

CONNECTED **VIBRANT** FLOURISHING

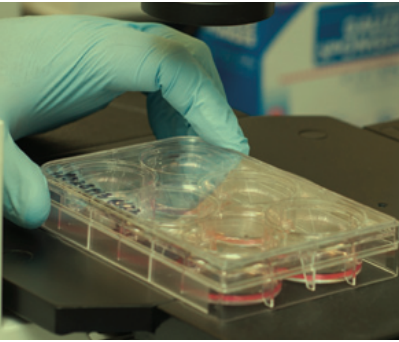




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Letter from the Director

From a lab-grown human heart to a driverless car, the research innovations poised to transform our health and quality of life will increasingly come not from traditional, siloed scientific research, but from trans-disciplinary collaborations between materials scientists and pharmacists, dentists and engineers, doctors and entrepreneurs.

The University of Michigan has two stated missions for its North Campus Research Complex: to expand the University's strengths in translational research, and to help

lead the resurgence of the Michigan economy. We are committed to supporting the collaborations and partnerships essential to complex research programs that build on U-M's ability to attract the most excellent and innovative researchers, programs, and private companies in the world.

In the six years since the NCRC's acquisition, more than 346 new jobs have been created, almost 800 events have taken place, and more than 30 partnerships have co-located here—and all while we've kept our operating expenses under budget every year since 2010. In the coming years, I look forward to the development of the 33% of the campus that remains unoccupied, and especially to activating the lab buildings.

Whether you are a faculty member, researcher, or business employee; a student or a member of the Ann Arbor community, we invite you to be a part of NCRC's exciting growth. It is thrilling to work on this connected, vibrant, flourishing campus.

Connected In 2015 NCRC welcomed U-M's Department of Chemical Engineering, whose many research projects, including those in emerging areas such as DNA sequencing on a chip, gene therapy, and bioinformatics, will also find an ideal home in NCRC's connected, interdisciplinary setting.

Additionally, U-M's Department of Pathology, the top-ranked residency program among large public U.S. universities, will soon be able to consolidate half of its clinical lab locations at NCRC, bringing capacity and demand into further alignment.

Vibrant One of the first groups, as well as one of the largest, to locate at NCRC, the Michigan Institute for Clinical & Health Research, recently supported researchers developing tiny blood-testing devices for cancer patients, a study of trauma and grief in Detroit-area youth, and community partners creating innovative training around ethics and research. Over the last year, the U-M Institute for Healthcare Policy and Innovation added 60 new members, hosted U-M's first exclusive MOOC, and was awarded 176 new grants, totaling over \$100 million. In March, IHPI also became one of four sites for the new National Clinical Scholars Program, along with UCLA, Yale, and Penn. The collaborative research of the Translational Oncology Program, the U-M Center for Integrative Research in Critical Care, and the Cardiovascular Research Center continues to be awarded a successful level of funding--especially important in a national climate of reduced funding for research.

Flourishing Entrepreneurial partnerships and projects are flourishing, as well. The Business Engagement Center saw an 11% increase in overall revenue, and the Tech Transfer Venture Center helped initiate 14 start-up companies. In addition to the achievements made by external partners, the Biointerfaces Institute co-hosted one of its research Challenges with the Translational Oncology Program. In the past year the two research units also collaborated to establish a fellowship program, and a startup company co-founded by BI and TOP investigators won a medical innovation competition.

Each of the programs at NCRC needs state of the art research and lab space to make the advances that translate valuable research discoveries into better human health; they also need opportunities for collaboration that are not typically available to individual researchers or small groups of investigators. We have the capacity to enable the kind of interdisciplinary efforts required for translational research—work that directly impacts human health.

In his inaugural address, U-M President Mark Schlissel said, "I want Michigan to be a place where faculty always believe they can do their best work. This means surrounding them with outstanding colleagues, students, and staff, providing cutting-edge infrastructure, developing the resources to support innovative research and teaching, and last but not least, celebrating their successes."

Together, we have built a robust research environment, one where we take risks, cross boundaries, and commit ourselves to doing research differently to advance human health. I feel fortunate to be part of it, and look forward to returning to you next year to once again celebrate the successes of the people collaborating and innovating here at NCRC.

DAVID CANTER, M.B., Ch.B.
Executive Director, NCRC

Leadership Vision



“The North Campus Research Complex is a major asset to the University of Michigan. It provides space for novel trans-disciplinary programs that enhance the University’s strengths in education and research, and gives us the capacity for greater public impact. The impressive work being done at the NCRC by our faculty, students, and staff helps position us for perpetual excellence as we are about to enter our third century as a preeminent public research university.”

- MARK SCHLISSEL, M.D., Ph.D.
University of Michigan President



“The College of Engineering is pleased to be a major partner at NCRC. Our faculty there are immersed in a stimulating environment that promotes collaborations with top researchers from other fields, producing completely new, groundbreaking ideas.”

- DAVID C. MUNSON, JR., M.S., M.A. AND PH.D.
Robert J. Vlasic Dean of Engineering

Dean David Munson Portrait April 3, 2009 Credit: Dwight Cendrowski



“NCRC provides a home for units that develop important solutions to critical health issues. A prime example is the Institute for Healthcare Policy and Innovation, which is transforming healthcare by bringing together leaders in policy and delivery, health services research, business, and philanthropy. IHPI’s bridge between academic research and real-world solutions is a terrific example of the power of NCRC’s culture of collaboration leading to new solutions.”

- MARTHA POLLACK, PH.D.
Provost and Executive Vice President for Academic Affairs



“I knew of the collaborative scientific community taking shape at the North Campus Research Complex long before I came to the University

of Michigan in March 2015. I’ve been a laboratory scientist for more than thirty years and feel that NCRC is a model for academic medical centers across the nation. From space planning to idea sharing, it’s an evolving hub of ingenuity and discovery. NCRC is a point of pride for the University, and I look forward to playing my part in helping it continue to flourish.”

- MARSCHALL RUNGE, M.D., Ph.D.
Executive Vice President for Medical Affairs



“Creativity and risk-taking are necessary to push back the boundaries of our understanding and reach new levels of achievement. The

faculty at the NCRC are creative risk-takers. One example, the Translational Oncology Program, brings together faculty from the College of Engineering, School of Public Health, College of Pharmacy and Medical School to tackle translating basic research discoveries into clinical advancements to improve the outcomes for cancer patients. This epitomizes the collaborative research efforts at the heart of the NCRC campus.”

- JAMES WOOLLISCROFT, M.D.
Lyle C. Roll Professor of Medicine and Dean of the Medical School

Anatomic Pathology
generates over **90,000**
surgical specimens
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

Pathology
has over
800 staff
and
150
faculty

Phlebotomy
performs over
250,000
blood
draws
per year

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

Pathology has gross
charges of over
\$600 million,
which represents over
10% of total
HHC clinical revenue

Research

PATHOLOGY AT NCRC

The new project of co-locating a large portion of the University of Michigan Health System's clinical pathology teams and educational programs to NCRC is underway. This venture will greatly facilitate the achievement of Pathology's clinical goals, providing a high level of support to UMHS patients and providers.

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.

The move to NCRC reduces Pathology's current geographic dispersion from 10 locations to 5, and positions Pathology to better support strategic UMHS services, such as transplantation and oncology. Co-location with the UMMS Biorepository will also facilitate activities central to the goal of positioning UMHS as a leader in precision medicine.

MICHIGAN INSTITUTE FOR CLINICAL & HEALTH RESEARCH

RECENT SUCCESSES

Device Developed by MICHR-Supported Team Helps Save Young Patient

A tiny device that can test extremely small blood samples was used to help save the life of a young girl just before Christmas. The device, developed by a U-M team including C.S. Mott Children's Hospital pediatric intensivists Timothy Cornell, M.D., and Thomas Shanley, M.D., and engineers Jianping Fu, Ph.D., and Katsuo Kurabayashi, Ph.D., is still in the research phase. However, its use was allowed under the FDA's "Expanded Access" program to help treat the young cancer patient, whose organs were shutting down. The patient's doctor was able to use the information provided by the test to support adjustments to her course of treatment and immune therapy, which rapidly improved her condition. She was eventually discharged home.

Despite the timing, MICHR's MIAP team was available and acted quickly to get the necessary FDA approval to use the device. Dr. Cornell has also received a pilot grant from MICHR to help him navigate the next steps in the commercialization of the device, which provides a way to understand what the immune system is doing by measuring cytokines in the blood.

The Michigan Institute for Clinical & Health Research (MICHR)

is at NCRC to enable and enhance clinical and translational research. MICHR is a catalytic partner that educates, funds, connects, and supports research teams at U-M and beyond to help people live healthy, vibrant lives.

How It Works

FOUNDED IN 2006, MICHR:

- ▶ Develops research talent through its education programs
- ▶ Helps investigators launch their ideas through pilot grant funding and consultation
- ▶ Connects researchers with community groups, clinics, practice-based networks, and potential study volunteers
- ▶ Supports research teams with clinical research management services, including:
 - biostatistical design and analysis
 - study management and monitoring
 - data management
 - a clinical trials office for industry partnerships
 - a fully-equipped and professionally-staffed clinical research unit



Research

MICHIGAN INSTITUTE FOR CLINICAL & HEALTH RESEARCH

MICHR Staff Members Publish Study on Ethics in Community-Engaged Research

MICHR staff and students developed a training workshop, “Ethical Protections in Community-Engaged Research,” in partnership with community partners engaged in research. The workshop was developed as an alternative to U-M’s standard responsible conduct of research training, with the intention of meeting the community partners’ specific training needs around ethics and research.

Since its initial development, the Research Ethics and Integrity Program has been refined and pilot tested at 10 CTSA’s across the country. Results show that participants demonstrate an increase in knowledge related to ethical conduct of research. Two articles that explain the piloting of this training, and lessons learned, have been published in Clinical and Translational Science.

Study of Trauma and Grief on Detroit-Area Youth Supported by MICHR Community-University Partnership

MICHR supports a study helping Detroit-area children who, as a result of trauma and grief, are in need of mental health services. The study is led by Julie Kaplow, Ph.D., now at the University of Texas Health Science Center at Houston. Karen Calhoun, a clinical research associate in MICHR’s community engagement program and senior health officer with City Connect Detroit, co-facilitates the study with Kaplow.

“We are on the tipping point of some innovative approaches to better assess mental health issues in children,” says Calhoun. “Grief is profound in these children, who are surrounded by so much death and loss, and we’re beginning to learn about the ways in which grief affects children differently than adults.”

Of the Detroit youth assessed so far, **86%** had experienced at least **two** traumatic events, such as physical abuse or witnessing violence.

← **100%** had experienced a significant loss, such as a parent, sibling, or close friend. ←

Have you met with MICHR yet?

Contact them today at **734.998.7474** or **um-michr@umich.edu** or visit them online at **www.michr.umich.edu**

Research

ENGINEERING

The U-M Department of Chemical Engineering offers a broad range of research projects in all major areas in traditional chemical engineering—fluids, polymers, colloids, reaction engineering, separations, and statistical thermodynamics—as well as emerging areas, such as DNA sequencing on a chip, gene therapy, metalloprotein drug design, bioinformatics, green chemistry and computational engineering. Together, Chemical Engineering faculty and students are creating new knowledge on the frontiers of these areas.



FACULTY STATISTICS:

Faculty: **24** tenured or tenure-track, **7** joint appointments

National Academy of Engineering Members: **4**

National Science Foundation Career Awards: **13**

Named Professorships: **17**

National Awards: **12** American Institute of Chemical Engineering (AIChE) Awards; **36** other awards from other national societies and organizations

Editorships & Editorial Boards : **7**

Fellows: **17**, including AIChE & American Physical Society





RESEARCH STATISTICS

Total Research Expenditures (2013):
\$13,494,719

Total Externally Sponsored Research Expenditures (2013): **10,980,534**

Papers published (2013):
136

Invention Disclosures (since 2005): **71**

Patents (since 2000): **20**

RESEARCH INFRASTRUCTURE

Total lab space:
9,158 sq. ft.

Student and research offices: **17,531 sq. ft.**



Research

ENGINEERING

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

Research

MEDICAL SCHOOL OFFICE OF RESEARCH

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.

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.

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.

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

MEDICAL SCHOOL OFFICE OF RESEARCH AT NCRC

Biomedical Research Core Facilities

Calendar Review & Analysis Office

Central Biorepository

Fast Forward Medical Innovation

Grant Review & Analysis Office

Honest Broker Office

Institutional Review Board - Medical School

Michigan Institute for Clinical & Health Research

Research Data Warehouse

Research Development Support

Unit for Laboratory Animal Medicine





BIOINTERFACES INSTITUTE

Researchers at the Biointerfaces Institute (BI) look closely at the critical junctures between living cells and other surfaces—biointerfaces—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

Co-location breaks through silos, spurs collaborations, and drives innovation. Twenty-four research groups from the University of Michigan's schools of Engineering, Dentistry, Medicine, and Pharmacy have been co-located in BI's over 50,500 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.

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.

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.

Prof. Tim Bruns was awarded a **2-year grant** from the **Craig H. Neilsen Foundation** for his proposal, "**Bladder Sensory Neuron Neuroplasticity after Spinal Cord Injury.**" The Neilsen Foundation supports scientific, charitable, and educational organizations conducting spinal cord injury research, training in spinal cord medicine, and providing services to assist individuals and families affected by spinal cord injury.

Prof. Cindy Chestek was also awarded a **2-year grant** from the Craig H. Neilsen Foundation for her proposal, "**Cortical Controller for Electrically Stimulated Grasping.**"

Prof. Sharon C. Glotzer was inducted into the **National Academy of Sciences** in 2014. Prof. Glotzer was also named the **John Werner Cahn Distinguished University Professor of Engineering**, and received the **Department of Chemical Engineering Outstanding Achievement Award.**

Long-time collaborators **Nicholas A. Kotov, Joseph B. and Florence V. Cejka Professor of Engineering, and Prof. Glotzer** were co-recipients of the **2014 MRS Medal** for their “foundational work elucidating processes of nanoparticle self-assembly.” **Prof. Kotov** was also named a **Materials Research Society (MRS) Fellow** in 2014.

Prof. Joerg Lahann won the **College of Engineering Service Excellence Award** in recognition of his work leading the development of the Biointerfaces Institute concept, and for turning that idea into an outstanding functioning unit.

