



MSU INNOVATION CENTER

2015 Annual Report



MICHIGAN STATE
UNIVERSITY



The MSU Innovation Center

The MSU Innovation Center combines technology commercialization, new company start-up support, and a portfolio of dedicated business and community partnerships to bring cutting-edge ideas to the marketplace. It is composed of Business-CONNECT, MSU's corporate relations office; MSU Technologies, the University's tech transfer office and Spartan Innovations, a company that starts companies.

The MSU Innovation Center stewards faculty, student and commercial partner ideas, bringing more than 150 discoveries annually into a

pipeline of patents, products and start-up businesses. Together, these solutions help build a diversified economy and jobs for Michigan.

MSU Innovation Center Members

Left to Right, Front Row: Angelia VanWoert, Charlene Fortin, Lori Fischer, Dave Washburn, Charles Hasemann, Rich Chylla, Anne DiSante, Ed Kim, Guangming He, Ray DiVito

2nd Row: Christi Lilleboe, Karen Studer-Rabler, Jen Folger, Janelle' Flores, Tana Boehm, Randy Sheets, Jeff Myers, Marta Sinclair, Jody Lancia, Sandy Clough, Ann Spalding

3rd Row: Randy Ramharack, Andy Newton, Amber Shinn, Tom Herlache, Paul Jaques, Reanee Unger, Brad Shaw, Ryan Jankovic, Jean Zwier

Not pictured: Brice Nelson, Andy McColm, Brian Polowniak, Suzanne Summers, Tina Ramos, Melanie Adkins, Karen Mackie, Michael Medvec, Greg Sadler, Ian Charles.



More than 150 years ago, our University was founded with a mission to create innovative solutions in agriculture, education and engineering, and to disseminate that knowledge to help advance the well-being and economic prosperity of the State of Michigan.

Our early land grant college advanced fundamental aspects of the way we eat, the way we learn, and the way we travel. This uncommon knowledge was propagated across the state and across the nation as students took what they learned back to farms, schools and industry, and collectively moved their communities forward. What began as a Michigan experiment became the national model for land grant universities—learning institutions that focus on translating knowledge to value for the United States and beyond.

The MSU Innovation Center is an important part of a 21st century implementation of that Land Grant heritage; we are dedicated to building strong research partnerships and fulfilling the challenge of finding practical and commercial applications for our scientific research and technological innovation. By helping to establish research

partnerships with companies, patenting the innovations of our faculty, and licensing technologies to partners, we move the University's intellectual capital into the able hands of entrepreneurs and major enterprises alike. The pages that follow share several examples from 2015, **including a collaboration with Exxon Mobil to create sustainable fuels for our future (page 23); the third edition of the Connected Math Project teaching children across the country (page 15); and new ways to harness thermoelectric energy (page 22).**

Moving great ideas from the laboratory to a patent office filing to a license to practice in the marketplace is a complex endeavor that may take years to complete. **2015 was a great year for MSU licensing activity, we enjoyed a 120% increase in revenue this year, earning \$9.37M in FY15, up from \$4.26 in FY14.** In the hands of the MSU Foundation, that revenue is used to fund research projects, professorships, and future commercialization efforts—a virtuous cycle. I congratulate our tech transfer staff and our innovative faculty and commercial partners for making this a very successful year.

Last, but not least, we celebrated the expansion of The Hatch this year, our student entrepreneurship and startup space. The Hatch is supported by a partnership among Michigan State University, MSU Federal Credit Union, and LEAP. The expansion allows us to serve more students, with deeper support. In the last year, we welcomed more than 180 student startup teams, and provided everything from business model assistance, to getting legal help, to a clever company name and web site, all in the fun and nurturing environment of The Hatch.

I invite you to read about our plans and progress in the following pages, and to join us as we work together to grow ideas into business success stories.

Charles A Hasemann, PhD

Assistant VP for Innovation & Economic Development

MSU Innovation Center & MSU Business-CONNECT, President, Spartan Innovations, L3C

MSU Innovation Center by the Numbers

— since —
2012



3 Departments: Business-CONNECT,
MSU Technologies, Spartan Innovations



36
Full-time staff



483
Active Licenses



376 Inventions available
for license on
technologies.msu.edu

See more at msu.technologypublisher.com



\$4.3M
to
\$9.4M

**120% Growth in
licensing revenue**



10%
Year-over-year growth in
corporate partnerships



4 GreenLight-hosted startup
events around the state
Detroit, Port Huron, Flint and
East Lansing



156
to
183
Growth of student teams in
Spartan Innovations/Hatch

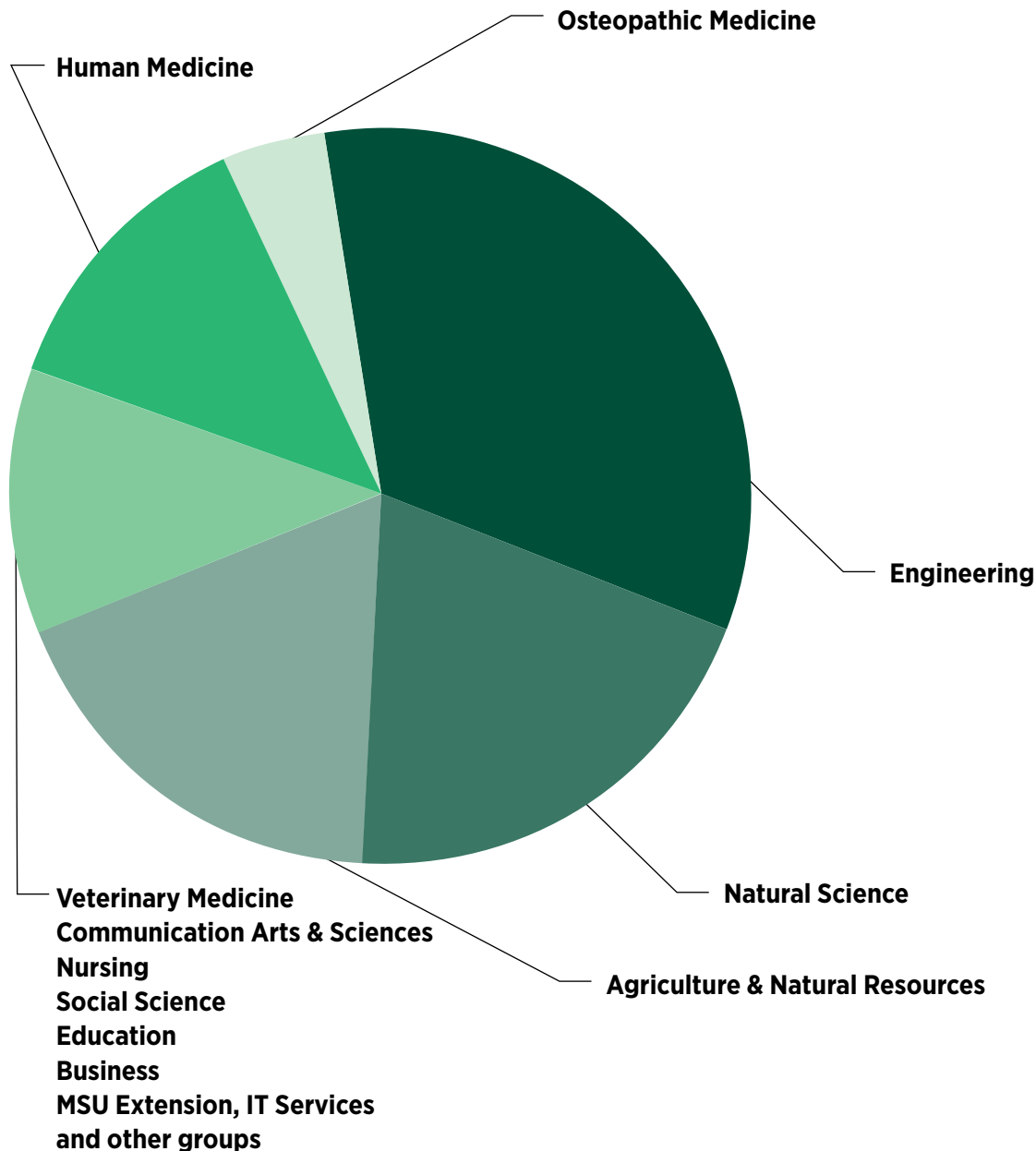
423
Inventors Engaged

\$1,524,034.76
royalties paid to MSU inventors
and authors in the last year

149
Community startup events
hosted in the 300 room

15%
Increase in disclosures
130 to 149

Invention disclosures by departments



DEPARTMENTAL DISCOVERY

Arts & Letters/Theater | Theatre2Film Project

Animal Science | Methods for Generating Induced Pluripotent Stem Cells

Entomology | Plant Based Biopesticides

Computer Science | Facial Recognition and Matching Technology, with Face Attribute Estimation

