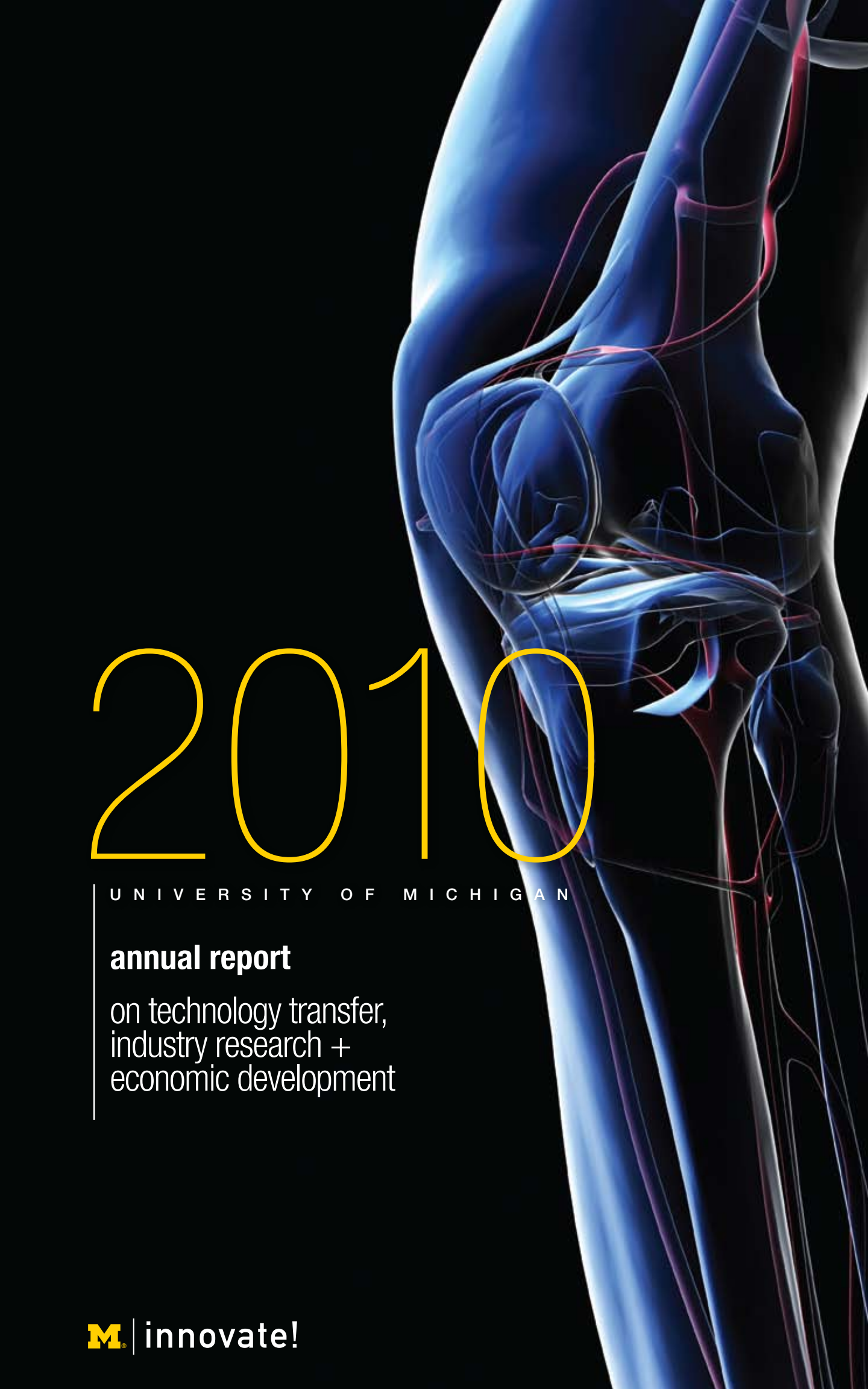


2010

UNIVERSITY OF MICHIGAN

annual report

on technology transfer,
industry research +
economic development

M | innovate!

engaging the entrepreneurial spirit.

YEAR ENDING JUNE 30, 2010

The graphic on the cover represents a class of work being pursued by a number of researchers at U-M, including growing ACL implants to reduce osteoarthritis, osteoporosis diagnosis tools, mimetic musculoskeletal materials to repair joints, and joint health.

THE engaged university

Message from the President

Innovation is essential to our regional and national prosperity, and the University of Michigan is firmly committed to accelerating economic transformation through creativity and entrepreneurship.

We want to connect our research and technology with the needs of our communities and make our society more prosperous. And we are eager to collaborate with companies to drive transformative research that can change the world.

We are dedicated to linking the great ideas of our faculty and students to the marketplace, spurring breakthrough technologies, and nurturing entrepreneurial ventures. And we find inspiration in the creative spirit and entrepreneurial aspirations of our students. They are the generation who will drive the economy of the future, one fueled by inventive thinking, knowledge, and confidence.

MARY SUE COLEMAN
President
University of Michigan

Message from the Vice President for Research

I invite you to review the broad and diverse talents and resources available at the University of Michigan as showcased in this year's Annual Report on Technology Transfer, Industry Research, and Economic Development. At the heart of the University's contributions are world-class researchers and their world-changing discoveries. In fiscal year 2010, our research spending reached $1.14 billion, a new milestone for us and the highest of any U.S. public university. But the University of Michigan is committed to more than making fundamental discoveries. We are dedicated to helping apply the benefits of our activities and the expertise of our faculty, staff, and students to enhance the regional and national economies. We welcome industry as our key partner in bringing emerging technologies to market. I hope you enjoy the stories of innovation and collaboration in this report. Please join us in helping to build the foundation of a revitalized economy.

STEPHEN R. FORREST
Vice President for Research
University of Michigan

TECH TRANSFER engagement

We take pride in reporting our performance and activities for this past year.

In fiscal year 2010 (FY10), U-M researchers reported 290 new discoveries from nearly every part of our campus. We worked to assess and protect these discoveries, as well as to analyze potential markets and identify prospective licensing partners. This resulted in another outstanding year in which we matched our all-time record of 97 agreements.

Our Tech Transfer Venture Center works closely with inventors, entrepreneurs, and the venture community, providing a one-stop hub for new U-M start-up opportunities. In FY10, we launched 10 new high potential start-up ventures, most located in Michigan, providing jobs and economic opportunities for our region. Since 2001, we have launched 93 new start-up ventures, placing us among the top universities in the nation.

Royalty revenues from our agreements grew 16 percent from FY09 to FY10. And thanks largely to one-time revenues from our FluMist® agreement, total tech transfer revenues reached an all-time record of $39.8 million in FY10, compared to $18.3 million last year. These revenues provide valuable resources that are reinvested in research, education, and innovation.

At a time when our region and state face difficult economic challenges, we are committed to building on our success with new initiatives and investments to spur further economic opportunities. Some examples include:

+ The launch of a new Venture Accelerator to extend the effectiveness of our Venture Center. Emerging U-M start-ups from our Venture Center portfolio will receive a full complement of business services within our state-of-the-art North Campus Research Complex (NCRC) facility.

+ Talent initiatives such as our Mentors-in-Residence program, where experienced entrepreneurs are "embedded" within the tech transfer team to enhance our assessment and commercialization capabilities.

We have accomplished a great deal in 2010. But there is still much more to do. I invite you to assist us in committing our technology, talents, and resources for the benefit of our University, our community, and beyond.

KEN NISBET
Executive Director
U-M Tech Transfer

The launch of a new Venture Accelerator will extend the effectiveness of our Venture Center. We are committed to building on our success with new initiatives and investments to spur further economic opportunity.

THE MISSION of U-M Tech Transfer is to generate benefits for the University, our community, and society through the transfer of University innovations.

U-M TECH TRANSFER

ABOUT | The U-M Tech Transfer team consists of professionals in technology assessment, protection, marketing, and licensing, who work closely with U-M researchers to license technologies to commercial partners. Our team also includes the staff of our Venture Center: business formation professionals who can accelerate promising start-up venture ideas and connect these opportunities with entrepreneurs and the venture community. We also have world-class legal advisers, marketing professionals, and administrative resources to enhance our capabilities in creating opportunity and engagement with our business and venture partners.

components of the tech transfer process

RESEARCH
▼
PRE-DISCLOSURE
▼
INVENTION REPORT
▼
ASSESSMENT
▼
PROTECTION
▼
MARKETING TO FIND OR FORM A LICENSEE
▼
LICENSE TO EXISTING BUSINESS { OR } ASSIST FORMATION OF A START-UP BUSINESS
▼
LICENSING
▼
COMMERCIALIZATION
▼
REVENUE
▼
REINVEST IN RESEARCH + EDUCATION

2010 fiscal year

RESULTS | Success in technology transfer is generally measured in numbers of inventions, agreements, new start-up ventures, and revenues. Other measures are equally important. The quantity and quality of our engagements—with researchers, students, and business and entrepreneurial partners—and the impact on the public of our technologies and ventures are also key indicators of success. The following pages of metrics and stories illustrate these successes.

