

OFFICE OF THE
VICE PRESIDENT FOR RESEARCH

UNIVERSITY OF ILLINOIS
URBANA-CHAMPAIGN • CHICAGO • SPRINGFIELD

ELEVATE.

VOLUME 3



ELEVATING IDEAS.



The University of Illinois is the state's most prominent and prestigious public university and a global leader of discovery and innovation. Our three campuses in **Urbana-Champaign**, **Chicago**, and **Springfield** have unique strengths and assets, and collectively, the University of Illinois is recognized for research and academic strengths across all disciplines.

The **Office of the Vice President for Research** (OVPR) advances the economic development mission of the University of Illinois by supporting research and innovation activities that elevate ideas into sustainable businesses and global solutions.

Our economic development framework includes a set of activities, initiatives, and priorities that support research through innovation and creativity, development of human capital and talent retention, and engagement with private and public partners to elevate the impact of the University of Illinois.

OVPR oversees an innovation pipeline and ecosystem that bring together research activities, technology commercialization, entrepreneurial education, and infrastructure to effectively move ideas and innovation from the laboratory into the hands of everyday users.



DR. LAWRENCE B. SCHOOK

VICE PRESIDENT FOR RESEARCH

EDWARD WILLIAM & JANE MARR GUTGSELL PROFESSOR

LARRY SCHOOK PROFILE

- Argonne National Laboratory Board Member
- Chicago Metro Metals Consortium Research & Innovation Subcommittee Co-chair
- Illinois Manufacturing Laboratory Executive Committee Co-chair
- Illinois Technology Association Internet of Things Council Member
- Joint Center for Energy Storage Research (JCESR) Governance Board Member
- National Academy of Sciences Institute for Laboratory Animal Science Roundtable
- UI LABS Founding Board Member

THIS IS AN EXCITING TIME for the people of Illinois. As we welcome Dr. Timothy Killeen as President of the University and Bruce Rauner as Governor, we recognize the opportunity to shape the future of our great state.

In a time of fiscal uncertainty, we are prioritizing programs and initiatives that will have the most impact. As we plan ahead—not only for the upcoming year, but for the future of the state and the University—we are focused on promoting technology and innovation and elevating economic growth. The University of Illinois is leading economic engagement activities across the state, supporting the development of new technologies that lead to the creation of startup companies and new jobs, developing a highly skilled workforce that competes globally, and enhancing the competitiveness of Illinois companies through public-private partnerships.

As one of the primary sources of new technologies, universities play an increasingly crucial role in the process of technological innovation. The University of Illinois is in a unique position to support the creation of new companies by attracting top talent to the state, which ultimately contributes to state and national economic, social, and cultural development.

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Higher education is essential to the state's economic vitality. By partnering with the state and local communities to develop a shared vision for growth, we can drive innovation, economic prosperity, and competitiveness for the state of Illinois.

— DR. LAWRENCE B. SCHOOK

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The University's innovation pipeline brings together research activities, technology commercialization, entrepreneurial education, and infrastructure to move ideas from the laboratory to the marketplace. Thanks to the exceptional work of our campus units that execute the functions of the pipeline, our cutting-edge research creates solutions to global challenges and changes the way people think, work, and live.

As the state's only land-grant university, the University of Illinois has a historical obligation to serve the people of Illinois through its teaching, research, public service, and economic development missions. Research is at the core of the University of Illinois' undergraduate and graduate education, corporate engagement and partnerships, and technology-based economic development.

Our future prosperity and competitiveness will be driven by our ability to align shared visions for growth and leverage our world-class assets. The University of Illinois will continue to partner with the state to identify priorities and build a statewide innovation network that enhances industrial strengths, regional resources, and unique capabilities.

Vice President Larry Schook and U of I Board of Trustees Chairman Ed McMillan at the OTM Share the Vision technology showcase.



UNIVERSITY OF ILLINOIS RESEARCH

As one of the greatest research institutions in the world, the University of Illinois educates the best and brightest researchers, scientists, and entrepreneurs. U of I faculty, students, and alumni have invented countless life-changing technologies, such as home air conditioning systems, sound-on-film movie technology, and numerous cancer drugs.

12,000+



There are **MORE THAN 12,000 RESEARCH EMPLOYEES** (faculty and staff) across all three campuses. This means that 40% of the total number of U of I employees' salaries are funded by external research grants.

\$214M

Nearly **\$214 MILLION IN SALARIES** is paid to the researchers and administrative staff whose jobs are funded by research projects. These employees stimulate the economies of Urbana-Champaign, Chicago, and Springfield and the entire state of Illinois as they pay taxes and spend money on goods and services in their communities.

\$385M

RESEARCH PROJECTS AT THE U OF I GENERATE MORE THAN \$385 MILLION in additional expenditures from the purchase of goods (e.g. laboratory supplies) and services used to facilitate research. Much of this money stays in the state through procurement from Illinois vendors.

11



NEW COMPANIES IN FY2014

Faculty and staff conduct scientific research and develop new technologies, often resulting in **SPINOFF COMPANIES THAT CREATE HIGH-TECH JOBS**, and each new job generates additional tax revenues and money being pumped back into the economy. In addition, the University earns royalties on these technologies, funneling more resources back into the innovation pipeline.

The American research university is the greatest renewable resource of innovation. From Nobel Prize winners to undergraduate students, all members of the U of I research community are engaged in creating new knowledge that solves the world's most pressing challenges.

The breadth of expertise across our academic programs and facilities and our emphasis on cross-disciplinary collaboration has resulted in new opportunities in agriculture, biomedical research, engineering, health sciences, and so many other areas. Our researchers push the boundaries of traditional research to find new ways that innovation and discovery can be transformed to make a global impact.

The University's robust research enterprise has a tremendous impact on local and state economies and is a significant contributor to economic growth across the state of Illinois. In fiscal year 2014, the University of Illinois received more than \$914 million in research funding from federal, state, and private sources. In addition to supporting laboratory research, this money stimulates the economy through its research operations and the creation of technology startup companies.