Computer Engineering | Plasma-Based 3-D Printer Technology

Environmental Engineering | Portable RGB Reflection Photoelasticity Using Smartphones/PDAs

Electrical Engineering | Wearable Brain-Sensing System for Early Neurological Disorder Detection

Mechanical Engineering | Liquid-Activated Biosensor Textiles and Platform

Human Medicine | Inhibition of Mycobacterium Tuberculosis Virulence

Horticulture | Day Neutral Strawberry

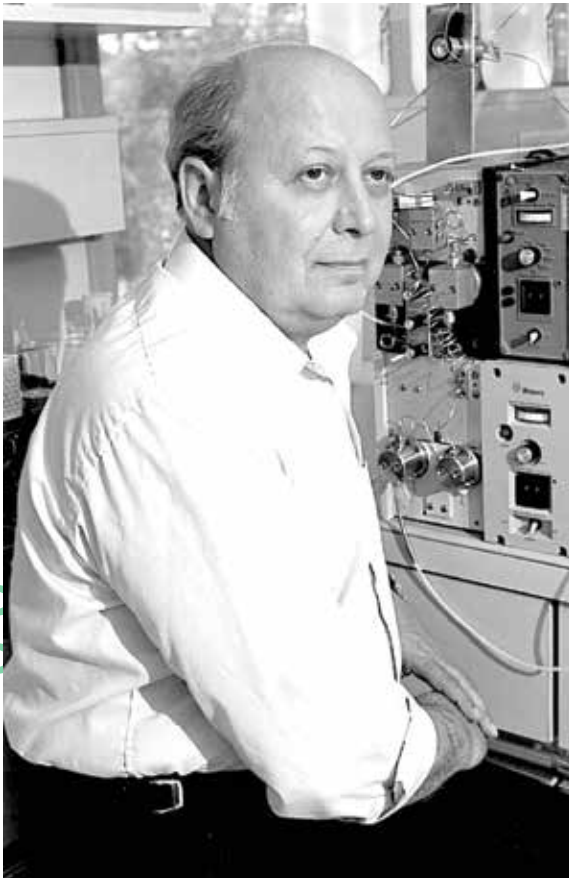
Physiology | Method for the Treatment of Fragile X Syndrome and Autism

Chemistry | Isolation and Purification of Shikimic Acid

Vet Medicine | A Dietary Supplement for Post-Exercise Recovery in Equine Athletes



Anniversary of Discovery



This year marks the 50th anniversary of Cisplatin's discovery as an anti-cancer drug here at Michigan State University. Cisplatin (and its updated form, carboplatin) is known to be the "penicillin of cancer drugs," because it has been one of the first, most widely-prescribed, and most effective treatment for many cancer diagnoses.

When designing and evaluating new cancer treatments, current-day researchers use the Cisplatin model as a gold standard to compare new medicines. Cisplatin may be best known for its role in helping Tour de France winner Lance Armstrong fight testicular cancer.

Cisplatin interferes with the growth of cancer cells, slowing their advance in the body. It is used to treat many types of cancer, but it is most widely prescribed for testicular, ovarian, bladder, lung, and stomach cancers. Platinum drugs are now used in 40% of all chemotherapy treatments.

Cisplatin's origins began well before 1965, in 1844, when it was first created by Italian chemist Michele Peyrone. For a long time it was known as Peyrone's chloride. But the really important



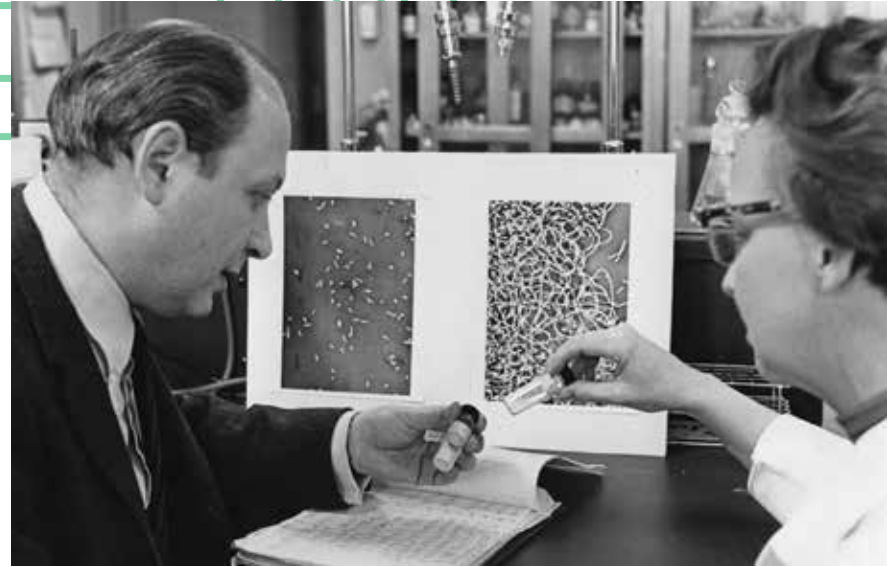
event was its fortuitous discovery as a cancer treatment by Barnett Rosenberg, a biophysical chemist at Michigan State University.

At the time, Rosenberg was trying to study the effect of electric fields on bacterial growth. During his experiments, he found bacteria grew 300 times their normal size but never divided, a very unusual result, when he used platinum electrodes to generate the electric fields. It took a while to figure out what was going on, but in the end he discovered the platinum electrodes were corroding in the test solution, producing Cisplatin.

Rosenberg published his remarkable findings in the journal *Nature* in 1965, and three years later, published another paper showing Cisplatin could cure tumors in mice.

Cisplatin has been widely used as a treatment for cancer since its approval by the US Food and Drug Administration in 1978. And while five other platinum drugs based on the structure of Cisplatin have been developed since, it has never been replaced.

This has completely changed how some cancers are treated. For instance, before Cisplatin's discovery the cure rate of testicular cancer was just 10%, but when combined with early detection the cure rate is now approaching 100%.



Rosenberg retired from Michigan State University in 1997 and continued research at his private laboratory, the Barros Research Institute in Holt, Michigan. Rosenberg passed away in the summer of 2009, but the royalties from Cisplatin and Carboplatin still provide great benefit to MSU.

All licensing royalties from MSU-owned innovations are transferred to the MSU Foundation, a non-profit corporation designed to support research at MSU. The MSU Foundation currently manages approximately \$425M, mostly derived from the Cisplatin and Carboplatin royalties. Cooperation between the MSU Foundation and the MSU Innovation Center helps create a virtuous cycle of reinvestment in commercializing technologies that serve the greater good. Years after the expiration of the patents, the licensing revenue received from Cisplatin and Carboplatin continue to deliver benefits to the MSU enterprise.



2015 Innovation Celebration

Held in the Huntington Club at Spartan Stadium, the MSU Innovation Celebration is an annual spring event that brings together University and community to honor MSU innovators and showcase several of the many inventions and innovations developed at MSU.

Technologies 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 the faculty and student excellence and innovation taking place across campus, and 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 2014's most exceptional innovator, and two exceptional innovations.

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 innovations developed at MSU to the marketplace, to celebrating more world-changing ideas, and to advancing the common good in uncommon ways for many years to come.

