MSU INNOVATION CENTER

2016 Annual Report

MICHIGAN STATE UNIVERSITY

The MSU Innovation Center combines innovation, technology commercialization, new company startup support, and a portfolio of dedicated business and community partnerships to bring cutting-edge ideas to the marketplace. Composed of Business CONNECT, MSU Technologies, and Spartan Innovations, the MSU Innovation Center stewards faculty, student, and commercial partner ideas, bringing more than 150 discoveries annually into a pipeline of patents, products, and startup businesses. Together, these solutions help build a diversified economy and jobs for Michigan.

The MSU Foundation, established in 1973, fuels economic development initiatives through the commercialization of cutting-edge technologies invented by Michigan State University faculty, staff, and students. At its core is an extensive program that focuses on the support of research, invention, and entrepreneurship.

MSU INNOVATION CENTER & MSU FOUNDATION STAFF

Left to right, front row: Angelia VanWoert, Lori Fischer, Guangming He, Ray DeVito, Charles Hasemann, Richard Chylla, Anne DiSante, David Washburn, Marta Sinclair, Chris Sell, Marcia Fittro, Dana Smith

Second row: Charlene Fortin, Janelle' Flores, Andrew McColm, Jen Folger, Susan Bukovick, Brad Shaw, Tana Boehm, Reanee Unger, Melanie Adkins, Jeff Myers, Jeanine Tomko, Randy Sheets, Gabriela Allum, Kay O'Berry

Third row: Tina Ramos, Jean Zwier , Tom Herlache, Jeff Smith, Ken Szymusiak, Traci Cannon, Paul Jaques, Randy Ramharack, Frank Urban, Aaryn Richard, Amber Shinn

Not pictured: Jamie Binger, Sandra Clough, Nina Isi Davis, Harry Ledebur, Brice Nelson, Ann Spalding, Karen Studer-Rabeler

The MSU Innovation Center launched as an intentional innovation and commercialization cluster four years ago, merging corporate engagement, technology transfer, and startup company formation with experiential student entrepreneurship support in the mix.

The Innovation Center is built on a strong partnership with the MSU Foundation, faculty, students, and local and statewide economic development organizations.

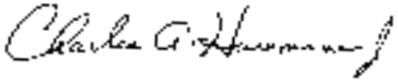
Meeting new challenges, finding creative solutions and effecting change is in our DNA, and we too are a work in progress, with great people who are committed to making us better every day. I can boldly say that we have developed impressive momentum, and I see consistent and significant upward trends in all the metrics we track and value.

As you will see in this report, many of our metrics show growth that out paces the general growth of MSU, and several are at all-time highs. We're finding new ways to support startups and translational research, with mature programs such as MSU MTRAC, that formed Michigan's first Innovation Hub in AgBio (see page 7) and brand new programs, such as the Conquer Accelerator, that show great promise for the future. MSU's corporate engagement grows at a double-digit pace, with significant productive partnerships with major corporations, as well as collaboration across the state with small companies and sister universities, working to grow and diversify Michigan's economy (page 14). With a new cohort of companies from MSU-derived intellectual property, we are building a pipeline that looks better every year (page 9).

Our support of student entrepreneurship yields great outcomes as well, an effort built on both the growth and maturation of a student's perspectives on markets and value, and their strengths in the real world after graduation. Better still, their startup companies are remarkable as well!

Newest of all, in partnership with University Advancement, we launched an intentional effort to engage the community and MSU alumni in our student entrepreneurship programs—drawing on the talents, passions, and generosity of willing Spartans to mentor and coach students, and help us build better and more sustainable programs (page 21).

So please enjoy selected highlights from our Fiscal Year 2016—a collection of facts, figures, stories, and celebrations from MSU's Innovation Center.

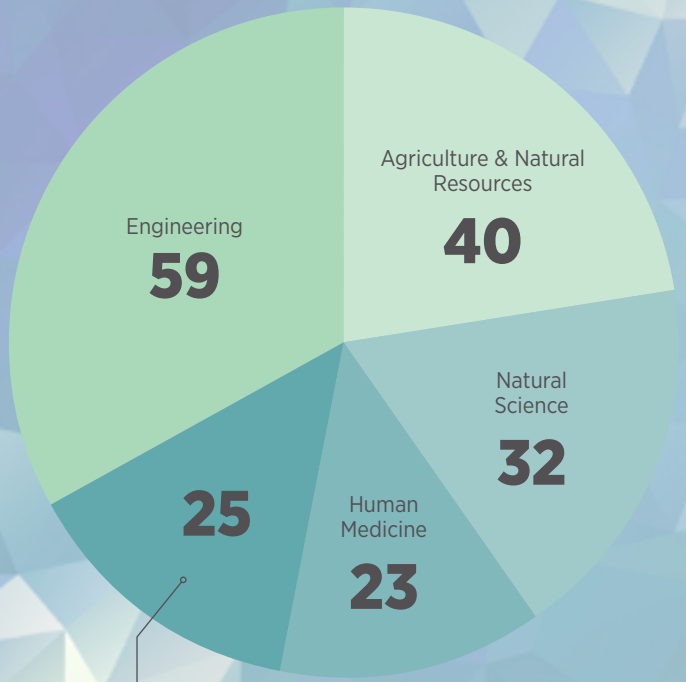


Charles A. Hasemann, PhD
Assistant Vice President for Innovation
& Economic Development

MSU INNOVATION CENTER

BY THE NUMBERS

INVENTION DISCLOSURES BY COLLEGE



Osteopathic Medicine: **8** | Veterinary Medicine: **4**
Arts & Letters: **3** | Communication Arts: **3** | Education **2**
Nursing: **2** | Business: **1** | Music: **1** | Other Groups: **1**