2010 INVENTION REPORTS

MEDICAL

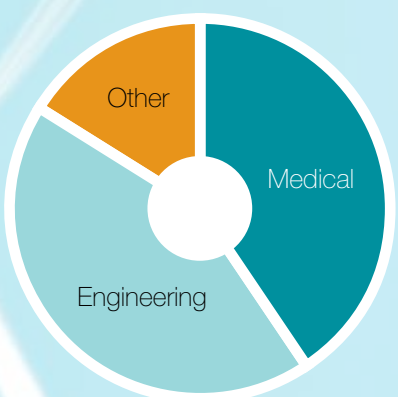
Anesthesiology	5
Biological Chemistry	1
Cell and Developmental Biology	1
Internal Medicine	30
Medical School Administration	1
Michigan Institute for Clinical & Health Research	1
Michigan Nanotechnology Inst	1
Microbiology & Immunology	2
Molecular Physiology	3
Neurology	5
Obstetrics & Gynecology	1
Otolaryngology	4
Pathology	10
Michigan Center for Translational Pathology	10
Pediatrics & Communicable Diseases	8
Pharmacology	5
Physical Medicine & Rehabilitation	2
Psychiatry	1
Radiation Oncology	7
Radiology	5
Surgery	15
Total	**118**

ENGINEERING

Aerospace Engineering	3
Biomedical Engineering	18
Chemical Engineering	15
Civil & Environmental Eng	4
Electrical Eng & Computer Sci	65
Mechanical Engineering	16
Materials Science & Engineering	4
Nuclear Eng & Radiological Sci	1
Total	**126**

OTHER

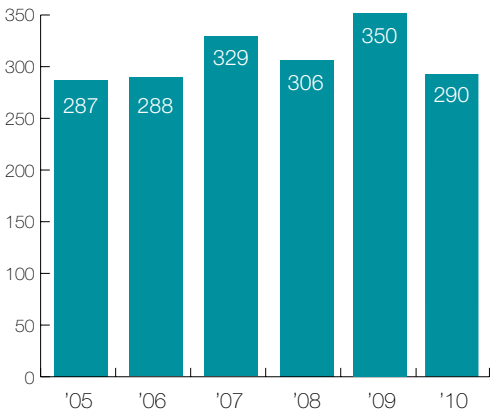
Biology	1
Chemistry	12
Mathematics	1
Physics	2
Psychology	1
Dentistry	3
U-M Dearborn	2
Education	1
Kinesiology	1
Life Sciences Institute	3
Michigan Administrative Information Services	1
Medicinal Chemistry	3
Natural Resources	1
Pharmacy	5
Autism & Communications Disorders Center	6
U-M Hospital	2
U-M Transportation Research Institute	1
Total	**46**



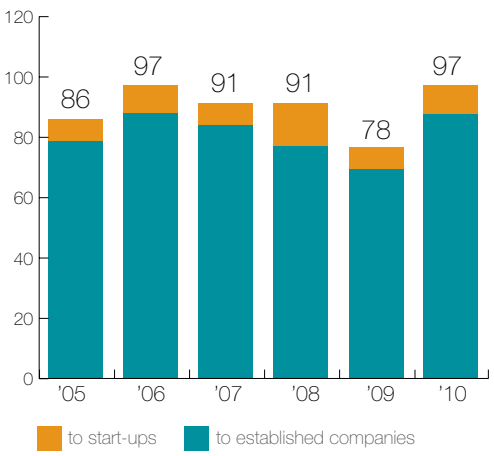
See pages 14–15 for a sampling of inventions, and www.ttannualreport.umich.edu for a complete list.

year in review

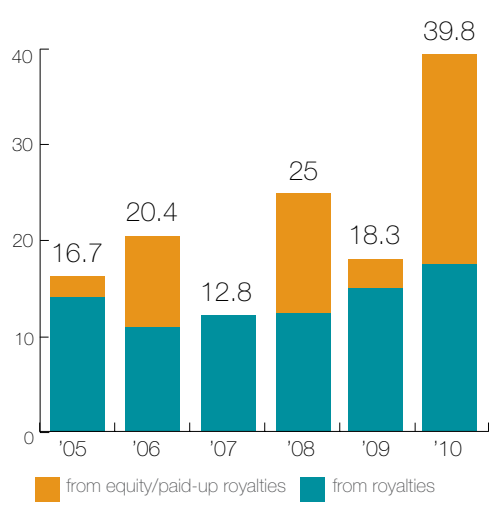
INVENTION REPORTS



LICENSE AGREEMENTS



LICENSE REVENUE (in millions)



2010 START-UP CLASS

3D Biomatrix
Crystalline structured transparent 3D scaffolds for cell culture (3D petri dish)

Civionics LLC
Dense wireless sensor networks for building automation systems

Crossbar
Next-generation, high-density crossbar array for improved computer memory

Hearing Health Sciences
Over-the-counter nutraceutical products for the prevention of noise-induced hearing loss

HistoSonics
Image-guided histotripsy system using ultrasound to excise and mechanically homogenize tissue

Infomotion Sports
Sensor-enabled sporting equipment for skill analysis and training

miRcore
Core facility for the discovery of MicroRNA disease biomarkers

Shepherd Intelligent Systems
Real-time fleet management plus customer-oriented vehicle location and time-of-arrival alert functions

Tangent Medical Technologies
Novel catheter stabilization systems for fluid/medication delivery

Vortex Hydro Energy
Sub-surface hydrokinetic power generating devices for rivers and oceans

Rising to the Challenge of Cancer Research

ASCENTA THERAPEUTICS | Shaomeng Wang

"It has always been my goal and desire to translate discoveries from the laboratory to the clinic," says Dr. Shaomeng Wang. That goal is being realized through Ascenta Therapeutics, a start-up focused on developing and marketing small-molecule therapeutics that attack cancer cells by restarting the normal process of apoptosis.

One of the things that makes cancer so formidable—and so difficult to treat—is the fact that cancer cells literally refuse to die. In a healthy organism, abnormal cells are removed through a process of programmed cell death known as apoptosis. But in cancer cells, the apoptosis pathways are defective, allowing cancer cells to thrive and, often, making them resistant to conventional therapy.

Targeting those defective pathways—and reinstating the process of apoptosis in cancer cells—has long been the research objective of Dr. Shaomeng Wang, U-M professor of medicine, pharmacology, and medicinal chemistry and Warner-Lambert/Parke-Davis Professor in Medicine. Thanks to the entrepreneurship of Wang and his colleagues, promising new anti-cancer treatments may soon find their way into clinical settings.

In 2003, Wang joined forces with Drs. Marc E. Lippman and Dajun Yang, both U-M professors at the time, to found Ascenta Therapeutics. The start-up was intended to function as a clinical development company for small-molecule anti-cancer therapeutics discovered in Wang's lab. As Wang observes, "Tech Transfer was extremely helpful in developing flexible mechanisms that allowed the company both to license multiple technologies and to provide ongoing research support."

From the beginning, interest among venture capitalists was strong, and, to date, Ascenta has accumulated $100 million in three rounds of funding. The start-up has advanced an orally active Bcl-2 inhibitor (AT-101) and a potent and orally active IAP inhibitor (AT-406) into Phase II and I clinical developments, respectively. In June of this year, Ascenta signed a global development and research agreement with Sanofi-Aventis to develop HMD2 inhibitors for cancer treatment. The agreement could yield as much as $400 million in milestone payments and royalties, allowing the company to pursue additional anti-cancer therapeutics. And, as proof that success breeds success, Wang has launched a second start-up, Ascentage Pharma Group, to develop and market other innovative drugs discovered in his U-M lab. As of March 2010, Ascentage has completed its first round of financing. Wang has been working closely with both start-up companies and currently serves as the chief scientific advisor for Ascenta and the chief scientific officer for Ascentage.

Generating High-Level Attention with Low-Power Microprocessors

AMBIQ MICRO | David Blaauw, Scott Hanson, Dennis Sylvester

Imagine a world in which clothing, phones, credit cards, appliances, cars, medical devices, roads, even entire buildings are embedded with tiny intelligent sensors that are constantly monitoring and managing activities.

That phenomenon, called ubiquitous computing, is already underway. But it's been hampered by the size of the batteries required to power conventional microchips.

All that could change, however, with the October 2010 launch of U-M start-up Ambiq Micro and its energy-efficient micro-controllers.

Ambiq's breakthrough technology is the result of nearly 10 years of research by U-M Electrical Engineering professors David Blaauw and Dennis Sylvester, with the assistance of research fellow Scott Hanson.

In 2005, realizing that many electronic devices are idle for much of the time, the team began developing new technologies to lower microprocessor energy use during sleep cycles. As Hanson notes, "This low-power technology allowed us to scale the solution down to a much smaller size and extend product lifetime on a much smaller battery."

