MSU INNOVATION CENTER Business CONNECT | MSU Technologies | Spartan Innovations

2014 ANNUAL REPORT



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MSU INNOVATION CENTER MEMBERS

LEFT TO RIGHT, FRONT ROW: Reanee Unger, Anne DiSante, David Washburn, Richard Chylla, Charles Hasemann

2ND ROW: Jen Folger, Pablo Parraga Ramirez, Brice Nelson, Ed Kim, Ray DeVito, Tana Boehm, Andy McColm, Marta Palmer, Amber Shinn

3RD ROW: Karen Mackie, Lori Fischer, Paul Jaques, Jody Lancia, Randy Sheets, Jean Zwier, Guangming He, Andy Newton, Greg Sadler, Janellé Flores

4ΤΗ (BACK) ROW: Tom Herlache, Michael Medvec, Charlene Fortin, Angelia VanWoert, Melanie Adkins, Kit Clark, Brad Shaw, Jeff Myers, Christie Lilleboe, Ryan Jankovic

NOT PICTURED: Ann Spalding, Brian Polowniak, Ian Charles, Randy Ramharack, Rick Warner, Sandy Clough, Suzanne Summers, Tina Ramos

s higher education is called upon to meet new and significant challenges facing a global society, Michigan State University is positioned to lead the way by doing what we have always done: MSU puts knowledge and research discoveries to work to make life better.

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. It is composed of Business CON-NECT, MSU's corporate relations office; MSU Technologies, the University tech transfer office; and Spartan Innovations, a company that starts companies.

The MSU Innovation Center stewards faculty, student, and commercial partners' ideas, bringing more than 130 discoveries annually into a pipeline of patents, products, and startup businesses.

LET'S CREATE VALUE TOGETHER.



ore than 150 years ago, MSU was the inspiration for what would become the nationwide system of land grant universities—accessible institutions of higher learning focused on translating knowledge to value for the United States

In 2011, with values centered on finding real-world applications for technology and research, democratizing opportunities and public service, Michigan State University embarked on a bold experiment and created the MSU Innovation Center. Uniting business engagement, technology transfer and commercialization, and the incubation of new companies based on faculty and student concepts, the MSU Innovation Center is the modern extension of that land grant heritage.

Located in the heart of the East Lansing business district, the MSU Innovation Center is co-located with The Hatch, MSU's student business incubator, and the City of East Lansing's Technology Innovation Center (TIC), a community business accelerator. Together, we create a "center of gravity" in our region for entrepreneurism and the commercialization of both university and community innovations. By integrating innovation, technology transfer, support for start-ups, and partnerships with businesses and communities, we bring path-breaking ideas to the marketplace to improve the quality of life in communities near and far and to help Michigan and the United States compete in a global economy.

Just a few years into the experiment, we are beginning to reap the benefits in diverse ways, as you'll see in the pages that follow: building strong research partnerships, moving technologies to market, launching startups, and anchoring a rich entrepreneurial ecosystem across our state.

MSU has valuable ideas to offer the world, and the MSU Innovation Center represents an opportunity to accelerate the production of value from that knowledge and creative spirit.

I hope you enjoy reading this first-ever annual report for the MSU Innovation Center, and encourage you to engage with us to deliver on our mission—let's create value together.

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Charles A. Hasemann, PhD Assistant VP for Innovation & Economic Development MSU Innovation Center & MSU Business-CONNECT President, Spartan Innovations, L3C

Innovation and entrepreneurship are an integral part of work at MSU. We continue to find more ways that we can translate the work being done on our campus to market, either through patents or by creating new start-up companies. Programs and resources for students, alumni, and faculty include classes and degrees in entrepreneurship, business incubators, special advisers, and gap funding to help start-ups get off the ground.

Lou Anna K. Simon President, Michigan State University

MSU has a broad research portfolio, ranging from its strength in nuclear physics, to areas like plant biology, medical research, and ecology. This research creates a fertile ground for discovery. And thanks to our industry partners, these discoveries in turn become life-saving treatments, innovative products, and job-generating startups. **Steve Hsu**

Vice President for Research and Graduate Studies

At MSU Technologies, our passion is to work with researchers to commercialize MSU discoveries for the public good. At MSU, we solve problems, protect the environment, cure disease, feed and nourish the hungry, and improve the standard of living globally. Our team is experienced with trained technologists, successful industry veterans, entrepreneurs, and a support staff of professionals all dedicated to our passion for innovation. Over the past two years, MSU Technologies has grown the number of technologies transferred to industry through licensing deals, and increased the revenue back to MSU for reinvestment in more research, more discovery, more innovation, and more service to the public. At MSU Technologies, we embrace the land grant mission for the 21st century. Please enjoy these stories. I promise there are many more to come.