APPLIED RESEARCH INSTITUTE

The Applied Research Institute (ARI)—a joint initiative between the Urbana College of Engineering and Vice Chancellor for Research—translates science into applied research for government and commercial customers. The ARI provides the University with a formalized mechanism for collaborating on open, proprietary, or classified projects in specialized research in areas such as advanced materials and manufacturing, data science, modeling and simulation, and cybersecurity.

ARI is collaborating with all three University of Illinois campuses, organizations across the state, and federal partners. A five-year agreement with Sandia National Laboratories was recently established to advance collaboration and information sharing. The partnership is aligned around the goals of solving the nation's biggest problems, sustaining and engaging human capital, and accelerating the adoption of new technologies.

The ARI has space in the Special Research Facility, an environment where University faculty, staff, and others can conduct research and other sponsored activities which involve the use of U.S. government restricted information and technologies.



MANUFACTURING



WORKFORCE



RESEARCH



COMMUNITY

INNOVATION & IMPACT

INNOVATION

Many of the world's greatest inventions and technological discoveries originated at the University of Illinois. A few of U of I's revolutionary innovations include:

A LEGACY OF INNOVATION

- Accessibility firsts, including curb cuts in streets and sidewalks, buses with wheelchair lifts, and wheelchair athletics
- “Illini Supersweet” sweetcorn
- NCSA Mosaic™
- Plasma display panel
- PLATO, the nation’s first computer-based program of instruction

EMERGING DISCOVERIES

- Cancer therapeutics
- Digital humanities providing library access to developing nations and rural communities
- Military infrared night vision technology
- PREZISTA® (HIV drug)
- Wearable electronics

ILLINOIS MANUFACTURING LABORATORY

The Illinois Manufacturing Laboratory (IML)—a partnership between the University of Illinois and UI LABS—delivers advanced manufacturing solutions to Illinois companies while providing a collaborative platform for launching economic revitalization strategies across the state.

Initially conceived by the University, IML was built on the idea that small- and mid-sized manufacturers in Illinois would benefit by accessing advanced technology, resources, and expertise not readily available to them. With support from the Illinois Department of Commerce & Economic Opportunity (DCEO), IML partnered with 8 Illinois-based manufacturing companies on a series of pilot projects which will help define future IML activities.

IMPACT

The University of Illinois positively impacts the entire state of Illinois:

- Main campuses in Urbana-Champaign, Chicago, and Springfield
- Regional health sciences campuses in Rockford and Peoria
- Extension services in every county
- Medical facilities and services (including U of I Hospital, U of I Cancer Center, and community clinics in Chicago)
- 78,500 students
- 700 public service and outreach programs
- \$914M+ in federal, state, and private research funding
- 678,000 living alumni (378,000 in Illinois)
- 465,000 annual patient visits at U of I hospital and clinics

ECONOMIC DEVELOPMENT

The University's approach to innovation and economic prosperity is strongly rooted in scientific research, discovery, and creating impact. We define the University's innovation ecosystem through the following **FIVE PILLARS:**

- Federally funded basic research
- Public-private partnerships
- Technology transfer support
- Infrastructure (facilities, funding, information)
- Entrepreneurial education and programming



INNOVATION & ECONOMIC DEVELOPMENT AT U OF I

The Office of the Vice President for Research serves as the University of Illinois' leading voice for economic development. We develop strategies that leverage the University's research enterprise to support the University's innovation pipeline, promote economic growth for the state, and elevate the profile of U of I research and innovation on a local and national scale.

The U of I successfully brings new technologies to the marketplace, serving as a powerful economic development engine for the state. OVPR connects the dots among stakeholders to strengthen collaboration and maximize impact.



JOEY MAK
Director of Innovation
& Economic Development
Office of the Vice President
for Research

ENGAGING INNOVATION CLUSTERS ACROSS THE STATE

The University is committed to partnering with government, industry, other academic institutions, and community organizations throughout the state to promote regional economic development. By enhancing these partnerships, working together to identify local challenges and opportunities, and leveraging University of Illinois and regional strengths, we can support job growth and other economic development priorities.

The U of I has led discussions around job creation and workforce development with community stakeholders across the state, including in Rockford, Peoria, the Quad Cities, and Southern Illinois, among others.



TALENT RETENTION

The University of Illinois attracts the best and brightest students from all corners of the globe seeking to advance their education. By aligning the University's research priorities with the needs of industry and local communities and allocating resources to compel recent graduates to stay in the Midwest, we can grow the regional economy and stem the outflow of talent leaving our borders. As the state's only land-grant institution, the University of Illinois has an obligation, enshrined in our motto of "Learning and Labor," to serve the state of Illinois by developing a workforce pipeline for the next generation of companies and jobs.

THINKCHICAGO

A partnership between the University of Illinois, the City of Chicago, World Business Chicago, Chicago Ideas Week, and 1871, **ThinkChicago** is aimed at attracting young, talented leaders to Chicago and the Midwest to showcase the professional and social opportunities that exist.



Urbana College of Engineering Dean Andreas Cangellaris (far left) and accomplished entrepreneur Urbana alumnus Shahid Khan (far right) congratulate Kelly Samara on receiving the EY Innovation Scholarship at ThinkChicago: Chicago Ideas Week.

CAMPUS 1871

Campus 1871 is a cross-campus event where students from the U of I's Chicago and Urbana campuses, University of Chicago, Northwestern, Illinois Institute of Technology, and Loyola University Chicago come together to create their own startups over the course of a weekend. U of I staff and alumni also participated by providing guidance to startup teams and judging the final competition.



1871 provides a physical space where members of Chicago's entrepreneurial and digital tech community unite. The U of I has a dedicated conference room that can be reserved by students, faculty, and staff.

DRIVING COMPETITIVENESS

By leveraging the strengths of our partners, the University of Illinois is uniquely positioned to identify challenges, co-create solutions, and increase the competitiveness and prosperity of the state and nation.