In 2008, Blaauw, Sylvester, and Hanson engaged Tech Transfer for business development assistance, and to explore funding opportunities for further product development. The result was $150,000 from the College of Engineering Translational Research fund (ETR), and Gap funding through U-M Tech Transfer.

In 2010, Ambiq earned $330,000 in business plan competitions, some sponsored by leading venture capital firms such as Draper Fisher Jurvetson.

With the help of U-M Tech Transfer Mentor-in-Residence David Hartmann, the new company has lined up prospective customers in key markets. And, with approximately $2 million in venture capital commitments, Ambiq is on track to meet its goal of first commercialization by 2014.

Measuring just one square millimeter, Ambiq Micro's prototype microcontroller is approximately 10 times more energy efficient than conventional microprocessors in active mode, and up to 130 times more energy efficient in sleep mode. Product applications for the technology range from medical devices to smart credit cards.

Leading a Revolution in MEMS

Ken Wise | Recipient of the 2010 Technology Transfer Career Achievement Award

According to Ken Wise (pictured here receiving the Technology Transfer Career Achievement Award at the 2010 Celebrate Invention event), the crowning achievement of the WIMS ERC has been the linking of sensor technology with wireless interfaces and embedded computing. "As a result," he explains, "microsystems now have the capacity to connect with the non-electronic world." And that, in turn, has opened the way to a true revolution.

In 1974, Ken Wise discovered an article left on his desk by an anonymous colleague. Written years earlier by Stanford's Dean of Engineering Frederick Terman, it predicted the inevitable decline of the Midwest's electronics industry.

Today, 36 years later, Wise is recognized as one of the world's foremost experts in sensor technology as well as a MEMS (microelectro-mechanical systems) pioneer and entrepreneur. And he still keeps a copy of the article that motivated him to create a MEMS industry in Michigan.

In 1995, along with colleagues Nader Najafi and Khalil Najafi, Wise launched the first MEMS instrumentation company in Michigan, Integrated Sensing Systems (ISSYS). Three years later, he and Khalil Najafi submitted a proposal to establish an Engineering Research Center on campus.

In September of 2000, the University of Michigan—in collaboration with Michigan State University and Michigan Technological University—received a ten-year, non-renewable grant from the National Science Foundation to create the Engineering Research Center for Wireless Integrated MicroSystems (WIMS ERC). Since then, the technology produced by Center researchers has addressed applications ranging from health care to national security. In addition, the Center has spawned 11 start-ups and contributed to the formation of 6 others.

Education has been another WIMS priority. Of the 4,000 pre-college students who have enrolled in WIMS summer courses, over 60 percent have gone on to major in science or engineering in college. The Center has also trained more than 150 Ph.D. students, several of whom have joined U-M start-up companies in the area.

Beginning in September of 2010, as a "graduated" NSF Engineering Research Center, the WIMS ERC began operation as a campus-wide institute. Wise says he will retire in May 2011, but those who know him believe his best contributions are still ahead.

Engineering a Better Option for Knee Replacement Surgery

Ellen Arruda and Lisa Larkin

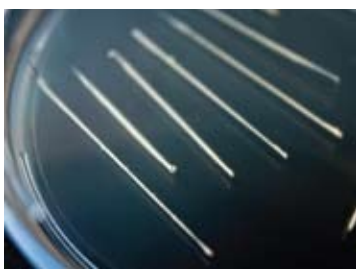
Every year, more than 350,000 Americans undergo anterior cruciate ligament (ACL) reconstructive surgery. That number is rising fast, particularly among adolescents.

During surgical repair of the ACL, replacement ligaments from cadavers or from the patient's own body are anchored to bones with permanent screws. It's a process with serious drawbacks. The tissue rejection rate from cadaver tissue can be as high as 25 percent. Transplanted ligaments tend to remain stiff and never fully integrate with the body. And within 12 years, nearly 70 percent of all patients develop osteoarthritis.

Several years ago, Professor Ellen Arruda, a mechanical engineer and specialist in tendon tissue engineering, and Professor Lisa Larkin, a muscle physiologist and muscle tissue engineer, set out to create a new paradigm for ACL reconstruction. Rather than adapting the conventional scaffold-and-screw design, they devised a bone-ligament-bone construct, a novel technology that uses the patient's own bone marrow stromal cells to grow a new ligament with boney ends for attachment to the bone of the patient.

"In essence, we wanted to develop a scaffold-free technology for complete ACL recovery," Arruda explains, "one that would integrate with the native tissue, fully restore biomechanical function—flexibility as well as strength—and avoid any future risk of osteoarthritis." Based on the latest data points from a pilot study using sheep, the two researchers have succeeded.

"At first, the most common response from surgeons and potential funders was: 'This can't be done,'" Larkin recalls. "U-M Tech Transfer was instrumental in helping us locate funding for pilot studies that proved it could be done. Now that we can make human-sized, implantable ACL replacements, we'll be pursuing FDA approval."



ACL trauma is on the rise, particularly among adolescents, and knee injuries are now the leading cause of high school sports-related surgeries. This new tissue engineering process developed by Professors Ellen Arruda and Lisa Larkin uses a patient's own bone marrow stromal cells to grow ligaments and bone attachments that can be sutured into place with no need for scaffolds or permanent screws.

Greening the Manufacturing Process

FUSION COOLANT SYSTEMS | Steven Skerlos

"By 2007, we had shown that our product was better for the environment, better for worker health, better for productivity, and better at preventing tool wear."

Fusion Coolant Systems is Steven Skerlos's second start-up. In 2005, he co-founded Accuri Cytometers, Inc. to provide life scientists with affordable, full-featured analytical flow cytometers. He is also director of the U-M's Environmental and Sustainable Technologies Laboratory, which is dedicated to promoting sustainable design and engineering education.

In a typical year, nearly two billion gallons of metalworking fluid (MWF) are used to make parts for automobiles, heavy industry, aerospace, and biomedical products. Without MWF, manufacturing would literally grind to a halt. But laced as they are with surfactants and other toxic chemicals, the fluids pose a serious threat to worker health and, as they enter the waste stream, the wider environment.

Now, after 10 years of research, Mechanical Engineering professor Steven Skerlos has devised a solution to the problem. Referred to as CHiP Lube (cryogenic high-pressure lubrication), the formula developed by Skerlos and his team replaces the 20+ toxic substances normally found in MWF with supercritical carbon dioxide and a lubricant that is non-toxic and renewable.

"By 2007, we had shown that our product was better for the environment, better for worker health, better for productivity, and better at preventing tool wear," Skerlos recalls. "The question was: how to move from a lab process to a marketable product?"

The answer came in the form of $87,000 in Gap funding from U-M Tech Transfer and the College of Engineering Translational Research fund, followed by an additional $140,000 in 2008 for prototype development and business-building activities. In 2010, a Phase I SBIR grant for $220,000 made it possible to launch Fusion Coolant Systems.

"Tech Transfer provided critical support that enabled us to demonstrate efficacy in an industrial setting," says Skerlos. "They also played a key role in executive recruitment. To me, entrepreneurship is a form of research. And with U-M's strong entrepreneurial culture and U-M Tech Transfer's expertise, faculty can commercialize their discoveries without giving up their day job."

Driving Innovation in Fleet Management

SHEPHERD INTELLIGENT SYSTEMS (SIS)

Five years ago a team of U-M engineering students led by Professor Christopher Ruf set out to design a global positioning system (GPS) capable of monitoring buses. Most of them never imagined that their "Magic Bus" technology would be spun out into a start-up, or that it would one day provide real-time fleet management services to universities, businesses, and municipal governments.

Team member Jahan Khanna was the exception. In 2009, he began upgrading the technology—taking what was essentially a time-of-arrival predictor system for passengers and transforming it into a multi-functional software platform for managing fleets of vehicles.

Khanna co-founded Shepherd Intelligent Systems in 2009. Within a matter of months, SIS technology was being used by the Ann Arbor Transportation Authority (AATA), City of Ann Arbor, and U-M Parking & Transportation Services as well as municipal vehicle fleets, taxi companies, and limousine services throughout the country.

"Although our system still has a strong passenger service component, which provides electronic bus arrival alerts and real-time vehicle mapping to thousands of riders daily, its real value lies in the fact that it offers a complete, real-time fleet management solution," says SIS co-founder and CEO Adrian Fortino. "With our technology, fleet managers can minimize fuel consumption, improve route efficiency, deploy workers and vehicles more effectively, optimize passenger loading, and monitor drivers. And the fleets can use their own GPS hardware system to do it since we provide a hardware-agnostic software platform."

According to Fortino, SIS has enjoyed "a great relationship" with U-M Tech Transfer. "They were very supportive during the technology licensing process," he says. "But even more significant is the support they've provided, offering advice, helping us build networks, and serving as a bridge with key customers."