TECHNOLOGIES ON DISPLAY

Precision Agricultural Technology | Bruno Basso

Phenometric Plant Growth Chamber | David Kramer

UNRAVEL: A Cognitive Task for Measuring Human Performance
Erik Altmann

Transparent Solar Technology | Richard Lunt

Carbon Fiber Technology for Graphite & Composite Technology
Larry Drzal

Variable Optical Control for Data Communication
Nelson Sepúlveda-Alanastro

Purification Membrane for Protein Biotherapeutics | Merlin Bruening

Osteoporosis Technologies | Laura McCabe

MSU Startup: TreeBorn Products | Brian Polowniak, CEO;
Dennis Fulbright, CTO

MSU Student Startup: TheraB Medical | Ryan Jankovic, CEO

MSU Student Startup: Tech Twurl | Usman Majeed, Patrick Chouinard,
Russell Schafer

MSU Student Startup: OneSound | Adam Schoonmaker, Phil Prescher,
Ryan Casler, Tanay Salpekar

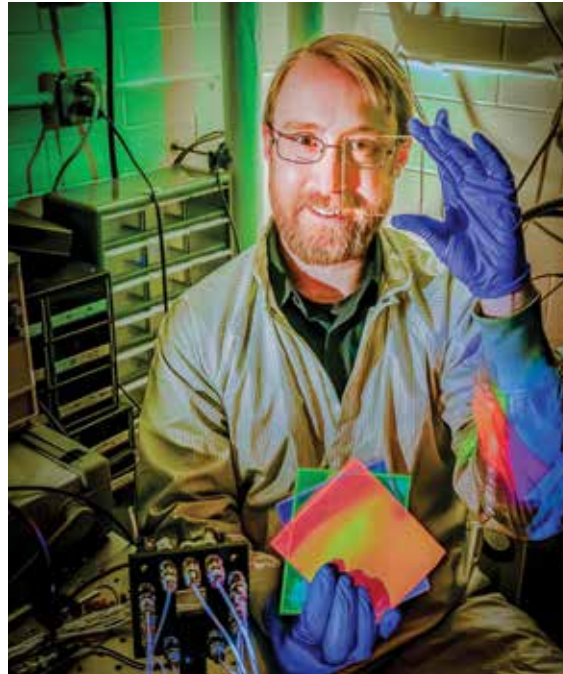


Innovator of the Year

Dr. Alvin Smucker

Professor of Soil Biophysics in the Department of Plant, Soil and Microbial Sciences

Dr. Smucker's research focuses on water retention of soils, particularly the application of subsurface water retention technologies. Drawing on decades of research on plant root systems, Dr. Smucker filed seven invention disclosures with MSU since 1981, earning three patents to-date. His innovative method of improving water retention, especially for sandy soils in arid regions, reduces irrigation demands, and boosts the efficacy of traditional agricultural practices.



2015 Innovation of the Year I

Dr. Richard Lunt

Assistant Professor in the Department of Chemical Engineering & Material Science

Transparent solar concentrators can be deployed on existing infrastructure to discretely harvest solar energy. Former attempts at transparent photovoltaics have fallen short, coloring or dimming the light that passed through them. Now, new solar materials can be installed on nearly any transparent surface without affecting the incoming light. Small organic molecules within the concentrator can be tuned to absorb only non-visible wavelengths, allowing natural visible light to pass through. Solar power is converted to electricity by thin photovoltaic strips. This technology is a flexible and inconspicuous means of harvesting solar energy that can be integrated onto building windows and mobile electronic displays.

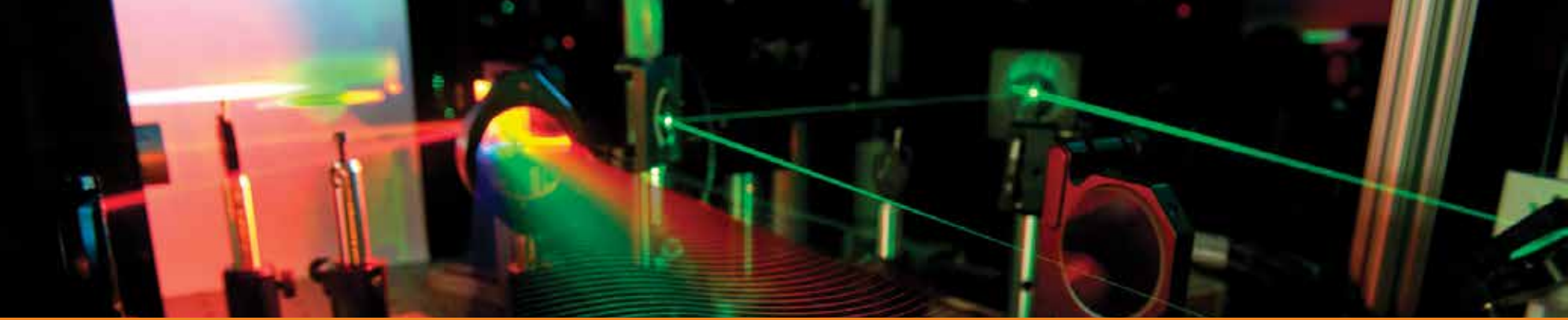


2015 Innovation of the Year II

Dr. Merlin Bruening

Professor in the Department of Chemistry

The technology Dr. Bruening developed is a method of rapidly and elegantly generating a high density of functionalized membranes at controlled pH. These membranes are useful for an array of applications related to protein purification. The membrane generation process is easily implemented, scalable, inexpensive, and yields membranes with markedly improved surface areas. Increased surface area corresponds directly with an improved overall protein binding capacity of the membrane. All of these qualities combined make this an incredibly powerful tool for academic research and industry for the study and isolation of protein biotherapeutics.



Inventors and Inventions



Erik Altmann

UNRAVEL: A Cognitive Task for Measuring Human Performance

Developed with Kimberly M. Fenn and David Z. Hambrick, Altmann's UNRAVEL task is a Python-based software technology that assesses placekeeping and other abilities and aptitudes.



Lawrence Drzal

Graphene Nanoplatelets for Multifunctional Composite and Energy Technology

Drzal and collaborators developed a suite of technologies focused on improving graphite production and applications for use in energy storage and conversion, photovoltaics and polymer nanocomposites.



Laura McCabe

Osteoporosis Treatment Technologies

This treatment for osteoporosis significantly enhances bone density in menopausal and colitis models, with qualities known to prevent gut inflammation. Treatment can be administered orally, so patients diagnosed with osteoporosis can avoid painful and inconvenient injections.

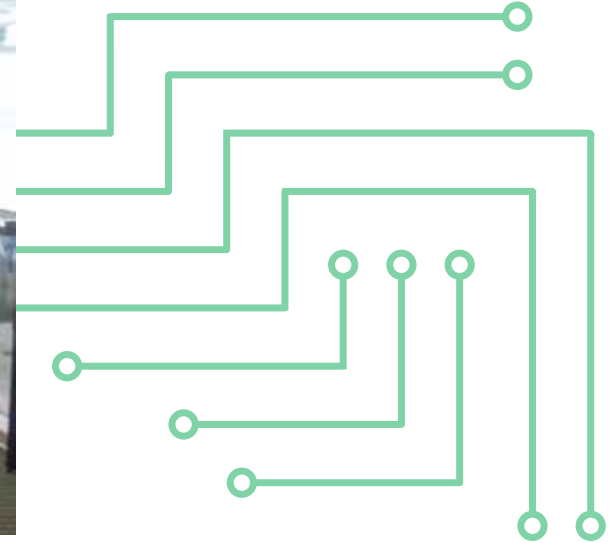


Nelson Sepúlveda-Alancastro

Variable Optical Control for Data Communication

This variable optical attenuator for infrared wavelengths features an integrated sensing system, and accommodates a large range of attenuation while only using a very small amount of power.

National Academy of Inventors



Michigan State University launches its own chapter of the National Academy of Inventors (NAI) on Wednesday April 23. Nineteen faculty members make up the inaugural Chapter, which includes MSU NAI National Fellows, Drs Stephen Hsu, Satish Udpa and Marcos Dantus.