NATIONAL ENGINEERING FORUM



Left to Right: Illinois Institute of Technology College of Engineering Dean Natacha DePaola, U of I at Urbana College of Engineering Dean Andreas Cangellaris, City of Chicago Deputy Mayor Steve Koch, Lockheed Martin VP of Engineering Jeff Wilcox, Former U of I President Robert Easter, Council on Competitiveness President & CEO Deborah Wince-Smith, University of Chicago Booth School of Business Dean Sunil Kumar, and U of I at Chicago College of Engineering Dean Peter Nelson

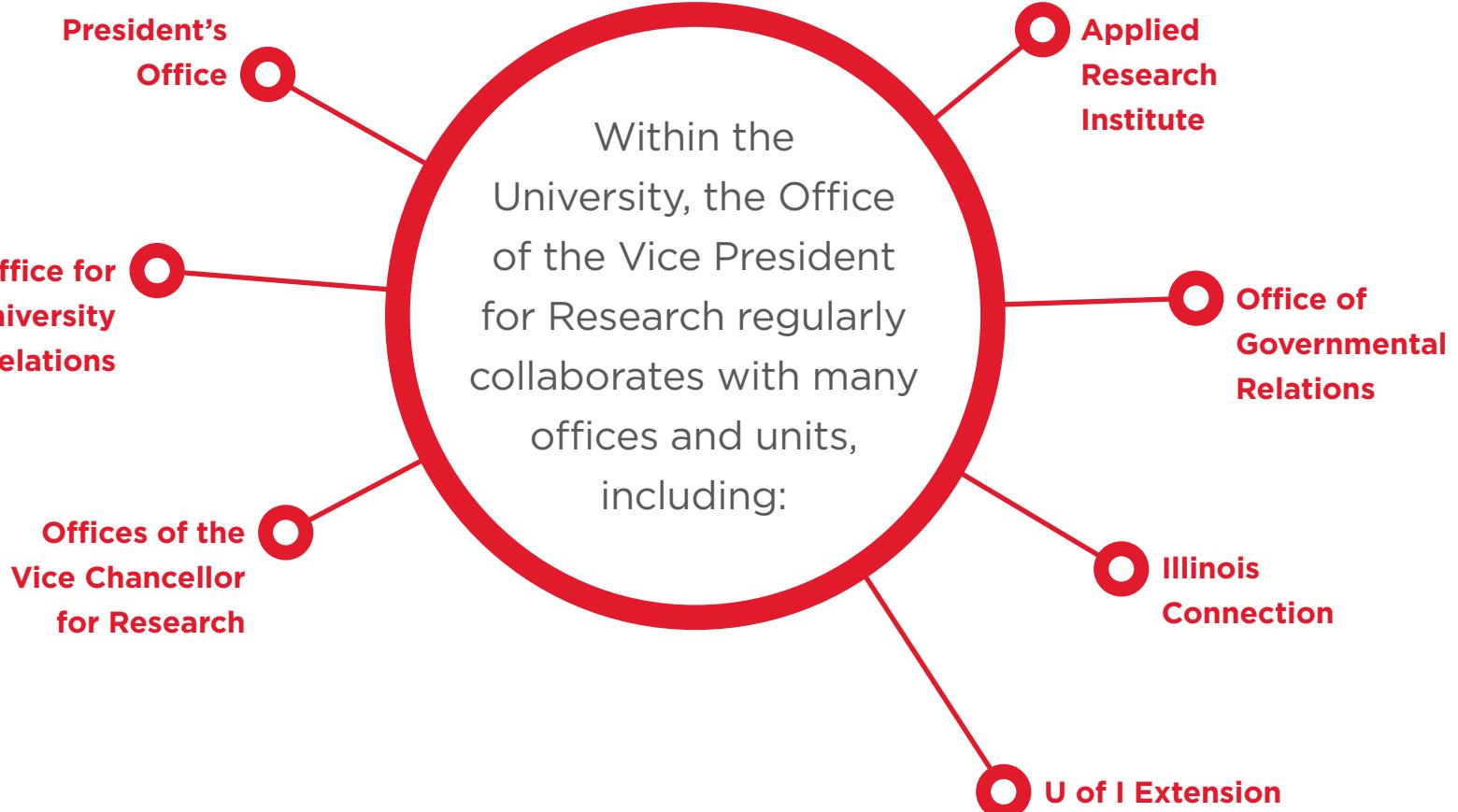
ABOUT NEF

Founded by Lockheed Martin in collaboration with the Council on Competitiveness, NEF brings together leaders concerned about the sustainability of the United States engineering enterprise and the impact on the nation's security and prosperity.

Former U of I President Robert Easter and Urbana College of Engineering Dean Andreas Cangellaris delivered remarks. Participants included Board Chairman Ed McMillan, Vice President for Research Larry Schook, Vice President for Academic Affairs Christophe Pierre, Chicago College of Engineering Dean Peter Nelson, and other faculty and staff from the Urbana and Chicago campuses.

In his keynote address, Chicago Deputy Mayor Steve Koch spoke about Chicago being a great place to live and build a career while highlighting several of Chicago's engineering achievements and strengths. Participants from a variety of industries, academic institutions, and government organizations brought a wealth of knowledge and expertise to a roundtable discussion, identifying engineering challenges that are specific to the Chicago region and opportunities to overcome these challenges.