Somin Lee, Assistant Professor of Electrical and Computer Engineering, was awarded an **NSF CAREER Award** for her research project, “**Engineering Plasmonic Nanoantenna Architectures for Efficient Nuclear Delivery.**”



Research

BIOINTERFACES INSTITUTE

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

- BI is the largest lab-based program at NCRC, with a footprint of over **50,500 square feet**.
- BI has over **300 researchers** on site.
- BI's faculty published **over 45 papers** in the first 6 months of 2015, including 3 BI papers in the 2015 January issue of *Nature Materials* alone.
- **BI has run 5 “BI Challenges”**—workshops that support innovative and early research to be leveraged for subsequent grant funding. Through these Challenges, BI has distributed **\$930,000** in seed funds, which have supported 27 researchers working on 14 successful proposals.
- Two Challenges were offered in FY 14-15: one with the Translational Oncology Program, which is also located at NCRC, and one with the UM Kellogg Eye Center.

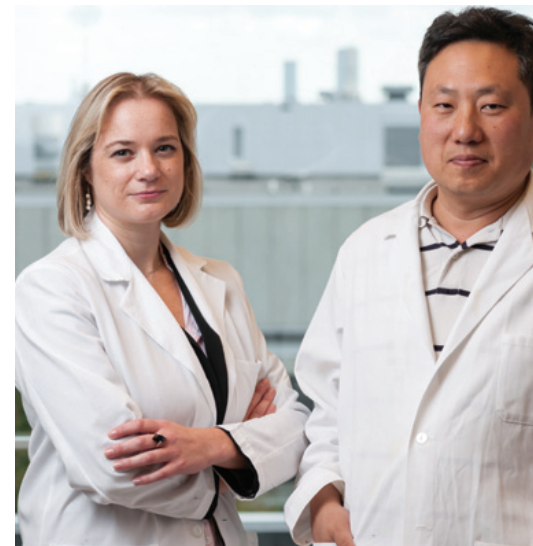
Research

BIOINTERFACES INSTITUTE

- In 2014-2015, BIRG hosted visiting researcher Dr. Belinda Seto, the Deputy Director of the National Eye Institute, and organized a well-attended symposium on science policy. The previous year's symposium focused on entrepreneurship and commercialization.
- BI has created four research centers, including the Single Cell Genomics Lab, the Visualization Lab, the Nanotechnicum, and the Optical Image and Analysis Lab. The Nanotechnicum alone has more than 150 users from 26 different lab groups, including 15 non-BI lab groups and two biotechnology companies.
- Eight BI faculty have leveraged their research to spin off start-up companies.



James Moon, John Gideon Searle Assistant Professor of Pharmaceutical Sciences and Biomedical Engineering, received the “**Melanoma Research Alliance Young Investigator Award**” for his work on the development of nanoparticle-based immunotherapy against melanoma.



In addition to being named a Lefkofsky Scholar, **Prof. Sunitha Nagrath** received a **3M Non-Tenured Faculty Award**. For over twenty-five years, this award has recognized outstanding new faculty, helping them remain in their teaching positions, conduct research, and achieve tenure.



Research

BIOINTERFACES INSTITUTE

Successes at NCRC

BI and TOP—co-located at NCRC—have established the Lefkofsky fellow program, and named BI faculty member Sunitha Nagrah and Andrew Rhim from gastroenterology Lefkofsky Scholars. Each will receive a \$75k per year research grant for 2-3 years to develop an inexpensive blood test for early stage cancer; the test will be available for clinical use as part of routine healthcare.

BI and TOP further collaborated by co-hosting a research Challenge titled
“Materials Technologies for Cancer Therapy”
at NCRC on December 12-13, 2014:

There were
50 faculty
participants

31 researchers
drafted
9 proposals
for seed money

3 successful
proposals received
\$50K each, for
a total of **\$150K**
in seed funds
distributed

5 student
researchers
attended the
Friday session

11 BI and TOP faculty
are participating in the
Certified Professional
Innovator Program,
an outgrowth of the
Materials Technologies
Challenge

A BI-TOP faculty proposal
to the National Cancer
Institute’s Physical
Sciences in Oncology
Center was leveraged
following the Materials
Technologies Challenge

BI and TOP are
currently developing
a joint submission
for this NCI grant
opportunity

Research

BIOINTERFACES INSTITUTE

Additionally, BI and TOP collaborators successfully beat out at least 5 other teams to win the inaugural FastForward Medical Innovation Shark Tank Event in May 2015. The competition was fierce, but Scarab Therapeutics, led by BI's Anna Schwendeman, Ph.D., and TOP's Mark Cohen, M.D., was declared the winner, and awarded \$2,500 in discretionary research funds. Scarab is a startup company that was formed to develop and market a new drug delivery platform that targets endocrine cancers, such as adrenal cancer.

The Glotzer Lab simulated how a solution of nanoparticle clusters in a liquid could work as computer information storage and made the simplest, one-bit cluster from plastic particles. A Rubik's Cube-like arrangement of nanoparticles could lead to a form of wet information storage, a team of Michigan engineers and collaborators at New York University have shown. Dr. Joshua Anderson of the Glotzer Lab has been awarded the CoMSEF Young Investigator Award for Modeling & Simulation by the American Institute of Chemical Engineers.

BI now houses the Single Cell Genomics Lab (SCGL), thanks to a strategic partnership between Dr. Max Wicha, BI, and the Fluidigm Corporation, which donated several of the key instruments. The SCGL provides multidisciplinary expertise and state-of-the-art microfluidics, imaging, and sequencing technologies to address unanswered questions related to cellular heterogeneity and complexity in cancer and other diseases. Research conducted in the lab evaluates critically important aspects of tumor initiation, multi-clonal expansion, and metastasis. The SCGL has the capability to assess novel, more effective targeting and personalized therapy for oncology patients. The SCGL is one of only four centers worldwide that has the required scientific expertise and cutting edge capabilities to conduct single cell genomics.

In July 2015, BI welcomed Professor of Urology Evan Keller, who moved his lab from the Comprehensive Cancer Center to NCRC. Prof. Keller does considerable collaborative research with Dr. Max Wicha, another BI (and TOP) faculty member. BI also assisted with the recruitment of Prof. Isabelle Lombaert, who joined BI in August 2015. Prof. Lombaert will have an appointment with the Dental School's Department of Biologic and Materials Sciences.



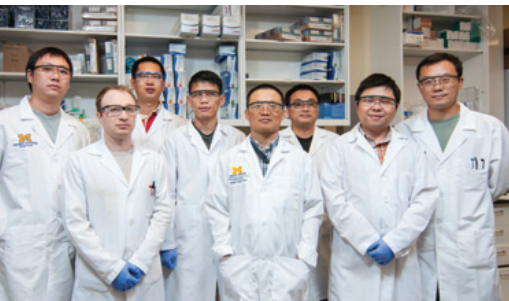
For more information on BI's research impact, visit their website:

www.biointerfaces.umich.edu

EXPERIMENTAL RESOURCES

The Cardiovascular Research Center (CVRC) at NCRC maintains unique experimental resources, including:

- Optical mapping, patch clamping, and molecular/cell biology suites
- Confocal microscopy
 - A transgenic rabbit colony
 - And an induced pluripotent stem cell laboratory



Research

CARDIOVASCULAR RESEARCH CENTER

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.

Co-location and collaboration

The close proximity of these scientists at NCRC enables CVRC researchers to pursue projects that would otherwise be difficult. The CVRC will continue to stimulate bench-to-bedside research that sheds light on molecular mechanisms underlying the development and progression of cardiovascular diseases; improve understanding of the most severe arrhythmias; develop new drug therapies for venous thrombosis; help patients by safely, effectively, and efficiently testing potential new drugs; and develop novel biomarkers for improved care of patients with hypertension.

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

- Ultrasound imaging and echocardiographic assessment of cardiac performance of both small and large animal models;
- Microsurgery and micromanometry, including aortic constriction (TAC or AAB), myocardial ischemia (LAD occlusion) and other possible cardiovascular surgeries;
- And telemetry with implantable probes.

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

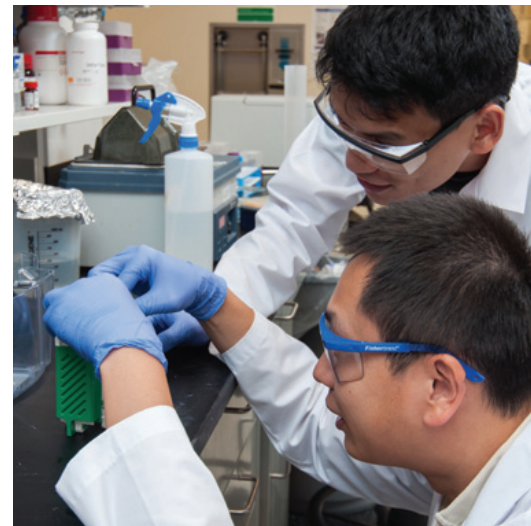
Research

CARDIOVASCULAR RESEARCH CENTER

NCRC's unique, collaborative environment has significantly enhanced the CVRC's research. The Office of Technology Transfer and the Venture Accelerator have increased the CVRC's entrepreneurship endeavors, leading to new inventions and patents. The Flux High Performance Computing facility has provided close, friendly support of CVRC's large scale computer modeling. In the past year, many CVRC investigators have been awarded federal funding to continue researching strategies to prevent and treat cardiovascular diseases.

The Vanguard of Medical Research

- Using human stem cell derived cardiac muscle cells, CVRC researchers have developed a human heart in a dish for cardiotoxicity testing
- CVRC researchers are working toward new strategies to treat both civilian and military trauma
- CVRC researchers are developing novel high-resolution technologies to accurately map and diagnose atrial fibrillation in human patients
- The Cardiovascular Cores provide 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
- CVRC researchers are also pioneers in developing novel large animal models to study human cardiovascular disease
- CVRC researchers have invented Smart Ablation, a safer way to cure cardiac arrhythmias
- CVRC researchers are at the forefront in the study of arrhythmogenic inheritable cardiac diseases associated with intracellular calcium dysfunction



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.

Focused energy and passion

“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. The power and uniqueness of MCIRCC, as we see it, is their ability to focus the energy and passion of the medical, engineering, academic, government, donor, and industrial communities to a single purpose.”

-Pete Tchoryk, CEO,
SpringMatter

Research

MICHIGAN 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.

End-to-End Management of the Research Pipeline

To accomplish this vision MCIRCC unifies scientists, clinicians, engineers, industry partners and funding streams to develop and deploy solutions that restore patient health. With a membership base comprised of more than 100 world-class researchers from 7 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.

Research

MICHIGAN CENTER FOR INTEGRATIVE RESEARCH IN CRITICAL CARE

MCIRCC's integrated team science model

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.

Bringing innovations to market

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 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 creates and accelerates high-impact research outputs within the critical care space, leveraging the following to significantly lower the barriers to integrated team science:

- Early awareness of big opportunities
- Rapid alert and mobilization of integrated science teams
- Leveraging foundational research communities for strategic advantage
- Accelerating “best in class” proposals with dedicated project management
- Support of high-risk research with new funding sources

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
- Advance patient-centric hospital-to-home care models

Research

MICHIGAN CENTER FOR INTEGRATIVE RESEARCH IN CRITICAL CARE

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 solutions that elevate patient care at a reduced cost.

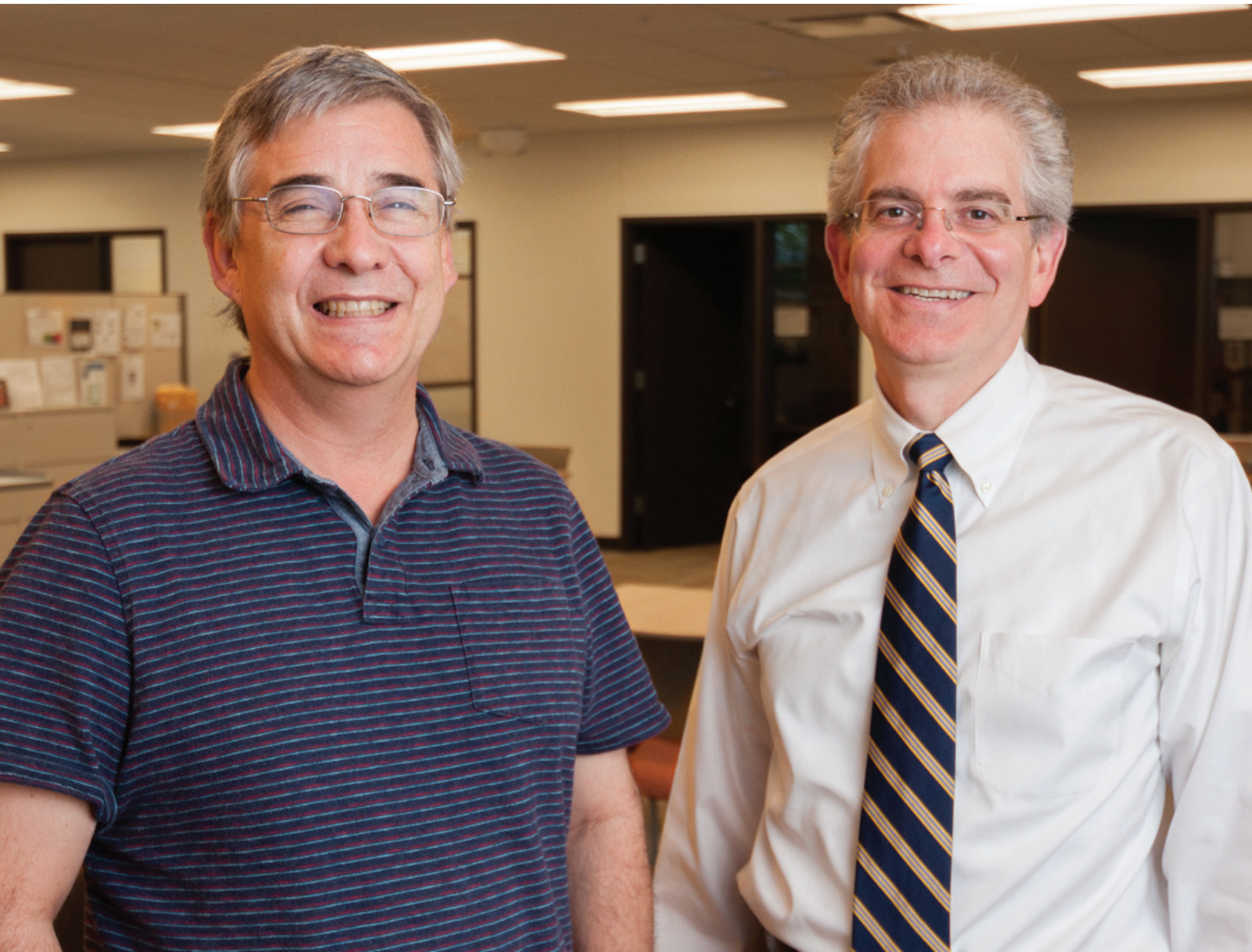
Untapped benefactors influence science and discovery

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



**U-M INSTITUTE FOR
HEALTHCARE POLICY
AND INNOVATION**



INFORMING PUBLIC POLICY

The V-BID for Better Care Act of 2014 – bipartisan bill introduced in the U.S. Congress to add V-Bid to Medicare, with evaluation criteria developed by Mark Fendrick, M.D., and the U-M Center for Value-Based Insurance Design

U.S. House Ways and Means Committee – testimony given by Helen Levy, Ph.D. on the Affordable Care Act

Michigan Health Care Cost & Quality Committee – testimony given by Jeff Kullgren, M.D.

