The University of Iowa
FY 2016 Annual Economic Development Report

Executive Summary

Key Outcomes

Via both ongoing and new initiatives (see below), the University of Iowa continued to advance economic development in FY 2016. University research generated intellectual property that was transferred to companies**.** This year, **a larger proportion of technologies (19 of 39 vs. 13 of 40) were licensed or optioned to Iowa companies** than in FY 2015. We also launched 14 new faculty-founded startups. These startups increased the number of employees and companies in our incubators. As a result, **the BioVentures Center is now at 100% occupancy** with 17 companies employing 90 people. Our programs have aided startups driving commercialization and raising capital through early de-risking of their technologies. In addition, faculty-led startups secured over **$1.6MM in non-dilutive capital**.

One program, the proof-of-concept **"GAP" funding program awarded $663,693 to University of Iowa faculty and staff,** distributed among 12 projects in FY 2016. These projects then **raised an additional $916,500 from other sources, including SBIR/STTR awards, NSF I-Corps grants, state grants and private equity.** The GAP funds have been cited by numerous faculty as a critical factor in moving their technologies toward commercialization.

In entrepreneurship, 101 teams, comprised of 308 entrepreneurs, attended Venture School to assess and improve the commercial viability of their startup ideas and business models. In addition, the NSF I-Corps Faculty Innovators Workshop assisted 34 faculty teams with development of a business model. **Six of these teams moved on to the highly competitive national NSF I-Corps program**, receiving $50,000 each for additional development.

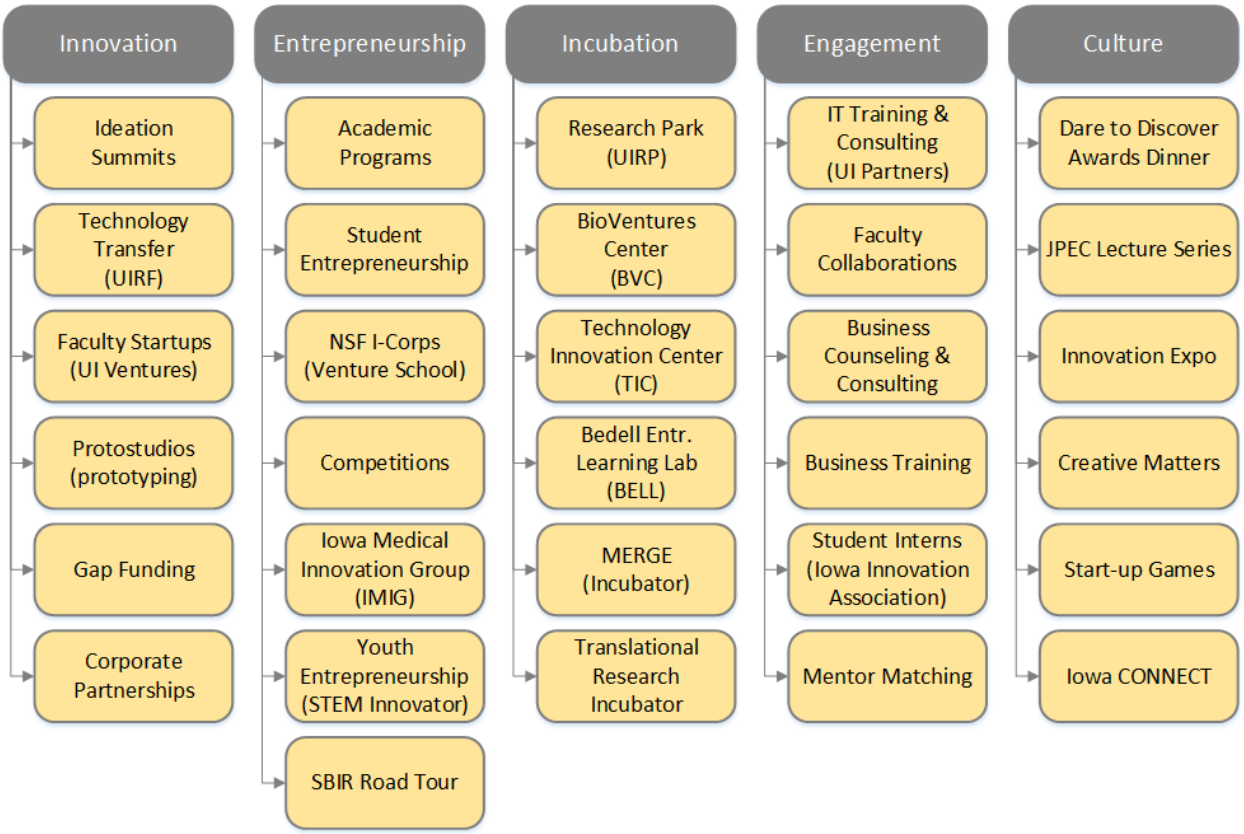
Finally, the University of Iowa was awarded a $1.5MM Strategic Infrastructure Fund grant from the Iowa Economic Development Authority to purchase 3D modeling software and hardware, prototyping and electronics equipment for a new cutting-edge biomedical and electronics prototyping hub in downtown Iowa City. This facility, called ProtoStudios, will fill a crucial gap in Iowa's existing network of advanced manufacturing hubs by providing the equipment and expertise needed to produce very small, high-resolution, biocompatible medical and electronic device prototypes.

Future Initiatives

In FY 2017, we will create new incentives and critical infrastructure to encourage and support faculty entrepreneurship across campus. This includes building two early-stage incubators as a part of a comprehensive lab-to-market incubation strategy for faculty startups. The first, a dry-lab (software/hardware) incubator called MERGE, will be located close to campus on the Iowa City Pedestrian Mall. Merge is a partnership spanning the University of Iowa, the Iowa City Area Development Group (ICAD), and Iowa City, with additional support from the U.S. Economic Development Administration. As noted above, MERGE will also house a biomedical/electronics prototyping facility called Protostudios, which is financed through a $1.5MM Strategic Infrastructure equipment grant from the Iowa Economic Development Authority (IEDA). In addition, a second (wet-lab) biomedical incubator— the Translational Research Incubator (TRI)—will be located on the University of Iowa's healthcare campus. TRI will open in October of 2016 and MERGE is scheduled to open in early 2017. Each facility will house 6-8 startups.

Organizational Structure and Programs

The University of Iowa's economic development strategy is organized around five major themes: *Innovation, Entrepreneurship, Incubation, Engagement, and Culture*. Programs within each of these themes are already yielding important economic development impact, as highlighted below.



Examples of UI Economic Development Impact

- Technology Transfer (Innovation) – The University of Iowa Research Foundation (UIRF) received 151 invention disclosures in FY 2016. It also executed 39 license or option agreements. **University of Iowa startups accounted for 16 of these deals (up 31% over FY 2015).**
- Faculty Startups (Entrepreneurship) – UI Ventures' focus on startup creation, executive recruiting and raising capital is paying dividends. There are **over 60 startups in the pipeline, 14 of which were added this year**. Moreover, startups are aggressively using university and state economic development resources to build value and advance through the commercialization pipeline. **In FY 2016, UI Ventures-assisted startups brought in over $1.6MM in non-dilutive capital**. The following two examples are illustrative of this process.
    - **iotaMotion** is developing an implantable robotic system to preserve hearing after cochlear implant surgery. It was founded by otolaryngologists Marlan Hansen and Chris Kaufmann in November 2015 and has since raised $275,000 in non-dilutive capital, including a NSF SBIR award.
    - **Viewpoint Molecular Targeting** is developing pharmaceutical drugs for diagnostic imaging and therapy for cancer, with a focus on metastatic melanoma. It was founded by Drs. Michael Schultz and Frances Johnson in 2008. They recently received a $300,000 SBIR grant from the NIH.
- Student Startups (Entrepreneurship) – Sixty-eight student-businesses are under development through the John Pappajohn Entrepreneurial Center's (JPEC) student incubator program housed at the Bedell Entrepreneurship Learning Laboratory. Lohman Earth Works and SwineTech are two examples of JPEC activities
    - **Lohman Earth Works**, was founded by Pierce Lohman, a senior at The University of Iowa, in 2012. Lohman Earth Works was awarded the University of Iowa co-student startup of the year award for 2015 and has been awarded over $4,000 from the university. Lohman Earth Works is a landscaping company serving the Quad Cities and surrounding areas specializing in patio, retaining walls, and grounds maintenance. The main goal of the company is to build long-lasting relationships with customers, grow

and keep the number of Iowa based employees in an industry where there is high turnover with employees and customers, while producing quality creative results.

- **SwineTech** creates products to reduce the Pre Wean Mortality (PWM) on sow farms, which allows farmers to increase production by 4-6%. SwineTech uses micro-regulated environments, audio sampling, classical conditioning, and "fitbit" technology to ensure that each pig is healthy. Co-founders Matthew Rooda, an Enterprise Leadership and Pre-Vet Med major, and Abraham Espinoza, a senior in Computer Science and Mathematics, were awarded $175,000 by many entrepreneurial centers across North America. Most notably they were finalists for Ag Tech company of the Year at the Prometheus awards in Des Moines and **took home 1st place and $30,000 in the International Business Model Competition (IBMC) at Microsoft.**

- Faculty Innovators Workshop (Entrepreneurship) – The University of Iowa was awarded a National Science Foundation (NSF) I-Corps Sites grant in FY 2015 to accelerate commercialization of discoveries by UI faculty, staff, and student entrepreneurs. As a result, 34 teams comprised of 99 entrepreneurs attended the Faculty Innovators Workshop to test the commercial viability of their idea or innovation. Upon completing the workshop, **six teams moved on to the National I-Corps program where they received an additional $50,000** to work on commercializing their innovation. Four other teams went through the Venture School program and are continuing to work on launching their business.

- STEM Innovator Program (Entrepreneurship) – This professional development program for teachers infuses innovation and entrepreneurship into K-12 classrooms. During FY 2016, 445 educators from 159 Iowa school districts impacted an estimated 18,727 Iowa students.

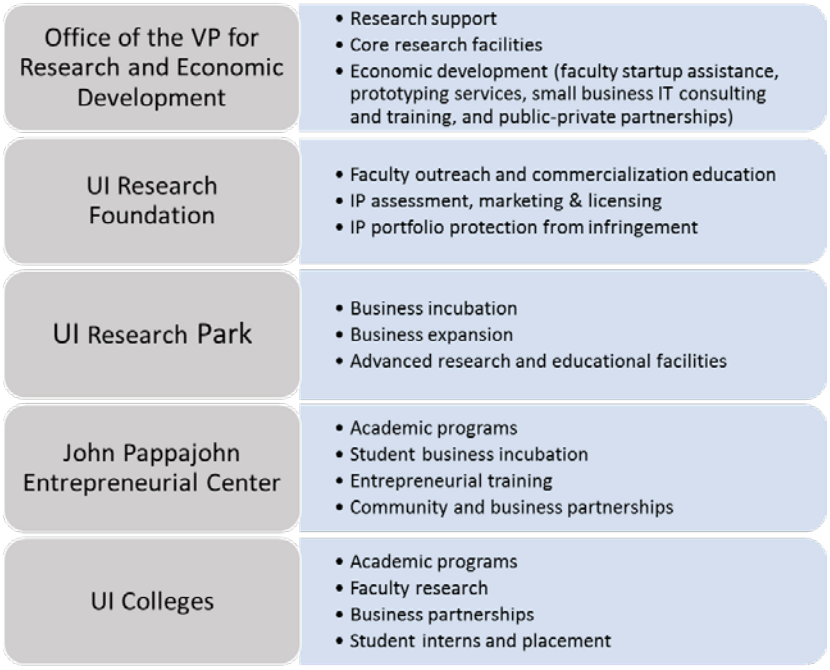
- Research Park (Incubation) – There are now **17 companies, including three new startups, located in the BioVentures Center (BVC)** at the University of Iowa Research Park (UIRP). The number of companies housed in the BVC has tripled from when it opened in 2008, and the **BVC is now at 100% occupancy**. **Currently 46 companies reside at the UIRP and employ over 1,635 people**. Key examples include:

  - **Voxello**, a communications solutions developer for disabled hospitalized patients has seen substantial growth in FY 2016 and is currently in clinical trials at the University of Iowa Hospitals and Clinics and in the process of receiving federal regulatory approval to go to market. The company has hired two new employees, bringing full-time staff to eight. In addition, Voxello has received capital awards from the federal SBIR program and the non-profit Innovation Iowa Corporation, as well as gap funding from the UI Office of Research and Economic Development.
  - **Exemplar Genetics**, founded in 2008, develops genetically engineered miniature swine to exhibit a variety of human disease states, which provides a more accurate platform to test the efficacy of new medications and devices. In 2015, **Exemplar was acquired by Intrexon—a synthetic biology company—and will "graduate" from the BioVentures Center and expand onto the Research Park.**

- Small Business Consulting (Engagement) – We continued our engagement with the Iowa small business community. Faculty/student teams completed **49 business consulting projects with companies located in sixteen Iowa counties and three in Illinois** (Delaware, Johnson, Linn, Polk, Iowa, Woodbury, Winneshiek, Poweshiek, Harrison, Wapello, Marion, Dallas, Fayette, Pottawatamie, Mahaska, Scott, and Rock Island, Lake and Cook in Illinois).

Economic Development Team

Research drives innovation at the University of Iowa. In FY 2016, total external funding at the University of Iowa was $552MM ($438MM in sponsored research). This places the University of Iowa among the nation's elite public research universities. Federal funding increased 4%, proposal submissions were up 3% (from 3,607 to 3,724), and awards granted were up 5% (from 2,240 to 2,352). This robust research enterprise, coupled with integrated economic development activities, plays an important role in supporting economic development in Iowa. Our economic development activities are directed by the Office of the Vice President for Research and Economic Development (OVPR&ED).



The following sections of this report will respond to specific areas, as requested by the Board of Regents. These include the impact of University of Iowa activities on the economic growth in Iowa, institutional activities and services that indirectly promote economic development, quantitative information regarding economic development activities in FY 2016, a summary of outreach and service activities, direct economic development assistance to Iowa communities, a summary of RIF expenditures, and emerging trends in the area of economic development.

Impact of UI Economic Development Activities on Economic Growth in Iowa

Job Creation and Wealth in Iowa

University of Iowa Research Park (UIRP) – The University of Iowa Research Park (UIRP) is a blended campus consisting of commercial ventures and a variety of university academic programs and infrastructure assets. As of June 30, 2016, 11 established companies and 30 startup companies were located in the park. These companies have access to university research infrastructure, including high-speed internet, university libraries and research facilities (i.e., core research facilities to support chemistry, biology, computation and instrumentation), faculty for joint collaboration, business support centers (i.e., the John Pappajohn Entrepreneurial Center, the Small Business Development Center and the University of Iowa Research Foundation) and students as interns or employees. In FY 2016, the companies affiliated with University of Iowa Research Park and the Technology Innovation Center reported over 1,635 employees.

BioVentures Center (BVC) – The BioVentures Center (BVC) located in the University of Iowa Research Park opened in November 2008. This 35,000 sq. ft. state-of-the-art biosciences incubator and office facility offers entrepreneurs and early-stage technology companies high-quality wet laboratories, a shared laboratory, a large multi-purpose room, multiple executive conference rooms and general shared space to meet their various business needs. At the end of FY 2016, 17 companies were located in the BVC employing approximately 90 people. Currently, the BVC is 100% occupied. Incubation at the BVC has helped companies such as Higher Learning Technologies (HLT), VIDA Diagnostics, KemPharm and Exemplar move beyond the startup phase.

Technology Innovation Center (TIC) – The Technology Innovation Center (TIC) provides office space and a nurturing business environment to early-stage technology-based ventures that do not require wet laboratories. In FY 2016, TIC reported a total of 13 companies and over 30 employees.

- **Corvida Medical** was originally formed as J&J Solutions when the co-founders, Jared Garfield and John Slump, were undergraduate students at the University of Iowa's Tippie College of Business. They started the company after one of the founders' sister was diagnosed with cancer. The two discovered that each year, millions of healthcare workers are being routinely exposed to the hazardous pharmaceuticals prepared and administered to patients, significantly increasing their risk for cancers, infertility, miscarriages, birth defects, genetic mutations, and other adverse events. Corvida obtained FDA 510(k) clearance in July 2015, for the Halo Closed System Transfer Device, a product designed to prevent clinicians from being exposed to hazardous medications such as those used in chemotherapy.
- **Innovas Technologies**, a designer and manufacturer of energy efficiency equipment, filed multiple patents and engineered systems for the University of Virginia, Trane, VCU, George Mason University, & Dominion Power with sales over $500,000. These systems are providing energy savings of more than 3 million kilowatt-hours per year, reducing greenhouse gas emissions by over 2200 tons/year, and delivering more than $300,000 in annual cost savings.

Bedell Entrepreneurship Learning Laboratory (BELL) – The Bedell Entrepreneurship Learning Laboratory is the University of Iowa's student business incubator. The 10,000 sq. ft. facility, which has 17 furnished offices and several conference rooms, offers a campus-wide program open to students from every college and major. The students receive intense mentoring and support as they launch or expand their businesses. The program, one of the first of its kind in the nation, has impacted over 700 students since opening in 2004. In FY 2016, 68 student businesses were being incubated at the BELL.

Institutional Activities and Services that Indirectly Promote Economic Development

Office of the Vice President for Research and Economic Development (OVPR&ED)

University of Iowa Research Park, BioVentures Center and the Technology Innovation Center – The University of Iowa offered a variety of educational and training programs for UIRP/BVC/TIC tenants in FY 2016. These included lunch & learns, mixers, a service industry speaker series providing guidance on legal issues, human resources and financial management, and Iowa Innovation Council programs.

The University of Iowa Research Park hosts quarterly roundtable meetings for company executives representing all park companies. The BVC multi-purpose room was utilized by over 50 outside groups including, but not limited to, legislative and state agency meetings, vendor shows, pitch and grow competitions, Chamber of Commerce events, Iowa City Area Development (ICAD) forums, STEM education meetings, and SBDC monthly lunch and learns. The state-of-the-art meeting and executive conference rooms at the BVC have become a vital meeting hub for both regional and state organizations.

John Pappajohn Entrepreneurial Center (JPEC)

JPEC offers one of the most comprehensive entrepreneurial education and business support programs in the nation. Featured programs supporting economic development include:

- Providing business consulting services to small companies located across Iowa through its faculty/student field study program (49 companies assisted in FY 2016)
- Hosting/sponsoring elevator pitch and business plan competitions to support innovation and new venture creation (11 competitions held in FY 2016, awarding over $100,000 in prize money.)
- Supporting the creation and launch of student-based businesses at the Bedell Entrepreneurship Learning Laboratory (BELL) located on the UI central campus; student entrepreneurs receive office equipment, computers, and access to high speed internet.
    - In FY 2016, total of 68 businesses participated in BELL. Since its opening in 2004, a total of 706 students from nearly every UI college have been impacted by the facility and associated programs.
- JPEC delivers campus-wide and online undergraduate entrepreneurial education and technology innovation

coursework in the MBA program.

  - In FY 2016, there were 4,054 total student enrollments in 123 sections of courses and 404 students graduated from one of the Certificate, BA, or BBA programs offered by JPEC.

- The Jacobson Institute for Youth Entrepreneurship is a comprehensive program that enriches K-12 students' lives through classroom and practical educational experiences.
  - During FY 2016, the Jacobson Institute licensed the BizInnovator curriculum to 140 Iowa high school teachers impacting 1,700 students.
  - Outside of Iowa, another 576 high school teachers are licensing BizInnovator and impacting an additional 4,496 students. Nationally, students have the ability to earn University of Iowa college credit. In FY 2016, 85 students nationally received University of Iowa college credit.
  - During FY 2016, the Jacobson Institute provided 73 Iowa teachers from 20 schools STEM Innovator training bringing the total number of Iowa schools engaged with STEM Innovator to 158 teachers from 58 schools. 10,527 Iowa students were impacted by STEM Innovator programs during FY 2016.
  - 161 youth participated in 6 summer camps held across Iowa.

Other Economic Development Activities – The economic development leadership team participated in a large number of economic development organizations in FY 2016.

Statewide:

- Iowa Business Council
- Iowa Innovation Council
- Iowa Innovation Corporation
- Iowa Economic Development Authority, Technology Commercialization Committee
- Iowa Biotechnology Association, Board of Directors
- Technology Association of Iowa, Board of Directors
- Technology Association of Iowa, Panelist Reviewer for TAI annual awards
- STEM Advisory Board

Local and Regional:

- Cedar Rapids Metro Economic Alliance Economic Development Committee
- Corridor Business Alliance
- Economic Development Center (EDC), Board Member
- Iowa Black Business Coalition
- Iowa City Area Chamber of Commerce, Member
- Iowa City Area Development Group, Board of Directors and Executive Committee
- Midwest Engineering Entrepreneurship Network (MEEN)
- Sioux City Chamber of Commerce, Member
- Storm Lake Chamber of Commerce, Member
- Council Bluffs Area Chamber of Commerce, Member
- Midwest Research University Network

National:

- Council on Competitiveness
- Small Business Administration (SBA)

- Global Consortium of Entrepreneurship Center (GCEC), Leadership Circle
- University Economic Development Association (UEDA)
- United States Association for Small Business and Entrepreneurship (USASBE)
- Colligate Entrepreneurship Organization (CEO)
- Students in Free Enterprise (SIFE)
- National Collegiate Inventors and Innovators Alliance (NCIIA)
- National Business Incubator Association (NBIA)
- Association of University Research Parks (AURP)
- National Academy of Inventors (NAI)
- The National Council of Entrepreneurial Tech Transfer (NCET2)

Metrics Describing University of Iowa Economic Development Activity in FY 2016 & FY 2015

	FY 2016	FY 2015
a. Number of disclosures of intellectual property	151	149
b. Number of patent applications filed		
• U.S. Applications	142	109
• National Applications	125	15
• Patent Cooperation	29	22
• Total Applications	296	148

c. Number of patents issued	67	50
d. Number of license and option agreements executed on institutional intellectual property	39	40
• In Iowa	19	13
e. Number of license and option agreement yielding income	128	135
f. Revenue to Iowa companies as a result of licensed technology	$1.26MM	$1.62MM
g. Number of startup companies executing licenses or options for UI technologies	22	15
• In Iowa	16	11

h. Number of companies in research parks, incubators and graduates located in Iowa	59	55
i. Number of new companies in research parks and incubators	4	6
j. Number of employees in companies in research parks/affiliates and incubators	1,635	1,966
k. Royalties and license fee income	$1.62MM	$1.87MM
l. Total sponsored funding	$552MM (based on total external funding) $438MM (sponsored research)	$565MM (based on total external funding) $433MM (sponsored research)
m. Corporate sponsored funding for research and economic development • In total • In Iowa	$75.9MM $1.9MM	$91.7MM $2.0MM
n. Iowa special appropriations for economic development in the following categories • Annual state appropriations for ongoing programs (TIC, ORP and CADD) • RIF appropriations	$209,279 $1,050,000	$209,279 $1,050,000
o. Estimated jobs created by SBDC clients	125	211

Direct and Hands-on Technical Assistance to Businesses, Faculty Inventors & Entrepreneurs

Office of the Vice President for Research and Economic Development (OVPR&ED)

University of Iowa Research Foundation (UIRF) – As the university's technology transfer office, the UIRF's primary functions are:

- Protecting IP through patents and copyrights
- Building a network of private-sector partners and experts to assess and commercialize UI technologies
- Advising on intellectual property terms in sponsored research agreements and clinical trials
- Executing outgoing material transfer agreements
- Protecting the university's IP portfolio against infringement

The University of Iowa Research Foundation (UIRF) received 151 invention disclosures (up 1.5% over last year). It also executed 39 license or option agreements. Iowa startups accounted for 19 of these option agreements.

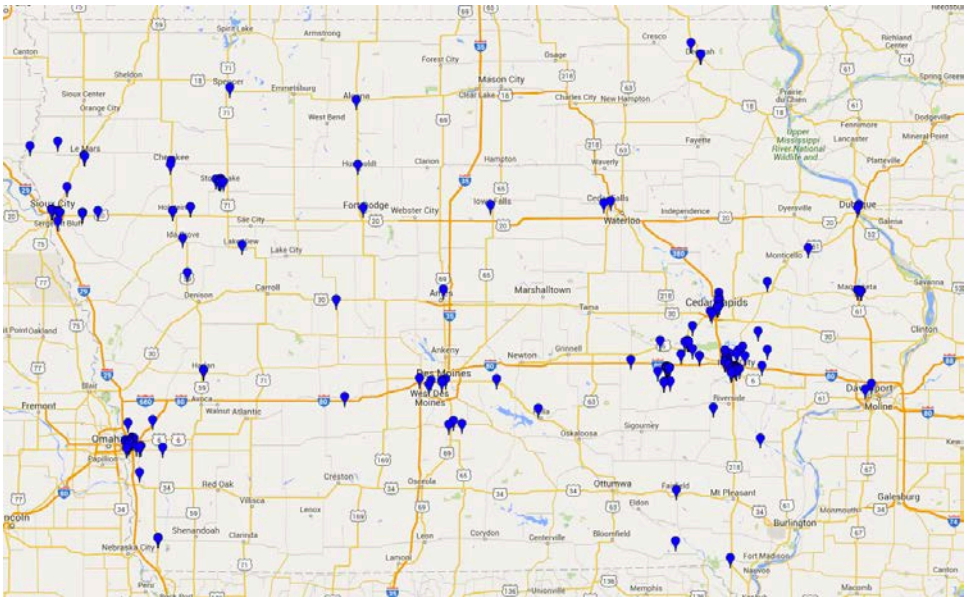
UI Ventures – UI Ventures focuses on faculty startup creation, financing, mentoring, and education. The organization's activities include:

- Promoting the Lean Startup method via four-week Innovators Workshops as a member of the NSF I-Corps program
- Applying this Lean Startup market discovery to validate the viability of potential ventures
- Introducing faculty to investors and entrepreneurs through Iowa Connect events
- Providing gap funding to advance promising IP toward industry licensing or UI Ventures
- Using Discovery to create viable business models, go-to-market plans, business plans, pro forma financials, via student teams and graduate level advisors
- Preparing startups for federal SBIR/STTR programs, competition/investor "Pitches", and developing business networks and partnerships
- Building business relationships and connecting ventures to these advisors, business mentors, and sources of capital
- Maintaining contact with key investors
- On-going education and mentoring for inventors and startup founders

There are now 60 startups in the UI Ventures pipeline, 14 of which were added in FY16. An additional 23 pre-ventures are discovering their market potential. A growing number of UI ventures are efficiently leveraging UI and Iowa state economic development resources to build value and developing investor partnerships. In FY16, UI Ventures-assisted startups brought in over $1.6MM in non-dilutive capital.

ProtoStudios – ProtoStudios, will be a cutting-edge biomedical and electronics prototyping hub located within downtown Iowa City's MERGE space to support the development of everything from biomedical devices to wearable technology. In 2016, ProtoStudios received a $1.5MM grant from the Iowa Economic Development Authority to purchase 3D modeling software and hardware, prototyping, and electronics equipment. The space is scheduled to open in early 2017.