This inaugural class includes the following members:

- **Evangelyn Alocilja**, Biosystems and Agricultural Engineering
- **Dean Aslam**, Electrical and Computer Engineering
- **Jes Asmussen**, Electrical and Computer Engineering
- **Bruce Dale**, Chemical Engineering and Materials Science
- **Christoph Benning**, Biochemistry and Molecular Biology
- **Marcos Dantus**, Chemistry
- **Larry Drzal**, Chemical Engineering and Materials Science
- **James Jackson**, Chemistry
- **Anil Jain**, Computer Science and Engineering
- **Dennis Miller**, Chemical Engineering and Materials Science
- **Norbert Mueller**, Mechanical Engineering
- **Muralee Nair**, Horticulture
- **Ramani Narayan**, Chemical Engineering and Materials Science
- **Donald Penner**, Plant, Soil and Microbial Sciences
- **Thomas Pinnavaia**, Chemistry
- **Robert Worden**, Chemical Engineering and Materials Science
- **Ning Xi**, Computer Science and Engineering
- **Stephen Hsu**, Physics
- **Satish Udpa**, Electrical and Computer Engineering

Inventors and Inventions



2015 Inventors

A-G

Robert Abramovitch
 Christoph Adami
 John Albrecht
 Yasser Aldhamen
 Evangelyn Alolcija
 Erik Altmann
 Andrea Amalfitano
 Sunpreet Arora
 Syed Hasan Arshad
 Aaron Asher
 Dean Aslam
 Jes Asmusen
 Senem Aykul
 Safoi Babana-Hampton
 Seungik Baek
 Aparajita Banerjee
 Randolph Beaudry
 Andre Benard
 Mohammed Ben-Idris
 Christoph Benning
 Subir Biswas
 Gary Blanchard
 Georg Bollen
 Saswata Bose
 Brian Bowe
 John Boyse
 Andrea Bozoki
 Merlin Bruening
 Lena Brundin
 C. Robin Buell
 Tyson Burghardt
 Niannian Cai
 Kai Cao
 Premjeet Chahal
 Shantanu Chakrabartty
 Mei-Wei Change
 Kamal Chauhan
 Jin Chen
 Martin Chilvers
 Jongeun Choi
 Andrew Christlieb
 Jose Cibelli
 Teresa Clark-Jones
 Dirk Colbry
 Timothy Collier
 Christopher Colvin
 Li Cui
 Marcos Dantus
 Isabel David
 Noraica Davilamelendez
 Nikolay Dimitrov
 Cheryl Doane
 Ke Dong
 Jinlan Dong
 Bo Dong
 Lawrence Drzal
 Swarnavel Eswaran Pillai
 Susan Ewart
 Deborah Feltz
 John Foss
 Eric Freedman
 John Frost
 Karen Frost

Wenjiang Fu
 Masanori Fujimoto
 Ryan Gallant
 Reginald Garavito
 Matthew Gattinger
 Barbara Given
 Charles Given
 Ankush Gokhale
 Maria Elena Gonzalez-Munoz
 Sherman Gorbis
 Amelia Gotwals
 Merrill Gould
 Timothy Grotjohn
 Yajun Gu
 Cuihua Gu

H-L

Troy Hale
 Raymond Hammerschmidt
 James Hancock
 Raza Haque
 Salah Hassan
 David Hodge
 Tim Hogan
 John Holloway
 Samuel Hoole
 Paul Hoole
 Samuel Hoole
 Alessandra Hunter
 Amy Iezzoni
 Janette Jacobs
 Anil Jain
 Paramsothy Jayakumar
 Krishnamurthy Jayaraman
 Sanghyup Jeong
 Shaowen Ji
 Ning Jiang
 Benjamin Johnson
 Shawn Kaeppler
 Nicholas Kanaan
 Linzi Kaniszewski
 Wilfried Karmaus
 Victor Karthik
 Amanpreet Kaur
 Linda Keilman
 James Kelly
 Christopher Kemp
 Niesa Kettler
 Matti Kiupel
 David Kramer
 Nicholas Kuuttilla
 Amy Lager
 Jean Lakin
 Scott Larsen
 Matthew Larson
 Ilsoon Lee
 Cheryl Leece
 Hao Li
 Wei Liao
 Chae Young Lim
 Jack Lipton
 Yan (Susie) Liu
 Weijing Liu
 Eryun Liu

Xiang-Yang "Alex" Liu
 Brenda Long
 Vadim Lozovoy
 Xu Lu
 Jing Lu
 Jue Lu
 Richard Lunt

M-S

Burra Madhukar
 Tapabrata Maiti
 Robert Maleczka
 Fredric Manfredsson
 Terence Marsh
 Victoria Marshall
 Erik Martinez-Hackert
 Laurent Matuana
 Michael McIntyre
 Collin Meierbachtol
 Rodrigo Menezes
 Emmanuelle Merced-Grafals
 Kenneth Merz
 Dennis Miller
 Joydeep Mitra
 Kevin Moran
 Donald Morelli
 Daniel Morris
 Abdul Motin
 Justin Mrkva
 Norbert Mueller
 Thomas Mullaney
 Philip Myers
 Shreya Nad
 Rance Nault
 Brian Neal
 Zachary Neal
 Richard Neubig
 Bai Nie
 Wenjing Ning
 Susan Nitzke
 Janet Olsen
 Randal Olson
 Jossian Oppenheimer
 Elisabeth Ostendorf
 Hasan Otu
 Cory Outwater
 Vidvuds Ozolins
 Karen Pace
 Pablo Parraga-Ramirez
 Nicholas Paulter
 Cyril Payen
 Lars Peereboom
 Fang Peng
 Karin Pfeiffer
 Jason Piwarski
 Farhang Pourboghra
 Kamala Qalandar
 Rahul Rane
 Gavin Reid
 Weijie Ren
 Ken Resnicow
 Ryan Ringle
 Wanda Roberts
 J. Alejandro Rojasflechas

Trevor Ruckle
 Jeffrey Sakamoto
 Stephen Samendinger
 Oishi Sanyal
 Trey Sato
 Harold Schock
 Harold Scott
 R. Taylor Scott
 Kim Scribner
 Nelson Sepulveda Alancastro
 Muhammad Shahzad
 Thomas Sharkey
 Steven Shaw
 Sivamayam Sivasuthan
 Milton Smith, III
 David Smithe
 Guo-Qing Song
 Nancy Songer
 Caryl Sortwell
 Dana Spence
 Kathy Steece-Collier
 Brian Strachan

T-Z

Deimante Tamkus
 Volodymyr Tarabara
 Jose Teixeira
 Oliver Tessmer
 Michael Thomas
 Nicholas Thrower
 Ravi Thyagarajan
 Edward Timm
 Erica Tobe
 Eric Torng
 Nathalie Trottier
 Chia-Hong Tsai
 Kimberly Turner
 Lalita Udpa
 Satish Udpa
 Christine VanderVoort
 Dechun Wang
 Ryan Warner
 Christopher Waters
 Evan Wegener
 Sainan Wei
 Salinda Wijeratne
 Curtis Wilkerson
 John Wise
 Peng Xu
 Lei Xu
 Shuitao Yang
 Chaofeng Ye
 Soweon Yoon
 Jing Yu
 Mingquan Yuan
 Timothy Zacharewski
 Geraldine Zeldes
 Hongmei Zhang
 Liangliang Zhang
 Dongyan Zhao
 Yimu Zhao
 Zheng Zheng
 Guoming Zhu
 Ali Ziyab

2015 Licensed Technologies (January 1–December 31, 2015)

A Method to Produce 3-acetyl-1, 2-diacyl-sn-glycerols (ac-TAGs) by Expression of an Acetyltransferase Gene Isolated from *Euonymus alatus*

Inventors: Timothy Durrett, John Ohlrogge, Michael Pollard
Licensee: WinnowGen, Inc.

B10244 Black Bean “Zenith”

Inventor: James Kelly
Licensee: Michigan Crop Improvement Association

Be SAFE: Safe, Affirming and Fair Environments

Inventors: Janet Olsen, Karen Pace
Licensee: National 4-H Council

Biocatalytic Synthesis of Quinic Acid

Inventors: John Frost, Karen Frost
Licensee: KeraFAST, Inc.