Research

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

Health services researchers spend every day focused on making healthcare more accessible, affordable, safe and effective. The Institute for Healthcare Policy and Innovation (IHPI) is fortunate to be housed in an extraordinary environment at the NCRC – the ideal location for collaboration and innovation. The NCRC provides the physical space for members of IHPI to put their heads together to think bigger and better.

We continue to change our space, and to be changed by it

Today, more than 460 health service researchers from 17 U-M schools, colleges, and institutes, alongside 5 partner organizations are all actively engaged members of IHPI. Over the last year alone, IHPI has added 60 new members. As our membership and diverse project portfolios expand, so does the space IHPI occupies within the NCRC. With every additional square foot, IHPI is able to open new avenues for realizing its mission of collaboration.

The current IHPI footprint includes approximately 87,000 square feet of formal and informal offices and meeting spaces in three NCRC buildings – 10, 14 and 16 – the latter serving as IHPI's home base. The newest spaces are designed to be welcoming thought havens for all – including those with offices, labs, clinics and classrooms located elsewhere on and off the U-M campus.

Collaboration. Evidence. Impact.

With grant funding currently at 531 active awards totaling over \$580 million, IHPI is fueling a movement to reshape health services research and policy.

The data and methods hub: Big plans for Big Data

Data is the raw material of IHPI's work. The data and methods hub based at NCRC offers members access to large data sets and connections with innovators in study methodology. The Team's efforts are already paying dividends, fostering greater professional development, enhancing synergies and advancing the overall quality of IHPI member projects.



Research

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

The team

Although each focuses on a singular topic or area of expertise, IHPI groups learn a great deal from one another. Many have found a physical home with the Institute at the NCRC.

The Center for Healthcare Outcomes and Policy aims to improve the efficiency of healthcare in the U.S. by optimizing clinical practice and informing healthcare policy.

The Center for Health Communications Research creates and researches health interventions that inspire informed health decision, broaden access to health information, and advance the field of health communications.

The Cancer Surveillance and Outcomes Research Team is an interdisciplinary group of investigators seeking to understand and improve how cancer patients and providers communicate and make decisions about treatments.

The Center for Bioethics and Social Sciences in Medicine is a joint program sponsored by the University of Michigan Medical School and the Ann Arbor VA, a multidisciplinary unit that integrates bioethics with key social science disciplines, bringing together in one entity research, education, policy work, and service.

The Center for Value-Based Insurance Design promotes the development, implementation, and evaluation of insurance benefit programs that incorporate V-BID principles. The Center uses faculty-conducted research studies to provide evidence to further promote the incorporation of V-BID principles in health insurance benefit designs.

The Center for Clinical Outcomes Development and Application provides expert consultation for measurement selection and application to evaluate clinical questions and interventions, develop new measures using state-of-the-art methods, and utilize novel measurement systems and strategies to inform the creation and refinement of interventions to improve health-related quality of life.

176 new grants totaling over **\$100M** awarded last year

\$74M in external funding expended for members' health services research

869 articles by **359** Institute members in **760** journals

Over 460 Faculty Members

10 seminars, **over 500** attendees

\$8.5M U.S. Renal Data System Coordinating Center grant

\$6.4M Center for Medicare and Medicaid Services (CMS) Innovation Grant to lower surgical costs and empower patients

\$6.8M Department of Defense (DoD) grant for veteran suicide prevention

\$5M Michigan Department of Community Health (MDCH) grant for the evaluation of the Healthy Michigan Plan – a one-of-a-kind state and university partnership involving 17 faculty members from 8 departments collaborating to evaluate Michigan's Medicaid expansion program

A FOCUS ON EDUCATION AND TRAINING

Developing tomorrow's leaders

Central to IHPI's mission is providing a fertile training ground for students and professionals to learn both the science and the art of conducting health services research. Through numerous education and training platforms, IHPI is preparing the next generation of leaders in health service research and policy.

Research

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

CQIs: Team research that benefits every Michigander

UMHS is home to many of the state's "Collaborative Quality Initiatives" (CQIs), coordinating centers seeking to address some of the most common, complex, and costly areas of surgical and medical care. With funding from Blue Cross Blue Shield of Michigan (BCBSM), CQIs work with healthcare providers throughout Michigan to collect data in a centralized registry. This data is analyzed and shared to identify processes that lead to improved delivery of care and outcomes, and guide quality improvement interventions.

The goals of the CQIs align directly with IHPI's focus on evaluating how health care works and how it can be improved. As a result, IHPI members are leading the majority of the U-M Health System's CQIs:

Anesthesiology Performance Improvement & Reporting

BCBSM Cardiovascular Consortium-Percutaneous Coronary

BCBSM Cardiovascular Consortium-Peripheral Vascular Interventions Collaborative

Michigan Arthroplasty Registry Collaborative for Quality Improvement

Michigan Anti-Coagulation Quality Improvement Initiative

Michigan Bariatric Surgery Collaborative

Michigan Breast Oncology Quality Initiative

Michigan Care Management Resource Center

Michigan Emergency Department Improvement

Michigan Hospital Medicine Safety Consortium

Michigan Radiation Oncology Quality Consortium

Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative

Michigan Surgical Quality Collaborative

Michigan Trauma Quality Improvement Program

Michigan Urological Surgery Improvement Collaborative

Michigan Value Collaborative

Over the last year
alone, IHPI has added
60 new members

The current IHPI
footprint includes
approximately
87,000 square feet

Research

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

The next big thing in health research is right at home at IHPI

In March 2015, U-M was named one of four sites for the new National Clinical Scholars Program (NCSP). Along with UCLA, Yale and the University of Pennsylvania, Michigan is part of a new initiative to train change agents in health care, community health, and public policy research.

The NCSP was developed in part in response to the 2014 announcement that the Robert Wood Johnson Foundation (RWJF) would end its clinical scholars program for physicians. Building on the hallmarks of the RWJF program, partners at each institution will work directly with their scholars to identify and develop projects that solve current real-world problems, while cultivating the scholars' unique research and leadership skills through mentoring, a tailored curriculum, clinical work, and a national annual meeting. The IHPI Clinician Scholars Program is open to those who have completed their medical degree and residence training, Doctor of Nursing Practice training, or Ph.D. in nursing.

Innovating in education

In early 2015 IHPI hosted the University's first U-M-only massive open online course (MOOC), offering "Understanding and Improving U.S. Healthcare: Special U-M Student Edition." The course was taught by Matthew Davis, M.D., M.A.P.P., Professor of Pediatrics and Communicable Diseases and of Internal Medicine in the Medical School, Professor of Public Policy in the Gerald R. Ford School of Public Policy, and Professor of Health Management and Policy in the School of Public Health.

To Davis, IHPI's new deputy director, both the topic and the format were right for the current moment. "With colleagues at U-M, I've conducted research about the confidence of medical students in various aspects of their education, and across the U.S. they are less confident about healthcare policy than just about any subject they study," he says. "Not many of the 130 medical schools in the U.S. teach about healthcare policy."



Research

U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

IHPI helps pave a “Path to Excellence”

As part of the U-M Medical School’s transformational new curriculum, medical students now have an opportunity to augment their training by pursuing one of three Paths of Excellence, each of which integrates foundational, investigative, and experiential learning beyond the required coursework.

One of those paths, Health Policy & Health Economics, is offered in collaboration with IHPI. It explores the many roles physicians play in a healthcare system, from medical practice and research to population health, policy, and organizational leadership. Students apply in January of their M1 year, and the work continues through the M4 year, preparing them to understand the framework of healthcare programs and systems, and the connections between stakeholders who function within them. The program also helps these students adapt their skills and knowledge in healthcare policy to analyze policy-making in a clinical area of interest.



U-M INSTITUTE FOR HEALTHCARE POLICY AND INNOVATION

Extending our reach and national presence

From the start, IHPI has aimed to create a stronger connection between the academic community and the “outside world” to ensure that members’ work has the broadest possible reach and impact. Tapping the expertise of leaders outside the university has been a key component of the plan for growth. In 2015, ten recognized leaders in healthcare policy and delivery, health services research, business, and philanthropy were named inaugural members of IHPI’s new National Advisory Board:

David Blumenthal, M.D., M.P.P., President and Chief Executive Officer, Commonwealth Fund

Garth Graham, M.D., M.P.H., President, Aetna Foundation

James K. Haveman, M.S.W., Former Director, Michigan Department of Community Health

Michael M. E. Johns, M.D., Professor, Schools of Medicine and Public Health, Emory University

Gary S. Kaplan, M.D., FACP, FACMPE, FACPE, Chairman and Chief Executive Officer, Virginia Mason Health System

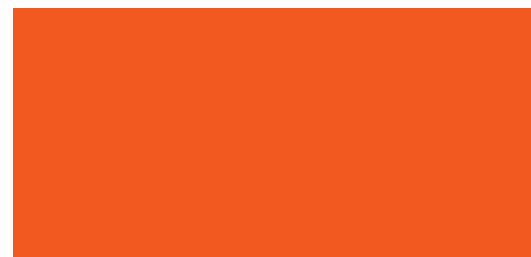
Paul McCreadie, M.B.A., M.S., Managing Director, Arboretum Ventures

Lewis G. Sandy, M.D., FACP, Executive Vice President, Clinical Advancement, UnitedHealth Group

Lisa Simpson, M.D., B.Ch., M.P.H., FAAP, President and Chief Executive Officer, AcademyHealth

Antonia M. Villarruel, Ph.D., FAAN, Dean, School of Nursing, University of Pennsylvania

Gail R. Wilensky, Ph.D., Senior Fellow, Project HOPE



For more
information visit
IHPI’s website:

ihpi.umich.edu

THE FUTURE OF TRANSLATIONAL RESEARCH

TOP plans to drive results through the following initiatives:

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.

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.

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.

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.

Research

TRANSLATIONAL ONCOLOGY PROGRAM

Cancer remains the second leading cause of death in the United States. This year alone, roughly 1.5 million Americans will be diagnosed. Unfortunately, progress in the treatment of the most common forms of cancer has been frustratingly slow, yielding only modest improvement in survival rates. There are bottlenecks in the drug development pipeline, with government and pharmaceutical companies funding only low-risk, incremental research which yields predictable results, as opposed to breakthrough science. What's more, the system of cancer research working toward cures has been extremely isolated: independent cancer investigators working in their separate laboratories studying their individual problems.

Leveraging a paradigm-shifting 'team science' approach, the U-M Comprehensive Cancer Center's Translational Oncology Program (TOP) brings together world-class scientists and physicians with diverse interests across the spectrum of cancer research. TOP's collaborative approach expedites the process of transforming lab concepts into novel products, procedures and treatments that benefit cancer patients.



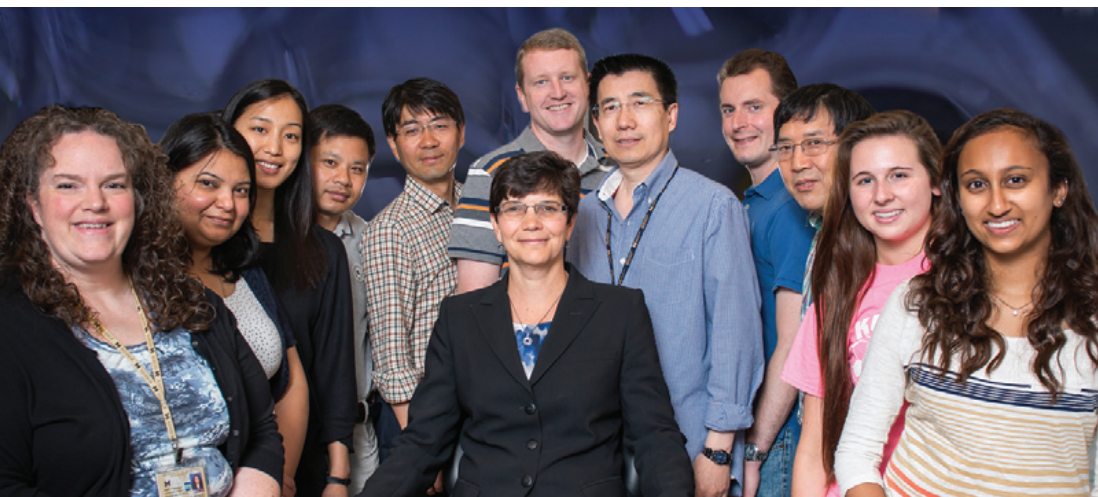
Research

TRANSLATIONAL ONCOLOGY PROGRAM

A paradigm-shifting approach

Under the leadership of Diane Simeone, M.D., TOP employs cutting-edge science and technologies to explore a wide variety of cancers from many angles. Interdisciplinary teams collaborate on the development of new therapy approaches. Their goal is to improve outcomes for the greatest range of cancer patients with better early detection tests, anti-cancer drugs and new ways to personalize treatments. 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's innovative research approach has attracted generous philanthropic support. That seed money has resulted in TOP members securing a significantly higher level of funding from the National Institutes of Health (NIH).



THE FUTURE OF TRANSLATIONAL RESEARCH (CONTINUED)

Venture accelerator fund: establish a mechanism to regularly churn out bold, innovative ideas that would not be supported by traditional means.

Portfolio of cancer drugs: develop 5-10 new drugs within 5 years at U-M to treat various cancers.

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.

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

Conquer metastatic disease: support efforts of a dedicated team focused on developing new treatments to prevent and cure metastatic disease — the number one killer of patients with cancer.