$1.4M

IN ROYALTIES DISTRIBUTED TO MSU FACULTY AND DEPARTMENTS

66

MSU SETS RECORD FOR ANNUAL LICENSES & OPTIONS

More on licenses and options, page 9

MSU SETS RECORD FOR NEW INVENTIONS DISCLOSED

179

221 RESEARCH AGREEMENTS

961

NDA/CDA AGREEMENTS EXECUTED

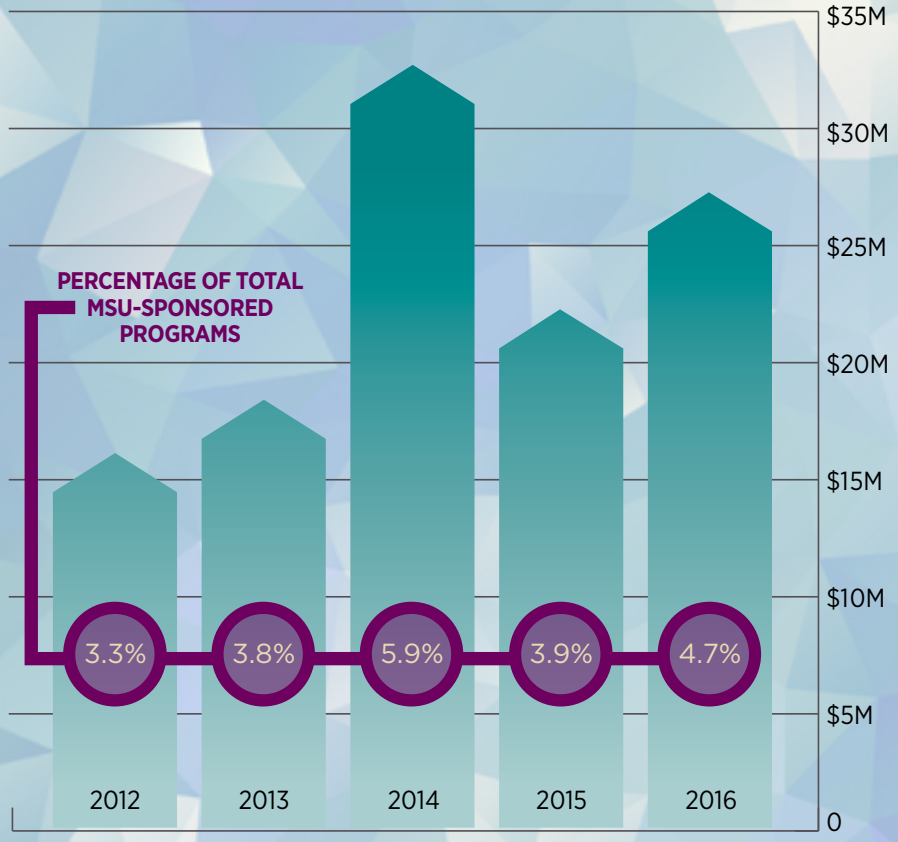
3.8 PER BUSINESS DAY

18%

2016 YEAR-OVER-YEAR GROWTH IN CORPORATE PARTNERSHIPS

CORPORATE SUPPORT OF MSU-SPONSORED PROGRAMS

More on corporate partnerships, page 13



155

STARTUP TEAMS SERVED IN THE HATCH

More on startups, page 17

5

GREENLIGHT EVENTS STATEWIDE

7,500

CUSTOMERS REACHED BY CONQUER ACCELERATOR TEAMS

6

NEW COMPANIES GRADUATED FROM INAUGURAL CONQUER ACCELERATOR

More on page 21

2016 Innovation Celebration

Held high above Spartan Stadium, the MSU Innovation Celebration is an annual event that unites university and community to honor MSU innovators and showcase several of the many inventions and innovations developed at MSU.

Technologies and student startups on display represent discoveries and scholarship from a diverse range of academic fields and potential commercial applications. Some are available for evaluation by interested commercial partners or have already been licensed by industry, while others are in early stages of development, but all represent faculty and student excellence and innovation taking place across campus, and they illustrate the ways MSU is driving economic development in Michigan and beyond.

The MSU Innovation Center presented three awards recognizing creativity and achievement in technology commercialization, applauding 2016's most exceptional innovator, innovation, and career achievement in tech transfer.

The MSU Innovation Center is pleased to pay tribute to the passion, creativity, and perseverance that have led to these examples of success. We look forward to moving even more MSU-developed innovations to the marketplace, while celebrating more world-changing ideas, and advancing the common good in uncommon ways for many years to come.