UI Partners – IT Assistance – UI Partners was created to help Iowa small businesses innovate by solving their information technology (IT) challenges using practical insights and ideas drawn from university faculty, staff, and students. UI Partners was piloted in Iowa City with two full-time IT professionals who directed a team of four student interns. Students had the opportunity to work with multiple businesses needing IT assistance. This experience was meant to prepare them for an IT career and in some cases may lead to permanent employment with UI Partners' clients. Services offered included free technology assessments, custom application development, advanced networking, computer optimization, security and performance, hardware and software installation, data backup, remote monitoring of mission critical PCs and website design. In FY 2016, the organization provided 11,960 hours of IT assistance to 292 clients in 68 Iowa communities and 40 counties. The counties served include: Buena Vista, Iowa, Pottawattamie, Linn, Woodbury, Johnson, Ida, Marion, Washington, Cherokee, Hardin, Plymouth, Sac, Warren, Winneshiek, Dubuque, Polk, Jackson, Guthrie, Black Hawk, Jones, Fremont, Jefferson, Louisa, Cedar, Worth, Benton, Clay, Greene, Kossuth, Crawford, Webster, Jasper, Mills, Story, Humboldt, Van Buren, Scott, Harrison, and Shelby.



Map of UI Partners locations in FY 2016

2016 Commercialization and Business Development Funding Awards

UI Ventures, in collaboration with the UIRF and outside experts, worked to vet new projects and provide proof-of-concept funds for projects that could lead to new company formation. A summary of projects evaluated in FY 2016 is shown below. An historical view of Grow Iowa Values Fund (GIVF) commercialization funding that stimulated startup activity is also provided in Appendix A.

Gap Funding Awards for FY 2016

Title	PI(s)	Venture/License	Gap Funding	Additional Funding	Technology
Development of a Self-Destructing Cellular Barcode for Single-Cell Analysis	Ankrum, James	License	$75,000		Medical Diagnostic
Algorithm to Rank Actionable Mutations for Personalized Cancer Treatment	Dai, Donghai & Thiel, Kristina	Startup	$75,000	$510,000	Predictive Precision Medicine
Concept Development of a Cochlear Implant Electrode	Hansen, Marlan & Kaufmann, Christopher	Startup	$75,000	$277,000, Investor interested	Medical Device
Alphavirus vaccines for the treatment of prostate cancer	Lubaroff, David & Harris, Hank	Startup	$75,000		Therapeutic Drug
Light driven sustainable desalination unit	Mubeen, Syed	Startup	$50,000	Investor interested	Environmental Device

A safe and efficient method of rapid surgical wound closure	Ries, Zachery	License	$32,024		Medical Device
Use of Thymol and Carvacrol (monoterpene phenols) for induction of increased skeletal muscle endurance, lean muscle mass and reduced adiposity	Sah, Rajan	Startup	$74,296		Nutraceutical
Advancing Copeptin as a Biomarker of Preeclampsia	Santillian, Donna	License	$75,000		Medical Diagnostic
Social Media Powered Real-Time Digital News Recommendation Service	Shafiq, Zubair	Startup	$75,000	Investor Interested	Cloud Social Software
Delirium prediction and screening by non-invasive point-of-care device	Shinozaki, Gen & Cromwell, John	Startup	$57,500	$52,500	Medical Device
A Silicon Nanowire Array Optoelectronic Cartridge For Cancer Biomarker Detection	Toor, Fatima & Salem, Ali	Startup	$64,873	$63,500	Medical Device
Light Based Dental Instrument for Treatment of Bacteria	Morio, Kimberly A.	License	$10,000	$13,5000	Dental Device
		Totals	**$663,693**	**$916,500**	

John Pappajohn Entrepreneurial Center (JPEC)

Venture School – JPEC offers an immersive "Lean LaunchPad," or business model canvas, bootcamp-style training program named Venture School to accelerate startups. Venture School targets community members in several towns across Iowa who are committed to investigating their business hypotheses and applying the scientific method to improve their concept and to better gauge the viability of their ideas. Venture School emphasizes real-world entrepreneurship through experiential learning, a flipped classroom, and immediate feedback. Upon completion of the program, 28 new ventures were launched and 21 existing startups or businesses refined their business models.

- In FY 2016, 101 teams comprised of 308 entrepreneurs attended Venture School to assess and improve the commercial viability of their startup ideas and business models. Upon completion of the program, 28 new ventures were launched and 21 existing startups or businesses refined their business model through Venture School. There were eight Venture School cohorts across the state in 7 cities: Iowa City, Des Moines, Cedar Falls, Council Bluffs, Cedar Rapids, Sioux City, and the Quad Cities.
    - Four Venture School teams have been accepted into regional accelerators (NMotion and ISA)
    - Four Venture School teams were nominated for a Prometheus Award
    - Venture School Alumni have won the Invest In She, Dream Big Grow Here, The Pappajohn Business Model Contest and one team qualified for the One in a Million pitch competition (Kaufman Foundation)
    - Venture School Lite, a three-hour workshop, was held in partnership with the Metro Economic Alliance in Cedar Rapids and with the SBDC in Ft. Dodge and Clarion.

Assistance to Businesses – JPEC faculty and staff provide one-on-one and faculty/student team-based consulting services to technology-based entrepreneurial companies located at the UIRP, the BELL and throughout Iowa's

Creative Corridor.

- JPEC staff provided consulting services to over 269 regional entrepreneurs and business startups, totaling over 9,356 hours of assistance.
- An estimated 6,600 hours of research, analysis and strategic planning services were performed for 55 Iowa companies assisted through the JPEC faculty/student team consulting courses.
- MBA students completed four technology commercialization feasibility studies for nascent technologies being developed by University of Iowa faculty.

Six-Week Start-Up – JPEC delivers this intense entrepreneurial training program for start-up and growing businesses. The initiative prepares aspiring entrepreneurs to launch new ventures and existing companies to grow their businesses. Two classes were held in Iowa City in FY 2016.

Seminars/Workshops/Lecture Series – JPEC hosted more than 16 different opportunities last year for students, faculty and persons from the community. In FY 2016, over 18,000 attendees came to learn from experienced entrepreneurs on a variety of topics including: the Technology Export Roundtable, various tax workshops, Entrepreneurial Boot Camps and lecture series.

Wellmark Venture Capital Fund – JPEC is the regional administrator of the $5M Wellmark Venture Capital Fund that supports the creation and growth of new businesses throughout the state. JPEC screens applicants, performs due diligence, evaluates business concepts, and assists applicants with their business plans. JPEC partners with area angel investors, equity fund managers, lenders, the Iowa Economic Development Authority, and the Small Business Administration to help business owners secure additional venture funding.

Elevator Pitch Competitions – Four various Elevator Pitch Competitions were held with $31,000 in cash prizes awarded to 33 teams. 102 total teams participated.

UI Business Plan and Model Competition – A total of 4 business plan and business model competitions were held. A total of $49,000 was awarded to 23 teams, with 110 teams participating. The top student team received an additional $5,000 and two teams had the opportunity to participate in the International Business Model Competition held at Brigham Young University. SwineTech won 1st place and received $30,000 in prize money. A 2nd student team, ORGANizer was quarterfinalist and won $2,000.

Iowa Medical Innovation Group (IMIG) – This unique, student-led program focuses on identification of solutions to clinical problems through collaborations between the Colleges of Medicine, Engineering, Business and Law. Students work on creating medical devices and/or Health IT solutions with the assistance of staff from JPEC and UIRF; to date, over 40 promising technologies have been identified and reviewed and four are currently moving forward in advanced phases of development in anticipation of forming startup companies.

UI Small Business Development Center (SBDC) – In FY 2016, the UI SBDC, which provides small business counseling services and training in Cedar, Johnson, Iowa, Poweshiek and Washington counties, served 268 entrepreneurs and small businesses, resulting in 23 new business starts. SBDC clients raised over $6 million in external financing and created an estimated 125 jobs. The SBDC also provided 1,034 hours of one-on-one counseling.

Direct Economic Development Assistance to Iowa Communities

Office of the Vice President for Research and Economic Development

UI Partners – UI Partners was created to help Iowa small businesses innovate by solving their information technology (IT) challenges using practical insights and ideas drawn from university faculty, staff, and students. The organization also offered IT training to support workforce development.

John Pappajohn Entrepreneurial Center (JPEC)

Online Education – Students who cannot come to Iowa City may still earn a BBA or Certificate in Entrepreneurial Management online through the University of Iowa's Division of Continuing Education. The certificate is also accessible through JPEC's partnership with several Iowa community colleges. Students located around the Des Moines area may earn the BA in Enterprise Leadership degree at the New Iowa Center for Higher Education.

Business Consulting Services – Through the Entrepreneurial Management Institute, JPEC offers business consulting services to entrepreneurial and startup companies around the state. In FY 2016, 49 projects were completed for Iowa-based companies and organizations.

Corridor Business Alliance

The Corridor Business Alliance was created in December 2009 and is composed of leaders from the Cedar Rapids Metro Economic Alliance, the Entrepreneurial Development Center, the Iowa City Area Chamber of Commerce, the Iowa City Area Development Group, Kirkwood Community College, MidAmerican Energy, Kirkwood's Small Business Development Center, the University of Iowa's Small Business Development Center, the Research Foundation and the John Pappajohn Entrepreneurial Center. More information on this regional approach is available at http://corridor2020.com/2009/11/corridor-business-alliance/. The overarching goal is to identify and leverage the region's unique educational, business development and industrial assets to enhance recruitment of new companies, development of innovative startup companies and retention of existing industry.

Economic Development Services Provided by the Research Parks, Incubators, Similar Service/ Units

The University of Iowa Research Park, BioVentures Center and Technology Innovation Center

Corporate tenants of the University of Iowa Park benefit from sustained relationships with University of Iowa in the form of access to specialized research facilities, library access, faculty consultation, research collaboration and access to students as interns and employees. University of Iowa resources also provide smaller companies with assistance in business planning, identification of professional service providers, introductions to local and state government agencies and the regional business community, help in identification of potential sources of investment and other funding and communications. For a list of companies and developers associated with the Research Park, BioVentures Center and Technology Innovation Center, see Appendix B.

University of Iowa Core Facilities

In addition to campus-based core university facilities, four specialized University of Iowa laboratories reside within the University of Research Park. These facilities provide technical support services critical to the growth of startup companies as well as UI and existing industry partners. These units provide Iowa with unique capabilities that IEDA and local economic development entities have utilized to recruit outside companies to the Research Park, the region and the state. These facilities include:

University of Iowa Pharmaceuticals (UIP) – The University of Iowa Pharmaceuticals, a division of the University of Iowa College of Pharmacy, offers contract analytical, development, and GMP manufacturing services to the pharmaceutical and biotechnology industry. The Center for Advanced Drug Development (CADD) within UIP is a U.S. Food and Drug Administration (FDA) registered and cGMP-compliant laboratory that works closely with the manufacturing groups at University of Iowa Pharmaceuticals. The focus of CADD is the development of analytical methods and testing to support the manufacture and control of clinical supplies of new drugs entering initial clinical trials.

CADD has a client base of mainly smaller biotechnology and pharmaceutical companies and a growing pool of U.S. and foreign pharmaceutical firms. CADD is particularly well positioned to work directly with discoveries from Iowa university research laboratories, thereby providing an opportunity to hasten technology transfer and shorten the time to market. The presence of these FDA registered facilities, along with the Center for Biocatalysis and Bioprocessing (CBB) makes the University of Iowa unique among U.S. universities in facilitating the development of new therapeutics from pharmaceutical and biotechnology-based companies, as well as serving to enhance the translational science research occurring within the University of Iowa.

Center for Biocatalysis and Bioprocessing (CBB) – The CBB is an interdisciplinary center that enhances research, education, and economic development in the board area of biotechnology. CBB membership consists of faculty and students across six colleges with a passion to advance innovations in Biocatalytic Science. The Center operates a microbial fermentation facility that serves as a Contract Manufacturing Organization (CMO) or Contract Research

Organization (CRO). The Center's facility specializes in both upstream and downstream bioprocessing with expertise in process scale up to reactor volumes up to 1000 liters. CBB clients range from multi-national corporations to small startup companies with fermentation needs for manufacturing food products, biofuels, biopharmaceuticals and other biotechnology products. Production ranges from small molecules to complex proteins, including alcohols, vaccines, antibiotics, anti-cancer drugs, polymers, high-value biochemicals, enzymes, pharmaceutical intermediates and derivatives of bioactive compounds. The CBB facility offers the capability to manufacture putative pharmaceuticals for human and animal health under cGMP conditions. The CBB is a distinguished bioprocessing facility located within a university setting. The CBB's extensive history of successful projects makes possible our ability to establish efficient, commercial scale bioprocesses characterized by reproducible yields of the highest quality material.

National Advanced Driving Simulator (NADS) – The National Advanced Driving Simulator (NADS) is a center for driving simulation excellence located at the University of Iowa Research Park. This center's mission is to improve driving safety through the research of human-motor vehicle connection. Development and research conducted at NADS is sponsored by government, military, and industry partners, saving lives and improving quality of life for motorists, as well as advancing the cutting edge in driving simulation. This facility is home to the one of the world's most advanced research driving simulators, the NADS-1. In addition, NADS has developed an in-house portable driving simulator, the MiniSim™, which is currently being marketed to research institutions around the country. Recent research at NADS has focused on detection of impaired drivers, distracted driving, drowsy driving, advanced vehicle crash warning systems, and future vehicle communication systems. NADS has added an autonomous vehicle to its fleet and is currently working to advance understanding and standardization at the interface between drivers and automation.

State Hygienic Laboratory – The State Hygienic Laboratory at the University of Iowa is the state's environmental and public health laboratory, serving all 99 counties by testing for and tracking infectious diseases and illnesses; performing newborn and maternal screening; and monitoring the air, water and soil for environmental contaminants. Each year, the Hygienic Laboratory conducts more than 500,000 tests for Iowans and an estimated 250,000 additional for clients outside of the state. The laboratory responds to public health threats such as Zika, Ebola, mumps, tuberculosis, Salmonella and many other infectious diseases. It is a national leader in newborn screening and water quality monitoring.

As a member of the CDC's Laboratory Response Network, the Hygienic Laboratory is part of a national network of labs that respond to biological and chemical threats. As such, the Hygienic Laboratory provides training, emergency response exercises and testing for the 144 sentinel labs located in hospitals and clinics throughout the state. The State Hygienic Laboratory is based in Coralville with additional laboratories in Ankeny and Milford.

Collaboration for Economic Development with Iowa Entities

Kirkwood Regional Center at the University of Iowa

Construction of the STEM center, a partnership between the University of Iowa and Kirkwood Community College, was complete in summer of 2015. The facility houses the professional development staff of the Grant Wood Area Education Agency (AEA) and provides STEM-related coursework and Career Academy experiences to high school students from seven regional school districts. College of Education faculty are partnering with the schools and Grant Wood AEA to provide K-12 professional development for teachers. The advanced TILE-like classroom design within the University of Iowa space of the Center serves to assess new models of teaching and learning, as well as to train high school and community college teachers in active learning delivery strategies.

A variety of UIRP technology companies and University centers and laboratories, including the State Hygienic Laboratory, the National Advanced Driving Simulator, UIHC, the Center for Computer-Aided Design and the Flood Center are serving as experiential sites to augment career academy experiences. Additionally, University of Iowa health science colleges are adding value to Kirkwood's highly successful Health Science Career Academies across all health disciplines. In addition, the Jacobson Institute for Youth Entrepreneurship at the College of Education has developed a new course, STEM Innovator's Business Innovation, which will be piloted in the fall of FY 2016. This unique center will also serve as a programmatic home for the Southeast Regional STEM hub created under the Governor's STEM Advisory Council. The College of Education undergraduate and graduate courses are being offered in the UI classroom space and UI faculty members are teaching career academy courses and serving as guest speakers for several courses. A UI Friday Speaker Series has been instituted at the KRCUI and we hosted a Pre-

Service STEM Teacher Conference in the space last fall.

MERGE

MERGE, is a new startup incubator in downtown Iowa City that will include offices for university and community startups, dedicated space for coding, and the latest prototyping and 3D modeling technology to transform innovative concepts into real-world products and devices. MERGE is a collaborative effort between the University of Iowa, the Iowa City Area Development (ICAD) Group, the City of Iowa City, and the Iowa City Public Library. Funding support includes $1.5M from the Iowa Economic Development Authority, and $800,000 from the U.S. Economic Development Administration. Established as a new state resource, MERGE will bring together entrepreneurs, startup companies, engineers, technology professionals, graphic artists, coders, students, professionals, and business resources all in one location.
MERGE will also house a biomedical/electronics workshop called Protostudios, which will fill a crucial gap in Iowa's existing network of advanced manufacturing hubs by providing the equipment and expertise needed to produce very small, high-resolution, biocompatible medical and electronic device prototypes.

IC CoLab

The University of Iowa is a sponsor of the IC CoLab, a co-working space developed by the Iowa City Area Development Group (ICAD Group) to serve the needs of young entrepreneurs and their businesses. Co-working is not just about the space, it's about a social gathering of people who share values and who are interested in the synergy that can happen from working with like-minded talented people in the same space. Co-working offers a solution to the problem of isolation many entrepreneurs experience while working at home and by providing a cost effective location with ongoing, daily support and connections to community resources. The IC CoLab is relocating its operations to MERGE.

FY 2016 Regents Innovation Funds (RIF)

RIF Impact for the University of Iowa

The Regent's Innovation Funds allow the University to produce high-value intellectual property that derives from faculty research and enhances technology transfer and commercialization through the concerted efforts of our integrated economic development model. The ultimate goal is to facilitate industry-academia partnerships in technology commercialization, cultivate student and faculty entrepreneurship, and continue to support and grow existing companies and create new companies in Iowa based upon UI technology. Additional funds were used to support:

- The development of innovations with commercial potential, with the result that more University of Iowa technology reaches the marketplace. The funding is intended to support a range of stages in technology development, from initial concept, through proof of concept, to licensing and commercialization.
- Building effective partnerships for economic development between the private sector and the University of Iowa.
- Increasing the effectiveness of University of Iowa resources in aiding existing state and regional economic development initiatives, including expanding projects with Iowa companies.

Successful Technology Transfer, Commercialization and Startups Enabled by UIRF and RIF Proof-of-Concept Support

Emmyon, Inc. is developing compounds to prevent and reverse changes in muscle gene expression that cause muscle atrophy. These compounds are currently in pre-clinical testing and have shown benefits in the prevention and treatment of skeletal muscle atrophy, induction of skeletal muscle hypertrophy, increased strength and exercise capacity, reduced body fat and blood glucose, decreased plasma cholesterol, and prevention of obesity, pre-diabetes and fatty liver disease. The group received $50,000 Proof-of-Concept support which led to the formation of the

company in 2011. Since then, Emmyon has received 2 SBIR Phase I awards of $160,002 in 2013, and $225,000 in 2016 as well as an STTR Phase I award of $225,000 in 2014.

iotaMotion, Inc is developing an implantable robotic system to adjust cochlear implant electrodes with the goal of improving long-term hearing outcomes. The UIRF funding of $75,000 triggered a development and funding cascade for iotaMotion as they brought in an additional $50,000 from Iowa program funds, and $225,000 from a Phase I SBIR within 6 months of receiving the GAP funding. This has led to securing a top executive in the field, support from Key Opinion Leaders and a potential partnership with at least 1 major cochlear implant company.

Viewpoint Molecular Targeting, LLC is developing pharmaceutical drugs for diagnostic imaging and therapy for cancer, with a focus on metastatic melanoma.

Regents Innovation Fund projects for FY 2015-FY 2016

RIF Program Summary	Description of Program	FY16 – RIF Expenditures From FY15 and FY16 Match Funds Source	Progress through June 30, 2016 ROI DATA
VP for Research	These funds have been instrumental in enabling the University of Iowa to expand the economic development infrastructure. These funds supported critical economic development functions associated with University Research Park, the BioVentures Center and the Technology Innovation Center.	**EXPENDITURES: $80,315** **MATCH: UI BioVentures Center in-kind contribution: $78,000**	Staff support for UIRP, BVC and TIC.

MERGE	MERGE, is a new startup incubator in downtown Iowa City that will include offices for university and community startups, dedicated space for coding, and the latest prototyping and 3D modeling technology to transform innovative concepts into real-world products and devices. MERGE is a collaborative effort between the University of Iowa, the Iowa City Area Development (ICAD) Group, the City of Iowa City, and the Iowa City Public Library. Funding support includes $1.5M from the Iowa Economic Development Authority, and $800,000 from the U.S. Economic Development Administration. Established as a new state resource, MERGE will bring together entrepreneurs, startup companies, engineers, technology professionals, graphic artists, coders, students, professionals, and business resources all in one location.	**EXPENDITURES: $183,606** **MATCH: UI BioVentures Center in-kind contribution; VPR Reserves: $271,028**	Funding was used to create architectural drawings and interior design concepts for the space that will be renovated to become MERGE—an incubator for community and university startups. The building being renovated is a former pizza restaurant and coffee shop. Inclusion of startup offices and a biomedical/ electronics workshop will require updates to mechanical, electrical and HVAC systems. The architectural design drawings were required to apply for a federal grant from the Economic Development Authority.
University of Iowa Research Foundation (UIRF)	UIRF builds relationships among UI researchers, industry, and startups to get UI innovations out into the world. UIRF staff work closely with researchers to help them understand industry needs, develop commercially valuable technologies, and find industry funding and partners. The licensing team matches companies with the researchers and technologies that can best address their needs. UIRF collaborates with UI Ventures to license technologies to startups and help them get launched.	**EXPENDITURES: $167,846** **MATCH: UIRF Seed Grants $197,483**	UIRF has implemented a new streamlined licensing process for UI inventor-founded startups, with generous and easy-to-understand terms. This has helped drive both startup formation and licensing in FY16. Associate directors of Licensing and IP have joined the UIRF team and are developing new processes to improve efficiency, expand the UIRF's network of industry contacts, focus resources on promising technologies that solve real-world problems, and teach inventors how to develop more valuable technologies. Customer discovery is now an integral part of the invention disclosure assessment process. The licensing team regularly travels to meet with companies and build long-term relationships.

UI Partners & Dev/IA	An external-facing organization that provided hands-on IT assistance and training to Iowa small businesses and their workforces, making them more innovative and competitive by leveraging student interns.	**EXPENDITURES: $440,362** **MATCH: UI Research Foundation Seed Grants and Reserves: $400,971**	Funding was also used for program development and staffing for engagement centers to impact statewide economic development efforts. In FY 2016, the organization provided 11,960 hours of IT assistance to 292 clients in 68 Iowa communities and 40 counties.
UI Ventures	An organization specifically focused on helping faculty, postdocs and graduate students create startups, find mentors, recruit CEOs and raise capital.	**EXPENDITURES: $150,000** **MATCH: UI Research Foundation Reserves $150,000**	These funds are used to bring resources and expertise to faculty, postdocs and graduate students who want turn their ideas into viable companies capable of raising private equity. The pipeline of investable startups to continue to grow as the program matures. In FY16, UI Ventures assisted 38 startup companies and an additional 26 pre-venture teams. UI Ventures launched 2 new programs in FY16 aimed at increasing the entrepreneurial education and networking among faculty inventors-- Faculty Innovators Workshop and Iowa Connect. Faculty Innovators Workshop, sponsored by NSF I-corps and operated in conjunction with JPEC, consisted of a condensed course of Venture School targeted to faculty-led companies. Iowa Connect involved a networking and education program designed to bring faculty into contact with investors and business leaders in their specific fields and increase day-to-day knowledge of running a research-based business.

Appendix A

GIVF Funded Projects		Startups Created	Potential Startup Identified	Startup Formed	Year Company Started	Company Name	Startup Is On-Going	Remains Under Consideration for Startup	GIVF stimulated What Result	UIRF Option or License
FY 2016										
Morio/Toor	71	36	√	√	2015	BECC Applied Sciences	Yes		Startup Formation	
Hansen/ Kaufmann	70	35	√	√	2015	IotaMotion	Yes		Startup Formation, follow on funding	Optioned
Ries	69									
Mubeen	68		√			EcoHawk Water Solutions		yes	Investor interest	
Abrons	67									
Shafiq	66		√							
Toor	65	34	√	√	2014	Advanced Silicon Group	Yes		Startup moved to Iowa	Partnership
Shinozaki	64	33	√	√	2016	Predelix Medical	Yes		Startup Formation	
Dai	63		√	√	2014	Immortagen	Yes		Follow on funding	Licensed
Santillan	62									
Sah	61		√					yes		
Lubaroff	60		√					yes		
Ankrum	**59**									
FY 2015										
Abrons	58		√							
Amendt	57	32	√	√	2014	NatureMiRi	Yes		Startup Formation	Optioned
Baker	56	31	√	√	2015	Clipse Therapeutics	Yes		Startup Formation	Optioned
Dai	55	30	√	√	2014	Immortagen	Yes		Startup Formation	Licensed
Haim	54									
Henry	53		√	√	2016	SynderBio	Yes		Startup Formation	Optioned
Hurtig	52		√	√	2013	Voxello	Yes		Startup Formation	Licensed
Jin	51		√	√	2014	InnoBioPharma	Yes		Startup Formation	Under negotiation

Laroia	50									
Wohlgenannt	49									
Xia	48		√	√	2014	Infondrian			Startup Formation	**Optioned**

FY 2014

Bowden	47		√	√	2013	Pure Oleochemicals	Yes		Startup Formation	Optioned
Choi	46	29	√	√	2013	Ramdo	Yes		Startup Formation	Licensed
Henry/Vigmostad	45	28	√	√	2016	SynderBio	Yes		Startup Formation	Optioned
Hurtig/Hahn	44	27	√	√	2013	Voxello	Yes		Startup Formation	Optioned
Jin	43	26	√	√	2014	InnoBioPharma	Yes		Startup Formation	Optioned
Norian	42		√	√	2010	Memcine	Yes			Licensed
Ozbolat	41	25	√	√	2014	BioPrint	No		Startup Formation	
Vandenbush	40		√	√	2010	Memcine	Yes		Startup Formation	Licensed
VanVoorhis	39		√					No		
Xia	38	24	√	√	2014	Infondrian	Yes		Startup Formation	Optioned

FY 2013

Anderson	37		√	√	2011	FxRedux Solutions	Yes	√	Product Beta	Licensed
Assouline	36	23	√	√	2012	NanoMedTrix	Yes		Startup Formation	Option expired
Bowden	35	22	√	√	2013	Pure Oleochemicals	Yes	√	Startup Formation	Optioned
Flynn	34		√	√	2013	pxAlpha	Yes	√	Startup Formation	Optioned
Marler/ Ozobolat	33	21	√	√	2013	Virtual Systems Engr.	Yes	√	Startup Formation	Licensed
Martins/Mickelsen	32		√	√	2011	Iowa Approach	Yes	√	Startup Formation	Licensed
McNamara	31	20	√	√	2014	Nuclease Probe Technologies	Yes		Startup Formation	Optioned, expired
Morcuende/Grosland	30	19	√	√	2012	Clubfoot Solutions	Yes	√	Startup Formation	Licensed
Peters	29					Zefon International			Licensed to Existing Company	Licensed
Raghavan	28								Project Terminated	
Vanden Bush/Bishop	27		√	√	2010	Memcine	Yes	√	Startup Formation	Licensed
Wahls	26		√	√	2011	Xcellerator	No		Startup	

									Formation	

FY 2012

Adams/Welsh	25		√	√	2011	Emmyon	Yes	√	Startup Formation	Licensed
Davidson	24	18	√	√	2013	Spark Therapeutics	Yes	√	Startup Formation	Licensed
Das	23				2012			√	Project Terminated	
Flynn	22	17	√	√	2010	pxAlpha		√	Startup Formation	Optioned
Howard	21		√	√	2012	Direct Spinal Therapeutics	Yes	√	Startup Formation	Licensed
Martins/Mickelsen	20	16	√	√	2011	Iowa Approach	Yes	√	Startup Formation	Licensed
Salem	19	15	√	√	2009	PolyImmunex	No		Startup Formation	
Wahls	18	14	√	√	2011	Xcellerator	No		Startup Formation	
Vanden Bush/Bishop	17		√	√	2010	Memcine	Yes	√	Startup Formation	Licensed