HOW IT WORKS

Recognizing that some of cancer's challenges require a complex approach, beyond what traditional biology offers, TOP engages engineers, computer scientists, imaging and genomics experts, and mathematicians, among others, to focus on linking:

Genomic data analysis

Molecular and genetic profiling

Cancer cellular biology

Molecular imaging

Experimental therapeutics

Pharmacology and drug development

Early detection

Research

TRANSLATIONAL ONCOLOGY PROGRAM

Early detection

Using advanced technology, a multidisciplinary team led by Sunitha Nagrath, Ph.D., Nithya Ramnath, M.B.B.S., and Diane Simeone, M.D., developed a novel method that provides a reliable, quick and noninvasive way to isolate and expand circulating tumor cells (CTC) from early stage cancer patients. The team has done this successfully with very early stage lung cancer patients, forging a path for its use with individuals at high risk for developing pancreatic cancer.

In another key effort led by Andrew Rhim, M.D., a TOP team identified circulating pancreatic cells in the bloodstream of patients with pancreatic tumors before the development of invasive cancer. A larger clinical trial assessing the use of measuring these cells in patients with pancreatic tumors is currently underway.

The team's studies suggest that these circulating cells seed in the bloodstream when the tumor is forming, before the development of invasive cancer, and before early stage cancers can be detected by traditional tests like computerized tomography (CT) and magnetic resonance imaging (MRI) scans. Identification and removal of tumors at this stage should lead to a high cure rate, but further work must be done to validate this concept, and develop automated technologies that will allow this approach to be used in the clinic.

Drug discovery and development

Shaomeng Wang, Ph.D., has performed pioneering work in the field of drug discovery, with groundbreaking efforts to bring the fruits of this work to the clinic. He runs a major laboratory in TOP, conducting drug design, synthesis, and development of small-molecule therapeutics for the treatment of various cancers, as well as development of new computational methods of drug design. His work has led to 67 new invention disclosures, resulting in 33 U.S.-issued patents, and four license agreements. To date, Dr. Wang has advanced four novel cancer drugs into Phase I/II clinical development, and several more drugs into late-stage preclinical development.

Research

TRANSLATIONAL ONCOLOGY PROGRAM

New treatment approaches

Under the leadership of Elizabeth R. Lawlor, M.D., Ph.D., a TOP team is studying metabolic changes in the childhood bone cancer Ewing sarcoma. While most patients respond to treatment, many relapse after their initial remission. Although the reasons are not yet completely understood, it is believed that there are cells in the original tumor that survive despite the delivery of highly toxic doses of chemotherapy.

Dr. Lawlor's team is discovering that many of the abnormal mechanisms that drive Ewing sarcoma survival and progression are actually normal processes in the developing embryo. In other words, the Ewing sarcoma cells develop tools to hijack and reactivate biology that is normally restricted to early human development. Understanding why this occurs is providing new opportunities for targeted therapies that will spare healthy tissue.





Research

TRANSLATIONAL ONCOLOGY PROGRAM

Close proximity to research-enhancing partners

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, as well as space to expand clinical trials. NCRC also provides an unprecedented opportunity to co-locate the program's multidisciplinary teams to focus together on cancer's major scientific challenges. TOP capitalizes on 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).

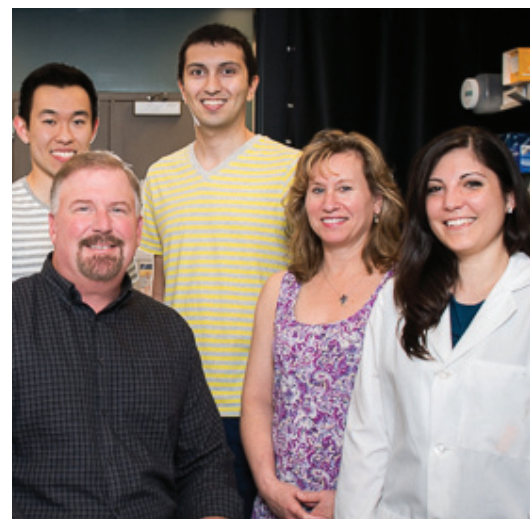
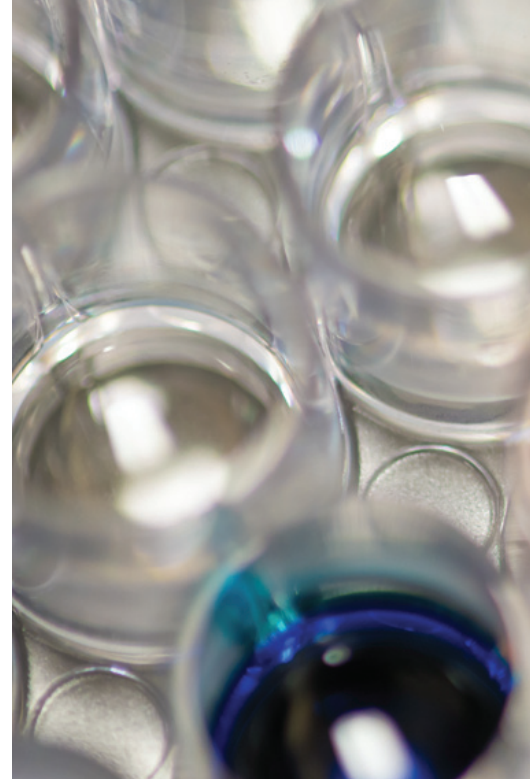
In addition to collaborating with one another, TOP researchers are in close proximity with partners who enhance their work, including researchers at the Center for Computational Medicine and Biology, Center for Molecular Imaging, Center for Organogenesis, Michigan Institute for Clinical and Health Research and Michigan Center for Translational Pathology.

Research

TRANSLATIONAL ONCOLOGY PROGRAM

TOP also leverages a close association with industry partners to facilitate drug development, and innovative clinical trials that allow investigators to align patients to specific therapies and monitor their response in real time. TOP-affiliated scientists and engineers also work with the U-M Ross School of Business to patent new technologies and establish biomedical companies, invigorating the economy and, most importantly, ensuring patients gain greater access to the treatments that will help them overcome their disease.

The opportunity NCRC offers to interdisciplinary innovators to collaborate and tackle the complex problem of cancer—with a laser 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.



In 2015 the BEC brought in **\$115.8M in overall revenue**, an **11% increase** from 2014

39 academic institutions and organizations contacted the BEC in 2014 for advice on developing their own, similarly structured unit, including Carnegie Mellon, Notre Dame, Ohio State, and the University of Texas System

In 2015 the BEC brought in **\$115.8M in overall revenue** an 11% increase from 2014

It has **11 employees**, including **6 relationship managers** who handle more than **1,200 corporate partnerships**

The BEC was founded in 2007 by U-M President Mary Sue Coleman, who famously told academic and business leaders they must "Partner or perish"

For more information about the BEC, visit their website:

bec.umich.edu

External Partnerships

BUSINESS ENGAGEMENT CENTER

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

NCRC has enabled the BEC to create a professional space to host companies to further public/private partnerships. Over 800 corporate visitors came through the BEC in the past year. Some stay: companies such as Aisen and Honda have leased space at the NCRC to work more closely and collaboratively with U-M researchers, while several other companies have inquired about space availability for future projects.

Through large research initiatives, such as the Mobility Transformation Center and the soon-to-be-announced Data Science Initiative, the BEC plans to grow corporate engagement on campus. It is also actively reaching out to faculty and research administrators through an internal marketing campaign to better inform them about what the BEC does, and how it can assist them in achieving their research goals.

"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." -Stella Wixom, Executive Director

BEC Objectives:

- Serve as a catalyst, bringing faculty and companies together for corporate engagement
- Secure philanthropic support for scholarships, fellowships and professorships
- Assist in the development of master research agreements
- Connect students with real world experiences





Lycera at NCRC

“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.”

-Paul Sekhri,
President and CEO
of Lycera

External Partnerships

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.

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, adaptability, 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 is advancing clinical candidates from distinct, yet complementary, areas of research, including immune metabolism, cell signaling, and immune cell differentiation. Lycera’s lead product candidate, LYC-30937, entered human clinical testing in April 2015. Additional programs, including an ROR gamma (ROR γ) agonist are advancing in preclinical studies.

New 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 ROR γ agonists for cancer immunotherapy, and clinical-stage candidate, LYC-30937, being studied for inflammatory bowel disease (IBD). Under the terms of the agreement:

- Lycera receives an \$82.5 million upfront cash payment. The upfront payment includes an exclusive option for Celgene to license Lycera’s portfolio of ex vivo ROR γ agonist compounds.

External Partnerships

LYCERA

- Lycera has the potential to receive near term payments of an additional \$22.5 million associated with the ex vivo licensing option rights.
- 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.

Lycera and Merck

In March 2011, Lycera announced an exclusive research collaboration with Merck, known as MSD outside the United States and Canada, to discover, develop and commercialize small molecules that antagonize the retinoic acid-related orphan receptor γ t (ROR γ t). ROR γ t is the key regulator of Th17 cell differentiation and IL-17 induction and a compelling target for treatment of many immune diseases.

In February 2013 Lycera announced another agreement with Merck, to discover, develop and commercialize small-molecule therapies directed to selected novel targets being investigated for the treatment of a broad range of immune-mediated disorders.

Under the terms of the agreement with Merck, Lycera received an upfront payment and research funding, and is eligible to receive in excess of \$300 million in research, development, regulatory and commercial milestone payments. Merck is responsible for clinical development and will have worldwide marketing and commercialization rights to any products that may be developed as a result of the collaboration. Lycera is entitled to receive royalty payments, as well as development and sales milestones, on global sales from any such products.

NEW TARGETS IN AUTOIMMUNE DISORDERS

“There are substantial unmet medical needs and opportunities in autoimmune disorders, and new targets representing attractive opportunities that we are very pleased to pursue through our collaboration with Lycera. Lycera’s innovative capabilities and productivity, exemplified by the ROR γ t program, make them ideal partners for Merck in this area of drug discovery.”

-Rupert Vessey, D.Phil.,
FRCP, Senior Vice
President of Global
Scientific Strategy,
Merck Research
Laboratories

For more information
on Lycera and its
collaborative research,
visit their website:

www.lycera.com

U-M PARTNERS AMONG LARGE PUBLIC UNIVERSITIES IN THE U.S.

All of this research is taking place at NCRC, in the collaborative environment of IHPI. This location fosters CCMR research teams working closely with U-M partners, including the following VA/UM consortia:

- 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

External Partnerships

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.

To make these changes, the VA Center for Clinical Management Research (CCMR) is conducting research in three focus areas:

- Finding ways to optimize healthcare decisions while maintaining a focus on patient centeredness;
- Developing and implementing innovative approaches to improve safe clinical care, especially for our most vulnerable, complex, and costly patients; and
- Improving patient outcomes with lower resource expenditures by devising sustained approaches to engage patients and their caregivers in self-management.

FOCUSED AREA 1: **Optimizing healthcare decisions with a focus on patient centeredness.**

CCMR investigators are creating predictive models that better estimate the individual risks and benefits of clinical management strategies, especially for patients with cardiovascular disease, and for cancer screening. These models are used to develop algorithms that identify how an individual patient may benefit, or be harmed, by potential therapeutic or screening approaches.

For example, the Veterans Affairs Risk Score Study is using automated data to better predict cardiovascular outcomes and develop a VA-specific Cardiac Risk Score to assist in personalizing cardiovascular care for Veterans. Early results show that Veteran-based risk predictions are better able to predict cardiovascular risk than external models.

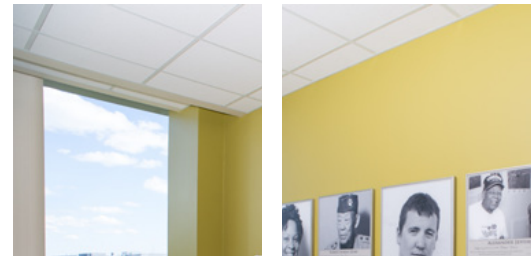
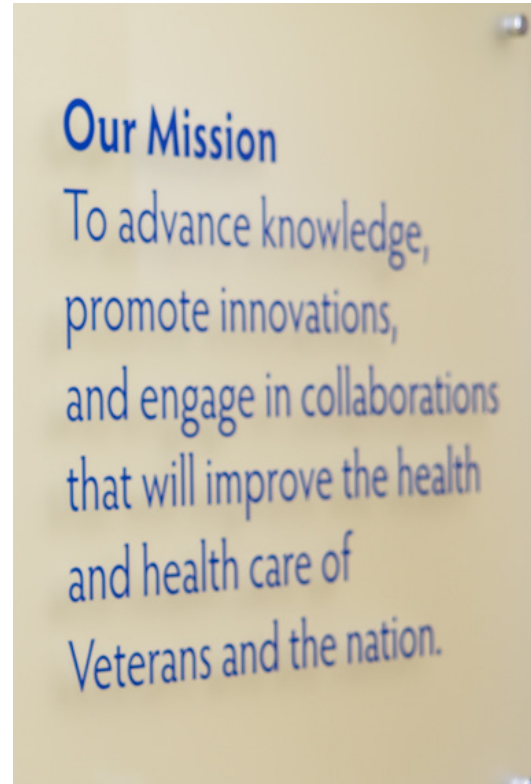
External Partnerships

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

Findings from this work will be used to develop automated tools that can be integrated into the electronic medical record, helping clinicians and patients to optimize and personalize cardiovascular risk reduction treatment decisions in the outpatient setting.

Building off of this research, CCMR investigators have been working with partners in VA's Office of Clinical Analytics and Reporting to create a novel performance measure for the management of dyslipidemia that is consistent with the new HEDIS (Healthcare Effectiveness Data and Information Set) performance measure, and also aligned with new VA/DoD clinical practice guidelines. This new measure is designed to create stronger incentives for prescribing statins in higher risk patients, and points toward the future of performance measures by helping providers to prioritize specific recommendations from the guidelines by probability of risk reduction.

Another study is working on developing and testing a decision aid to help Veterans make informed decisions regarding colorectal cancer (CRC) screening. CRC screening is a widely recommended, evidence-based preventive service that has traditionally been underused. Over the last decade, organized efforts by VHA to increase population screening for CRC among Veterans have been successful. But these population-centered efforts have increased screening utilization in a way that is not always concordant with screening benefit, particularly among older Veterans. As patients get older and acquire health problems, the benefit of screening decreases and the potential harm of screening increases—hence the need for a more tailored approach that considers patients' age and health status.





External Partnerships

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

FOCUSED AREA 2: Developing innovative approaches to improve care for our most vulnerable, complex, and costly patients.

CCMR has a strong track record of improving care by focusing on systems-based solutions for two especially vulnerable patient subgroups: 1) patients with significant mental health problems, and 2) hospitalized medical patients.