Over the course of the Magic Bus implementation, the University of Michigan has seen a 22 percent increase in ridership. Also, approximately 85 percent of all U-M bus passengers use the SIS system to receive route updates and alerts via e-mail and text messaging. The company is now in the process of building a nationwide customer base and responding to requests from as far as Bangalore, India.

Engaging Advisory Talent

U-M Tech Transfer National Advisory Board

Since its inception in 2002, the U-M Tech Transfer National Advisory Board (NAB) has played a key role in guiding our strategies and operations. Composed of representatives from industry, the venture capital and entrepreneurial communities, government, and other university tech transfer offices, the NAB provides experience, expertise, and diversity for a valued outside perspective. Recent NAB projects include advising our catalyst talent initiative and helping to plan our new Venture Accelerator, which will be located in U-M's North Campus Research Complex.

Members of the National Advisory Board include:

Thomas Bumol
Vice President
Eli Lilly
San Diego, CA

Marshall Cohen
President and CEO
Princeton Power Systems
Princeton, NJ

John Denniston
Partner, Kleiner
Perkins Caufield & Byers
Menlo Park, CA

Richard Douglas
Senior Vice President of
Corporate Development
Genzyme Corporation
Cambridge, MA

Michael Finney
CEO and President
Ann Arbor SPARK
Ann Arbor, MI

Larry Freed
President and CEO
ForeSee Results
Ann Arbor, MI

Kenneth Graham
Sr. Managing Principal
Inverness Graham
Investments
Newtown Square, PA

Farnam Jahanian
Chair, Computer
Science and Engineering,
University of Michigan
Ann Arbor, MI

Edward Pagani
VP and General Manager
Beckman Coulter
Molecular Diagnostics
Southfield, MI

Ken Pelowski
Managing Partner
Pinnacle Ventures
Palo Alto, CA

Thomas Porter
Founder/General Partner
Trillium Ventures
Ann Arbor, MI

John Santini
President and CEO
On Demand Therapeutics
North Chelmsford, MA

Rick Snyder
Chief Executive Officer
Ardesta
Ann Arbor, MI

Carl Stjernfeldt
Partner
Castile Ventures
Waltham, MA

Maria Thompson
Co-founder/CEO (retired)
T/J Technologies
Northville, MI

Jack Turner
Associate Director
MIT Technology
Licensing Office
Cambridge, MA

Tom Washing
Founding Partner
Sequel Venture Partners
Boulder, CO

Jeff Williams
President and CEO
Accuri Cytometers
Ann Arbor, MI

Community Outreach

U-M Tech Transfer staff play significant roles in other university, community, and national organizations. These commitments and collaborations support our mission but, more importantly, assist other partnering organizations with their activities and allow us to give back to our communities and our profession. Some examples of this outreach include:

STUDENT ENTREPRENEURSHIP | In addition to our TechStart internship program for entrepreneurial U-M graduate students, members of our staff play key liaison roles and mentor projects for several student entrepreneurship initiatives, including the Center for Entrepreneurship, Zell Lurie Institute, M-Powered, 1,000 Pitches student competition, Frankel Fund, and Dare to Dream.

ANN ARBOR SPARK | Members of our staff hold board and committee positions within Ann Arbor SPARK, our regional economic development organization. We also collaborate on numerous initiatives and events that enhance Ann Arbor's entrepreneurial ecosystem.

ANN ARBOR SPARK
IGNITING INNOVATION

CELEBRATE INVENTION | Each fall we honor our U-M inventors by showcasing a sample of their innovations at a community-wide networking event that attracts 300–400 leaders from our university, government, business, and venture communities.

AUTM | The Association of University Technology Managers is an international organization for technology transfer professionals, providing training, advocacy, best practices, and connections. Our staff actively participate at AUTM meetings and contribute to dialogue on national issues. Our very own Director of Licensing, Robin Rasor, will become president of AUTM in 2011.

AUTM
Association of University Technology Managers®
Advancing Discoveries for a Better World®

2010 TechStart intern Katherine Moynihan

U-M start-up 3D Biomatrix presenting at the 10th annual Celebrate Invention reception.

Fiscal Year 2010 Discoveries

AEROSPACE ENGINEERING

- Recursive-Least-Squares-Based Cumulative Retrospective Cost Adaptive Control
- Retrospective Cost Adaptive Control with Online Retrospective Cost Identification
- Thermally Actuated Composite Structures

ANESTHESIOLOGY

- Target Directed Tube Feed Pump
- RiskWatch–Real-Time Visual Alert Display for Use during Anesthesia or Critical Care
- Multi-Modal Automated Algesiometer
- Automated State Scoring Software
- Sleep Scoring Software

BIOLOGICAL CHEMISTRY

- SAGA - Software for the Assignment of NMR Spectra of Proteins

BIOLOGY

- Peptides for Reduction of Cardiac Contractility and Cardiac Function

BIOMEDICAL ENGINEERING

- Novel Total Variation Models for Denoising
- Surface Modification and Biologic Conjugation on Two Dimensional and Three Dimensional Polyester Material Structures
- Microfluidic System for Measuring Cell Barrier Function
- Ion Channel-Based Assay for the Activity of Transporter Proteins
- Device for Cell Preparation for Cryopreservation
- A Numerically Optimized Active Shield for Improved TMS Targeting
- Patient Interface between an Ultrasound Therapy Transducer and the Perineal Window
- Fabrication of Thermogelling Composites for Bone Regeneration
- Dehydrated Aqueous Polymer Solutions
- Rotating Bubble Clouds for Therapeutic and Other Applications
- Development of Polymeric Nanoparticles for Ultrasound Imaging and Therapy
- Technique for Obtaining Simultaneous ASL/BOLD Functional MRI Contrast in the Whole Brain
- Liquid Glass Electrodes for Nanofluidics
- On-Column Detection in Gas Chromatography
- Homogeneous Immunoassay Microarrays for Multiplexed Biomarker Analysis
- Method for Optical Detection of Pancreatic Cancer
- Targeted Polymer-Drug Conjugates for Treatment of Liver Cancer
- Microthread Arrays

CELL AND DEVELOPMENTAL BIOLOGY

- A Novel microRNA that Regulates Neural Differentiation of Stem Cells

CHEMICAL ENGINEERING

- Aqueous Phase Decarboxylation of Fatty Acids
- Flexible and High Transparent Surface Plasmon Polarizer
- Membrane-Based Reactors and Processes for Chlorosilane Hydrogenation
- Electrochemical Processes and Electrocatalysts for Chlorosilane Hydrogenation
- Red Blood Cell-Mimetic Particles
- Layer by Layer 3D Inkjet Printing
- Co-Electrodeposited Hydrogel-Conducting Polymer Electrodes for Biomedical Applications
- New Generation of Ionic Conducting Membranes for Lithium Batteries
- Biodiesel Synthesis from Wet Algal Biomass
- Catalytic Hydrothermal Upgrading of Crude Algal Bio-Oil
- Catalytic Hydrothermal Liquefaction of Algae
- Shapeshifting of Multicompartmental Polymeric Particles
- Hydrogel Coatings for Cell Culture
- Xeno-Free Expansion Platform for Human Embryonic Stem Cells
- Plasmon Driven Chemical Reaction

CHEMISTRY

- Microscale Western Blot
- Benzodiazepinone Compounds and Methods of Treatment Using Same
- Anhydrate Phase of Dasatinib
- Realistic 3D Gelatin Models as a Simulation Tool for Joint Injections
- PAA Nanoparticles for Enhancement of Tumor Imaging
- Alkylation of Ga-Based III-V Semiconductor Surfaces Using Grignard Reagents
- Directed Solar Energy and Charge Transport in Novel Architectures
- Energetic Cocrystals
- Nanoparticle-Based Cell-Targeted Fluorescent Oxygen Sensor
- Miniature Electrochemical Biosensor for Measurement of Glucose in Microliter Quantities of Tear Fluid
- Methods and Compositions for the Treatment of Immune Disorders
- Software Correction of Aberration, Alignment and Focusing Errors in Spectrographs

CIVIL & ENVIRONMENTAL ENGINEERING

- A Facultative Methanotroph for Environmental Remediation Applications
- Portable, Wireless Multi-Channel Impedance Analyzer
- White Pigmentable Strain Hardening Brittle Matrix Composites
- Pigmentable Strain Hardening Brittle Matrix Composites which Utilize Recycled Materials and Reduce Carbon Footprint of Composite

DENTISTRY

- Inhibition of Orthodontic Relapse by Local Administration of Recombinant Protein
- An Antibody to Detect Phosphorylated Runx2
- Tubular Scaffolds for Tissue Regeneration