Rich Chylla Executvie Director, MSU Technologies



Past & Future

A HISTORY OF LIFE-SAVING DISCOVERY CISPLATIN, THE WORLD'S MOST EFFECTIVE CANCER TREATMENT DRUG

Discovered by Michigan State University physicist Dr. Barnett Rosenberg, and his colleagues in the early 1970s, Cisplatin and Carboplatin are two of the most widely used and successful treatments for cancer.

Rosenberg and his colleagues were testing the effects of electromagnetic energy on cells, when they observed that a particular platinum compound stopped the cells from replicating normally. Derived from the heavy metal platinum, Cisplatin can stop the division of cancer cells. Believed to operate by cross-linking DNA molecules, Cisplatin, when combined with other chemotherapies, results in profound cure rates for testicular cancers, and has the ability to significantly lower the rate of head, neck, bone, and early stages of ovarian cancer. In 1979 Carboplatin was developed as a second-generation platinum drug with fewer side effects than its predecessor Cisplatin.

Rosenberg retired from Michigan State 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

"The MSU Foundation is a strategic resource that helps Michigan State University achieve preeminence in its role as a leader in research, discovery, and innovation."

-Dave Washburn, MSU Foundation Executive Director

and Carboplatin still provide great benefit to MSU.

The university's share of licensing royalties from MSU-owned innovations go to the MSU Foundation, a nonprofit corporation designed to support MSU, particularly its research mission and subsequent commercialization activities at MSU Technologies.

The MSU Foundation currently manages \$480M, the greatest part of that funding derived from the Cisplatin and Carboplatin royalty. Spartan Innovations, created as a wholly-owned subsidiary of the MSU Foundation, focuses on turning ideas, technologies, and creative activities into Michigan businesses. The 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.



MTRAC PROGRAMS Define the future of bioagriculture



Supported by The MSU Innovation Center and the Office of the Vice President for Research and Graduate Studies, 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 science and technology.

Ideal candidates are MSU biotechnology and bioprocessing innovations that have the potential to create superior value-added products and materials. Projects will have shown promise in the laboratory, but need further development in order to become successful in a competitive market.

MTRAC Director Andy McColm announced the first three BioAg projects selected for grants awarding a total of \$268,841 to the 2014 series of projects.

BRUNO BASSO GEOYIELDS

GeoYields is a comprehensive crop yield model system, enabling higher crop production with more efficient use of inputs, such as fertilizers and irrigation. Building on 40 years of research at MSU, the grant will upgrade the scalability of existing models to allow their use in precision agricultural applications, along with the integration of unmanned aerial vehicle (drone) telemetry data. This technology will allow farmers a "bird's-eye view" of their fields in HD, to realize the potential of precision agriculture with the use of "big data" analytics.

BRUCE DALE

AFEX PRETREATMENT TECHNOLOGY

This project demonstrates the large-scale production of bio-based chemicals using MSU's patented Ammonia Fiber EXpansion (AFEX) pretreatment technology for cellulose-based feedstocks. The ability to process cellulosic feedstocks in a cost-effective way has long been the limiting factor in using non-food crops and crop residues to produce biofuels and other useful chemicals. AFEX pretreatment solves this technology challenge by enabling farmers to realize a new revenue stream from previously unused crop remainders, and for consumers to benefit from reduced renewable fuel costs.

GEMMA REGUERA

ELECTROCHEMICAL BIOREACTOR

Dr. Reguera has developed a novel electrochemical bioreactor design which can convert low-cost pretreated feedstocks, such as corn stover, into useful end products such as ethanol and biobutanol. The microbial catalysts, coupled with an electrochemical reactor, allow for simultaneous digestions and fermentation of the cellulosic feedstocks in a "one pot" reactor. This reduces both the cost and the complexity of the bioprocessing plant. If successfully developed to full industrial scale, these electrochemical bioreactors could significantly reduce the cost of bio-based industrial chemicals my minimizing undesirable byproducts.







