ILLINOIS INNOVATION INDEX

2018 R&D INDEX

ILLINOIS' R&D LANDSCAPE & PATH FORWARD

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WHY R&D MATTERS

Research and development (R&D) is the lifeblood of innovation. Universities, businesses, and federal agencies all leverage R&D to generate discoveries that drive economic development and improve quality of life. For major universities, academic research has always been a core function. However, over the past decade, universities have placed an increased emphasis on commercializing discoveries made through academic research—thus bringing campus discoveries to market more quickly. For businesses, effective R&D is vital to competitiveness as companies look to grow their share of increasingly globalized markets. Lastly, research conducted at federally financed R&D centers ensures the country stays on the leading edge of discovery in important areas like advanced materials, defense, energy, supercomputing, and many more. Together, universities, businesses, and national labs create an ecosystem of innovation through R&D that helps drive societal progress.

KEY FINDINGS

- Illinois ranks 8th nationally in total R&D activity, reaching $16.5 billion in 2015 (the latest year for which data is available). However, total R&D activity has stagnated since 2011, growing just 0.8 percent annually over that period, compared with 3.7 percent growth nationally.
- A number of factors have influenced Illinois' slow R&D growth in recent years. On the business side, several of Illinois top R&D industries have seen limited growth, including chemicals (pharmaceuticals) and machinery manufacturing. On the academic side, Illinois' largest research universities have seen steady growth in R&D activity. However, many smaller public universities have been forced to curtail R&D efforts.
- Business R&D in Illinois reached $12.7 billion in 2015, up from $12.4 billion in 2014. Between 2011 and 2015, business R&D activity grew relatively slowly—at an annual rate of 1.4 percent, compared with 4.9 percent growth nationally.
- Illinois business R&D industries of strength match many of the state's top industries by employment, business output, and talent production. Top business R&D industries include chemicals manufacturing (Illinois ranks 6th nationally), machinery (2nd nationally), finance & insurance (2nd nationally), and food manufacturing (4th nationally).
- Patent activity in Illinois reached an all-time high in 2015, with 5,028 utility patents awarded. Patents awarded in Illinois grew by 7.2 percent annually between 2011 and 2015, faster than the national average over that period.

- Academic research activity reached $2.4 billion in 2016, a slight increase over 2015. Despite this growth, academic research activity in Illinois has grown just 0.4 percent annually since 2012, compared with 2.2 percent growth nationally. As a result, the state fell from 8th in academic R&D in 2015, to 10th in 2016.
- Compared with the national average, universities in Illinois receive a greater share of their federal funding from the Department of Energy (6.2 percent, compared with 4.6 percent nationally), Department of Health and Human Services (including the National Institutes of Health, 58.3 percent, compared with 53.3 percent nationally), and the National Science Foundation (18.7 percent, compared with 13.2 percent nationally).
- In recent years, the share of academic research funded by the business sector has risen significantly in Illinois. Between 2012 and 2016, business-funded academic research increased by 8.6 percent annually in Illinois, compared with 6.4 percent growth nationally. These university-industry research partnerships are key to academic research and innovation growth in the state.
- Areas of academic research strength in Illinois include health-related disciplines, most notably medical sciences and chemistry, as well as computer science. Health-related academic research pairs well with the state's business R&D strength in pharmaceuticals, while strength in computer science matches the state's strong production of talent in the field—which ranks second nationally.
- In 2016, Illinois academic institutions produced 13,410 academic articles (Illinois ranks 6th nationally), disclosed 759 inventions (11th nationally), were awarded 241 patents (10th nationally), and created 181 license or options agreements (18th nationally)—all increases compared with 2015 figures.
- Illinois' federally funded research and development centers (FFRDCs), Argonne and Fermilab, contribute more than $1 billion in activity to Illinois R&D landscape annually. Research activity at Argonne has grown by 1.9 percent annually since 2012, faster than the national average for FFRDCs.
- Though R&D in the state has grown relatively slowly in recent years, there are steps that can be taken to build on the many bright spots in Illinois' R&D landscape. On the academic side, stable state funding for public universities and the creation or expansion of university-industry research collaborations can help grow areas of R&D strength. On the business side, additional support for early-stage R&D focused companies and the expansion of wet lab space can help catalyze growth.

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OVERALL R&D

R&D ACTIVITY STAGNATES IN ILLINOIS

Total R&D activity in Illinois increased to $16.5 billion in 2015, up from $16 billion in 2014.[1] This 3.1 percent increase follows a steep decline in 2014, when R&D activity fell 5.3 percent (from $16.9 billion in 2013 to $16 billion in 2014). Despite the uptick in activity in 2015, overall R&D activity has stagnated since 2011, growing at an annual rate of just 0.8 percent over that period, compared with 3.7 percent growth nationally.[2]

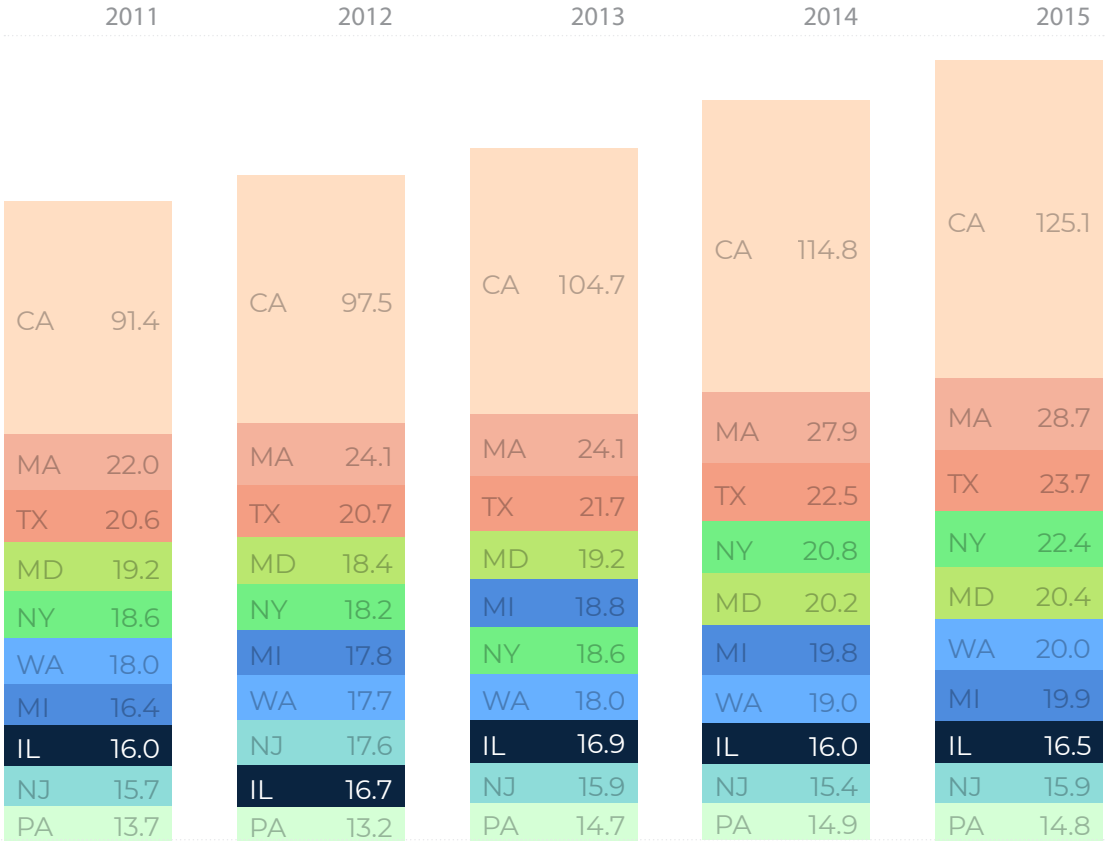
Illinois lags the national average for R&D intensity, a measure of all R&D activity as a percentage of state GDP. Illinois ranks 22nd nationally in R&D intensity, with 2.1 percent of GDP spent on R&D, compared with 2.7 percent nationally. Illinois is the fifth largest state by GDP ($772 billion in 2015), but ranks 8th in R&D activity.

[1] "R&D activity" refers to R&D expenditures, as defined by the National Science Foundation (NSF). The latest available data for overall R&D is from 2015.

[2] Here, annual growth rate refers to compound annual growth rate (CAGR).