Canine Serum

Inventors: Niesa Kettler, Thomas Mullaney
Licensee: Zoetis LLC

Conventional Soybean Varieties

Inventor: Dechun Wang
Licensee: Michigan Soybean Promotion Committee

Conventional Soybean Variety E07051

Inventors: John Boyse, Cuihua Gu, Dechun Wang
Licensee: Michigan Soybean Promotion Committee

Conventional Soybean Variety E10174

Inventors: John Boyse, Cuihua Gu, Dechun Wang
Licensee: Michigan Soybean Promotion Committee

Conventional Soybean Variety E11399

Inventors: John Boyse, Cuihua Gu, Dechun Wang
Licensee: Michigan Soybean Promotion Committee

COSY Infinity (software)

Inventors: Martin Berz, Georg Hoffstaetter, Weishi Wan, Kyoko Makino, Jens Hoefkens, Bela Erdelyi
Licensee: Battelle Energy Alliance, LLC

Coursera Online Specialization—Game Design and Development

Inventors: Casey O'Donnell, David Wheeler, Brian Winn
Licensee: Coursera, Inc.

Dollar Spot-Resistant Creeping Bentgrass Strains “Flagstick”

Inventors: A. Ronald Detweiler, Joseph Vargas
Licensee: DLF Pickseed USA

E6012 Soft White Winter Wheat

Inventors: Janet Lewis, Eric Olson, Lee Siler, Richard Ward
Licensee: Michigan Crop Improvement Association

Enzymes and Genes to Produce Triacylglycerols, Including sn-3-Acetyl Triacylglycerols

Inventors: Anne Milcamps, David Pan, Michael Pollard
Licensee: WinnowGen, Inc.

Food-Grade Soybean Variety E07130-T

Inventors: John Boyse, Cuihua Gu, Dechun Wang
Licensee: Michigan Soybean Promotion Committee

GeoYields (software)

Inventor: Bruno Basso
Licensee: CiBO Technologies, Inc.

Imported from China (film)

Inventors: Troy Hale, Geraldine Zeldes
Licensee: University of Washington

Improved Luminescent Solar Concentrator for Opaque, Semitransparent, and Transparent Applications

Inventor: Richard Lunt
Licensee: Ubiquitous Energy, Inc.

Insect Cell Lines for Use in Baculovirus Expression Vector System (BEVS)

Inventor: Suzanne Thiem
Licensee: BioMarin Pharmaceuticals, Inc.

iSleep: Unobtrusive Sleep Monitoring System Using Smartphones

Inventors: Tian Hao, Guoliang Xing, Gang Zhou
Licensee: Hao Tech, LLC

Isolation and Purification of Shikimic Acid

Inventors: John Frost, Karen Frost
Licensee: KeraFAST, Inc.

KECSA—Movable Type Implicit Solvation Model (KMTISM)

Inventors: Kenneth Merz, Zheng Zheng
Licensee: QuantumBio Inc.

Laser Pulse Fidelity Measurement

Inventors: Marcos Dantus, Vadim Lozovoy, Bai Nie
Licensee: Biophotonic Solutions, Inc.

Manistee MSL292—A Potato Variety

Inventors: Joseph Coombs, David Douches, Christopher Long
Licensee: Hansen Seed Potatoes, LLC

Methods and Apparatus for Determining Arterial Pulse Wave Velocity

Inventors: Mingwu Gao, Mohsen Moslehpour, Ramakrishna Mukkamala, Da Xu, Guanqun Zhang
Licensee: Retia Medical, LLC

Methods and Systems for Cropland Evaluation and Crop Growth Management

Inventor: Bruno Basso
Licensee: CiBO Technologies, Inc.

Monitoring and Optimizing Breath and Footsteps During Exercise Using Smartphones

Inventors: Tian Hao, Guoliang Xing, Gang Zhou
Licensee: Hao Tech, LLC

Mothers In Motion (health and wellness intervention)

Inventors: Mei-Wei Chang, Susan Nitzke, Ken Resnicow
Licensee: Michigan Department of Health and Human Services

N11283 Navy Bean “Alpena”

Inventor: James Kelly
Licensee: Michigan Crop Improvement Association

Natural Mineral Tetrahedrite as a Direct Source of Thermoelectric Materials

Inventors: Xu Lu, Donald Morelli
Licensee: Alphabet Energy Inc.

Near-Infrared Harvesting Transparent Luminescent Solar Concentrators

Inventors: Richard Lunt, Yimu Zhao
Licensee: Ubiquitous Energy, Inc.

Non-Tinted UV Luminescent Solar Concentrator Composed of Inorganic Phosphors for Opaque, Semitransparent, and Transparent Applications

Inventors: Richard Lunt, Yimu Zhao
Licensee: Ubiquitous Energy, Inc.

Novel Alkaline Synthesis of Biocompatible Gold Nanoparticles Using Dextrin as Reducing and Capping Agent

Inventors: Evangelyn Alocilja, Michael Anderson, Edith Torres-Chavolla
Licensee: Aqua Clara International, Inc.

One-Pot Synthesis of Chitosan-Coated Iron Oxide Nanoparticles (ChION) and Extraction Assay of Bacteria and Proteins From Biological Matrices

Inventor: Evangelyn Alocilja
Licensee: Aqua Clara International, Inc.

PBS-12SF Cells: An Immortalized Chick Cell Line for Production of Human and Veterinary Vaccines

Inventors: Christopher Colvin, Paul Coussens, Patty Dickerson-Weber, Kristen Smith (Pabst)
Licensee: Boehringer Ingelheim Vetmedica GmbH

SALUS (Systems Approach to Land Use Sustainability) Model

Inventors: Bruno Basso, Joe Ritchie
Licensee: CiBO Technologies, Inc.

Science Teacher Professional Development Materials for Improving Teachers' Content Knowledge

Inventors: Jan Eberhardt, Joyce Parker
Licensee: National Science Teachers Association

Several Elite Stevia Testing Lines

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

Soybean Line E11431

Inventors: John Boyse, Cuihua Gu, Dechun Wang
Licensee: Michigan Soybean Promotion Committee

Stable, High Potential Redox Shuttles for Overcharge Protection in Lithium Batteries

Inventors: Nicholas Boersma, Matthew Gregory, Thomas Guarr, Nicholas Mortimer, Robert Polik
Licensee: Jolt Energy Storage Technologies, LLC

Stevia Variety ‘10-43’

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

Stevia Variety ‘10-43-3’

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

Stevia Variety ‘12-05-005’

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

Stevia Variety ‘12-05-144’

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

Stevia Variety ‘12-05-149’

Inventors: Randolph Beaudry, James Hancock, Ryan Warner
Licensee: PureCircle Sdn. Bhd.

System for Large-Scale Face Retrieval

Inventors: Anil Jain, Charles Otto, DaYong Wang
Licensee: NEC Corporation of America

That Strange Summer (film)

Inventor: Geraldine Zeldes
Licensees: Ann Arbor District Library, Comcast Cable Communications Management, LLC, Detroit Free Press, Filipino American National Historical Society—Michigan Chapter, Schoolcraft College

Thermoelectric Materials Based on Tetrahedrite Structure for the Thermoelectric Devices

Inventors: Xu Lu, Donald Morelli, Vidvuds Ozolins
Licensee: Alphabet Energy Inc.

Thermoelectric Materials Based on Tetrahedrite Structure with Modified Composition for Thermoelectric Devices

Inventors: Xu Lu, Donald Morelli, Vidvuds Ozolins
Licensee: Alphabet Energy Inc.

Utilization of Waste Stillage from Existing Corn Ethanol Dry Mills as Synergistic Additive for Enzymatic Hydrolysis and Fermentation of Lignocellulosic Biomass

Inventors: Venkatesh Balan, Shishir Chundawat, Bruce Dale, Leonardo da Costa Sousa
Licensee: Valicor Separation Technologies, LLC



In Focus

MSU MTRAC Programs Define the Future of Bio-Based Products

Supported by the MSU Innovation Center, the Office of the Vice President for Research and Graduate Studies, the College of Natural Science, and the College of Engineering, the Michigan Translational Research and Commercialization (MTRAC) Program for the Bio-Economy was established through a grant from the MEDC 21st Century Jobs Trust Fund, with matching funds from MSU for a total of \$2.4M. These funds are focused on one of the University's core strengths: Ag/Bio-based materials science and technology.