93%

increase in license and option deals on MSU Technologies in 2014

Arts & Letters

Education/Kinesiology

Environmental & Health Safety

National Superconducting Cyclotron

Nursing & OM

full-time staffers employed at MSU Innovation Center

teams seeking help at the Hatch in AY 2012 units combined to create the MSU Innovation Center



won by startup students in competitions in AY 2013–14

620 contracts, grants, and gifts from corporate sponsors for MSU research

and education programs totalling

\$33M



diverse inventions

ARTS & LETTERS MIGRATIONS OF ISLAM PLANT GENES THAT CONTROL PHOTOSYNTHESIS CHANGING I**MPORTED** FROM **CHINA** EDUCATION / KINESIOLOGY KING MOTIVATION APP FACIAL RECOGNITION PROGRAMS ENGINEERING MAPPING & RECOMMENDING USER INTERESTS IN SOCIAL NETWORKS ENVIRONMENT & HEALTH SAFETY SAFETY TRAINING G R THERAPIES FOR TREATING PARKINSON'S DISEASE MOVEMENT DISORDERS **CLINICAL DIAGNOSTICS** FOR **MULTIPLE SCLEROSIS** PULSE ASER FIDELITY MEASUREMENT NATURAL SCIENCE HERMOELECTRIC TRAHEDRI CISION **Magnetic field** RING IN HIGH RADIATION THE LIVING HISTORY PROJECT: STORIES TOLD **MICHIGAN'S OLDEST** SOCIAL SCIENCE UNRAVEL: COGNITIVE TEST FOR MEASURING IMAN PERFORMANCE LAYERED SKIN SUTURING PAD INTRAMUSCULAR **INJECTION TRAINING PAD**

2014 Innovation Celebration

The MSU Innovation Celebration is an annual event that brings together university and community to honor MSU innovators and showcase several of the many inventions and innovations developed at MSU. It's an informative and fun event, with networking opportunities that bring together inventors, funders, and companies to celebrate innovation.

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 2013's most exceptional innovator, exceptional innovation, and a career-long track record of innovation and technology commercialization.

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.





INNOVATION OF THE YEAR

Dr. Robert B. Abramovitch Assistant Professor, Microbiology & Molecular Genetics

This technology is a pair of biosensors that enable the identification of compounds that inhibit *M. tuberculosis* virulence adaptation physiologies required for chronic infections. The compounds may work to dramatically reduce TB treatment time, and has potential to revolutionize the management of one of the world's most deadly active pathogens, providing relief to millions.

INNOVATOR OF THE YEAR

Dr. Anil Jain University Distinguished Professor, Computer Science & Engineering

Dr. Jain's research advances rapid facial and fingerprint recognition, to foil everadvancing attempts to avoid detection. Results address challenges in terrorism, crime, and securing sensitive digital records. Dr. Jain's work not only represents continued advancement in the realm of biometrics, but also serves as a critical rebuttal to the methods employed by criminals to thwart established biometric identification practices.

MSU TECHNOLOGY TRANSFER Achievement Award

Dr. James F. Hancock Professor, Department of Horticulture

Dr. Hancock has released four new Northern Highbush blueberry varieties: Draper, Liberty, Aurora, and Huron. All have excellent fruit quality, are highly productive, produce robust and exposed berries that can be machine harvested, and have a long shelf life. Approximately twenty million plants of these four varieties have been sold. They represent approximately 10% of worldwide Northern Highbush blueberry acreage, making them among the most widely planted of all Northern Highbush varieties.

technologies on display

Non-Invasive Diagnosis of Gastroesophageal Reflux Using Very Low-Frequency Accelerometric Detection Ira Gewolb, Frank Vice Pediatrics & Human Development

AFEX Biomass Processing Bruce Dale Chemical Engineering

Parkinson's Research Jack Lipton *Translational Science & Molecular Medicine*

Silicone Veterinary Models Beatrice Biddinger Small Animal Clinic

DOCUMENTARY FILM

Imported from China Geraldine Zeldes, Troy Hale *School of Journalism*

Software for Fingerprint Detection, Face Sketch Detection Anil Jain Computer Sciences & Engineering

Laser for Standoff Detection Marcos Dantus Chemistry

Natural Mineral Tetrahedrite as a Direct Source of Thermoelectric Materials Donald Morelli *Chemical Engineering*