COLLABORATION AS A CATALYST



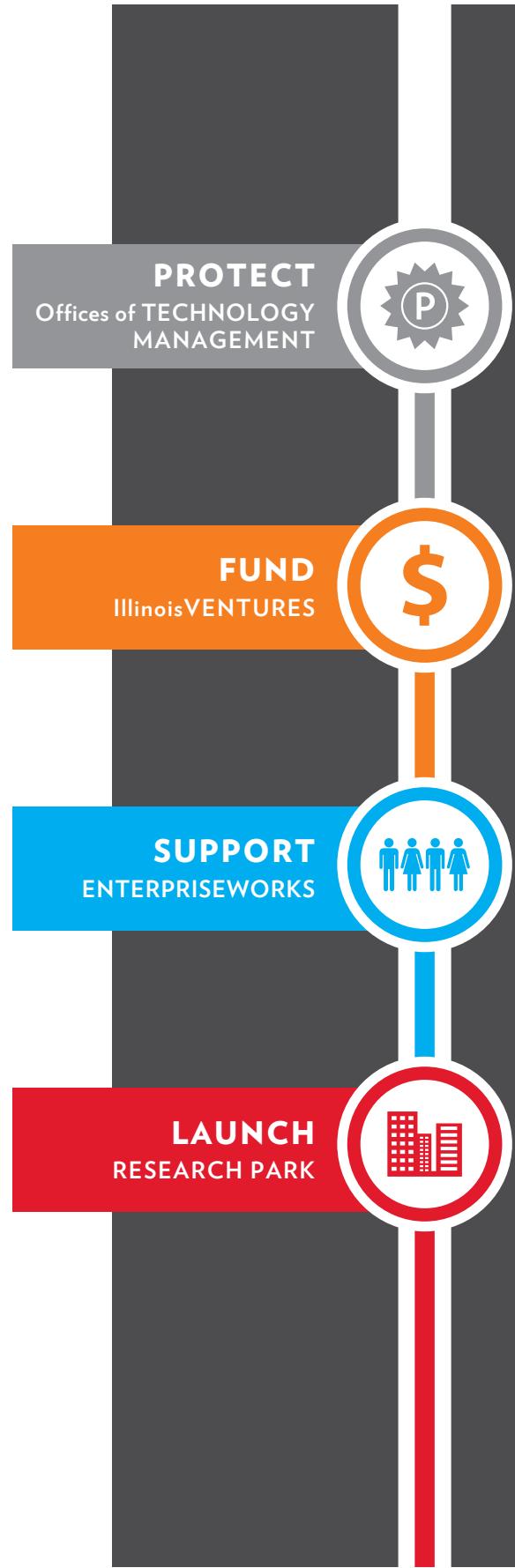
INNOVATION & ECONOMIC PROSPERITY UNIVERSITY

The Association of Public and Land-grant Universities (APLU) designated the University of Illinois an "Innovation and Economic Prosperity (IEP) University." This designation recognizes institutions that work to advance the economic well-being of their states, regions, and the nation through a variety of exemplary, innovative, and sustainable efforts.

CHICAGO METRO METALS CONSORTIUM LEADER

The U of I worked with more than 60 stakeholders in the Chicago Metro Metals Consortium (CMMC)—an organization that supports and strengthens the region's metal manufacturing cluster—to secure an "Investing in Manufacturing Communities Partnership" (IMCP) designation from the U.S. Department of Commerce. The IMCP program revolutionizes the way federal agencies leverage economic development funds. Vice President Schook chairs the CMMC's Research & Innovation Subcommittee.

OVPR UNITS



OVPR drives innovation and economic development by channeling research through a commercialization pipeline that **PROTECTS, FUNDS, SUPPORTS,** and **LAUNCHES** ideas into businesses and global solutions. The Offices of Technology Management (OTM), IllinoisVENTURES, EnterpriseWorks, EnterpriseWorks Chicago, and the Research Park combine to form a unique model that drives technology transfer, company formation, and supports economic development.

The technologies that are developed and commercialized at the University of Illinois lead to licenses with global and regional companies, the launch of startup companies that develop new products and services to improve lives, create high-tech jobs, generate tax revenues for the state and local community, and earn royalty revenue for the University.

UNIT DIRECTORS

The success of the University's technology transfer and entrepreneurial efforts is propelled by the leaders who direct the functions of the innovation pipeline. The Offices of Technology Management, IllinoisVENTURES, EnterpriseWorks, EnterpriseWorks Chicago, and the Research Park are guided by experts in their field who are active in the following organizations:

- Association of University Technology Managers
- Certified Licensing Professionals
- Chicago Innovation Mentors
- Illinois Medical District
- Illinois Science & Technology Coalition
- Illinois Technology Association
- Innovate Illinois Advisory Council
- Licensing Executives Society
- MATTER (health technology incubator in Chicago)
- State Science & Technology Institute

WADE GREEN
INTERIM DIRECTOR
Office of Technology Management-Chicago



LESLEY MILLAR-NICHOLSON
DIRECTOR
Office of Technology Management-Urbana



NANCY SULLIVAN
CEO & Managing Director
IllinoisVENTURES

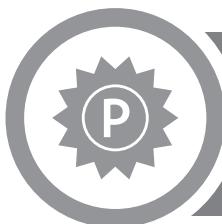


LAURA FRERICHS
DIRECTOR
EnterpriseWorks
University of Illinois
Research Park



KAPILA VIGES
DIRECTOR
EnterpriseWorks Chicago





PROTECT

The Offices of Technology Management (OTMs) on the Urbana and Chicago campuses evaluate, protect, market, and license the University's intellectual property.

The OTMs play a critical role in helping faculty and students elevate their ideas into tangible products and services. Working closely with the other units in the OVPR pipeline and across campus, the OTMs promote a team-based approach to technology transfer, innovation, and economic development. OTM staff members are consulted during the early stages of partnership development to negotiate intellectual property terms. A noteworthy example of a successful partnership with a technology commercialization component includes the \$50 million Abbott Center for Nutrition Learning and Memory on the Urbana campus.

FY2014 data

348 INVENTION DISCLOSURES

363 U.S. PATENTS FILED

111 U.S. PATENTS ISSUED

11 NEW STARTUP COMPANIES

\$30.66 MILLION EARNED IN ROYALTIES

TOP 3
ROYALTY GENERATING TECHNOLOGIES (Chicago):

PREZISTA®
(HIV-AIDS treatment drug)

TICE BCG
(bladder cancer treatment and prevention drug)

INTENSIFIED ALGEBRA
(mathematical program for at-risk high school students)

TOP 3
ROYALTY GENERATING TECHNOLOGIES (Urbana):

NATIVE OXIDE
(semiconductor technology)

MARKETMAKER
(interactive food industry database)

SOYBEAN GERMPLASM
(collection of soybean germplasm having a wide range of agronomic traits)

FUND

IllinoisVENTURES is a startup and early-stage technology investment firm focused on research-driven companies. As a public-private partnership, IllinoisVENTURES helps elevate ideas by providing seed funding to startup companies.