Ideal candidates are MSU biotechnology and bioprocessing innovations that have the potential to create superior and sustainably-produced products and materials. Projects will have shown promise in the laboratory, but need further development in order to become successful in a competitive market. The following are examples of BioAg projects selected for grants to help make them broadly available for consumer use.

Bruce Dale

Commercialization of AFEX-Treated Biomass as an Animal Feed for Beef Cattle
In collaboration with Bernie Steele and Bryan Bals at MBI

MTRAC funding of this project has allowed Dr. Dale's team to scale up ethanol production from AFEX pellets to a commercial scale of 3000L, and conduct animal feed trials with beef cattle, leading to FDA approval. FDA approval will enable large scale market tests and decrease the risk involved in market penetration. This is part of the long-term goal to build 200 ton/day AFEX depot facilities that will be capable of producing enough feed for approximately 50,000 cattle on multiple feedlots.

Gemma Reguera

Microbial Electrochemical Reactors (MERs)

The MER developed by Dr. Reguera provides a proof-of-concept that her reactor can produce high value chemicals without being inhibited by the waste byproducts that typically build up in similar processes. Dr. Reguera will work to produce the polymer precursor 1,3-propanediol (PDO) using glycerin as a substrate. 1,3-PDO can be formulated into a variety of industrial products including composites, adhesives, laminates, and polyesters.

John Frost

Synthesis of Biobased p-Hydroxybenzoic Acid (pHBA) at Kilogram Scale

Dr. Frost has developed an improved fermentation process to produce shikimic acid, most commonly used as the starting material in the manufacture of the anti-influenza drug Tamiflu. With MTRAC funding, his lab will be able to scale-up and further improve the microbial synthesis and purification of this specialty chemical for commercial production.



The Connected Math Project

Meeting middle school math needs in schools and online

In the early 1980s, MSU mathematics researchers Glenda Lappan and Elizabeth (Betty) Phillips were working with middle school students, seeking a new way to help students grasp math concepts at a pivotal point in their education.

The Connected Math Project was created to better assist students and teachers in developing mathematical knowledge, skills, understanding and an appreciation of the connection between mathematics and other disciplines.

The first units were published in 1985, and used by teachers to make a transition away from traditional “show and practice” methods of teaching. Each unit was focused on a different area of mathematics and encouraged students by illustrating math in “real world” problem-solving situations. CMP is designed to adapt to changing needs of students and instructors in the classroom.

In 1991, the National Science Foundation funded the first installment of CMP. Through this NSF funding, schools were able to create richer educational opportunities for students and teachers. A second revision was completed in 2000, and a third in 2010 reflected additional research and fully integrates Common Core State Standards for Mathematics.



The third edition of CMP is currently Michigan State University’s highest-grossing educational product, earning more than \$4.8M in the last year alone. Built with robust online resources to support the millions of copies in middle schools across the country, CMP is published by Pearson Education, Inc.



We cannot tell the story of the Connected Math Project without also recognizing the contributions of MSU Technologies technology manager Kari Haldenwanger. Kari was instrumental in guiding the growth and evolution of CMP.

A Chemistry graduate of Lawrence Technological University, Kari worked in the automotive

industry for more than 13 years before coming to MSUT. As a materials engineer, she was part of one of the first initiatives to use recycled plastics in new automobile construction and worked as a senior buyer of automobile safety systems and technologies.

When we lost Kari to cancer in April, 2015, the University lost a keen technology commercialization expert, researcher advocate, and friend.

Startup Spotlight



TheraB Medical Inc.

TheraB Medical Inc. (TheraB) was originally developed by MSU biosystems engineering students Oliver Bloom, Vu Hoang, and Alexa Jones, and later launched with the help of \$150,000 in pre-seed stage funding from Quantum Medical Concepts, a Michigan-based medical sector investment firm.

TheraB developed the SnugLit Portable Phototherapy Blanket, a wearable swaddle that treats newborn jaundice. Jaundice is caused by a high level of pigment in the blood called bilirubin, which causes the skin to look yellow. A newborn baby's still-developing liver may not yet be able to remove this bilirubin from the blood. TheraB's swaddle provides the blue light needed to help the newborn break down the bilirubin molecules as the liver develops.

The unique SnugLit swaddle design promotes parent-infant bonding while decreasing the stress to mother and baby, and allows for easier breastfeeding. Traditional treatments may include separating mother and infant treating the child on a light board, or the use of bulky non-portable blankets. The SnugLit swaddle design is a more intimate and more cost-effective method of treating jaundice.

TheraBMedical.com



TreeBorn Products

This startup company has found a way to apply Michigan's role as first in chestnut production to the booming microbrew industry. Treeborn Products craft-roasts chestnuts to be used in the brewing process for both gluten-free and regular ales, stouts and porters. Their craft-roasting process helps maximize chestnuts' naturally sweet, nutty flavor.

While chestnuts have been used extensively as a brewing ingredient in Europe, Treeborn's product brings chestnuts to the American brewing market in the form of flavorful, easy-to-use chips that can be applied at all stages of brewing.

More than 40 breweries around the world partner with Treeborn to enhance their beers. In Michigan, Jolly Pumpkin Brewery in Dexter, MI uses chestnut chips to produce Fuego del Otono: The Fire of Autumn. Brewmasters from Short's Brewing Company add chestnuts to their Bellaire Nut Brown Ale. Glutenberg Brewing Company in Montreal uses Treeborn chestnuts as the base of their award-winning gluten-free Red.

TreebornProducts.com

CiBOTechnologies

CiBO Technologies is an analytical software system that incorporates previous innovations in agricultural simulation alongside real-time weather monitoring, remotely sensed imagery, spatial yield data, and information gathered by Unmanned Aerial Systems (UAS). This comprehensive crop yield model system is founded on research conducted by Michigan State Professor Bruno Basso, and will give farmers and researchers greater control over field management.

CiBO Technologies' drones are able to measure crop reactions to a variety of stresses including drought, pests and nutrient deficiencies. This knowledge allows farmers to address issues in their fields and specific problem locations, eliminating the guess and check method of field problem solving.

Building on decades of research in agricultural yield modeling, CiBO Technologies provides growers the ability to simulate an array of different growing parameters, including water balance, soil organic matter concentrations, nitrogen and phosphorous levels, drainage, root water uptake, soil evaporation, and transpiration. In combination with historic and real-time environmental data, CiBO Technologies allows growers to make critical decisions regarding input and cost, helps to increase yields, and decreases environmental impacts.

CiBOTechnologies.com

Student Startups



TechTwurl

Tech Twurl is a web-based electronics buyback company, specializing in smartphones. Customers have the options of being paid through PayPal, check or Bitcoin.

In 2015 the Tech Twurl team developed a mobile application called Protection to give users instant access to the website offerings and additional features. Protection, introduced at 2015 Student Startup Madness at SXSW Interactive, allows users to buy, sell, and repair their current device as well as purchase a new or used device from Tech Twurl. Usman Majeed is Tech Twurl's CEO, Patrick Chouinard is Chief Data Officer and supply chain major Russell Schafer is Chief Operating Officer.

TechTwurl.com

OneSound

OneSound is a mobile app that allows everyone at an event to be the DJ. Users can create synchronized playlists at your party that stream one sound to one device.

All members of the startup team are computer science majors, and the co-founders met in a computer programming club. While using a music program on the computer with properties similar to OneSound, they noticed areas where improvements could be made, particularly in regards to portability. It was something they all enjoyed using, but agreed should be available on their phones, so they created an app to support their idea. Team members include Adam Schoonmaker, Phil Prescher, Ryan Casler, and Tanay Salpekar.

OneSoundApp.com



LykeMe

LykeMe connects people who have similar social and professional interests within their area. Using this interest and skill profile, this platform is also used to refer users to new—and possibly unknown—events, activities and groups in their area.

LykeMe, founded by Josh Ogundu and Yoseph Radding, hope this platform will connect people of different social, racial, and socio-economic backgrounds. They aspire to show people around the world that everyone is similar, and they believe LykeMe will help people from various walks of life to connect through their similarities rather than focus on their differences.

lykeme.com



York Project

The York project is a streetwear company that specializes in shirts, hats, beanies, and other accessories. They operate with a simple mission: to help those in need, and help make the world a better place to live by donating some of their good fortune to those around them. For every product sold, the startup donates a needed article of clothing to a homeless man or woman in America.