TECHNOLOGIES ON DISPLAY

DRUG TARGETS FOR TREATING CANCER, PAIN, INFERTILITY
André Bachmann, PhD

MAVEN QUOTIENT
William Donohue, PhD

DETECTING GLASS COMPOSITE FAULTS
Mahmoodul Haq, PhD

ADVANCED OPTOGENETIC NEURAL COMMUNICATION
Wen Li, PhD

IMPROVED STEVIA VARIETIES
Ryan Warner, PhD

GENERATION OF OPTIMAL ANTIBODIES
Tim Whitehead, PhD

ZIPPED LIGNIN GENES FOR IMPROVED PULPWOOD
Curtis Wilkerson, PhD

ADVANCED ANTI-KNOCK ENGINE SYSTEM
Guoming (George) Zhu, PhD

MSU STARTUP: ISLEEP
Guoliang Xing, PhD
Tian Hao, PhD

MSU STARTUP: BLACK PINE ENGINEERING
Zach Hoyle, Norbert Mueller, PhD

STUDENT STARTUP: AERBOTS
Mario Swaidan

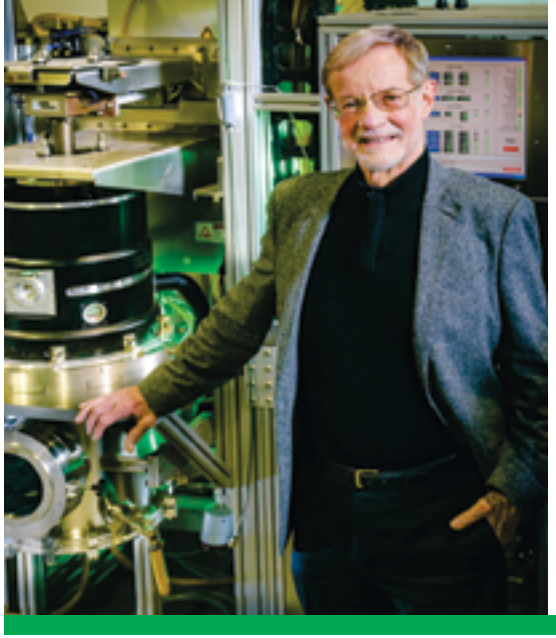
STUDENT STARTUP: BRINGITT
Jarett Lazare, Danny Meltser

STUDENT STARTUP: CONECTER
Zoe Zappitell, Brittney Urich

STUDENT STARTUP: MOHYI LABS
John Mohyi

STUDENT STARTUP: ROZE INC.
Oswald Chisala, Audrey R. Pena, Samuel Phiri, Daniel Shumaker

STUDENT STARTUP: YORK PROJECT
Joshua York



TECH TRANSFER ACHIEVEMENT AWARD

Jes Asmussen, PhD

University Distinguished Professor, Electrical and Computer Engineering

Asmussen holds 26 U.S. and more than 20 international patents in the field of microwave technology and microwave processing. These methods have been critical to the advancement of the semiconductor industry. Asmussen's design incorporates proprietary internal tuning and precise control of microwave mode and plasma conditions, which enable operation at the extremes for desired plasma applications. This advanced equipment is used in the deposition and growth of polycrystalline and single-crystal diamonds used in industrial, scientific, and gemstone applications.

INNOVATOR OF THE YEAR

Gemma Reguera, PhD

Professor, Microbiology, Molecular Genetics

Geobacter bacteria transfer electrons to external electron accepters in order to produce the energy required for life. Reguera has shown this process can assist in remediation of radioactive and toxic metals from the environment, or for generation of renewable energy. Reguera develops novel strains of Geobacter for both purposes. Geobacter microbial electrochemical reactors are used to produce the compound 1,3-propanediol (PDO) from industrial waste glycerin. 1,3-PDO is widely used to formulate industrial polymer products such as composites, adhesives, laminates, and polyesters.

INNOVATION OF THE YEAR

Bruno Basso, PhD

Professor, Geological Sciences, Methods for Cropland Evaluation & Growth Management

Intensive agricultural practices raise serious concerns about humanity's ability to increase productivity while maintaining sustainability of row-crop production systems. To tackle this problem, Basso created algorithms and software for advanced crop system models that incorporate plant physiology to predict impacts of weather, soil, and management practices on crop yield. This integrates diverse disciplines to understand agricultural systems and improve decision-making, from small farmsteads in the developing world to industrial producers and policy makers at all scales.

First Innovation Hub in Michigan

MSU LAUNCHES STATEWIDE AGBIO RESOURCE

In April, the Michigan Strategic Fund approved $3.5 million in funding to support the acceleration of technology transfer from Michigan's higher education institutions, nonprofit research centers, and hospital systems, with a focus on Agriculture Biology. Michigan State University's Translational Research and Commercialization Program (MTRAC) received $1 million of that funding, matched by $1.27 million from MSU, designating the university as the first innovation hub in the state.

MTRAC is housed in the MSU Innovation Center, where technology transfer, startup support and a portfolio of dedicated business and community partnerships combine to bring ideas to the marketplace.

"As an innovation hub, we will be able to support innovators across the state to advance the AgBio field," said Richard Chylla, executive director at MSU Technologies in the MSU Innovation Center. "The success of the MSU program and interest from those outside the university helped us achieve this milestone."

Prior to receiving the hub designation, MTRAC reviewed 63 project proposals, awarding 24 of them in the last 26 months. To date, the funding resulted in the creation of two startup projects, nine jobs, and three licenses to industry. Additionally, work done on these projects under MTRAC enabled $12.4 million in additional follow-on development funding.

> **"As an innovation hub, we will be able to support innovators across the state to advance the AgBio field."**
>
> **Richard Chylla,** *Executive Director, MSU Technologies*

Supported projects focus on cutting-edge agriculture-related research and bio-economy technologies that have commercialization potential, based on private sector interest.

Projects are reviewed and scored for funding consideration by an oversight committee comprised mainly of AgBio investors and industry representatives. Committee members also provide critical and ongoing project mentoring.

As of April, all the MTRAC programs across Michigan funded 79 projects, helped develop 13 startup companies and projects, created 33 jobs, secured $21.4 million in funding, and licensed technology to three Michigan companies.

MEDC's Entrepreneur and Innovation Initiative establishes Michigan as the place to create and grow a business by providing high-tech startup companies with access to a variety of critical resources, such as funding and expert counsel, from ideation to maturation. Administration of the MTRAC program for the Michigan Strategic Fund is part of this Initiative.

tinyurl.com/AgBioMSU

Ideal MTRAC candidates are innovations related to agriculture and biotechnology, with the potential to create superior value-added products and materials. The following AgBio projects are a sample of those selected for grants to help make them broadly available for consumer use:

Federica Brandizzi, PhD

Single-Modifier Strategy for Plant Biomass and Productivity Enhancement, Transition from Model Species to Commercial Crops

In an effort to address food security issues related to increasing land scarcity for crops, Brandizzi has established a new technology based on the over expression of a single gene. This over expression causes an increase in photosynthesis, biomass, and digestibility.

