parts using innovative technology to make automobiles more eco-friendly. These partners are flourishing in NCRC’s collaborative environment: in the past year, the Business Engagement Center’s overall revenue increased 11 percent, while the Tech Transfer Venture Center helped launch 19 start-ups in 2015 with 14 companies in the Accelerator Program.

U-M has always promoted individual excellence among its researchers, but ever since President Emeritus Mary Sue Coleman exhorted us to “partner or perish,” there has been growing recognition that collaboration and team-based science are also essential. President Mark Schlissel—an M.D./Ph.D. himself—has continued to emphasize cross-school interdisciplinary science, and the living proof of that is at NCRC.

NCRC faculty members, researchers, administrators, and students have built a diverse, inclusive community in which they can take risks and do research differently. I share their commitment to human health, and feel fortunate to be part of the advancement of NCRC’s robust research environment. I look forward to returning to you again next year to share the successes of the groups collaborating and innovating on this connected, vibrant, flourishing campus.

DAVID CANTER, M.B., CH.B.
EXECUTIVE DIRECTOR, NCRC
Leadership Vision

“The North Campus Research Complex is a major driver of the University of Michigan’s academic excellence. It fosters the greatest ambitions of our outstanding faculty and students and is a state-of-the-art home to several thriving transdisciplinary research programs. As we prepare to enter our third century as a preeminent public research university, the NCRC is giving our innovative programs and researchers the space to excel, collaborate and thrive.”

- UNIVERSITY OF MICHIGAN PRESIDENT MARK SCHLISSEL

“The spirit of the North Campus Research Complex really embodies our future strategic direction to be an integrated, collaborative academic medical center that equally serves the three parts of our mission: patient care, research, and education. Our goal is to build connections that foster creativity, innovation and inclusion, all of which are greatly facilitated by an environment such as NCRC. The multidisciplinary teams and work across numerous departments are examples of the excellence that comes from the collaboration and connections made possible at NCRC.”

- DR. MARSCHALL RUNGE, M.D., PH.D., EXECUTIVE VICE PRESIDENT FOR MEDICAL AFFAIRS

“NCRC has become a vibrant hub of activities that showcase our commitment as a public research university to societal impact. Not only does it house interdisciplinary and translational research that ranges from health policy to connected and automated vehicles, it is also the home of our Business Engagement Center and our Office of Technology Transfer, groups that work to align our research with the needs of industry and to encourage its application to the public good.”

- S. JACK HU, PH.D., VICE PRESIDENT FOR RESEARCH

“NCRC’s culture of collaboration and inclusion brings together ambitious, solution-focused leaders in research, policy, business, and philanthropy. The diverse, inventive interdisciplinary teams nurtured at NCRC are translating academic research into leading-edge technologies and real-world solutions to critical health issues, and pioneering new approaches to medical research and clinical implementation.”

- MARTHA E. POLLACK, PROVOST AND EXECUTIVE VICE PRESIDENT FOR ACADEMIC AFFAIRS

“In 2009, the NCRC was a blank canvas and a dream of bringing together leading research groups in medicine and engineering. Now, with a cast of more than 2,500, the NCRC has become an active scene for collaboration, targeting challenges faced by healthcare providers with new technologies that can be readily translated to clinical use.”

- ALEC D. GALLIMORE, PH.D., ROBERT J. VLASIC DEAN OF ENGINEERING
The U-M Comprehensive Cancer Center’s Translational Oncology Program (TOP) uses paradigm-shifting ‘team science’ to bring together world-class scientists and physicians with diverse interests across the spectrum of cancer research. TOP’s collaborative model expedites the process of transforming lab concepts into novel products, procedures and treatments that benefit cancer patients.

“The focus of the Translational Oncology Program at NCRC is singular: how to treat cancer better,” says TOP Director Diane Simeone, M.D. “To make this happen we adopt a comprehensive approach—on one hand researching the disease from different angles by drawing on the vast and world-class expertise of our basic scientists, clinicians and experimental therapeutics researchers, and on the other, focusing on drug development and commercialization processes in order to reach patients faster. I am tremendously excited to develop this vision at NCRC.”
Under Dr. Simeone’s leadership, TOP’s innovative research approach has attracted generous philanthropic support. That seed money has, in turn, resulted in TOP members securing a significantly higher level of funding from the National Institutes of Health (NIH). Currently, TOP’s areas of study include cancers of the breast, bladder, ovaries, and prostate gland, along with lymphomas, neuroblastomas, and sarcomas. Their discoveries are also applied to other cancers every day—TOP epitomizes the breadth and depth of expertise across the university, consisting of 30 highly accomplished investigators who represent 10 U-M schools and institutes, most of which are ranked in the top 10 nationally (including the Medical School, the College of Engineering, the School of Dentistry, and the College of Pharmacy).

Single-cell analysis core: purchase the latest single-cell genomic analysis system, for use across the Cancer Center. This will enable researchers to develop blueprints of the complex genomic mutations that occur within a single cell, helping us develop highly personalized treatments that halt cancer at its roots.

Early detection blood test: accelerate the use of state-of-the-art technology to develop a simple, non-invasive blood test to detect all cancers at their earliest stages.

Circulating Tumor Cells (CTC) detection core: purchase equipment for use across the Cancer Center to automate the process of capturing and culturing CTCs for the early detection of cancer.

Personalized CTC therapeutics: take samples of cancer patients’ blood through an algorithm to test precision medicine — recommend the right treatment for the right patient at the right time.
TRANSLATIONAL ONCOLOGY PROGRAM

TOP’s location at NCRC means immediate access to core facilities that help facilitate the biomedical research process, including robust pre-clinical model systems that mimic the patient environment. TOP also leverages its close association with industry partners to facilitate drug development, and expand innovative clinical trials which allow investigators to align patients to specific therapies and monitor their responses in real time. TOP-affiliated scientists and engineers also work with the Ross School of Business to patent new technologies and establish biomedical companies, invigorating the economy and, more importantly, ensuring that patients gain access to the treatments that will help them overcome their disease.

The opportunity that NCRC provides interdisciplinary innovators to collaborate and tackle the complex problem of cancer—with a laser-sharp focus on saving lives—is unparalleled. By pooling ideas and knowledge, and looking at cancer from different angles, TOP will substantially accelerate discovery, and impact the way many types of cancer are treated within our lifetime.

For more TOP news, visit ncrc.umich.edu/research/research-programs/translational-oncology-program.

THE FUTURE OF TRANSLATIONAL RESEARCH (CONTINUED)

Cancer research education: conduct community outreach to bring awareness to TOP’s efforts, ultimately generating additional funding for paradigm-shifting research.

TOP scholars program: establish a program to cultivate future leaders in clinical research trained in research methodology and able to work collaboratively and creatively with their interdisciplinary colleagues to translate knowledge into real-world solutions.

Venture accelerator fund: establish a mechanism to regularly churn out bold, innovative ideas that would not be supported by traditional means.
“Problems don’t know what discipline they are supposed to fall under; they are just problems. We can bring to bear the intellectual power of our outstanding schools and colleges to approach problems from every angle and perspective. Our Institute for Healthcare Policy and Innovation brings together a wide range of scholars from 17 of our schools and institutes to address these problems.”

-U-M President
Mark Schlissel

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

When it comes to today’s healthcare, what’s working? Who benefits? At what cost? And under what circumstances?

These are the essential questions that health services researchers tackle every day in determining the most effective ways to organize, manage, finance, and deliver high quality care; reduce medical errors; and improve patient safety. As the nation’s largest university-based group of health services researchers, the Institute for Healthcare Policy & Innovation (IHPI) and its more than 470 faculty members are driven to answer these questions through high-impact, collaborative research, and to stimulate change in ways that impact practice and policy.

Collaboration fosters innovation

Working with NCRC, IHPI has structured the physical space within its administrative home at the North Campus Research Complex to capitalize on the creativity, productivity, and synergy that the complex exemplifies. IHPI’s footprint of just more than 87,000 net assignable square feet across Buildings 10, 14, and 16 includes formal offices and workstations, along with informal work and meeting spaces. The recently refurbished Collaboratory and Think Tank offer touchdown areas and brainstorming venues to IHPI members, wherever their primary offices may be located.

In order to promote research collaboration, a great number of IHPI-affiliated groups have joined the physical space at NCRC over the last few years. Most recently, the Michigan Oncology Quality Consortium relocated from the Comprehensive Cancer Center, and key research groups have expanded their footprints in association with upticks in research awards.

IHPI space also includes approximately 14,000 square feet of newly renovated areas in Building 14, allowing the Robert Wood Johnson Clinical Scholars and the new IHPI Clinician Scholars Programs to more fully utilize their offices and learning space, and increasing
U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

the efficiency of workspace for a host of research groups. The Center for Bioethics and Social Sciences in Medicine (CBSSM) relocated into a portion of this updated space within Building 14 (from its previous space in Building 16), allowing for additional growth.

Fostering the next generation of health services researchers

IHPI has found early success in honing a program of focused career development, scaffolding the entire career arc from undergraduate to established investigator. With a particular focus on early career faculty and cultivating a new generation of health services researchers, IHPI leverages its resources to assist investigators and trainees by investing in training and education programs at a number of levels.

To bolster its support of U-M faculty launching careers in health services research, IHPI recently formed the Early Career Faculty Advisory Council (see sidebar), selecting a dozen committed and engaged assistant professors and lecturers who will advise the Institute’s leadership on how it can best deploy resources to serve this growing segment of IHPI’s membership (more than one-third of IHPI’s members are early career faculty). The council provides a venue to develop the leadership and mentorship capabilities of early stage faculty, increase the opportunities for collaboration and intersectional innovation that enrich research portfolios, and create a vibrant environment that will encourage IHPI’s top minds to continue their careers at the University of Michigan.

The IHPI Clinician Scholars Program (see sidebar, page 11), part of the National Clinician Scholars Program, offers unique clinical and community-based research training through intensive mentorship, designed for clinicians to become change agents driving policy-relevant research and partnerships to improve health and healthcare.

EARLY CAREER FACULTY ADVISORY COUNCIL

Twelve IHPI faculty members have been selected to serve on the ECFAC, advocating for early career faculty professional development programs and activities within IHPI, and providing perspective and feedback on issues and opportunities identified and brought to the council by the Institute Leadership Team:

Sameer Saini, M.D., M.S. (Chair)
Amy Bohnert, Ph.D. (Chair-elect)
Geoffrey Barnes, M.D., MSc.
Tammy Chang, M.D., M.P.H., M.S.
Deena Costa, Ph.D., R.N.
Donovan Maust, M.D., M.S.
Michelle Moniz, M.D., M.Sc.
Scott Regenbogen, M.D., M.P.H.
Ann-Marie Rosland, M.D., M.S.
Jennifer Waljee, M.D., M.P.H., M.S.
Lauren Wallner, Ph.D., M.P.H.
Maria Woodward, M.D.
IHPI AT THE FIVE-YEAR POINT

More than 470 faculty members from 17 U-M Schools, Colleges, and Institutes.

Membership grew by 51 members in the last year.

Grant funding at 574 active health services research awards, totaling $620M

$123M in extramural funding expended for members’ health services research

186 new grants totaling nearly $100M awarded last year, with 22 new awards greater than $1M each

1534 journal articles by 364 IHPI members in 712 journals, with 121 articles in 22 highest-impact journals, such as the New England Journal of Medicine and JAMA

87,531 square feet in IHPI’s footprint

11 seminars and workshops, with more than 450 attendees

IHPI priority areas:

Evaluate the impact of healthcare reform

Improve the health of communities

Promote greater value in healthcare

Innovate in IT and healthcare delivery

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

Through the National Clinician Scholars Program, the University of Michigan, University of California Los Angeles, University of Pennsylvania, and Yale University, in partnership with the U.S. Department of Veterans Affairs, have teamed up to educate nurses and physicians together to serve as leaders, researchers, and change agents in healthcare, community health and public policy.

This program builds on the very successful foundation of the Robert Wood Johnson Foundation (RWJF) Clinical Scholars Program for physicians. U-M has trained RWJF Clinical Scholars since 1995, awarding a master’s degree in health and healthcare research to those who completed the program. This new program expands on the RWJF program by including nursing and pharmacy scientists in addition to physicians, to address new and emerging inter-professional issues related to healthcare delivery and improving the health of communities. The VA Center for Clinical Management Research, based at the VA Ann Arbor Healthcare System, is also a partner in the U-M program.

Other career development opportunities include regular research seminars and methods workshops, an R01 “Bootcamp” in partnership with the Medical School, and K award workshops, in partnership with the Michigan Institute for Clinical & Health Research.

And for the second straight year, IHPI is hosting weekly lunch-and-learn sessions during the summer for students working with IHPI faculty, offering students opportunities to learn more about IHPI members’ professional and career experiences. Last year’s program included nine lunch-and-learn sessions attended by an average of 13 students each session, with 19 faculty serving as co-hosts.