Founded by Josh York, the York Project started as a basement project in Livonia, Michigan in February 2013, and quickly grew. They have since helped more than 8,000 individuals in need in every major region of the country, and work with local college student volunteers to hand out donations in cities around the United States. This socially-conscious startup has been featured in USA Today, the Huffington Post, FOX News and more.

yorkproject.com



Katie Reynard: Fashion for the Fire

In collaboration with the Firecracker Foundation, Raynard is the featured designer for “Fashion for the Fire,” an avant-garde fashion show at The Runway in downtown Lansing.



Pridgit

Nick Lazich talks at Detroit TechWeek about Pridgit, a global marketplace and network where customers can purchase, or create, 3D printable objects.



Entrepreneurship Ecosystem

Building an Entrepreneurship Ecosystem

While entrepreneurship is, at its core, about launching new businesses, we think about it as more than that. Entrepreneurship is a vital life skill that extends far beyond the ability to launch a venture, one that prepares individuals to deal with the rapid changes and complexity of our world. Michigan State University aspires to develop a deeper understanding of the entrepreneur experience, in order to help extend the entrepreneurial mindset to the many, not the few.

We are committed to growing an entrepreneurial ecosystem across the state of Michigan that integrates innovation, technology, business partnerships, and professional support for start-ups and hands-on experimentation.

The voice and experience of real-world entrepreneurs is a key component of our ongoing effort to design, develop and test new education and support solutions. This ecosystem helps move ideas from concept to market, and relies on strong relationships across university units, as well as with community partners and economic development agencies, venture and angel funders, regional accelerators and incubators, and local leaders to create a network of support and success.

GreenLight Business Model Competition

The GreenLight Business Model Competition is a startup event series that brings together entrepreneurs and small business supporters from all over the State of Michigan. In addition to networking with innovators and venture capital investors from across Michigan, participants pitch their new business ideas to a panel of esteemed judges for a chance at winning up to \$50,000 in prizes.

East Lansing's event marks the statewide conclusion of a series of regional pitch competitions designed to support entrepreneurial activity across the state of Michigan. Thanks to support from the Michigan Economic Development Corporation, Spartan Innovations held regional events in Flint, Port Huron and Detroit that culminated in a final event in East Lansing. Finalists from regional events won automatic entries in the final event.

Airway Innovations won the grand prize of \$25,000, with their medical device that helps secure a patient's breathing tube. Whirlpool Corporation partnered with Spartan Innovations and GreenLight Michigan to create the \$5,000 Home & Housewares Award, promoting purposeful innovation that helps homes run smoothly. This was won by AutoMowticCo, "the Eco-friendly, financially dominant future of lawn care"

The Hatching

The Hatching is a monthly community business pitch event created by Spartan Innovations, the MSU Innovation Center and LEAP. This event is part of a community-wide effort to support local entrepreneurs and make the Lansing region a great place to start a business. The Hatching helps move new, local business ideas from concept to reality, and provides winners with funding, legal support, market research, office space and more.

Held in East Lansing on the fourth Thursday of each month, this casual, informal event awards \$1,000 and a suite of support services to each monthly pitch winner. Competitors and startup enthusiasts use the event to network, recruit team members and cheer for their favorite ideas each month.



The first annual Lansing Maker Week is a week-long lineup of tours, hands-on projects and keynotes surrounding the maker movement.

Lansing Maker Week

A team of more than a dozen community partners kicked off Michigan's first Maker Week, and the Midwest's first Startup Weekend: Maker Edition. Held October 6-12, the first five days are stacked with tours, projects and guest speakers in make subject areas like 3D printing, textiles, food and drink, electronics and programming, and the intersection of 21st century jobs and maker skills.

Startup Weekend: Maker Edition provided superior experiential education for technical and non-technical entrepreneurs. Beginning with Friday night pitches and continuing through brainstorming, business plan development, and basic prototype creation, Startup Weekends culminate in Sunday night demos and presentations. Participants create working startups during the event and collaborate with like-minded individuals outside of their daily networks.



The Hatching is a monthly pitch event that awards \$1k in funding, space, legal and research support to a regional startup.



GreenLight Business Model Competition draws entrepreneurs from around Michigan to compete for startup funding.



Alphabet Energy and MSU

Low-Cost Thermoelectric Breakthroughs

Alphabet Energy entered an exclusive commercialization agreement with MSU on a breakthrough thermoelectric material tetrahedrite, for use in industrial and other thermoelectric systems. Alphabet is a leader in commercializing the first large-scale thermoelectric generators for waste-heat recovery.

Thermoelectric materials convert any waste heat source into electricity. While they have been studied for decades, only a few have reached commercial applications because of their low efficiency, high cost, and use of rare elements.

“In our search for efficient, abundant, and nontoxic thermoelectric materials, we were led to the tetrahedrites, a family of compounds of commonly occurring elements, by theoretical calculations of their properties,” said Don Morelli, a professor of materials science at MSU. “The fact that they are naturally-occurring minerals is an added bonus—one can either synthesize them in the lab, or use the natural

mineral itself as a source thermoelectric material. The compounds are especially interesting because they combine very low thermal conductivity with unusually good electronic properties.”

Morelli, who led the research that was published in the journal *Advanced Energy Materials*, said the process is only the first step in creating a low-cost, widespread technology for converting heat to electricity.

In early 2015, Alphabet Energy announced the availability of the Alphabet Energy PowerModule™ products convert exhaust heat into valuable electricity for energy-intensive industries like automotive, manufacturing, defense, and mining. The Alphabet Energy PowerModule™ is a solid-state, liquid-cooled electrical generator using Alphabet Energy’s proprietary PowerBlocks™ thermoelectric materials, developed with MSU tetrahedrite technology.

MSU Partners with ExxonMobil to Advance Biofuel Research

A new \$1 million collaboration between Michigan State University and ExxonMobil will expand research designed to advance the development and ultimately the production of algae-based fuels.

David Kramer, MSU's John Hannah Distinguished Professor in Photosynthesis and Bioenergetics at the MSU-DOE Plant and Research Laboratory (PRL), says that the overall goal of the partnership is to improve the efficiency of photosynthesis in microalgae to economically produce biofuels and bioproducts.

"Photosynthesis is the biological process that plants and algae use to store solar energy in biomass. It is how all our food is made, and we would starve without it," said Kramer, who is leading the grant with Ben Lucker with the PRL and Joe Weissman, Distinguished Scientific Associate at ExxonMobil. "What we want to know is: how can we improve the process so that algae can save enough energy to power our cars as well as make products like plastics?"

The key to bioenergy is the efficiency of photosynthesis, the process algae use to capture solar energy. Past research has shown that algae have efficient photosynthesis under optimal conditions in the laboratory. Under realistic growth conditions in algal production facilities however, their efficiency drops. We need to maintain and even improve photosynthesis under real production conditions.

One of these technologies, developed through a grant from the U.S. Department of Energy (Energy, Energy Efficiency and Renewable Energy program) is a matrix of specialized chambers, called the environmental PhotoBioReactor, that allow algae to be studied in detail under simulated production environments.

The potential of ePBRs led to a spin-off company, Phenometrics, launched by the MSU Innovation Center. The company is merely three

years old, but steady orders for the bioreactors have the company already running in the black.

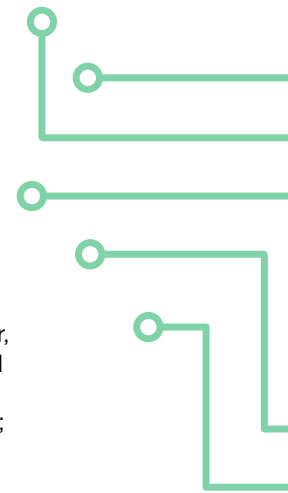
"We know certain types of algae produce bio-oils. The challenge is to find and develop algae that can produce bio-oils at scale on a cost-efficient basis, said Vijay Swarup, Vice President of ExxonMobil Research and Engineering Company, "Algae biofuels research and development is a long-term endeavor and we are partnering with the leading scientists in the fields to better understand the fundamental science and support their groundbreaking research."