All R&D Activity by State

Source: National Science Foundation National Center for Science and Engineering Statistics (NCSES)

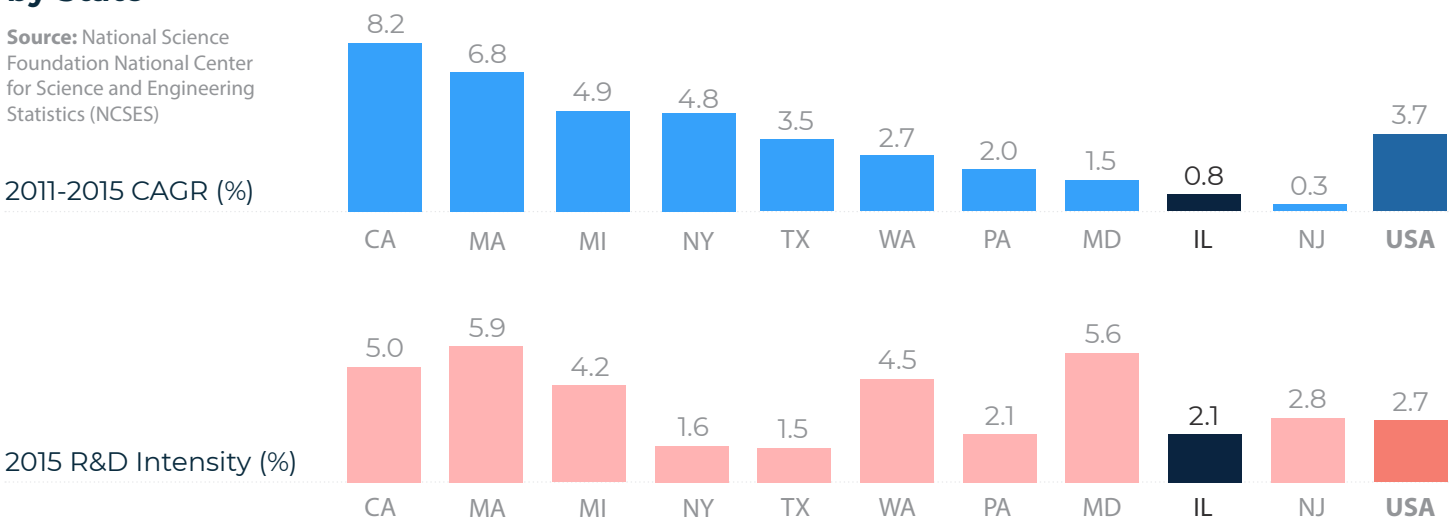


Top 10 States
2011-2015 ($ billion)

USA Total 428.2 435.3 456.1 477.7 495.2

All R&D Activity by State

Source: National Science Foundation National Center for Science and Engineering Statistics (NCSES)



UI LABS BOOSTING INNOVATION THROUGH PARTNERSHIPS AND PLATFORMS

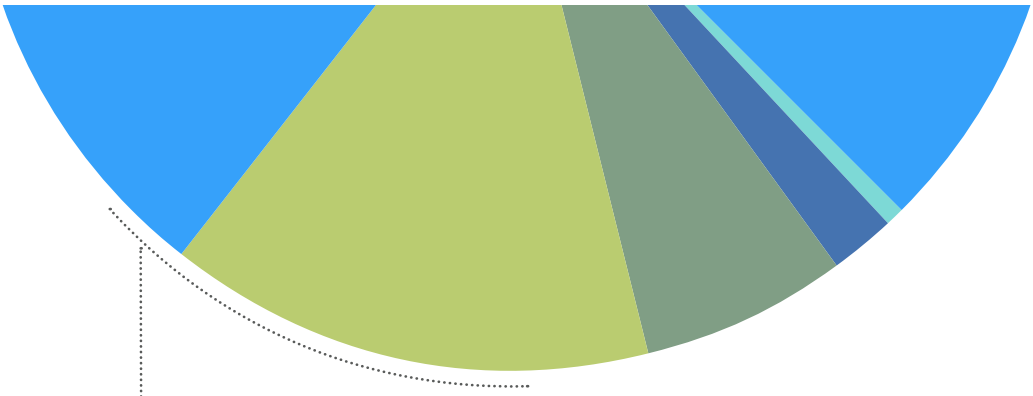
UI LABS is an organization helping to grow innovation in Illinois. Launched in 2014, UI LABS provides advanced R&D resources in the manufacturing space through its Digital Manufacturing and Design Innovation Institute (DMDII). It supports projects in product development, advanced manufacturing, supply-chain resilience, and cybersecurity in manufacturing. UI LABS also launched City Digital in 2015, which uses Chicago as a testbed for new urban infrastructure technologies including physical infrastructure, water, energy, and mobility. In 2017, City Digital merged with the Smart Chicago Collaborative to form the City Tech Collaborative. UI LABS also partners with Illinois universities to further its research and technology-commercialization goals. Through its partnerships and platforms, UI LABS provides Illinois' business and academic communities with unique support, helping expand R&D in the state. UI LABS R&D has addressed areas ranging from optimizing stormwater management to prevent flooding for Chicago residents to using information in the manufacturing process to make every part better than the last.

UNIVERSITIES, FEDERAL LABS CONDUCT OUTSIZED SHARE OF R&D

As is the case in most states, most of Illinois' R&D activity is conducted by businesses. Compared to peer states, higher education institutions conduct a greater share of R&D activity in Illinois. Thanks to the state's two national laboratories, Argonne and Fermilab, the share of R&D conducted by federally funded R&D centers (FFRDCs) in Illinois is more than double that of peer states. Federal research is also boosted the USDA's National Center for Agricultural Utilization Research in Peoria, IL. Overall, the share of R&D conducted by federal agencies, the state, and other non-profits organization in Illinois is significantly lower than in peer states.

R&D Funding by Performer 2015

Source: National Science Foundation National Center for Science and Engineering Statistics (NCSES)



	Illinois total, $ bln (share)	Concentration vs. Top 10 States
Business	12.71 (77.0%)	0.99
Higher Education	2.39 (14.5%)	1.20
FFRDC	1.04 (6.3%)	2.04
Federal	0.29 (1.7%)	0.30
Other Nonprofit	0.08 (0.5%)	0.37

BUSINESS R&D

BUSINESS R&D ACTIVITY SHOWS MODEST GROWTH

Illinois has one of the largest business communities in the United States, with 38 Fortune 500 companies and $800 billion in annual GDP.[3,4] To accompany this business volume, the state is also a leader in business sector R&D. In 2015, Illinois businesses conducted $12.7 billion in R&D activity, up from $12.4 billion in 2014.[5] This increase comes after business R&D activity shrank from 2013 to 2014 ($13.1 billion to $12.4 billion). Overall, business R&D growth was relatively slow in Illinois between 2011 and 2015, growing at an annual rate of 1.4 percent, compared with 4.9 percent growth nationally. Illinois ranks 8th among states for business R&D activity.

Despite the volume of R&D activity conducted by businesses in Illinois, the state falls below the national average for business R&D intensity—a measure of business R&D activity as a percentage of private-industry output. In 2015, Illinois business spent 1.8 percent of business output on R&D, compared with 2.3 percent nationally. Business R&D intensity has fallen since 2011, when business in the state spent 2 percent of output on R&D.