CCMR research on improving the care of patients with mental health problems this past year included noteworthy findings on the impact of antipsychotics in patients with dementia, the assessment and management of behavioral symptoms of dementia, social support and PTSD treatment-seeking, and the benefits of same-day integrated primary care-mental health services in diagnosing and treating patients with PTSD. New grants were initiated to study how to incorporate patient-reported outcomes into quality measurements of depression care; VA's response to guidance regarding risks of psychotropic medication use; a primary care intervention to reduce prescription opioid overdoses; and an approach for facilitating use of the Veterans' Crisis Line in high-risk patients.

CCMR's research on improving the care of hospitalized patients in 2015 centered around decreasing complications of hospitalized Veterans through more appropriate use of catheters, and improved management of complications arising from sepsis and in-hospital cardiac arrest. Publications in 2015 showcased a variety of approaches developed and tested by CCMR researchers for reducing catheter-associated urinary tract infections, including a model for reducing infections based on:

- a partnership between researchers and VA regional leadership,
- criteria for appropriate urinary catheter use that can be incorporated into the electronic medical record or a phone app, and
- a model for reducing indwelling catheter use and catheter-associated urinary tract infections specifically for nursing home patients.

External Partnerships

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

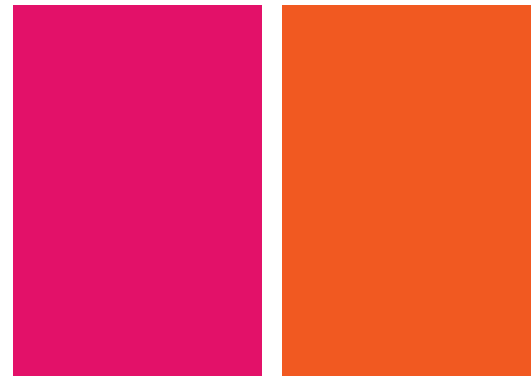
Work on management of sepsis this past year has included redefining sepsis care and survival, and examining readmissions after hospitalization for severe sepsis. A new study is working to identify key patient-level and hospital-level factors that are associated with long-term outcomes and healthcare utilization for in-hospital cardiac arrest, to help develop new strategies for quality improvement within VHA and elsewhere.

FOCUSED AREA 3: Using innovative approaches to improve the effectiveness and efficiency of patient self-management and treatment engagement.

Work in this area includes research on engaging patients in the prevention and management of chronic illnesses. Much of this work includes collaboration with VA's National Center for Health Promotion and Disease Prevention to evaluate refinements to the VA's MOVE! weight management program, in an effort to improve weight loss in VA patients. For example, this past year CCMR investigators have been in the final stages of their evaluation of the VA Diabetes Prevention Program, through which they have evaluated the benefit of diet, exercise, and other weight loss interventions specifically tailored for individuals who are pre-diabetic. Preliminary data suggest this program is more effective than the MOVE! program for achieving weight loss.

Other research in this area centers on the development, testing, and implementation of innovative interventions with a particular emphasis on non-traditional approaches to enhance diabetes care and self-management. One research project is evaluating an intervention designed to structure and facilitate health supporters'—non-professional caregivers'—involvement in primary care, so that patients can become more actively engaged in their care, and in improving their diabetes treatment processes and outcomes. The intervention includes patient and health supporter coaching, preparation by phone before patients' primary care visits, after-visit summaries by mail, and biweekly automated phone calls to prompt action on new patient health concerns.

CONNECTED VIBRANT FLOURISHING



PROJECTS



External Partnerships

CENTER FOR CLINICAL MANAGEMENT RESEARCH, VA ANN ARBOR HEALTHCARE SYSTEM

Related research is collecting community-based data on the use of non-household family members or friends willing to act as “CarePartners” to support patient self-management of diabetes. Using Interactive Voice Response (IVR) technology, patients receive regular calls to assess their self-management goals, caregivers receive reports of these calls, as well as training on how to support their patient, and care managers receive alerts if patients report critical values (e.g., very high or low blood sugars). Use of the CarePartners program has been linked with consistent improvements in medication adherence, diabetes self-management behaviors, physical functioning, and psychological distress.

In addition to engaging caregivers, CCMR is examining approaches that use peers to activate patients and promote self-management. Recent research has shown that peer support programs can improve glycemic control among Veterans who have diabetes and poor glycemic control. One ongoing study is testing the effectiveness of a technology-enhanced peer coaching (TEC) program in improving glucose control relative to peer coaching without technology enhancement. The technological tool is an iPad application that encourages interaction by providing choices of materials to view, using audio-visual elements, and incorporating a goal-setting process for developing self-management action steps and questions that patients can discuss with their doctor at their next clinic visit. Ongoing weekly contact between the Veterans is supported by a confidential phone system.

These are just some examples of the research done at CCMR in 2015. In an era of rising healthcare costs and rapid technology advancement, the use of technology to better support health care delivery, and to improve appropriateness, safety, and efficiency of more Veteran-centric care is 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

External Partnerships

TECH TRANSFER VENTURE ACCELERATOR

Tech Transfer is a key component in the University of Michigan's efforts to foster innovation and entrepreneurship. Tech Transfer connects faculty and students to real-world research, educational and business opportunities that speak to the core missions of the University.

Tech Transfer licensing professionals work with faculty to assess, protect, and market the research discoveries that make U-M's business partners more competitive. Tech Transfer's Venture Center is a one-stop shop for entrepreneurs and investors interested in U-M startup opportunities. Included in the Venture Center is the Venture Accelerator, 20 emerging U-M startups that occupy labs and offices adjacent to Venture Center resources.

A HUB FOR ENTREPRENEURSHIP

Last year, the Venture Center helped to launch 14 startups, or more than one startup every 4 weeks.

Tech Transfer's Digital Discovery Center helps faculty members establish value propositions for their ideas, and provides visualization and technical assessments that move concepts from theory to wireframes and initial screens. Compliance experts are brought in to provide guidance on regulatory, privacy, and security issues. Tech Transfer specialists provide guidance to model the best commercial path for a new innovation, and collaborate with other organizations to accelerate promising ideas to market success. The Digital Discovery Center is initially focusing on health IT applications, and has received pilot funding from the William Davidson Foundation.

Leading venture firm praises U-M startup performance

"Osage University Partners analyzed the new venture creation organizations at many of the top universities. We found the U-M Venture Center has a robust process with resources to create valuable startup opportunities, and a track record that places it among the top universities in startup investment performance." -Marc Singer, Managing Partner, Osage University Partners



WHAT TECH TRANSFER DOES FOR U-M AND ITS BUSINESS PARTNERS

Transforms research discoveries into tangible benefits for the general public

Leverages business and venture partnerships to stimulate regional and national economic development

Increases the influx of research dollars and resources for the U-M academic community

Enriches educational experiences through student internships and hands-on learning opportunities

Attracts and helps retain the very best students, faculty and entrepreneurial partners

Enhances U-M's reputation and stature

BRINGING A VALUABLE SERVICE TO NCRC

MSIS's flexible work environment and open office configuration in Building 200 allows them to reposition staff quickly to more effectively support projects and meet customer needs

Since its grand opening in January 2015, the Help Me Now service team has resolved 742 requests at NCRC

The MSIS Service Desk also resolves an average of 377 NCRC-related tickets per month—a 235% increase over last year—submitted via phone, email, or the MSIS website

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

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

MSIS added QR codes to conference signs, making it easy to look up room availability

Scientific Support

MEDICAL SCHOOL INFORMATION SERVICES

Medical School Information Services (MSIS) goes wherever help is needed, whether it's a lab, office, or conference room. MSIS device support teams visit NCRC offices and labs to provide assistance so researchers can stay focused on their work. Whether a customer contacts MSIS in person, via email, or submit an online request for service, their goal is to complete the task in as few interactions as possible.

MSIS offers on-demand, face-to-face support for IT products and services at their NCRC Help Me Now location. Help Me Now is also the front door for loaner equipment and A/V equipment requests across NCRC, and NCRC tenants can even request a Help Me Now pop-up to provide support at meetings or events.

Based on the success of the Help Me Now desk in NCRC's Building 18, MSIS opened a second location in the renovated Taubman Health Sciences Library in August 2015.

A third location will launch in the UMHS Towsley Center in late Fall 2015. Positioned closer to their customers, these three locations will enable MSIS to support many more people through walk-in services.

Scientific Support

MEDICAL SCHOOL INFORMATION SERVICES

Tracking customer satisfaction

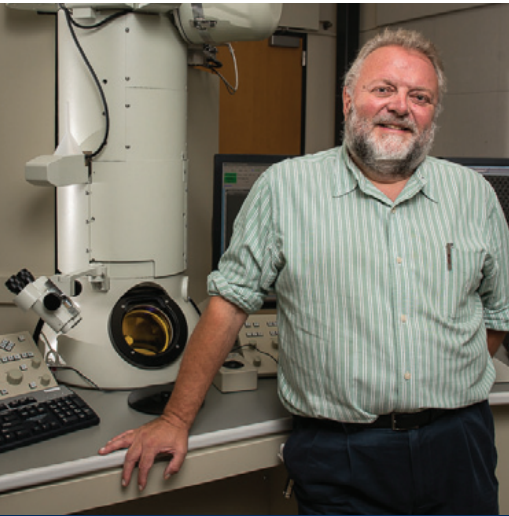
MSIS strives to continuously deliver and improve outstanding customer experiences by conducting a quarterly survey to track customer satisfaction and drive improvement. These survey results help MSIS identify successes and address shortcomings, assess the impact of their improvement efforts, and define and launch new services.

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

MSIS designs and implements services focused on individual investigators and their laboratories to facilitate their research and academic success. In the coming year, MSIS will increase support for PIs, delivering these services directly to labs at NCRC. This will enable PIs to increase their productivity, while also reducing their risk as much as possible.

MSIS is also expanding its capabilities to meet the information services needs of researchers, making it easier for NCRC researchers to collaborate with their colleagues across the U-M Health System.





Scientific Support

THE MICHIGAN CENTER FOR MATERIALS CHARACTERIZATION (FORMERLY THE NORTH CAMPUS ELECTRON MICROBEAM ANALYSIS LABORATORY)

The University of Michigan North Campus Electron Microbeam Analysis Laboratory (EMAL) has completed its move to NCRC. Given that the facility has a much broader scope than just electron beam analysis, the facility has adopted a new name: the Michigan Center for Materials Characterization. A new director, Professor Emmanuelle Marquis, has been appointed by the College of Engineering administration; several new staff will be hired over the coming months. Dr. John Mansfield has become the new Senior Director for Education and Engagement, and a new laboratory manager will be appointed shortly.

There are now 12 pieces of equipment in the user facility, ranging from a state-of-the-art aberration corrected transmission electron microscope to a nano-indenter mechanical testing system.

This instrumentation is open to users across campus, from local industry, and from other academic institutions. The facility is located in Building 22 and access is via the door immediately adjacent to the south entrance to the building. Visitors and potential collaborators are always welcome.

Scientific Support

NCRC RESEARCH SERVICES

NCRC opened Research Services in 2011 as a site amenity supporting 400-500 colleagues. At the time, mail and courier packages were the only two services offered. Since then, Research Services' mission to deliver high quality, timely research support services to all of the university occupants at NCRC has led to significant growth in their offerings to the NCRC research community.



NCRC RESEARCH SERVICES OFFERINGS

Research Services has grown to support 2,400 colleagues with 15 services:

- Autoclaving
- Bio-Hazardous Waste Handling
- Dock Management
- Glass Washing
- Mail Services
- Biological Sample Transporting
- Packaging and Shipping Service for Dry Ice, Dangerous Goods and Hazardous shipments
- Property Disposition Staging
- Laboratory Laundry Services
- Gas Cylinder Assistance
- Logistically supports OSEH in collection of E-waste and batteries for pick-up and staging removal from the site by the vendor as arranged by OSEH
- Dry Ice Staging/storage
- Locker distribution
- Logically supports the collection of pipette tip boxes for recycling and shipped back to the vendor
- Interlibrary book loan support

High-Quality Service

- Since the start of services in early 2013, the ULS team has seen an almost 90% increase in the growth and scope of its services
- Occupants have remarked that Research Services allows them to utilize the research associates and/or students specifically for lab-related research
- That lab-related research directly supports 83 research labs and 95 PIs at NCRC, in addition to all the other NCRC occupants, several customers at the Medical School, and LSI
- The ULS team's level of service once again earned solid high marks in the annual NCRC Quality of Life Survey
- Many research labs have stated that the level of services at the NCRC are unmatched by any other U-M campus location

Scientific Support

NCRC RESEARCH SERVICES

In 2012 NCRC partnered with Unity Lab Services (ULS), part of Thermo Fisher Scientific. ULS has a staff of five dedicated employees performing services for NCRC. True to Research Services' vision of utilizing existing site infrastructure, and staff expertise and flexibility to provide time- and equipment-intensive services, ULS delivers high quality, cost effective, adaptable, expandable service. Despite the high volume ULS currently supports, they are able to perform many requests the same business day, or within two business days.

Most recently Research Services has implemented phase one of a new packaging and shipping service that will support the use of dry ice, and the shipping of dangerous goods and hazardous shipments. The service will eventually be offered to the entire university. Having a regionally dedicated and experienced staff on site increases Research Services' ability to consistently and safely handle, transport, and deliver hazardous shipments.



For more information on the valued services Research Services provides, and the growth potential for expanding these and other services to additional U-M departments and campus sites in the very near future, contact them at

NCRClabservices@umich.edu

Scientific Support

UMMS CENTRAL BIOREPOSITORY

World-class care for biospecimens

The UMMS Central Biorepository (CBR) provides state-of-the-art research infrastructure to support and optimize the standardized collection, processing, storage and distribution of human biological specimens and associated clinical data for University of Michigan biomedical researchers. Part of the Strategic Research Initiative, and a reporting unit of the Medical School Office of Research, the CBR's mission is to enhance the full spectrum of its research portfolio by providing a world-class, accredited, standardized, safe and monitored environment for the processing, storage and distribution of high-quality normal and diseased biospecimens annotated with detailed clinical and laboratory data.

Centralization, efficiency, integrity

The means to achieve this mission include deployment of standard operating procedures for these services, implementation of a structured Quality Management System, and a centralized operation established according to international standards and best practices. Centralization enables operational efficiencies through economy of scale and elimination of redundant biorepository workflows throughout the UMMS. Sample integrity is maintained through the use of automated temperature tracking devices, alarm systems and appropriate back up power when needed. Inventory monitoring and tracking of sample chain custody is achieved through the use of a dedicated Laboratory Information Management System (LIMS) called LabVantage.