With MTRAC funding, Brandizzi's lab will transfer the technology from a model plant species into two crops of high economic relevance, soybean and alfalfa. The expected outcome of this approach is an increase in seed yield of soybean plants and also an increase in biomass and improved quality of alfalfa plants.

Christopher Saffron, PhD

Biomass Valorization by Pyrolysis and Electrocatalysis to Create Liquid Fuels, Chemical Intermediates and Advanced Materials

Even when petroleum is inexpensive, making advanced materials from it can be complicated, dangerous, and costly. In an attempt to solve this problem, Saffron and his team will be utilizing 2016 MTRAC funding to advance and optimize processes to convert renewable plant bio-oil into commercially viable products such as cyclohexanol, ethylene glycol, polyols, carbon foams, and fuel oil. This project relates to Saffron's previous MTRAC funding which enabled the building of a small pyrolysis reactor.

Kyung-Hwan Han, PhD

Improvement of Commercial Value of EliteTree Technology

Han was awarded an MTRAC grant to continue his work on the EliteTree technology, designed to produce poplar trees with greater wood density at an accelerated growth rate. His work will include initial field trials. If successful, these trees, grown as short-rotation crops, will provide a consistent, renewable, high-energy supply of woody biomass feedstock with the potential to significantly improve the profitability of the bioenergy, fiber, industrial chemical, and pulp and paper industries.

Solar Energy with Clear Benefits

TRANSPARENT PHOTOVOLTAIC TECHNOLOGY BREAKTHROUGHS

Ubiquitous Energy entered into an exclusive commercialization agreement with MSU on breakthrough near-infrared transparent luminescent solar concentrator technologies. These technologies will be used in the deployment of light-harvesting functionality in the form of products and surfaces.

Ubiquitous Energy is a Silicon Valley technology company leading the development of transparent photovoltaics with its award-winning ClearView Power™ technology—the world's first truly transparent solar technology.

With a mission to eliminate the battery life limitations of mobile devices and power smart glass for buildings, Ubiquitous Energy is implementing its ClearView Power technology into a wide range of products as an invisible, on board source of electricity. Their work in commercializing a range of technologies enables seamless deployment of light-harvesting functionality.

This technology was developed by 2015 MSU Innovation of the Year awardee, Richard Lunt, PhD. Lunt is a co-founder of Ubiquitous Energy and a member of the Scientific Advisory Board. An assistant professor of chemical engineering and materials science, Lunt is an expert in excitonic materials for solar energy and thin-film electronics. He has worked extensively in the field of excitonic photovoltaics and electronics for nearly a decade, winning an NSF CAREER Award, a DuPont Young Professor Award, the GPEC Solar Energy Innovation Award, and a MassCEC Catalyst Award. Lunt holds more than 15 U.S. patents, the majority of which have been licensed.

ubiquitous.energy

Precision Magnetic Field Measurement

INNOVATIONS FOR PARTICLE ACCELERATORS

Michigan micro-glass fabrication company Translume entered into an exclusive license agreement with MSU on technologies that produce precision tools for measuring magnetic fields in high-radiation environments.

Translume is a leader in micro-machining of fused silica glass, offering a variety of fabrication and integration services. Using proprietary laser writing and etching techniques, Translume fabricates devices that combine optical waveguides, microfluidic components and glass micromechanical elements.

MSU Professor Georg Bollen, PhD, and faculty member Ryan Ringle, PhD, developed a novel high-precision probe for measuring magnetic fields based on Penning traps. In the influence of ionizing radiation from gamma-rays, neutrons, and other energetic charged particles, conventional magnetic-field measuring equipment quickly deteriorate and fail. This new device is able to withstand high doses of ionizing radiation without significant damage, allowing for much longer periods of operation before radiation damage would require replacement. The Penning trap design is ideal for applications in space, nuclear and fusion reactors, and particle accelerators.

Ringle and Professor Bollen are both physicists in MSU's National Superconducting Cyclotron Laboratory. Bollen is a university distinguished professor of physics & experimental systems and division director in the Facility for Rare Isotope Beams. Joining MSU in 2000, Bollen designed and now operates the Low Energy Beam and Ion Trap, the most advanced mass-measurement facility in the world.