EDUCATION

- World Food System Model

ELECTRICAL ENGINEERING & COMPUTER SCIENCE

- An Un-Cooled Resonance Pyro/Piezo Electric Infrared Sensor Array
- Circuit Level Timing Speculation for Latch Based Design
- Dynamics of Molecular Responses to Flu Infection
- Dependable, Efficient, Scalable Architecture for Management of Large-scale Batteries
- A Privacy Wizard for Social Networking Sites
- Self-Healing Memory Design Using Low Overhead Adaptive Circuit
- Spoof Surface Plasmon Polariton Waveguide and Switch Based on Resonance and Absorption
- Photonic Crystal - Metallic Structures and Applications
- Process Variation Characterization of Chip-Level Multiprocessors
- Computationally Efficient Intersection Collision Avoidance System with Guaranteed Safety Performance
- Carbon Nanotube Hybrid Photovoltaics
- On-Chip One-Time Random ID Generation Using Oxide Breakdown
- A Self Updating Least Recently Grant Arbitration Technique for Advanced Extended Interconnect
- Computer-Based 12 Lead ECG Analysis to Identify the Origin of Ventricular Arrhythmias
- Wafer Scale Bilayer Graphene Film Synthesis Technology
- Sun Tracker for Small-Scale Solar Energy Systems
- High Performance Gate-level Simulator Using GP-GPUs
- A Battery-Driven Micro-Solar Power Subsystem for Outdoor Sensor Nodes
- Method and System for Automated Network Operations
- Personalized Health Risk Assessment for Critical Care
- Ultrathin Flexible Photovoltaics Using Epitaxial Liftoff
- An Integrated Pixel of Organic Photodetector and Organic Thin Film Transistor
- Low-Power Area-Efficient SAR ADC
- Visible/Near-Infrared Photodetectors
- Multi-Purpose Microfluidic Platform for Single-Cell-Level Assay
- Tensor Transmission-Line Metamaterials
- Improved High Efficiency SOLEDs
- Magneto-Electric Process for Conversion of Optical to Electrical Energy
- Top Gate, Bottom Contact Pentacene Transistor
- Thin Film Cochlear Electrode Array
- High Efficiency Inverted Organic Photovoltaic Devices
- Optical Excitation, Interrogation and Attenuation of Acoustical Waves Propagating On Interfaces
- Shrinkage Techniques for Nanoscale Patterning
- Neural Probes Integrated with Optical Simulation Capability
- Method for Continuous Fabrication of Micro- to Nano-scale Patterns
- Open-Circuit Enhancing Transparent Electrode in Inverted Organic Photovoltaic Devices
- Roll-to-Roll Process for Polymer Solar Cells
- Cauterization Needle with Embedded Sensing
- Low Power Reference Current Generator with Tunable Temperature Sensitivity
- Intraocular Surgical Implantation Technique and Device
- LED-Based Large Panel Lighting
- Multifunctional Thin Film Stack Based Plasmonic Color Filters
- Display Device with Photovoltaic Capability
- Hemispherical Focal Planes Based on Epitaxial Lift Off
- Low Cost, High Intensity Integrated WOLED Fixtures
- Design of Low Cost, Low Complexity Phased Arrays
- Resistive Switches with Breakdown Elements
- Low Leakage, Low Voltage Memory Cell
- Integrated Circuit with Sleep Mode
- Unidirectional Coupled Sectorial Loops Antenna
- Nanomanufacturing Process Based on Dynamic Nano-Cutting
- Microfabricated Battery
- Thermal and Solvent Annealing Influence on the Performance of Bulk Heterojunction Photovoltaic Cells
- Ordered Organic Multilayer via Crystal Surface Energy Matching
- A Process to Print Antennas onto 3D Contoured Substrates
- Method of Improving Exciton Dissociation at Organic Donor-Acceptor Heterojunctions
- Purification of Carbon Nanotubes Using Agarose Column and Density Gradient Ultracentrifugation
- Ultrabright Fluorescent OLEDs Using Phosphor Triplet Sinks
- Nanoscale Metal Oxide Resistive Switching Element
- Epitaxial Lift-Off Using Sacrificial Etch Protection Layers for Reuse of Wafers
- Power Generating Coatings
- Precision OVJP Nozzle Substrate Spacing System
- Method to De-embed the Effects of Cable Motion in Microwave Measurement Systems
- Method for Large-Domain Microwave Breast Imaging
- Antenna and Propagation Model for Free-space Measurements and Experimental Inverse Scattering

INTERNAL MEDICINE

- Method and Apparatus for Shear Wave Detection from Ultrasound Guided Biopsies
- Method and Apparatus for Real-Time Distributed Signal Processing for High-Performance Medical Ultrasound System
- Merkel Cell Carcinoma Prognostic Marker
- Biologically Active Linear Capped Seton
- Screening for Dual HIF-1a and HIF-2a Inhibitors and Inhibitors that Are Synergistic with HIF Inhibition
- Large-Bore Endovascular Closure Device
- NE-Based Burkholderia Vaccine
- Synthesis of Baker-Huang PAMAM Dendrimers
- Block Synthetic Method for Dendrimer Synthesis
- Atrial Fibrillation Ablation Database
- Technique for Assessing Left Ventricular Systolic and Diastolic Heart Function
- Compounds Acting as Peptide Gap Junction Modulators and Their Uses
- Methods and Compositions for Regulating Cardiac Function
- Esophageal Displacer
- Esophageal Temperature Sensor and Cooling System
- Biventricular Pacing Electrode for Cardiac Resynchronization
- Discerning Mechanisms of Atrial Fibrillation from the Surface ECG
- 3-Dimensional Mapping and Ablation System
- Digital Manometry, Bedside Balloon Test
- GREB1a Monoclonal Antibody
- Deubiquitinase Inhibitors as Anti-Microbial Agents

This is just a sampling of the 290 technologies developed by U-M researchers in FY 2010. For a complete list, see **www.ttannualreport.umich.edu**

- Mutational and Gene Expression Profile to Predict Response to Poly(ADP-Ribose) Polymerase
- An Antiviral Lectin with Improved Properties
- dnMEK Transgenic Mouse Model for Lupus Erythematosus
- Individualized Index for Predicting Lupus Flares
- Clinical Questionnaires
- Hand Assessment Program
- Spiro-Oxindole MDM2 Antagonists
- Biomarkers of the Antitumor Activity of MDM2 Inhibitors in Acute Myeloid Leukemia
- Peptidomimetic Small-Module Inhibitors of the WDR5 and MLL1 Interaction
- Multi-Lumen Apparatus and Method for Combining Peptides for Endoscopic Delivery and Targeted Application
- Nanoemulsion Vaccines
- A Simulator for the Emergent Placement of a Transvenous Pacemaker

KINESIOLOGY

- Multiple Reflex Testing Device for Young Children

LIFE SCIENCES INSTITUTE

- Antibiotics Bearing a Desosamine Deoxysugar
- Expression Clone of Mocr-UTX
- A Biosynthetic Pathway for Heterologous Expression of an NRPS Drug and Analogs

MATERIALS SCIENCE ENGINEERING

- Generic Plug-based Metal Bonding and Friction Stir Repair Technology for Metal Parts
- An Organic Electronic Device for Excitonic Energy Transfer across Thick Metal Film
- Mineral Composites Bonded with Plastic Coal
- Membranes for Liquid-Liquid Separation
- A Direct Measurement, Impact-Press Device for Dynamic Characterization of Materials

MATHEMATICS

- Algorithms and Designs for Replacing ADCs with Analog-to-Information Converters

MECHANICAL ENGINEERING

- Hybrid Powertrain System Using Free Piston Linear Alternator Engines
- A Robust, High-Speed Miniaturized Thermal Modulator for Comprehensive 2D Gas Chromatography
- Low Rolling Resistance Vehicle Design
- Device and Software to Aid Carpooling
- Laser Micro-Angioplasty Using Second Harmonic Micro-Generators
- Low Inertia, High Torque Eddy Current Motor
- An Apparatus and Method for Measuring the Mechanical Properties of the Perineal Body
- Fluorescence Imaging Cell Ablation Sorting
- Non-Invasive Bio-Impedence Device for Diabetes Evaluation
- Sensor for In-Situ Identification of Phase Transformation for Direct Metal Deposition
- Multi-Phasic Engineered Constructs for Human ACL Replacement Tissue
- HCCI Chemical Kinetics Solver
- Multi-Mode Combustion Simulator
- HCCI Correlations
- Laminar Flame Speed Correlations
- Aftertreatment Catalyst Kinetic Models
- $LiCoO_2$ Battery Electrodes
- A Frequency-Based Method for Detecting Rumble Strips in Automotive Applications

MEDICINAL CHEMISTRY

- Method for Enzymatic Production of Decarboxylated Polyketides
- Substrate-Competitive Tyrosine Kinase Inhibitors
- Class of Chemical Crosslinkers for High-Throughput Protein Complex Analysis