WHAT WE DO

Deliver secure, monitored storage of high quality research biospecimens

Track and record entire biospecimen life cycle for detailed sample history

Ensure linkage between sample and study participant using coded, unique identifiers

Offer Standard Operating Procedures for reliable sample storage and processing

Provide consistent governance and a regulatory framework for the use and distribution of donated materials

Link specimens to data for increased scientific value

Follow a rigorous Quality Management System for continual process improvement

WHAT WE OFFER

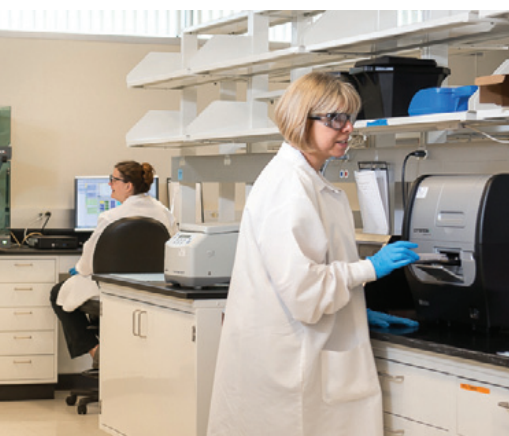
Open for business since September 2014

Approximately 200,000 samples stored at the biorepository from 5 research programs; 4 more in development

Current sample types stored include DNA, serum, plasma, urine, and tissue biopsies

A broad-use consent form is available for researchers wishing to create a biorepository collection

Over 22,000 DNA samples have been extracted from whole blood and of those, over 17,000 have had qualified GWAS results available to UMHS researchers



Scientific Support

UMMS CENTRAL BIOREPOSITORY

PHYSICAL FOOTPRINT

Co-location is the key

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 state of the art labs requiring little modification. As a result, both the biorepository sample processing facility and the sample storage facility were able to get up and running quickly. Working with the NCRC Plant Operations, Medical School Information Services, as well as Architecture and Engineering Construction, CBR had a highly energized team committed to creating a unique infrastructure, supporting alarmed and monitored ultra-cold storage of samples in mechanical freezers and liquid nitrogen vapor phase cryogenic containers.

Study Workflow

Most studies contributing biospecimens to the Central Biorepository are located off the NCRC Campus. The NCRC-sponsored courier service, NCRC Laboratory Services, has been instrumental in executing workflow for the UMMS Central Biorepository (CBR), and for these studies, especially the Michigan Genomics Initiative (MGI).

Lab Services' flexibility in handling schedules, added pickups, and transportation of various samples at various temperatures has been critical to successful biospecimen transfer to the CBR. This service of NCRC reduces the workload for CBR staff and as a result, empowers CBR to focus on supporting the medical science that ultimately helps patients. The CBR is confident about its exciting partnership with NCRC as they grow and face new challenges.

Scientific Support

BIOMEDICAL RESEARCH CORE FACILITIES

There are more than 90 core facilities at the University of Michigan, 12 of which comprise the Biomedical Research Core Facilities (BRCF). Part of the University of Michigan Medical School Office of Research, the BRCF is a group of centralized labs and resources that provides researchers access to the latest technologies and equipment in biomedical research.

The forefront of collaboration

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

BIOINFORMATICS CORE: Founded in 2012, the Bioinformatics Core assists researchers interpreting complex, high-throughput biological data, including DNA, RNA and Protein. The 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 9 services to their portfolio, and testing 127 pieces of software in their service selection.

BIOMEDICAL RESEARCH STORE: The Biomedical Research Store stocks more than 700 items from 12 vendors at 5 locations around campus, available for immediate purchase.



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



MiCores

BRCF is in the final stages of implementing MiCores, an online system from iLab Solutions designed to streamline the process of ordering and billing for core service requests. The following Cores are currently in the system:

Bioinformatics Core

Biosafety Containment Core

Epigenomics Core

Flow Cytometry Core

Metabolomics Core

Microscopy & Image Analysis Laboratory

Proteomics & Peptide Synthesis Core

Sample Preservation Freezer Farm Facility

Transgenic Animal Model Core

Vector Core

Scientific Support

BIOMEDICAL RESEARCH CORE FACILITIES

DNA SEQUENCING CORE: The DNA Sequencing Core is one of the largest such 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 North Campus Research Complex, with 26 highly trained, helpful individuals on staff. They operate instruments that perform DNA sequencing, genotyping, gene expression analysis, DNA quantification and quality control. Analysis at the Flow Cytometry Core can be scheduled within 24 hours, and for cell sorting, appointments are made within 48 hours, reducing wait time from weeks to 1-2 days. Thanks to recent advancements in digital acquisition, sorting is also now 3-10 times faster.

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

BRCF strives to meet the increased expectations that have resulted from advancements and accelerated changes throughout the scientific research community. It requires top-of-the-line resources for BRCF to maintain their status as elite, next-generation providers of expertise, platforms and materials. The co-location of Core Facilities at NCRC is instrumental in fostering an environment of collaboration and partnership. Eventually, BRCF Director Cassandra Wong envisions a core facilities mall at the NCRC, a one-stop shop to keep pace with research technology, meeting the needs of investigators across the continuum of biomedical research.

For more information about the Biomedical Research Core Facilities, download their flyer.

[medicine.umich.edu/
medschool/sites/medicine.
umich.edu/medschool/files/
BRCFOverviewFlyer_12Cores.pdf](https://medicine.umich.edu/medschool/sites/medicine.umich.edu/medschool/files/BRCFOverviewFlyer_12Cores.pdf)



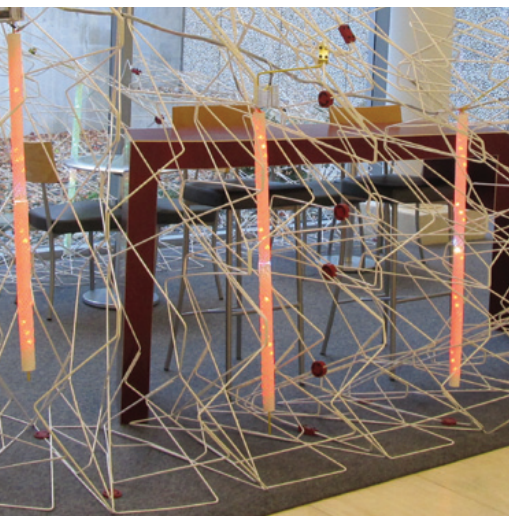
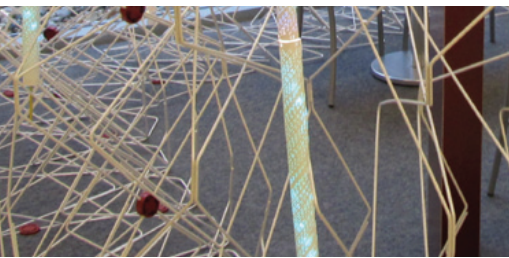
Community

HIGHWIRE

HighWire is a room-scale interactive installation composed of nearly two miles of robotically-formed steel wire integrated with an array of microphones and motion sensors. Located on the ground floor of NCRC Building 18, HighWire was conceived, designed, and built by the Applied Research Collaborative (ARC), a collaboration of the U-M Taubman College of Architecture and Urban Planning, School of Information, and Medical School Information Services (MSIS). The goal of this collective design effort was to create an installation that promotes collaboration and conversation among researchers at NCRC.

HighWire explores technology-space integration, contemporary digital fabrication techniques, and the adaptation of the physical environment to support social interaction. The technical infrastructure for HighWire uses Arduino, an open-source electronics prototyping platform featuring flexible, easy-to-use hardware and software. The Arduino microcontrollers provide a real-time visual register of interactions in the space.

By blurring the boundary between the physical architecture and the digital information world, HighWire becomes a place where people can contribute, interact, and share an infinity of ideas, fostering creativity, and embodying the collaboration goal of NCRC.



Community

NCRC ART

Scientists and artists share a common instinct for abstract, imaginative thought. Developing a dialogue between the two is NCRC Art's main objective.

NCRC Art supports the STEM to STEAM educational initiative—the push to include Art & Design with Science, Technology, Engineering, and Math. Inventive thinking is a key component to all of these fields. With that in mind, NCRC Art is invested in presenting the work of emerging artists alongside thought-provoking art by established artists in the same way that NCRC is invested in supporting emerging research.

In keeping with the spirit of research at NCRC, through its display of art and its arts programming, NCRC Art supports an environment that generates innovation and inspiration. With a year-round schedule of rotating contemporary art exhibitions, NCRC Art offers thought-provoking art that gets the NCRC community thinking creatively.





WELL CONNECTED

“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.”

-Kritika Rajan,
U-M student

Each year NCRC hosts the NCRC EXPO, an opportunity for groups that enhance the NCRC Community’s quality of life to promote their offerings. In 2015 more than 20 service units at NCRC will participate, showcasing their work for over 500 visitors.

Community

NCRC AMENITIES

NCRC is committed to supporting work-life balance. Collaborate!@NCRC, NCRC Art, the HighWire installation, and the MLibrary@NCRC, as well as Green Power, Childcare, and on-site wellness education and fitness programs are just some of the ways NCRC strives to improve the quality of life on its campus.

In response to the needs of NCRC parents, North Campus Children’s Center (NCCC) opened in July 2011. 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 community members.

In addition to conveniently located childcare and support for breastfeeding moms—the NCRC campus has four private lactation rooms with Wi-Fi—NCRC also hosts MHealthy exercise and relaxation classes. Body sculpting, cardio, yoga, Nordic walking, and dance fitness are among the many class offerings.

Periodic on-site StayWell® Wellness Screenings 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.

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.

MLIBRARY@NCRC

MLibrary@NCRC provides diverse information services to partner with units across NCRC, spending over \$20M each year on electronic resources for U-M researchers. Their informationists help users understand tools that can assist with interdisciplinary collaboration, such as the faculty expertise tool, Michigan Experts. They also offer individual and group information consultations, and instruction on topics ranging from conducting effective searches to utilizing data visualization tools. In addition, they conduct complex literature searches and collaborate with faculty on research.

MLibrary@NCRC Offers:

- Tricks to search databases and web resources—from PubMed to Google—more effectively
- Expertise in bioinformatics, data management, expert literature searching, and more
- Consultation and instruction on citation management tools, such as Endnote and Mendeley
- Identification of funding resources
- Help resolving grant compliance issues related to the NIH Public Access Policy
- Data management consultation
- Library books delivered to your NCRC departmental mailbox and returned through the MLibrary@NCRC book drop

MLibrary@NCRC's key goal in the coming year is to assist faculty, students and staff in meeting the funding requirements of various federal agencies with regard to data management and the resulting publications. Federal agencies require researchers to submit data management plans and make their resulting publications available to the public. MLibrary@NCRC informationists will provide small-group instruction sessions and consultations to help researchers understand the changing regulatory landscape, and can assist in the development and execution of robust data management plans.

RECENT ACCOMPLISHMENTS

Office of Research – Research Funding and Grants Guide

Working with the Office of Research, MLibrary@NCRC informationists have worked to create a consolidated campus-wide resource to connect researchers to funding opportunities.

MCIRCC – Proposal Development Unit (PDU)

Working with the Proposal Development Unit at the Michigan Integrative Center for Research in Critical Care, informationists are providing personalized consultations on funding opportunities. PDU Manager Jaine Place expressed that MCIRCC “couldn’t ask for better partners” in this process.

Fast Forward Medical Innovations (FFMI)

Engineering Librarians have created a patents-searching video and brochure for use by FFMI for a Patents and Intellectual Property workshop.

To learn more about MLibrary@NCRC, visit their website:

www.lib.umich.edu/mlibrary-ncrc

QUALITY OF LIFE SURVEY

SURVEY FACTS

Email distribution to 2,168 NCRC community members, plus QR code/URL handouts

Open from April 9 - April 23, 2015

561 respondents, response rate of 25.8% (2014 - 22%, 2013 - 24%)

Area of Focus	Respondents Satisfied* 2015	Respondents Satisfied* 2014	Respondents Satisfied* 2013	Respondents Satisfied* 2012	Respondents Satisfied* 2011
Overall Satisfaction	88%	88%	83%	76%	65%
Building Access & Wayfinding	76%	77%	68%	66%	58%
Building Security	84%	87%	82%	82%	77%
Building Services	90%	86%	87%	82%	79%
Research Services	89%	94%	86%	82%	NA
IT Services	80%	80%	83%	72%	65%
Conference Rooms	78%	81%	62%	NA	NA
Amenities & Requests	84%	84%	81%	NA	NA
Communications	70%	71%	61%	NA	NA
Parking	81%	75%	74%	73%	66%
Transportation	80%	82%	63%	n/a	n/a
Collaboration	63%	62%	57%	44%	34%
Fitness / Wellness	92%	93%	62%	50%	57%
Food	53%	62%	53%	16%	15%

Satisfied is defined as: *satisfied* and *very satisfied* on the 6-point scale of the survey.

Of the 561 respondents that took the survey:

- 28% are new occupants (moved to NCRC within the last year)
- 23% work in a laboratory in some capacity
- 42% use the North-East Shuttle bus
- 25% are Wellness Center members
- 8% are faculty members

**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. The questions either asked for levels of satisfaction or the extent to which respondents agreed with statements.*

GREEN POWER AT NCRC

By utilizing a gas turbine generator in its Power House, NCRC co-generates electricity and useful heat, alongside its DTE partner for the site. 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. 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.



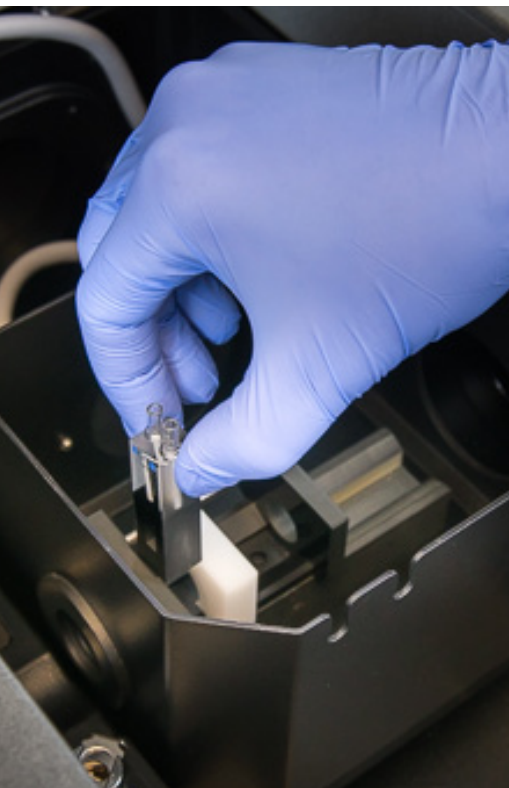
The 427 megawatt hours generated from October 2014 to September 2015 by solar panels is equal to the amount of energy released by burning 10,122 gallons of oil a year. Co-generation reduces CO₂ emissions by 9,400 metric tons of carbon dioxide (MT CO₂) per year.