[3] 2018 Fortune 500 list

[4] Bureau of Economic Analysis, U.S. Department of Commerce, 2017

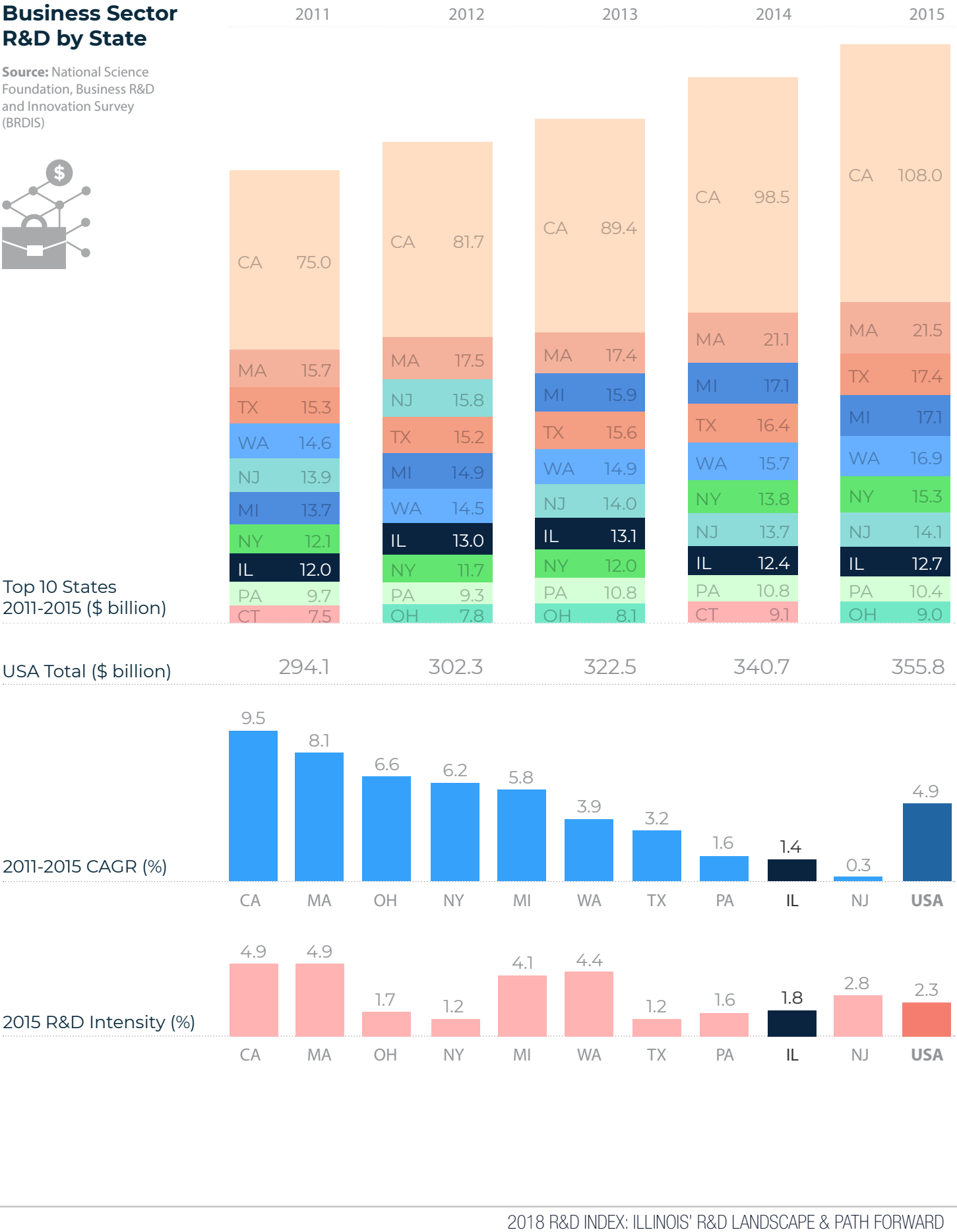
[5] Latest available data on business R&D comes from the 2015 NSF Business Research and Development and Innovation Survey (BRDIS).

ADM AND DUPONT OPEN NOVEL PLASTIC R&D FACILITY

In 2018, Archer Daniels Midland Company (ADM) and DuPont opened the world's first dedicated pilot production facility for furan dicarboxylic methyl ester (FDME), a molecule extracted from fructose that can be used to create biobased plastics and other materials. Nearly one-tenth of the world's oil is used to make the plastic products we use every day, from shopping bags to food containers. However, plastics made from FDME eliminate the need for oil, while also being more cost efficient and eco-friendly than plastics created from fossil-fuels. In addition, plastics made from FDME extend the shelf life of various products while using less material. Located in Decatur, IL, the new joint facility is the result of an R&D partnership between two national R&D leaders, with ADM providing expertise in corn fructose and DuPont in chemicals. Together, ADM and DuPont are engineering the future of plastics in Illinois.

Business Sector R&D by State

Source: National Science Foundation, Business R&D and Innovation Survey (BRDIS)



USG ENGINEERING INNOVATIONS IN SUSTAINABLE BUILDING MATERIALS

Headquartered in Chicago, USG Corporation is the largest distributor of wallboards (or drywall) in the United States. The company has built a culture of innovation in Illinois, beginning more than a century ago when it introduced Sheetrock brand wallboards, allowing for faster installation and improved building safety. Now USG is taking on sustainability, with nearly 100 engineers and scientists developing innovative sustainable products at the company's Corporate Innovation Center in Libertyville, IL. With buildings accounting for 40 percent of carbon dioxide emissions in the U.S., cities are searching for ways to reduce their carbon footprint. Thanks to R&D conducted in Illinois, USG released their Sheetrock Brand EcoSmart Panels in 2017. The new panels employ an eco-friendly manufacturing process that consumes 25% less water and 20% less energy than traditional wallboards.

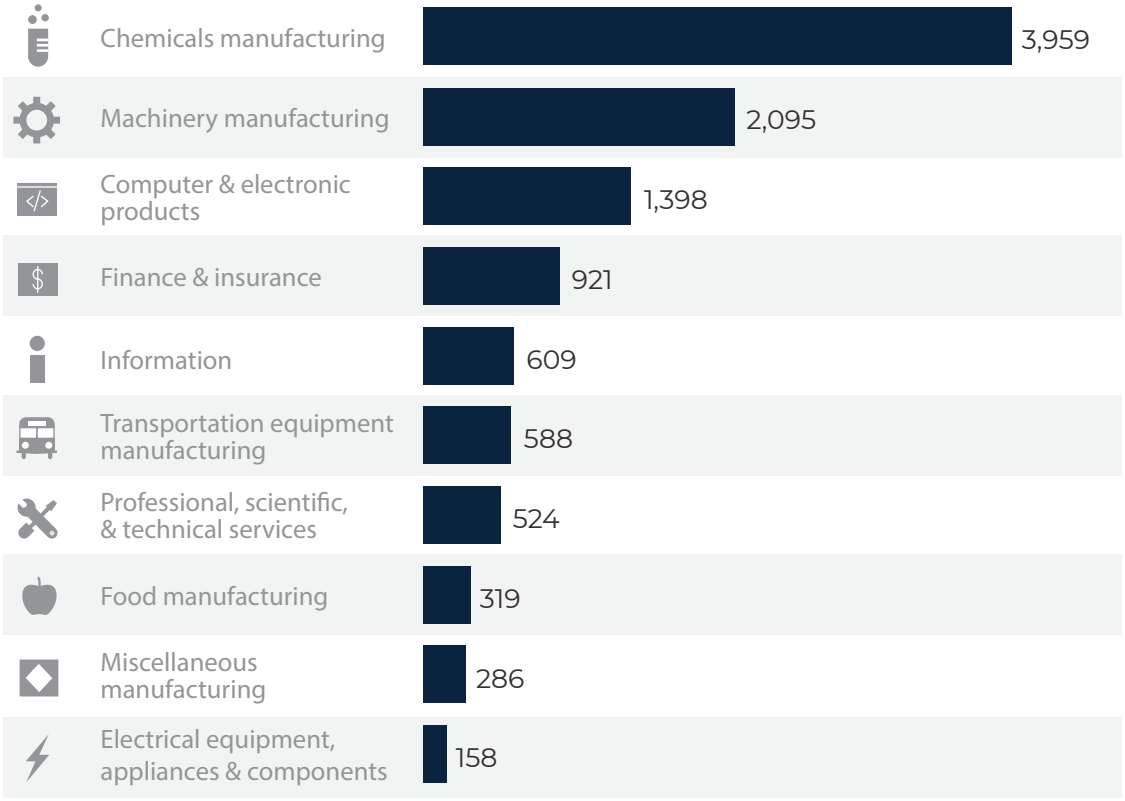
GROWTH MIXED IN ILLINOIS' TOP BUSINESS R&D INDUSTRIES