MICHIGAN CENTER FOR TRANSLATIONAL PATHOLOGY

- Functional and Genetic Association of Gene Fusions in Cancer
- DNA Methylation and Transcript Isoform Regulation in Prostate Cancer
- Tissues, Urine Sediments and Cell Line Multiple Metabolite Data
- Therapeutics Targeting SPINK1 for Treatment of Prostate Cancer
- ERG Binding Peptides as Potential Therapeutics
- Chromosomal Translocations as Therapeutic Targets for Prostate Cancer
- Small Molecule Inhibitors of EZH2
- Potential Inhibitors of Oncogenic Histone Methyltransferases
- Using Phage Epitopes to Profile the Immune Response
- Rationale for Inhibition of Poly (ADP-Ribose) Polymerase in ETS Gene Fusion Positive Prostate Cancer

MICROBIOLOGY & IMMUNOLOGY

- FRET Calculator - Software
- E. coli Virulence Factors Associated with Urinary Tract Infections

MOLECULAR PHYSIOLOGY

- Keratin 8 and 18 Mutation Are Risk Factors for Developing Liver Disease of Multiple Etiologies
- Prevention of Cardiac Injury
- Treatment for Insulin Resistance, Type 2 Diabetes, Hyperglycemia and Syndromes

NATURAL RESOURCES

- Sediment Ecotoxicity Assessment Ring

NEUROLOGY

- Face Mask to Facilitate Use of Continuous Positive Airway Pressure by Patients with Obstructive Sleep Apnea
- Graphic Reporting Summary for Polysomnogram Reports
- Equipment History and Prescription Order Program
- Mechanical CPAP
- Nerve Whiz

NUCLEAR ENGINEERING & RADIOLOGICAL SCIENCES

- Isotope-Imaging Integrated Deconvolution

OBSTETRICS & GYNECOLOGY

- Self-Contained, Atmosphere Generating Culture System

OTOLARYNGOLOGY

- Facial Motility Reanimator
- Micronutrient Formulation to Attenuate Drug Induced Ototoxicity
- Biosection for Patients with Head and Neck Cancer
- Design for Endotracheal Tube

PATHOLOGY

- Inhibitors of MLL Leukemia
- Mitochondrial Acetylation Changes during Aging
- EZH2 Mammalian Expression Vector
- mDot1 Expression Vector
- G9a Expression Vector
- CARM1 Expression Vector
- A Method for Just in Time Derivatization
- Blood Storage Bag Modifications to Facilitate Sample Extraction and Unit Subdivision
- Biomarkers Predictive of Progression of Fibrosis
- Inhibitor of Heat Shock Protein 70

PEDIATRICS & COMMUNICABLE DISEASES

- Biomarker for GVHD
- A Method for Solubilizing Integral Membrane Proteins
- Sensor for Monitoring Cardiac Function in Patients with Congenital Heart Disease
- A Microfluidic Platform to Determine Post-Translational Histone Modifications (Epigenetic Signatures) on Circulating Monocytes
- A Microfluidic Platform for Real-Time Determination of Functional Immune Status
- Pulmonary "Flipper" Stent Valve
- Transdermal Drug Dose Restriction by Partial Imposition of Inert Barrier
- A Eukaryotic Expression Vector Optimized for High Expression of Recombinant Proteins in Mammalian Cell Expression Systems

PHARMACOLOGY

- Adjunctive Therapy to Be Used in Combination with a Thrombolytic Agent for Thrombolysis and Maintenance of Vessel Patency
- Thermal Stabilization of Cocaine Esterase
- High Throughput and High Strain Rate Cell Stretch Deformation Instrument Based on Orthogonal Optical Capture
- Fluorescent Probes to Study Ion Channel Surface Expression and Trafficking
- Cell Lines with Inducible RGS Expression

PHARMACY

- Novel Method to Enhance Transmembrane Clearance
- Ion-Pair Mediated Intestinal Absorption of Zanamivir Esters
- Active Self-Healing Biomaterial System with High Encapsulation Efficiency for Biomacromolecule Delivery
- Townsend Compound Library 2 - Appendix B

PHARMACEUTICAL SCIENCES

- Methods and Compounds for Inhibiting Breast Cancer Stem Cells

PHYSICAL MEDICINE AND REHABILITATION

- The Language Independent Functional Evaluation (L.I.F.E. Software)
- Alternative Harness for Existing Special Need Car Seats

PHYSICS

- Multi Well Reader for Asynchronous Rotation
- Rapid Identification and Antimicrobial Susceptibility Testing of Bacteria

PSYCHIATRY

- A Novel Means of Inflammatory Profiling: Application to Diagnoses and Prognoses in MDD and Chronic Medical Illness

PSYCHOLOGY

- Knowledge Trainer Database

RADIATION ONCOLOGY

- Mimetic Compounds and the Use Thereof
- Trocar with Three Attachments
- Brain Catheter
- Second Generation Mimetic Compounds and the Use Thereof
- Prevention and Treatment of Dermal Neurofibromas Using Skin Creams and Lotions
- bHSP90-EGFR Complex Disruption for Chemoradiosensitization of Solid Tumors
- Prevention and Treatment of Dermal Neurofibromas Using Skin Creams/Lotions

RADIOLOGY

- Multimodality (AUS & DBT) Breast Screening System
- Detection of Breast Cancer on Digital Tomosynthesis Mammograms
- Radiolabeled Targeted Peptides and Compositions Containing One or More Peptides as Imaging or Therapeutic Agents
- Local Compression during Automated Ultrasound Scanning
- Partial Volume Averaging Estimation Without 100% Blood Normalization

SOFTWARE/AUDIO/VISUAL GENERAL

- Simple Text/Network Mining with a Known Lexicon
- Michigan iPhone Application
- Diving Injury Prevention Video

SURGERY

- Combination Therapy for Pancreatic Cancer
- mTOR Regulation and Therapeutic Rejuvenation of Aging Hematopoietic Stem Cells
- Human Body Composition and 3D Injury Database for Automotive Safety
- Methods for Diagnosing the Malignant Potential of Pancreatic Cystic Lesions
- Off Pump Surgery Technique for In-Flow Conduit
- Percutaneous Access and Closure Device
- Fluoroscopy Access Needle Guide
- Extravascular Vascular Closure Device
- Atraumatic Vascular Needle
- Bicycle Helmet Warning System
- Rapidly Deployable Aortic Occlusion System
- Diagnostic Marker for Clinical Diagnosis of Deep Vein Thrombosis
- Urinary Bladder Button
- iStethoscope
- Fiber Optic Probes for Transcutaneous Raman Spectroscopy Bone Diagnostic

industry engagement

Collaborations with industry are a cornerstone of our mission, providing enhanced learning opportunities and critical research challenges for our students and faculty.

BUSINESS ENGAGEMENT CENTER | The Business Engagement Center (BEC) provides industry with a gateway to the U-M's vast resources, talent, and expertise. Through the BEC and partner offices in the College of Engineering, the Medical School, and on the Dearborn and Flint campuses, the center works closely to integrate the resources of the entire university community and to assure a welcoming, user-friendly path for prospective partners.

These engagements typically include:

- Partnering with university faculty on research programs
- Contracting with university units to develop and deliver customized training programs for professional-level employees
- Recruiting students seeking internships or embarking on full-time careers
- Licensing technologies through U-M Tech Transfer
- Developing strategic giving programs that align with company goals
- Utilizing university lab space/facilities
- Leveraging student design projects to solve business challenges

ann arbor area BUSINESS MONTHLY magazine

"The creation of the BEC three years ago was a milestone in developing focused and efficient collaborations with industry. Since its inception, the BEC has opened the university's doors to over 500 new businesses and is on pace to host over 1,000 corporate visits in the coming year."

DARYL WEINERT | Executive Director, BEC

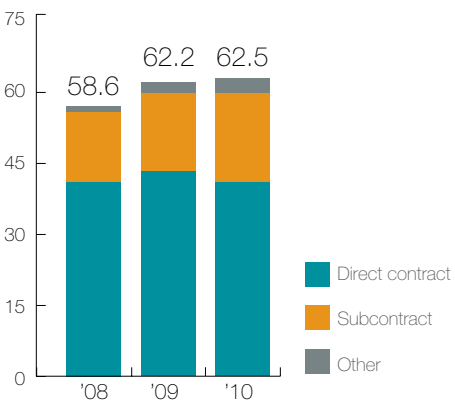
MbusinessLink

Among the many new tools for industry is the BEC's quarterly electronic newsletter, *MbusinessLink*. The award-winning publication features stories about resources, U-M student talent, research, and opportunities for engagement as told by the businesses that partner with the university on a daily basis.

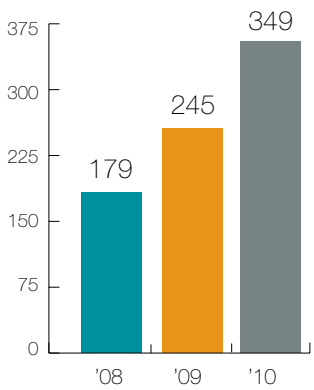
Through its hub and spoke design, the BEC provides companies like ExxonMobil (Nelson Quimm is shown here meeting with BEC relationship manager Stella Wixom) with a central access point to multiple university resources.