This is equivalent to:

1,971 average sized **vehicles'** annual CO₂ emissions

1,407 average sized **households'** annual CO₂ emissions

Planting **7,705** acres of **trees**



Community

NEW FACULTY RECRUITS AND INTERNAL MOVES TO NCRC

EVAN KELLER

Biointerfaces Institute

WENDY MARDER

Rheumatology/Internal Medicine

EMILY SOMERS

Rheumatology/Internal Medicine

ZANETA NIKOLOVSKA-COLESKA

Translational Oncology Program

SUN DUXIN

Translational Oncology Program

HOWARD CRAWFORD

Translational Oncology Program

KAREN MCLEAN

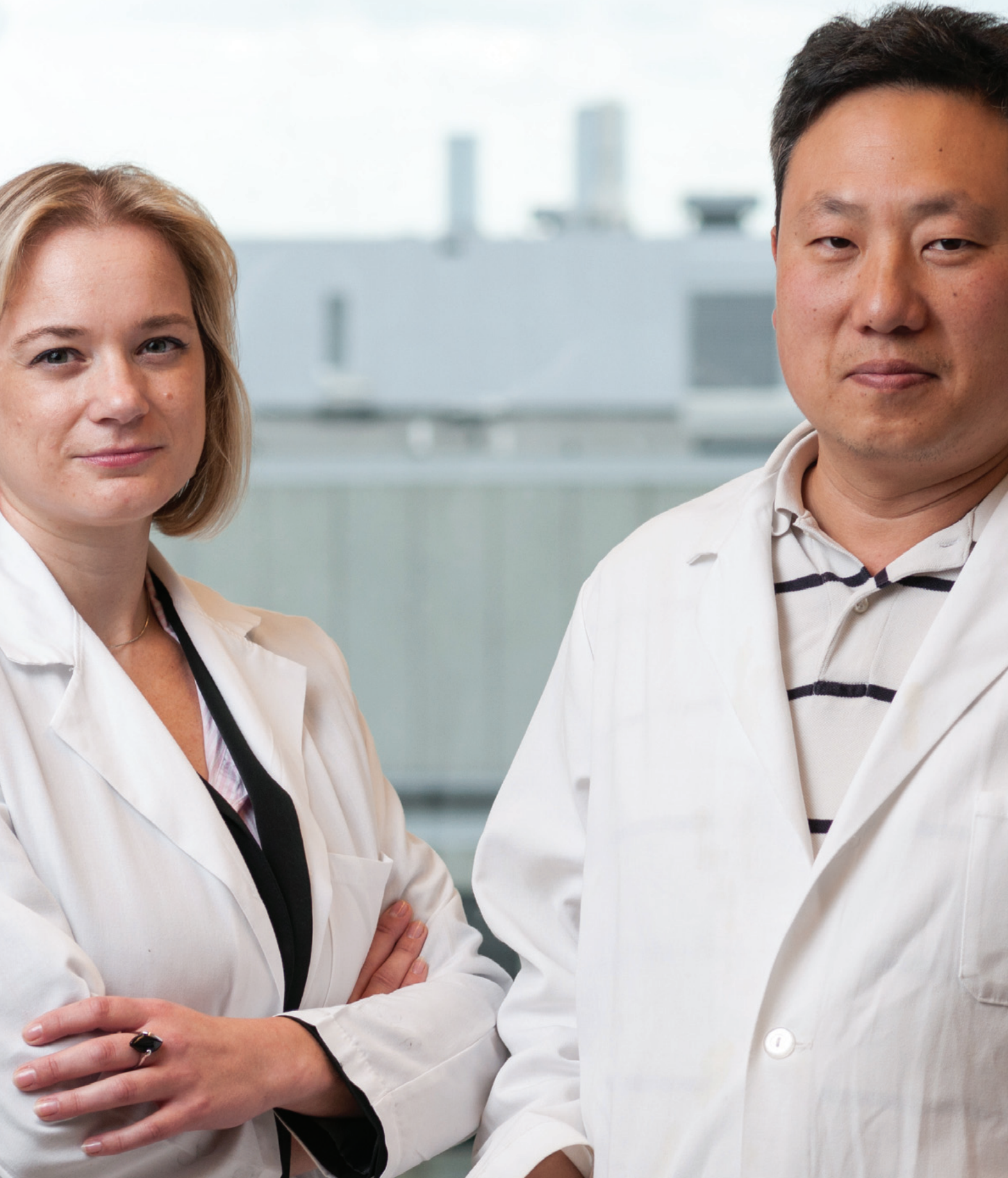
Translational Oncology Program

SHAOMENG WANG

Translational Oncology Program

CHAO-YIE YANG

Translational Oncology Program





Snapshot

MCITY MOBILITY TRANSFORMATION CENTER

The University of Michigan's Mobility Transformation Center is a public/private R&D partnership developing the foundations for a commercially viable ecosystem of connected and automated vehicles. MTC's central goal is to develop and implement an advanced system of connected and automated vehicles in Ann Arbor by 2021. MCity is a test lab at MTC designed to simulate urban and suburban roadways to provide a real-world environment for safe, repeatable testing of new, connected and automated vehicle technologies before they are tried out on public roads.

MCity is unique—it's not a test track, but a test environment for automated and connected vehicles of the future. Locating MCity at NCRC creates a space for many disciplines across U-M to come together to go beyond technical developments, addressing the legal, social, regulatory, political, economic, business, certification, consumer acceptance, and urban planning issues key to implementation. Partners are also drawn from industry, governmental organizations, and other academic institutions to accelerate progress and shape the future of mobility. This dense, complex atmosphere of collaboration makes realizing the potential of these vehicles much more efficient.

A ONE OF A KIND FACILITY

"[MCity] is really a one of a kind facility because it has a dedicated traffic control network, it has signs and roadways that can be changed, adjusted—we can remove lane markings, we can replace signs, or even take them away all together.

We can program the traffic network to operate however we want it to. There's nothing else like it anywhere."

-Jim Sayer, Deployment Director at the Mobility Transformation Center



Snapshot

MCITY MOBILITY TRANSFORMATION CENTER

Connected, automated, autonomous

“Connected” means that vehicles can anonymously and securely exchange data with other vehicles, and with the infrastructure, including location, speed, and direction, via wireless communication devices. This makes possible the use of applications that warn drivers of emerging dangers, such as a car slipping on ice around an upcoming curve, or a car that may be likely to run a red light ahead; they can also provide fuel-saving eco-operation advice.

Communication devices embedded in the infrastructure can make it possible to manage the flow of traffic across an entire region, timing lights for optimal traffic flow, for example. Bicycles and pedestrians can also be connected via portable devices.

Connected vehicles can also enable various levels of automation, allowing certain driving functions, such as acceleration, braking, and steering, to be machine-activated by technology built into the vehicle. Automation requires a sufficient number and variety of sensors, connections and maps to create situation awareness, and robotic functionality to mimic the role of the human driver.

“Autonomous” is something of a misnomer when applied to vehicles, in that the vehicle still needs to connect to other entities to update things like 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 drivers would. Unlike connected vehicles, however, they cannot detect traffic situations that are blocked by physical barriers, or out of range of their sensors.





THOUSAND OF CONNECTED VEHICLES

“We can test vehicles here—the whole system is here—and then move them out to the streets of Ann Arbor, where we already have thousands of connected vehicles, and then across the region, with all of the conditions that represent what’s happening more broadly, across the country.”

-Peter Sweatman, Director
of the Mobility
Transformation Center

For more information
about MCity, visit the
Mobility Transformation
Center website:

www.mtc.umich.edu

Snapshot

MCITY MOBILITY TRANSFORMATION CENTER

With MTC’s three planned on-roadway deployments of thousands of vehicles across the region, and a unique off-roadway test facility that simulates an urban environment, allowing ways to test ideas and approaches to develop practical systems before they are evaluated on actual roadways, Southeast Michigan has become the epicenter for 21st century mobility.

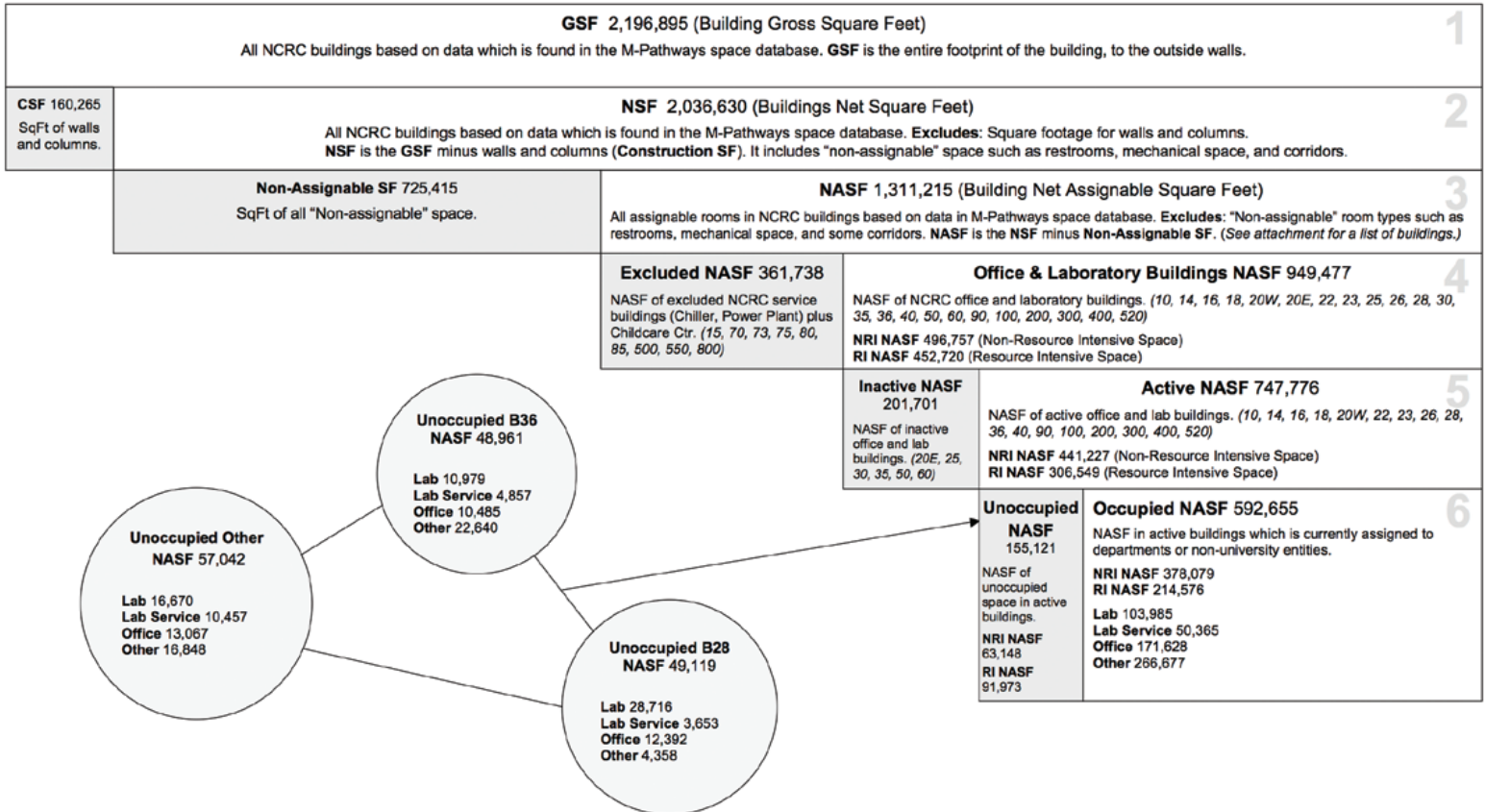
Not only is MCity’s facility on North Campus unique among its competitors, but manufacturers don’t have anything like it, either—and the transformation to connected and automated mobility will be a game-changer for safety, efficiency, and energy, making life better in our cities and suburbs. The Mobility Transformation Center signifies a huge commitment on the part of U-M to advance these beneficial technologies.

Snapshot

SPACE USAGE AT NCRC

Starting with 2.2 million square feet of gross sq. ft. (1), the net assignable sq. ft. (NASF) at NCRC is approximately 1.3 million (2). Excluding the 90,000 NASF GMP facility, the NASF for office and lab buildings is approximately 970,000 sq. ft. (3). Of this area, approximately 580,000 sq. ft. have been activated for offices and labs (4). Of that activated space, approximately 300,000 sq. ft., or 53% of the current capacity, is occupied. Another 130,000 sq. ft., or 23%, has been committed, leaving about 139,000 sq. ft. available (5).

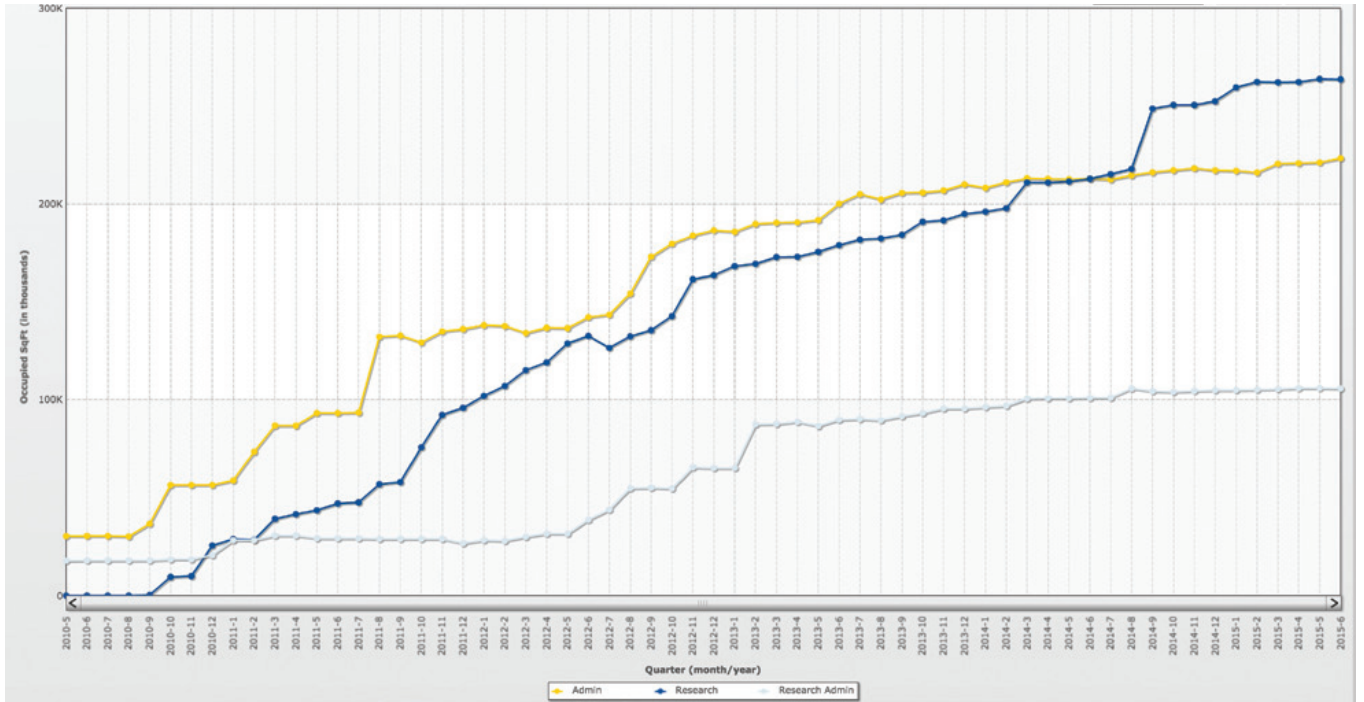
NCRC RI/NRI Analysis Inclusions & Exclusions
Data current as of June 30, 2015. Gray boxes show excluded space.