FY 2011

Anderson	16	13	√	√	2011	FxRedux Solutions	Yes	√	Startup Formation	Licensed, terminated
Baker	15	12	√	√	2010	Tansna	Yes	√	Startup Formation	Option Terminated
Doddapaneni*	14								Project Terminated	
Comeron, Manak	13								Project Terminated	
Vanden Bush/Bishop	12	11	√	√	2010	Memcine	Yes	√	Startup Formation	License
Howard	11	10	√	√	2012	Direct Spinal Therapeutics	Yes	√	Startup Formation	Licensed

FY 2010

Schlutz	10	9	√	√	2009	ViewPoint Mole. Targeting	Yes	√	Startup Formation	Optioned
Adams	9	8	√	√	2012	Emmyon	Yes	√	Startup Formation	Licensed
McCray	8								Ongoing Research	
Lim	7	7	√	√	2007	JL Meditech	No	Not viable	Lack of viability	Lack of viability
Leddy	6	6	√	√	2009	Voltesla	No	Not viable	Startup Formation	Optioned then terminated

FY 2007

Abramoff	5	5	√	√	2009	IDX	Yes		Startup	Licensed

									Formation	
Arnold	4	4	√	√	2005	ASL Analytical	Yes		Startup Formation	Material Transfer Agreement
Hohl	3	3	√	√	2005	Terpenoid Therapeutic	No		Startup Formation	Licensed
Welsh	2	2	√	√	2007	Exemplar Genetics	Yes		Startup Formation	Licensed
Wohlgenannt	1	1	√	√	2006	OMR Sensors	No	**Not viable**	Lack of viability	Lack of viability
TOTAL	71	36								

Appendix B

Name of Business or Other Entity Served	City	County	University Unit that Interacted with Business or Other Entity
AMBI Group	Coralville	Johnson	Technology Innovation Center
ASL Analytical	Coralville	Johnson	BioVenturesCenter
Bio::Neos, Inc.	Coralville	Johnson	BioVenturesCenter
Brain Image Analysis	Coralville	Johnson	Technology Innovation Center
BRL HR	Coralville	Johnson	Technology Innovation Center
Cardiostrong	Coralville	Johnson	BioVenturesCenter
Cardiovate	Coralville	Johnson	BioVenturesCenter
Cellular Engineering Tech	Coralville	Johnson	BioVenturesCenter
Componica, LLC	Coralville	Johnson	Technology Innovation Center
CorvidaMedical	Coralville	Johnson	Technology Innovation Center
Digital Artefacts, LLC	Coralville	Johnson	Technology Innovation Center
EGR International Inc.	Coralville	Johnson	Technology Innovation Center
Emmyon	Coralville	Johnson	BioVenturesCenter
Exemplar	Coralville	Johnson	BioVenturesCenter
Foundations in Learning	Coralville	Johnson	Technology Innovation Center
Hennepin Life Sciences	Coralville	Johnson	BioVenturesCenter
Higher Learning Technologies	Coralville	Johnson	BioVenturesCenter
Immortagen	Coralville	Johnson	BioVenturesCenter
Integrated DNA	Coralville	Johnson	BioVenturesCenter
Innomatix, LLC	Coralville	Johnson	Technology Innovation Center

InnovasTechnologies	Coralville	Johnson	Technology Innovation Center
iotaMotion	Coralville	Johnson	BioVenturesCenter
JP II Medical Research	Coralville	Johnson	BioVenturesCenter
Memcine	Coralville	Johnson	BioVenturesCenter
NanoMedTrix	Coralville	Johnson	BioVenturesCenter
Pelvinn	Coralville	Johnson	Technology Innovation Center
RamaancharTechnologies, Inc.	Coralville	Johnson	Technology Innovation Center
RDB Bioifnormatics	Coralville	Johnson	BioVenturesCenter
Santos Human	Coralville	Johnson	BioVenturesCenter
The Thomas Group	Coralville	Johnson	Technology Innovation Center
Viewpoint Molecular Targeting	Coralville	Johnson	BioVenturesCenter
Voxello	Coralville	Johnson	BioVenturesCenter
RESEARCH PARK TENANTS	Coralville	Johnson	UI Research Park/TIC Graduate
Behavioral Diagnostics	Coralville	Johnson	UI Research Park
Brighton Group	Coralville	Johnson	UI Research Park
ConnectFive	Coralville	Johnson	UI Research Park
General Dynamics Information	Coralville	Johnson	UI Research Park
Integrated DNA Technologies	Coralville	Johnson	UI Research Park
KemPharm, Inc.	Coralville	Johnson	UI Research Park
Kirkwood Regional Center at the University of Iowa	Coralville/CedarRapids	Johnson/Linn	UI Research Park
LeepfrogTechnologies	Coralville/DesMoines	Johnson/Polk	UI Research Park
MediRevv	Coralville	Johnson	UI Research Park
Noel-Levitz	Coralville	Johnson	UI Research Park
Siemens	Coralville	Johnson	UI Research Park
Stanley Environmental, Inc.	Coralville	Johnson	UI Research Park
VIDA Diagnostics	Coralville	Johnson	UI Research Park
OTHER BUSINESS INCUBATOR GRADUATES ACTIVE IN IOWA			
Ecolotree, Inc.	North Liberty	Johnson	Technology Innovation
Corcoran Communications, Inc.	Iowa City	Johnson	Technology Innovation
Innovative Software Engineering	Coralville	Johnson	UI Research Park/TIC
Bio-Research Products, Inc.	North Liberty	Johnson	Technology Innovation
aJileSystems, Inc.	Cedar Rapids	Linn	Technology Innovation
CompuTerra, Inc.	Cedar Rapids	Linn	Technology Innovation
HomeSafe	Coralville	Johnson	Technology Innovation
The Patient Education Institute	Coralville/Iowa City	Johnson	UI Research Park/TIC
Police Law Institute	North Liberty	Johnson	UI Research Park/TIC
Corridor Business	Coralville	Johnson	Technology Innovation

Journal			
EpleyMarketing	North Liberty	Johnson	Technology Innovation
Sebesta Blomberg, Inc.	Cedar Rapids	Linn	Technology Innovation
ViveMedia	Coralville	Johnson	Technology Innovation
DEVELOPERS			
Myriad Developers, Inc.	Cedar Rapids	Linn	UI Research Park
TMD, L.L.C.	Solon	Johnson	UI Research Park
Midwest Development & Invest.Corp.	Fairfield	Jefferson	UI Research Park
Liberty Growth	Iowa City	Johnson	UI Research Park
Hunter Companies	Cedar Rapids	Linn	UI Research Park
S & S Developers	Iowa City	Johnson	UI Research Park
EMRICO	Iowa City	Johnson	UI Research Park
Ryan Companies, US	Cedar Rapids	Linn	UI Research Park
LMC, LLC	North Liberty	Johnson	UI Research Park
Oakdale 8, LLC	Iowa City	Johnson	UI Research Park

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FY16 Board of Regents, State of Iowa, Annual Economic Development and Technology Transfer Report

PRESENTED BY
MICHAEL CRUM, VICE PRESIDENT FOR ECONOMIC DEVELOPMENT AND BUSINESS ENGAGEMENT,
OFFICE OF THE PRESIDENT

October 19–20, 2016

Economic development is a top priority for Iowa State University. Indeed, it is a **prominent goal in the university's strategic plan**, and the university is very proud of the tremendous impact it has on the state economy. **In 2016 Iowa State received the prestigious designation as an *Innovation and Economic Prosperity University*** by **the Association of Public and Land Grant Universities** (APLU), the first university in Iowa to receive this recognition. As the APLU states, "The designation acknowledges universities working with public and private sector partners in their states and regions to support economic development through a variety of activities, including innovation and entrepreneurship, technology transfer, talent and workforce development, and community development."

The Office of Economic Development and Industry Relations (EDIR), which moved into the new **Economic Development Core Facility** in the ISU Research Park in June 2016, consists of the following key university economic development units that provide integrated and comprehensive business, technical, entrepreneurial support, and educational services to Iowa State's clients and partners:

- ***Center for Industrial Research and Service*** works with business and industry to enhance their performance through service offerings in four general areas: technology, growth, productivity, and enterprise leadership.
- The ***Small Business Development Center***, administered by Iowa State, consists of 15 regional centers serving all 99 counties in Iowa. SBDC assists individuals interested in starting new companies and provides business services and counsel to existing companies across Iowa to solve management problems, to improve operations, to seek financing, and to pursue new opportunities. Iowa State also operates a regional center.
- ***Pappajohn Center for Entrepreneurship*** serves entrepreneurs, provides entrepreneurial opportunities for students, hosts statewide business plan competitions, and leads university-wide academic programs in entrepreneurship, including an interdisciplinary minor in entrepreneurial studies, graduate courses, a recently-approved major in entrepreneurship for business students, and a newly-launched PhD program in entrepreneurship.
- ***ISU Research Foundation*** and ***Office of Intellectual Property and Technology Transfer*** manage, market, and license the intellectual property of ISU researchers and work with them to patent inventions and market the innovations to commercial partners.
- ***ISU Research Park*** provides a resource-rich environment including close proximity and easy access to Iowa State University for its tenant companies, which include start-ups and established companies that range from growing entrepreneurial ventures to global corporations. The Research Park offers high quality labs and office space, as well as numerous services and amenities that support the efforts of science- and technology-based organizations.

EDIR also serves as the gateway or portal to the university's expertise, capabilities, resources, and facilities that support and enhance economic development throughout the state. Thus, EDIR works very closely with other university units that contribute to the university's economic development efforts and impact, including the Office of the

Vice President for Extension and Outreach, the Office of the Vice President for Research, and the academic colleges.

ISU promotes economic growth in Iowa in a number of ways. We provide business and technical assistance to existing companies, we support the creation of new companies, we help attract new companies and entrepreneurs to Iowa, we create intellectual property and help move research ideas to the market, and we contribute to workforce and entrepreneurial development.

Business and Technical Assistance

During federal FY15, which is the most recent full year for the program, the **America's SBDC Iowa,** provided business assistance to individuals and companies **in all 99 counties totaling 3,141 clients** and 13,191 counseling hours. As a result of this counseling, **322 new businesses** were started and **1,586 jobs were created**. Additionally, SBDC assistance was credited by clients with increasing their capital infusion by more than $62.5 million and increasing their sales by more than $62.7 million. **This translates into 4 new jobs every day, a new business every 27 hours and an increase of $5.2 million in sales each month.**

The **ISU SBDC regional center**, in partnership with the ISU Pappajohn Center for Entrepreneurship, provided 533 hours of counseling assistance to startup and existing companies; **served 236 clients with one-on-one counseling**; **educated 184 attendees through workshops**; provided advice to several hundred clients via telephone and e-mail; and advised a number of technology companies in the areas of licensing, equity-based financing, market entry, and numerous operational areas. The centers **documented 45 new business starts with 144 new jobs created** that have generated **$2,791,160 in capital infusion**.

CIRAS has been working with companies in communities across Iowa for more than 50 years and has a vision for Iowa of healthy communities through business prosperity. **Cumulatively, over the past five years, CIRAS and partners have reported impact from companies totaling over $2 billion dollars ($1.8 billion in sales gained or retained, $229 million in new investments, $73 million in costs saved or avoided) with 28,653 jobs added or retained as a result of the assistance received.**

During FY16 **1,561 businesses from 95 counties** in the state received assistance on projects or attended educational workshops from CIRAS staff or partners. Companies responding to surveys reported **$424 million in total impact** — $359 million in sales gained or retained, $52 million in new investments, and $13 million in costs saved or avoided. Company executives stated that **5,400 jobs were added or retained** as a result of the assistance they received from CIRAS and its partners. The following summarizes the results of the four primary CIRAS programs for this past year:

- The CIRAS **Procurement Technical Assistance Program** (PTAP) works with Iowa businesses, from one-person operations to some of the state's largest employers, to help them understand the government procurement process and

to secure contracts. CIRAS is the only organization in the state of Iowa that provides contracting assistance at all three levels of the government market segmentation—local, state, and federal. Last year, CIRAS staff **counseled nearly 800 companies**, resulting in **more than $173 million in government contract impact** as a result, in part, to this assistance. The Defense Logistics Agency, which funds CIRAS to provide assistance to Iowa companies, indicated this impact **helped create or retain 3,465 jobs**.

- In 2015, **467 small- to mid-sized manufacturers** received assistance under the **Manufacturing Extension Partnership** (MEP) program. Companies *responding to third party surveys reported nearly **$248 million in financial impact*** from technical assistance and workshops on technology, growth, enterprise leadership, and productivity.

- CIRAS' **Economic Development Administration University Center Program** (EDAUCP) focuses on growing small businesses by coaching them on how to develop and commercialize innovative new products, processes, services or business models. Last year, CIRAS staff worked with **40 distinct clients on 10 different projects and events**. The program's Iowa Machinery Manufacturer's Innovation Summit held in the spring attracted 67 attendees.

- The CIRAS Technology Assistance Program (TAP has a mission to promote assistance to Iowa companies with technical problems and advancing R&D activities. The program is composed of two segments that support Iowa businesses in unique ways: the technology assistance group (includes materials, non-destructive evaluation, and engineering) provides shorter-term technical assistance, while the research cost-sharing program helps Iowa companies access ISU's faculty and facilities for research by providing a 1:1 cash-match on research projects. In 2015, CIRAS provided **technology assistance services to 58 distinct businesses**. Companies responding to surveys reported **$37.9 million of total economic impact** from the technology services they received.

Appendix 1 provides some illustrative examples of CIRAS, SBDC, and ISU Extension and Outreach projects with Iowa companies and entrepreneurs during the past year.

During the five year time frame FY2011-2015, more than 13,000 different companies in Iowa representing all 99 counties benefitted from CIRAS and SBDC business and technical assistance and/or education/training services.

This past year the **Community and Economic Development (CED) program within ISU Extension and Outreach helped 117 minority-owned business owners start or improve their own businesses, and assisted with the creation and the retention of 78 jobs for minority employees.** The estimated value of the jobs created/retained is $1,830,000.

For fiscal year 2016, the **ISU Extension and Outreach Value Added Agriculture Program** conducted several business **feasibility and market analysis studies enabling Iowa business' to qualify for loans and USDA loan guarantees** through

their local and/or regional banks and USDA-Rural Development. The in-depth studies examined the economic, market/marketing, technical, management, and financial aspects of the proposed business start-up or expansion. **Rural economic development feasibility and market analysis studies for ten local businesses in FY 2016 resulted in investments of $57 million into the Iowa economy and the potential for 248 newly created jobs when completed.** The projects cover a wide variety of business sectors, from dairy processing to aquaculture production facilities and a large scale regional sports complex to rural Iowa lodging facilities. The common thread is that VAPG feasibility and market analysis projects help clients gain access to capital that strengthen rural Iowa economies.

The ISU Research Park

The ISU Research Park has been hugely successful because companies find great value in having a closer physical presence to the university as it facilitates working with faculty and graduate students on research, tapping into and recruiting the graduate and undergraduate student talent pool, and accessing university facilities. Research Park tenants include companies of all sizes and industry focus, though engineering and technology firms and bioscience firms comprise the largest proportion, reflecting the STEM strengths of the university. Tenants include companies that were incubated at the Research Park as well as established global companies. **Four of the last five Iowa companies to go public started and reside in Ames, with three getting their start at the Research Park and two are still located at the Research Park.**

Today, the Research Park is a 300-acre development just south of campus with more than 600,000 square feet of building space. **Thirteen new companies and affiliates, five university departments (one of which rejoined the park after a 17-year absence), and seventeen pre-incubator companies joined the Park in FY16**, bringing the **historical total to 280 companies and 4,985 employees for current and former tenants that are still in existence world-wide.** Currently, there are **74 companies and research centers and 17 pre-incubator companies, and 12 affiliates located in the Park, employing 1,709 and 179 people, respectively**.

In June 2016 the Research Park launched the **ISU StartUp Factory** to provide a stronger support system for students, faculty and staff wanting to create businesses. Entrepreneurs in the StartUp Factory receive formal training, resources, and access to a network of business mentors, advisors, counselors and investors in two 26-week blocks: the first a formal curriculum centered on business validation, and the second, customized to their individual business needs. The **inaugural cohort is comprised of eleven companies** representing a wide range of technologies, products, and services. Two cohorts are admitted each year.

Workforce Development

Of course, a key component of the university's value proposition related to economic development, and its primary mission, is providing a world class education that provides students with the technical, analytical, problem-solving, communications, and social responsibility skills required in today's workplace. Iowa State is the largest

university in Iowa with **36,600 students**, and despite our Midwest location, our student body is quite diverse. **Nearly one in four Iowa State students is either a minority (12.6%) or international student (11.3%).** Our students represent every Iowa county, all 50 states and 125 countries. This diversity leads to a wide array of perspectives, capabilities, and ideas that enrich the learning environment. Not surprisingly, our graduates are in high demand and we have a **campus wide placement rate of almost 95%** (i.e., 95% of undergraduate students are employed in their field or are pursuing graduate education within six months of finishing their undergraduate studies).

Iowa State is well known for providing students with professional development activities on campus that provide great opportunities for companies to utilize our students' talents. We have excellent entrepreneurship programs in every college as well as "experiential learning" centers that provide opportunities for cross functional teams of students to work on business projects. **Each year more than 200 Iowa State students intern at ISU Research Park companies**. Additionally, engineering students complete a senior capstone project, and several faculty across campus integrate company projects into their courses.

During the summer of 2016, the **Pappajohn Center for Entrepreneurship** kicked off its 10-week summer accelerator program for students. **Thirteen students on eight (8) business teams** who participated in the Center's various pitch and business plan competitions throughout the year **were selected to spend the summer in a hands-on mentoring environment at the ISU Research Park to launch and grow their companies.** Students participated in educational sessions, received mentoring, and essentially interned in their own companies instead of working elsewhere during the summer. **All eight businesses have successfully launched.**

Additionally, the Pappajohn Center for Entrepreneurship **placed 19 student interns in startup companies located at the ISU Research Park**, and reported **more than 2,000 students enrolled in entrepreneurship-themed coursework** across campus. **Over 4,500 individuals participated in programs and classes focused on entrepreneurship, startups and small business.**

The CyBIZ Lab interdisciplinary student consulting program offers business solutions to companies of all sizes as well as supports faculty commercialization efforts. The improved performance resulting from these interactions allow businesses to retain and often expand their workforce. **Eighty (80) CyBIZ Lab students working part-time completed 45 consulting projects** and additionally facilitated several live case classroom projects that gave students the opportunity to work with actual businesses to solve business problems.

CyBIZ Lab has established a number of partnerships across campus that have expanded the learning opportunities for students and significantly increased the impact students have had with real businesses. **CyBIZ Lab worked with CIRAS to support five (5) companies participating in the ExportTech program**; completed **two (2) projects concurrently with engineering senior design cases**; paired up to perform **market validation research with 10 tech transfer projects that had received RIF funding** through EDIR; partnered with the Colleges of Business, Design and

Engineering on internal curriculum and program research projects; and as part of their normal operations worked with clients that included startups, non-profit organizations, communities, college administrators, small and medium sized businesses, and large global companies. CyBIZ Lab is unique in that teams are interdisciplinary and include both undergraduate and graduate students working together; projects also have a flexible timeline outside the classroom schedule, which allows teams to be highly responsive to company needs.

Senior capstone design projects are the culmination of engineering education for undergraduate students. Iowa companies, through a partnership between CIRAS and the College of Engineering, provide students with challenging opportunities to apply their engineering knowledge to real-world applications as a final step in preparation for joining the workforce. In addition to the senior capstone design projects, engineering students have worked with companies on projects related to lean manufacturing and facility planning.

By working with the students, companies gain a new perspective on difficult engineering problems as well as the value engineers bring to an organization. As a result of the projects, many companies achieve innovative solutions that lower costs and enhance quality and productivity. This collaborative program reinforces the benefits and challenges of working in team environments. The program also allows companies to gain insights regarding students as potential future employees.

In 2015, **engineering students worked on 106 projects, 80 of them with Iowa companies. This included 41 different Iowa companies across 23 Iowa counties**. Companies responding to surveys reported **impacts of nearly $22 million** for these projects.

ISU's **College of Engineering Community Outreach** is celebrating fifteen years of high quality STEM programming to create and deliver experiences that engage, educate and interest students of all backgrounds with a focus on creating an engineering pipeline to support workforce and economic development in Iowa and the nation. In the 2015-16 academic year, college programs engaged with business and industry partners impacting tens of thousands of individuals with over **5,000 young people participating in FIRST LEGO League and Jr. FIRST LEGO League**, **386 active Project Lead The Way programs and nearly 1,000 youth engaging in engineering kids summer camps.** In addition, **approximately 20,000 students and families were impacted through hands-on events** such as the state fair, school field trips and activities, and **over 500 teachers and administrators attended ongoing training and professional development** throughout the year. The college is keeping Iowa youth inspired through STEM initiatives today to build a better Iowa for tomorrow.

CED Extension and Outreach is part of the Iowa Retail Initiative (IRI), a collaboration to create thriving rural communities. Iowa State University is leading this initiative to support Iowa's independent retailers and revitalize rural downtowns. Financed by a Strategic Initiatives Grant from ISU Extension and Outreach, IRI unites existing campus services and provides a single point of contact for rural communities and retailers seeking help. In fall 2015, **33 ISU students in the interior retail design studio class developed design concepts to enhance local retail experiences for**

14 Marshalltown retailers on Main Street and within the local mall. These businesses included two ethnic grocery stores, an upholstery store and a local bike shop. In spring 2016 the Retailscapes studio worked with businesses in Jefferson. IRI hosted a summit in June 2016, at which 70 local community retailers and economic leaders showcased their communities, shared their retail and economic needs and lessons learned, and were given the opportunity to connect to IRI and other resources available from ISU and other state programs to help develop thriving communities.

In addition to professional development opportunities on campus, ISU's career services offices work closely with companies to assist them in establishing internships for our students. Internships provide students the opportunity to apply what they are learning on campus as well as the opportunity to experience firsthand the type of work environment they will be entering after completing their studies. Companies benefit from the interns' work output (many companies calculate a return on investment for their internship programs, and the returns are impressive), and they use the internship as a testing ground for prospective new employees. This past year our career services offices were able to document **2,487 ISU interns who were employed by more than 1,067 different Iowa employers located in 164 communities in 76 counties**. These numbers do not include students who found internship opportunities on their own nor do they include students who had non-internship jobs related to their field of study.

Iowa State also contributes to workforce development in the state by supporting students' learning and skill development even before they get to the university. For example, Iowa State University's North Central STEM Hub, one of six regional hubs of the Iowa Governor's STEM Initiative, has been connecting education and business to increase student interest and ability in STEM. The North Central STEM Hub has hosted STEM festivals at the Iowa State Fair and in Marshalltown and Mason City, where families engaged in hands-on STEM activities hosted by formal and informal K-12 educators, community colleges, businesses, and economic development organizations. **The North Central STEM Hub supported more than 350 educators and 17,900 K-12 students** in the region with STEM Scale-Up programs in an effort to increase the students' interest and ability in STEM. ISU Extension and Outreach professionals play a significant role in each region through representation on each of the six Regional Advisory Boards.

4-H is the youth program of America's Cooperative Extension Service and is the nation's largest youth development organization. In Iowa, 4-H Youth Development programs are headquartered at Iowa State University and available through ISU Extension and Outreach offices in all Iowa counties. 4-H connects almost 1 in 5 Iowa K-12 students to service opportunities in Iowa communities, and to Iowa's higher learning institutions and career opportunities in the state, thus **providing incentives for young people to stay, study, and work in Iowa.** 4-H emphasizes learning by doing, or experiential learning. Iowa 4-H had **direct, educational contact with 99,538 youth in the 2014-2015 program year** (September 1 to August 31) a growth of 5 percent from the previous year. Another 21,000 youth participated in programs of a shorter duration (less than six hours of programming). This means that **Iowa 4-H touches the lives of about 20 percent of all K-12 youth in Iowa** by providing education in citizenship and leadership, communication and the arts, healthy living, and STEM. **This reach includes more than 16,000 youth of color.** 4-H teaches

youth what they can do and what they can be, right here in Iowa – encouraging entrepreneurship and invention, and developing the state's future workforce.

Finally, several ISU units provide training and related educational activities to a wide variety of individuals, occupations, and industries across the state. **Appendix 2** provides several such examples.

Research and Technology Transfer

ISU promotes economic growth in Iowa through its research and technology transfer – conducting basic research which is at the foundation of many innovations in the marketplace, and collaborating with companies on their specific research and development initiatives to help them introduce new products and services and improved methods for creating and delivering these new offerings. We excel at developing collaborative relationships with companies so that our groundbreaking research can be put to practical use to not only improve business practices but also improve lives.

ISU had a record setting year in FY16 with **total sponsored funding of about $426 million**, **including $252 million for research**. Businesses, corporations, and commodity organizations accounted for approximately $44 million of sponsored funding.

In FY16 ISU researchers submitted **143 disclosures of intellectual property**, and our technology transfer office **filed 49 patent applications**. Additionally, last year ISU technologies resulted in **84 license and option agreements worldwide with 45 in Iowa**. ISU currently has **153 license and option agreements yielding income. Iowa companies earned $5.2 million revenue from ISU licensed technologies in calendar year 2015, and five startup companies based on ISU technologies were formed in Iowa.** Globally, total sales revenues from ISU licensed technologies were **$67 million**, not including germplasm.

The **Regents Innovation Fund** program at Iowa State has a competitive research component that pairs ISU faculty members with Iowa industries (primarily new to young startups) to create economic benefit for the companies. Please see **Appendix 3** for a complete report on Regents Innovation Fund uses and results.

Assistance to Communities

Assistance to Iowa communities is the focus of many of the programs managed by ISU Extension and Outreach. Some examples of direct economic development assistance to Iowa communities are provided below.

Stronger Economies Together (SET)

Over the past year Community and Economic Development Extension and Outreach (CED) has partnered with USDA Rural Development on a national initiative to help rural communities explore regional economic advantages, and formulate economic blueprints for multicounty collaboration. The Stronger

Economies Together (SET) program involves step-by-step coaching to guide the design and implementation of a viable regional economic development plan; in-depth demographic and socioeconomic data analyses tailored to the region; and identification of the region's comparative economic advantages. CED and USDA-RD worked in two regions: Henry, Jefferson, and Washington counties; and Lee (IA), Clark (MO), and Hancock (IL) counties. Overall, SET is in place in 70 regions in 31 states, and has helped participating rural communities leverage more than $112 million in economic activity.

CD-DIAL Builds Decision-making Capacity

CD-DIAL (Community Development—Data, Information, and Analysis Laboratory) works with communities and organizations to build decision-making capacity as they collect and use information about their local populations. In 2015–16, CD-DIAL conducted surveys for the city of Ames (4 surveys), and county surveys on Access to Essential Services for Wapello, Cass, Cerro Gordo and O'Brien counties.

Student Involvement in Community Development

This year the Partnering Landscape and Community Enhancements (PLACE) program involved more than 165 students in outreach projects in dozens of Iowa communities, including Sheldon, Marshalltown, Jefferson, Perry and Des Moines. The ILR Community Visioning Program employed eight student interns to assist in assessments and analysis in 10 communities.

University Extension Community Development Collaborative

In 2012, Community and Economic Development Extension and Outreach (CED) established a partnership with the City of Dubuque and the University of Wisconsin and created a joint faculty position specializing in community planning and leadership. The agreement and joint appointment is one of the first of its kind in the country between two land-grant institutions. During spring 2016, the University Extension Community Development Collaborative assembled a team of ISU Extension and Outreach colleagues to begin a three-phase community engagement and development process along the Central Avenue Corridor in Dubuque. The City of Dubuque is interested in revitalizing the Central Avenue Corridor and recognizes that the businesses and residents have a number of concerns about the area. The three phases involve fact-finding civic engagement field work, design and development at the individual business level, and at the business district/corridor level. The project will help the City of Dubuque support and foster the success of businesses along the Central Avenue Corridor.