The University has leveraged IllinoisVENTURES' success in attracting additional outside financing for early stage companies to support technology commercialization on the campuses. The OTMs rely on input from IllinoisVENTURES staff to bring technology into practical use for public benefit as quickly and effectively as possible. Additionally, IllinoisVENTURES provides mentoring and seed funding to startup companies in EnterpriseWorks, EnterpriseWorks Chicago, and the Research Park, thereby contributing to the thriving innovative community at the University.

INVESTMENTS
IN **75** COMPANIES

\$65M UNDER MANAGEMENT SINCE INCEPTION

\$47.5M INVESTED IN TECHNOLOGY STARTUP COMPANIES

\$1.5M+ POC FUNDING AWARDED TO 22 UIC RESEARCHERS

#1
IN GAP FUNDING FOR THIRD-PARTY CAPITAL ATTRACTION
—INNOVOSOURCE

\$600M IN THIRD PARTY CAPITAL RAISED BY IllinoisVENTURES-BACKED COMPANIES

PROOF-OF-CONCEPT FUNDING

Researchers often have viable technologies that require additional development before being commercialized. PROOF-OF-CONCEPT (POC) FUNDING is a bridge in the funding gap between basic scientific research and its entry into the marketplace as a sustainable technology.

The IllinoisVENTURES Regional Proof-of-Concept program launched in Fall 2014 with a network of Illinois institutions, including the University's Urbana and Chicago campuses. This program is supported by the Illinois Department of Commerce & Economic Opportunity and the Illinois Science & Technology Coalition.

CHICAGO: The IllinoisVENTURES-managed Chancellor's Innovation Fund (CIF) is a hybrid proof-of-concept program and equity investment fund. More than \$1 million in CIF proof-of-concept funding has been awarded to UIC researchers.

URBANA: The Illinois Proof-of-Concept (IPOC) program provides funding to researchers to help demonstrate an innovation's market viability to potential investors and partners.

POC Success Story: \$45M for REVOLUTION Medicines

Proof-of-concept programs on the Urbana campus have aided in the formation of 9 startup companies, including REVOLUTION Medicines, a biotech startup company that is based on the research of Professor Martin Burke and launched in early 2015 with \$45 million in funding from Third Rock Ventures.



SHARE THE VISION: SAN FRANCISCO

The Urbana OTM hosted the annual Share the Vision technology showcase in San Francisco. Held in partnership with the annual Silicon Valley Roundtable Dinner organized by the U of I Foundation and the Illini Center West, six faculty entrepreneurs from the Urbana campus presented their research to an audience of corporate and venture capital representatives and University alumni. Chancellor Phyllis Wise opened the event and College of Engineering Dean Andreas Cangellaris moderated. Speakers included Rashid Bashir, Martin Burke, Carl Gunter, William P. King, John Rogers, and Andrew Singer.



SUPPORT

EnterpriseWorks and EnterpriseWorks Chicago are business incubators for early-stage technology firms, most of which originate at the University of Illinois. Both incubators offer entrepreneurial programming and support services that help tenants create and maintain sustainable businesses.

The flagship program of EnterpriseWorks Chicago is its **Health, Technology, Innovation** (HTI) initiative. Anchored in the Chicago Technology Park on the UIC campus, HTI is a collaboration space where scientists, engineers, investors, and industry experts validate technology, create new products, and accelerate new ventures.

FY2014 data

110+
COMPANIES
GRADUATED



240+
SBIR/STTR GRANTS
AWARDED

85+
STARTUPS

\$822M+
VENTURE CAPITAL/
ANGEL FUNDING
RAISED

TOP 3
COLLEGE TOWN
INCUBATOR
—INC. MAGAZINE

TOP 12
BUSINESS INCUBATOR
CHANGING THE WORLD
—FORBES

ENTREPRENEURS-IN-RESIDENCE

(EIRs) are seasoned entrepreneurs who provide guidance and consulting services in a variety of business areas to new entrepreneurs and startup companies.

On the Chicago campus, EIRs provide expertise and leadership through the Proof-of-Concept Accelerator, a program that combines hands-on consulting experience for students while defining the most viable commercial pathways for early stage technologies.



On the Urbana campus, EIRs provide business consulting to University of Illinois Research Park clients and faculty, staff, and student entrepreneurs. In 2014, EIRs consulted 280 distinct companies/individuals for a total of 483 consultations.

I-START

The University of Illinois and Illinois Department of Commerce & Economic Opportunity (DCEO) established the I-Start Entrepreneur Assistance Program (I-Start) to advance innovation, stimulate company formation, and retain talent in Illinois. I-Start offers U of I researchers a suite of professional services, including business development, legal setup, SBIR application assistance, bookkeeping, and marketing assistance.

Due to the success on the Urbana campus, this program has been replicated on the Chicago campus through EnterpriseWorks Chicago. More than 50 clients across both campuses have received funding.



LAUNCH

Located on the Urbana campus, the Research Park is a technology hub for corporate research and development operations and startup companies.

A visible result of the incorporation of economic development and innovation into its core mission, the Research Park has sprouted a vibrant, multidisciplinary community that produces highly influential technological advances, builds a talent pipeline for high-tech corporations, and provides experiential learning opportunities for students. The Research Park significantly impacts the community by incubating new startups, attracting large corporations, creating jobs, and contributing millions of dollars in tax revenue to the state and local community.