Snapshot

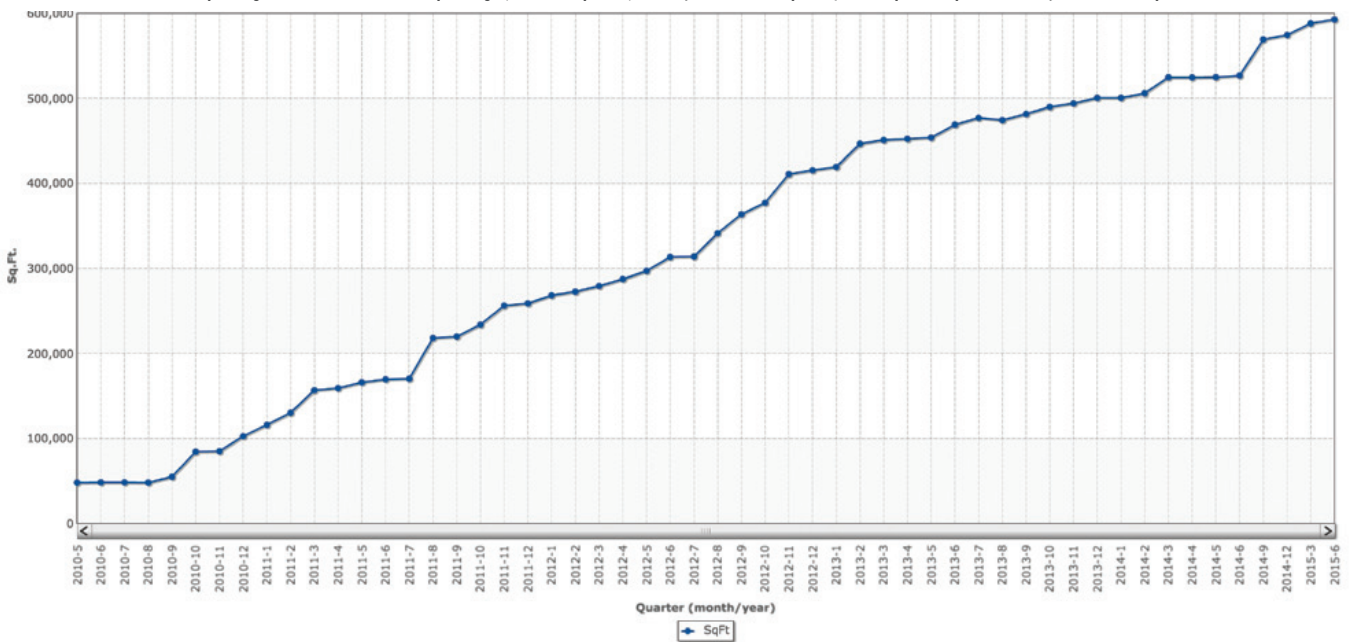
SPACE USAGE AT NCRC

NCRC Occupied Space Research vs. Admin



NCRC Total Occupancy

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



M | NORTH CAMPUS RESEARCH COMPLEX FACT SHEET

2,488 PEOPLE

Work at NCRC as of August 2015

346 NEW JOBS CREATED

As of October 2014

257 TOTAL

Faculty Members

71

Wet Lab Faculty Members



WORK AT NCRC

GROWTH

8 RESEARCH GROUPS

- Biointerfaces
- Cardiovascular
- Chemical Engineering
- Computational Medicine and Bioinformatics
- Distributed Health
- Emergency Medicine
- MCIRCC
- Translational Oncology



11 ADVANCED INSTRUMENTS

Let scientists and engineers study materials at the most detailed level

3 PRIVATE COMPANIES

- Lycera
- Honda
- BoroPharm

1 PUBLIC

Veterans Affairs

20+

Venture Accelerator Companies

PARTNERSHIPS

10

University of Michigan Schools

9

Shared research facilities

1 INSTITUTE

Institute for Healthcare Policy and Innovation



BUS

15 NEW BUSINESSES

Opened up on Plymouth Rd since June 2009

150,282

Rides on the North-East Shuttle (Sept. 2014 - April 2015)

585

Rides on the Bio Research Shuttle (June 2014 - March 2015)



COMMUNITY

EVENTS



EXPENSES

\$97M operating expenses

Operating expenses 15% less than budgeted

\$66M total capital expenses

FY2010 - FY2015



FINANCES

\$108 MILLION

To acquire NCRC in 2009

32 ACRES

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



MCARD

9,512



Mcards Granted NCRC Access (July 2015)

ART

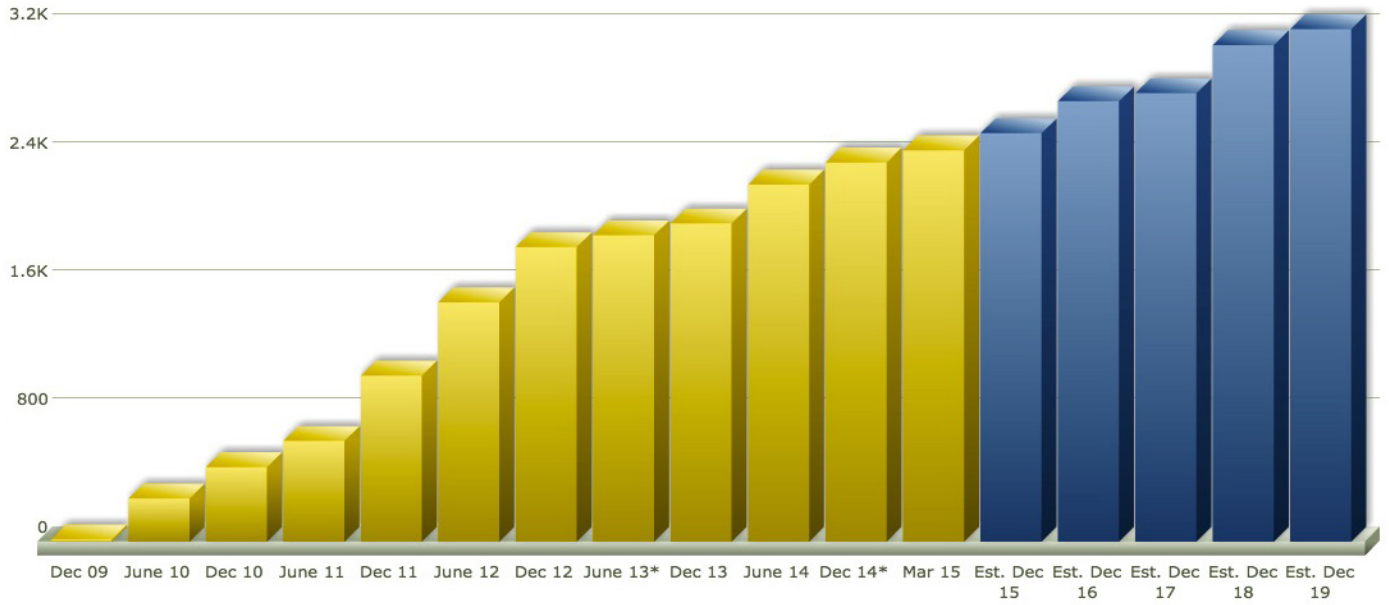
25

Total art exhibits

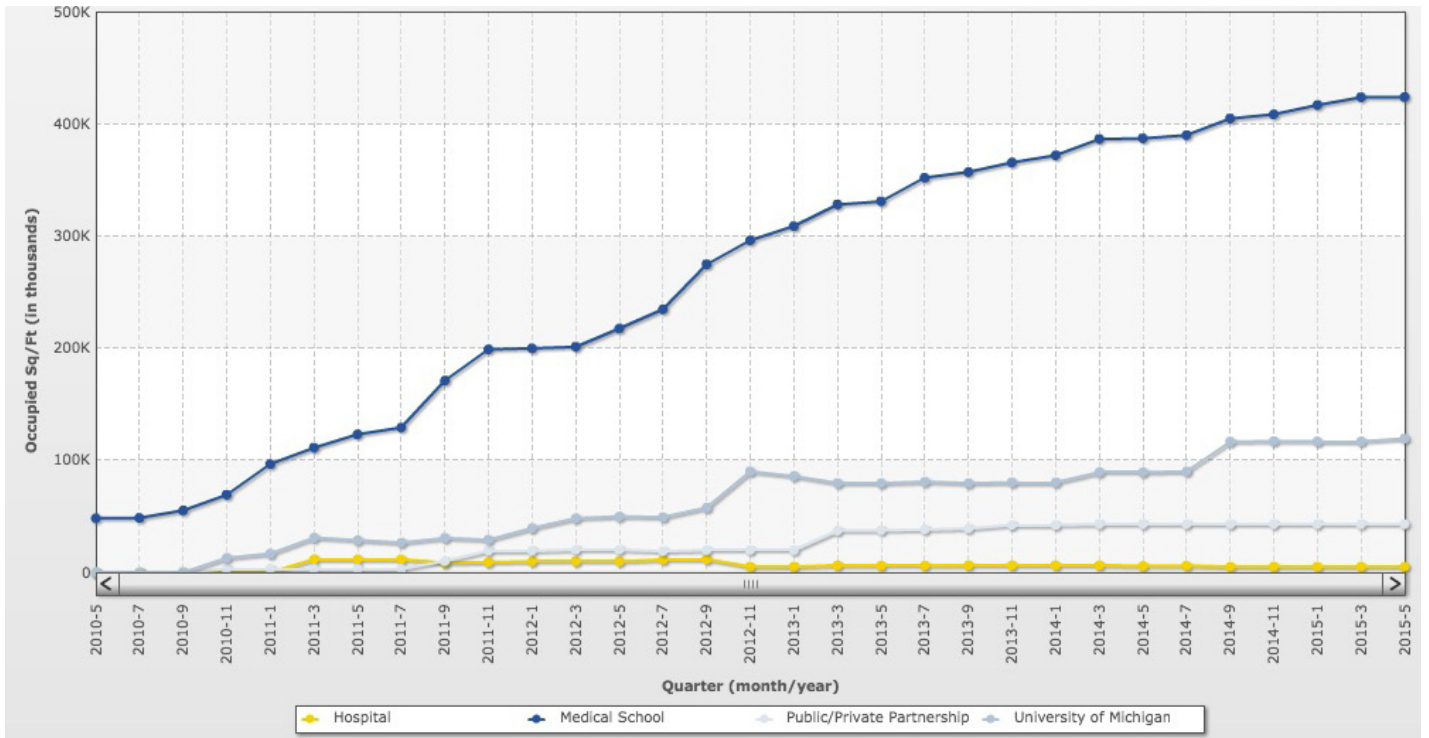
Snapshot

OCCUPANCY, PEOPLE, JOBS AND EVENTS

NCRC Actual and Estimated Occupancy Over Time



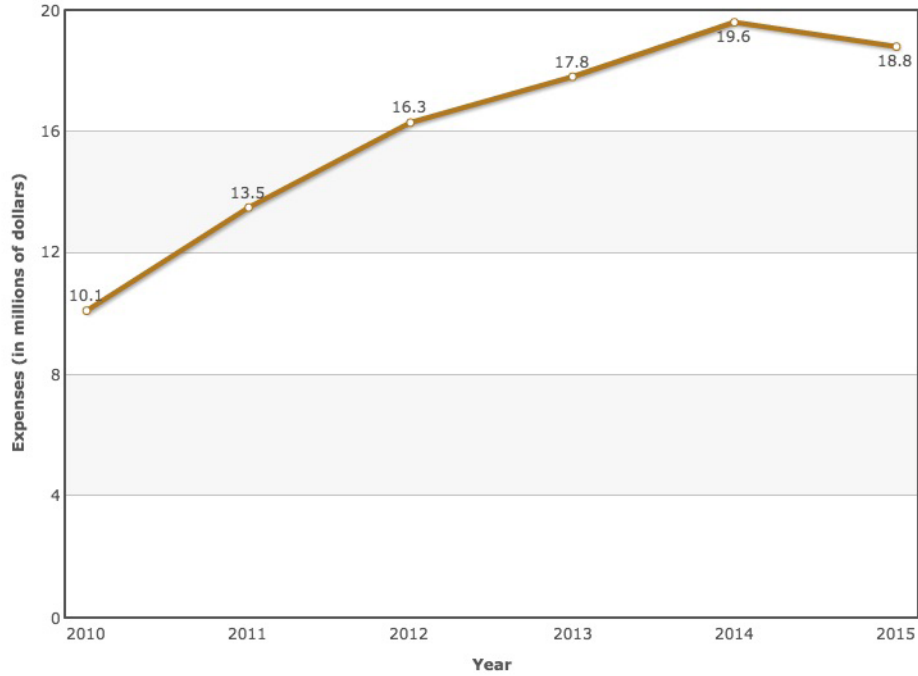
NCRC Occupied Space (by Organization)



CAPITAL AND OPERATING COSTS

OPERATING EXPENSES

Operating expenses at NCRC have run at approximately 15% less than projected.



CAPITAL INVESTMENT

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