Big ideas need big data

As part of IHPI’s efforts to enrich and enhance research activities among its members in support of the Institute’s strategic goals, IHPI’s Data and Methods Hub extends a number of important resources and tools to the IHPI community in the areas of data management and research methodology.
IHPI CLINICIAN SCHOLARS PROGRAM

Seven scholars were selected to join the IHPI Clinician Scholars Program’s inaugural 2016-2018 cohort, beginning their training in July-August 2016:

Lindsay Admon, M.D., completed residency in Obstetrics and Gynecology at U-M (VA Scholar)

Sue Anne Bell, Ph.D., FNP-BC, currently Clinical Associate Professor of Nursing, U-M School of Nursing

Antoinette Coe, Ph.D., Pharm.D., completed her pharmacy training at Virginia Commonwealth University

Margaret Greenwood-Ericksen, M.D., M.P.H., trained in Emergency Medicine at the Harvard Affiliated Emergency Medicine Residency Program, where she served as chief resident (VA Scholar)

Cornelius D. Jamison, M.D., M.S.P.H., Family Medicine resident at Duke/Southern Regional AHEC in Fayetteville, NC (VA Scholar)

Sarah Shubeck, M.D., current general surgery resident, U-M

Brian Stagg, M.D., completed Ophthalmology Residency at the Moran Eye Center at the University of Utah

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

These support services focus on improved access to and handling of unique data sets, as well as increased access to thought leaders on research methodology and dissemination of new methodological approaches. The goals of the Data and Methods Hub include helping to build a vigorous and supportive community for IHPI researchers, in order to foster greater professional development, enhance synergies, and continually advance the overall quality of research by IHPI members.

IHPI’s data offerings to its members and their research teams include OptumInsight data from 61 million privately insured individuals over a 14-year period, which is currently utilized by 26 separate IHPI projects studying everything from the impact of no-cost contraception on utilization and direct medical expenditures, to predictors of persistent opioid use post-surgery. Other datasets made available through IHPI include Medicare data from 55 million enrollees, as well as the rich data resources of the Health Care Cost Institute (HCCI), currently supporting four IHPI teams of researchers. U-M is one of only seven university-based partners with access to HCCI data, which include information from a number of private insurers on a variety of healthcare encounters by some 50 million people.

Research and policy: bridging the gap

Ensuring that IHPI members’ work has the greatest possible impact on healthcare policy and practice by promoting evidence-based decision making is one of the major goals of the institute. By framing and sharing IHPI members’ policy-relevant work, the government and external relations function of IHPI’s “Impact Accelerator” raises the visibility of IHPI’s research strengths among policymakers seeking expertise in health services research and health policy.

IHPI’s role within the policy arena includes offering tools, training, and consultation to faculty who want to expand the impact of their research, and helping them build relationships through coordinated outreach to state and federal policymakers and other stakeholders.
Over the last year, the Impact Accelerator has supported more than 30 IHPI faculty members in interactions with congressional staff members, providing testimony before congressional committees, serving on state task forces for a number of issues, and has also hosted congressional visits on campus.

IHPI also provides pathways for its members to participate in policy through many policy organizations outside of government, by building relationships and sharing IHPI expertise and research findings with think tanks, trade associations, and other health organizations and thought leaders. IHPI has secured opportunities for its faculty to participate in briefings, roundtables, and advisory boards, and speaking roles with the Alliance for Health Reform, AcademyHealth, Medicaid Health Plans of America, and Michigan Hospital Association, among others. The National Governors Association recently added IHPI to its short list of experts and consultants for its state Policy Academies and roundtables.

IHPI’s influence on practice and policy is highlighted in the following examples:

Medicare began including antipsychotic use in its nursing home quality rating system earlier this year as a way to reduce use for unwarranted diagnoses, in part because of IHPI research quantifying the magnitude of these drugs’ risk to patients. The U.S. General Accounting Office is also working to reduce the use of antipsychotics in patients with dementia outside of nursing homes.

Recently-issued ‘Choosing Wisely’ recommendations from the Society of General Internal Medicine caution physicians against placing PICC lines (an IV device) simply for convenience, reflecting findings from the Michigan Hospital Medicine Safety Consortium (HMS), a Collaborative Quality Initiative including 52 Michigan hospitals supported by Blue Cross Blue Shield of Michigan (BCBSM), which found that up to a quarter of patients who receive IVs may not need them, and may also develop clots or infections as a result.

IHPI members Sanjay Saint, M.D., M.P.H., Chief of Medicine at the VA Ann Arbor Healthcare System, and Jennifer Meddings, M.D., M.Sc., assistant professor of
internal medicine, published the Ann Arbor Criteria for Urinary Catheter Appropriateness, which helps hospital practitioners choose between three different catheter types, consider non-catheter strategies, and address common bedside challenges that give rise to catheter overuse, which increases patients’ risks of developing urinary tract infections (UTIs).

Research from the U-M-led Michigan Bariatric Surgery Collaborative (MBSC), another BCBSM CQI, indicating that the risk of complications is lower when the procedure is performed by a high-volume surgeon in a high-volume hospital has led three major U.S. hospitals, including the University of Michigan Health System, to set minimum-volume standards their surgeons must maintain in order to perform common procedures.

**Looking back while forging ahead**

IHPI’s goals and priorities, and its future as an institute, are founded upon the substantial achievements in health services research and health policy that have distinguished the University of Michigan over the last two centuries. As a way of honoring that history, last year the Institute compiled an interactive online timeline of significant milestones achieved across U-M, as well as by IHPI’s local partners, and also installed a 70-foot-long version on the ground floor hallway between NCRC Buildings 10 and 14.

This year IHPI launched a “Strategic Initiatives Catalyst” to help identify, evaluate, prioritize and launch signature projects aligned with IHPI’s strategic priorities in research and education/training. The Catalyst will play an essential role at IHPI by vetting opportunities for important and significant initiatives, bringing members together for effective collaborations, and propelling successful ideas into implementation.

The Healthy Michigan Plan evaluation is an example of one such initiative well into implementation, and a new collaborative initiative to improve opioid prescribing in Michigan hospitals is preparing to launch this fall.

IHPI marked the fifth anniversary of its approval by the U-M Board of Regents on May 19, 2016, and looks toward its next five years, and beyond, with renewed enthusiasm for innovative opportunities to tackle current and future healthcare challenges. As IHPI looks forward to celebrating the University’s bicentennial in 2017, the Institute will continue to build on U-M’s storied accomplishments by expanding its contributions to health services research, health professional education, and health policy.

**EVALUATING THE EFFECTS OF HEALTHCARE REFORM IN MICHIGAN**

IHPI researchers are the lead evaluators of Michigan’s Medicaid expansion. This team’s work is providing valuable information for state and national policymakers as well as enriching the national discussion about healthcare reform. IHPI has assembled an interdisciplinary team of 17 University of Michigan faculty members across multiple schools and departments, and is working with the Michigan Department of Health and Human Services to provide periodic evaluation finding over the next three years.

For more information on IHPI’s many initiatives, visit ihpi.umich.edu
The hallmark feature of the Cardiovascular Research Center (CVRC) is its assembly of investigators—including emerging scientists—with multidisciplinary backgrounds, a broad array of skills, and international reputations in their respective fields. The close proximity of scientists at NCRC enables these investigators to pursue projects that stimulate bench-to-bedside research.

Cardiovascular Core Services at CVRC also offers the following methods of cardiovascular system measurement:

- ultrasound imaging, including assessment of cardiac performance, and vascular anatomy and function, of both small and large animal models;
- microsurgery, including aortic constriction (TAC or AAB), myocardial ischemia (LAD occlusion), and microcatheter-based approaches for measuring function and drug delivery;
- state-of-the-art phenotyping services for animal models ranging from zebrafish all the way to large animals, with a primary focus on mouse and rodent models of disease;
- and telemetry with implantable probes, for measuring EKG, blood pressure, blood glucose, temperature and activity in conscious freely moving animals.

These resources have propelled highly translational research, and developments to improve understanding and therapy for cardiovascular diseases.

Tools for the Job

The CVRC maintains unique experimental resources, including:

- optical mapping, patch clamping, and molecular and cell biology suites;
  - confocal microscopy;
  - a transgenic rabbit colony;
  - a state-of-the-art interventional and electrophysiology suite;
  - and an induced pluripotent stem cell laboratory.

Cardiovascular Core Services at CVRC also offers the following methods of cardiovascular system measurement:

- ultrasound imaging, including assessment of cardiac performance, and vascular anatomy and function, of both small and large animal models;
- microsurgery, including aortic constriction (TAC or AAB), myocardial ischemia (LAD occlusion), and microcatheter-based approaches for measuring function and drug delivery;
- state-of-the-art phenotyping services for animal models ranging from zebrafish all the way to large animals, with a primary focus on mouse and rodent models of disease;
- and telemetry with implantable probes, for measuring EKG, blood pressure, blood glucose, temperature and activity in conscious freely moving animals.
Co-location and innovation
NCRC’s unique, collaborative environment has positioned CVRC researchers for success: in the past year, CVRC investigators have been recognized by their peers with numerous awards. Many CVRC investigators have also been awarded federal as well as industry funding to continue researching strategies to prevent and treat cardiovascular diseases.

The Office of Technology Transfer and the Venture Accelerator have also increased CVRC’s entrepreneurship endeavors, leading to new inventions and patents. Support for results-based innovation is also provided by a pre-doctoral training program focused on cardiovascular research and entrepreneurship.

In addition, the Flux High Performance Computing facility provides close, friendly support of CVRC’s large scale computer modeling. The Michigan Translational Research and Commercialization for Life Sciences Program support has enabled the launching of a new company, CARTOX, LLC, developer of an innovative human stem cell-derived cardiac monolayer plating technology that significantly advances preclinical drug cardiotoxicity testing. And the newly-launched Michigan Biology of Cardiovascular Aging Program greatly increases the potential of CVRC to generate knowledge about the mechanisms of cardiovascular diseases and arrhythmias related to aging, including atherosclerosis, and atrial fibrillation.

CVRC represents the vanguard of medical research. Its teams at NCRC are at the forefront of:

- the development of a human heart in a dish for cardiotoxicity testing, using human stem cell derived cardiac muscle cells;
CARDIOVASCULAR RESEARCH CENTER

• pioneering novel large animal models for a wide range of human diseases including cardiovascular diseases, infectious diseases, genetic diseases and regenerative medicine;

• the Virtual Physiological Rat Project, an NIH-supported National Center for Systems Biology initiative to simulate, analyze, and predict physiological function in healthy and diseased subjects;

• the launch of an iPSC Regeneration Core;

• piloting computation systems models in improving and refining diagnosis for cardiovascular disease;

• the creation of an Animal Model Phenotyping and Preclinical Research Course;

• new strategies to treat both civilian and military trauma;

• novel high-resolution technologies to accurately map and diagnose atrial fibrillation in human patients;

• the invention of Smart Ablation, a safer way to cure cardiac arrhythmias;

• and the study of arrhythmogenic inheritable cardiac diseases associated with intracellular calcium dysfunction.

Co-location at NCRC supports the innovative approaches that allow the CVRC to shed light on the molecular mechanisms underlying the development and progression of cardiovascular diseases. Their research improves understanding of the most severe arrhythmias, and is essential to the development of new drug therapies for venous thrombosis. By examining the interplay between aging and inflammation on cardiovascular health; investigating genetic and molecular mechanisms of inheritable cardiac diseases; and safely, effectively, and efficiently testing potential new drugs, CVRC is making an enormous impact on cardiovascular health.

For more information on CVRC, go to medicine.umich.edu/medschool/research/research-strengths/team-science/cardiovascular-research-center
BIOINTERFACES INSTITUTE

Researchers at the Biointerfaces Institute (BI) look closely at biointerfaces—the critical junctures between living cells and other surfaces—to develop new technologies for understanding, diagnosing, and treating disease. BI researchers are aided in their efforts by another, equally critical type of interface: daily, face-to-face interactions with researchers from diverse disciplines.

The critical junctures of medical research

Twenty-five research groups from the University of Michigan’s schools of Engineering, Dentistry, Medicine, and Pharmacy have been co-located in BI’s over 53,500 square foot research space at NCRC to advance research in four main areas:

Biomaterials and Drug Delivery: creating and applying cutting-edge biomaterials to guide tissue regeneration; designing highly selective, robust, and biocompatible sensors; altering surface chemistry to improve tissue/microfluidic implant interfaces; and developing novel mechanisms to deliver complex drugs to hard to reach places for prolonged periods of time to maximize therapeutic efficacy.

Nanotechnology: replicating protein functions by inorganic nanostructures for end-use therapeutics and diagnostics, such as selective targeting of breast cancer cells, long-term implants for brain recording, artificial bone marrow, and single cell metabolism monitoring.

Microfluidics and Sensors: developing novel sensors and sensor materials to enable high throughput sensing, integrated sample processing for point-of-care diagnostics, and ubiquitous environmental monitoring.

Cell and Tissue Engineering: exploiting cell biology to regenerate tissues and treat debilitating diseases, evaluating the role of tissue remodeling in the progression of metabolic and cardiovascular diseases, and using human pluripotent stem cells to develop therapeutic protocols.