Extension Community Arts Specialist

During summer 2015 an individual was hired as an assistant professor in the department of Art and Visual Culture and as an extension community arts specialist. Her position was created under the ISU President's high-impact hires initiative, and places her in the role of using the arts to "improve the fabric" of community life in Iowa's cities and towns. Increasingly, research shows that art and the act of "making" can be powerful tools in building a community's identity, economic vitality, and quality of life. Thus far, projects have been undertaken in Sioux City, Perry, Ames, Waverly, Webster City, Hampton, Louisa County, Marion, and Jefferson.

Regional and Local Partnerships with ISU Extension and Outreach
CED maintains partnerships and shares joint community development specialist positions with the Chamber of Commerce of Keokuk, the economic development organization of West Liberty (WE-LEAD), the development organization of Cedar County (CCEDCO), and the West Liberty Chamber of Commerce. Each local economic development position is jointly funded by ISU Extension and Outreach and a local partner; the person serves as a local development official who provides economic development education on a part-time basis.

Extension and Outreach cosponsors joint position with Iowa League of Cities
A joint educational position with the Iowa League of Cities focuses upon local government finance. In 2015–16, the Office of State and Local Government Programs trained 1,468 government officials. At the 2015 Municipal Professionals Institute and Academy, 284 city clerks, administrators, and finance officers received instruction on a variety of topics related to local government.

Refugee Community Alliance
A new joint position was created in 2016 with the Des Moines Area Refugee Community Alliance, serving as a CED specialist and as the refugee community plan coordinator for the Alliance. The goals of the collaboration are to (1) increase communication, collaboration, and coordination among service providers, and between service providers and refugee communities, and (2) increase community and private sector understanding of refugee resettlement needs and economic opportunities.

Community Sustainability Collaborative
In March 2016 the Center on Sustainable Communities (COSC) and CED partnered to form the Community Sustainability Collaborative. Since 2005 COSC has hosted more than 350 workshops, lectures, seminars, open houses, forums, and hands-on sessions pertaining to sustainability and energy conservation in construction and community planning. The partnership will bring ISU and CED expertise to the efforts to deliver green building and healthy living programming to communities across Iowa. Since forming the Collaborative, solar energy workshops have been conducted in Fairfield, Creston, and Tipton, and two bilingual building science and weatherization workshops have been held in collaboration with Habitat for Humanity.

Iowa's Living Roadways Community Visioning Program
The Community Visioning Program celebrates its twentieth anniversary in 2016. The program has helped rural communities plan transportation enhancements using state funds from the Iowa DOT. To date, 209 Iowa towns have completed the process and collaborated with design teams to create conceptual transportation enhancement plans. The program continues to make a significant impact throughout the state.

Community Design Lab
The Community Design Lab (CDL) is a partnership between the ISU College of Design and ISU Extension and Outreach that focuses on long-term, issue-driven design research with the goal of developing models that focus on sustainable

development at various scales (building, neighborhood, city, region, etc.). In December 2015 CDL celebrated the second year of the Agricultural Urbanism Toolkit by hosting more than 100 designers, farmers, local school coordinators, chefs, and representatives from health organizations to share success stories in designing and implementing Toolkit strategies. The Toolkit uses strategies such as school gardens, farmers markets, and food hubs to promote economic development and local food-system revitalization in communities. In addition to the toolkit, CDL worked with Seed Savers of Iowa, the Healthiest Ames Initiative, the city of Des Moines (the East 30th Street Corridor Plan), and the city of Carroll Recreation Department to develop sustainable design strategies for their projects/initiatives.

Iowans Walking Assessment Logistics Kit (I-WALK)

First offered in 2010, I-WALK is a partnership with the Iowa Department of Public Health and ISU Extension and Outreach. The goal of I-WALK is to develop community coalitions and provide them with relevant local information to help them continuously update, implement, and evaluate the infrastructure and programs to support a more walkable, healthy, and safe community. In 2015-16 the program revisited four sites to evaluate the progress and provide additional assistance for the community to reach their goals. These sites included Knoxville, West Union, Bellevue, and Perry.

University Facilities and Services

Last year, we featured two university facilities in this report: the Office of Biotechnology that manages 31 facilities and service units on campus and the Veterinary Diagnostic Laboratory, the state's only public veterinary diagnostic laboratory (VDL) and only VDL accredited by the American Association of Veterinary Laboratory Diagnosticians. VDL annually processes 75,000 cases and conducts approximately 1.5 million tests.

This year we highlight the **Iowa State University BioCentury Research Farm (BCRF),** the first-in-the-nation integrated research and demonstration facility dedicated to biomass production and processing. This one-of-a-kind facility allows the integration of the production, transportation, storage and processing of agronomic crops to end products. Researchers have access to 2,000+ acres of test ground, which includes full crop production management for high risk development and support for high intensity innovative methods. The BCRF is a collaborative university resource managed by the College of Agriculture and Life Science's Center for Crops Utilization Research. Additional funding is provided by Center for Industrial Research and Service and Office of the Executive Vice President and Provost. The BCRF closely partners with the College of Engineering and the BioEconomy Institute on research, demonstration, and commercialization.

From FY2012-2016 sixty research projects totaling nearly $82.5 million were conducted at BCRF. One-half of these projects were industry funded and one-half were federally funded. Additionally, BCRF received 21 awards and donations totaling over $12 million, and it completed 32 fee for service projects generating more than $230,000. Importantly, BCRF serves as an outstanding educational facility preparing future professionals for agriculture and bioengineering careers as 17 professors from eight (8) departments trained 181 undergraduate students, 28 graduate students and three (3) post-docs.

An excellent example of the university-industry collaborations that take place at the BCRF is the **research partnership between Iowa State and Argo Genesis**

Chemical, a subsidiary of Seneca Petroleum. Together ISU and Argo Genesis developed a process that converts soybean oil into thermoplastics, the soft, rubbery polymers that can be melted and re-formed over and over again. **Argo Genesis funded, and in 2015 donated to the university, the Bio-Polymer Processing Facility, a $5.3 million industrial-scale pilot plant** that can make about 1,000 pounds of bio-polymers per day. The plant contains two main processes, one to turn soybean oil into a monomer, and the second part to turn that monomer into a polymer. The polymer can then be used in asphalt, adhesives, coatings, and packaging. **Argo Genesis and their affiliated companies have optioned or licensed three technologies and filed 47 patent applications (3 US, 47 foreign) as part of this partnership.**

Major Economic Development Collaborations

Iowa State University takes great pride and pleasure in its collaborations with both private and public sector partners. These collaborations are essential to achieving the university's and the state's economic development goals. The first four sections below identify new collaborations begun or formalized this past year. The remaining sections describe on-going significant state and regional collaborations.

SBDC Partnering to Promote and Support Women Entrepreneurs

Initiatives and resources for women entrepreneurs was a focus of America's SBDC Iowa during the past year, as it partnered with approximately 30 other service providers to create the Women's Entrepreneur Council. This group has met quarterly to gather and disseminate information regarding the resources and services available to women entrepreneurs in the state of Iowa. All participating service providers are committed to this collaborative effort that will better utilize existing programs and avoid duplicating efforts to improve support and service to women entrepreneurs. Due to the work of this group, America's SBDC Iowa has also been working with the Secretary of State's office to establish a definition of women-owned businesses and to better track the number of women-owned businesses in the state.
America's SBDC Iowa has also worked with the Lieutenant Governor's office to hold roundtables for women business owners in Iowa. The roundtables provided women business owners the opportunity to showcase their businesses as well as to discuss with the Lieutenant Governor the obstacles to running a small business in Iowa.

SBDC and Google Team Up

America's SBDC Iowa is partnering with Google to present "Let's Put Our Cities on the Map" workshops. The workshops help businesses improve their information where customers search for them the most – Google Search and Maps. Google has found that "businesses that have complete business information online are twice as likely to be considered by reputable customers." The partnership with Google allows the SBDC to provide additional services to small businesses in Iowa, and Google helps promote the SBDC to small businesses in Iowa. A total of 17 workshops have been held thus far, with another 19 scheduled. Interest in these workshops continues to expand.

CIRAS Metal Additive Manufacturing (AM) Partnership

Through a partnership, CIRAS was able to bring a metal additive manufacturing system to Iowa State University. It represents a $900,000 investment made with funds from CIRAS, Iowa State University's College of Engineering, the Iowa Economic Development Authority, and the federal NIST Manufacturing Extension Partnership. The system will be used to help Iowa's industry to understand how to

utilize this emerging technology to gain competitive advantages and provide student access to the technology.

CED, SBDC and the Iowa Black Business Coalition Inaugural Event
Community and Economic Development, America's SBDC Iowa and the Iowa Black Business Coalition collaborated in November 2015 to bring together lawyers, professors, and award winning entrepreneurial leaders to share their knowledge about business and entrepreneurialism with African American business owners. The Untraditional Start a Thon was a one day workshop to increase entrepreneurship among African Americans using a culturally relevant framework. Despite inclement weather and a last minute venue change, 16 business owners were able to participate in this inaugural event.

Iowa State University and University of Northern Iowa Collaboration on Technology Transfer Services
Iowa State University and the University of Northern Iowa UNI) continue to partner in technology transfer. The partnership allows UNI to access Iowa State resources for technology transfer. UNI has the option to manage the protection and commercialization of their innovations, or they can opt to have the ISU Research Foundation provide these services. Iowa State is not charging a fee for this service, but sharing in any income that is generated from the UNI innovations.

ISU Partnership with the City of Cedar Rapids
In 2015 the university formed a partnership with the City of Cedar Rapids and established a jointly funded Iowa State agricultural bio-based industries research and extension liaison position. The liaison has an office in Cedar Rapids, and works closely with the city's processing industries to identify opportunities for collaborating with Iowa State scientists, engineers, economic development, and extension specialists. The nature and scope of future collaborations are still emerging, but will likely include: research and development on more environmentally friendly processing technologies; adding value to processing waste streams through coproducts and byproducts; development of innovative products — such as biorenewable fuels and biobased products — from agricultural raw materials; exploring new directions for food ingredients that boost health and wellness; and facilitating training opportunities to enhance the skills and capabilities of Cedar Rapids industry employees.

ISU Partnership with Cultivation Corridor
Iowa State University serves on the Board of Directors of the Cultivation Corridor, a regional economic development initiative to attract ag-bioscience firms to Iowa that was launched in April 2014. Other board members include Iowa Economic Development Authority, leading Iowa companies in the ag-bioscience industry, and Iowa commodity groups. ISU also serves on the Advisory Cabinet of the Executive Director of the Cultivation Corridor. ISU's Office of Economic Development and Industry Relations works closely with the Cultivation Corridor, providing university expertise and services to support the Corridor's efforts.

State-wide Committees, Councils, and Task Forces
Many representatives from ISU serve on committees that promote economic development programs, such as the Iowa Innovation Council, the Iowa Innovation Corporation, the Biosciences Alliance of Iowa, Iowa Meat Processors Association, Association of Business and Industry Advisory Council, Institute of Food Technologists-Iowa Section, the Iowa Lean Consortium, Professional Developers of

Iowa, the Iowa Business Council, Innovate Iowa!, Technology Association of Iowa, Capital Crossroads, IA Sourcelink and the Cultivation Corridor.

Midwest Grape and Wine Industry Institute

The Midwest Grape and Wine Industry Institute, supported by ISU Extension and Outreach, was formed in 2006 by the Iowa Board of Regents as a result of the state's evolving grape and wine industry. The goals of the MWGWII are to:

- conduct research to evaluate cold-hardy grape varieties that can thrive in the Midwest;
- conduct enology research and develop vinification techniques;
- develop a wine quality award program that will provide wine buyers with a quality-assurance stamp of approval;
- establish an outreach program to the industry by offering training opportunities to cellar workers and winemakers;
- partner with community colleges to develop job training programs specific to growing grapes and making wine.

As of July 2016, Iowa has 104 native wineries producing approximately 333,737 gallons of wine per year, and 300 commercial vineyards covering 1,000 acres of grapes. The grape and wine industry in Iowa continues to grow. According to a 2012 study by Frank, Rimerman + CO. LLP, the economic impact of the Iowa wine and grape industry on the state's economy is $420 million.

Future Plans

Iowa State University greatly appreciates the resources and support that it receives from the Board of Regents and the legislature to carry out its economic development initiatives and activities. The primary purpose of this report is to show the huge economic and quality of life impacts we have been able to achieve for the state with the resources entrusted to us. The following sections identify how we plan to use additional resources to enhance the impact of university technology transfer and service on the creation of jobs and wealth in Iowa.

Small Business Development Centers. By helping its clients improve and grow their businesses the SBDC generates new tax dollars for the Iowa treasury in the form of sales tax revenue from increased client sales and income tax revenue from new jobs created by clients. The SBDC is returning approximately $2.50 in new tax revenue for every one dollar it receives in funding (based on the $67 million increased sales revenue and 1,568 new jobs attributed to SBDC assistance by clients, and the approximate $2.3 million state, federal and local funding for the program. SBDC is a good investment for the State of Iowa!

With additional funds, the SBDC would increase its number of satellite locations and staff to better reach the rural areas that currently need more service. Today, America's SBDC Iowa has 50 satellite locations it utilizes to serve clients. Small businesses are an integral part of the economy in Iowa and this is especially true in rural Iowa. Small businesses generate most new jobs, provide a sense of community in rural areas, and create long-lasting positive impacts. **Historic**

data reveal that the number of businesses started and jobs created is directly tied to the number of counseling hours we provide. Thus, this would be our top priority if state funding for SBDC was increased.
The SBDC also wants to provide more training and do more to educate existing businesses in an effort to strengthen our small business foundation within Iowa. Under the current funding conditions, we are unable to offer the needed level of training.

It should be noted that SBDC is working diligently to collaborate and partner with other organizations, both public and private, throughout the state to ensure that we are not duplicating efforts and to leverage each other's resources and efforts.

Iowa State University Research Park. The Research Park is in the midst of a significant expansion, which will double the developable acreage and include commercial amenities such as a restaurant, fitness center, child care facility, parks, walking and biking paths that are expected by young professionals today. Within the next 12 months, a fitness center and a full-service restaurant will open. Additional commercial projects are in development.

Any new funds to the ISU Research Park would be utilized to support costs associated with the expansion of the Park as well as to increase marketing efforts to attract new tenant companies.

The Center for Industrial Research and Service. CIRAS has been supporting the growth of Iowa industry since 1963. CIRAS has successfully leveraged the state funding to bring in additional federal grants and fees to expand technical assistance, education programs, and economic development studies to assist Iowa businesses. **In FY16 CIRAS helped generate an additional $1.50** of Federal awards and fee income for each $1 of base budget provided, yielding over $3 million of additional funding to support state economic development efforts.

For every $100,000 of additional funds that are made available, **CIRAS could leverage the funds** to bring in up to $150,000 from grants and fees and hire two new business professionals **to expand technical assistance and education services provided to Iowa businesses**. These two staff would work with about 70 companies, help them create and retain nearly 250 jobs, and generate $18 million in new sales, cost savings, and investment impact.

ISU Extension and Outreach. Extension and Outreach works across ISU colleges and with external partners to provide technical assistance, research-based education, and access to the resources of ISU to improve the quality of life in the state. Iowans want an economy that can form new businesses, grow existing industry, enhance communities, and recruit companies to the state. With Iowa STEM jobs expected to grow by 16 percent this decade, Iowans see the need to stop the "brain drain" and take steps to develop the state's future workforce, connecting youth with opportunities here in Iowa.

With additional funding, ISU Extension and Outreach will expand economic development projects to broaden Iowans' entrepreneurial aspirations with

education and technical assistance. Extension and Outreach also will address the distinct needs of minority populations, as well as a burgeoning local foods industry and many struggling rural downtowns. These are only a few of the basic needs and urgent trends facing this state.

ISU Extension and Outreach expects to leverage every $100,000 in new state funds with $150,000 in new federal matching funds, grants, fees, and gifts to generate a projected $2.5 million of impact and 25 new jobs throughout Iowa. **For every $100,000 of new funds, an estimated 2.5 additional staff will be hired to address growing demands and increase the depth and reach of work with families, businesses, and communities in all 99 counties across the state.**

Summary of ISU Economic Development and Innovation Data	
a. Number of disclosures of intellectual property	143
b. Number of patent applications filed	49
c. Number of patents awarded	15
d. Number of license and option agreements executed on institutional technologies: in total	84
in Iowa	45
e. Number of license and option agreements yielding income	153
f. Revenue to Iowa companies as a result of licensed technology (CY15)	$5.2 million
g. Number of startup companies formed (through licensing activities)	
in total	6
in Iowa	5
h. Number of companies in research parks and incubators	
pre-incubator companies	17
private	57
university related	17
i. Number of new companies in research parks and incubators	
pre-incubator companies	17
private	13
university related	4
j. Number of employees in companies in research parks and incubators	1,709
Royalties and license fee income	$3.3 million
k. Total sponsored funding received	$425.8 million
How much of this is for research	$252.5 million
l. Corporate sponsored funding received for research and economic development, in total	$43.8 million
in Iowa	$11.9 million
m. Iowa special appropriations for economic development, in total	$2.525 million
SBDC	$1.037M
CIRAS Technology Assistance Program	$1.365M
ISU Research Park	$0.122M
Regents Innovation Fund	$1.050 million
n. Research expenditures (federal, state and local; business; nonprofit; institution funds; all other sources):	$261.5 million
o. Licenses and options executed per $10 million research expenditures (FY13 data from AUTM is most recent available)	3.2

p. Sales of licensed products by Iowa-based companies (CY15)	$5.2 million
q. Number of employees for current Research Park tenants and incubators, as well as former tenants that are still in existence in basic form world-wide	4,985
Note: Unless noted, the data provided above are FY16 data.	

Appendix 1: CIRAS, SBDC and ISU Extension & Outreach company and community projects

Davenport-based Sears Manufacturing Co., a leading manufacturer of pneumatically controlled seats for construction and agriculture industry, looked to CIRAS for assistance with evaluating and providing insights on a corrosion issue. CIRAS utilized its nondestructive evaluation and material technical resources to identify the root cause. Sears' Strategic Quality Manager, Kelly Sheffler, stated CIRAS "gave us the clarity and the necessary supporting data to understand what the root cause was." This project helped ensure the quality of a new air compressor design and maintain Sears' reputation for reliability. The company estimated impact from this project to be $4.5 million in retained sales, 12 jobs retained, and a cost savings of $40,000.

Orange City-based Quatro Composites, a global provider of composite structures for aerospace, medical, and industrial markets was an early adopter of CIRAS' new metal Additive Manufacturing (AM) system. Quatro saw great potential in the technology and worked with CIRAS to build a five-axis fixture that would help the company gain an advantage through speed and the ability to produce complex parts that cannot be produced economically today. Quatro's Program Manager, Jack Ward, noted "To be able to send something out (to be built) and get it back quickly is awesome. Now that the design rules are broken…I can do stuff that I couldn't actually do before."

Harrisvaccines (MERCK Animal Health) in Ames, focuses on revolutionizing animal health vaccines and enhancing productivity in the swine, cattle, equine and farmed shrimp industries. CIRAS provided assistance in designing a new plant layout for the production, shipping and receiving processes. The project led to significant improvements in productivity and plant efficiency, which led to $6,000,000 in increased sales.

George-based Dur-A-Lift, manufactures farm equipment, scooters and hydraulic lift equipment is ramping up production in a new 26,000-square-foot building. CIRAS helped designed the new building with a focus on maximizing productivity and cost effectiveness. Demand is high for Dur-A-

Lift products and the expectation is that the new building will enable them to double their sales based on the added capacity.

Humboldt-based Sisters Home Style Entrees produces frozen meals that provide individuals and families the opportunity to eat home-cooked meals made from quality ingredients at an affordable price. The Iowa Small Business Development Center (SBDC) and CIRAS helped boost production by facilitating a move from a 2,500-square-foot facility to a new 30,000-square-foot manufacturing plant. The added capacity has provided added flexibility in pursuing new markets and should generate an additional $80,000 per month in new sales.

Affordable Buckets in Victor increased sales by $325,000 after attending one of CIRAS' Internet Marketing Boot Camps. Owner Geri Wester stated "if you're on the Web and you're not getting on that first or second search page, you're kind of lost." Participation in the boot camp, follow up coaching, and recent internet marketing webinars has helped the business better target potential clients and make their business stand out online. Over 100 Iowa manufacturers have participated in the boot camps since their launch in 2012.

Upper Iowa Tool & Die & Innovations in Cresco reached out to CIRAS in search of ways to expand their company. After strategy discussions led to a realization of the company's "default future", it became apparent that their original plans of vertical integration would not help them reach their goals. After exploring options, the company decided to enter in the 3D printing business to complement their precision tooling business. "Iowa State University and CIRAS were a blessing," said owner Scott Fortune. "I'm very thankful for the help they gave us, because we probably would have muddled down the wrong path and regretted it and struggled. But now, it's all good."

Simply Soothing in Columbus Junction worked with CIRAS to streamline its business practices and explore new markets. The company credits CIRAS with helping to boost sales by more than $1.6 million. As a small business owner, it can be overwhelming to drive to the next step, CIRAS helped the company to concentrate on the right things. CIRAS also has helped the company understand the government procurement process. "Now we work smarter, not harder and make fewer mistakes," CEO of Simply Soothing, Freda Sojka said. "Working with CIRAS is one of the best things that's ever happened to us."

Grasshorse Technologies in Winfield nearly doubled their sales in the past two years after CIRAS helped them find new life in government contracting. CIRAS helped Grasshorse identify find potential business opportunities in the government sector; with market research on competitors and target agencies at the federal, state, and local levels; and with understanding and providing a plan for marketing. They have

participated in a number of government contracting webinars and events, but found the most value in the one-on-one assistance spent with CIRAS staff. The list of Grasshorse clients now includes the city of Cedar Rapids, the Louisa County Community Foundation, 20th Century Fox and the Iowa Lottery. "It was a miracle that CIRAS contacted us," owner of Grasshorse Technologies, Kathy Buxton said.

CIRAS NEWS has published the final four segments of **"Special Report: Working on Workforce,"** providing Iowa businesses with data-driven information and real-world examples of creative ways Iowa companies are addressing the skills shortage. Articles have focused on sharing employees, automation, the benefits of being lean, and key performance indicators (KPIs) that should be watched as Iowa and its businesses plot which overall strategies to implement.

CIRAS, Meat Science Extension (College of Ag and Life Sciences (CALS), Extension and Outreach), and the Center for Crops Utilization Research (CALS) have partnered to help **Iowa food manufacturers** improve their businesses, deliver safe foods, and deploy the latest technology. Over the past five years, this partnership has served nearly 45 percent of food manufacturers in Iowa, resulting in over 1,700 jobs added or retained and creating an economic impact of more than $326 million.

Legacy Logistics Freight, Inc. won the Deb Dalziel Women Entrepreneur Achievement Award in 2016. Owner, Sarah Novacek worked closely with America's SBDC Iowa to develop and grow her freight brokering businesses from a small one account company to a multi-million-dollar company doing work nationwide. Her business is 100% female owned and operated and serves national brands such as Jennie-O and Hormel. The SBDC partnered with the NIACC John Pappajohn Business Incubator to provide resources, services, and office space to grow her company.

The 2016 Neal Smith Entrepreneur of the Year Award was Tony Halsted of Hoover's Hatchery. Tony came back to help run his family business after spending time working across the nation. Under his leadership, the business has gone from a traditional hatchery to an international business known for their exclusive Red Ranger and Black Asian chickens. Hoover's Hatchery has changed the way they do business and has been able to expand significantly. The company created 40 new jobs in the town of Rudd, which as a population of 370. The company is an example of how businesses in rural Iowa can make a significant impact on the communities in which they are located.

ISU Extension and Outreach's Community and Economic Development program (CED), Iowa Department of Public Health, and University of Iowa College of Public Health continue their collaboration on the **Shop Healthy Iowa** program. Store owners receive technical training in produce handling, assistance in redesigning store space to promote healthy eating choices to customers, and promotional materials. Sales of fresh produce have high gross profit margins for stores, magnified when the volume of sales

increases. However, the risk in offering more fresh produce for sale lies in the greater energy and time investments required to realize those profits and the potential for increased inventory to perish before sales increase. Participation in the Shop Healthy Iowa program is designed to provide store owners with the needed assistance to increase sales of fresh produce. The program was piloted in Perry, West Liberty, and Muscatine in 2015 and is currently being implemented in Ottumwa and Marshalltown. In 2017 the program will move to Davenport and Sioux City.

During 2015, the **ISU Extension and Outreach Value Added Agriculture Program** conducted several business feasibility studies enabling Iowa businesses to qualify for loan guarantees through their local banks and USDA-Rural Development. The in-depth studies examined the economic, market, technical, management, and financial aspects of the proposed business start-up or expansion. Rural economic development feasibility studies for nine local businesses in 2015 resulted in investments of $37.2 million into the Iowa economy and the potential for 126 newly created jobs when completed. The projects vary greatly from dairy processing to aquaculture production facilities and rural lodging issues to renewable energy projects; but the common thread is that VAPG feasibility projects help Iowa clients gain access to capital to strengthen rural economies.

CED has managed the **ISU Road Scholar Program** since 2007, teaching local businesses to **capitalize on tourism in Iowa**. In 2015–16, 239 citizens, 85 community leaders, and 295 business leaders/entrepreneurs received assistance through these programs. As a result 41 businesses were expanded or improved, individuals took 7 new leadership roles, 42 organizations were assisted or strengthened. The estimated dollar value of the jobs that were created or retained was $725,937.

A series of nine **customer service/hospitality trainings** were conducted between April 1 and June 30, 2015, as part of funding received from the Central Iowa Tourism Region through a grant from Travel Iowa. The two-hour sessions focused on the economic development value of tourism in Iowa, customer service skills needed by front-line workers, tips on creating Ambassador programs and Familiarization tours, what travelers are looking for when touring a community, and assessment tools employers can use to determine their employees' customer service skill set. Sessions and their attendance were: Iowa Falls (41), Ames (117), Centerville (52), Marshalltown (25), Pella (84), Newton (44), Ottumwa (80), Bloomfield/Davis County (22), and Clear Lake (50). Outcomes after the session include the community of Ames submitting a grant to create an Ambassadors program and to start Familiarization tours to help front-line hotel, restaurant, convenience store, and gas station workers familiarize themselves with Ames attractions.

Appendix 2: Training and Related Educational Activities

Center for Industrial Research and Service (CIRAS)

CIRAS held its second annual **Iowa Vendor Conference** in Ankeny with a goal of helping Iowa business leaders gain a better understanding of how to do business in the government sector. More than 100 companies were able to expand their government contracting potential through attending diverse workshops, participating in a best practices panel discussion and networking with a variety of resource partners and buyers, such as the National Parks Service, Offutt Air Force Base, Iowa National Guard, and the Department of Transportation.

CIRAS hosted an **Innovation Summit** with more than 80 attendees to help spark progress in Iowa's metal fabrication sector. Metal fabrication, one of the largest manufacturing sectors in Iowa, is a key driver in Iowa's economy, but economic data shows we are slow to invest and adopt new or even proven technologies. Experts provided updates on technologies, including additive manufacturing, automation, internet marketing strategy and capital equipment advancements, followed by discussion and long-term coaching on finding opportunities to implement these innovative practices in each company's business.