FY2014 data

90+
COMPANIES
CURRENTLY IN THE
RESEARCH PARK

\$103M
ESTIMATED ANNUAL
PAYROLL

+1,500
EMPLOYEES, INCLUDING
400+
STUDENT WORKERS

300+
COMPANIES IN THE
RESEARCH PARK OVER
THE LAST 12 YEARS

**CURRENT
TENANTS**
INCLUDE
FORTUNE 500
COMPANIES:

AB InBev, ABBOTT, ABBVIE,
ADM, AMEREN, CATERPILLAR,
DOW CHEMICAL, GRAINGER,
JOHN DEERE, RAYTHEON,
STATE FARM, & YAHOO

Vice President School delivers remarks at the Ameren Innovation Center Grand Opening



Bottom: Caterpillar celebrated the 15th anniversary of its U of I Simulation Center



INNOVATION CENTERS:

Corporate Innovation Centers locate in the Research Park to:

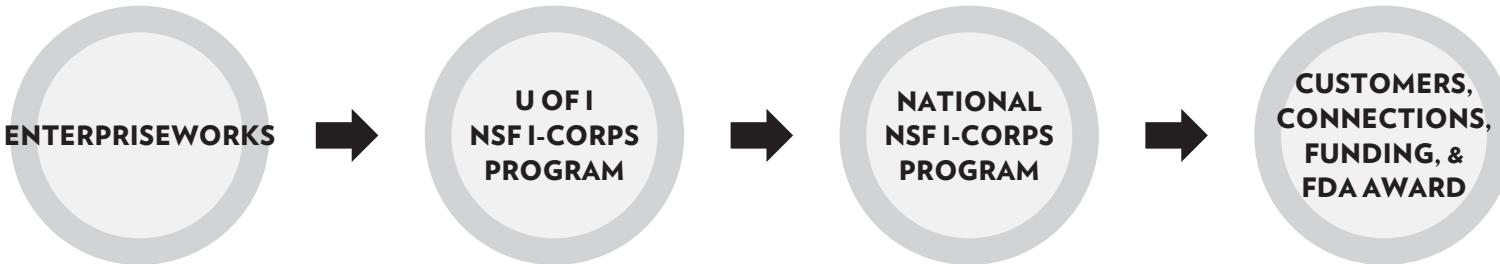
- **LEVERAGE** the University's research strengths
- **GAIN ACCESS** to top-notch faculty and student talent, scout research trends and innovations
- **ENGAGE** with technology startups

CASE STUDY: PHOTONICARE

Leveraging biomedical engineering, business, and even parenting expertise, Stephen Boppart, MD, PhD, and Ryan Shelton, PhD, developed a new technology that enables physicians to better diagnose and manage ear infections. Boppart and Shelton founded PhotoniCare Inc., a University of Illinois startup that moves this new technology, the CLEARVIEW™ otoscope, from the laboratory to the marketplace.

Boppart and Shelton realized that many of the tools used by physicians were rudimentary, limiting patient care and recovery. This realization, plus the frustration and pain Shelton experienced as a parent of a child with recurring ear infections, prompted the development of the technology startup company.

The current technology used to diagnose ear infections is an otoscope, which simply provides a picture of the eardrum surface. PhotoniCare's technology allows physicians to look through the eardrum to directly visualize the infection in the middle ear. This new information could improve decision-making for the use of antibiotics and surgery, resulting in improved outcomes for children with this common disease.



ESTABLISHING THE COMPANY

A 5-year \$5 million National Institutes of Health (NIH) grant allowed Dr. Boppart to advance his research and develop the idea for this primary care device, but the PhotoniCare team utilized the University's innovation pipeline and comprehensive entrepreneurial ecosystem to elevate his idea and start the company.

OTM protected the intellectual property so the company could move forward. "My Technology Manager was very open to my ideas and was very diligent in reviewing new technologies," says Boppart. "The OTM helped me build a strong patent portfolio."

In addition to providing seed funding and business advice, IllinoisVENTURES served as a resource for other potential investors.



Left to Right:
The PhotoniCare Team
is composed of
Dr. Stephen Boppart,
Dr. Ryan Shelton,
Gary Durack,
and Ryan Nolan.

The IllinoisVENTURES team facilitated many important introductions that helped PhotoniCare secure additional funding.

In addition to providing PhotoniCare a home base, the EnterpriseWorks incubator has afforded many valuable opportunities and resources for business development and growth. I-Start funding allowed the team to seek advice for legal documents, build a website, and other necessary steps to establish the company. Participation in the National Science Foundation Innovation Corps (NSF I-Corps™) program led to direct contact with more than 40 customers and the opportunity to participate in the national program, which led to access with some of the top otologists in the world, an additional 120 customers, great

connections, further funding, and a Food & Drug Administration Pediatric Device Innovator Award. The company also engages regularly with the EnterpriseWorks staff and participates in countless entrepreneurial programs and events.



The CLEARVIEW™ otoscope allows physicians to see not only the surface of the eardrum, but through the eardrum and into the middle ear where disease occurs, resulting in better diagnoses and management of ear infections.

PHOTONICARE TIMELINE

JUN 2013	PhotoniCare founded by Professor Stephen Boppart and Dr. Ryan Shelton
JUL 2013	Received EnterpriseWorks I-Start award
JUL 2013	Selected to participate in Chicago Innovation Mentors program
SEP 2013	Selected for National Science Foundation Innovation Corps (NSF I-Corps™) Site program at U of I
JUN 2014	Selected for national NSF I-Corps™ program
JUL 2014	Moved into EnterpriseWorks incubator
FEB 2015	Received Pediatric Device Innovator Award from Food & Drug Administration in partnership with Sheikh Zayed Research Institute

BENCH TO BEDSIDE TECHNOLOGY

Since the founding of the company in 2013, PhotoniCare has quickly moved its technology from "bench to bedside" and is now changing the standard of care by moving it from "patient to population." The PhotoniCare team wants to make state-of-the-art technology, such as the CLEARVIEW™ otoscope, available at the front line of healthcare.

Dr. Boppart feels his roles as a researcher and an entrepreneur complement each other nicely. "Academic research can only take ideas so far in the medical device space," he says. "My role in the lab is to generate new ideas, and my role in the startup company is to heal people by getting our ideas and technologies into the market."