A CULTURE OF COLLABORATION AND INNOVATION

Last year, BI and the Kellogg Eye Institute collaborated by co-hosting a research challenge titled “B-Eye” at NCRC; Dr. Belinda Seto, Deputy Director of the National Eye Institute, was the keynote speaker. Topics of interest included:

- eye structure function
- diseases of the front of the eye
- diseases of the back of the eye
- extraocular eye diseases
- stem cell engineering
- biosensors
- drug delivery to the eye

There were 50 faculty participants, and approximately 50 researchers and students in attendance. A total of 21 researchers drafted 8 proposals for seed money. BI’s Steve Schwendeman and Ron Larson both received outside funding as a direct result of the B-Eye Challenge collaboration.
BI Research and Faculty Awards 2016

Co-location breaks through silos, spurs collaborations, and drives innovation. The rich research environment at NCRC has contributed to several BI research and faculty awards. In just the past year:

• Prof. Max Wicha, Madeline and Sidney Forbes Professor of Oncology and Internal Medicine, has received from NCI a $6.5 million Outstanding Investigator Award to study cancer stem cells, the small number of cells within a tumor that fuel its growth and spread.

• Prof. Somin Lee, Assistant Professor of Electrical and Computer Engineering, received the 2016 AFOSR YIP Award for her proposal, “Sub-Diffraction Temperature Mapping of Protein Interconversions.”

• Prof. Jinsang Kim of Materials Science and Engineering was the 2016 recipient of the “Monroe-Brown Foundation Research Excellence Award” from the College of Engineering.

• Prof. Nicholas Kotov, Joseph B. and Florence V. Cejka Professor of Engineering, received the Rexford E. Hall Innovation Excellence Award for 2015-2016.

• Prof. James Moon, John Gideon Searle Assistant Professor of Pharmaceutical Sciences and Biomedical Engineering, was awarded an NSF Career Award for “Engineering multilamellar vaccine platforms for vaccination against HIV.”

• Prof. Peter Green, the Vincent T. and Gloria M. Gorguze Professor of Materials Science and Engineering, has been elected an AAAS Fellow for significant contributions toward understanding the structure and nanoscale properties of polymers, and for leadership in the field of materials.

For more information on BI’s research impact, visit their website:

www.biointerfaces.umich.edu
U-M CENTER FOR INTEGRATIVE RESEARCH IN CRITICAL CARE

The U-M Center for Integrative Research in Critical Care (MCIRCC) journey started nearly three years ago with one aspirational vision: To transform critical care medicine for improved patient care and outcomes by accelerating science and moving it from bench to bedside. To accomplish this, MCIRCC unifies scientists, clinicians, engineers, industry partners and funding streams to develop and deploy solutions that restore patient health.

Team science
Because of the fast pace and complexity of critical care, many of the most important problems can only be solved by multidisciplinary research teams. At the same time, funding opportunities are increasing for large-scale, team-driven research that tackles complex problems like critical care with transformative solutions. This has created a target-rich environment that MCIRCC exploits using its integrated team science model.

U-M and NCRC provide the ideal environment for MCIRCC to assume an elite position among academic institutions in bringing university-led critical care innovations to market. The MCIRCC Catalyst (see sidebar) has developed a strong commercialization-focused infrastructure to amplify innovation and prioritize research aimed at rapid translation from bench to bedside via the following strategies:

• team science rooted in clinical and market relevance

• alignment with FDA regulatory considerations and commercialization pathways

• early integration strategies with industry, entrepreneurs and donors

• emphasizing platform technologies for impact across the spectrum of care

MCIRCC’S MISSION

To bring together world-class expertise and create partnerships throughout U-M and with external partners to develop and deploy critical care solutions that are precise, predictive, proactive, and personalized for real world impact.

“With proper focus on the intersection of clinical, business, and technology domains we can innovate rapidly together.”

-Matt Patterson, CEO of AirStrip
With a membership base comprised of more than 100 world-class researchers from seven U-M schools and colleges, MCIRCC has made tremendous headway thanks in part to the MCIRCC Catalyst—the framework that integrates its unique combination of assets including operational structures, membership programs and technology systems to execute MCIRCC’s vision in a scalable design.

The result is the creation of a new, innovative business model at U-M for the academic research enterprise that provides end-to-end management of the research pipeline. MCIRCC’s performance over the past year has proven this model to be efficient, cost effective and nimble.

Every discussion and future-state prediction about transforming healthcare involves data analytics. Paired with advanced technology, big data—or what MCIRCC likes to call the “right data”—is an important facet of MCIRCC’s brand, and integral to their future success and sustainability.

This vision leads MCIRCC to: push research beyond the idea stage, for real world impact; create groundbreaking new technologies, products, and services; and help researchers and industry partners commercialize their innovations.
Elevating patient care at reduced cost

The fast pace and complexity of critical care make it ripe for transformative change using advanced technology solutions. Forthcoming healthcare reform and market shifts will further stress the patient care delivery system, requiring health systems to respond and adapt via innovative and disruptive solutions to stay relevant and ahead of the competition. UMHS is in a position to dominate the marketplace in the creation and testing of such solutions that elevate patient care at a reduced cost.

MCIRCC seeks to bridge the gap between clinical experts, research masterminds, industry partners and technological advances to transform critical care delivery using data in motion and cognitive computing to improve patient outcomes at reduced costs by way of the following strategies:

- Deploy big data analytic platform to elevate value of analytics portfolio via agile research, development and testing
- Blend clinical expertise with predictive analytics and cognitive computing to develop clinical decision support tools
- Utilize advanced analytics to deliver personalized and evidence-based medicine in UMHS test beds
- Harness ultra-high fidelity clinical data and physiologic waveform for data in motion phenotyping

“We work with a large number of academic research institutions, and I can safely say that we have never encountered a center that unites all the stakeholders in the community so effectively.”

-Pete Tchoryk, CEO of SpringMatter
Pathology has gross charges of over $600 million, which represents over 10% of total HHC clinical revenue. The Pathology Department at the University of Michigan is the #1 ranked residency program among large public universities in the U.S.

Pathology labs perform 5.7 million billable procedures that generate over 11 million discrete results each year. Anatomic Pathology generates over 90,000 surgical specimens per year.

For more MCIRCC news, go to: micircc.org

**MICHIGAN CENTER FOR INTEGRATIVE RESEARCH IN CRITICAL CARE**

**Untapped benefactors influence science and discovery**

Disruptive solutions using advanced technology appeal to a unique, untapped pool of sophisticated benefactors willing to contribute their entrepreneurial expertise, passion, and financial support to find high-impact, real-world solutions. MCIRCC cultivates new funding sources for high-risk, high-reward discovery work and translational research by offering government agencies, donors and strategic industry leaders a seat at the table:

- Offer mechanisms that allow benefactors to provide iterative and positive feedback to drive exploration, impact and output in critical care
- Measure success based on products delivered to market that improve patient outcomes at reduced costs
- Develop marketing communications that engage the “right” donors and industry partners for financial and resource support of key initiatives

Another MCIRCC partner, AirStrip CEO Matt Patterson, says, “There is tremendous alignment of vision and mission between AirStrip and MCIRCC. With proper focus on the intersection of clinical, business, and technology domains we can innovate rapidly together to create clinician workflows in healthcare that are a must-have to thrive in an increasingly challenging economic landscape.

AirStrip sees the University of Michigan as a standard bearer of trusted and credible leaders in academic medicine. To see that combined with a visionary arm like MCIRCC that is also capable of executing at an industry pace is a dynamic combination that is often touted by others but rarely lives up to its billing.”
PATHOLOGY AT NCRC

The co-location of a large portion of the University of Michigan Health System’s clinical pathology teams and educational programs at NCRC is now well underway. “This space is being planned for ten years’ worth of anticipated growth,” Department of Pathology Chair Charles Parkos said. “We’re using full Lean-based approaches to make this a collaborative community for our departments, which is a newer concept. Right now we are separated into ten different sites. This will bring at least five of those together.”

Pathology has seen steady annual growth rates of 7-8%, exceeding the capacity of currently allocated space. Insufficient space for clinical operations has been consistently cited by the College of American Pathology in laboratory inspections. Moving into laboratories at NCRC that incorporate Lean design principles will not only align capacity with demand, but will provide an environment that fosters higher levels of collaboration among staff, trainees and faculty.

“This space is being planned for ten years’ worth of anticipated growth”

-Charles Parkos, Chair, Department of Pathology

The move positions Pathology to better support strategic UMHS services, such as transplantation and oncology. This venture will greatly facilitate the achievement of Pathology’s clinical goals, providing a high level of support to UMHS patients and providers. Co-location with the UMMS Biorepository will also facilitate activities central to the goal of positioning UMHS as a leader precision medicine.

According to David Canter, Director of the North Campus Research Complex, Pathology’s move will add hundreds more people to NCRC, bringing its total number of workers to around 3,200 within the next four to five years. “One of the original purposes of the NCRC was to really develop translational sciences and shift from basic science to applications in clinical practice,” said Canter. “By putting pathology alongside other researchers, we hope it will be a fruitful collaboration of ideas.”

PATHOLOGY BY THE NUMBERS

Pathology labs perform 5.7 million billable procedures that generate over 11 million discrete results each year

Anatomic Pathology generates over 90,000 surgical specimens per year

Pathology has over 800 staff and 150 faculty

Phlebotomy performs over 250,000 blood draws per year

The Pathology Department at the University of Michigan is the #1 ranked residency program among large public universities in the U.S.

University of Michigan Pathology ranks 8th in the nation for NIH funding for Pathology Departments

To learn more about the UMHS Department of Pathology, go to: pathology.med.umich.edu
MICHR’s Impact Includes:

- 140 active research protocols, assisted, on average, per month
- 1,600 different investigators who have benefitted from MICHR services
- 10,000 offsite visits to support research conduct
- 15,000 investigators served, scholars trained, and workshop attendees reached since 2007
- 20,000 active research volunteers registered at UMClinicalStudies.org
- 40,000 clinical research participants served
- 200,000 laboratory specimens related to clinical & translational research processed
- $14M dollars disbursed directly to trainees for tuition, salary, stipends, and research
- $20M pilot grant dollars disbursed, resulting in:
- $204M in self-reported extramural funding since 2007

Michigan Institute for Clinical & Health Research

Celebrating its 10th year, the Michigan Institute for Clinical & Health Research (MICHR) empowers researchers and research communities, within and outside U-M, to create a positive impact on health. The research support provided by MICHR significantly influences the translation of investigative science into innovative improvements in clinical care and health policy.

MICHR is led by George Mashour, M.D., Ph.D., who also serves as the Associate Dean of the Medical School and the newly-appointed Executive Director of Translational Research in the Medical School Office of Research. In this latter capacity, he reports directly to the U-M Vice President for Research and oversees translational endeavors across all U-M schools and campuses. MICHR is a strong partner with the Medical School’s Office of Research, including the Fast Forward Clinical Trial Transformation initiative.

Enabling and enhancing research

- MICHR is a catalytic partner that educates, funds, connects, and supports research teams at NCRC, and beyond. Their many services for investigators and research team members include:
  - Consultation & advising: expert opinions on everything from study aims, feasibility, biostatistics, and bioethics to protocols, staffing, budgeting, collaboration, regulatory support, grant proposals, community engagement, and participant recruitment.
  - Education & mentoring: competency-based education for clinical trial conduct, based on international good clinical practice standards; training relevant to clinical research through degree, certificate, and mentored research programs; community-based participatory research; informatics tool workshops; and more.
MICHIGAN INSTITUTE FOR CLINICAL & HEALTH RESEARCH

- Funding & grant writing: seed grants, bench-to-bedside pilot grants for Phase 1 and Phase 2/3 studies, and grant review and editing services to strengthen proposals.

- Study preparation: partnership development with community-based organizations and practice-based research networks; protocol development and review, data capture tools, database development, and standard operating procedures; customized participant recruitment strategies and tools, including UMClinicalStudies.org; FDA submission support; and assistance with industry-sponsored study start-ups.

- Study conduct: randomization tools, study/data monitoring/mentoring, biostatistical analysis, and more; clinical research facility with highly-skilled clinical research teams providing extended stay services and outpatient appointments, a mobile clinical research team, and a core research lab for specimen collection, processing, shipping, and storage; and research informatics tools for electronic data capture.

- Results dissemination: support for manuscripts, co-writing with community partners, and a communication toolkit for dissemination to a wide range of audiences.

In 2014, the Dean, the Medical School Research Board of Directors (RBOD), and MICHR identified the enterprise-wide goal of transforming clinical trials at the University of Michigan by 2018. Dr. Mashour is co-Chair of the Clinical Trials Subcommittee, and MICHR is co-leading many initiatives related to clinical trials. Part of the Strategic Research Initiative, “Fast Forward Clinical Trials” is engaging the entire institution in creating the new knowledge needed to improve clinical care, value, and health outcomes by successfully executing a diverse portfolio of high-quality clinical trials.
Strategies to achieve this goal include:

• foster a UMHS culture that values, rewards, and supports clinical trial activities;

• develop a coordinated, sustainable infrastructure that supports operational excellence throughout the life cycle of clinical trials;

• develop a highly trained, innovative, and skilled workforce, including those who initiate and those who conduct clinical trials;

• translate U-M discoveries into clinical trials;

• fully integrate the clinical trials enterprise and the clinical care delivery system;

• and demonstrate the value of clinical trials to patients, families, and society.