translume.com

RECOGNIZING EXCELLENCE INVENTORS & PATENTS

INVENTORS

Eric Achtyes
Christoph Adami
Kamran Ali
Michael Allen
Evangelyn Alocilja
Dean Aslam
Jes Asmussen
Rafael Auras
Clement Aussignargues
Bhushan Prabhakar Awate
Andre Bachmann
Shanker Balasubramaniam
Terry Ball
Aparajita Banerjee
Rahul Banerjee
Cornelius Barry
Bruno Basso
Wolfgang Bauer
Peter Beard
Randolph Beaudry
Matthew Bedewitz
Christoph Benning
Norman Birge
Subir Biswas
Laura Bix
Gary Blanchard
Barbara Blanco-Fernandez
Stephen Blosser
Carl Boehlert
Clifford Bohm
Silas Bonczyk
John Boyse
Merlin Bruening
Lena Brundin
Allison Burg
Marcelo Campos
Kai Cao
Joanna Carroll
Kimberly Cassida
Shatadru Chakravarty
Siva Rama Krishna Chalasani
Anand Chandrasekhar
Duo Chen
Jongeun Choi
Jacek Cholewicki
Michelle Cirillo
Gary Cloud
Mark Colson
Paige Conway
Melanie Cooper
Marco Cortesi
Charles Coslor
Marcos Dantus
Saptarshi Das
Isabel David
Kalyanmoy Deb
Loïc Déjardin
Sudhanwa Dewasthale
Timothy Dietz
Kirk Dolan
William Donohue
Lawrence Drzal
Daniel Ducat
Michael Ezzo
Bin Fan
Kevan Farrell
Dezhi Feng
John Frost
Dennis Fulbright
Chintan Gandhi
Patricia Ganey
George Garrity
Sandeep Gaudana
Abhinav Gaur
Ira Gewolb
Mehran Ghasemlou
Cesar Gonzalez Esquer
Daniel Graiver
Timothy Grotjohn
Cuihua Gu
Deepak Gunasekaran
Emilie Gupta
Elodie Hablot
Faezeh Hajiaghajani Memar
Hu Han
James Hancock
Mahmoodul Haq
Janice Harte
Sheng-Yang He
Xie He
Beth Herbel-Eisenmann
Arend Hintze
Gregg Howe
Rufus Isaacs
James Jackson
Anil Jain
Andrew Jarosz
Jae-Wook Jeong
Kate Johnson
James Kelly
Cheryl Kerfeld
Vahid Khademi
Anton Khomenko
Tae Hoon Kim
Que Kong
Manoochehr Koochesfahani
Ermias Koricho
Caitlin Kowalsky
Steve Kozlowski
David Kramer
James Kremer
Richard Leep
Ryan Leverenz
Jie Li
Qianfeng Li
Tongtong Li
Wen Li
Wei Liao
Peter Lillehoj
Jack Lipton
Jiankun Liu
Xiang-Yang Alex Liu
Xiyuan Liu
Yan (Susie) Liu
Nathan Lounds
Vadim Lozovoy
Xu Lu
Ben Lucker
Richard Lunt
Hong Luo
Wei Ma
Joshua MacCready
Robert Maleczka
Fredric Manfredsson
Shannon Manning
Keith Mason
Sarah Matthews
Laura McCabe
Robert McGough
Kevin Moran
Donald Morelli
Mohsen Moslehpour
Ramakrishna Mukkamala
Muraleedharan Nair
Ramani Narayan
Bradley Neumann
Wenjing Ning
Brian Nohomovich
Casey O'Donnell
John Ohlrogge
Eric Olson
Philip Olson
Katherine Osteryoung
Samuel Otten
Charles Otto
Charles Owen
Glenn Pape
Taiwoo Park
Keyurkumar Patel
Fang Peng
David Phillips
John Popovich
Amy Porter
Shahram Pouya
Theodore Prawat
Martin Priess
J. Richard Pursley
Chunqi Qian
Clark Radcliffe
Hayder Radha
Amy Ralston
Ahmed Ramadan
Mikhail Redko
Norman Reeves
Gemma Reguera
Jian Ren
Sunisa Roidoung
Robert Roth
Chong-Yu Ruan
Maria Rubino
Anton Ryabtsev
Dmitrijs Sabasovs
Alireza Safaripour Tabalvandani
Christopher Saffron
Javier Salas
Joseph Salatino
Paul Satoh
Megan Schanz
Kurt Schindler
Jorden Schossau

PATENTS

Animequom Adams
Pejman Akbari
Evangelyn Alocilja
Jes Asmussen
Rafael Auras
Gregory Baker
Venkatesh Balan
Carmille Bales
Cornelius Barry
Christoph Benning
Tetyana Berbasova
Martin Berz
Norman Birge
Babak Borhan
Shantanu Chakrabartty
Albert Cheh
Shishir Chundawat
Joseph Coombs
Leonardo da Costa Sousa
Bruce Dale
Marcos Dantus
Loïc Déjardin
Sudhanwa Dewasthale
David Douches
Lawrence Drzal
James Dye
Keith Emery
John Frost
Bingtuan Gao
Hunter Gartner
James Geiger
Eliana Gonzales-Vigil
Daniel Graiver
Timothy Grotjohn
Yajun Gu
Larry Gut
Elodie Hablot
James Hancock
Janice Harte
Sheng-Yang He
Kadek Hemawan
Troy Hendricks
Tim Hogan
Pei Huang
Florin Iancu
James Jackson
Xuwei Jiang
Hyunjoong Kim
Yunsung Kim
Aspi Kolah
Patrick Kwon
Ming Woei Lau
Ilsoon Lee
Kin Sing Lee
Janet Lewis
Yonghua Li-Beisson
Carl Lira
Xiang-Yang Alex Liu
Xiaoming Liu
Christopher Long
Vadim Lozovoy
Jing Lu
Jue Lu
Ryan Maloney
Derek Marshall
Peter McGhee
Alberto Leonel Mendoza
Dennis Miller
James Miller
Rachel Miller
Eric Moellering
Norbert Mueller
Matt Mutka
Partha Nandi
Ramani Narayan
Siriyupa Netramai
Lionel Ni
Bai Nie
John Ohlrogge
Sudeshna Pal
John Partridge
Lars Peereboom
Janusz Piechna
Thomas Pinnavaia
Ezhiyl Rangasamy
Gavin Reid
Donnie Reinhard
Michael Reinke
Bryan Ritchie
Chong-Yu Ruan
Maria Rubino
Sari Ruuska
Catherine Ryu
A. Mahdi Saeed
Jeff Sakamoto
Emma Setterington
Muhammad Shafiq
Lee Siler
Milton Smith III
Zhensheng Tao
Chrysoula Vasileiou
Erin Vogel
Dechun Wang
Wenjing Wang
Richard Ward
Curtis Wilkerson
Saunia Withers
Ning Xi
Li Xiao
Jing Xu
Xi Yang
Jiazheng Yuan
Weiqing Zeng
Zhongnan Zhang
Jianguo Zhao
Feng Zhu