When asked about the role of a startup company in supporting research endeavors, Dr. Shelton says, "All science or engineering based research programs need a connection to industry... whether via a startup company, academic-industry grants or consulting arrangements, or even just informal connections. Industry connections are critical in relating your research to real-world problems and applications."

Boppart and Shelton attribute company success to many—PhotoniCare teammates Gary Durack and Ryan Nolan, undergraduate and graduate students, research scientists, clinicians, and patients.

CASE STUDY: CAPIO BIOSCIENCES

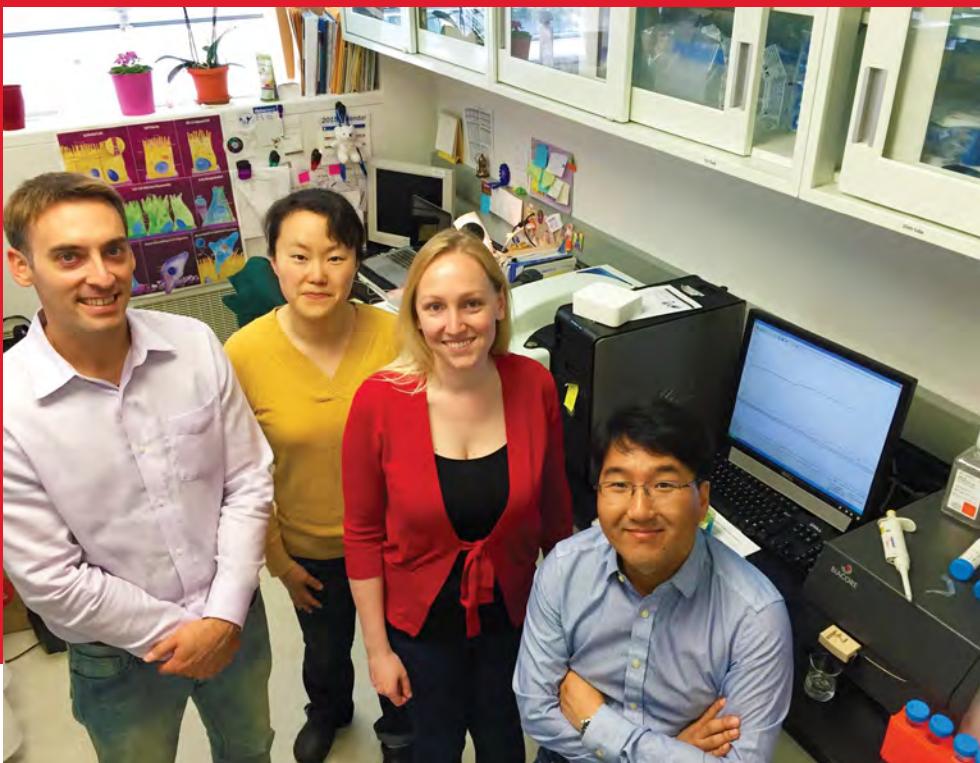
University of Illinois at Chicago (UIC) researcher Dr. Seungpyo Hong has developed the *UiChip™*, a new medical device that detects circulating tumor cells (CTCs). CTCs are cells that escape from solid tumors and travel through the blood to other parts of the body and can be responsible for the metastasis, or the spreading of cancer cells.

Metastasis that is induced by CTCs is one of the major reasons that cancer is so fatal. Through research that focuses on the intersection of materials science, biology, and nanotechnology, Dr. Hong and his team designed the *UiChip™* and founded a company called Capio Biosciences, Inc., to bring this new technology into hospitals and clinics. (Capio means “capture” in Greek.)

Current CTC testing methods are expensive, complex, and unable to accurately detect CTCs. There are two challenges in detecting CTCs: they are extremely rare (generally only one in one billion are detected) and they are very heterogeneous, making it difficult to specifically isolate the complete spectrum of CTCs.

Forming a company opens new possibilities for translating technologies developed in university labs. It gives me great satisfaction to have the opportunity to collaborate on innovative technologies that have a direct impact on health and society.

—DR. SEUNGPYO HONG, FOUNDER, CAPIO BIOSCIENCES



Dr. Seungpyo Hong is an Associate Professor of Pharmaceutics and Bioengineering and the Director of Graduate Education for the College of Pharmacy at the University of Illinois at Chicago.

Left to right: The Capio Biosciences team is composed of Dr. Melbs LeMieux, Dr. Ja Hye Myung, Dr. Carolyn Hollands, and Dr. Seungpyo Hong.

After applying for a patent, publishing several papers about the new technology, and obtaining promising data from human blood samples (in vitro tumor cells spiked into the healthy donors' blood), Hong was ready to proceed with starting the company.

Hong credits the University of Illinois' robust innovation pipeline with providing the necessary resources and support to move his technology out of the laboratory to form a startup company. "The Chancellor's Innovation Fund proof-of-concept award was really the driving force for establishing the company," says Hong. "OTM staff was extremely helpful in protecting the intellectual property that was developed in my lab. IllinoisVENTURES has shown a great deal of interest in our company and we have had numerous productive meetings.

EnterpriseWorks Chicago provided a student consulting team via the POC Accelerator and assisted with our SBIR/STTR application."

Hong utilized a mentoring team from Chicago Innovation Mentors, an organization co-founded by the University, for guidance in launching his new venture. Hong also acknowledges his postdoctoral advisor, Dr. Robert Langer, a well-known engineer and biotechnology professional, for sharing his passion for innovation and entrepreneurship.

The Capio Biosciences team recently launched a clinical pilot study through the University of Illinois Cancer Center with Dr. Gina Votta-Velis and Dr. Arkadiusz Dudek. The study is in its early stages, but researchers have collected multiple blood samples from several prostate cancer

patients. The results have been promising, showing that *UiChip™* can capture a few dozen CTCs from just one mL of blood, which indicates that this non-invasive, cost-effective technology has the potential to complement or even replace conventional technologies such as invasive biopsies and costly CT/PET scans that can cause pain or discomfort. Hong and his team are also in the process of analyzing 150 blood samples from a previous clinical study conducted with UNC cancer patients.