The impact of MICHR’s work with researchers has been powerful. The recent success of 3D-printed tracheal splints is a salient example. As Dr. Glenn Green, Professor of Otolaryngology, stated: “Assistance from MICHR was invaluable in negotiating the complex regulatory framework to create life-saving devices for children. Getting these devices to children would have taken years longer, if even possible, without stepwise guidance and early translational support from MICHR. MICHR’s support has literally saved several children that would have otherwise passed away.”

MICHR supports investigators and study teams in all U-M schools and colleges. We encourage investigators to think of MICHR as a unique research resource and extended research team. Visit www.michr.umich.edu for more information, or to make an appointment for consultation.
The University of Michigan Department of Chemical Engineering faculty and students are working at the edge of new frontiers in chemical engineering—in polymers, statistical thermodynamics, and fluids, as well as emerging research areas, like gene therapy, bioinformatics, and DNA sequencing on a chip. This work requires exactly the kind of collaborative, innovative, silo-breaking research facilitated by NCRC, where many chemical engineering projects have found a home.

**Chemical Engineering Research Areas**

**Catalysis and Reactions:** Understanding reactions and finding the most efficient pathways to biofuels and other important chemicals

**Biomolecular Engineering:** Discovering and applying chemistry of life for medicine and more

**Cellular Engineering:** Understanding the chemical drivers of cell behavior and harnessing cells’ processing power

**Computing and Simulation:** Refining theory and guiding experiments

**Nanotechnology:** Applying new chemical behaviors at small scales

**Materials:** New properties for new devices and purposes

**Polymers and Complex Fluids:** Understanding soft matter

**Energy:** Sustainable solutions for energy harvesting and storage

**Microfabricated Systems:** Electronics and ultraportable, accurate diagnostic tools

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**Faculty Statistics:**

- **Faculty:** 22 tenured or tenure-track, 8 joint-appointed
- **National Academy of Engineering Members:** 4
- **National Science Foundation Career Awards:** 14
- **Named Professorships:** 19
- **Internal Awards (since 2004):** 24 U-M and College of Engineering awards for teaching, research and service—And 21 faculty members have received recognition from U-M or the College of Engineering during their careers for teaching, research or service.
- **National/International Awards:** 13 American Institute of Chemical Engineering (AIChE) Awards; 39 awards from other national societies and organizations
- **Editorships & Editorial Boards:** 7
NCRC’s research environment has supported several Chemical Engineering investigators on their path to honors and awards:

Mark Burns, the T.C. Chang Professor of Engineering and Chair of the Department of Chemical Engineering, has recently been named the Anthony C. Lembke Department Chair of Chemical Engineering.

Professor Burns won the 2016 AIChE Food Pharmaceutical and Bioengineering Award. Burns was recognized for pioneering advances in the field of microfluidics including the development of an integrated DNA analysis device and microfabricated components and the successful licensing of that technology.

Sharon C. Glotzer, the Stuart W. Churchill Collegiate Professor of Chemical Engineering, was named the John Werner Cahn Distinguished University Professor of Engineering.

Nicholas Kotov, the Joseph B. and Florence V. Cejka Professor of Chemical Engineering Professor, received the UNESCO Medal for his work on biometric self-organization of nanocolloids, ultra-strong nanocomposites, tissue engineering with nanomaterials, and nanoscale drugs.

Prof. Kotov was also the 2016 recipient of the Royal Society of Chemistry’s Stephanie L. Kwolek Award. The Kwolek Award is to recognize exceptional contributions to the area of materials chemistry from a scientist working outside the United Kingdom. This award, given biennially, is named after Stephanie Louise Kwolek, who invented Kevlar™.

Suljo Linic, Professor and Class of 1938 Faculty Scholar, was selected as the winner of the 2016 Michigan Catalysis Society Parravano Award for Excellence in Catalysis Research and Development.

Greg Thurber won a National Science Foundation Faculty Early Career Development (CAREER) Award.

For more information and Chemical Engineering news, visit engin.umich.edu/che
The Medical School Office of Research (OoR) supports an internationally recognized research enterprise at NCRC, where the shared goal is pursuing innovative science and improving the lives of patients and their families.

“The state-of-the-art facilities and support provided by the NCRC help us serve the research community and, ultimately, contribute to positive patient impact,” notes Steven Kunkel, Ph.D., U-M Medical School Senior Associate Dean for Research. “Across the spectrum, our primary mission is to support a culture of innovation and efficiency.”

Core Functions

- Create and maintain strategic resources to enhance investigators’ competitiveness
- Streamline research processes to increase research team satisfaction
- Build and refine coordinated infrastructure to support high-quality research
- Accelerate and enhance research through external partnerships to impact health
- Engage the research community by improving cross communication.

OoR team members touch virtually every facet of Medical School research. All units work together to facilitate and impact key research functions and processes at the Medical School. The OoR is also leading the implementation of the multi-million dollar Strategic Research Initiative, a project involving the entire U-M Medical School research enterprise, to fast-forward to tomorrow’s cures.

To learn more about the Medical School Office of Research, go to research.umich.edu
EMERGENCY MEDICINE

U-M has the most highly NIH-funded emergency medicine department for research in the U.S. In fact, it receives 12% of the NIH’s emergency medicine funding.

EM research spans from prevention research to state-of-the-science critical care research in its new EC3 unit.

Five U-M Emergency Medicine researchers are among the top 50 most highly NIH-funded emergency medicine researchers in the country.

U-M Emergency Medicine leads and participates in large national clinical trial networks (NETT, PECARN, StrokeNet, PETAL) and leads the only CDC-funded injury control research center housed in an emergency medicine environment.

EMERGENCY MEDICINE RESEARCH

As one of the most successful, productive academic emergency medicine programs in the country, the U-M Department of Emergency Medicine’s research capacity has flourished in the last decade. And now, with a hub of activity located at NCRC, momentum is picking up thanks to synergy with research across campus.

U-M Emergency Medicine (EM) is home to seven major centers and programs that provide national leadership in such areas as neurologic emergencies, pediatric emergency care, injury prevention, critical care, stroke, and more. Four of those groups are now located at NCRC, primarily in Building 10:

• The Acute Care Health Services Research Unit: Led by Mahshid Abir, this virtual, multi-disciplinary research unit is focused on research related to the continuum of acute care delivery, from pre-hospital to inpatient. The group researches all aspects of acute care delivery, including access, capacity cost, efficiency, utilization, and outcomes.

• Michigan Center for Integrative Research in Critical Care (MCIRCC): Kevin Ward leads a research group that brings together scientists, clinicians, engineers, and industry partners to develop and deploy cutting-edge solutions that elevate the care, outcomes, and quality of life of critically ill and injured patients and their families.

• Michigan Emergency Department Improvement Collaborative (MEDIC): A statewide consortium, led by Keith Kocher, is working to advance the science and quality of emergency care through collaboration with hospital emergency departments across the state. MEDIC is sponsored by Blue Cross Blue Shield of Michigan and Blue Care Network.

• University of Michigan Injury Center: This CDC-funded research program is dedicated to reducing injury through research and education. Led by Rebecca Cunningham, the group focuses on prescription drug overdose, concussion, violence, transportation safety, and sexual violence. It is one of only nine CDC-funded injury centers in the country.
EMERGENCY MEDICINE

In addition, a number of individual EM investigators, including Drs. Scott VanEpps, Frederick Korley, Robert Neumar, Tulasi Jinka, and M. Hakam Tiba, occupy lab space in Building 26, where they are advancing their research in the areas of stroke and critical care.

Individually, each group provides national and regional leadership in its field, and each is known for its multidisciplinary research approach. And what is the one thing they all say about the value of being located at NCRC? That their co-location with other groups facilitates interdisciplinary research collaboration that would not be possible elsewhere.

“As we continue to grow a robust, productive research portfolio, we are working to bring in new researchers in emergency medicine as well as continue to develop research capabilities in our clinical faculty, who contribute significantly to our overall body of work,” says Bob Neumar, Chair of Emergency Medicine. “Having a physical space that can serve as ‘home’ to our research functions allows us to cultivate talent and ensure connection with other groups with mutual interests.”

“Having a physical space that can serve as ‘home’ to our research functions allows us to cultivate talent and ensure connection”
- Bob Neumar, Chair of Emergency Medicine
EMERGENCY MEDICINE

In celebration of the department’s expansive research, EM research groups, along with clinical faculty, other research faculty, fellows, residents, and staff recently convened at the department’s inaugural William G. Barsan Emergency Medicine Research Forum, named for the department’s founding chair.

Held at NCRC, the event drew 118 attendees interested in learning about the outstanding research being done by the EM team. The day featured a keynote address by Dr. Barsan and presentations by 14 faculty, residents, and fellows; a poster session highlighted work from 35 research projects.

Rebecca Cunningham, Associate Chair for Research for Emergency Medicine, says, “Emergency Medicine, by definition, touches a broad array of specialties and disciplines, and our research portfolio spans bench research to large clinical trials. The NCRC location has provided a unique research environment and resource for our faculty. The location near the Institute for Healthcare Policy and Innovation and so many other collaborators has worked as a force multiplier to bring multidisciplinary teams to share ideas that will position U-M well to continue to lead the country in Emergency Medicine research.”

“The location near the Institute for Healthcare Policy and Innovation and so many other collaborators has worked as a force multiplier”

- Rebecca Cunningham, Associate Chair for Research, Emergency Medicine

For more information on how Emergency Medicine is creating the future of emergency care, visit medicine.umich.edu/dept/emergency-medicine
THE BEC IS COMMITTED TO:

Serving as a catalyst, bringing faculty and companies together for corporate engagement

Assisting in the development of master research agreements

Securing philanthropic support for scholarships, fellowships and professorships

Connecting students with real world experiences

BUSINESS ENGAGEMENT CENTER

The Business Engagement Center (BEC) at the University of Michigan is the front door connecting faculty and students with companies for mutually beneficial partnerships, exceptional experiences and opportunities to grow industry engagement at U-M.

The BEC was founded in 2007 by former U-M President Mary Sue Coleman, who famously told academic and business leaders, “Partner or perish.” “Her point was that we can’t have a strong University of Michigan without a strong state of Michigan,” says Stella Wixom, Executive Director of the BEC. “It was a real emphasis on recognizing that we needed to be more available to small- and medium-size businesses in the state.”

NCRC has enabled the BEC to create a professional space to host companies to further public/private partnerships. BEC was also a co-sponsor of Habitat for Humanity of Huron Valley’s Bid to Build: Annual Auction and Celebration, hosted at NCRC, and has an ongoing collaboration with the Office of Tech Transfer, Fast Forward Medical Innovation and the Venture Accelerator, all located at NCRC.

Wixom notes: “Being at NCRC enables the BEC staff to be in close proximity to the researchers and labs of the University of Michigan. We have access to five conference rooms in our immediate vicinity along with ample parking, giving us the ability to host companies ranging from startups to Fortune 100 with ease.”

Over 800 corporate visitors come through the BEC each year, and since 2013 more than 65 academic institutions and organizations have contacted the BEC for advice on developing their own, similarly structured units.
External Partnerships

BUSINESS ENGAGEMENT CENTER

In 2016 alone, 25 academic units reached out to the BEC, including Australian National University, The Ohio State University, University of Washington, University of Cincinnati Research Institute, New York University, and Virginia Tech, and the BEC was featured in an April Smart Business Columbus article focusing on how Ohio State is trying to build a bridge between research and industry, and how the University of Michigan is leading the way in collaborating with businesses.

Through large university-wide research initiatives, such as the Mobility Transformation Center and the Data Science Initiative, the BEC has grown corporate engagement on campus. BEC is also actively reaching out to faculty and research administrators as part of an internal marketing campaign to better inform them about what the BEC does, and how their support can assist investigators and units in achieving their research and philanthropic goals.

BEC GROWTH

Since 2007, the BEC has grown from a staff of 3 to 11 employees, including 7 relationship managers who handle more than 1,200 corporate partnerships.

2015 overall revenue was $116.4M, a 12% annual increase.

Of that revenue, $37.9M was corporate philanthropy, and corporate research expenditures totaled $78.5M.

For more information about the BEC, visit their website:

bec.umich.edu
Lycera at NCRC

“During our residence at the NCRC, Lycera has advanced significantly, building a promising pipeline of therapeutic candidates”

-Paul Sekhri, President and CEO, Lycera

LYCERA

Lycera is a biopharmaceutical company with a mission to develop new classes of oral immune modulators that can selectively suppress or activate the immune system, for the treatment of autoimmune diseases and cancer.

As Paul Sekhri, President and CEO of Lycera, notes: “Lycera has benefitted greatly from our presence in the NCRC community and our close collaborations with leading researchers at the University of Michigan. Central to these efforts have been NCRC’s acclaimed resources and facilities to support translational research in the life sciences. During our residence at the NCRC, Lycera has advanced significantly, building a promising pipeline of therapeutic candidates to address unmet needs in immunology and immuno-oncology.”