Robert Michael Sgambelluri
Erik Shapiro
Bradley Sherrill
Yan Shi
Megan Shiroda
Lee Siler
Steven Skrypec
Milton Smith, III
Caryl Sortwell
Allison Speers
Richard Spreng
Josh Springer
Aaron Stebbins
Michael Steele
John Suddard-Bangsund
Xiaochen Tang
Andrew Temme
Leslie Thomas
James Tiedje
Christopher Traverse
Bruce Uhal
Christie-Jasmine Valle
Steven van Nocker
Christine Vandervoort
Frank Vice
Jonathan Walton
Aaron Walworth
Dayong Wang
Dechun Wang
Hongbing Wang
Ryan Warner
Juyang Weng
Mark Whalon
David Wheeler
Timothy Whitehead
Brian Winn
John Wise
John Withers
Josh Wong
Robert Worden
Brian Wright
Mark Wyckoff
Yining Xia
Shuitao Yang
Yiqun Yang
Jian Yao
Yuki Yoshida
Dennis Young
Jenna Young
Margaret Young
Kefei Yu
John Yurkon
Geraldine Zeldes
Jenny Zeng
Li Zhang
Peng Zhang
Xiaofeng Zhao
Zejia Zheng
Kai Zhou
Guoming Zhu
Yvonne (Bonnie) Zoia

MSU Partners with Simplot to Advance Potato Research

A $1.75 million partnership between Michigan State University and the J. R. Simplot Company will expand research designed to improve potatoes, specifically varieties used in chips and french fries.

This work is led by David Douches, PhD, professor and director of the MSU potato breeding and genetics program. As the only full-time MSU faculty member focused on potato research, Douches leads research on how to help position potato growers to produce the best potatoes for specific consumer products. In this case, the objective is to identify potato varieties that yield the optimum golden potato chip.

The overall goal of this project is to create superior potato varieties that contain Simplot's low acrylamide and bruising resistance traits.

Discovered as a component of food in 2002, acrylamide is a chemical that can form naturally in some plant-based foods during high-temperature cooking processes such as frying and baking. In high doses, it has been found to cause cancer in animals. Lowering acrylamide levels will benefit consumers by making fried potatoes healthier. In March 2016, the FDA published strategies to help growers, manufacturers, and food service operators lower the amount of acrylamide in foods associated with higher levels of the chemical. Simplot's low acrylamide trait meets this FDA goal.

While the low acrylamide trait will produce a healthier food, the bruising resistance trait will create a product with better consumer aesthetics. Bruised potatoes make unacceptable french fries and chips, because the bruise turns into black spots when the potato is cooked. Simplot's low-bruising technology reduces this waste.

This is where Douches' work comes in. Through his years of research, MSU holds a broad library of potato varieties boasting high genetic diversity with a large variety of preferred potato traits. In this collaboration, MSU varieties will be crossed and selected for combinations of these superior traits alongside Simplot's proprietary low acrylamide and bruising resistance traits. In the end, the work should produce potatoes with superior agronomic traits for the farmers, as well as a superior product profile for the consumer.

STATEWIDE PARTNERSHIPS GROW MICHIGAN

Built on collaboration between Michigan's leading research universities and supported by the Michigan Economic Development Corporation and the Michigan Strategic Fund Board, the **Michigan Corporate Relations Network** (MCRN) is a statewide partnership designed to build relationships between Michigan's corporations and universities.

MCRN partners (Michigan State University, Western Michigan University, Wayne State University, University of Michigan, University of Michigan-Dearborn, and Michigan Technological University) collectively produce more than $1.8 billion dollars of research annually, the substrate from which Michigan can grow a more diverse and productive economy. MCRN programs facilitate access for Michigan companies to this research capacity, talent, and technology.

Built to help companies overcome a common challenge faced by small companies and entrepreneurs, MCRN Small Company Innovation Program/Technology and Commercialization Assistance (SCIP/TCA) program provides matching funds up to $40,000 to Michigan small businesses to help cover the cost of conducting a research project at any Michigan public university. This program helps meet research and development needs to get products and services to market faster.

At MSU, SCIP/TCA projects cover diverse topics including anaerobic digesters, improved shelf life for fresh fruit, sleep quality, biodiesel improvements, turbine designs, urban agriculture, feline vaccines, and septic systems.

The MCRN Small Company Internship Award (SCIA) program provides funding to help small businesses working in STEM fields to hire university students as interns on projects that are beneficial to the company and academically relevant to the student. The program provides a 50:50 cost share for 12-week internships. More than 20 MSU students have worked at Michigan-based companies under this program.

MCRN's Expertise and Resource Portal serves businesses both within Michigan and around the globe. This search tool, combined with the business engagement services at each MCRN university, provides a means for businesses to quickly find and access resources at the MCRN universities.

The MCRN program has built a cooperative across MCRN partner schools. Corporate engagement offices routinely make referrals and work on projects together, simplifying and streamlining company access to the right experts on the right projects. It is often noted, "We may compete on the football field, but we are true partners in growing Michigan's economy."

michigancrn.org

Mercedes-Benz Financial Joins Forces with MSU

Mercedes-Benz Financial is modernizing its approach with innovative, entrepreneurial students at MSU. What began as a meeting with Business-CONNECT to explore collaboration became a project with the Burgess Institute for Entrepreneurship & Innovation at MSU's Broad College of Business and Lansing Economic Area Partnership to develop out-of-the-box ideas for the Mercedes-Benz brand.

"MSU x Mercedes-Benz" partnership events take place in the MSU Innovation Center's 300 Room, partnering Mercedes-Benz employees with entrepreneurial students to learn about strategic planning and business modeling. The 300 Room also serves as a co-branded working space for Mercedes-Benz events.

MSU STARTUP SPOTLIGHT

Hao Tech

Hao Tech utilizes disruptive sensing technologies for better living though mobile devices. MSU graduate student Tian Hao, PhD, MSU Associate Professor Guoliang Xing, PhD, and College of William and Mary Associate Professor Gang Zhou, PhD, formed Hao Tech in 2015. Hao Tech's primary product in development is iSleep, a contact-free sleep sensor.