CIRAS partnered with the U.S. Commercial Service, with support from the Iowa Economic Development Authority, Iowa Small Business Development Centers (SBDC), FedEx, and Iowa Farm Bureau, to grow **ExporTech** in Iowa. This program is a structured strategy development process designed to connect small manufacturers with experts to help them navigate the export sales process and develop plans to grow their businesses internationally. In its second year, a total of 12 Iowa manufacturers have participated, and new models are being tested to host local versions of the program throughout the state.

In the fall of 2015, CIRAS launched the **Manufacturing Leadership Program** to help Iowa manufacturers develop their next generation of leaders. Fifteen participants from companies large and small spent a week in Ames to learn fundamental business skills, develop their leadership skills, and grow their network of fellow leaders. “What’s really, really important is being able to lead. An effective leader knows what he or she knows and doesn’t know about parts of the business” said Jack Ward, program manager for Quatro Composites in Orange City.

Thousands of Iowans celebrated national ***Manufacturing Day*** throughout the month of October 2015. Manufacturers, Elevate Iowa, community colleges, ISU Extension and Outreach, and countless local organizations stepped up to meet CIRAS’ ambitious goal of holding an event in each of Iowa’s 99 counties. A total of 132 events were held across the state, ranking Iowa 5th nationally in number of events despite our relatively small size. CIRAS’s efforts to ensure that manufacturing day was truly a

statewide activity were recognized nationally by the U.S. Department of Commerce.

In January of 2016, CIRAS released a step-by-step training schedule that provides access to government contracting training throughout the state of Iowa. The plan includes both online and on-site in each corner of the state. The training is based on best practices from around the country, inputs from CIRAS clients and long standing CIRAS courses. Bill Hayes of Straight Shot Express said the courses have been beneficial "Through several training sessions, we have a better understanding of how the government process works and how to work within the process." **CIRAS received national recognition from the Association of Procurement Technical Assistance Centers for Outstanding Project of the Year** for their work on the development and implementation of this statewide training plan.

Community and Economic Development (CED) in ISU Extension and Outreach empowers communities to shape their own futures through research, education, community engagement, economic development, and community planning and design. CED has multiple community development specialists in place with expertise and/or experience working with minority-owned businesses and community business leaders. CED serves as an essential conduit between Iowa's communities and the resources of Iowa State University, creating partnerships with private and public sectors for the betterment of Iowans.

The **Data Indicators Portal**, a Vice President for Extension and Outreach initiative, is now available to Extension and Outreach staff, and to the public on a test web platform. Iowa Community Indicators Program provides web-based information products such as local retail trade analysis and demographic and economic indicators. Users are able to access 2015 population estimates by county and city, as well as data on the median age by sex, the ratio of males for every 100 females, and total population by sex. CED staff conducted workshops throughout the state on using the website.

In 2015, as part of CED's **Iowa Government Finance Initiative** (IGFI), CED for the first time released city level annual fiscal conditions reports for all 945 cities in Iowa. In addition to including the up-to-date fiscal data for all the cities in Iowa for the year 2015, the reports also include the recently released U.S. Census data on select socioeconomic characteristics at the city level. The reports are the only source in the state of Iowa for cities wishing to access the most updated socioeconomic and fiscal information in a format customized with a narrative for every city in the state. In addition to the annual reports, IGFI provided local governments an alternate perspective about their financial health and performance and provided training targeted at elected officials and public employees. Using local government finance data, IGFI analyzes trends and financial performance of selected indicators.

The **Geospatial Technology Training Program** conducted five ArcGIS two-day short courses for a total of 25 planners and local officials from

throughout the state. GIS specialists also provide walkability assessments for two organizations.

CED again co-sponsored the third annual **Bicycle Trail Tourism Conference** in Perry, Iowa. Fifty-five attendees learned strategies for turning the popularity of bicycling into economic development opportunities for communities on and near the nearly 2,000 miles of bike trails in Iowa.

CED published **Reducing Local Regulatory Barriers to Local Foods: Municipal Zoning for Local Foods in Iowa Guidebook**. Using examples of zoning code language from municipalities across the nation, the guidebook provides guidance and sample code language for reducing barriers to, and promoting urban agriculture production and sales activities.

Agriculture and Natural Resources Extension and Outreach (ANR) provides research-based information and resources to educate Iowa's farmers, producers, and agribusinesses. Much of Iowa's economy thrives on the state's rich agricultural heritage. ANR programs impact all Iowans, whether they live in rural or urban areas, and have been developed to improve quality of life. ANR specialists are engaged with farmers, researchers, organizations, agencies, agribusiness, and communities at state, regional, and national levels.

Commercial horticulture programs increase fruit and vegetable production in Iowa. According to the 2012 National Agricultural Statistics Service, total horticulture sales in Iowa equal $123 million. ISU Extension and Outreach horticulture specialists work with fruit, nut, vegetable, nursery, sod, and greenhouse growers to enhance yield, quality, efficiency and safety. For example:

- Iowa has 7,724 acres under vegetable production that generate nearly $14 million in local food sales. Research in vegetable cropping systems at Iowa State has shown that integrating cover crops can decrease fall nitrogen (N) leaching by 20 lb. per acre. This improves water quality and leads to a total saving of 154,480 lb. of N that otherwise would leach and make its way to our rivers and streams. Cover crops field days, workshops, hands-on-activities, and on-farm trials reached more than 700 Iowa growers.
- Over the past few years Iowa State research has focused on selecting cold hardy grapevines adapted to Iowa's harsh winters, apple rootstocks that increase 'Honeycrisp' production efficiency, and low labor training systems. These efforts have resulted in increased yields and an increase in unit price. Iowa's largest and most profitable fruit crops are apples and grapes. Apples at $0.863 (record high) per pound brought in an estimated $3.45 million in 2015 (up 17 percent from 2014). Wine grapes generated an estimated $2.5 million in revenue in 2012 (the wine and grape industry has an economic impact estimated at $420 million). As Iowa State research continues to focus on crops and cropping systems suited for Iowa, growers will continue to see an increase in yields and unit price.

- The apple industry is small, with less than 40 orchards across the state, but even a single orchard can have a significant impact. Orchardists actively used methods learned from Iowa State webinars to protect their crop from frost. One orchard alone was able to save approximately 25 percent of their crop by applying methods learned from the discussion. Sold directly to consumers, that crop has a direct value of $250,000 and an indirect value of greater than $500,000 in other sales related to the agritourism portion of the business that revolves around the orchard. Other orchards had varying degrees of success based on the protection method they implemented.

Farmers, financial lenders, farm managers, and agriculture educators need current, unbiased agricultural economics and business information to make sound farm management decisions. The **Ag Decision Maker website**, www.extension.iastate.edu/agdm, offers access to up-to-date information, including new and emerging issues critical to their success. This web-based resource supports many ISU Extension and Outreach farm management programs. From July 1, 2015, to June 30, 2016, the website averaged 9,488 visitors per day, a 9 percent increase from the previous year. The average visitors per day was more than 10,000 in five of the last 12 months. Overall, downloads of information sheets and decision tools reached 1.8 million for the 2016 fiscal year while more than 100 information files, decision tools, voiced media, and teaching activity files were added or updated on the site. More than 15,000 users receive monthly updates highlighting the materials on the Ag Decision Maker site. The AgDM Twitter feed promotes materials and events throughout the month to 1,293 followers and had 122,000 impressions during the past 12 month period.

During 2015, **Highly Pathogenic Avian Influenza** (HPAI) resulted in the loss of more than 30 million layers and pullets (chickens) and 1.5 million turkeys in Iowa from infection or depopulation due to exposure to the virus. Seventy-seven poultry production sites across 18 Iowa counties were impacted by HPAI, including backyard flocks and pullet and hatchery sites. A study commissioned by the Iowa Farm Bureau Federation estimated Iowa's economic loss at $1.2 billion. This study projected that egg layer operations affected by the outbreak expected to take 18-24 months before reaching pre-outbreak production levels due to quarantine requirements, access to pullets, and the need to maintain a desired age distribution among layers. Turkey producers were predicted to be out of production for approximately 30 weeks.

- Starting July 7, 2015, poultry producers associated with 58 of the 77 premises affected by HPAI worked with ISU Extension and Outreach farm management specialists to develop, improve, or make final adjustments to the USDA-APHIS Work Plans and Financial Plans, including budgets outlining the necessary steps to prepare and finance their operation's return to productivity.

- Through in-person meetings with producers, business partners, and family members, farm management specialists assisted producers as they worked through USDA-APHIS procedures to determine fair compensation and calculate losses and predict future expenses.

With specialists in the field and on campus, the Iowa Pork Industry Center works to promote efficient pork production technologies in Iowa, maintain Iowa's pork industry leadership, and strengthen rural development efforts. For example:

- Working with a feed company, **ISU Extension and Outreach administered training, coaching, and guidance to 19 pork finisher sites** owned by 15 farm families. From the ongoing program, producers were able to improve their feed efficiency by a reduction of 12 pounds per pig each year. As a result of implementing these new practices an estimated 5 million pounds of feed was saved. Valued at $0.085 per pound, the savings is $400,000 for less feed being fed. Other management areas showing improvement included reducing medical costs to $1.52 per pig. Implementing practices to reduce sort loss (sorting pigs by size) resulted in savings of thousands of dollars.
- As Iowa produces about one-third of the pork in the nation, health and safety is important to this industry. Over the past two years, **more than 5,000 producers have been trained on how to implement bio-security protocols.** While the exact savings of the bio-security training is not known, even a small adoption of implemented changes in biosecurity result in a potentially large payback.
- Extension workshops **prepare pork producers for the Common Swine Industry Audit**, which provides consumers greater assurance that animal well-being and food safety criteria are being met. While economic budgets are not yet available, a significant number of Iowa pork producers now have the information to pass an audit, which will enable them to continue marketing their pigs through specific packers.

In 2012 and 2014, the Iowa Beef Center and allied industry partners conducted two statewide **Heifer Development meeting series focused on best management practices** for developing yearling females and longevity of first-calf females. More than 900 producers attended. A follow-up survey in summer 2015 monitored medium- and long-term impact. As a result of the 2014 program, 90 percent of survey respondents implemented or planned to implement a new best management practice. Together the 2012 and 2014 Heifer Development programs have had an economic impact of $1.04 million per year for the 900 attendees of the in-person series. In addition, this program has educated an additional 4,400 people through YouTube, as well as helped drive economically sound decisions for an additional 3,450 producers through Ag Decision Maker document downloads of heifer development decision tools and accompanying fact sheets. This expansion of the cowherd will not only help support a strong cow-calf industry, but also adds value to Iowa’s economy and ensures a consistent supply of high quality, affordable beef for the consumer.

Iowa State University Extension and Outreach annually trains representatives from about 600 businesses and 2,000 employees who come from more than 90 counties in Iowa and from the six surrounding states in the **commercial manure applicator program**. These businesses annually handle and apply about 1.5 million tons of solid manure and 3 billion gallons of liquid/slurry manure that has a fertilizer value of about $250 million, while doing about $70 million of business. At Iowa's liquid manure application companies, each employee handles about 5 million gallons of manure per person, meaning each person annually impacts how $150,000 of organic fertilizer is applied. More than 75 percent of the trained employees reported that the information provided was useful to their company. Many of those surveyed reported that it helped them make better equipment purchase decisions and provide better manure application recommendations to their clients.

Roughly 13 million acres of Iowa's land is cash rented each year for crop production, pasture, and other purposes. ISU Extension and Outreach offers a variety of **tools to assist landlords and tenants in determining fair land rental rates.** In 2015, ISU Extension and Outreach farm management specialists conducted 81 leasing meetings across the state, with more than 1,845 land owners, operators, and ag business professionals attending. A post-meeting survey found that 30 percent of respondents indicated that they would decrease land rental rates for the following year based on the information provided at the leasing meetings. Iowa State's annual cash rent survey for 2016 found that typical cash rental rates declined by $16 per acre, confirming the leasing meeting survey result. Thus, the $16 per acre drop in typical land rental rates would result in a $208 million decline in farm expenses to tenants and lowered rental income for land owners. The ISU Extension and Outreach Cash Rent Survey was downloaded 164,234 times in 2015. Sample cash lease forms were downloaded 138,820 times.

In 2015, the **Pesticide Education Safety Program** directly contributed to 10,649 Iowa commercial pesticide applicator jobs with a total salary base of over $357 million, based on 2015 wage information from Iowa Workforce Development. In addition, 14,887 private pesticide applicators received recertification training through the program.

ISU Extension and Outreach Meat Science program provides companies from the United States and around the world with cutting edge education on meat processing and food safety technologies. In addition to offering workshops for small processors, training programs for some of the nation's largest processors also are developed and delivered. In FY16, 890 people from the United States and 150 from other countries participated in extension short courses, regulation updates, Hazard Analysis Critical Control Point (HACCP) food safety workshops, and multi-level training sessions. These educational programs resulted in an economic impact in Iowa of approximately $78 million in retained or increased sales, $1.1 million in cost savings, $3.4 million in increased investment, and 21 jobs created or retained.

ISU Extension and Outreach hosted 14 **Crop Advantage Conferences** across Iowa; 2,094 farmers and agribusiness professionals attended. Participants could be categorized as 60 percent farmers, 34 percent agribusiness, and 6 percent other. The majority (55 percent) of the attendees farmed between 250 to 1,000 acres and 28 percent farmed 1,000 to more than 5,000 acres. As a result of hearing information on soil fertility and nutrient management, 45 percent of farmers surveyed felt savings would be $5-10 per acre on their farms, while 26 percent estimated the savings would be $10-20. After attending the presentation, 95 percent of producers agreed they would be using soil testing to re-evaluate crop fertility inputs before applying chemicals. After attending a session on managing crop margins, farmers agreed or strongly agreed they were able to manage seed costs, seed treatments, fertilizer inputs, and herbicide inputs, and improve grain marketing. As a result of implementing these changes, 44 percent indicated there would be an impact of $5-10 per acre, while 24 percent indicated there would be an impact of $10-20 per acre.

According to the USDA Economic Research Service Economic Research Report 184, page 21, published in April 2015, herbicide resistance costs farmers over $60 per acre per year. Unfortunately, several fields in Iowa have developed herbicide resistant weed populations and in tight economic times, farmers cannot afford this loss. To address this issue, ISU Extension and Outreach conducted a series of **Weeds Week workshops** in August 2015; 234 farmers, dealers, crop consultants, and Department of Transportation employees, representing approximately 2.5 million row crop acres, attended the meetings held across the state. If information provided at these meetings prevents herbicide resistance development on each of the approximately 2.5 million acres represented at the workshops, at $60 per acre, the impact will be over $135,000,000 in improved farm profits annually in Iowa. In their after-meeting evaluation, participants recorded that they were better able to properly identify weeds, select herbicides effective on those weeds, use effective herbicide rates, and manage the weeds in a manner minimizing the potential for the development of herbicide resistance.

4-H Youth Development prepares Iowa's young people for future careers. Youth develop communication, citizenship, leadership, STEM, and healthy living skills by participating in 4-H educational learning experiences. Youth are challenged to actively pursue education beyond high school and build skills that improve their communities and world. 4-H programs reach more than 100,000 Iowa youth every year**.**

4-H Youth Development addresses the STEM literacy gap; last year 50,059 youth participated in STEM-related programing. The Iowa Governor's STEM Advisory Council has identified STEM-abled workers (skilled in science, technology, engineering, and math) as a critical component of the growth of Iowa's economy. The council has stated that

STEM workers drive our nation's innovation and competitiveness and are central to our economic vitality. The growth in STEM jobs continues, and it is imperative to address the critical talent gap in the current workforce and student education related to STEM literacy, decision-making, and practices.

Educating Iowa's 4-H youth in the area of **Animal Science STEM** programming is a key priority for ISU Extension and Outreach. More than 14,000 youth are enrolled in a livestock project area. It is critical that they gain the necessary skills in science, technology, engineering, and math. By partnering with internal and external resources, several initiatives both statewide and nationally have been developed to increase knowledge and behavioral change in youth involved in animal science fields. Face-to-face and online resources allow youth to learn in the changing environments of today. A variety of project opportunities include the Iowa State Fair, an annual 4-H Animal Science conference, as well as the more than 10,000 youth required to be certified in food safety and quality assurance training. This training has resulted in more than 85 percent of the youth indicating their increase in both ag production knowledge and applying that knowledge to management and animal care changes in their own operations.

The **Entrepreneur for a Day** (E4D®) program was launched by the North Iowa Area Community College John Pappajohn Entrepreneurial Center in 2005, and purchased for use by Iowa State University College of Business and ISU Extension and Outreach 4-H Youth Development in 2015. The purpose of the E4D® program is to introduce students to the essential concepts of business and entrepreneurship, through both personal enrichment and for future community, county, and statewide economic vitality. Additionally, E4D® serves as a recruitment tool for the College of Business. The initial objective is to introduce the E4D® program by educating and motivating students about business and entrepreneurship. The current program model is delivered in two segments: a 2 to 2 ½ hour in-class presentation and an all-day program at Iowa State University College of Business. Students learn the definition of "entrepreneur" and practice teamwork and leadership skills in a business simulation. They also gain knowledge of how supply and demand affect the price of a product. In addition they learn how to identify resources necessary to operate a business, marketing as a way to advertise products, and the difference between a debit and credit. E4D® also introduces youth to opportunities within the field of business, including accounting, finance, marketing, management, information systems, and supply chain.

Human Sciences Extension and Outreach provides research-based information and education to help families make decisions that improve and transform their lives. Specialists work with Iowa State's College of Human Sciences and in partnership with other organizations and agencies to meet the needs of Iowa families.

The Earned Income Tax Credit (EITC) augments the wages of low- and moderate-income workers and, in turn, this flow of income makes a

substantial economic impact in local communities. EITC recipients circulate their refunds through the local economy, creating a ripple effect that exceeds the size of the original refund. This money bolsters family financial well-being, strengthens neighborhoods, assists small businesses, and spurs local economic development. During the 2016 tax season, ISU Extension and Outreach worked with community partners to recruit and train 51 volunteers to provide free tax preparation services to low- and moderate-income families through the **Volunteer Income Tax Assistance (VITA) program**. In 2016, VITA volunteers working at 17 VITA sites helped 1,555 low- and moderate-income Iowans complete their 2015 income tax returns. Special efforts are made to increase awareness of the EITC and VITA programs in rural Iowa. As a result, 482 filers qualified for the EITC and received $841,392 in the 17 counties that participated in the ISU Extension and Outreach/community partnerships to expand VITA programs in rural Iowa.

Human Sciences Extension and Outreach offers educational opportunities to strengthen Iowa's early childhood education workforce Iowa ranks first in the nation for the percentage of young children with employed parents (American Community Survey, 2014). In Iowa, 42% of children under age 5 and 27% of children ages 4-15 are in some form of paid child care. The Iowa early care and education industry employs 22,716 individuals and supports an additional 5,100 jobs in related industry sectors (CED, 2015). Throughout Iowa, there are 13,260 licensed and registered child care programs, with revenue of $447.6 million. These regulated programs employ an estimated 7,280 child care professionals. Non-regulated child care is estimated to employ an additional 3,000 or more individuals. The projected average growth rate of child care professionals from 2014-2024 is expected to increase nationally by 5% (Bureau of Labor Statistics, 2016). Although child care is expensive for families, the national median pay for child care workers is $9.77 per hour (Bureau of Labor Statistics, 2016). Iowa families and employers depend on early care and education for more stability for today's employees and to lay the foundation for tomorrow's workforce. Iowa business leaders recognize that investments in high quality care and education lead to improved outcomes for Iowa's children, resulting in less need for special education, higher graduation rates, and increased college attendance – all leading to higher earnings and greater productivity.

- Human Sciences Extension and Outreach training programs include on-site and online learning experiences for new, emerging, and skilled professionals. The aim is to increase understanding and practice of research-based best practices to improve quality care and education for young children.
- Human Sciences Extension and Outreach programs taught 4,727 early care and education professionals new skills to promote early learning, literacy, science, math, and nutrition education.
- Of the more than 2,469 participants completing course assignments and responding to surveys, 96 percent demonstrated new knowledge, skills, or program improvements. Evaluations show that teachers and caregivers significantly increased understanding in

parent communication, child development, early learning, managing children's behavior, nutrition, and health and safety practices

Through "**Juntos Para Una Mejor Educación (Together for a Better Education)**," ISU Extension and Outreach worked with local school districts and community organizations to bring together 184 community volunteers, 174 Latino youth, and 187 Latino parents to assist these youth in graduating from high school and pursuing higher education. Youth who do not complete high school cost the state nearly $90 million in reduced state tax revenues over their lifetime, and close to $2 million per year in additional welfare costs, and will face higher unemployment and have increased health issues. They also are 10 times more likely to be incarcerated. Research shows that Latino youth are at greatest risk for dropping out of school between the ninth and tenth grades.

- Juntos helps Latino parents learn how they can help their children be successful in school, and also helps parents and youth realize the long-term benefits of graduating from high school and participating in higher education.
- Based on data from individuals who completed evaluation surveys, after participating in Juntos, 99 parents gained information about navigating their children's school system. They also have gained information about how to help their youth access higher education.
- In addition, 140 youth have improved their understanding of what they need to do as a student to prepare for and increase their opportunities to go to college. Youth also increased their communication with their parents, teachers, and school counselors in regard to accessing information and assistance to help them succeed in school and pursue higher education.

Human Sciences Extension and Outreach specialists have taught the **ServSafe® food safety certification** program for more than 20 years as registered instructors for the National Restaurant Association Educational Foundation's internationally recognized food safety certification program. ServSafe® is one of the programs approved to meet the Certified Food Protection Manager credential. Participants are from commercial retail foodservices such as restaurants and institutional operations such as hospital and schools. Close to 2,500 Iowans participated in the classes taught by ISU Extension and Outreach last year, with about 80 percent successfully earning certification. In recent years, classes have been taught in Spanish to reach new Iowans. This outreach effort continues in partnership with the Iowa Restaurant Association. Commercial operations recognize the value of training staff in safe food handling procedures, as an incident of a foodborne illness can be devastating for business. In addition, having staff members certified in food safety can be a marketing advantage, as many operations post these certificates. Proper preparation, holding, and service of food are critical in any place where food is served. Many ServSafe® participants work in operations that serve those considered at greater risk of contracting a foodborne illness due to

compromised immune systems; food safety training can avoid costly medical expenses. Iowa has adopted a version of the Food and Drug Administration Food Code that requires at least one supervisory employee in licensed foodservices be certified in food safety through an approved program.

Appendix 3: YEAR END FULL REPORT: JULY 2016, IOWA STATE UNIVERSITY RIF PROGRAM

EXECUTIVE SUMMARY

GIVF/RIF Commercialization Program

The projects pair ISU faculty with Iowa companies to create or improve products or processes. Each project lasts two years. One year after the completion of the project, the Iowa companies are surveyed for impact by the Center for Industrial Research and Service (CIRAS). These funds are a **critical source of gap funding**. They represent a unique resource that can be applied toward the success of Iowa companies. A summary of the projects funded to date is below, followed by the list of active projects. **Since its inception, 130 projects** have been funded through the Commercialization Program. **One hundred eighteen of these projects are complete** and many show excellent progress in improving the competitiveness and profitability of the Iowa companies involved. **Forty four startup companies have been assisted**; **including 26 new companies that were started in the first ten years as a direct result of the GIVF/RIF funding; one of these startups was acquired in the past year by a large international firm, based in part of the success of the projects funded through RIF**. In addition, one industry partner invested in a $5.3 million biopolymers plant at the ISU Biocentury Research Farm that was dedicated on August 26, 2015. **In total, more than 85 Iowa companies have participated in the program.**

Surveys are conducted by CIRAS one year after project completion (true impact takes a minimum of 5-10 years).

Survey Results for FY06-07 through FY14-15 Projects

Project Dates	Survey Year	Companies Surveyed	Jobs Created or Retained	Total Sales Increase	Total Investment & Cost Savings	Average Impact per Company
FY06-FY07	FY08	9*	71	$9,100,000+	$23,500,000	$3,600,000
FY07-08	FY09	9	18	$3,700,000	$2,760,000	$720,000
FY08-09	FY10	8**	6	$600,000	$732,000	$166,500
FY09–FY10+	FY11	7**	13	$675,000	$967,000	$234,571
FY10-FY11	FY12	6**	6	$1,750,000	$1,730,000	$580,000
FY11-FY12	FY13	12**	13	$2,470,000	$2,571,000	$420,083
FY12-FY13	FY14	6**	21	$750,000	$1,315,000	$344,167
FY13-FY14	FY15	2	3	N/A	$1,167,000	$583,500
FY14-FY15	FY16	5**	3	N/A	$454,500	$90,000

*All surveyed companies were start-up companies. ** Surveys were not completed for all projects (not everyone chooses to participate in the survey.). +The sales increase was primarily from 1 successful project, but the jobs impact was spread. Many companies indicated it was too early to tell the sales impact (this is a frequent comment through the years).

Project Outcomes for FY09 through FY16**

Year Project Completed	Number of Projects	Number of Publications & Presentations	Number of Invention Disclosures	Number of External Funding Applications	Number of Applications Awarded	External Funding Received*
FY17+	7	11	4	7	3	$425,000

FY16+	15	10	3	15	2	$770,000
FY15	14	10	2	3	2	$384,999
FY14	7	19	1	16	4	$370,000
FY13	4	6	2	12	5	$795,000
FY12	11	50	4	12	6	$6,364,000
FY11	11	46	3	20	6	$940,000
FY10	14	99	6	47	13	$2,720,000
FY09	15	53	4	48	20	$3,500,000

**Data was not collected for FY07-08. *A number of external funding applications were still pending at the time of reporting and not all award amounts were reported. +Partial results, projects are not complete.

Proof of Concept Initiative

The GIVF/RIF funds have been incorporated into a Proof of Concept Initiative (POCI) http://www.industry.iastate.edu/POCI.html. The POCI is intended to build on the foundation started by the GIVF program, include additional funding sources such as i6, IPRT company assistance, Plant Sciences, etc., and position Iowa State to more rapidly propel technologies toward market opportunities. We will do this by emphasizing both the business opportunity and the technology in projects that are funded through the POCI. By doing this we will position young companies to be able to attract the next stage of funding from either the state, angel or VC sources and/or position technologies to be more attractive commercialization opportunities for existing companies.

There were an additional 16 projects funded under the POCI, using non-GIVF/RIF funding sources. A grand-total of 146 projects have been funded through the POCI model from FY07 – FY16; note that i6 funding terminated on March 31, 2014, so future POCI projects will not include this funding source. Final reports for projects funded with i6 and Plant Sciences Institute funds were provided in the full year report for FY14. Summary statistics for all POCI projects (GIVF/RIF and all other funding sources) are as follows:

Project Outcomes for FY09 through FY16⁺⁺

Year Project Completed	Number of Projects†	Number of Publications & Presentations	Number of Invention Disclosures	Number of External Funding Applications	Number of Applications Awarded†	External Funding Received**
FY17⁺	7	11	4	7	3	$ 425,000
FY16⁺	15	10	3	15	2	$ 770,000
FY15	14	10	2	3	2	$ 384,999
FY14	11	22	1	25	8	$ 1,330,000
FY13	5	10	6	16	6	$ 1,020,000
FY12	11	50	4	12	6	$ 6,364,000
FY11	11	46	3	20	6	$ 940,000
FY10	14	99	6	47	13	$ 2,720,000
FY09	15	53	4	48	20	$ 3,500,000

⁺⁺Data was not collected for FY07-08.
†Includes all projects funded through the POCI.

**A number of external funding applications were still pending at the time reports were submitted and some information on award amounts was not included.
⁺Partial results, projects are not complete.