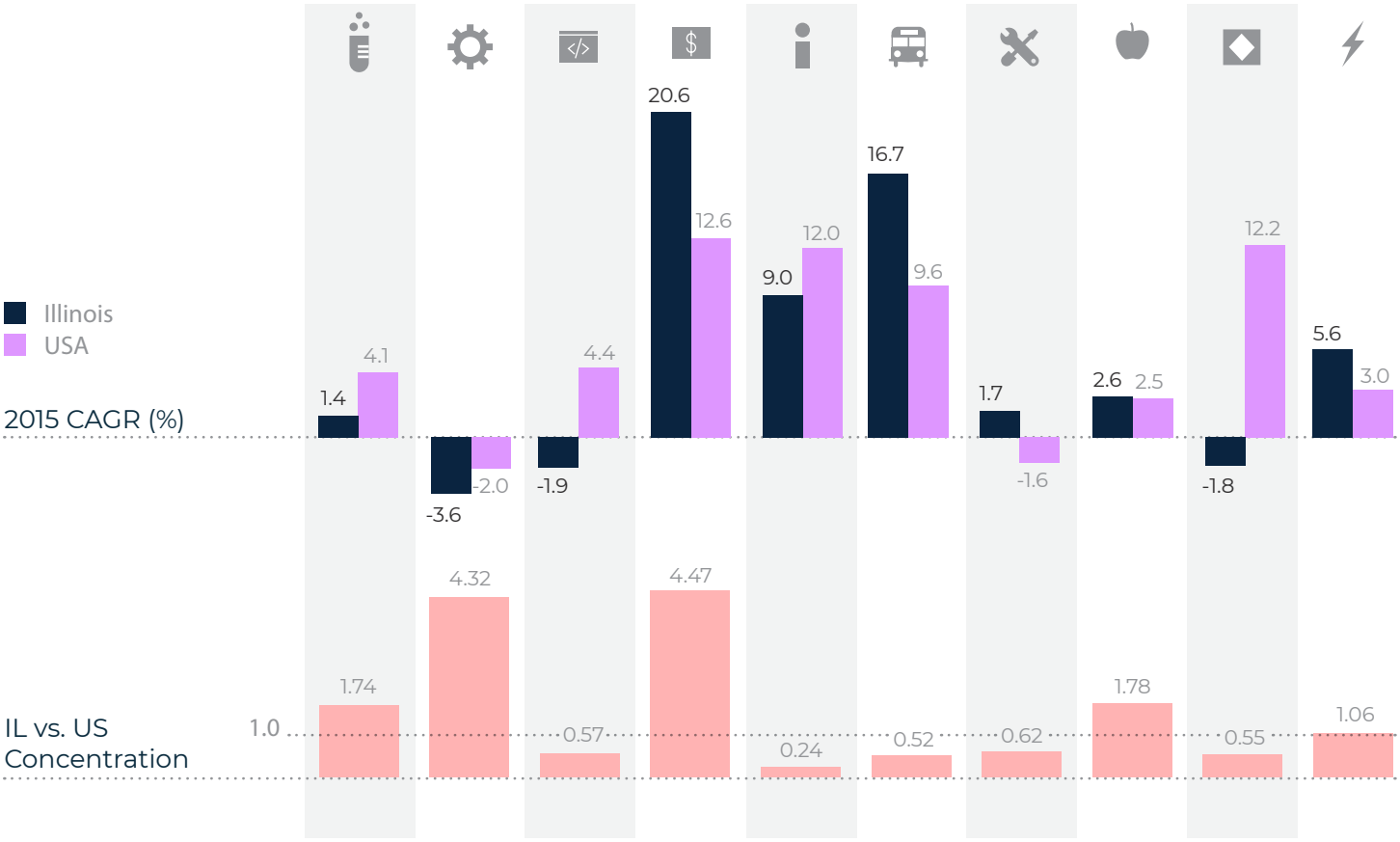
Illinois' business R&D strengths match many of the state's top industries by employment, business output, and talent production. Compared to the national average, R&D concentration in both machinery manufacturing and finance & insurance is more than four times the national average. R&D concentration in chemicals[6] and food manufacturing also exceeds the national average. Strength in chemical manufacturing (Illinois ranks 6th nationally by R&D volume) is driven by the state's robust pharmaceutical industry, which includes industry leaders like Abbott, AbbVie, Baxter, and Takeda, as well as growing companies like Lundbeck and Horizon. The state's R&D strength in machinery manufacturing (2nd nationally) can be attributed to Illinois industry leaders Caterpillar, Illinois Tool Works, and John Deere. Allstate, Discover, and State Farm help drive Illinois R&D strength in finance & insurance (2nd nationally), while strength in food R&D (4th nationally) can be attributed to industry leaders like ADM, ConAgra, and Kraft Heinz.

[6] Both in Illinois and nationally, R&D in pharmaceuticals makes up the majority of activity in chemicals manufacturing R&D.

Top 10 Business R&D Industries Illinois 2015 ($ million)

Source: National Science Foundation, Business R&D and Innovation Survey (BRDIS)





Growth in Illinois' key business R&D industries is mixed. Though Illinois remains a leader in chemicals manufacturing, R&D in the industry grew just 1.4 percent annually from 2011 to 2015, compared with 4.1 percent growth nationally. R&D in machinery manufacturing declined by 3.6 percent annually from 2011 to 2015, compared with a 2 percent decline nationally. Computer and electronic R&D also declined 1.9 percent annually over the same period, despite 4.4 percent annual growth nationally.

Conversely, R&D in finance & insurance has grown rapidly in Illinois since 2011—at an annual rate of 20.6 percent from 2011 to 2015, compared with 12.5 percent annual growth nationally. Transportation equipment R&D has also seen tremendous growth in Illinois, growing 16.7 annually between 2011 and 2015, significantly higher than national growth of 9.6 percent. R&D areas which have grown more quickly in Illinois than nationally also include; professional, scientific, and technical services; food; and electrical equipment, appliances, and components.

R&D ACCELERATING FOOD INNOVATION IN ILLINOIS

Illinois is home to many of nation's largest food companies, including Fortune 500 companies ADM, Kraft Heinz, Mondelez International, McDonald's, US Foods, Conagra, TreeHouse Foods, and Ingredion. Today's ultra-competitive food landscape requires companies to create new and innovative products at breakneck pace. To that end, Illinois' leading food companies are taking steps to spark innovation. Recently, Kraft Heinz, McDonald's, and Conagra relocated their respective headquarters to downtown Chicago, helping them gain access to the city's innovative workforce.

To keep up with the pace of innovation in food, Illinois companies are placing an increased emphasis on R&D. One example is the Sara Lee Frozen Bakery business, which is building a new joint corporate and R&D space in Oakbrook Terrace, bringing R&D professionals and executives under one roof. Large companies are also leveraging Chicago's vibrant food startup scene to drive innovation. To tap into this startup scene, Tyson Foods launched a $150M Chicago-based VC fund in 2016. In addition, Kraft Heinz launched it's Springboard Incubator Program in March of 2018. In Illinois' food sector, the efforts of R&D driven companies and connectivity between the corporate and startup communities is driving innovation.

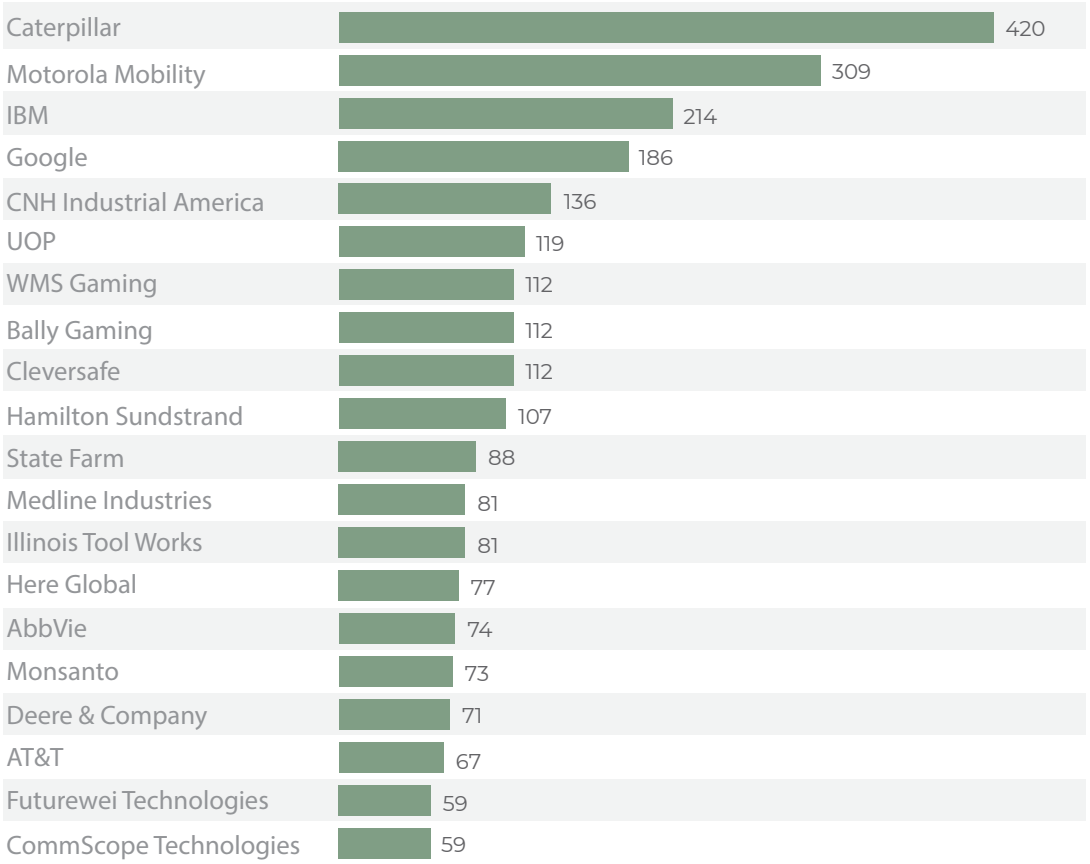
ILLINOIS PATENT ACTIVITY REACHES ALL-TIME HIGH

Patents are often the tangible outcome of R&D activity, representing the creation of a new product or service. Illinois ranks 7th nationally in patent activity, with 5,028 utility patents awarded in Illinois in 2015, a new record for the state.[7] From 2011 to 2015, patents awarded in Illinois grew at an annual rate of 7.2 percent, compared with 6.7 percent growth nationally. Illinois produces 304.7 patents per $1 billion in R&D activity, compared with 284.7 nationally.