Actively making the bedroom smarter, iSleep is turning smart mobile devices into sleep listeners. Almost 30 percent of the adult population in the United State will have disrupted sleep due to a sleeping disorder, and more than 50 percent of the population is affected by frequent snoring. Sleep deprivation has the ability to cause depression, obesity, a loss of productivity, and drowsy days.

Frequent snoring is often a sign of sleep apnea, and it may be life-threatening when left untreated. Sleep apnea is characterized by loud and frequent snoring, choking, or gasping while asleep. These symptoms often go unnoticed because they are not detectable though regular doctor visits or blood tests.

iSleep takes a spectrum analysis of these sounds and creates an early screening tool for sleep apnea. The mobile application turns users' smart devices into sleep trackers activated by sound. The app is a contact-free, sound-based system intended to be left on a nightstand. Through sound activation, iSleep will record real-time sleeping data and help the user get a better night's sleep.

haolabs.com

MSU STARTUP SPOTLIGHT

Jolt

In addition to launching their startup, Jolt Energy Storage Technologies LLC won the Global Automotive and Mobility Innovation Challenge Award for their novel lithium-ion battery additive. The award was given to Jolt, founded by MSU's Thomas Guarr, PhD, and his business partner, Jack L. Johnson, and developed in Guarr's lab at Michigan State's Bioeconomy Institute.

The additive in the batteries works by activating when the cell is fully charged and capping the cell voltage at the maximum value that the battery is designed for. Thus, it prevents dangerous over-voltage conditions that often lead to fires, explosions, and other "rapid disassembly events." The additive can be introduced into batteries with virtually no change in the manufacturing process.

"This technology improves safety and performance, and, ultimately, offers battery manufacturers an opportunity to reduce costs," explains Guarr, who has been the R&D director of MSU's Holland pilot plant since 2011.

Jolt's co-founder Johnson is a former Johnson Controls engineer who led the team that built the JCI lithium battery plant in Holland and developed all of the necessary manufacturing processes, as well as safety and quality control measures. Johnson is also a co-founder of another West Michigan startup, Volta Power Systems.

jolt-energy.com

SPOTLIGHT: STUDENT ENTREPRENEURSHIP

STUDENT STARTUP: **BRINGITT**

Jarett Lazare, Danny Meltser

Bringitt is a student-to-student shipping network, designed to make shipping items easier and more convenient. This mobile app creates a network of students delivering items across the state.

Invented after one too many frustrating trips back home for forgotten needs, the Bringitt app connects students traveling home with students in the same area who need something delivered to them back at school. Students post items they need delivered, with a destination and time to the Bringitt app and other users are given the opportunity to pick the items up and deliver them.

Real-time item tracking and the ability to message drivers provides convenience and peace of mind when requesting items for delivery. The Bringitt app focuses on safety, offering cashless in-app transactions, insurance and real-time tracking. The Bringitt app allows students to get paid for helping out one another, and it makes delivering items from home to school a little easier. Above, the Bringitt team poses with judges from ABC's hit show "Shark Tank" after winning the $10,000 first prize in the National Automatic Merchandising Association OneShow Competition in April.

bringitt.com

STUDENT STARTUP: **ROZE INC.**

Oswald Chisala, Audrey R. Pena, Samua Phiri, Daniel Shumaker

Roze Inc. creates technologies to simplify daily living and make interacting with others easier.

Roze is developing a parallel-computing infrared radiation sensor with a custom-made micro-processor. This wireless sensor functions as a signal to let people know if a room is occupied.

The Roze Smart Sensor Dock alerts users if people are entering or exiting a room with a series of small flashing lights. The device is automatic and comes with an app for roommates to create schedules.

Over time, the app will automatically learn users' schedules to create a seamless and convenient experience. Installation in door frames is simple, using integrated magnets.

Roze was an Entrepreneurial Eight finalist at the South by Southwest (SXSW) Interactive Festival Student Startup Madness competition in March.

gust.com/companies/roze_inc

STUDENT STARTUP: **MOHYI LABS**

John Mohyi

Mohyi Labs is a product development company focused on creating a Bladeless Drone.

Featured in Spring 2016 on "America's Greatest Makers" on TBS, Mohyi Labs seeks to create a safer, more durable, more stable drone that uses innovative propulsion technology.

Mohyi's Ducted Counter-Vortex Impeller technology seeks to revolutionize the consumer drone industry, logistics, and personal transportation. Its patent-pending design works by altering the airflow out of a vortex pattern and converting it into usable thrust. Advantages of the technology include the potential to exceed the efficiency of existing bladed propulsion and the ability to operate both in the air and in aquatic environments.

mohyilabs.com

SUPPORTING INNOVATION

Translating great ideas into market-ready technologies and products is a team effort. While faculty and students alike are a prolific source of innovation, the effort to move them to the market takes a broad ecosystem of professional, intellectual, and financial support from both MSU and our community of alumni and partners.

The Innovation Center strives to create connections at this interface of academia and the real world of commerce, markets, and entrepreneurs. We do this in the classroom, in our creative centers such as **the Hive,** where students can exchange and nurture ideas, and in **the Hatch,** where students launch their own companies. At MSU Technologies and Spartan Innovations, MSU's faculty and graduate students turn their ideas into actual products and companies. This is only possible thanks to the key partners who support this ecosystem of innovation.

While some outstanding examples are listed here, we seek new partners and supporters every day.

The **MSU Foundation** is a strong partner to MSU's work in technology commercialization and the support of faculty and student entrepreneurship. The foundation directly invests in the translation of ideas to products at Spartan Innovations, Conquer Accelerator, and the **University Corporate Research Park** (UCRP). At the UCRP, the foundation provides facilities and building sites for technology enterprises, initiatives, and university/industry collaboration. Two former foundation directors are founding donors to the Institute for Entrepreneurship and Innovation at the Broad College of Business.