MSU STUDENT START UP: **Air Fuel** Jeffrey Hall

MSU STUDENT START UP: **Folyo** Ashley Brimley, Victoria Bujny, Caitlin McDonald

BY DHARMA BUM PHOTOGRAPHY

ALL PHOTOS

MSU STUDENT START UP: **Carbon Cash** Jon Bauer, Bernard Eisbrenner, Patrick Schmitz

MSU SPIN OUT: **CourseWeaver** Rob Fulk, CEO *East Lansing*

Startup Spotlight



HARNESSING THE POWER OF ALGAE

Phenometrics' flagship product is a photo bioreactor, the PBR101. The PBR101 is used to optimize scaled production at the bench by accurately mimicking scaled production conditions, thus helping select the best strain of algae and conditions for maximizing product yield. This saves both time and money. The PBR101 can also be used as a research tool for discovery of new strains of algae, new by-products, etc.

Phenometrics products are designed by scientists, engineers, and real-world users for research or production purposes to optimize algal growth and production.

Multiple systems for simultaneous optimization of growth conditions either by condition, algal strain, or both, may be used. Up to 256 reactors, each with its own programmed experiment, can be controlled simultaneously by a single computer running Algal Command, Phenometrics' software written specifically for customized experimentation for the optimization of algal growth conditions.

This university spin-out is based on the research of Dr. David Kramer, Hannah Distinguished Professor in Photosynthesis and Bioenergetics, Department of Biochemistry and Molecular Biology.

SIMPLIFYING EDUCATIONAL RESOURCES

Developing and organizing lesson plans and course content, working with limited education resources, and tracking student progress is a challenging time-consuming process. CourseWeaver seeks to solve this dilemma. Think of it as "iTunes for Education" where a "course playlist" is compiled from educational materials, videos, and homework available on the system, assembled into a course by the teacher, then purchased by the student.

An advanced content management system, CourseWeaver is built for and in collaboration with educators. CourseWeaver gives educators around the world the ability to share effective lessons and choose the educational models that work best for their teaching style. This open-source platform provides access to thousands of shared resources and allows them to collaborate with other teachers.

CourseWeaver offers tools to help educators learn how to create and publish their own content, which can be shared for free or sold in the CourseWeaver Content Marketplace.

This university spin-out is based on the research of Dr. Gerd Kortemeyer and Dr. Wolfgang Bauer.



student startup spotlight FOLYO

Folyo began with the belief that inspirational artwork should be accessible to everyone. This technology is a social ecommerce platform created to promote a curated portfolio of emerging student talent. Folyo simplifies finding, buying, and selling art by providing a series of services to artists to aid in selling their artwork, while also ensuring quality and timeliness to buyers. Finding one-of-akind pieces is made easy and enjoyable. Folyo is the missing link between student artists and the world.

Folyo teaches student artists skills like marketing and sales, necessary to be a successful entrepreneur, and guides them through pricing and shipping. A successful storefront on Folyo gives artists the confidence they need to pursue their passion. Buyers and sellers both create accounts with the site, and can browse, share, and purchase art. Folyo creates a supportive online community by including social features, such as the ability to "treasure" artwork, share reviews, and discuss art in forums. www.Folyo.com

STUDENT STARTUP SPOTLIGHT

Developed after taking an introduction to sustainability course, Carbon Cash is an app that rewards students for conserving electricity and reducing their carbon footprint with discounts from their favorite retailers.

Carbon Cash is a behavioral energy efficiency app specifically designed for college students living in residence halls, on-campus apartments, and off-campus rental properties. This app tracks the electricity consumption of participating buildings and displays that information to the user. Users then receive feedback about how to avoid wasteful energy use, how much energy they are using, and where their usage stands in relation to their peers. The app also includes competitions between different buildings and universities, educational material on climate change, and most importantly rewards that are available for users to redeem upon earning Carbon Cash.

Carbon Cash can be earned when a user's building uses less electricity than it is projected to use in a given month, by interacting with educational material about sustainability and energy use, or simply by logging in to check usage levels.

www.CarbonCash.com



Partnerships & Progress

FACESKETCH ID SYSTEM MORPHO PARTNERSHIP YIELDS GLOBAL SECURITY GAINS

Hand-drawn forensic sketches based on witness descriptions are a traditional yet time-consuming method used to catch criminals. But in some cases, authorities don't have the luxury of time. An automated sketch recognition system developed at Michigan State University is changing this race against the clock.