Lycera has built a world-class R&D engine by leveraging its expertise in immunology, metabolism, and chemistry to generate a portfolio of highly promising drug targets based on compelling science and prevailing medical need. Supported by a culture of scientific excellence, innovation, and collaborative working relationships with premier researchers worldwide, Lycera has built a portfolio of selective immune modulators that promise not simply incremental gains, but substantial advances in treatment, offering novel mechanisms of action to deliver improved efficacy and safety profiles.

The company’s lead clinical candidate, LYC-30937-Enteric Coated, was developed by Lycera based on ATPase modulators developed by Dr. Gary Glick, Ph.D., Werner E. Bachman Professor of Chemistry at the University of Michigan, and in-licensed from the University of Michigan. LYC-30937-EC was developed as an orally administered gut-directed therapy that combines localized activity with selective action against disease-causing immune cells.

Dr. Peter D. R. Higgins, M.D., Ph.D., Director of the Inflammatory Bowel Disease Program at the University of Michigan Health System, presented positive preclinical findings for the LYC-30937-EC program at the European Crohn’s and Colitis Organisation Congress in March 2016. LYC-30937-EC has now completed Phase 1 clinical studies in healthy volunteers and expects to initiate a Phase 2 clinical study in patients with ulcerative colitis in mid-2016.
LYCERA

Lycera’s most advanced program in cancer immunotherapy focuses on oral, selective RORγ (“RORγ”) agonists. The retinoic acid-related orphan receptor-gamma t (RORγt) is a nuclear receptor transcription factor that acts as an immune cell master control switch driving the generation and function of Th17 (helper) and Tc17 (cytotoxic) T cells. The company’s RORγ agonists combine multiple anti-tumor mechanisms into a single therapeutic by modulating gene expression to reprogram immune cells for improved function, as well as decrease immunosuppressive mechanisms. Based on the company’s groundbreaking research, Lycera plans to initiate clinical studies in 2016 with an oral, selective RORγ agonist compound.

Lycera and Celgene agreement

In June 2015 Lycera and Celgene announced a global strategic collaboration to advance Lycera’s innovative pipeline, including Lycera’s first-in-class RORγ agonists for cancer immunotherapy, and clinical-stage candidate, LYC-30937-EC, being studied for inflammatory bowel disease (IBD). Under the terms of the agreement:

- Lycera received an $82.5 million upfront cash payment.

- The upfront payment included an exclusive option for Celgene to license Lycera’s portfolio of ex vivo RORγ agonist compounds, which was exercised for an additional $17.5M payment.

- As part of the strategic agreement, Celgene obtains the exclusive right to acquire Lycera upon conclusion of the option period or achievement by Lycera of pre-specified clinical milestones. During the option period, Lycera will retain full control of its research and development programs.

- Following the exercise of the option to acquire Lycera, shareholders will be also eligible to receive future success-based milestones.

“We are very excited to partner with Lycera, a company that has created two programs based on great, potentially breakthrough science,” said George Golumbeski, Senior VP of Business Development & Licensing at Celgene. “The collaboration structure utilized here allows us to work very closely with Lycera to expand and progress their programs, and the structure aligns all involved in the work toward a future M&A event. I very much look forward to seeing these exciting programs mature.”

For more information on Lycera and its collaborative research, visit their website: www.lycera.com
THREE FOCUS AREAS

CCMR’s focused research all takes place in the collaborative environment of IHPI, which enables CCMR research teams to work closely with U-M partners, including the following VA/U-M consortia:

- Center for Bioethics and Social Sciences in Medicine (CBSSM): Finding ways to optimize healthcare decisions while maintaining a focus on patient centeredness

- Patient Safety Enhancement Program (PSEP) and Mental Health Services Research: Developing and implementing innovative approaches to improve safe clinical care, especially for the most vulnerable, complex, and costly patients

- Quality Improvement for Complex Chronic Conditions (QUICCC): Improving patient outcomes with lower resource expenditures by devising sustained approaches to engage patients and their caregivers in self-management

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

For the second time in two decades, the Veterans Health Administration (VHA) is undergoing major transformation. The VA Strategic Plan directs VHA to become more Veteran-centric, to use technology to better support health care delivery, and to improve appropriateness, safety, and efficiency of care for the 8.1 million Veterans it serves.

In an era of rising healthcare costs and rapid technology advancement, these measures are necessary to VHA’s retaining its status as a model for providing efficient and high-quality care. As healthcare reform broadens choices for citizens, VHA must become a healthcare system where well-informed Veterans choose to obtain their care.

To make these changes, the VA Center for Clinical Management Research (CCMR) is conducting research in three focus areas: (1) finding ways to optimize healthcare decisions while maintaining a focus on patient centeredness; (2) developing and implementing innovative approaches to improve safe clinical care, especially for the most vulnerable, complex, and costly patients; and (3) improving patient outcomes with lower resource expenditures by devising sustained approaches to engage patients and their caregivers in self-management.

Examples of CCMR research conducted each of these three areas in 2016 are provided below.

Optimizing healthcare decisions

Much of the work in this area addresses not only how to get patients the proper treatment when they need it, but also on how to ensure that patients do not receive risky and costly treatment when they are at low risk for a disease.

For example, CCMR and U-M investigators in the Center for Bioethics and Social Sciences in Medicine (CBSSM) have demonstrated the feasibility of using a machine-learning risk prediction model to identify patients at high and low risk for chronic hepatitis C (CHC). The use of a risk prediction model to
External Partnerships

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

Prioritize CHC treatment has the potential to maximize benefit, while minimizing harm and containing costs. Such a model could be of tremendous benefit to VHA, given the large amount of resources currently devoted to pharmaceuticals for the treatment of CHC in Veteran patients. CCMR investigators are hoping to test this model in VHA.

In another study, CCMR investigators are working with the Center for Health Communications Research (CHCR) at the Institute for Healthcare Policy & Innovation (IHPI) to develop, implement, and evaluate a web-based decision support tool for helping VHA primary care providers discuss the risks and benefits of lung cancer screening, based on a patient’s individual risk of developing lung cancer. They will be using an innovative quality improvement program developed by the Institute for Healthcare Improvement to help VA medical centers determine how to incorporate the tool into a busy clinical practice.

CCMR investigators are also developing ways to pinpoint when medical services should be “de-intensified”—reduced, removed, or simply not started when such services are unnecessary, or potentially harmful. For example, recent analyses of VA data have demonstrated opportunities for de-intensifying treatment of older patients with low glucose or blood pressure levels.
External Partnerships

Improve safe clinical care

CCMR has a strong track record of improving care for our most vulnerable, complex, and costly patients, and is currently focused on developing innovative approaches that focus on systems-based solutions for two especially vulnerable patient subgroups: patients with significant mental health problems or substance use disorders, and hospitalized medical patients.

Research on improving care for hospitalized patients produced the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC), which specifies indications for peripherally inserted central catheter (PICC) use. Other research completed this past year by the Patient Safety Enhancement Program (PSEP) showed that hospital patients given anti-heartburn drugs have a higher risk of dying, and less than half of U.S. hospitals require flu shots for staff, despite the risk posed to patients. Findings from CCMR’s research on patients with sepsis showed that sepsis survivors are often re-admitted to the hospital for preventable reasons, and mortality among Veterans with severe sepsis has declined, but significant variations in mortality rates across VA hospitals persists. Finally, in a June 2, 2016 New England Journal of Medicine article, CCMR investigators revealed that efforts by the Agency for Healthcare Research and Quality to reduce catheter-associated urinary tract infections (CAUTI) in U.S. hospitals have paid off in the non-ICU setting, as evidenced by a 32% reduction in CAUTI rates.

CCMR research on improving the care of patients with mental health problems or substance use disorders this past year included noteworthy findings on the determinants of opioid overdoses, and on mortality risk from antipsychotic drugs in patients with Parkinson’s Disease and dementia. A new study was initiated to examine the impact of VA antipsychotic reduction efforts on patients with dementia.

New grants to improve care for patients at risk of opioid overdose or at risk for suicide were also funded. Efforts to reduce the risk of opioid overdose will use motivational interviewing plus cognitive behavioral strategies in the primary care setting to provide tailored feedback on risks of opioid use, and to elicit commitment from patients to reduce overdose risk behavior and over-reliance on opioids for pain management.
An intervention for reducing suicidal behavior will target Veterans hospitalized for a recent suicidal crisis who have not yet used the Veterans’ Crisis Line. These patients will be provided with brief, motivational interviewing-based therapy in an effort to increase use of the Crisis Line, thereby decreasing the likelihood of future suicide attempts.

Engaging patients and their caregivers Improving the effectiveness and efficiency of patient self-management and treatment engagement has mainly focused on the development, testing, and implementation of innovative interventions, with a particular emphasis on enhancing patients’ self-management and prevention of chronic conditions. One new line of work is in this area uses theories of behavioral economics to design interventions.

Findings from one such study showed that use of a lottery encouraged patients to screen for colon cancer. New work in this area will use these theories, as well as theories from health psychology, to design interventions to motivate patients to engage in healthy behaviors to prevent type 2 diabetes mellitus.

CCMR investigators participating in the QUICCC (Quality Improvement for Complex Chronic Conditions) partnership with U-M continue their research on the effects of providing automated feedback to non-household family members or friends willing to act as “CarePartners” for supporting patients with their self-management activities. This past year results were published from a study that used this approach for caregivers of VHA patients with chronic heart failure. Findings showed that when CarePartners experienced significant caregiving strain and depression, systematic feedback about their patient-partner decreased those symptoms.
Recently funded research in this focus area is examining the effect of computer-based Cognitive Behavioral Therapy (cCBT) programs for assisting Veterans with management of their depression and with pain management. One new study utilizes peers to promote the use of cCBT for patients with depression. Another study is testing the hypothesis that artificial intelligence-based CBT will result in functional outcomes that are at least as good as standard telephone CBT for patients with chronic pain, while improving patient engagement and satisfaction and reducing costs. The artificial intelligence approach will determine each patient’s personally-tailored treatment plan based on daily feedback via interactive voice response on patients’ physical activity, physical functioning, and CBT skill practice.

All of the above research is taking place in the collaborative environment of IHPI, which enables CCMR research teams to work closely with U-M partners, including the following VA/U-M consortia referenced above:

- VA/U-M Quality Improvement for Complex Chronic Conditions (QUICCC)
- VA/U-M Patient Safety Enhancement Program (PSEP)
- VA/U-M Center for Bioethics and Social Sciences in Medicine (CBSSM)
- VA/U-M Mental Health Services Research

More on CCMR is available at annarbor.hsrdr.research.va.gov.
TECH TRANSFER SETS NEW PERFORMANCE RECORDS

Tech Transfer set several performance records in fiscal year 2015:

- 160 patents
- 164 licenses and option agreements
- 19 new startups

Largely due to the monetization of a license with Genzyme for a treatment from Dr. Jim Shayman for Gaucher Disease, U-M received $78.8M in Tech Transfer revenues, also a new record.

TECH TRANSFER VENTURE ACCELERATOR

Over the past five years, U-M Tech Transfer has helped to launch 64 new startups, or one every four weeks. In early 2016, U-M startup Millendo closed one of the biggest venture capital funding rounds in Michigan in the last few years, bringing in $62 million to further develop their treatment for adrenal cancer and develop other women’s health therapies.

U-M Tech Transfer is a key component in the University’s efforts to foster innovation and entrepreneurship, and is responsible for the commercialization of U-M research discoveries. Tech Transfer licensing and startup professionals help U-M investigators create new companies, and license their inventions to existing companies.

In addition to providing technology assessment, protection, market analysis and licensing services, Tech Transfer leveraged the facility resources within the NCRC to locate the Venture Accelerator adjacent to its Tech Transfer offices, providing a robust set of business services within a convenient environment.

The Venture Center is a one-stop shop for entrepreneurs and investors interested in U-M startup opportunities. Included within the Venture Center is the Venture Accelerator, with lab and office facilities for emerging U-M startups; it is located adjacent to Licensing, and in proximity to other NCRC resources.

The Venture Center team also provides tenants with networking opportunities to accelerate their progress, and Tech Transfer operates a robust Mentors in Residence program (see photo) that brings seasoned venture professionals into Tech Transfer to assist with commercialization activities. Although Tech Transfer provides services across campus, the NCRC location has allowed it to work very effectively with the research community located in the NCRC.

For more Tech Transfer news, visit: techtransfer.umich.edu
BRINGING A VALUABLE SERVICE TO NCRC

By the end of May 2016, MSIS had already handled nearly as many requests as in all of 2015, including at the NCRC location.

MSIS’s flexible work environment and open office configuration in Building 200 allows them to redeploy staff quickly to more effectively support projects and meet customers’ needs.

Most MSIS Service Desk customers receive a reply within two hours, and report a 99 percent satisfaction rating with their MSIS experience.

MSIS conducts a quarterly survey to track satisfaction and drive improvement; results are published quarterly on the MSIS blog.

The survey plays a key role in identifying successes, addressing shortcomings, and launching new services.

MSIS co-hosted a number of large-scale events in NCRC facilities, including Hacks With Friends and the Michigan IT Symposium.