RESEARCH DEVELOPMENT AND ADMINISTRATION | Industry research programs are coordinated by the Division of Research Development and Administration (DRDA). This unit ensures smooth, productive engagements with industry partners by providing comprehensive proposal development and award services, and contract negotiation.

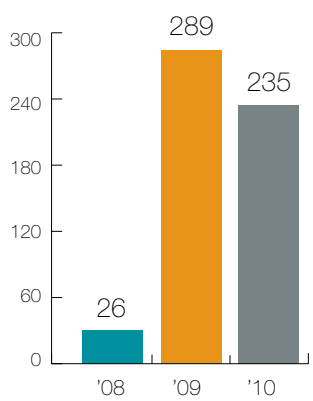
INDUSTRY RESEARCH
(in millions)



INDUSTRY VISITS*



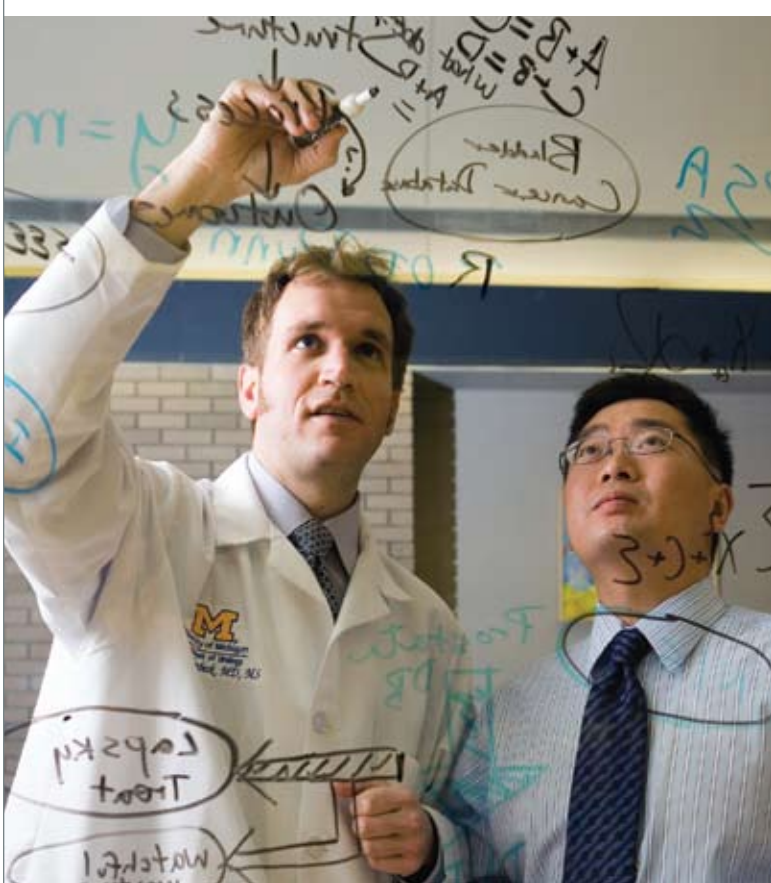
NEW ENGAGEMENTS**



* Includes either company visits to campus involving U-M personnel beyond BEC staff, or visits to a company.
** Interactions with businesses not previously engaged with the BEC.

"Industry research collaborations take many forms around the U-M campus, from direct sponsorship to work organized as consortia with other industry and governmental partners. These relationships provide vital connections for our faculty and students as they tackle the most pressing societal challenges."

MARVIN PARNES | Associate Vice President for Research and Executive Director of Research Administration



Planning for Michigan's Electrifying Future

The Michigan Public Service Commission Collaborative Grant

Plug-in electric vehicles are being hailed as the next evolutionary step in transportation—an idea whose time has come. But what infrastructure changes will these new vehicles require? What supports must be put in place? What impact will electric vehicles have on the electric grid? And on the environment?

In 2008, the Michigan Public Service Commission (MPSC) offered a $5 million grant to the research collaborative best able to answer those questions—and help prepare Michigan to lead the way in electric vehicle innovation.

Taking the lead, the U-M Transportation Research Institute (UMTRI) and the Michigan Memorial Phoenix Energy Institute assembled a winning team comprising DTE Energy and General Motors, along with researchers from the College of Engineering, the Ross School of Business, the School of Natural Resources and Environment, and UMTRI.

As a member of the U-M contingent, Electrical Engineering professor Ian Hiskens has been studying the impact of large numbers of electric vehicles on the distribution grid. "This grant provides an opportunity for exploring strategies that maximize future opportunities," he observes. "The partnership has enabled us to seed future projects, build connections, and establish trust between organizations that are vital to the success of plug-in electric vehicles."

"Grid impact, consumer impact, and environmental impact" is how Joseph Malcoun, strategy and corporate development associate for DTE, summarizes the work of the past year. As he notes, "This unique collaboration helped develop strong content for the dialogue that has to happen in order for Michigan to take the lead in electric vehicle preparedness."

As part of their multifaceted work, university and corporate members of the MPSC grant partnership launched an annual event entitled "The Business of Plugging-In Conference." Now in its second year, the conference aims to promote dialogue and education among all stakeholders, with the goal of making Michigan a hub for plug-in electric vehicle-related business and innovation. Pictured are (from left to right) Gerard Anderson, president and CEO, DTE Energy; Nigel Francis, executive vice president, Bright Automotive; Knut Simonsen, vice president strategy and corporate development, DTE Energy.

Diversifying the Medical Research Community

Centocor R&D and the University of Michigan forge new model for academic–industry partnerships

Over the years, industry partnerships have become increasingly common within the U-M research community—yielding important outcomes in fields ranging from computer engineering to health care. But, in 2008, when Assistant Dean for Graduate and Postdoctoral Studies Victor DiRita was asked to help finalize the details of a postdoctoral fellowship program proposed by Centocor Research & Development, Inc., he knew he was working on "something unique—and uniquely important to the future of medical education and research."

Centocor R&D designed the program to build and diversify the company's pipeline of talent by supporting postdoctoral researchers from underrepresented populations. Officially established in early 2009, the Centocor R&D Postdoctoral Fellowship offers up-and-coming minority scientists the opportunity to work on campus with U-M Medical School faculty and with teams of Centocor researchers at the company's Pennsylvania headquarters. The projects, selected by a joint committee of Centocor and U-M representatives, focus on immune-mediated inflammatory disorders.

In 2009, the committee approved a joint proposal by Professor Juanita Merchant, a specialist in cell growth in the luminal intestinal tract, and Centocor R&D scientist Pamela Hornby, whose current research focuses on peptides involved in gut motility. The ultimate goal of their project is the development of a drug specifically targeted for functional bowel syndrome.

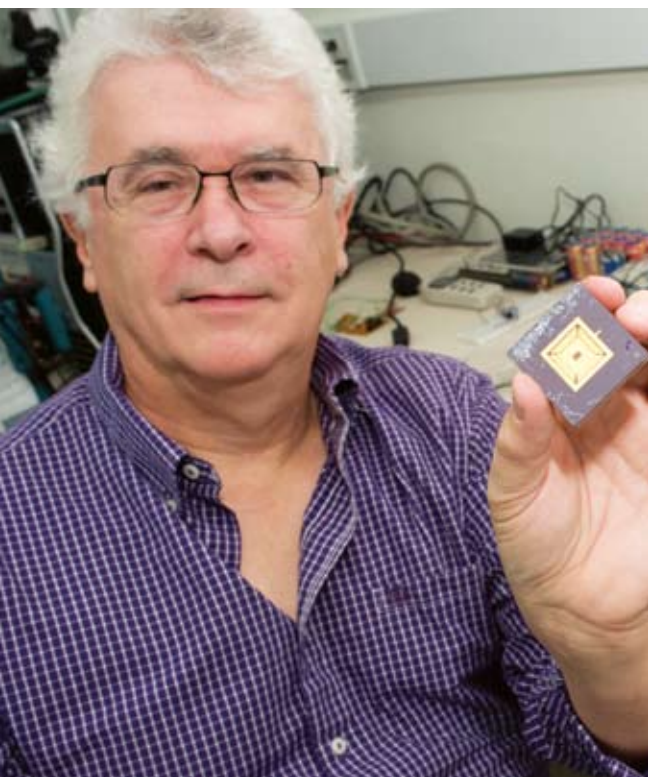
The first fellowship was awarded to immunologist Angel Varela-Rohena, Ph.D., a native of Puerto Rico. As Merchant notes, "It was an excellent marriage of skills. In addition to developing several assays, Dr. Varela-Rohena widened our scientific perspective with his broad knowledge of basic immunology."

Since then, a second fellowship has been awarded, and five promising new candidates are under consideration for the coming year.

A new joint initiative by Centocor Research & Development, Inc. and the University of Michigan serves as an innovative model for industry–academic fellowship programs. Citing scientific excellence and diversity as key drivers in the company's success as a global pharmaceutical organization, Dr. Miguel Barbosa, vice president, head, immunology research & external innovation at Centocor R&D, notes that the fellowship was designed "to foster the training of the next generation of scientific leaders by forging strong relationships with African American, Hispanic, and Native American researchers." Pictured are Dr. Juanita Merchant and Dr. Angel Varela-Rohena.