ExxonMobil





Innovation Center Events



August

Hatch Expansion—The Hatch, MSU's student entrepreneurship incubator doubled in size last year, thanks to a gift from the Michigan State University Credit Union. The MSU Innovation Center held a ribbon cutting and opened the doors to the 300 Room, a community entrepreneurship space as well. This photo features partners Dr. Steven Hsu, MSU Vice Pres Research & Graduate Studies; Paul Jaques, Spartan Innovations; April Clobes, MSU Federal Credit Union; Dave Washburn, MSU Foundation; Bernie Esibrenner, MSU Entrepreneur Assoc.; Bob Trezise, LEAP.

September

President Simon kicks off Student Startup Lunch—MSU president Lou Anna K Simon meets with student CEOs every quarter to learn about new student companies formed, student needs, and to find ways the university can support and expand on student entrepreneurship efforts.

November

Alumni Leaders Visit MSU Innovation Center—Alumni met with students and staff in a day-long exploration of entrepreneurial activity at MSU, touring new spaces, meeting with student CEOs and company teams, and working through new ways to mentor and support student businesses.

December

LAUNCHED—Lansing-area business leaders gathered for the finale of the Hatching, a community business pitch event, and to toast the recent accomplishments of innovators and entrepreneurs in the Greater Lansing community. MSU Startup TheraB won the competition, and is pictured with the panel of expert judges.

March

Students at SXSW with @MSUStartupBus—Michigan State University student teams have been top-ten finalists at the Student Startup Madness Competition for the last three years. This event is held in Austin, Texas at South by Southwest Interactive. This year, students crowdfunded and built the MSU Startup Bus to help take more startup companies to support finalists Tech Twurl and represent MSU.

April

Demo Day—Eight MSU student startup companies talked with the public and potential investors about their products and services during the first-ever MSU Student Startup Demo Day.





Hatch Expansion



President Simon kicks off Student Startup Lunch



Alumni Leaders Visit MSU Innovation Center



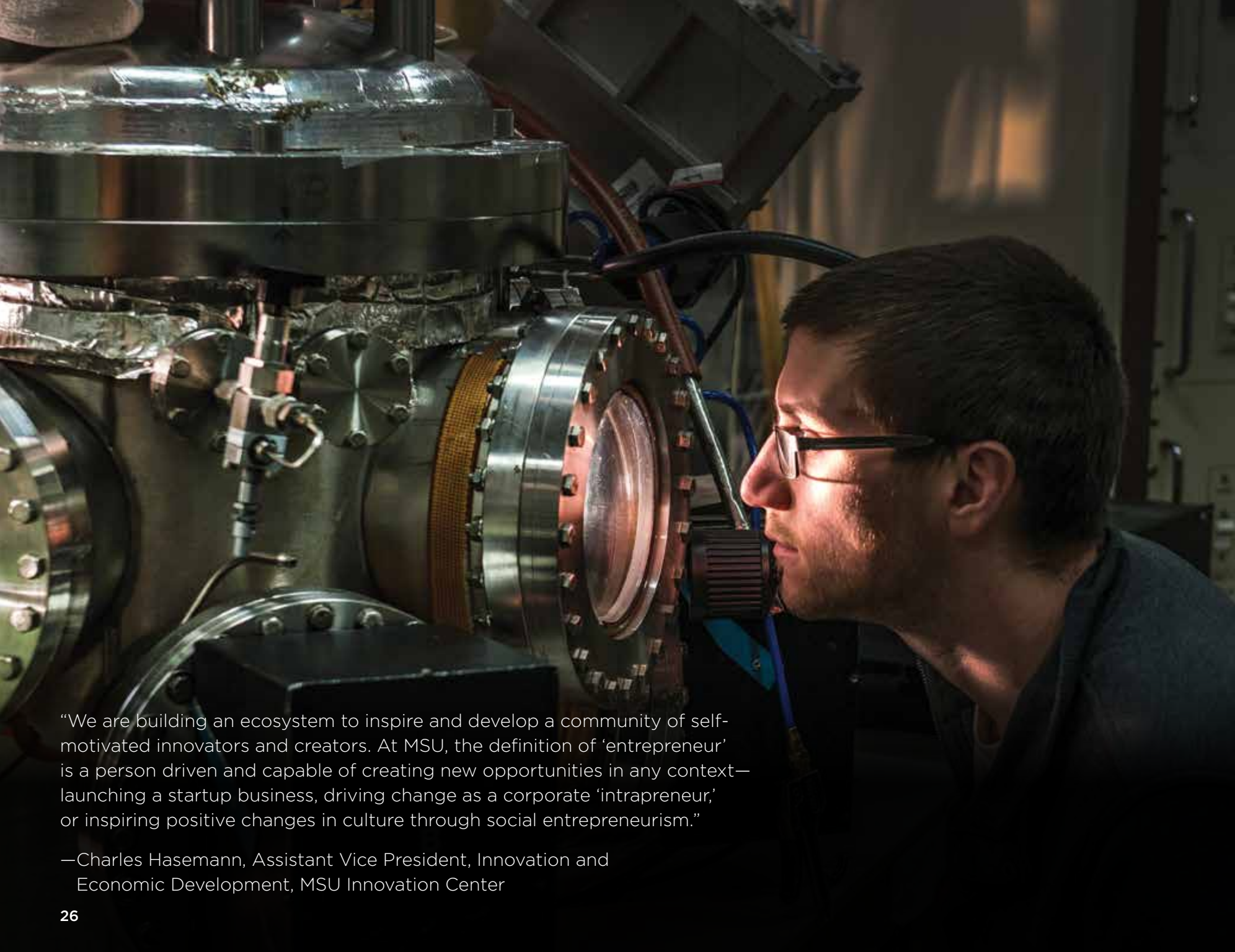
LAUNCHED



Students at SXSW with @MSUStartupBus



Demo Day



“We are building an ecosystem to inspire and develop a community of self-motivated innovators and creators. At MSU, the definition of ‘entrepreneur’ is a person driven and capable of creating new opportunities in any context—launching a startup business, driving change as a corporate ‘intrapreneur,’ or inspiring positive changes in culture through social entrepreneurship.”

—Charles Hasemann, Assistant Vice President, Innovation and Economic Development, MSU Innovation Center

Entrepreneurship at MSU: Help us go further

Everyone who loves Michigan State University knows of its determination to educate young people, its extraordinary global connections and its ambition to be one of the world's leading research universities. We have a remarkable history of advancing the common good with an uncommon will.

Our success has placed us on an extraordinary path—but if we are to achieve our full potential we need to empower our students and faculty and make available the resources to achieve their dreams. The Empower Extraordinary campaign will propel this great university forward through its people and with you at its side.

Entrepreneurs of All Kinds at MSU— Building an Ecosystem to Inspire

Michigan State University aspires to grow an entrepreneurial ecosystem that integrates innovation, enhanced technology, new teaching models, professors of practice, business partnerships, and professional support for startups and hands-on experimentation. We are evolving curriculum to include entrepreneurship-based courses to help students chart their own paths, providing hands-on learning experiences to increase collaboration and communication skills, and meeting real need and demand through company-sponsored partnerships and design projects. We are also investing in programming and resources that help move ideas from concept to market.

This requires a strong network of university units, community partners, economic development agencies, venture and angel funders, regional accelerators, and incubators. Our success is supported by the voice and experience of real-world entrepreneurs in the design, development, and testing of new education and support solutions.



This assembling of programs and relationships helps to break down silos and increase collaboration across units and services to bring path-breaking innovation to the marketplace and to establish a platform for experimentation.

This campaign includes goals for funding student startup support programs in the Hatch and the Hive, and endowing the GreenLight Business Model Competition and the GreenLight Fellowship Program. Both GreenLight programs support early and next stage startup partner development. Supporters and partners work with the Innovation Center to identify additional ways to support entrepreneurship at MSU, in the form of travel stipends, lecture series, and student organization support.

givingto.msu.edu/unit/entrepreneurship.cfm



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