[7] Includes all patents, not only those awarded to businesses. Data via the United States Patent and Trademark Office (USPTO).

Top 20 Business by Patents Awarded Illinois 2017

Source: US Patent and Trademark Office, Wellspring Scout Data Platform



In 2017, businesses producing the most patents in Illinois included Caterpillar, Motorola Mobility, IBM, and Google. Illinois industry pillars State Farm, Illinois Tool Works, and Deere & Company are also among the top 20 patent-producing businesses. Illinois ranks 8th nationally for patents awarded to businesses.[8]

[8] 2017 USPTO data accessed via the Wellspring Scout Data Platform. Includes patents awarded to companies where at least one named inventor is based in Illinois. Each patent may be associated with multiple states based on locations of named inventors.

CATERPILLAR LEADING WORLD-CLASS R&D FROM ILLINOIS

Caterpillar, which has called Central Illinois its global R&D headquarters for nearly a century, invests between 4-5 percent of sales into product and technology development. As the world's leading manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines, and diesel-electric locomotives, Caterpillar has a long history of using leading-edge technology to provide customer solutions. These solutions include innovations in additive manufacturing, autonomous machines, data analytics, and safety products.

One example of this innovation is Caterpillar's fleet of more than 100 autonomous trucks currently at work worldwide. With no operator in the cab, these vehicles can work non-stop—meaning they can run about two and a half additional hours per day. High-fidelity LIDAR, radar, and sensors allow these autonomous trucks to "see" and gather a staggering amount of information about their surroundings. Over a two-year period, these autonomous trucks have moved more than 700 million tons of material with 20 percent higher productivity than trucks with human operators.

In addition to Caterpillar's R&D headquarters in Peoria, the company sponsors two Data Innovation Labs—at University of Illinois Urbana-Champaign and University of Illinois at Chicago—to engage motivated cross-functional teams of students to solve some of Caterpillar's most pressing problems. Today, Caterpillar is an open innovation company offering more sustainable products and solutions by leveraging world-class expertise and speeding up the pace of R&D through industry, government, and academic institution partnerships.

FEDERAL LABS

FEDERAL LABS REMAIN A PILLAR OF ILLINOIS' R&D LANDSCAPE

Illinois' federally funded R&D centers (FFRDCs), Argonne and Fermilab, contribute more than $1 billion in R&D activity to the state each year. Argonne National Laboratory conducted $734 million in R&D activity in 2016, while Fermi National Accelerator Laboratory conducted $324 million—both increases over 2015 levels.[9] Argonne's research activity has grown by 1.9 percent annually since 2012, faster than the national average for FFRDCs.

The vast majority of funding for FFRDCs comes from the federal level. However, compared to the national average for such facilities, Argonne receives a significantly greater share of its funding from business (2.7 percent, compared with 1 percent for all FFRDCs). This is largely thanks to Argonne's user facilities, scientific facilities that the lab maintains for the use by Argonne scientists, private industry, academia, and other organizations. User facilities at Argonne include the Advanced Photon Source (APS) and the Argonne Leadership Computing Facility (ALCF).

[9] Latest available data on FFRDC activity comes from the 2016 FFRDC Research and Development Survey.

ARGONNE'S NEW TRACER CENTER OFFERS ENHANCED R&D CAPABILITIES

Argonne NATIONAL LABORATORY

This year, Argonne National Laboratory formally opened the Argonne TRACER Center (Trace Radioisotope Analysis Center). The TRACER Center provides a new, permanent home for the nation's only laser-based krypton atom-counting machine. The center employs a novel technique called Atom Trap Trace Analysis (ATTA) that captures and counts isotopes of the rare element krypton (Kr) to determine the age of ice and groundwater. One of only a few such devices in the world, it provides valuable information about the dynamics, flow rates, and direction of water in aquifers, particularly those vital to arid regions. The new TRACER Center is the culmination of 15 years of research sponsored by the Department of Energy. So far, the new center has dated samples from diverse and extreme geographies, from wetlands and deserts to glacial ice. Its users have included the U.S. Geological Survey, Sandia National Laboratory, the University of Chicago, and Ben-Gurion University of the Negev in Israel.

ACADEMIC R&D

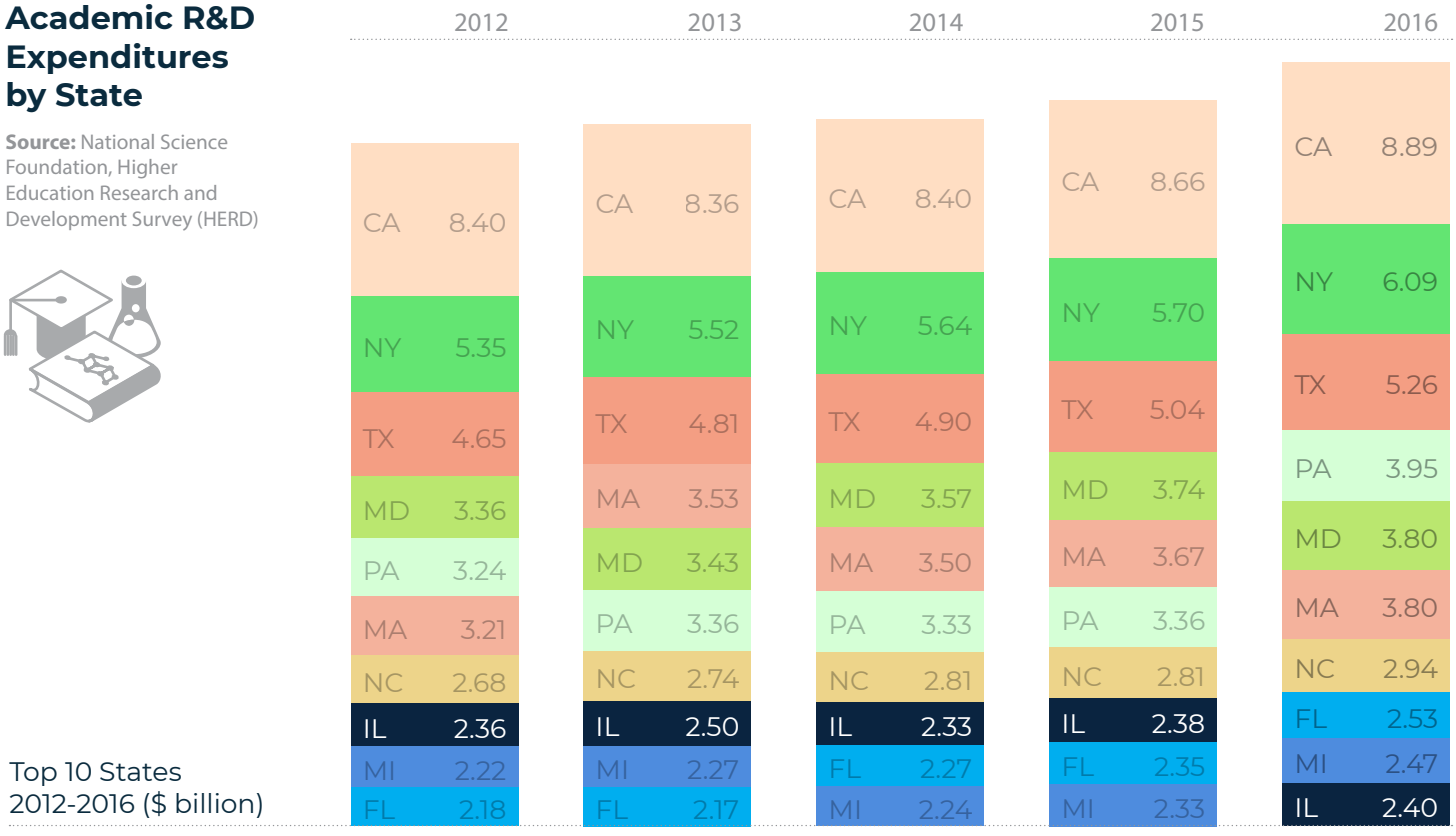
ILLINOIS' ACADEMIC RESEARCH GROWTH SLOWS