Exploring the Upper Limits of Low Energy Computing

Trevor Mudge and ARM Limited



Trevor Mudge (pictured), along with U-M Professors David Blaauw and Dennis Sylvester, recently invented a novel interconnect technology that allows dozens of microprocessors to talk to one another in an energy-efficient manner on a single chip. It is an enabling technology that will reduce the power and cost of computers used in the "cloud," and will help ARM leverage their low-power expertise to compete in a new market.

In the past two decades, cell phones have evolved from relatively simple communication devices into mobile supercomputers—an evolution made possible by ever-shrinking microprocessors. But as functionality has increased, so has the challenge of providing reliable micro-scale power sources to support that functionality.

Ten years ago, Electrical Engineering and Computer Science professor Trevor Mudge accepted the challenge by shifting his focus from the development of high-performance computers to the pursuit of new technologies for ultra-low-power computing. "My goal is to push even further into the energy-efficient space," he says, "to find ways of increasing performance with less energy."

It's a goal shared by many businesses, including ARM Limited, a UK-based company that licenses intellectual property for energy-efficient semiconductors used in mobile handsets and across a wide range of other applications. Five years ago, at the invitation of his former graduate student and current ARM Vice President of Research and Development Krisztian Flautner, Mudge and several of his U-M colleagues entered into a five-year, $5 million research partnership with the company.

One of the team's earliest projects resulted in an ARM product known as the Intelligent Energy Manager (IEM) system, a technology that enables mobile phones to automatically self-adjust their battery usage. Overall, the outcomes have been so impressive—nearly 40 patents and a spinoff company—that ARM has opted to renew the contract.

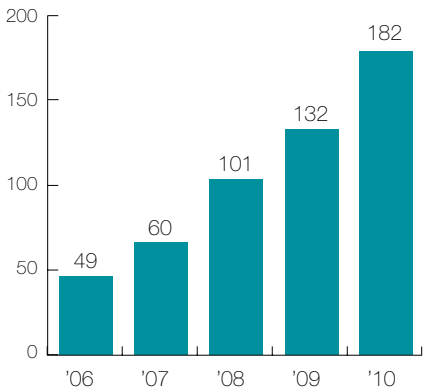
As Flautner notes, "Our alliance with the University of Michigan has been mutually beneficial, leading to significant advances in the high-performance, low-power processing platforms that are essential to the next generation of microcomputers."

engaged in economic development

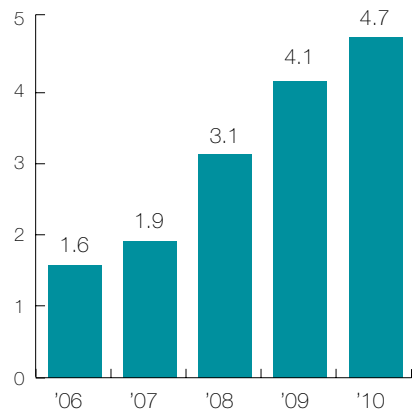
IRLEE | The Institute for Research on Labor, Employment, and the Economy (IRLEE) assesses the impact of economic restructuring and provides hands-on assistance to distressed businesses, non-profits, and communities throughout the Great Lakes region. These efforts, undertaken by staff, students, and faculty, enhance the retention and revitalization of existing businesses undergoing economic transition and assist communities experiencing major plant shutdowns and downsizing by linking them to resources and facilitating new enterprise formation. IRLEE also provides local, state, and regional economic forecasting services for business, government, and academic constituencies.

Among the many communities assisted by IRLEE in FY 2010 was Hamtramck, Michigan, where stakeholders were assembled to identify critical community needs, and key federal and state agencies were brought in to help fund those needs. In addition, IRLEE arranged to send two graduate interns from the School of Social Work to support Peoples Community Services, a local human service non-profit, in implementing several community initiatives.

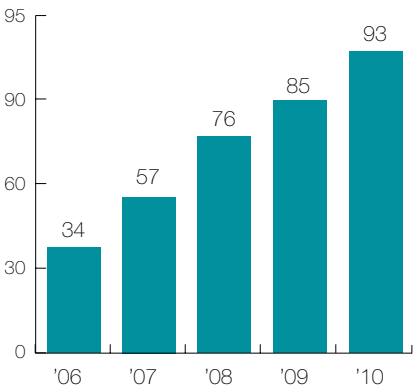
ACTIVE CLIENT FIRMS RECEIVING ASSISTANCE



EXTERNAL SPONSORED CONTRACT REVENUES (in millions)



COMMUNITIES RECEIVING ASSISTANCE



ATTRACTING GE TO SOUTHEAST MICHIGAN | GE continues to expand its presence in Michigan—particularly at its new Advanced Manufacturing and Software Technology Center in Van Buren Township. This state-of-the-art IT and research facility, which opened its doors in October 2009, currently employs about 450 experienced information technology professionals and will grow to house the largest concentration of GE IT professionals in the world. The information technologists and engineers working at this center are helping GE develop innovative new software, processes, and technologies to drive excellence in manufacturing. The university continues to help GE expand its recruiting and research relationship as their total employment grows to more than 1,100 professionals at the center and to roughly 3,500 professionals across the state.

U-M START-UP ACQUISITIONS | Three U-M start-ups have been acquired in recent years by strong industry partners, demonstrating the quality and growth potential of these ventures and paving the way to accelerated growth and job creation.

HealthMedia was acquired by Johnson & Johnson, expanding their products and services for online health care coaching and growing the employee base here in Ann Arbor.

In 2009 HandyLab was purchased by BD (Becton Dickinson and Company) with plans to integrate and expand their portfolio of molecular diagnostic assays and automation platforms, addressing vital issues that impact the cost and quality of our health care.

In 2010, Arbor Networks was acquired by Tektronix Communications, part of Danaher Corporation, adding a full suite of network security and management solutions with plans to expand the Ann Arbor operation by 30 percent in 2011.

MOVE TO NORTH CAMPUS RESEARCH COMPLEX |

In October 2010, U-M Tech Transfer and the U-M Business Engagement Center moved their core offices to the NCRC, part of a 2-million-square-foot complex, once a major Pfizer research center, housed on 174 acres of land. The move is part of the university's effort to expand our commitment to innovation, engagement, and commercialization activities.

VENTURE ACCELERATOR |

A new Venture Accelerator managed by U-M Tech Transfer's Venture Center is planned for the NCRC. The Accelerator will house emerging U-M start-ups, and provide an expanded suite of business services to enhance the quality and time-to-market for promising U-M start-up ventures.

innovate!

Great ideas change everything

At the University of Michigan, we believe that great ideas can change everything. As an institution, we put our commitment and support behind a vision of university innovation that connects with the needs of our communities, advances the economy, and makes our society more prosperous.

Getting from a great idea to real-world impact takes a unique blend of inspiration and expertise, vision and practicality, individual effort and teamwork. In recent years, the university has steadily ramped up resources and programs to assist successful innovation and promote its critical place in our mission.

The university encourages faculty innovation and risk-taking in research, teaching, and service; encourages the tech transfer process; connects would-be entrepreneurs with mentors and venture funding; and provides a culture that recognizes and rewards entrepreneurial activities. In addition, it provides a structure to connect the university and industry to spur transformative research that can change the world.

Our student entrepreneurs bring their ideas to fruition in a UM-supported incubator, inspired by mentors, competitions, and the energy of hundreds of peers. And they become the college graduates who can drive an economy that demands creativity, knowledge, and people willing to take risks.

We invite you to join our innovation revolution.

To learn more, visit www.innovate.umich.edu

U-M has remarkable resources for innovation and economic transformation:

$1.14 billion RESEARCH PORTFOLIO in health, energy, nanotechnology, information technology, and more.

NINETEEN SCHOOLS AND COLLEGES, with unparalleled breadth and depth of expertise.

The BUSINESS ENGAGEMENT CENTER, a single portal for businesses to access U-M resources.

U-M TECH TRANSFER connects our research discoveries to businesses and venture partners. Its MICHIGAN VENTURE CENTER provides a one-stop hub for U-M start-up opportunities.

The INSTITUTE FOR RESEARCH ON LABOR, EMPLOYMENT, AND THE ECONOMY helps enterprises adapt to economic change.

The MEDICAL INNOVATION CENTER stimulates innovation on transformative medical devices.

The ZELL LURIE INSTITUTE FOR ENTREPRENEURIAL STUDIES AT THE ROSS SCHOOL OF BUSINESS and THE CENTER FOR ENTREPRENEURSHIP encourage student entrepreneurs.

The UNIVERSITY RESEARCH CORRIDOR, a joint effort by U-M, Michigan State University, and Wayne State University, encourages collaboration and accelerates economic transformation.

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