Principal Investigator	FY15 RIF Projects (To finish May 31, 2016)	Award Amount
Steve Carlson	Development of Plant-Derived Feed Additives that Eliminate Salmonella from Poultry	$37,630

Namrata Vaswani	Video Denoising-Phase I	$50,000
Tim Day	Identification of a Non-antibiotic Drug that Prevents BRD at the Feedlot	$12,500
Zhiyou Wen	Establishment of a mobile Revolving Algal Biofilm (RAB) cultivation system for treating industrial and municipal wastewater on site	$50,000
James Reecy	A Novel Assay for Rapidly Identifying Bovine STEC Carriers in Feedlots	$49,734
Steve Carlson	Development of a Genetic Test for Salmonella Resistance in Cattle	$23,500
Amy Kaleita-Forbes	Towards Real-Time Nitrate Monitoring in Tile-drained Water in the Midwest: Assessment of Ion Species	$26,330
Tim Ellis	Static Granular Bed Reactor (SGBR) Pilot Test Treating Primary and Secondary Sludge	$40,413
Steve Carlson	Plant Extracts that Efficiently Enhance Muscle Growth in Swine	$33,300
Jim Roth	National Implementation of the Secure Egg Supply (SES) Data Portal—Phase II	$50,000
Hui Hu	Development of an Advanced Spray Diagnostics Test Rig for the Measurements of Spray Flows Exhausted from Liquid Fuel Injectors-Phase II	$50,000
Eric Cochran	Development of Biorenewable Thermoplastic Block Copolymers—Phase II	$50,000
Balaji Narasimhan	Evaluation of α-Synuclein Immunotherapeutics in Animal Model of Parkinson's Disease—Phase II	$50,000
Alan Russell	A Castable, Ceramic-reinforced Aluminum Composite—Phase II	$23,329
David White	Plunger Cast Equipment Design, Fabrication, and Product Engineering for Commercial Scale Polymer—Phase II	$10,000
	FY16 RIF Projects (To finish May 31, 2017)	
Namrata Vaswani	Video Denoising—Phase II	$50,000
Al Jergens	Electronic Canine Collar Advancement thru Multi-purpose, Proof-of-Concept Trials	$44,500

Ratnesh Kumar	In-Situ Wireless Soil Moisture and Salinity Sensor and Extension for Nitrate and Other Nutrients/Ion Sensing	$50,000
Rudy Valentine	Effect of HMB Supplementation on Adipose Tissue Inflammation and Metabolism	$50,000
Keith Vorst	Technology for Real-Time Detection of Contamination in Food Processing Systems and Packaging for Value-added, Waste-Stream Diversion	$50,000
Wenyu Huang	Co-Production of High-Value Chemicals with "Drop-in" Biofuels from Lignocellulosic Biomass Using a Novel Liquid-phase Refinery Process	$50,000
Martin Thuo	No Heat Soldering	$50,000

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Development of a Plant Derived Feed Additives that Eliminate Salmonella from Poultry

PI: Steve Carlson

Company Partners (if applicable, company names only): Diamond V

Project Goal: To identify essential oils that dislodge Salmonella from the intestinal tracts of poultry.

Publications/presentations based on project: A publication has been created and is under review by the co-authors at Diamond V. We recently presented the work to FSIS and we presented the work at an international poultry conference (IPSF) in January 2016.

Invention disclosures: none

External funding applied for (indicate received/denied/pending): We submitted a grant to the National Pork Board to examine the possibility that these results extrapolate to swine- unfunded

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

We found that the essential oils had only a modest effect on dislodging Salmonella from the poultry gut, and that the dislodge Salmonella were potentially more virulent after exposure to the essential oils. Thus the essential oils alone will not be pursued further in broilers. However, our preliminary studies revealed that one of the essential oils may be effective in turkeys if combined with a prototype product being developed by Diamond V. We would like to pursue this possibility in Phase II.

Additionally, we found that an existing Diamond V poultry product (XPC) dislodges Salmonella from the chicken gut and it also minimizes the antibiotic resistance and virulence of the Salmonella. These findings have profound implications for the poultry industry and the Iowa-based company Diamond V:

XPC's novel effects on Salmonella burden, virulence, and antibiotic resistance is a unique marketing tool for Diamond V, and the company will likely acquire a greater market share in the broiler industry.

By reducing the load and virulence in Salmonella through the use of XPC, the poultry industry is going to see a reduction in poultry-associated salmonelloses in humans.

This latter point will dramatically aid in the marketability of U.S. poultry, while also boosting consumer confidence.

RIF FUNDING: PROGRESS REPORT

Report Type: Interim (Phase I and Phase II)

Title: Novel Machine Learning Based Approaches for Low-light Image or Video Denoising

PI: Namrata Vaswani; Soumik Sarkar

Company Partners (if applicable, company names only): Rockwell Collins

Project Goal: Development of denoising algorithms for low-light images and videos

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Publications/presentations based on project:

1. Technical report submitted to Rockwell Collins: Literature Review: Low-light Images & Videos, Noise types and Denoising Algorithms, Final report under preparation

2. Review presentation made to Rockwell Collins: Low-light Images & Videos, Noise types and Denoising Algorithms, Phase II interim review (April 2016), Co-PI Sarkar presented "A Deep Autoencoder Approach to Natural Low-light Image Enhancement" in Rockwell Collins Inc., Cedar Rapids, IA (May 2016)

3. Journal paper: K. G. Lore, A. Akintayo, and S. Sarkar, LLNet: A Deep Autoencoder Approach to Natural Low-light Image Enhancement, Pattern Recognition, 2016.

4. Conference paper: Guo and Vaswani, Video denoising via online sparse and low rank matrix decomposition. SSP workshop 2016.

Invention disclosures: None

External funding applied for (indicate received/denied/pending): None

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

In Phase II of the project, PI Vaswani and student has focused on developing an automatic and robust video denoising toolbox that combines the state-of-the-art existing denoising approaches with online robust PCA methods such as ReProCS - We tested the effect of replacing ReProCS with other robust PCA methods in their proposed Layering- Denoising (LD) method. Results on the Waterfall dataset shows that ReProCS is

the best kernel. We also proved a theorem that, for an image corrupted with i.i.d. Gaussian noise, the number of pixels with very large noise magnitude (larger than some threshold) is upper-bounded. We are currently exploring the advantage of ReProCS for correlated Gaussian noise.

Co-PI Sarkar and students focused on deep learning based approaches to image denoising – we have developed a technique called LL-net and have evaluated it on the dark text image provided by Rockwell Collins, as well as on other data. Besides showing the enhancement results for the Poisson vs. Gaussian noise models, we showed the pros and cons of training with either type of noise and explained the underlying factors contributing to our observations. Dataset generation technique is equally crucial to algorithm effectiveness. More recent results involve a union of the two noise models with modifications in the synthetic image generation scheme involving a combination of tone mapping in addition to gamma darkening. A color version of LLNet is now available. The team is currently discussing with Rockwell Collins scientists to move towards hardware implementation of the proposed algorithm.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Identification of a Drug that Prevents BRD at the Feedlot

PI: Tim Day

Company Partners (if applicable, company names only): AeroGenics LLC

Project Goal: The goal of this study is to perform a small pharmacokinetic study to establish that the non-antibiotic drug reaches therapeutic levels and does not leave residues in meat at two weeks after the drug has been discontinued.

Publications/presentations based on project: none

Invention disclosures: none

External funding applied for (indicate received/denied/pending): We applied for a USDA SBIR grant in October 2015- unfunded. However, AeroGenics has raised the cash to pay for half of the efficacy study in 2016. We have already submitted a Phase II RIF proposal for the other half of the money.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

The pharmacokinetic study was performed in August 2015. We received the data in early 2016 and found that the drug achieves therapeutic concentrations in the blood. Thus we are planning on performing an efficacy study to demonstrate that the drug will prevent the development of BRD in feedlot calves. We would like to perform this study in the Fall of 2016, if Phase II funding is acquired.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Establishment of a Mobile Revolving Algal Biofilm (RAB) Cultivation System for Treating Industrial and Municipal Wastewater on Site

PI: Zhiyou Wen

Company Partners (if applicable, company names only): Gross-Wen Technologies

Project Goal: To develop a pilot-scale mobile Revolving Algal Biofilm (RAB) cultivation system that can be used to treat effluents produced by industrial manufacturing facilities and municipal wastewater treatment plants.

Publications/presentations based on project:

Gross M, Zhao XF, Mascarenhas V, Wen Z**.** (2015) Effects of surface physicochemical properties and the surface textures on the initial colonization and attached growth in algal biofilm. *Biotechnology for Biofuels*. 9: 38.

Gross M, **Wen Z**. (2015) Revolving Algal Biofilm (RAB) Cultivation System: Evaluation of Production, Economics, and Life Cycle. In: *9th Algal Biomass Summit,* Washington DC. September 30-October 2, 2015

Wen Z. (2016) A Revolving Algal Biofilm (RAB) reactor for microalgal cultivation. In: *Institute of Biological Engineers (IBE) 2016 Annual Conference,* Greenville SC. April 7-9, 2016.

Invention disclosures: N/A

External funding applied for (indicate received/denied/pending):

Funded: Evaluation of the performance of a revolving algae biofilm system for recovery of nitrogen and phosphorus from municipal wastewater. $199,409; PI: Wen Z; Sponsor: Metropolitan Water Reclamation District of Greater Chicago. Period: 07/2014 – 12/2016

Funded: Deriving a new biobased product from wastewater: Production of a slow release algal-based fertilizer. $100,000; PI: Gross M; Sponsor: USDA SBIR Phase I: 06/2016 – 12/2016

Pending: Deriving a new biobased product from wastewater: Production of a carbon negative algal-based slow-release fertilizer. $100,000; PI: Gross M; Sponsor: EPA SBIR. Period: 06/2016 – 12/2016

Pending: Enrichment of selenium in microalgae biomass for enhancing the feed quality. $866,460; PIs: Probir D.; Wen Z; Sponsor: Qatar National Research Fund. Period: 01/2017 – 12/2019

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

In this project, we propose to develop a pilot-scale mobile Revolving Algal Biofilm (RAB) system that can be used to treat effluents produced by industrial manufacturing facilities and municipal wastewater treatment plants. In particular, we proposed build a mobile RAB system in a trailer that can be transported into on-site in either industrial facility or municipal wastewater plant.

During the project period, we have designed the mobile RAB system, procured the large equipment (such as pilot-scale RAB system and the customer trailer), and developed the standard operational protocol of the RAB system. The trailer was delivered in February 2016. In term of RAB based algal culture, we started the RAB reactor in the algal production greenhouse to confirm the new RAB design to be functional with smooth operation. We then installed the RBA reactor in the trailer. The mobile RAB algal culture system proved very efficient for growing algae at a pilot scale with great flexibility of location.

Use the mobile RAB system, the algal culture research get a lot of exposure and interests from various industries needing cost-effective wastewater treatment technologies. ISU researchers are currently working with Chicago Wastewater Treatment Plant and two local companies to install the mobile RBA system for treating the wastewater produced from those facilities. The final goal is to implement a commercial scale RAB system as an efficient way for nutrient recovery from those wastewater streams.

During the project period, the research team worked on several proposals for extending the algal research. The team successfully secured a USDA SBIR (Phase I) project to develop a fertilizer product from the algal biomass after the wastewater treatment. It is expected that the RAB system will eventually be a solution to wastewater treatment plant for treating wastewater in an efficient way.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: A Novel Assay for Rapidly Identifying Bovine STEC Carriers in Feedlots

PI: Jim Reecy

Company Partners (if applicable, company names only): PathoVacs; USDA

Project Goal: To develop a test to rapidly classify cattle with respect to their potential colonization with *Escherichia coli* (STEC; *E. coli* O157:H7 [O157].

Publications/presentations based on project:

Invention disclosures: June 15th Provisional Patent Application submitted.

External funding applied for (indicate received/denied/pending):

Dr. Indira Kudva has submitted a CRIS project to USDA-ARS for funding to further this research (pending).

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Serum samples were collected from 12 calves before (day 0) and after (approximately day 21 and 49) colonization with human Shiga toxin producing *Escherichia coli* (STEC; *E. coli* O157:H7 [O157] as well as 3 calves which were not colonized and had samples collected at the same time points. These serum samples were analyzed with a gas chromatograph/Mass spectrophotometer where we were able to quantitate more than 1000 metabolites. Statistical analysis shows that there are a subset of metabolites (33) that are nominally significantly associated with time points, suggesting that they change with *Escherichia coli* (STEC; *E. coli* O157:H7 [O157]) infection. Using this subset of metabolites we are able to group animals by E. *coli* strain or lack of colonization and time point. To date our analyzes indicate that it may be possible to develop a rapid test to classify cattle with respect to their potential colonization with *Escherichia coli* (STEC; *E. coli* O157:H7 [O157]. This has food safety implication for the beef industry as they would have an easy to use test to monitor for STEC *E. coli* colonization.

RIF FUNDING: PROGRESS REPORT

Report Type: Final- update on SBIR funding

Title: "Development of a Genetic Test for *Salmonella* Resistance in Cattle"

PI: Steve Carlson

Company Partners (if applicable, company names only): PSR Genetics

Project Goal: The goal of the project is to identify a genotype that confers *Salmonella* resistance to black cattle. Our previous studies identified a resistance-conferring genotype in non-black cattle, which compromise only 20% of the cattle in the U.S. And thus the aim of this project is to expand the scope of this genotype, and thus the marketplace for a genetic test, to the majority of U.S. cattle.

Publications/presentations based on project: We presented our data to the Akaushi Breed Association Annual Meeting on Oct. 31, 2015 in Santa Rosa, NM. We also presented our data to the Aubrac Association on Nov. 7, 2015 in Wellsburg, KS.

Invention disclosures: None as of yet

External funding applied for (indicate received/denied/pending): We submitted a USDA SBIR grant proposal in Oct. 2015. We will be submitting a revision in October 2016.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

PSR Genetics previously found a gene that consistently leads to *Salmonella* resistance in certain cattle, specifically those that are non-black (*e.g.*, Red Angus, Charolais, Piedmontese, Braunvieh, Shorthorn, Tarentaise, *etc.*). For black cattle, the resistance is rare and only occurs sporadically with an unknown genetic basis. In this study, we screened 3,717 blood samples for potential *Salmonella* resistance using an assay that was developed by PSR Genetics. In this assay, we incubated *Salmonella* with blood cells and quantified the number of *Salmonella* that can survive within the white blood cells- this is the assay that preliminarily identified the non-black cattle that resist *Salmonella*. Of these 3,717 blood samples, *Salmonella* resistance was observed in 60 samples from black cattle. Our next step was to identify genes whose expression was diminished in these 60 samples. We focused on 34

genes that encode for proteins exploited by *Salmonella* during the infection process. In 55 of the 60 samples, 10-12 genes were significantly less expressed although it was not the same 10-12 genes in each sample. That is, any of the 34 genes could be "hypo-expressed" and lead to resistance. The next step is to identify the genetic differences in these 34 genes in the 55 samples. We will also need to confirm that the white blood cell-associated resistance extrapolates to the live animal, by performing experimental infection studies. As such, we will be submitting a USDA SBIR grant for the funds needed for the next study. Once completed, we will identify a set of genetic differences that confer the *Salmonella* resistance to black cattle. We will then partner with GenSeek to create a multi-gene "chip" that will detect the specific subset of genes differences that lead to *Salmonella* resistance in black cattle. Given the likelihood that *Salmonella* will be declared as an adulterant in beef in the next year or two, we envision that the packing plants will pay a premium for cattle that are verified to harbor the subset of resistance genes. This premium will augment the appeal of the genetic test for the industry.

Update on SBIR funding:

In October 2015 we submitted an SBIR grant proposal to the USDA. In April of 2016 we received the reviews of this proposal and the program officer indicated that we just missed the funding cut-off. He indicated that we would have been the next funded grant if the program had the additional funds. He strongly encouraged that we address the few criticisms and re-submit next year.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Towards Real-Time Nitrate Monitoring

PIs: Amy Kaleita-Forbes

Company Partners (if applicable, company names only): Agri-Drain

Project Goal: To characterize ion species present in tile drained water, in support of development of a nitrate sensor.

Publications/presentations based on project:

Zimmerman, B. and A. Kaleita, "Analysis of the constituents that influence electrical conductivity of agricultural drainage water," Poster presented at the 2016 Iowa Water Conference, March 2016, Ames, IA.

One poster to be presented at the annual meeting of the ASABE in July 2016; two journal articles to be submitted for review July/Aug 2016.

Invention disclosures: None

External funding applied for (indicate received/denied/pending): None at this time.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

During the summer and fall 2015, thanks to an unusually wet summer and autumn, we collected drainage water samples from ISU tile drainage research plots outside of Ames, as well as from a drainage district collector tile culvert near Colo. These were sent for analysis of ion species composition at the Iowa Hygienic Laboratory in Ankeny. We then characterized the typical levels and variability of ions that affect the electrical conductivity of such waters, as well as determined the major drivers of changes in electrical conductivity and ion composition.

This information will be necessary in order to further our development of a nitrate-specific dielectric sensor, because all ions, including nitrate, will contribute to the dielectric signal generated by the tile drain water. Moving forward, we are using the concentration information developed through this RIF project to refine our laboratory procedures in development of the sensor, which is currently funded by the USDA National Institute for Food and Agriculture (NIFA). Working with Agri-Drain and the CyBiz student team on this project, we determined a target price point of $300 for an accuracy of +/- 2 mg/L.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: SGBR Pilot Test on Primary and Secondary Sludge

PIs: Timothy G. Ellis

Company Partners (if applicable, company names only): Fox Engineering Associates

Project Goal: To evaluate the performance of the SGBR to treat primary and secondary sludge at short retention times (e.g., 24 hours) and ambient temperature.

Publications/presentations based on project: manuscript in preparation entitled: Laboratory and pilot-scale demonstration of the Static Granular Bed Reactor (SGBR) for treating primary and secondary sludge from a municipal wastewater treatment plant

Invention disclosures:

External funding applied for (indicate received/denied/pending): proposal in preparation for the NSF Grant Opportunities for Academic Liaison with Industry (GOALI) program

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress): The laboratory portion of the study has shown that the SGBR system achieved removal efficiencies of TSS and COD of over 90% treating primary and secondary sludge from the Ames Water Pollution Control Facility. This is well in excess of the approximately 50% removal efficiency currently being achieved by the conventional (heated) digesters at the plant. The influence of the organic loading rate on the removal efficiency was evaluated under differing conditions ranging from 0.93 to 1.66 $kg/m^3 \cdot d$ at a range of hydraulic retention times of 48 to 24 hours. Effluent pH, alkalinity, and VFA values did not fluctuate much indicating the superior stability of the system.

A pilot-scale 1000-gallon SGBR was installed at the Ames Water Pollution Control Facility and has been operating for approximately 4 months with excellent results. The target influent concentration was 2000 mg/l and within 3 weeks of start-up the SGBR achieved greater than 95% solids removal. Chemical oxygen demand (COD) removal also exceeded 95% removal within 2 weeks of start-up. These results have been even better than

the laboratory portion of the study suggesting that scale-up of the SGBR from lab scale to full scale will be feasible. Other indicators of system performance and stability (e.g., volatile fatty acids, alkalinity, gas production, etc.) have been excellent. The SGBR has been operated at an ambient temperature of 23ºC. Methane content of the biogas produced has averaged 71.5% with the balance being primarily carbon dioxide. This study demonstrates the good applicability of the SGBR system to treat primary and secondary sludge and reinforces the premise that the system is a viable option for municipal wastewater treatment plants wanting to optimize the performance of their anaerobic digestion systems with respect to solids and COD removal, renewable energy production, prevention of odors, and minimization of sludge requiring ultimate disposal.

RIF FUNDING: PROGRESS REPORT

Report Type: Interim

Title: Plant extracts that efficiently enhance muscle growth in swine

PIs: Steve Carlson

Company Partners (if applicable, company names only): Diamond V

Project Goal: To identify plant extracts that reduce myostatin expression and thus enhance muscle growth in swine that are fed these extracts.

Publications/presentations based on project: none as of yet

Invention disclosures: ISURF Case Number 04531, Cruciferous plant extracts that inhibit myostatin in swine

External funding applied for (indicate received/denied/pending): none as of yet

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

In our preliminary studies (Phase I) we identified two diets that increased feed efficiency, muscle accretion, and muscle fiber density in growing pigs. These two diets are: (1) kale extracts plus ground mustard seed; and (2) four cruciferous vegetable extracts plus ground mustard seed.

We are awaiting data regarding myostatin gene expression and serum sulforaphane, the latter of which is the beneficial inhibitor of myostatin expression. These data will be available at the final report.

Based on the data derived to date, Diamond V would like to pursue Phase II funding in order to demonstrate the beneficial effects of these diets in finisher pigs. Ultimately, these diets could be added to their existing swine products- either XPC or SynGenx.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: National Implementation of the Secure Egg Supply (SES) Data Portal—Phase II

PI: James Roth, Center for Food Security and Public Health

Company Partners (if applicable, company names only): GlobalVetLINK (GVL)

Project Goal:

The project goal is to gather system requirements for a National Secure Egg Supply (SES) Data Portal. We plan to use the project funds to hire two contract programmers to work with the Center for Food Security and Public Health (CFSPH) and GVL to gather system requirements for the data portal. This work is an essential step for transitioning the current Iowa – only data portal to a sustainable national portal commercialized by GVL. The portal will be beta tested by an Iowa egg producer that has used the Iowa –only demonstration portal. The long term goal is that the SES plan and data portal will become operational nationwide and that it can be expanded to control additional poultry diseases nationwide.

Publications/presentations based on project:

September 12, 2014: Webinar (Jim Roth and Kevin Maher) with Pat Stonger (DayBreak Eggs) and University of Minnesota Partners

September 15, 2014: SES Group Conference Call (approximately 60 participants) – Presentation by Jim Roth on the future plans for the data portal and voluntary preparedness component of the SES.

Meeting with Pat Stonger, UMN partners at the US Animal Health Association meeting in Kansas City, on October 19.

GVL Workshop with Iowa Egg Producers, Thursday, December 18, 2014

Invention disclosures: None

External funding applied for (indicate received/denied/pending):

Currently exploring potential funding sources related to the egg industry

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

In close collaboration with the CFSPH team at Iowa State, between January 2015 and May 2015, GlobalVetLINK delivered the following functionality in the national Secure Egg Supply portal in Phase I of the RIF grant:

- Implemented the SES portal prototype complete with SES branding and sample data
- Created three user role types (Production Manager, Incident Command, Auditor)
- Established data architecture
- Created beta API for data inputs and outputs with minimal usage documentation
- Implemented basic functionality for an SES Producer
    - Premises maintenance
    - House maintenance
    - Daily reporting
    - Enhanced cleaning and disinfecting checklists
- Implemented basic functionality for an SES Auditor
    - Associate a third party audit "sign-off" with a premises
- Implemented basic functionality for an SES Incident Commander
    - View premises, daily production data and bio-security data by premises

Implemented a user sign-up process

Phase II of the project began on June 1, 2015

- GVL hosted two webinar sessions.
    - The audiences were egg producers and state veterinarians. A third session was hosted specifically for the state of Michigan.
- The GVL development team worked to ensure a sound product was available for demonstrations and prepared the sign-up protocol for egg producers.
- A GVL team member attended the SES meetings in conjunction with the NEUSAHA meetings in Harrisburg, PA.
- Deployment process has been finalized and the system is available on GVL production servers.
- Marketing designed and executed a training worksheet in addition to training GVL staff on onboarding and customer support of the product.
- The GVL team is working to determine a method to share data with EMRS2.
    - GVL team member met with Dr. Fred Bourgeois at USAHA annual meetings to discuss this possibility.
- The incident command feature has been implemented as an option in the GVL SAHO login for streamlined access and ease of use.
- GVL and ISU held several meetings to discuss lessons learned from the HPAI outbreak and the direction the industry is taking the SES program
- A GVL team member attended NCUSAHA conference to attend HPAI lessons-learned sessions including one presented by Dr. Patty Fox, USDA
- GVL and ISU held several meetings to discuss leveraging work done with the SES portal to accommodate other SFS programs. We are optimistic that this investment will be successfully leveraged with other SFS programs in the future.

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RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Development of an Advanced Spray Diagnostic Test Rig for the Measurements of Spray Flows Exhausted from Liquid Fuel Injectors—Phase II

PIs: Dr. Hui Hu (Iowa State University; Tel: 515-294-0094/Email: huhui@iastate.edu)

Mr. Spencer Pack (UTC Aerospace Systems; Tel: 515-633-3460/Email: Spencer.Pack@utas.utc.com)

Company Partners (if applicable, company names only): UTC Aerospace Systems

Project Goal: Build and certify a 250 psi spray rig at ISU to the characterize spray flows exhausted from liquid fuel injector/atomization nozzles.

Publications/presentations based on project: None to date.

Invention disclosures: None to date.

External funding applied for (indicate received/denied/pending):

UTAS $50K cost match with ISU agreement. No others pending.

A joint research proposal to be submitted to NSF is under preparation.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

The joint program, entitled "Development of an Advanced Spray Diagnostics Test Rig for the Measurements of Spray Flows Exhausted from Liquid Injectors- Phase II", has begun at United Technologies Aerospace Systems and Iowa State University. The objective of the project is to develop an advanced spray diagnostics test rig (up to an elevated pressure of 250psi) to quantify spray characteristics and to elucidate important processes in fuel spray flows, such as the breakup of liquid fuel jets and sheets, atomization and evaporation of fuel droplets, and air/fuel mixing by using advanced laser-based spray diagnostic techniques. The proposed high-pressure spray test rig will be used to assist UTAS in developing next generation fuel nozzles/injectors for maximized energy efficiency while minimizing pollutant emissions, and maintaining the operability requirements.

The high-pressure spray diagnostics test rig has already been successfully manufactured and installed at Aerospace Engineering Department of Iowa State University. Some preliminary experiments have already been conducted to test the spray flow rig at several elevated pressure levels. More comprehensive experiment campaign to characterize spray flows exhausted from UTAS fuel injectors are undergoing. The researchers from ISU and UTAS are in the conversation to write joint research papers and submit joint research proposals for external funding in order to build a self-sustainable high-pressure spray test facility based on the preliminary measurement results derived from this RIF project.

In summary, the project has made very good progress. The research team has been holding bi-weekly meetings throughout the entire program to ensure that all the program goals are met in a timely manner.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Development of Biorenewable Thermoplastic Block Copolymers—Phase II

PIs: Eric Cochran, Chris Williams

Company Partners (if applicable, company names only): ArgoGenesis Chemical, LLC, Archer-Daniels Midland Co, Seneca Petroleum, Kraton Polymers, LLC

Project Goal:

The goal for this project is to create a cost effective way to chemically synthesize specialized hybrid materials (biorenewable thermoplastic block copolymers) that current technology does not allow for.

Publications/presentations based on project: None

Invention disclosures: ISURF 04435

External funding applied for (indicate received/denied/pending): None

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

The goal of this project, as mentioned before, is to create a method that will help merge industry's cost effective, but limited in the number of monomers that can be polymerized, way of synthesizing rubber with a novel technology that allows the polymerization of a wider spectrum of monomers, including biorenewables.

Our main focus is still in the synthesis of chain transfer agents (CTAs) that can serve as termination agents for industry's rubber production. Currently we have synthesized a wide variety of CTAs which have seen some preliminary success. One of our CTAs has a halogen handle and has seen as high as a 50% effectiveness as a termination agent. Other CTAs have also shown some potential, however their effectiveness rate is lower that 30%. We are currently working on taking the successes that we have had and optimizing the reaction conditions so that we increase our conversions and get into the 90+% range.

Additionally we are looking at a new way of "growing" the CTA off of a living polymer. Instead of terminating the reaction with a CTA, the new procedure will consist of a series of steps to convert the living

polymer into a CTA. First few attempts have shown some partial success (<10%) and we are currently working on the reaction conditions to improve these results.