R&D activity at Illinois' higher education institutions reached $2.4 billion in 2016, a slight increase over 2015.[10] Research activity reached a peak of $2.5 billion in 2013, thanks in large part to the National Center for Supercomputing Applications' (NCSA) Blue Waters supercomputer project at the University of Illinois at Urbana-Champaign. Academic R&D activity has remained relatively constant over the past five years, growing at an annual rate of 0.4 percent since 2012, compared with 2.2 percent growth nationally.

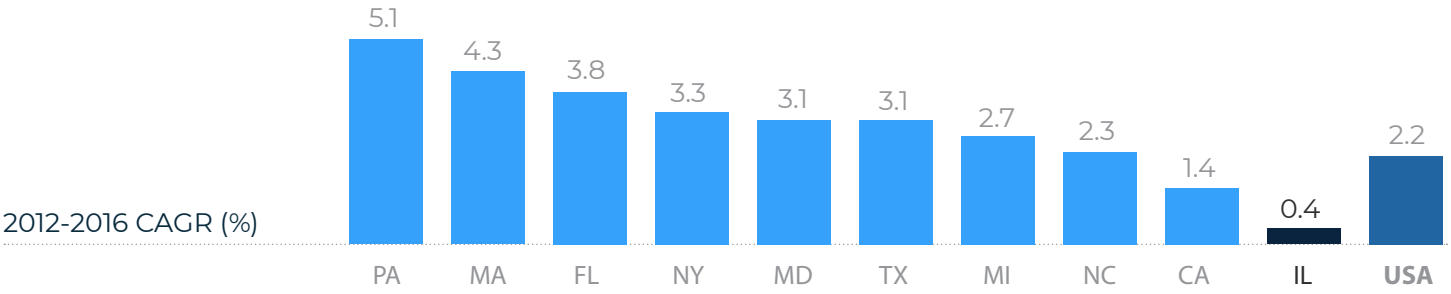
[10] Latest available data on academic R&D comes from the 2016 Higher Education Research and Development Survey (HERD).

Academic R&D Expenditures by State

Source: National Science Foundation, Higher Education Research and Development Survey (HERD)



Top 10 States 2012-2016 ($ billion)



Though overall academic research in Illinois has grown slowly over the past five years, significant disparities in research growth exist between universities in the state. Since 2012, Illinois' two largest research universities have seen steady growth in research activity—Northwestern University (3.1 percent annual growth) and the University of Illinois at Urbana-Champaign (1.7 percent annual growth). However, research activity at all other universities in Illinois declined at a collective rate of 1.9 percent annually over the same period. Disparities in research growth also exist between public and private universities. Academic research at private universities in Illinois grew 1.5 annually from 2012 to 2016, while research at public universities fell by 0.9 percent annually during the same period. In fact, research activity at public universities other than the University of Illinois at Urbana-Champaign fell 4 percent annually from 2012 to 2016.

ACADEMIC RESEARCH FUNDING LED BY THREE FEDERAL AGENCIES

As is typical for most states, Illinois receives a large portion of its academic R&D funding from federal agencies. However, Illinois receives a greater share of its R&D funding from federal agencies than the nation as a whole—receiving 58.6 percent of funding from the federal-level, compared with 54 percent nationally. Illinois is also more reliant on institutional funds and funds from non-profit organizations compared with the national average. Compared to the national average, higher education institutions in Illinois receive a smaller share of funding from state and local governments and other sources (including donor gifts designated for research). However, in recent years, universities in Illinois have stepped up efforts to raise research funding from non-traditional sources, including gifts from donors that are dedicated to research.[11]

[11] "All Other Sources" category in the following exhibit

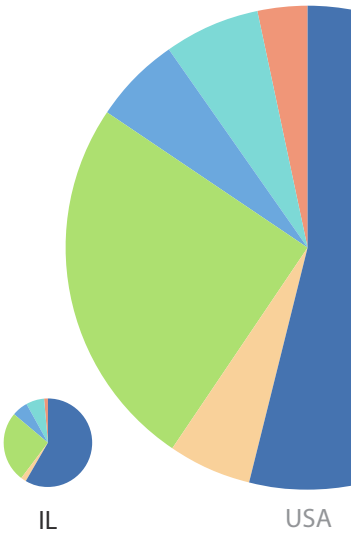
Compared with the national average, higher education institutions in Illinois receive a greater share of funding from the Department of Energy (6.2 percent, compared with 4.6 percent nationally), Department of Health and Human Services (including the National Institutes of Health, 58.3 percent, compared with 53.3 percent nationally), and the National Science Foundation (18.7 percent, compared with 13.2 percent nationally). Strength in funding from the Department of Energy is largely driven by academic research associated with Argonne and Fermilab. The large share of funding from the Department of Health and Human Services can be attributed to the growth of health-related research in Illinois, including research conducted at the Illinois Medical District and leading research hospitals, such as Northwestern University, Rush University, the University of Chicago, and the University of Illinois. Strength in National Science Foundation funding is led by the University of Illinois at Urbana-Champaign, which is among the top recipients of NSF funding nationwide.[12]