MSIS was an exhibitor at the NCRC Fall Expo.

MEDICAL SCHOOL INFORMATION SERVICES

Medical School Information Services (MSIS) works in partnership with UMHS faculty, staff, and students to provide innovative information services that advance the future of healthcare through discovery, lifelong learning, and the delivery of clinical care. MSIS is uniquely positioned to understand customers’ needs and help them to create, teach, and use information effectively through the delivery of services, technology, consulting, training, and support.

MSIS Research IT helps NCRC laboratories and researchers use increasingly complex systems and technologies while maintaining secure, functional environments. By working in partnership with researchers to develop new solutions, MSIS integrates investigators’ technology needs into new, comprehensive information services.

MSIS designs and implements Research IT services focused on individual investigators and their laboratories to facilitate research and academic success. In the coming year, MSIS will increase support for primary investigators (PIs) by delivering these services directly to labs across UMHS, including NCRC. This will enable PIs to increase productivity, while also reducing risk.

Onsite to provide information technology and services support to NCRC, MSIS also offers on-demand, face-to-face support for information technology and services at their Help Me Now (HMN) location in Building 18. HMN is also the front door for loaner equipment and A/V requests across NCRC; tenants can even request an HMN “pop-up” to provide support at meetings or events.

Based on the success of the HMN location at NCRC, in August 2015 Medical School Information Services opened a second location in the renovated Taubman Health Sciences Library, and will soon open a third location in the U-M Health System (UMHS) Towsley Center. Designed to make MSIS services more convenient to their customers, these three locations will enable MSIS to support many more people through easily-accessible walk-in services.
MSIS is available wherever help is needed, whether it's a lab, office, or conference room. In addition to their standard support locations, MSIS device support teams visit NCRC offices and labs to provide assistance so researchers can stay focused on their work. Whether contacted in person, via email, or an online request, MSIS's goal is to complete the task in as few interactions as possible.

MSIS is also expanding its capabilities to meet the information services needs of NCRC researchers, by developing and offering tools that make it easier to collaborate with colleagues across UMHS and U-M. A new group, Laboratory Research and Technology Solutions (LabRATS), was formed to evaluate whole lab needs and identify broad foundational, enterprise capability opportunities that, when filled, can propel research forward. This team recently completed two enterprise research notebook pilots and is working toward identifying a single product for university-wide use.

Over the coming year, MSIS will engage in a unification effort with Medical Center Information Technology (MCIT), other UMHS IT and IS professionals, and partners across UMHS to improve the way UMHS develops and delivers information technology and services to all of its customers and clients. This unification effort is being led by new UMHS Interim CIO, Andrew L. Rosenberg, M.D., and UMHS Associate CIO Ted Hanss.

For more information, visit msis.med.umich.edu.
The Michigan Center for Materials Characterization, or (MC)², is the new College of Engineering’s (CoE’s) shared microscopy and characterization facility. (MC)² houses state-of-the-art equipment, including aberration corrected transmission electron microscopes, dual beam focused ion beam / scanning electron microscopes, an x-ray photo-electron spectrometer, a tribo-indenter, an atomic force microscope, and an atom probe tomography instrument.

(MC)² supports a diverse multi-disciplinary user-base of more than 450 users from various colleges and departments across the U-M campus, more than 100 internal research groups, and 20 non-academic companies. The mission of (MC)² is to provide cost-effective, efficient, safe, and socially responsible access to advanced characterization equipment and expertise, thereby promoting, enabling, and encouraging cutting-edge education, research, and business development.

The (MC)² website is located at:
mc2.engin.umich.edu
CBR BIOSPECIMENS ARE VALUABLE RESOURCES ENABLING TRANSLATIONAL AND PERSONALIZED MEDICINE EFFORTS AT U-M:

More than 265,000 specimens are stored at the CBR, representing nine research programs; five more are in development.

CBR provides expertise in regulatory issues (consents and IRB applications for example), biospecimen processing or fractionation, and biospecimen long-term storage.

DNA has been purified from almost 40,000 specimens and is linked with qualified GWAS results from greater than 20,000 of these specimens.

CBR staff will assist in planning for specimen collection or transferring a pre-existing collection.

System for continual process improvement.
PROVIDING SOLUTIONS

CBR services are provided under a Quality Management System, ensuring standardized practices and validated processes.

Secure, 24/7-monitored cryostorage of biospecimens in a CAP-accredited biorepository.

Logistics for the collection, processing, storage and distribution of biospecimens.

Processing of biospecimens to specified analytes, such as DNA, RNA, and plasma.

Portable cryostorage units for short-term storage or transport of biospecimens.

Full chain-of-custody records for specimens.

LIMS provides study management, tracking of annotated specimens, and data storage.

LIMS and DataDirect connects biospecimens and analytes with the study participant’s clinical data.

UMMS CENTRAL BIOREPOSITORY

Taking advantage of NCRC facilities

The biorepository is a key component of the Medical School’s research strategy, and as such, fast implementation of this resource was necessary. The NCRC campus provided new, well-equipped laboratories, allowing both the biorepository sample processing facility and the sample storage facility to begin operations quickly in September 2014.

CBR leadership is now working with NCRC Plant Operations and Medical School Information Services, as well as architecture and engineering construction teams, to design new, dedicated, streamlined, and efficient laboratories and storage areas for a new Central Biorepository opening in late 2017. Using existing physical infrastructure and sharing utilities and design concepts with co-located medical school departments (Pathology for example) and with Core Laboratories, will speed the construction of this new state-of-the-art facility. The new CBR will feature:

- Continuously expanding cryostorage space
- Dramatically increasing capacity for automated processing and distribution
- Nucleic acid extraction from additional biofluids, tissues, and cell-free biofluids
- Streamlined workflows for transfer of retrospective biospecimen collections

For more information, go to medicine.umich.edu/medschool/research/office-research/biorepository
BIOMEDICAL RESEARCH CORE FACILITIES

Part of the University of Michigan Medical School Office of Research, the Biomedical Research Core Facilities (BRCF) is a group of centralized labs and resources that provide U-M researchers access to the latest technologies and equipment in biomedical research.

The Cores strive to meet increased expectations resulting from the accelerated changes happening throughout the scientific research community. It requires top-of-the-line resources for the Cores to maintain their status as elite, next-generation providers of expertise, platforms and materials.

With 11 Cores spanning nearly 25 locations around the University of Michigan Medical School (UMMS) campus, it’s no surprise that the locations of those facilities play a crucial role in the advancement of U-M research and projects.

Nearly half of the BRCF Cores are located at the NCRC, including:

- Bioinformatics Core
- Biomedical Research Store
- DNA Sequencing Core
- Flow Cytometry Core
- Microscopy & Image Analysis Laboratory-North

POWERFUL SYNERGIES

“The spontaneous interactions between people using the Core Facilities, both at the customer and staff level, produce powerful synergies and processes for research. In no situation is this more clear than with the Bioinformatics and DNA Sequencing Cores, who are at the forefront of collaboration in their fields.”

-Cassandra Wong, Director of the Biomedical Research Core Facilities

Scientific Support
BIOMEDICAL RESEARCH CORE FACILITIES

BRCF Cores at NCRC

Founded in 2012, the Bioinformatics Core assists researchers with interpreting complex, high-throughput biological data, including DNA, RNA and Protein. This Core has developed software, databases, and visualization tools to meet these needs, including two new software applications, Epee and Jacquard, available nationally. The Bioinformatics Core has doubled the number of projects performed in the last year, including adding nine services to their portfolio and testing 127 pieces of software in their service selection.

The Biomedical Research Store’s NCRC location has grown right along with the North Campus Research Complex. Since opening the NCRC location in 2011, the Biomedical Research Store has more than tripled their stock on location. Since the launch of the NCRC delivery service in January 2015, the Biomedical Research Store has made more than 750 deliveries around the Complex. The Biomedical Research Store stocks more than 700 items from 12 vendors at five locations around campus, available for immediate purchase.

The DNA Sequencing Core is one of the largest facilities in the Midwest, processing more than 250,000 samples per year. The Core occupies approximately 10,000 square feet of laboratory space in the NCRC, with 26 highly trained individuals on staff. They operate a wide variety of instruments that perform DNA sequencing, genotyping, gene expression analysis, DNA quantification and quality control.

The Flow Cytometry Core NCRC location has upgraded the Astrios #3 to dual PMT EQ and is now able to resolve particles down to 100 nanometers in size. Analysis at the Flow Core can be scheduled within 24 hours. For cell sorting, appointments are made within 48 hours, reducing wait time from weeks to a day or two. Thanks to advancements in digital acquisition, sorting is now 3-10 times faster.

The Microscopy & Image Analysis Laboratory (MIL-North) is accessible to trained and authorized users 24 hours a day, 7 days a week. The MIL-North offers expert consultation, training and experimental design and state-of-the-art equipment for microscopic imaging.

The MIL-North has served over 250 researchers since its doors opened in November 2011. At least 35 different labs have used the facility, including two commercial users.
BIOMEDICAL RESEARCH CORE FACILITIES

MIL-North
The Microscopy Imaging Laboratory (MIL-North) in Building 20 is sister facility to the Microscopy Imaging Laboratory located in the Biomedical Sciences Research Building on the Medical Campus. Accessible to trained and authorized users 24 hours a day, 7 days a week, it is managed by a staff member with over 30 years of research experience utilizing multiple imaging technologies.

The MIL-North offers expert consultation, training, experimental design and state-of-the-art equipment for microscopic imaging. The facility provides researchers with the latest imaging instrumentation equipment, including widefield fluorescent microscopy, laser scanning confocal microscopy, and high resolution stimulated emission depletion (STED) confocal microscopy. Also included are workstations loaded with software for digital image analysis, deconvolution, and 3D volume rendering. Between the MIL in BSRB and the MIL-North at NCRC, nearly all imaging and histological research needs can be serviced.

The location of the MIL-North has exposed the facility to a unique clientele. Users come from a variety of departments and colleges, including the Medical School and the College of Engineering. This unique population has challenged the MIL-North to expand expertise in imaging both biological and non-biological samples.

The future of the MIL-North includes continued upgrades of equipment to accommodate advances in imaging research technology, while ongoing evaluation of the current equipment in the facility is used to respond and adapt to the needs of researchers.

The MIL takes pride in its cooperative interactions with imaging industry leaders. These partnerships develop opportunities to provide state of the art microscopy and image analysis technology.

At the time of installation the Leica TCS SP8 gSTED Laser Scanning Confocal Microscope was the only system of its kind in the U.S. It is a state-of-the-art system that allows for direct imaging of structures down to 50 nm. The system is an adaptation of conventional confocal technology that allows use of standard imaging preparation protocol. In 2014 the Nobel Prize in Chemistry was awarded to Stefan Hell for the development of the STED super-resolution fluorescent microscopy technology.

For more news on the Biomedical Research Core Facilities, go to: medicine.umich.edu/medschool/research/office-research/biomedical-research-core-facilities
NCRC HOSTS ACCREDITATION VISIT

The U-M Human Research Protections Program (HRPP), in which the IRBs play a central role, recently underwent successful reaccreditation by the Association for the Accreditation of Human Research Protections Programs (AAHRPP). The site visit was hosted at the NCRC, and interviews with more than 100 institutional representatives took place on-site or via NCRC teleconferencing resources. AAHRPP representatives commended IRB-HSBS and IRBMED on the quality of their operations, participant’s clinical data.

HEALTH SCIENCE AND BEHAVIORAL SCIENCE INSTITUTIONAL REVIEW BOARDS AND THE INSTITUTIONAL REVIEW BOARDS OF THE UNIVERSITY OF MICHIGAN MEDICAL SCHOOL

The Health Science and Behavioral Science Institutional Review Boards (IRB-HSBS) and the Institutional Review Boards of the University of Michigan Medical School (IRBMED) currently provide support to nearly 5,000 active research studies that represent a full spectrum of research activity, from small, student-led studies, to national survey research and large drug and device clinical trials that may enroll hundreds of participants.

Co-location simplifies regulatory education

Because IRB-HSBS and IRBMED are both located in the NCRC, it is convenient for IRB staff members to meet informally to resolve problems or to work together on a number of shared projects. For example, as part of their commitment to ongoing regulatory education, IRB-HSBS and IRBMED work closely in the development of short multimedia presentations; this effort is known as the University of Michigan IRB Collaborative, or U-MIC.

Designed to provide regulatory education to both IRB members and the research community at large, U-MIC presentations have become a familiar educational medium throughout the university, and even nationwide. In 2014, the national research ethics organization, Public Responsibility in Research & Medicine (PRIM&R), selected the U-MIC program as the focus of a panel discussion at their annual conference.

Recently, the IRBs worked with the UMMS Central Biorepository office, also located within the NCRC complex, in the development of the new eResearch application for biorepository studies and a standard biorepository consent template.
And currently, the IRBs are preparing for the wider utilization of the single or central IRB process for multi-site research studies; this process enables a single IRB to oversee research conducted at multiple sites rather than requiring individual IRB review at each participating site. The IRBs are also planning for significant changes to human subjects regulations that have been proposed by the federal Office of Human Research Protections (OHRP).