We are still very confident that we are now closer to creating a different molecules that will serve as terminator with a high termination efficiency which will require no other undesirable side reactions. Once we synthetize these CTAs we will continue to test their efficacy to polymerize a wide range of different monomers.

Kraton Polymers, LLC continues to be very interested in joining efforts in perfecting and further developing this method. We are currently negotiating a Master Sponsored Projects agreement with Kraton.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Evaluation of α-Synuclein Immunotherapeutics in Animal Model of Parkinson's Disease

PI: Balaji Narasimhan

Company Partners (if applicable, company names only): PathoVacs, PK Biosciences

Project Goal: To delay onset and/or retard progression of PD in a proxy murine model of human PD via delivery of "***Trojan horse"*** polyanhydride nanoparticles formulated with $F(ab)_2$ fragments of high affinity polyclonal antibodies (sHA-PAbs, developed in phase I)) and monoclonal antibodies (sHA-MAbs) experimentally generated against epitopes unique to aggregated/pathological human α-Synuclein, across the blood brain barrier to slow down neuronal degeneration and cell death.

Publications/presentations based on project: None

Invention disclosures: None

External funding applied for (indicate received/denied/pending): An STTR grant proposal submitted to the National Institutes of Health was denied funding. The proposal "α-Synuclein based nanomedicines for Parkinson's disease" has been bolstered with new data for re-submission.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

This Phase II study comprised **three objectives:** Toward objective #1 (PathoVacs, Inc.), we successfully generated $F(ab)_2$ fragments of sHA-PAbs [sHA-PAbs-F $(ab)_2$], which were encapsulated within polyanhydride nanoparticles for animal studies. Additionally, in collaboration with the ISU Hybridoma Core Facility, we successfully generated a panel of 27 sHA-MAbs with exquisite singular specificity for the pathological (aggregated) form of human recombinant α-Syn. Toward specific aim#2 (PathoVacs and PK Bio), we examined one clone and determined that the sHA-MAb (IgG2a isotype, secreted by clone 6G7) has diagnostic potential as evidenced by its differential reactivity, i.e., react more strongly with sera of PD patients compared with sera from healthy age-matched individuals. We are systematically evaluating diagnostic potential of the remaining 26 sHA-MAbs, following which an ELISA for early accurate diagnosis of PD will be developed using the best sHA-MAbs.

Animal studies: The next step in the project was to test the therapeutic efficacy of our $F(ab)_2$ fragments of sHA-PAbs. Prior to injecting $F(ab)_2$ fragments into animals, we determined whether they crossed the blood-brain barrier to reach their intended target. The dose and route of were similar to that described previously for an α-synuclein antibody (Games et al., J Neurosci, 2014 • 34(28):9441–54).

Animal study 1: Animal protocols were approved by the Iowa State University IACUC. Albino mice (Jax strain B6(Cg)-Tyrc-2J/J were purchased from Jax Mice, and after acclimation were administered fluorescently labeled $F(ab)_2$ fragments via intraperitoneal injection. Each mouse received either 25 μg $F(ab)_2$ solubly or encapsulated in 500 μg of 20:80 CPH:SA nanoparticles. All mice were imaged on days 3, 7, and 14 days post-administration. During imaging, mice were kept under anesthesia with 2.5% isoflurane in 100% O_2, at 2.5 L/min. At each time point, a cohort of mice was euthanized and the brain, live, kidney, and spleen were dissected for ex vivo imaging.

Results: We observed an increased fluorescence in liver, kidney and spleen but not in brain.

Animal study 2: Since $F(ab)_2$ fragments did not reach the brain after intraperitoneal administration, we next explored if intranasal administration would be facilitate entry into the brain. In this study, we intranasally administered 25 μg $F(ab)_2$ solubly or 25 μg encapsulated within 500 μg of 20:80 CPH:SA nanoparticles. Anesthetized animals were imaged on days 1 and 3 post-immunization. In addition, ex vivo images of the brain and lungs were captured.

Results: We observed an increased fluorescence in lung tissue but not in brain.

Animal study 3: Finally, a repeated, high dose regimen was used to examine the ability of encapsulated $F(ab)_2$ fragments to reach the brain. Each mouse received an intraperitoneal administration of either 250 μg $F(ab)_2$ solubly or encapsulated within 5 mg 20:80 CPH:SA nanoparticles for three consecutive days. Anesthetized animals were imaged 1 and 4 days after the last administration. In addition, mice were euthanized at each time point and the brain, liver, kidney, and spleen were imaged ex vivo.

Results: We observed an increased fluorescence in liver, kidney and spleen but not in brain.

Next steps: Based on the current studies, polyanhydride nanoparticles are being functionalized with TPP to enable BBB penetration. These functionalized particles will be used to encapsulate the F(ab)2 fragments and animal experiments will need to be performed to confirm BBB penetration. In addition, we mentioned previously, we are evaluating the diagnostic potential of the remaining 26 sHA-MAbs, following which an ELISA for early accurate diagnosis of PD will be developed using the best sHA-MAbs. Based on these studies, we anticipate submitting multiple grant proposals to NIH.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: A Castable, Ceramic-Reinforced Aluminum Composite—Phase II

PI: Alan Russell

Company Partners (if applicable, company names only): NewTech Ceramics

Project Goal: Develop a test casting of Al + BAM composite that contains regions with slow cooling rate, intermediate cooling rate, and fast cooling rate. Test the mechanical properties of metal taken from each of these regions to determine the relationship between cooling rate and mechanical properties.

Publications/presentations based on project: None yet.

Invention disclosures: This IP is protected by U.S. patent no. 7,172,641, "Ultra-hard boride-based matrix reinforcement"; issued 6 Feb, 2007, Cook B.A., Russell A.M., Harringa J.L., Biner S.B., and Anderson I. ISURF has licensed this patent to NewTech Ceramics.

External funding applied for (indicate received/denied/pending): An SBIR Phase I proposal entitled "Processing Optimization to Produce a Low-cost, Eco-friendly, High-modulus, Weldable Aluminum-matrix Composite" was submitted on June 13, 2016 to the National Science Foundation requesting funding in the amount of $211,000 to continue development of this material. This funding decision is pending.

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Several test castings were performed from specimens prepared by mixing aluminum, magnesium, and boron in alumina crucibles and heating for various combinations of time and temperature. From these experiments, it was determined that a slowly cooled specimen held at 1400°C for one hour produced the best result. It is nearly free of the porosity that had marred earlier test castings in this project. The composite was 92.7% Al and 7.3% BAM.

A test weld demonstrated that the material can be welded by tungsten inert gas (TIG) welding. A cross-section of the welded piece is revealed that the size and distribution of BAM in the fusion zone is essentially the same as in the material that was not welded, a desirable outcome.

Al + BAM specimens were tested at Oak Ridge National Laboratory by pin-on-disk wear testing. These measurements predict how well this composite material will perform in severe wear environments. Aluminum metal generally performs poorly in high-wear environments. The presence of BAM in the aluminum was expected to improve wear resistance. The wear test showed that the Al+BAM wear rate was three times lower than in aluminum without BAM, and the Al+BAM also had a 25% lower coefficient of sliding friction.

The commercialization goal is to produce a simple, low-cost, environmentally friendly method for producing a high-modulus, wear-resistant, weldable aluminum. The findings of this project confirm that every one of the characteristics underlined is achievable in Al+BAM.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Plunger Cast Equipment Design, Fabrication, and Product Engineering for Commercial Scale Polymer Mortar Composite (PMC) Pipe Manufacturing—Phase II

PI: David White

Company Partners (if applicable, company names only): r-Pipe

Project Goal:

1) Fabrication of Plunger Cast Equipment and Molds for 24" product; 2) Manufacture 24" diameter specimens for commercial testing; 3) Commercial testing and validation

Publications/presentations based on project:

Invention disclosures:

External funding applied for (indicate received/denied/pending):

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

June, 2016

During May and June, there have been a series of on-site meeting with representatives from the Ames Laboratory to deliver the mold, install connection pieces to the mold press, and evaluate the performance of the mold and heaters. During this process it was discovered that the outer mold and the top flange to not match up properly and the Ames Laboratory picked up the mold on June 23 to make modifications.

Several trial mixtures were evaluated during this period and the results look promising.

There have also been several meeting during this period with ISU officials regarding the rental of the pipe mold. Currently a draft agreement has been developed and R-Pipe is waiting on our insurance carrier to verify the insurance requirements.

One the mold is returned from ISU, it will be evaluated and casting of the pipe sections for commercial evaluation can begin.

December, 2015

The plunger cast equipment and molds are in the final stages of assembly by the Ames Laboratory Machine Shop. The prototype equipment has gone through a preliminary run out and some minor modifications are being addressed. A project review was conducted on December 18 to identify the final assembly details. 100% completion is anticipated for on the equipment and mold will be completed by January 8, 2016. R-Pipe has hired an Iowa company to fabricate the needed hydraulic press, and this will be completed by January 15, 2016. With equipment now nearly completed, it is anticipated that the manufacture of test specimens can begin in January 18, 2016. According to our most recent project review with the Ames Laboratory, the Phase 2 funding as approved will be sufficient to complete the work.

July 2015

Project goals have been slowed because of the extra time taken to fabricate the Plunger cast equipment and molds. The Ames Laboratory Machine Shop is expected to complete the equipment by 6.26.2015. Requirements for a hydraulic press has been completed and this will be purchased using Phase 2 funding. It is anticipated that manufacture of the test specimens will begin in late August.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Electronic Canine Collar Advancement thru Multi-purpose, Proof-of-Concept Trials

PIs: Al Jergens

Company Partners (if applicable, company names only): PetMeasure

Project Goal:

This trial aims to use an automated dog collar to measure real-time animal core body temperature and transmit these data to veterinary clinicians via a mobile (phone) application. The measurement of these data will optimize remote patient mangement following general anesthesia events and/or surgical procedures.

Publications/presentations based on project:

None at this time

Invention disclosures:

External funding applied for (indicate received/denied/pending):

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

This project has made real advances in collar design and in vivo data collection over the past 6 months. The focus has been on collar device refinement with regards to consistency/longevity of paired sensor (temperature) readings and their correlation to other measures of core (e.g., esophageal and rectal) body temperature. Using 3 student workers trained in collar placement and recording, 10 dogs undergoing orthopedic surgical procedures were targeted for assessment due to the length and nature of their anesthetic event and the impact this intervention plays in maintenance of body temperature.

Results indicate that consistent temperature recordings are possible with the collar device although there is some variability in the sensor-to-sensor readings on a patient. Temperature recordings were possible in all phases of an

anesthetic event in each dog, including IV catheter placement, anesthesia induction, anesthesia maintenance with/without external heat, and patient recovery. Trial data also show good and predictable correlation of collar temperature detection to core body temperature via esophageal probe but not with core body temperature using a rectal probe. Another subset of animals where remote monitoring of body temperature is advantageous will be performed in dogs in ICU with recurrent or persistent fevers. In these instances, temperature fluxes may occur in response to natural disease course (clinical relapse or remission) or medical (antimicrobial) intervention.

Goals for the next 12 months are ambitious and include: (1) expansion of canine cohorts to include other specialty cases (such as internal medicine), (2) beta testing of ICU patients as described above, and (3) out-patient monitoring with a harness device in healthy dogs. In this latter trial, we will be investigating out-patient, continuous monitoring of body temperature but also measurement of other indices including mobility patterns, heart rate, respiratory rate, and pulse character.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: In-Situ Wireless Soil Moisture and Salinity Sensor and Extension for Nitrate and other Nutrients/Ion Sensing

PIs: Ratnesh Kumar

Company Partners (if applicable, company names only): Microwaves by the Weber, Inc.

Project Goal: Research and Technology Transfer Efforts towards In-Situ Wireless Soil Moisture and Salinity Sensor, and extension for Nitrate Sensing

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Publications/presentations based on project: Several industry presentations have been made to Monsanto/ClimateCorp/Solum, DuPont-Pioneer, and Raven Industries. I am trying to also organize a presentation in India to folks at International Crop Research Inst. For Semi-Arid Tropics and Ministry of Agriculture and Farm Welfare. The work was also presented at these conferences:

1. Energy Harvesting and Storage, 2015, Santa Clara, "In-Situ, Sensor-Aided Sustainable Agriculture and Broadband Vibrational Energy Harvesting"
2. S. Tabassum, Q. Wang , W. Wan, S. Oren , M. A. Ali , R. Kumar, and L. Dong, "Plasmonic Crystal Gas Sensor Incorporating Graphene Oxide for Detection of Volatile Organic Compounds", IEEE International Conference on Micro Electro Mechanical Systems (MEMS), Shanghai, China, Jan. 2016.

Invention disclosures: One invention disclosure on soil moisture and salinity sensor with its wireless interface was filed prior to the RIF funding (ISURF 04183), and development and tech transfer work on that is continuing. In addition, two new invention disclosures were filed in Fall 2015, one on Nitrate sensing (ISURF 04454) and another on Plant Gas Sensing (ISURF 04453). Also, the Vibration Energy Harvesting invention (ISURF 4354) was submitted for a Full Patent Application, on 4/11/16. (The harvested energy can be used for powering our remote sensors.)

External funding applied for (indicate received/denied/pending): One NSF proposal that was submitted to NSF titled, "PFI: AIR - TT: In-Situ Wireless Soil Sensor for Moisture, Salinity and Ions", with period of performance May 2016-Oct. 2017 (18 months) has been funded in the full amount of $200K. A second NSF proposal was submitted to NSF titled, "INFEWS/T3: Reducing Energy Demand and Water Discharge Pollutants in Agricultural Food Production: Sensors, Models and Socio-Economics", with period of performance August 2016-August 2020 (5 years) in the amount of $3M, engaging 8 researchers from 4 institutes (ISU-ECE/Ag/Econ, USDA-ARS, UCI, McGill) and 3 Industries (Raven, mCUBE and MWBW Inc).

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress): The research work on In-Situ Soil Moisture and Salinity Sensing and its Wireless Interface was completed prior to RIF funding. Subsequent to RIF funding we have been engaged in its prototyping and technology transfer efforts. A new version of the sensor is currently prototyped, with some hardware bugs corrected, and that will have the additional capability of operating in Sleep mode, and extra

amplification of transmission power. Once the hardware development is completed, software development work will be started to interface computer with the sensor, and to calibrate the sensor readings.

The development work on Nitrate sensor is also progressing. A Dept. level seminar presentation was made by the PhD student Zhen Xu in March 2016, along with a poster presentation. The current work is focused on the sensing part, which consists of a microfluidic system for flowing the soil solution along a channel for electrophoretic separation of different ions and a current readout mechanism. The sensing part and its sensing principle has been verified in the lab. Additional research would be needed to make a complete sensor that will have additional microfluidics for drawing in soil solution, its filtering to remove soil particles and gasses, and an integrated stimulation and readout mechanism.

We signed a NDA with the Raven Industries in Sept. 2015. A demo to Raven was presented on ISU campus in the same month. Raven invited us back for another demo at their site in Sioux Falls, SD in Nov. so a larger group could see the working of the sensor. The discussion about options licensing is taking place between Raven and ISURF, and is close to being finalized (Jay Bjerke is our point of contact, and can share more details of the progress). We also signed an NDA with Pioneer in Jan. 2016, and a demo and presentation to them on March 30, 2016 . Finally, an NDA with Monsanto/ClimateCorp/Solum was signed in August 2015, and revised in May 2016, while a demo and presentation was given in May 2016. IntelliFarm is another company, a start-up based in Nebraska, that is interested in our technology, and to whom we made a presentation in May 2016. For further discussion, we would need to enter an NDA with them.

RIF FUNDING: PROGRESS REPORT

Report Type: Interim

Title: The Effect of HMB Supplementation on Adipose Tissue Inflammation and Metabolism

PIs: Rudy Valentine

Company Partners (if applicable, company names only): MTI

Project Goal:

To examine the mechanisms of a novel and safe therapy that results in fat loss, reduced adipocyte size and inflammation, increased adipocyte fatty acid metabolism and improved metabolic health in obese individuals.

Publications/presentations based on project: N/A

Invention disclosures: N/A

External funding applied for (indicate received/denied/pending): N/A

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

The project is underway, with six participants officially enrolled in the study. Baseline data, including body composition, metabolism, muscular fitness and inflammation, has been collected on five of six participants and the intervention will be complete on this first wave of participants in early September.

RIF FUNDING: PROGRESS REPORT

Report Type: Final

Title: Technology for Value-Add Recycled Plastics and Real-Time Detection of Contamination in Food Packaging and Waste-Stream Diversion

PIs: Keith Vorst and Wyatt Brown (Cal Poly, San Luis Obispo)

Company Partners (if applicable, company names only):

Amcor Rigids
Dart
Peninsula Packaging
Niagara Bottling
IdeoPak
American Packaging Company

Project Goal: To define methods and systems for optimizing recycled plastics packaging substrates to provide value-add features and increase shelf-life of perishable products through real-time data capture during manufacturing and packaging operations.

Publications/presentations based on project:

Speaker/Presenter

K.Vorst. 2016. Innovations in Recycled Plastics Packaging Technology. REFOCUS Recycling Summit for Society of Plastics Industries (SPI). Orlando, FL. April 26-27.

K.Vorst. 2016. Real-Time Detection of Organic and Inorganic Contamination in Packaging. 6th International Symposium on Food Packaging-Supporting Safety and Innovation, International Life Science Institute (ILSI). Barcelona, Spain Nov 16-18.

Publications:

Curtzwiler, G., Maples, A., Williams, E., Davis N., De Leon, E., and Vorst., K. 2016. Added value of increased ultraviolet protection by incorporating recycled polyethylene terephthalate into packaging. Trends in Food Science and Technology Submission June 2016 (in-submission).

External Funding:

2016 INFEWS/T3: Enabling Innovative Systems Solutions with High Voltage Atmospheric Cold Plasma at the Intersection of Food, Energy, and Water, National Science Foundation

(NSF) Proposal number 1639054 $2,168,720.00 (not reviewed). Note: Includes a large component on monitoring packaging contamination, removal or organic and inorganic compounds to add value to plastics.

2015-2016 Online Contamination Analysis of RPET During Extrusion and Thermoforming Processes and Shelf-life Extension of Fresh-Cut Produce. Funded – Iowa State University Polymer and Food Protection Consortium.

Invention disclosures:

1.) **Application Number 62/324,790; ISURF# 04335:** Atty. Docket. No 29609.0740 Method for Optimizing Plastics Compositions Used in Packaging to Increase Shelf-Life of Perishable Products and System Thereof

2.) Publication Number US 20140332994 A1 Detection in Thermoplastics (Danes and Vorst) International Application Number PCT/CL2014/000020

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

This work has shown commercial viability of real-time analysis during plastic conversion is correlated to PCR content, compound identification and thus, shelf-life extension. The results from thermo-mechanical processing of polyethylene terephthalate, which is known to cause main chain degradation of the polymer, produced a multitude of degradation byproducts that reflect or absorb UV light and can be controlled though blending, additives and monitoring during conversion. Work completed at ISU mounted with in-line sensors (UV-vis, IR, X-ray), with room for three more optical sensors (i.e.- Raman, fluorescence, etc.) demonstrated optimized blends and compounds for increased material performance. The current system has successfully collected full scans from 200-800 nanometers at a speed that can match industry standard extrusion rates. This data will be processed using an algorithm that combines data from the aforementioned sensors to predict PCR content and extend shelf-life by utilizing additives and compounds not visible to the human eye but capable of blocking specific electromagnetic wavelengths that cause degradation to food products .

Blends of polyethylene terephthalate containing various amounts of post-consumer recycled material (PCR) were run simultaneously through several different types of sensor arrays such as inline UV-Visible light spectrometer (UV-Vis) and an energy dispersive x-ray diffraction (ED-XRF) and infrared (IR). Each sensor collected various data signals from which determines various classes of chemical compounds and heavy metals present in the polymer matrix. Proof of concept work was done in the Iowa State University Packaging Lab in conjunction data collected on a commercial extrusion monitoring equipment has demonstrated the potential integration into existing manufacturing and packaging systems. Corporate partners have been engaged to allow the current lab beta system to be installed in commercial extrusion and packaging lines to demonstrate scalability to provide value add to recycled plastics (Table 1).

Table 1. Task Progress

Obj.	Task	Milestone or Type	Milestone Verification	Anticipated Date	Status
1	Build sensor array	Milestone	Calibrate sensor array at ISU	July-November 2015	Completed ✓

2	Determine sensitivity of sensor array in lab	Go/No Go	Threshold levels established for multiple polymers using lab extruder	November-December 2015	Completed ✓
3	Install array in commercial processing facility	Milestone	Sensor array output to website server	January- February 2016	August 2016
4	Model output and predict quality using sensory array and lab validation	Milestone	Data collected by sensor array compared to values collected in lab considering safety, quality; shelf-life predictive modeling	February-May 2016	Completed ✓
5	Investigate commercialization strategy with corporate partners; economic analysis	Milestone	Licensing and revenue opportunities to university and IP partners	May 2016	Completed ✓

RIF FUNDING: PROGRESS REPORT

Report Type: Interim

Title: Co-Production of High-Value Chemicals with "Drop-in" Biofuels from Lignocellulosic Biomass Using a Novel Liquid-phase Refinery Process

PI: Wenyu Huang

Company Partners (if applicable, company names only): Esstar Bio Technology, LLC

Project Goal: The goal of this project is to demonstrate the technical feasibility of a two-step biomass conversion process, and the economical feasibility of co-production of high-value chemicals and "drop-in" biofuels from biomass.

Publications/presentations based on project: One presentation was given to a group of surface scientists in Ames Lab with the focus on structure-catalytic property relationship of the catalysts. Two presentations were given in BASF (03/15/16) and ExxonMobil (3/16/16) to attract industrial interests. Private presentations were given during conferences for potential collaborations.

Invention disclosures: Plan to file one application based on the conversion of levulinic acid to β-acetylacrylic acid. β-acetylacrylic acid is a high-value chemical that sales at $20~100/gram currently.

External funding applied for (indicate received/denied/pending):

Denied: DOE STTR (Project title: Catalytic Transformation of Cellulosic Waste Streams to Dicarboxylic Acids and Diols

To be submitted: NSF STTR (Project Title: Catalytic Transformation of Lignocellulosic Waste Streams to Value-Added Chemicals)

Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

During Phase I of this project, we successfully achieved all the milestones. We successfully converted raw corn stover to target chemicals with high yield, and separated them with high extraction efficiency. We demonstrated that the crude levulinic acid obtained in the first step could be used directly for biofuel production with excellent yield. These results proved our two-step biorefinery concept.

We successfully conducted a large scale conversion of levulinic acid to fuels and chemicals using a 1-liter reactor at Iowa Energy Center's BECON facility. We demonstrated that biofuel production could be conducted at large scale with excellent yield. We also evaluated the lifetime of the catalyst in continuous flow mode. The catalyst can maintain its activity during a 2-day run.

We collaborated with the ISU CyBIZ group to carry out techno-economic analysis. The results showed that the co-production of high-value furfural and succinic acid could significantly cut down the minimum selling price of biofuel, which could be competitive with petroleum-based fuels. The results also suggest the utilization of low-cost dry animal manure may make the biofuel production even more competitive. The results greatly encouraged us to carry out more research using manure as the feedstock.

We applied for a DOE STTR grant based on the core technology in the RIF phase I project, which is the conversion of cellulosic waste streams to dicarboxylic acids and diols. Even though the proposal was not selected for funding, it was a good practice and we received many constructive comments. We will act on those comments and revise our proposal for future SBIR/STTR applications.

In Phase II, we will continue collaboration with Esstar and Daniel Anderson (ISU Agricultural & Biosystems Engineering) to utilize abundant animal manure in Iowa for the co-production of high-value furfural, succinic acid, and biofuels.

RIF FUNDING: PROGRESS REPORT

Report Type: Interim

Title: No Heat Soldering

PI: Martin Thuo

Company Partners (if applicable, company names only): SAFI-Tech

Project Goal: Scale production of undercooled metal materials and develop application demonstrations for cold soldering and printing conductive lines.

Publications/presentations based on project: None

Invention disclosures: Contributions to ISURF #04335, new disclosure in preparation

External funding applied for (indicate received/denied/pending):

SAFI-Tech PI, Ian Tevis, with Prof. Martin Thuo: NSF SBIR Phase I – funded ($225,000)

SAFI-Tech PI, Ian Tevis, with Prof. Martin Thuo: DoD SBIR Phase I - Denied

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Progress report (300 word maximum, please focus on results in non-technical terms and commercialization progress):

Project Milestones

1. SAFI-Tech has scaled the technology production to 50 g by adopting a commercial heated soup maker to the manufacturing process. The undercooled state is confirmed by ion milling leading to flow of the underlying liquid.

2. The higher temperature solder (SnZn) was sheared into solid microparticles at elevated temperatures. At elevated temperatures, Zn was too reactive to allow formation of a self-limiting protective oxide shell at ambient conditions. Pure indium is being considered as an alternative to SnZn while we explore methods of controlling reactivity of zinc (e.g. by working under Argon). Eutectic BiSn is also being explored.

3. An organic flux with moderate flux activity was used to join two copper sheets together to make a conductive joint. Flux allows pressed undercooled particles to wet and adhere to the surface of the copper.

Business Milestones

1. CyBIZ lab continues to work with SAFI-Tech to identify customers who may purchase our technology, identify potential competitors, and assess possible markets. SAFI-Tech has been admitted to ISU's StartUp Factory program that has a large focus on customer discovery.

2. SAFI-Tech has pivoted from the syringe application system to the direct write and paste application systems with great success.

Deliverables

1. SAFI-Tech has developed a paste/flux and application method for cold soldering copper sheets together using Field's metal. These sheets can be picked up and can support the sheets through the soldered connect.

2. SAFI-Tech has developed paste and direct-write demonstrations.

Despite some challenges in achieving the milestones, significant progress has been made and alternatives sought. We will continue to pursue these deliverables by developing alternative design rules or pathways to generate better interfaces between materials and at reduced cost.

University of Northern Iowa
Annual Economic Development and Technology Transfer Report - 2016

Section 1. UNI's Economic Development Activities to Enhance Economic Growth in Iowa – Highlights and Summary

The University of Northern Iowa (UNI) provided economic development assistance throughout all of Iowa during the past year. Businesses, communities and organizations were served in all 99 Iowa counties for the 17th consecutive year. UNI's economic development outreach programs are housed in the Business and Community Services (BCS) division. Since 2000, BCS has engaged the entire university community in its outreach efforts including faculty, staff, students, and alumni – all of whom play a critical role in *Building a Better Iowa*.

Specific areas of service offered by UNI BCS include: entrepreneurship, community and economic development, market research, environmental research and service, sustainability, advanced manufacturing, metal casting, and new Iowans.

Some exceptional outcomes and recognition in the past year include:

- Served as a leader in growing Iowa's position in additive manufacturing research, development and direct company assistance. UNI's Metal Casting Center (MCC) received one of the first Strategic Infrastructure Grants from the Iowa Economic Development Authority (IEDA) to substantially expand service to small- and medium-sized businesses across the state. Additional 3D sand mold printing services and R&D were added and a new design lab opened in partnership with Hawkeye Community College;

- Recognized by the International Business Innovation Association (InBIA) as the Student Entrepreneurship Program of the Year. InBIA is an international association with 2,100 members from 60 countries that recognized UNI's John Pappajohn Entrepreneurial Center (JPEC) in the inaugural year of the award;

- Awarded the winner of the President's Higher Education Community Service Honor Roll in the category of Economic Empowerment. UNI was recognized for the Institute for Decision Making's (IDM) work and its leadership with grass roots economic and neighborhood development in Northeast Waterloo;

- Served as the host institution for the Green Iowa AmeriCorps project. UNI's Center for Energy and Environmental Education (CEEE) led an effort with volunteers to weatherize 14 homes and conduct 175 educational programs reaching 13,000 people across the state; and

- Surpassed the 3,000 level for the number of military and contract painters certified by UNI's Spray Technique Analysis and Research for Defense (STAR4D) program.