The FaceSketchID System identifies criminals quickly and accurately by matching forensic sketches to large mug shot and photo databases maintained by law enforcement agencies. MSU licensed FaceSketch to Morpho, the world's largest biometrics company, so it can be used by more law enforcement agencies worldwide.

Anil Jain, MSU Distinguished Professor in the Department of Computer Science and Engineering and 2014 Innovator of the Year, led the development of the system. Jain and MSU Technologies have worked collaboratively with Morpho for many years on a number of technologies. "Due to advances in computer vision and machinelearning algorithms, FaceSketch can use facial features to find commonalities between forensic sketches and mug shots," Jain said. "It is a valuable resource that allows law enforcement agencies to quickly apprehend criminals, especially when no photo or video of the suspect is available."

FaceSketch also can match sketches of criminals captured in low-resolution surveillance video to mugshots or driver's license databases. In addition, the system has the capability to appropriately modify digitized sketches to make the suspect appear younger, for a better match with database images.

"Facial sketch matching represents the next generation of facial recognition systems," said Thomas Chenevier, Morpho senior vice president of products and innovation. "MSU researchers have created a powerful new tool that will allow law enforcement to solve more crimes to safeguard our communities."

CONSUMER PRODUCT RESEARCH PARTNERSHIP ON INGREDIENT SAFETY

In 2014, Michigan State University, with partnership and support from the Grocery Manufacturers Association and the food, beverage, and consumer products industries, established the Center for Research on Ingredient Safety (CRIS).

An independent, academic, science-based center, CRIS will serve as a reliable and unbiased source for information, research, training, and analysis on the safe use of chemical ingredients in consumer packaged goods including foods, beverages, cosmetics, and household consumer products.

The center will work to achieve the following goals:

- Expand basic and applied research on the safety and toxicology of ingredients in food, packaging, cosmetics, and household care products
- Develop and validate testing methods and strategies for evaluating the safety of ingredients in food, packaging, cosmetics, and household care products
- Establish a graduate training program that prepares scientists for a career in assessing the safety and toxicology of ingredients in food, packaging, cosmetics, and household care products that includes training in risk assessment and U.S. and international regulatory policies
- Inform the public, health professionals, regulators, and the scientific community on research matters reflecting the state-of-the-science pertaining to the safety and toxicology of ingredients in food, packaging, cosmetics, and household care products

CRIS is supported through the establishment of a \$4M endowed chair that will be funded with contributions provided by the **Grocery Manufacturers Association** and individual corporate donors, which include Abbott Nutrition, Bumblebee Seafoods, Bush Brothers & Company, Campbell Soup Company, Cargill, The Coca-Cola Company, ConAgra Foods, Ecolab, General Mills, The Hershey Company, Hormel, Kellogg Company, Kraft Foods Group, McCormick & Company, Mondelēz Global LLC, PepsiCo, and Unilever.

Entrepreneurial Ecosystem & Community



Left: GreenLight Business Model Competition draws entrepreneurs from around Michigan to compete for startup funding. Center: Representative Sam Singh tours the MSU Innovation Center to learn about startup projects at MSU. Right: The Hatching is a monthly pitch event that awards \$1K in funding, space, legal, and research support to a regional startup.

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 that integrates innovation, technology, business partnerships, and professional support for start-ups and hands-on experimentation. Student entrepreneurs develop skills such as creativity, sales, and teamwork skills that top





employers' lists for traits in new employees and future leaders. As part of the "T-shaped personality" desired by employers, we believe entrepreneurship is a great element of breadth to add to the depth of discipline that a student will get in their major degree.

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 for young people. In the process, we have broken down silos and collaborated across units and around the state to bring path-breaking

innovation to the marketplace and to establish a platform for experimentation.

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. It is our ambition to fill the University Corporate Research Park and the region beyond with innovation-based companies that will change the face of Michigan.



Each quarter, President Simon meets with a set of student entrepreneurs to assess needs, explore growth, and learn about the newest ideas.

MSU INNOVATION CENTER

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325 E. Grand River Ave., East Lansing, MI 48823

- TEL 517 355-2370
- EMAIL info@technologies.msu.edu
- WEB innovationcenter.msu.edu



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