The **Gerstacker Foundation Entrepreneurial Grant Program** is an opportunity for undergraduate students from the science, technology, engineering, and math (STEM) disciplines to compete for funding for a research concept with entrepreneurial potential.

The **Forest Akers Trust Entrepreneurial Grant Program** is another opportunity for undergraduate students to compete for funding for a research concept with entrepreneurial potential. This program focuses on, but is not restricted to, non-STEM disciplines.

For both the Gerstacker and Forest Akers programs, students develop a concept, conduct the research, and present their findings with the goal of getting their concept into use or production.

Opportunities for support are built every semester and come in many forms, from the 45 alumni mentors who worked with the five startups in the **Conquer Accelerator** this summer (page 21) to the generous support of Donald Anderson, who founded the **James Ian Gray Scholarship in Entrepreneurial Studies.** Read more about this year's winner, Zoe Zappitell, at right.

To learn more about how you can get involved in MSU's entrepreneurship ecosystem, connect with Chris Sell, profiled at right, or visit the entrepreneurship section of MSU's **Empower Extraordinary campaign.**

givingto.msu.edu/unit/entrepreneurship.cfm

IN FOCUS:
The James Ian Gray Scholarship in Entrepreneurial Studies

This year marks the inaugural award of the James Ian Gray Scholarship in Entrepreneurial Studies, given to one innovative student each year, based on their contributions to entrepreneurship at MSU. The scholarship seeks to support current MSU students who study entrepreneurship and experience the risks that accompany starting their own company.

The MSU Innovation Center is proud to award this $10,000 scholarship to Zoe Zappitell, co-founder of the startup company Conecter, and president of the MSU Women in Entrepreneurship student organization.

Ian Gray, PhD, the scholarship's namesake, is MSU's past vice president for research and graduate studies, and one of the founding leaders behind the creation of the MSU Innovation Center (home of the Hatch, MSU's student entrepreneurship incubator) and Spartan Innovations (providing programmatic support for the experiential side of student startups).

Built with the generous donation of Donald C. Anderson, M.D., a physician, pediatric cancer researcher, drug discoverer, and entrepreneur, this gift encourages and supports promising students who choose to pursue entrepreneurship as part of their undergraduate experience.

Zappitell is an active champion of the MSU entrepreneurship environment; she frequently volunteers her time to support other students, MSU entrepreneurship programs, and Hatch events. Along with co-founder Brittany Urich, her startup Conecter was a member of the inaugural Conquer Business Accelerator cohort in 2016 as well.

Students are chosen for the scholarship based on engagement with the MSU Innovation Center, participation in coursework as part of the undergraduate minor in entrepreneurship, utilization of opportunities to interact with commercial entities, and experience risk-taking in an effort to expand entrepreneurial efforts while completing a degree. Students who are awarded the James Ian Gray Scholarship are eligible to receive it for two consecutive years.

New Faces Chris Sell

Christopher Sell is the new director of alumni and entrepreneur engagement at the MSU Innovation Center. A career educator, project manager, fundraiser, and business developer, he's passionate about creating things to solve problems and connecting people to opportunity. A two-time MSU grad with more than six years of experience in higher education, Sell is committed to leveraging relationships with industry, alumni, and college students to retain and attract talent in the state and contribute to Michigan's revitalization.

In his current role at the MSU Innovation Center, he leads efforts to build advocacy and support for the entrepreneurship ecosystem and student entrepreneurs at the university.

Welcome, Chris!

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MSU LAUNCHES
BUSINESS ACCELERATOR

The Conquer Accelerator launched in May 2016, a collaborative effort at MSU through partnerships with the Michigan State University Foundation, Spartan Innovations, and the MSU Federal Credit Union. Designed to help both newer and established companies overcome business hurdles, Conquer emphasizes smart planning and growth, structured educational components, and extensive mentorship from a broad, experienced bench of alumni professionals. For startups from MSU, the Conquer Accelerator fills a crucial gap in the development cycle of student startups in the entrepreneurial ecosystem.

Each summer, a cohort of Conquer teams works though an intense, 10-week program, culminating with a final demo-day presentation to investors. These teams receive $20,000, mentorship, collaborative working space and support in exchange for 5 percent equity.

ConquerAccelerator.com

CONQUER
ACCELERATOR

CONQUER COHORT Startup Teams

Your building blocks for flight, **AerBots** designs and builds modular, snap-fit drone kits, making the drone hobby accessible for everyone. With a focus on simplifying complicated machinery, AerBots builds flying machines that consumers can upgrade and repair themselves, allowing more time in the air and less time on repair.

Artificially Intelligent Machineshop (AIM) uses a software-as-a-service model to streamline American manufacturing and cut lead time to component scale-up in half. Working with machine shops across the United States, AIM leases automated machining components that pair cloud technology with minimal human input to reduce labor costs.

Conecter is a mobile application bringing together students on large college campuses. Through spontaneous events and activities, students will be able to make friends and connect to their local community.

Golfler is a mobile application that helps golf courses route food and beverage orders and tee time booking, as well as range-finding, scorecards, weather, and pace-of-play tracking. Golfler brings the amenities of the clubhouse to a golfer's phone, and helps golf courses provide value throughout the game.

Protection provides affordable and convenient mobile device warranties. The Protection plan offers same-day repairs, half off the repair cost, and a low monthly price. Protection partners with repair stores across the United Sates to help consumers save money on their phone insurance.

York Project is a clothing company that pairs sales with layers of support for homeless men and women in the United States. For every garment sold, a care package is donated to a regional shelter. York's business model also creates training and work opportunities for homeless individuals in their manufacturing and production process.

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