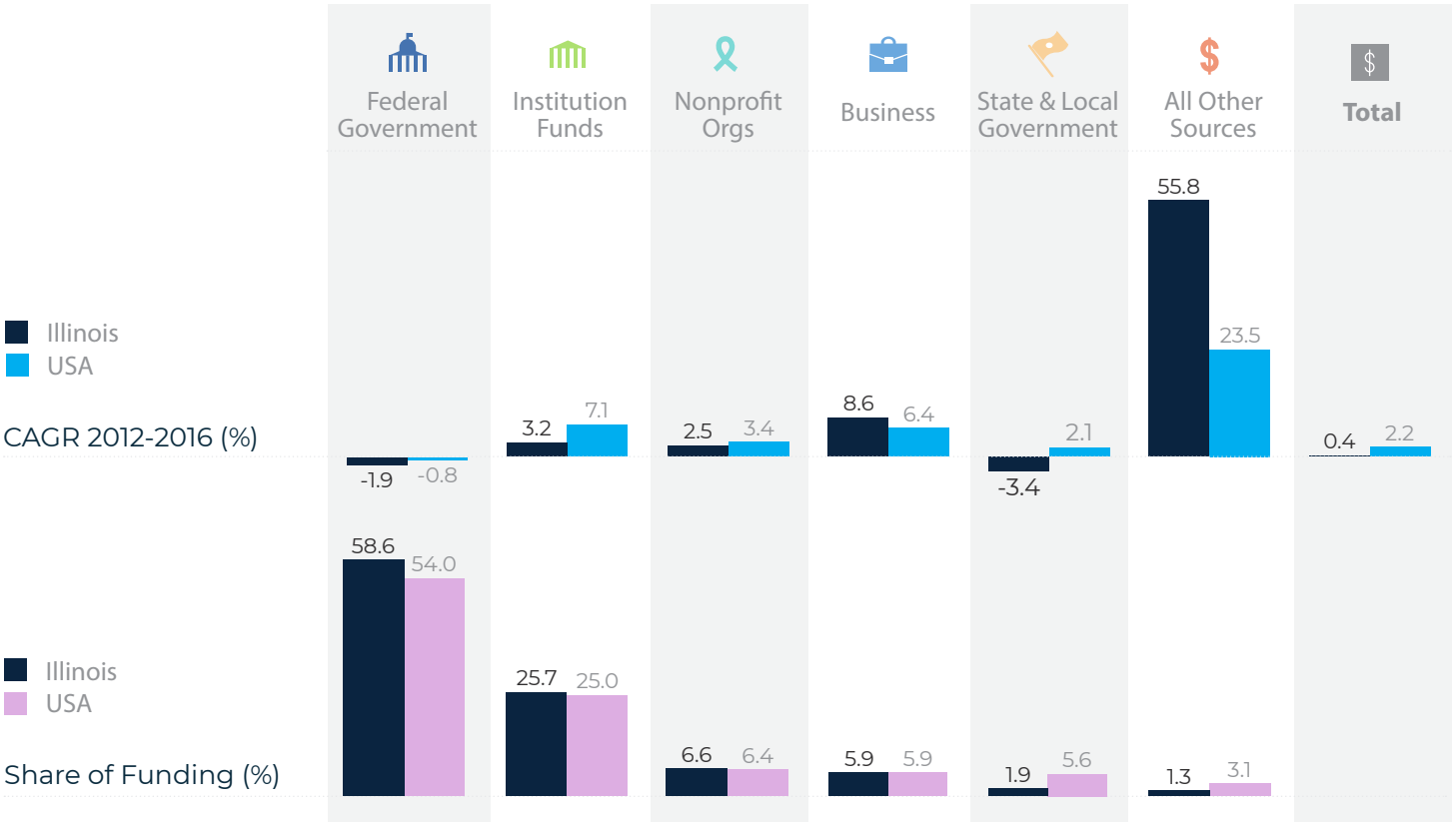
[12] Top universities by NSF funding

Academic R&D Funding by Source 2016 ($ million)

Source: National Science Foundation, Higher Education Research and Development Survey (HERD)

	Illinois ($ mln)	USA ($ mln)
Federal Government	1,406	38,794
Institution Funds	617	17,975
Nonprofit Organizations	158	4,615
Business	142	4,211
State & Local Government	47	4,025
All Other Sources	32	2,214
Total	2,401	71,833





Illinois also ranks 8th nationally in academic R&D funded by the business sector. Research activity funded by industry grew 8.6 percent annually between 2012 and 2016, faster than the national average of 6.4 percent. University-industry partnerships have been a focus of research universities across the state. Recent university-industry research partnerships include Northwestern University's partnership with Exelon for clean energy innovation; Abbott's partnership with the University of Illinois at Urbana-Champaign's Center for Nutrition, Learning, and Memory (CNLM); Abbvie and the University of Chicago's partnership to advance cancer research; and Caterpillar's partnership with the University of

Illinois at Chicago Innovation Center. University-industry research partnerships are also fostered by intermediary organizations like UI LABS and mHUB. In addition, the University of Illinois' proposed Discovery Partners Institute is envisioned to foster R&D partnerships with the university, where faculty and students work side-by-side with businesses to foster next-generation innovation in key sectors. Such partnerships will be key to Illinois' academic research growth in coming decades.

NEW $115 MILLION CENTER TO ADVANCE BIOENERGY RESEARCH

CABBI
CENTER FOR ADVANCED BIOENERGY AND BIOPRODUCTS INNOVATION

In 2017, The U.S. Department of Energy (DOE) announced funding for a new $115 million center for the advancement of bioenergy research to be housed at the University of Illinois at Urbana-Champaign (UIUC). Coined the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), the new center is a collaboration between UIUC's Institute for Sustainability, Energy, and Environment (iSEE) and the Carl R. Woese Institute for Genomic Biology (IGB). One of the major challenges of coming decades is how to provide sustainable sources of energy that meet societal needs as the population continues to grow. CABBI's goal is to develop efficient ways to grow, transform, and market biofuels and other bioproducts to help met future energy demands. In addition to resources within UIUC, the university is partnering with 17 other institutions to make CABBI possible, including other top-tier research universities and national laboratories.

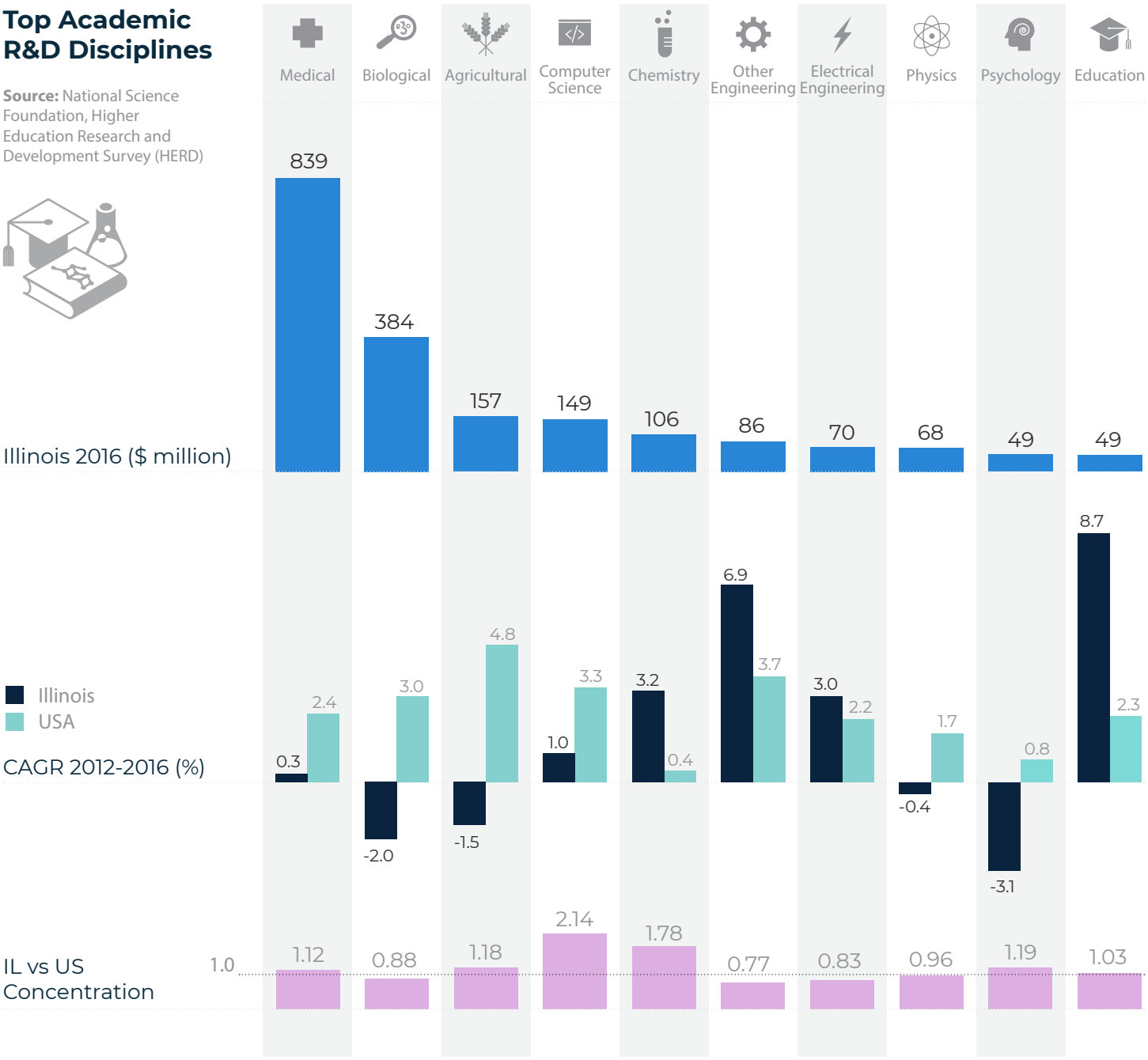
HEALTH & COMPUTER SCIENCE AMONG TOP ACADEMIC RESEARCH DISCIPLINES

Many of Illinois' strongest academic research disciplines align well with areas of business R&D and talent pipeline strength. These areas of strength include computer science (where the state's academic research concentration is more than twice the national average), as well as health-related fields like chemistry, medical sciences, and psychology. Illinois' strength in computer science research compliments the state's talent production in the field, which ranks 2nd nationally.[13] Academic research strength in health-related area's aligns well with Illinois' production of health STEM degrees and the state's robust pharmaceutical R&D activity. Overall, health-related fields account for around half of all academic research activity, both in Illinois and nationally.