Along with the offices of IRB-HSBS and IRBMED, the location of the UM Office of Research (UMOR), the Medical School Office of Research (OoR), the Michigan Institute for Clinical and Health Research (MICHR), and the Office of Technology Transfer (OTT) within NCRC facilitates easy collaboration between the units, as well as with the growing number of researchers who maintain laboratories and offices within the complex.

Learn more about IRB-HSBS and IRBMED at research-compliance.umich.edu/irb-health-sciences-and-behavioral-sciences-hsbs, and at medicine.umich.edu/medschool/research/office-research/institutional-review-boards-irbmed.
NCRC RESEARCH SERVICES

In 2011, when NCRC site leadership began looking at service provisions to support research, the focus was on offering an onsite team that would benefit occupants directly by taking care of menial tasks, allowing investigators more time to prioritize research. NCRC Research Services was implemented as a suite of services supporting wet lab research, and administrative support of the labs.

Research Services began by supporting a few hundred occupants in 2011, and has consistently grown over the past five years to supporting over 2600 colleagues. NCRC is projected to grow over the next four years to a total site population of approximately 3500.

The NCRC Quality Of Life (QOL) Site Survey Report for 2016 continues to show an increase in satisfaction with Research Services, similar to each previous survey. Over the last five years satisfaction scores were as follows:

2012 (82%)  2013 (86%)  2014 (85%)
2015 (89%)  2016 (94%)

Between May 2015 and April 2016:

• 56,866 pounds of bio hazardous waste was removed from NCRC

• 113 hazardous material shipments, both domestic and international, were shipped with no regulatory citations, all of which arrived within the parameters set by the customers

• 1871 biological samples were transported from the NCRC across the U-M Ann Arbor Campus

• 1008 cycles of glasswashing were completed

• 455 cycles of “dry goods” autoclaving and 212 cycles of ethylene oxide sterilization were also completed

RESEARCH SERVICES OFFERINGS

NCRC Administration partners with Unity Lab Services (ULS), a part of Thermo Fisher Scientific, Inc., to provide the following services:

• Autoclaving (dry goods/clean)

• Bio-Hazardous Waste Removal

• Dock Management

• Glasswashing

• Mail Sorting

• Biological Sample Transport (Ann Arbor Campus)

• U-M Packaging and Shipping Services (for hazardous materials)

• Property Disposition Support

• Laundry Services Support

• Gas Cylinder Support

• E-Waste Material Support

• Dry Ice Recycling Storage

• Locker Management

• Universal Recycling Support for OSEH

• Interlibrary Book Loan Support

Scientific Support
Currently, removal of biomedical waste for off-site sterilization is being implemented at the Medical School and the Life Sciences Institute (LSI). LSI implementation of the biohazardous waste program began in February 2016 and to date, 5,419 pounds of waste have been removed, at a total cost of $1029.

Beginning March 15, 2016, the removal of biohazardous waste was implemented at the Medical School. As of May 5, 2016 the team has successfully assisted in removing 8,537 pounds of waste, at a total cost for $1622. Follow-up interviews with customers have yielded positive feedback on the waste removal process, and resulted in a few adjustments to better suit user needs and waste generation volume. Recent results from a very simple survey asking if the research community is satisfied with the biohazard waste disposal service overall resulted in an astonishing 85% satisfaction rating.

As a result of Research Services’ success over the past five years, an initiative is underway to share best practices and scale services beyond NCRC. Research Services’ principles could apply to all services that fall under their umbrella; however, they would be managed commonly and administered locally, specific to the needs of the site.

To contact Research Services, email: ncrclabservices@umich.edu
NCRC AMENITIES

NCRC is committed to creating a more diverse, equal, and inclusive workplace. Childcare, support for breastfeeding moms, on-site wellness education and fitness programs, and an interfaith reflection space, as well as the Janus Safety Lab, NCRC Art, and the HighWire installation are just some of the ways NCRC strives to improve the quality of life for everyone in the NCRC Community.

Additional conveniences:

• Interactive digital signs are displayed in all NCRC lobbies, and map to nearly all occupants at NCRC, as well as displaying their contact information.

(Continued on page 58)
NCRC AMENITIES

Health and safety
The Janus Safety Lab, a recent addition to NCRC, is a demonstration lab used to educate and raise safety awareness for those visiting the facility. It is divided into two halves: a good/right/correct side, and a bad/wrong/incorrect side. A yellow line down the center of the lab provides a visible separation between the two halves and banners on each side identify which side is correct and which is incorrect.

A variety of safety and health topics are presented in the lab, including biological safety, chemical storage and labeling, electrical safety, fire safety, compressed gas use and handling, personal protective equipment, and hazardous waste management. Each right/wrong item is identified with a code and the codes are displayed on wall banners within the lab.

A retrospective survey of 14 months of lab inspection data revealed that just 28 of 471 possible items accounted for 58% of all items noted by lab inspectors. NCRC has ensured that these items are reflected in the Janus Safety Lab.

The NCRC also has a Building Incident Response Team (BIRT) program to ensure a safe community. The BIRT program was developed by the Office of Emergency Preparedness in concert with the University of Michigan Police Department, using best practices from emergency first response disciplines. NCRC Building Incident Response Teams are led by NCRC Facilities and are made up of volunteer faculty and staff members from each occupant group throughout the entire NCRC campus. Team leaders are appointed BIRT Liaisons, and are trained to interface with first responders. Together, BIRT Liaisons and BIRT Members will assist in quickly evacuating buildings due to a fire condition, or directing people to shelter in the event of severe weather.
NCRC AMENITIES

Reflecting another facet of health and safety, NCRC hosts periodic on-site StayWell® Wellness Screenings to help employees keep track of important numbers, including blood pressure, cholesterol, weight and height. Health professionals review the data and provide individualized recommendations.

Other MHealthy programs offer weight management, ergonomics awareness, tobacco cessation, and support for mental and emotional health. MHealthy exercise and relaxation classes such as body sculpting, cardio, yoga, Nordic walking, and dance fitness are also among MHealthy’s NCRC offerings.

There is also an Interfaith Reflection Room for prayer, contemplation, meditation, reflection, and practice in Building 14, Room D104. The Reflection Room is an inclusive and welcoming space for all NCRC occupants, who are of many diverse religious and non-religious backgrounds.

In addition to taking advantage of the NCRC’s variety of health and wellness offerings, several NCRC community members ride bicycles to work, so bike racks are conveniently located all over campus. NCRC residents are also able to easily access other U-M campuses on university buses and the city of Ann Arbor AATA buses, which offer several quick routes to Central Campus, the Medical School and UMHS, and downtown Ann Arbor.

As U-M student Kritika Rajan noted, “I feel very well connected to the rest of the university while working at NCRC. It’s so easy for me to jump into a bus and commute between NCRC and the medical campus in 10 minutes.” NCRC also has ample parking, including paid visitor parking, as well as a Park & Ride Lot within one mile of NCRC.

NCRC EXPO (Cont.)

• Michigan Center for Materials Characterization
• Michigan Institute for Clinical & Health Research (MICHR)
• Microscopy & Image Analysis Laboratory
• MLibrary@NCRC
• NCRC Administration & Facilities
• NCRC Building Incident Response Team (BIRT)
• NCRC Research Services
• North Campus Children’s Center
• Occupational Safety and Environmental Health (OSEH)
• Physiology Phenotyping Core
• Picasso@NCRC
  • PNC Bank
  • ULAM
• UM Bioinformatics Core
NCRC AMENITIES

In addition to conveniently located childcare and support for breastfeeding moms—the NCRC campus has four private lactation rooms with Wi-Fi—the North Campus Children’s Center (NCCC) cares for children ages 3 months to 5 years, offering childcare and early childhood education up to 12 hours per day year-round. The center also offers a summer camp program for school-age children. The NCCC is available to children of faculty, staff, and students, as well as Ann Arbor community members.

Fostering creativity

Scientists and artists share a common affinity for abstract, imaginative thought. NCRC Art supports the STEM to STEAM educational initiative—the push to include Art & Design with Science, Technology, Engineering, and Math.

In the same way that NCRC is invested in supporting emerging research, NCRC Art is invested in presenting the work of emerging artists, alongside thought-provoking art by established artists. With a year-round schedule of rotating contemporary art exhibitions, NCRC Art offers thought-provoking art that gets the NCRC community thinking creatively.

A complement to the art in NCRC’s Building 18 galleries, NCRC’s HighWire can be experienced on the ground floor of Building 18. HighWire, a room-scale interactive installation, explores technology-space integration, contemporary digital fabrication techniques, and the adaptation of the physical environment to support social interaction.

Composed of nearly two miles of robotically-formed steel wire integrated with an array of microphones and motion sensors, HighWire blurs the boundary between physical architecture and the digital information world. It is a place where people across disciplines can contribute, interact, and share ideas, fostering creativity, and embodying NCRC’s unique collaborative environment.
**FRESH AND HEALTHFUL**

- PRG uses only antibiotic-free, steroid-free, free range chicken
- **72%** of all products are sourced from local suppliers
- PRG works extensively with MHealthy dieticians to create MHealthy options
- Food is made from scratch: no frozen soups; all deli salads are made in-house
- PRG’s first deli was located at Domino Farms—it was only 500 square feet

**PICASSO@NCRC**

Over 25 years ago, Gerald Attee and his wife Nihad opened their first deli in Ann Arbor. Picasso Restaurant Group (PRG), still an Ann Arbor-based company, now operates 15 restaurants and eateries in some of the most prestigious buildings in the Metro Detroit area.

PRG continues to exceed expectations by delivering the very best in product offering with a heavy focus on local purchasing, while still giving customers the service and attention one can only receive from a local owner-operated establishment.

Personalized guest interactions are PRG’s passion. To create an exceptional guest experience, PRG hires people with personality and drive. PRG prides itself in the diversity of its employee partners and strives to develop each and every one of them.

PRG continuously takes recommendations and feedback. Guests at Picasso@NCRC are even offered an interactive feedback board to open lines of communication with the PRG team.

At NCRC, PRG and its experienced staff designed and developed a cutting edge micro-restaurant concept for the newly renovated cafeteria. Picasso@NCRC was born with the passion of turning cafeterias into upscale eateries that truly make guests feel like they are “going out” to eat.
QUALITY OF LIFE SURVEY

The 2016 NCRC Quality of Life Survey showed higher ratings in:
• overall satisfaction
• building access
• research services
• IT services
• amenities & requests
• communications
• transportation
• food

The most marked gains were in the areas of research services, amenities & requests, and food.

The 2016 survey was:
• distributed via email to 2,319 NCRC community members;
• open from March 29 to April 11, 2016;
• and had 507 respondents, for a 25.8% response rate (an increase from 22% in 2014 and 24% in 2013).

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<td>Overall Satisfaction</td>
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<td>88%</td>
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<td>66%</td>
<td>58%</td>
</tr>
<tr>
<td>Building Security</td>
<td>85%</td>
<td>85%</td>
<td>87%</td>
<td>82%</td>
<td>82%</td>
<td>77%</td>
</tr>
<tr>
<td>Building Services</td>
<td>85% †</td>
<td>90%</td>
<td>86%</td>
<td>87%</td>
<td>82%</td>
<td>79%</td>
</tr>
<tr>
<td>Research Services</td>
<td>94% †</td>
<td>88%</td>
<td>85%</td>
<td>86%</td>
<td>82%</td>
<td>NA</td>
</tr>
<tr>
<td>IT Services</td>
<td>82% †</td>
<td>80%</td>
<td>80%</td>
<td>83%</td>
<td>72%</td>
<td>65%</td>
</tr>
<tr>
<td>Conference Rooms</td>
<td>78%</td>
<td>78%</td>
<td>81%</td>
<td>62%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Amenities &amp; Requests</td>
<td>84% †</td>
<td>76%</td>
<td>84%</td>
<td>81%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Communications</td>
<td>75% †</td>
<td>71%</td>
<td>70%</td>
<td>61%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Parking</td>
<td>80% †</td>
<td>81%</td>
<td>75%</td>
<td>74%</td>
<td>73%</td>
<td>66%</td>
</tr>
<tr>
<td>Transportation</td>
<td>83% †</td>
<td>80%</td>
<td>82%</td>
<td>63%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Collaboration</td>
<td>64%</td>
<td>64%</td>
<td>62%</td>
<td>57%</td>
<td>44%</td>
<td>34%</td>
</tr>
<tr>
<td>Fitness / Wellness</td>
<td>92%</td>
<td>92%</td>
<td>93%</td>
<td>62%</td>
<td>50%</td>
<td>57%</td>
</tr>
<tr>
<td>Food</td>
<td>86% †</td>
<td>53%</td>
<td>62%</td>
<td>53%</td>
<td>16%</td>
<td>15%</td>
</tr>
</tbody>
</table>

*Satisfied is defined as: satisfied and very satisfied on the 6-point scale of the survey.
Note: A 6-point Likert scale was used for all satisfaction-related questions, considering the need for consistency and standardization within the survey, and to allow comparison with future surveys. Survey questions either asked for levels of satisfaction, or the extent to which respondents agreed with statements.
Community

MLIBRARY@NCRC

MLibrary@NCRC, located on the ground floor of Building 18, is a branch of the University Library dedicated to providing diverse information services through partnership with NCRC researchers, staff and affiliates. MLibrary@NCRC informationists collaborate with researchers and staff across a variety of units, including:
• Medical School Office of Research,
• Institute for Healthcare Policy and Innovation,
• Medical School Information System,
• ULAM,
• and Technology Transfer.