The ability to detect spontaneous CTCs will give physicians an early indication of the spread of cancer to other areas of the body. Moreover, this detection provides a powerful tool for cancer prognosis, diagnosis of minimal residual disease, assessment of tumor sensitivity to anti-cancer drugs, and ultimately a more personalized anti-cancer therapy for the patient.

CAPIO BIOSCIENCES IN THE OVPR PIPELINE

"Capio Biosciences is a terrific example of a startup company that elevates the culture of innovation at UIC. Dr. Hong and his team have successfully transferred University of Illinois research into a viable technology by leveraging the resources available through our innovation pipeline and entrepreneurial ecosystem."

—KAPILA VIGES, DIRECTOR, ENTERPRISEWORKS CHICAGO



CASE STUDY: VANQUISH ONCOLOGY

Through cross-campus and interdisciplinary collaboration among research faculty and staff, the University of Illinois is revolutionizing cancer research and drug discovery faster than ever before.

Vanquish Oncology Inc. is a U of I drug startup company that develops personalized therapeutics for unmet or underserved cancer markets, or any cancer with a poor survival rate. Dr. Paul J. Hergenrother, Professor of Chemistry on the Urbana-Champaign campus, co-founded the company based on a decade of research.

Vanquish Oncology's cancer therapeutic is different from other therapeutics because it is a direct activator of procaspase-3, an enzyme that is overexpressed in many types of cancer, including lung, breast, colon, and brain. Vanquish Oncology's drug PAC-1 activates this enzyme, turning it on and thereby killing the cancer cells. This is a novel mode-of-action for an anticancer drug.

The new drug has the unique capability of reducing tumor volume and penetrates the blood-brain barrier and thus has potential to treat primary brain tumors and cancers that metastasize to the brain from other sites. This is cutting-edge technology in the medical industry as there is currently no other comparable drug on the market.



Dr. Timothy Fan (left) and Dr. Paul Hergenrother (right) evaluated their anti-cancer compound in pet dogs with cancer before beginning the human clinical trial.

It has been really exciting to be a part of the synergy between the Urbana-Champaign and Chicago campuses. The U of I Cancer Center is an outstanding resource for University startups like ours, and I look forward to seeing more groundbreaking drugs being developed at the University.

—DR. PAUL HERGENROTHER, CO-FOUNDER, VANQUISH ONCOLOGY

INNOVATION PIPELINE

Vanquish Oncology is a successful product of the University's innovation pipeline that protects, funds, supports, and launches new technologies. Dr. Hergenrother worked with OTM during the discovery stage to evaluate and license the new technology. "My Technology Manager was awesome," says Dr. Hergenrother. "There is a lot of work that happens with patents and business development behind the scenes of which I am not even aware."

Hergenrother received proof-of-concept funding through OTM, and IllinoisVENTURES provided the initial seed funding. This investment allowed Hergenrother and his team to start the company and catalyzed a \$4 million angel investment. "The IllinoisVENTURES investment was critical to our company formation," Hergenrother says. "Many investors are hesitant to be the first to invest, but no one wants to be the last, either."

Proof-of-concept funding helps researchers further develop new technologies before they are ready for commercialization. Seed funding is an investment often used to start a business.

Hergenrother says his research would not have moved out of the laboratory so quickly if he did not have the company as a vehicle to transfer the benefits of the technology back to society. "The development of our cancer drug has progressed remarkably well thanks to having a formal enterprise in place. Without the company, we could not have opened a clinical trial so quickly."

CLINICAL TRIAL

Through a Phase 1 human clinical trial at the UICC, researchers are treating cancer patients with PAC-1 to determine the maximum dose that a human can safely tolerate in an effort to help these late-stage cancer patients. Once the maximum dose level is determined and approved, the trial will move to Phase 2 to determine its efficacy.

Targeted approaches of individualized cancer treatment mark a trend in cancer therapeutics. The UICC Clinical Trial Office specializes in

conducting interventional clinical trials, which are generally new therapies focused on curing cancer and improving the current standard of treatment. The length of time it takes to move from drug development to a clinical trial is highly variable, but on average it takes 10-17 years. However, with the support of the UICC, Vanquish Oncology brought the drug to clinical trial only 18 months after receiving the angel investment.

The momentum from the PAC-1 human clinical trial has helped

The University of Illinois Cancer Center (UICC), located on the Chicago campus, aims to reduce the burden of cancer through research, education, outreach, prevention, detection, and the treatment of cancer.



Vanquish Oncology provides an excellent model of interdisciplinary and cross-campus collaboration between the Urbana and Chicago campuses. The drug was developed on the Urbana campus and Dr. Timothy Fan conducted clinical trials on dogs with cancer at the U of I Veterinary Teaching Hospital. Dr. Alex Lyubimov, Director of the Toxicology Research Laboratory at UIC, coordinated the toxicology work, and the Phase 1 human clinical trial led by Dr. Oana Danciu is taking place at the Cancer Center in Chicago.

The unique relationship between cancer clinicians and University of Illinois researchers will lead to the accelerated process of cancer drug development and the creation of a cancer drug pipeline.

—DR. ARKADIUSZ DUDEK, DIRECTOR, U OF I CANCER CENTER CLINICAL TRIAL OFFICE

accelerate other developments—as the drug has the potential to treat other types of cancer, including pediatric brain cancer—and has generated interest by a second company in licensing another drug discovered at U of I.

PAC-1 is being used to treat cancer patients (any solid tumors and lymphomas) through a Phase 1 human clinical trial.



The University of Illinois has an extraordinary platform for innovation—brilliant researchers, state-of-the-art facilities, programs that take discovery to the marketplace and train students to solve the problems of tomorrow. We will build on that strong foundation, fostering collaboration and partnerships like never before to turbo-charge our efforts and help lead progress and economic growth for our state and nation.

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— TIMOTHY KILLEEN
UNIVERSITY OF ILLINOIS PRESIDENT

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