[13] Illinois Innovation Index: 2017 Talent Issue

Top Academic R&D Disciplines

Source: National Science Foundation, Higher Education Research and Development Survey (HERD)



NEW INITIATIVES ADVANCING MEDICAL RESEARCH AT ILLINOIS UNIVERSITIES

THE UNIVERSITY OF CHICAGO

The Duchossois Family Institute at the University of Chicago Medicine

In 2017, the Duchossois Family Foundation announced a $100 million gift to University of Chicago (UChicago) Medicine to create the Duchossois Family Institute (DFI) at the University. The gift marks the largest single donation in the history of UChicago Medicine. DFI will advance research on interactions between the microbiome, genetics, and the immune system, with the goal of identifying and preventing diseases before they develop in patients. The Institute will allow faculty and students to focus on preventing disease by optimizing the body's own defenses and finding new ways to maintain well-being. In addition to research enabled by the DFI, the Institute will plug in to the expertise of the University's Polsky Center for Entrepreneurship and Innovation to bring breakthroughs to market through partnerships with industry, venture capitalists, government agencies, like-minded philanthropists and the public.

ILLINOIS

The University of Illinois Opens the Carle Illinois College of Medicine

In July, The Carle Illinois College of Medicine in Urbana-Champaign welcomed its first class of students. The new medical school is the first in the nation designed to heavily incorporate engineering and advanced technology into the curriculum. The new four-year medical school is a partnership between the University of Illinois at Urbana-Champaign and Carle Health System, based in Urbana. Though other medical schools incorporate engineering into the curriculum, the Carle Illinois College of Medicine is the first to make technology and engineering principles the foundation of four-year medical education, with each course designed by a scientist, a clinical scientist, and an engineer. The school received over 1,000 applications for 32 slots in its inaugural class, which will receive four years of free tuition.

UIC UNIVERSITY OF ILLINOIS AT CHICAGO

The University of Illinois at Chicago's Hub for Clinical and Translational Research

In 2016, the University of Illinois at Chicago (UIC) received $17.7m in grant funding from the National Institutes of Health continue the research efforts of the university's Center for Clinical and Translational Science (CCTS). The CCTS was first funded by the NIH in 2009 as part of the Clinical and Translational Science Award (CTSA) program. The CTSA network of over 60 medical research institutions—known as hubs—seek to accelerate the research process, enabling scientific discoveries to reach patients and populations faster. UIC's CCTS seeks to improve population health, particularly among minorities and underserved

populations. As one of the few U.S. universities with the full range of health science colleges—including the largest medical college in the country—UIC has provided fertile ground for the establishment and growth of the CCTS.

Illinois Institute of Technology Leads Grant to Create Visual Prosthesis

In 2017, the National Institutes of Health (NIH) awarded the Illinois Institute of Technology (IIT) a $11.8 million grant for the development of a visual aid device that would allow the blind to regain some vision-like capabilities. The device works by bypassing the retina and optic nerves, instead connecting directly to the visual cortex of the brain. Though there is currently no cure for blindness, this artificial vision system may be the best alternative form of treatment. IIT researchers will lead the NIH grant, which also includes researchers from six partner institutions; University of Chicago; Johns Hopkins University; University of Texas, Dallas; Sigenics, Inc; MicroProbes for Life Science; and the Chicago Lighthouse for the Blind and Visually Impaired. Researchers hope the outcome of the new grant project will be the evaluation of a first-of-its-kind intracortical visual prosthesis using novel implantable wireless stimulator devices.

Lakeside Discovery to Accelerate Northwestern Biomedical Research

In 2018, Northwestern University and Deerfield Management announced the launch of Lakeside Discovery, LLC. The new initiative will see Deerfield provide up to $65 million in targeted funding to help advance technologies created through Northwestern's biomedical research. Lakeside further expands Northwestern's commitment to innovation in therapeutics, nearly 30 years after the discovery of Lyrica on the university's campus. Over the past decade, Northwestern has captured more than $4.2 billion in National Institutes of Health funding. The collaboration between Deerfield and the university will add to an already thriving healthcare community in Chicago that includes top research institutions, major healthcare industry partners, and innovative tech spaces.

Rosalind Franklin Creates Disease-based Centers

Along with the university's new Innovation and Research Park, which is set to open in 2019, Rosalind Franklin University of Medicine and Science recently announced the creation of three new disease-based centers. These centers will be focused on genetic disorders, cancer cell biology, and proteomics and molecular therapeutics, respectively. Along with the university's new Brain Science Institute, these new centers will be housed at the Innovation and Research Park. Space for each center within the new facility will spur collaboration between university researchers and industry, with the ultimate goal of bringing new life-saving treatments to patents.

Southern Illinois University Edwardsville Developing Novel Treatment for Alzheimer's

Researchers at Southern Illinois University Edwardsville (SIUE) are developing novel small molecule therapeutics targeting Alzheimer's disease (AD). An estimated 5.4 million people in the U.S. have AD, projected to grow to 13.8 million by 2050 with economic impact estimated to reach $1 trillion. There is no cure for AD and new therapies are urgently needed. Preclinical evidence shows such small molecules reduce markers of AD pathological progression and enhance cognition. The targeted approach also limits peripheral side-effects, while impacting critical areas of the brain associated with AD. This research has been supported with more than $3 million in funding from the National Institutes of Health, National Institute on Aging.

ACADEMIC RESEARCH OUTPUT RISES

While expenditures measure input into the academic research process, academic articles and technology transfer metrics measure the innovation output of academic research.[13] Despite ranking 10th in academic research activity, Illinois ranks sixth nationally in academic article output, with 13,410 academic science and engineering articles in 2016. Illinois universities produced 5.9 articles per $1 million in research activity in 2016, compared with 4.6 nationally. Illinois ranks fourth nationally in articles per $1 million in research activity.[14]

Academic institutions in Illinois were awarded 241 patents in 2016, growing by 3 percent annually since 2012, compared with 8.3 percent annual growth nationally. Academic institutions in Illinois also disclosed 759 inventions and created 181 licenses or options agreements in 2016. Revenue from university licensing agreements reached $1.25 billion in Illinois from 2012-2016, ranking fourth among states.[15]

[14] Technology transfer is the process through which university research discoveries become commercially available.

[15] National Science Board: Science & Engineering Indicators 2018

[16] Data via the Association University of Technology Managers (AUTM). More on technology transfer can be found in the annual University Entrepreneurship Issue of the Index.

ILLINOIS' PATH FORWARD

Following the Great Recession, Illinois' R&D landscape has struggled to match the growth of many peer states. On the academic side, the state's budget impasse and subsequent uncertainty has undoubtedly slowed R&D growth at in-state public universities. This is especially evident among smaller public research universities, many of whom have been forced to curtail their research activities. On the business side, Illinois' three largest R&D sectors—chemicals, machinery, and computer & electronics—have seen either a decline in R&D activity, or growth that lags the national average. Despite these trends, strengths in Illinois' R&D landscape offer a pathway to growth.

Academic research strength in computer science mirrors the state's impressive talent production. However, these strengths have thus far not been mirrored in business sector R&D, where activity in related industries like computer & electronic products and information technology (IT) fails to match that of many peer states. To boost business sector R&D activity in these areas, universities should look to establish or expand research partnership with industry. For industry, such partnerships offer outside research expertise, new perspectives, and recruiting opportunities. For universities, partnering with industry can provide alternative funding sources, insight into trends, and special facilities. Such university-industry partnerships are already helping to amplify the state's medical and pharmaceutical research communities.

Moving forward, state support for innovation is critical. On the academic side, growth for Illinois' R&D landscape depends heavily on stable funding for the state's public universities. Funding certainty provides public universities with the ability to create long-term personnel, facility, and infrastructure plans that are necessary to attract outside funding and grow research activity. Beyond stable funding, the state can follow the lead of peer states to directly support academic research growth. This support might include initiatives to attract and retain star researchers, or direct investment to help spur growth in key research and innovation areas—such as biotech or computer science.

To attract and retain business R&D activity in Illinois, the state can demonstrate its commitment to growth by making the R&D tax credit permanent. Though the credit is currently in place, it has lapsed four times in the past 15 years, creating uncertainty for companies as they plan their R&D activity. In addition, the creation of a venture development organization in Illinois could help early-stage, R&D focused companies grow their research efforts. Finally, the state should look to promote the growth of wet lab space, which is currently in short supply, limiting life science research growth. Adding this lab space would provide both industry and university life science researchers with room to expand and launch new collaborative research partnerships. Taking these steps would provide a strong foundation for research growth in Illinois.

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ILLINOIS SCIENCE & TECHNOLOGY COALITION

The Illinois Science & Technology Coalition (ISTC) is a member-driven nonprofit that measures, connects, and enriches the Illinois innovation economy. Created by the State of Illinois over 25 years ago, we make powerful links between the state's universities, industry, startups, and government to strengthen our economy and talent pipeline through data collection, policy advocacy, and programs.

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