The University Library spends over $20M each year on electronic resources for U-M researchers. Informationists can help researchers and administrators identify and effectively utilize the appropriate resources for literature reviews, scientific discovery, research impact, interdisciplinary collaboration, and more. In addition, they conduct complex literature searches and collaborate with faculty on research. They also offer individual and group information consultations, and instruction on topics ranging from systematic review searches to using data visualization tools to creating data sharing plans in compliance with funder mandates.

RECENT ACCOMPLISHMENTS

• Office of Research Research Funding and Grants Guide
  Working with the Office of Research, MLibrary@NCRC informationists have created a consolidated campus-wide resource to connect researchers to funding opportunities.

• Expansion of Available Informationist Expertise
  Additional informationists are located at NCRC weekly, with expertise in systematic reviews and ORCID.

• Data Management and Sharing Services
  Informationists worked with researchers and staff to help them meet federal agency funding requirements related to data management.

• In-depth Engagement with Clinical and Policy Researchers
  Collaborating with faculty in the Robert Wood Johnson Clinical Scholars program, informationists delivered curriculum-based instruction. Additionally, informationists worked one-on-one with multiple scholars and their research assistants on projects including systematic reviews and narrative reviews.
MLibrary@NCRC offers:

- Training to more effectively search databases and web resources from PubMed to Google
- Expertise in bioinformatics, data management, and expert literature searching
- Consultation and instruction on citation management tools, such as Endnote and Mendeley
- Training and individual consultation on grant-seeking
- Help resolving grant compliance issues related to the NIH Public Access Policy
- Data management/data sharing plan consultation
- Library books delivered directly to NCRC departmental mailboxes and returned through the MLibrary@NCRC book drop

One of MLibrary@NCRC’s goals in the coming year is to provide a diverse range of workshops to address researchers’ information-seeking and management needs. Workshop topics will include:

- creating data sharing plans,
- National Institutes of Health Public Access Policy (NIHPAP) compliance,
- researcher name disambiguation through ORCID,
- citation management tools,
- finding research funding,
- and using SciENcv for NIH biosketches.

To learn more about MLibrary@NCRC, visit www.lib.umich.edu/mlibrary-ncrc
**GREEN NCRC**

Co-generation happens when natural gas is burned to generate electricity via a gas turbine generator, and heat from the exhaust is collected to create steam for heating with a heat recovery steam generator. By producing its own energy using natural gas, NCRC has more reliable power generation during outages.

By utilizing a gas turbine generator in its Power House, NCRC co-generates electricity and useful heat, alongside our DTE partner for the site. In addition, the lower price of natural gas, compared to electricity, means that co-generating power for NCRC results in an estimated savings of $500K per year. Over time, this cost savings will offset lease rate increases at NCRC.

In addition to reducing CO₂ emissions through co-generating power, NCRC has adopted the U-M composting program. All post-consumer waste, such as compostable plates, cups, flatware, bowls, napkins, and take out containers, along with uneaten or unwanted food, can be placed in specially marked bins at the usual locations.
NEW FACULTY RECRUITS AND INTERNAL MOVES TO NCRC

AMANDA GARNER
Translational Oncology Program

YU LE
Translational Oncology Program

PHIL PALMBOS
Translational Oncology Program

KELLY ARNOLD
Biomedical Engineering

ISABELLE LOMBAERT
Biointerfaces Institute

LONGCHUAN BAI
Translational Oncology Program

WILLIAM STACEY
Biointerfaces

SCOTT VANEPPS
Biointerfaces

ARIEL LINDEN
Institute for Healthcare Policy and Innovation
The University of Michigan’s Mobility Transformation Center (MTC) is a public/private R&D partnership developing the foundations for a commercially viable ecosystem of connected and automated vehicles. MTC partners are drawn from industry, government, and academia to accelerate progress and shape the future of mobility. MTC’s central goal is to develop and implement an advanced system of connected and automated vehicles in Ann Arbor by 2021.

Mcity, a test lab at MTC, is designed to simulate urban and suburban roadways and provide a controlled environment for safe, repeatable testing of connected and automated vehicle technologies before they are tried out on public roads. In addition, MTC is developing three on-roadway deployments of thousands of vehicles in Ann Arbor and across the region, which will test ideas in real-world driving conditions.

As MTC Director Huei Peng notes, “Mcity will accelerate progress. It would take thousands of cars driving millions of miles on real streets for cars to encounter the challenges that can be readily simulated safely in Mcity, and repeated at will, to test connected and driverless vehicles.”

Mcity is unique—it’s not a test track, but a test environment for automated and connected vehicles of the future. Locating Mcity on U-M’s North Campus creates a space for many disciplines across U-M to come together to go beyond technical developments and address the legal, societal, regulatory, political, economic, business, consumer acceptance, and urban planning issues key to implementation.
**MCITY MOBILITY TRANSFORMATION CENTER**

**Snapshot**

**Connected, automated, autonomous**

“Connected” vehicles can anonymously and securely exchange data—including location, speed, and direction—with one another, and with the surrounding infrastructure, via wireless communication devices. This makes it possible to warn drivers of emerging dangerous situations, and to continuously adapt traffic signals to real-time traffic, easing congestion. Bicycles and pedestrians can also be connected via portable devices.

“Automated” vehicles allow certain driving functions—acceleration, braking, steering—to be machine-activated by technology built into the vehicle. Automation requires a variety of sensors, connections and maps to create situation awareness, and robotic functionality to mimic the role of a human driver. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) connectivity can serve as additional “sensors” that provide valuable information about other vehicles and features of the infrastructure. In this way, connectivity enables automated responses to warnings, and ultimately enables a vehicle to drive by itself.

“Autonomous” is something of a misnomer when applied to vehicles—the vehicle still needs to connect to other entities to update maps, GPS, and remote control commands. A fully autonomous vehicle drives itself without input or command from the outside, and does not rely on communications from other vehicles. Instead it carries sensors, decision-making software, and control features to “see” its environment and respond, just as a human driver would. Unlike connected vehicles, however, autonomous vehicles cannot detect traffic situations that are blocked by physical barriers, or out of range of their sensors.
Increased awareness of Mcity and MTC after Mcity opened in 2015 helped spike interest from potential industry collaborators. Today, MTC’s Leadership Circle of industry partners has grown to 17 companies, and its roster of affiliate industry members numbers more than 40. Enthusiasm for MTC’s work is growing among researchers as well, with 29 R&D projects now underway.

The transformation to connected and automated mobility will be a game-changer for safety, efficiency, and energy, making life better in our cities and suburbs. MTC and Mcity signify a huge commitment on the part of U-M to advance these beneficial technologies.

For more information about Mcity, visit the Mobility Transformation Center website: www.mtc.umich.edu
**SPACE USAGE AT NCRC**

1. Starting with 2.2 million gross building sqft.
2. The occupiable sqft at NCRC is approximately 1.3 million (net assignable sqft - NASF).
3. Excluding 362,000 NASF which is comprised of utility buildings, the childcare center, and the GMP facility, there is approximately 941,000 sqft of office and lab buildings.
4. Of this office and lab building space, approximately 741,000 sqft is considered active.
5. Of the active NASF, approximately 678,00 sqft is currently occupied.
6. This leaves about 63,000 NASF of unoccupied office and lab building. In summary, 91% of NCRC’s active NASF and 72% of its total capacity (active and inactive NASF space) is occupied.

### NCRC RI/NRI Space Analysis Inclusions & Exclusions
Data current as of June 30, 2016. Gray boxes show excluded space.

<table>
<thead>
<tr>
<th>GSF 2,197,854 (Building Gross Square Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All NCRC buildings based on data which is found in the M-Pathways space database. GSF is the entire footprint of the building, to the outside walls.</td>
</tr>
<tr>
<td>NSF 2,037,570 (Buildings Net Square Feet)</td>
</tr>
<tr>
<td>All NCRC buildings based on data which is found in the M-Pathways space database. Excludes: Square footage for walls and columns. NSF is the GSF minus walls and columns (Construction SF). It includes “non-assignable” space such as restrooms, mechanical space, and some corridors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-Assignable SF 735,133</th>
<th>NSF 1,302,437 (Building Net Assignable Square Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sqft of all “Non-assignable” space.</td>
<td>All assignable rooms in NCRC buildings based on data in M-Pathways space database. Excludes: “Non-assignable” room types such as restrooms, mechanical space, and some corridors. NSF is the NSF minus Non-Assignable SF.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Excluded NASF 361,738</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF of excluded NCRC service buildings (Chiller, Power Plant) plus childcare. (Ex. 715, 70, 73, 75, 86, 88, 500, 550, 850)</td>
</tr>
<tr>
<td>Office &amp; Laboratory Buildings NASF 940,699</td>
</tr>
<tr>
<td>NASF of NCRC office and laboratory buildings. (10, 14, 16, 18, 20W, 20E, 22, 23, 25, 26, 28, 30, 35, 40, 45, 60, 66, 100, 200, 300, 400, 520)</td>
</tr>
<tr>
<td>NRI NASF 405,921 (Non-Resource Intensive Space)</td>
</tr>
<tr>
<td>RI NASF 444,778 (Resource Intensive Space)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inactive NASF 200,098</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF of inactive office and lab buildings. (20W, 25, 35, 36, 40, 50, 60, 100, 200, 300, 400, 520)</td>
</tr>
<tr>
<td>Active NASF 740,601</td>
</tr>
<tr>
<td>NASF of active office and lab buildings. (10, 14, 16, 18, 20W, 22, 23, 25, 26, 28, 30, 35, 40, 45, 60, 100, 200, 300, 400, 520)</td>
</tr>
<tr>
<td>NRI NASF 441,709 (Non-Resource Intensive Space)</td>
</tr>
<tr>
<td>RI NASF 298,892 (Resource Intensive Space)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupied NASF 677,881</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF of active buildings which is currently assigned to departments or non-university entities.</td>
</tr>
<tr>
<td>NRI NASF 412,304</td>
</tr>
<tr>
<td>RI NASF 265,497</td>
</tr>
<tr>
<td>Lab 141,403</td>
</tr>
<tr>
<td>Lab Service 54,386</td>
</tr>
<tr>
<td>Office 193,144</td>
</tr>
<tr>
<td>Other 288,888</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active Unoccupied NASF 62,720</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASF of unoccupied space in active buildings.</td>
</tr>
<tr>
<td>NRI NASF 29,325</td>
</tr>
<tr>
<td>RI NASF 33,395</td>
</tr>
</tbody>
</table>

All data pulled from M-Pathways SCP and Campus tables (FY16 Period 12).
SPACE USAGE AT NCRC

NCRC Occupied Space Research vs. Admin

Occupancy Facts: Current Capacity (active space): 590,000 net sq. ft. | Occupied Space: 469,000 net sq. ft.

NCRC Total Occupancy

Quarter (month/year)
NORTH CAMPUS RESEARCH COMPLEX
FACT SHEET

2,735 PEOPLE
Work at NCRC as of July 2016

350+ NEW JOBS CREATED
Since June 2009

225 TOTAL
Faculty Members

80
Wet Lab Faculty Members

11 ADVANCED INSTRUMENTS
Let scientists and engineers study materials at the most detailed level

3 PRIVATE COMPANIES
Lycera
BoroPharm
Denso

1 PUBLIC
Veterans Affairs

13+ Venture Accelerator Companies

GROWTH

8 RESEARCH GROUPS
Biointerfaces
Cardiovascular
Chemical Engineering
Computational Medicine and Bioinformatics
Distributed Health
Emergency Medicine
MCIRCC
Translational Oncology

10 PARTNERSHIPS
University of Michigan Schools

1 INSTITUTE
Institute for Healthcare Policy and Innovation

9 Shared research facilities

250
150
200
100
50
0
EVENTS

15 NEW BUSINESSES
BUS
Opened up on Plymouth Rd since June 2009

515,702 Rides on the North-East Shuttle
(July 2014 - June 2016)

1,520 Rides on the Bio Research Shuttle
(June 2014 - April 2016)

COMMUNITY

32 ACRES
Of NCRC land transformed into Mcity, a testing ground for connected and automated vehicles by the Mobility Transformation Center

92% SATISFIED WITH QUALITY OF LIFE

EXPENSES
$115M in operating expenses
$75M in total capital expenses
FY2010 - FY2016

FINANCES

$108 MILLION
To acquire NCRC in 2009

34 Total art exhibits

Mcard
11,114
Mcards Granted NCRC Access
(June 2016)
NCRC ACTUAL AND ESTIMATED OCCUPANCY OVER TIME

NCRC OCCUPIED SPACE (BY ORGANIZATION)
Capital and Operating Costs

Operating Expenses

Capital Investment

After the initial capital expenditure for its purchase, capital expenditure at NCRC has been less than projected.