A summary of key economic development/technology transfer program outcomes during the past year is as follows:

Overall

- Provided service in all 99 counties to more than 3,120 unique business, community and local government clients with an additional 22,000 unique visitors to MyEntre.Net/IASourceLink
- Reached more than 410,000 Iowans through BCS programs and projects
- Engaged 271 faculty members and nearly 233 students in the delivery of BCS services and another 2,800 students were reached by BCS programs
- Leveraged each $1 invested by the state with $5 in private grants, fees or federal funding

Entrepreneurship, Business Incubation and Technology Transfer

- Provided job growth assistance to 137 second-stage Iowa companies through Advance Iowa, the state's certified Economic Gardening program
- Entrepreneur participation in IASourceLink online resources, a joint program of UNI and IEDA, increased to 56,000 user sessions
- 14 new companies located in the UNI incubators
- 75 innovators graduated from the Innovation Incubator and the former 4th Street Incubator
- The Business Concierge team provided on-demand business and market information to 1,307 businesses
- 253 new clients served by UNI's Small Business Development Center (SBDC)
- 19 student businesses housed in the JPEC's R.J. McElroy Student Business Incubator and 29 additional student entrepreneurs assisted by the affiliate program
- UNI faculty and staff submitted 10 new intellectual property disclosures
- 2 patents received and 3 new patents filed
- 2 new license agreements approved and a total of 9 license agreements currently generating income
- Formalized an agreement with the Iowa State University Research Foundation to assess and commercialize intellectual property and proceed with a joint patent and licensing project

Waste Reduction, Environmental Assistance and the Bioeconomy

- Buy Fresh, Buy Local participating restaurants and institutional buyers spent $2.5 million on locally grown foods in 2016
- Green Iowa AmeriCorps sites combined to weatherize 114 homes, conducted 175 educational programs with over 13,000 people in attendance, implemented over 325 team projects in the community, and garnered over 7,325 volunteer hours
- Through the Corporation for National and Community Service, CEEE now has an AmeriCorps VISTA Program and began a long term initiative to improve access to good food populations in need in Northeast Iowa
- The Tallgrass Prairie Center (TPC) distributed native prairie seeds to 45 Iowa counties as part of its roadside vegetation project
- The TPC explored the use of prairie that is planted for nutrient reduction as a fuel

- The Iowa Waste Reduction Center (IWRC) launched a Green Iowa Brewery project with 9 small breweries across Iowa
- Environmental technical assistance and on-site reviews provided to 218 small businesses
- GeoTREE developed numerous web mapping/GIS applications that serve Iowa Workforce Development, the Waterloo African American Cultural and History Museum, the Iowa Governor's STEM Advisory Council, and others
- GeoTREE developed a series of story mapping applications in conjunction with the Geographic Alliance of Iowa
- GeoTREE completed a project to model solar radiation potential for all of Iowa
- GeoTREE supported a web GIS application which hundreds of users from every county in Iowa utilize for acquiring raw and derived remote sensing data products
- The Recycling Reuse Technology Transfer Center (RRTTC) provided recycling and reuse project funding and outreach services provided to 20 companies and organizations

Local Economic Development

- IDM and the Center for Business Growth & Innovation (CBGI) continued as a designated Economic Development Administration (EDA) University Center and expanded the regional entrepreneurship project into its fourth region (Southwest Iowa)
- IDM partnered with Strategic Marketing Services (SMS) to assist Iowa's investor-owned utilities and Rural Electric Cooperatives to assess data collected by the Synchronist program
- Community clients reported creating an average of approximately 1,500 jobs as a result of local economic development technical assistance from IDM
- Strategic planning and comprehensive technical assistance provided to 42 community partners and 2 additional regional groups across Iowa
- IDM expanded the market for economic development training to include a six-state region through the Heartland Economic Development Course and experienced record enrollment of 90 in 2016
- The New Iowan's program provided training to hundreds of law enforcement officials across the state and participated in anti-human trafficking activities
- IDM facilitated the first Iowa Tourism Industry Sector Plan to enhance Iowa tourism
- IDM partnered with IEDA and Iowa utilities for an analysis of statewide existing industry survey data

Advanced Manufacturing & Market Research

- UNI's MCC provided custom 3D sand-cast mold printing services to 80 foundries and supply chain companies through its additive manufacturing program, mostly small and medium enterprises
- MCC worked on 50 company R&D projects and provided outreach to 54 additional foundries
- MCC hosted an open house with 200 attendees for a new collaborative design lab with Hawkeye Community College
- MCC conducted Dept of Defense sponsored research with all branches of the military
- Market research and competitive intelligence provided to 18 Iowa companies by SMS
- Painting and coating R&D provided to each branch of the military and 10 Iowa companies

Section 2. Technology Transfer and Intellectual Property

FY 2016

	UNI
Number of disclosures of intellectual property	10
Number of patent applications filed	3
Number of patents awarded	2
Number of license and option agreements executed on institutional intellectual property	2
Number of license and option agreements yielding income	9
Revenue to Iowa companies as a result of licensed technologies	$3,100,000
Number of start-up companies formed, in total and in Iowa	142/142
Number of companies in research parks and incubators	29
Number of new companies in research parks and incubators	14
Number of employees in companies in research parks and incubators	116
Royalties/license fee income	$21,722
Total sponsored funding	$39,100,000
Corporate-sponsored funding for research and economic development and revenue generation (excludes corporate philanthropy - all in Iowa)	$435,000
i. Annual appropriations for economic development ii. Regents Innovation Fund	$1,066,419 $900,000

Section 3. Overview of UNI's Economic Development Programs

UNI outreach services for community and economic development activities are outlined in a table format on the following eight (8) pages. The format provides a brief overview of each program, its purpose, those served, outcomes for the past year, and some aggregate outcomes as well. Together, the programs served 3,120 unique businesses and organizations in the past year and another 22,000 individuals through the MyEntre.Net entrepreneurial development system and IASourceLink.

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Institute for Decision Making (IDM)	Hands-on community and economic development guidance and research	Economic development organizations, chambers, city councils, communities, and others	✓ Developed the first Iowa Tourism Industry Sector Plan to enhance Iowa tourism ✓ Assistance and research provided to 42 community partners and 2 regional development groups ✓ Partnered with the Iowa Economic Development Authority and Iowa utilities for an analysis of statewide existing industry survey data ✓ Assisted 4 regions with developing and implementing regional entrepreneurship plans	✓ Served 774 communities, counties and groups in nearly all of Iowa's counties to date ✓ Community clients report 1,500 – 2,000 new jobs annually as a result of IDM assistance ✓ Trained over 875 economic development professionals
Iowa Waste Reduction Center (IWRC)	Free, confidential, non-regulatory environmental assistance for small businesses	Small businesses throughout Iowa	✓ Environmental technical assistance on-site reviews provided to 188 small businesses including 21 food waste reduction projects and 9 green brewery project visits ✓ Painter training provided to all military branches at UNI and 7 satellite sites	✓ Provided 5,935 on-site reviews to Iowa small businesses ✓ Trained and certified 3,300 military/contractor painters since 2003
Strategic Marketing Services (SMS)	Market research and analysis	Businesses, entrepreneurs and non-profit organizations	✓ Market research and analysis services provided to 18 Iowa companies	✓ Since 1990, market research and analysis services provided to 275 Iowa companies

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
John Pappajohn Entrepreneurial Center (JPEC)	Research, entrepreneurship education, technology transfer, and capital investment programs	Students interested in entrepreneurship, UNI faculty and staff, entrepreneurs, new ventures, and rapidly growing small companies	✓ 1,699 businesses and individuals assisted through all JPEC programs ✓ 19 student business owner running 13 businesses with 72 employees provided space and services in the student business incubator ✓ 29 student business owners provided services as part of the student business affiliate incubator program ✓ 22 entrepreneurs participated in UNI's Venture School ✓ 448 students in the College of Business Administration (CBA) and in the College of Education (COE) provided professional readiness training regarding the personal elevator pitch	✓ Provided 60 students with internships through CIPCO program since FY05 ✓ JPEC Student Business Incubator provided space to more than 78 business owners since FY05 ✓ Consulted with 597 faculty and staff from colleges and universities around the U.S. and the world regarding student business incubation since FY08 ✓ 1,658 CBA students learned about and crafted an elevator pitch through presentations by JPEC instructors since FY13 ✓ 36 businesses and nonprofits completed projects by Entrepreneurial Strategy (MKTG 3586) students since FY11
New Iowans Center	Helping Iowa communities and businesses accommodate the needs of newcomers	Communities, faith-based organizations and businesses	✓ Increased the number of training sessions for law enforcement officials by 20% ✓ Awarded multi-year contract to address disparities in Iowa's child welfare system ✓ Created a colorectal cancer awareness campaign for Asian immigrants	✓ Assistance in accommodating the needs of newcomers provided to more than 250 Iowa companies and organizations ✓ More than 30,000 copies of four different guides/manuals (and untold electronic copies) distributed throughout Iowa

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Center for Business Growth & Innovation/ Small Business Development Center (CBGI/SBDC)	Rural/urban entrepreneurship development, online entrepreneurship resources, business consulting, business training, business incubation	Small and medium sized businesses, entrepreneurs, entrepreneurial service providers, community leaders	✓ 30,635 Iowans served by a CBGI program or online resource in FY16 ✓ IASourceLink visited by over 22,000 unique visitors from Iowa with more than 56,000 total sessions. ✓ The Iowa Business Concierge grew its client base by completing 1,307 business intelligence requests ✓ Dream Big Grow Here attracted 119 contestants online to compete for a total prize pool of $40,000 ✓ The Regional SBDC served 266 clients over the 9 county region ✓ 8 client companies graduated from the Innovation Incubator	✓ IASourceLink reached 86,366 unique users since its launch in 2012 ✓ Engaged more than 450 entrepreneurs in the Dream Big Grow Here grant contest since 2010 ✓ Over 3,000 business intelligence requests completed since 2010 ✓ 75 total companies graduated from CBGI and Innovation Incubators ✓ Webinar views total more than 20,000 live and archived since FY04

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Advance Iowa	Rural/urban consulting program focused on small and medium sized existing businesses providing succession planning, strategic planning, business consulting, training, peer round tables	Small, medium enterprises	✓ 137 companies assisted ✓ 4 seminars on Succession Planning and 6 seminars on Strategic Planning ✓ Business Roundtables started in West Des Moines and Dubuque ✓ Services to clients in 51 counties ✓ Presentation at Iowa Association of Business and Industry (ABI) conference with 82 attendees	✓ Project work with 287 mid-sized companies across the state in all quadrants of the state
Tallgrass Prairie Center (TPC)	Research, techniques, education, and source-identified seed for restoration and preservation of native vegetation	Iowa counties, state and federal agencies, commercial native seed producers, the community, students, educators, restoration ecology discipline, and others	✓ Native seed for county roadsides distributed to 45 counties in Iowa ✓ Published Prairie in Seed book and launched Seed Mix Calculator ✓ Began the Prairie on Farms Program to provide technical assistance for conservation plantings of prairie ✓ Consulted with state DOT leaders nationwide on the use of Integrated Roadside Vegetation Management (IRVM) program for pollinator habitat ✓ Explored the use of prairie that is planted for nutrient reduction as a fuel	✓ More than 40,000 acres of Iowa counties' rights-of-way restored to native vegetation ✓ Increased public knowledge regarding prairie and prairie restoration ✓ Made research information available to restoration ecology community ✓ Over 75 species of certified, source-identified seed available to seed industry

Center for Energy and Environmental Education (CEEE)	Technical assistance, educational programs and leadership in energy conservation and renewable energy, environmental conservation and community-based agriculture	Iowa cities, counties, Iowa schools, teachers, farmers, businesses, elected officials, state agencies, community leaders, citizen organizations	✓ CEEE Helping Students Protect the Environment Teacher PD reached 40 teachers, approximately 1,600 K-12 students, 2,000 community members, and 900 teachers through an e-newsletter ✓ CEEE's AmeriCorps VISTA Program began a long term initiative to improve access to good food to populations in need in Northeast Iowa ✓ Green Iowa AmeriCorps sites combined to weatherize 114 homes, conduct 175 education programs with over 13,000 people in attendance, implemented 325 team projects in the community, and garnered over 7,325 volunteer hours ✓ Iowa School Energy Challenge engaged 20 secondary schools in energy efficiency, provided educational programs for 1,450 students and provided hands on training for 296 students ✓ Buy Fresh Buy Local participating restaurants and institutional buyers in the Black Hawk county area spent $2.5 million on locally grown foods	✓ CEEE's Northern Iowa Food & Farm Partnership facilitated purchases of $21 million worth of locally grown food products from hundreds of area farmers by food vending institutions since 1998 ✓ CEEE's energy education program provided materials and training to 114,554 students and 7,051 teachers since 2009

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Recycling and Reuse Technology Transfer Center (RRTTC)	Recycling and by-products research, education and outreach	Serving Iowa businesses, the recycling industry and Iowa citizens	✓ Research project funding and outreach services related to recycling and reuse provided to 20 companies and organizations	✓ Completed over 42 RRTTC funded research projects and over 170 reports and publications available ✓ Outreach and services provided to more than 3,500 individuals, including business/industry, K-12 students, teachers, and Iowa citizens
Materials Innovation Service (MIS)	Mechanical, physical and chemical tests of metals, polymers and cementitious materials	Serving Iowa manufacturers and suppliers	✓ Technical assistance and testing provided to 5 companies across Iowa	✓ Technical assistance or testing provided to approximately 160 companies with more than 2,000 hours of testing provided since the beginning of the program
Panther Initiative for Environmental Equity and Resilience (PIEER)	Environmental social justice awareness, education, outreach, and research	Serving Iowans, especially those affected by environmental equity issues	✓ Provided outreach awareness and education related to environmental social justice to 10 organizations	✓ Provided outreach and educational awareness to 10 organizations and more than 2,600 individuals, including UNI, the community and governmental organizations

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Metal Casting Center (MCC) and Center for Additive Manufacturing	Metal casting technologies, applied research, testing and training	Iowa casting users, foundries and foundry suppliers	✓ Maintained active contracts with 50 companies, provided outreach projects to 4 Iowa foundries and technical assistance to 50 additional foundries ✓ Conducted DOD-sponsored research into front line manufacturing of cast parts, conducted DOE sponsored research into surface finish improvements in cast parts, worked with the Department of the Navy on Ohio Class submarine castings, and worked on Air Force project in aerospace replacement parts ✓ Sponsored commercialization of Zircon Sand Additive, 2 patents submitted	✓ Completed over 150 industry-funded research projects to date

Programs	Services	Those Typically Served	FY Results listed.	Cumulative Results
Geoinformatics Training, Research, Education and Extension Center (GeoTREE)	Geospatial technologies, education, research, and outreach activities for federal, state, local and tribal agencies	Federal, state, local, and tribal (FSLT) government agencies	✓ Completed a project to model solar radiation potential for all of Iowa ✓ In collaboration with the Iowa Department of Natural Resources, updated 14/55 Iowa watersheds National Hydrography Dataset water body area data ✓ Supported a web GIS application which hundreds of users from every county in Iowa utilize for acquiring raw and derived LiDAR data products ✓ Supported numerous web mapping/ GIS applications that serve outreach purposes including the Iowa Governor's STEM Advisory Council	✓ Delivered greater than 100 terabytes of geospatial data throughout all counties in Iowa ✓ Provided free geospatial software tools downloaded by users throughout Iowa and the world ✓ Developed numerous web mapping and GIS applications used throughout Iowa ✓ Provided more than 20 training and educational workshops for hundreds of federal, state, local, and tribal government staff members ✓ Provision of a solar radiation potential web mapping application for use by citizens, companies and agencies to investigate solar radiation potential anywhere in the state of Iowa (http://www.geotree.uni.edu/web/solar/)

Section 4: Regents Innovation Funding Report

UNI's 2016 Regents Innovation Funding Annual Report (also known as Skilled Worker and Job Creation Fund) was submitted as a separate report in the Board of Regents, State of Iowa format.

Section 5: Collaborative Projects

Each year, UNI works closely with the other Regent institutions and state and federal agencies on collaborative projects. The following projects represent a sampling of these collaborative projects.

Metal Casting Center (MCC) Collaborates with Ames Laboratory, ISU and UI

- The MCC is collaborating with the Iowa Innovation Corporation and Ames Lab at Iowa State University to investigate the characterization of and assistance with the commercialization of spray atomized metal powders for direct metal laser sintering.

- The MCC is collaborating with the University of Iowa, University of Michigan and Caterpillar, Inc. on a project funded by the U.S. Department of Energy.

Institute for Decision Making (IDM) Collaborates with Iowa Economic Development Authority, Iowa Utilities, Travel Federation of Iowa and the Iowa Tourism Industry

- *Analysis of Statewide Existing Industry Survey Data*
  IDM, in partnership SMS, helped the BEST of Iowa Management Team, (Iowa Economic Development Authority, MidAmerican Energy, Black Hills Energy, Alliant Energy and the Iowa Area Development Group) identify and analyze the characteristics of Iowa employers who have mature/declining products and employers facing workforce availability challenges. The analysis was conducted utilizing existing industry survey data collected by economic development organizations across Iowa from May 2014 and May 2015. The findings were used in evaluating and revising the economic development assistance provided to Iowa companies by the state of Iowa, the utilities and economic development organizations around Iowa.

- *Iowa Tourism Industry Sector Plan*
  IDM collaborated with Travel Federation of Iowa, Iowa Economic Development Authority's Iowa Tourism Office, the Iowa Department of Cultural Affairs, Iowa Department of Natural Resources, Iowa tourism marketing regions, and other representatives of the Iowa tourism industry to develop the *Iowa Tourism Industry Sector Plan*. The planning process, facilitated by IDM, involved broad stakeholder input from across Iowa and culminated with the first shared vision and statewide plan designed to maintain and grow Iowa's competitive position as a tourism destination.

Center for Energy and Environmental Education (CEEE) Collaborated on Projects with ISU and UI.

- CEEE collaborated with the Iowa Commission on Volunteer Service to host a significant AmeriCorps Program with 35 service members serving many Iowa communities by offering comprehensive energy services to people in need.

- CEEE and ISU Extension worked closely together on local food initiatives in Region 9 Extension, which includes Black Hawk and surrounding counties. UNI and ISU Extension jointly funded a local food coordinator to expand local markets for local agricultural products among institutional buyers, and make locally grown foods visible to the residents of the region.

- CEEE worked with the University of Iowa's Center for Global and Regional Environmental Research (CGRER) in developing a climate statement signed by many scientists across Iowa. CEEE also participates in the annual Climate Educator's Forum organized by CGRER.

Center for Business Growth and Innovation (CBGI) Partnerships Key to Success

- IASourceLink: The CBGI and IEDA IASourceLink partnership continues to deliver one of the most content rich and highly utilized SourceLink models in the nation to Iowa business owners. Efforts to collaborate continue with other state and national resource partners that assist in this program. Co-contributors include ISED Ventures, Women's Business Center, Iowa Department of Revenue, Iowa Commission on the Status of Women, Iowa Innovation Corporation, Technology Association of Iowa, John Pappajohn Entrepreneurial Center, Connect Iowa, Iowa Waste Reduction Center, SourceLink, U.S. Small Business Administration, Iowa Small Business Development Centers, Iowa Farm Bureau/Renew Rural Iowa, Iowa Area Development Group, Iowa Association of Business and Industry, BizStarts, and more. In FY 2015, 22,454 visitors sought information and business assistance with 1,307 direct interactions with Iowa business owners via the Iowa Business Concierge services. Additionally, 18 UNI MyEntre.Net powered webinars available on IASourceLink attracted 2,053 attendees – an average of 114 business owner attendees per online presentation.

- Dream Big Grow Here: CBGI, the Iowa Bankers Association, VentureNet Iowa, Renew Rural Iowa, the Iowa Economic Development Authority, Veridian Credit Union, and Advance Iowa partnered to conduct the fourth annual Dream Big Grow Here contest. This contest generated close to one million visitors and tens of thousands of online votes and comments supporting Iowa small business owners. The contests represented all Iowa counties. The 119 contestants competed for $40,000 in awarded prize money.

UNI Programs Partner with the University of Iowa and North Iowa Area Community College (NIACC) to Deliver Venture School

- CBGI and JPEC partnered with the University of Iowa's John Pappajohn Center and the NIACC John Pappajohn Center to deliver an eight-week session of Venture School on the UNI campus. 8 companies consisting of 22 participants used the lean launch approach to engage in customer discovery and prepare a business canvas model.

Advance Iowa

- The UNI Advance Iowa program partnered with West Des Moines Economic Development and Historic Valley Junction to offer a series of workshops geared toward existing business owners. The focus was on financial analysis, strategic planning and market research.

- The UNI Advance Iowa program partnered with the Greater Dubuque Development Corp. to offer a monthly Peer Round Table and provide project services and consulting support to 10 small-medium business clients.

John Pappajohn Entrepreneurial Center (JPEC) Collaborations

Meskwaki Settlement School Entrepreneurship Class

- JPEC partnered with COE to provide a half-day class focusing on innovation, creativity and entrepreneurship principles for the 21 students and 13 teachers from the Meskwaki Settlement School.

Lemonade Camp

- UNI's John Pappajohn Entrepreneurial Center partnered with Cedar Falls Main Street to offer the week-long Lemonade Stand camp for third through sixth graders. The camp teaches the students the basics of running a business as well as the importance of philanthropy and giving back. The 17 students raised nearly $1,000 for local charities in two hours of selling lemonade on a Saturday morning in June.

GeoTREE Center Partnered with IEDA, Iowa Department of Natural Resources, and Iowa Department of Agriculture and Land Stewardship

- In collaboration with the IEDA Energy Office, the GeoTREE Center developed a solar radiation potential database and web mapping portal for the state of Iowa. The results of this project provided all interested stakeholders (e.g., private homeowners, business owners, cities, solar photovoltaic installation companies, agencies, etc.) with the ability to investigate solar radiation potential for every location in Iowa - http://www.geotree.uni.edu/web/solar/.

- In collaboration with the Iowa Department of Natural Resources, the GeoTREE Center is updating the Iowa contribution for the National Hydrography Dataset. Eight UNI Geography students are updating the database and have completed six watersheds. They are presently working on eight more watersheds and will eventually complete all 55 watersheds in Iowa.

- The GeoTREE Center is collaborating with multiple organizations across the state (e.g., Polk County Soil and Water Conservation District, the East Central Iowa Council of Governments, City of Waterloo) to develop geographic databases and to model urban stormwater and pollutant runoff. The GeoTREE Center is developing six prototype watershed databases and carrying out modeling urban stormwater runoff in those watersheds. These activities will help characterize geographically runoff/pollutant patterns.

Iowa Waste Reduction Center (IWRC) Collaborated with State and National Partners

- IWRC partnered with the Iowa Department of Natural Resource's Land Quality Bureau to reduce food waste directed toward Iowa landfills. This collaboration entailed promoting the IWRC's Food Waste Reduction Web portal, completing joint presentations and providing technical on-site visits to food waste generators.

- IWRC collaborated with the Iowa Department of Natural Resources and the federal Environmental Protection Agency through the Strategic Goals Program. This project involved all three organizations working together to plan and implement two workshops per year that provide pollution prevention and environmental assistance to Iowa businesses.

Strategic Marketing Services (SMS) Partnered with Iowa Organizations

- SMS conducted primary and secondary research performed for IWRC. Exploring what degrees of commonality and distinction exist between the STAR4D program and potential U.S.-based competitors, SMS concluded that STAR4D offers a comprehensive set of research, development and training offerings that is, in fact, unique among U.S. companies and organizations.

- SMS assisted Northeast Iowa Community College (NICC) with evaluation of environmental scans performed by other U.S. community colleges, analyzed previous scans performed by NICC, gathered information from NICC's 2016 environmental scan committee, and generated a white paper that presented observations and recommendations for an appropriate scope and structure for this year's upcoming scan.

RRTTC/Panther Initiative for Environmental Equity and Resilience (PIEER) Collaborated with Many Cedar Valley Organizations

- RRTTC/PIEER collaborated with Tri-County Head Start, Operation Threshold, Birthright, and Young Parents Together to deliver lead education and awareness to their staff, volunteers, clients, and parents of unborn and young children. Oral presentations as well as written materials were given.

- RRTTC/PIEER partnered with Blue Zones, Healthy Cedar Valley Coalition and North Iowa Farm Partnership to organize the Cedar Valley Food and Film Festival. Local food producers and supporters were available to showcase their products and services to kick off the farmer's market season. Four films were also shown followed by a discussion that included upcoming technology, healthy food choices, water quality, and food waste.

Tallgrass Prairie Center (TPC)

- TPC works with dozens of partners at the state and federal level, including the Integrated Roadside Vegetation Management program, the Iowa Dept of Transportation, Federal Highway Administration, Prairie on Farms Project, US Dept of Agriculture-National Resource Conservation Service, Iowa Nutrient Research Center, Leopold Center for Sustainable Agriculture, and ISU STRIPS project. Collaboration included a large team with Iowa State University and the University of Iowa in the Iowa Watershed Approach project, led by the Iowa Flood Center (US Housing and Urban Development grant).

Section 6. Suggestions for New or Expanded Programs to Enhance UNI's Impact on Iowa

UNI proposes a combination of new and expanded initiatives to support entrepreneurs and small businesses. Our primary focus is to enhance existing programs that have proven effective in building vitality for Iowa's economy. Entrepreneurs and small businesses will receive direct assistance in all regions of Iowa while BCS builds on the momentum of Iowa being recognized as a supportive place to start and grow a business. A brief description of the key initiatives is outlined below.

1) Advance Iowa (AI) – The Battelle Memorial Institute has outlined economic development strategies for Iowa and specifically recommended expanding AI as a strategic priority in the recently released "Economic Development Roadmap for Iowa." UNI's AI program is endorsed by IEDA as Iowa's Economic Gardening hub. Second stage companies are defined as having 10-99 employees and at least $1 million in sales and are responsible for a significant number of newly created jobs, positively impacting our local and state economy. With assistance from AI, Iowa's second stage companies can begin to enter the growth curve and to develop and expand into national and global markets. UNI's AI program has experienced success in delivering strategic assistance and support to more than 130 second stage Iowa companies in the past year. Additional funding is required to expand the service delivery channel by modestly increasing the staffing capacity through designated regional

representatives and supporting entrepreneur roundtables. These expanded efforts will target companies within the state that have the greatest potential for job growth.

2) Additive Manufacturing – Supporting the foundry industry has long been a unique service of the UNI Metal Casting Center. The installation of a large-format 3D sand mold printer, direct metal printer, and plastic printers has placed UNI in a unique position to help more than 100 companies adopt new technologies. However, small- and medium-sized foundries and pattern shops in Iowa need technical assistance prior to effectively using 3D printing technologies. CAD designs and virtual reality modeling are needed for these companies to effectively integrate 3D printing into their operations. The UNI Metal Casting Center has partnered with Hawkeye Community College to develop a design lab to serve basic industry design needs for 3D printing. With additional investment, the design lab can expand services to provide industry-wide employee training in advanced design techniques and software utilization. Both company employees and students will receive tailored training to become effective designers and substantially enhance the Iowa workforce. Design services can also be offered remotely to community colleges across Iowa. This expansion of services and partnerships is yet another step toward the UNI Metal Casting Center becoming the premier additive manufacturing center in the United States.