Energizing Wisconsin’s Economy

2015 Wisconsin Bioscience Economic Development Report
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Welcome to Biosciences of Wisconsin

Wisconsin is acclaimed for innovation in the biosciences with many success stories to validate this recognition. We pride ourselves on our entrepreneurial spirit, work ethic, and loyalty to our companies and to this state. Our goal is to discover new avenues of innovation and collaboration that catalyze economic growth and bring life-saving treatments to individuals across the world.

Our economic impact: For every one direct bioscience job, two more indirect jobs are created in Wisconsin. Wisconsin biosciences companies employ approximately 36,000 people with average wages that are 175% the average wage for all other industries. These multiplier effects are felt most strongly on additional jobs related to utilities, construction, transportation, and most strikingly—manufacturing. Our challenge is to create many more success stories and to expand our statewide economic impact.

Building on this success, Wisconsin has the potential for tremendous economic growth in the bioscience sector, but collaboration will be key. Our manufacturing and medical device sectors rely upon one another for long-term growth. The health IT and therapeutics sectors are dependent upon one another for healthcare delivery, and private industries are reliant on our academic and research systems for both the talent and innovative technologies they create.

The entire state of Wisconsin needs to foster collaborations between industry partners, research institutions, and policymakers for substantial bioscience economic development and industry growth.

I trust the data and information contained in this Wisconsin Biosciences Economic Development Report will energize everyone to take action and participate in exploring ways to translate more technologies into innovative healthcare, agricultural, and environmental products that improve the human condition and create a global impact. Wisconsin’s bioscience industry is well poised to meet tomorrow’s challenges that will also allow us to grow and bring prosperity to all.

Sincerely,
Lisa Johnson

CEO
BioForward
Executive Summary of the Wisconsin Biosciences Economic Development Report

Industry Environment
The Wisconsin Biosciences Economic Development Report, conducted by consulting firm Ernst and Young in 2015, found that the state’s bioscience industry currently comprises approximately 1,600 establishments and approximately 36,000 employees and has performed consistently with neighboring Midwestern States.

While the number of establishments and employees has remained steady, wages have been on the rise since 2008. The state’s major activity hubs are located in Milwaukee and Dane counties, home of companies that manufacture life science kits, agricultural biotechnology products, medical devices, diagnostics, and therapeutics plus provide health IT services.

These innovative bioscience and health IT companies play a major role in attracting and maintaining talent to our hub. Several bioscience companies founded in Wisconsin, such as TomoTherapy (Accuray), Cellular Dynamics (FujiFilm), and Tetronics (Sigma-Aldrich), have achieved significant success and are seen as validation of the commercialization of academic research. Alongside our startups, large “anchor” companies establish the perception of strong employment opportunities for recent graduates, adding to the draw of Wisconsin’s research universities.

Academic and Research Environment
Wisconsin boasts a strong academic base, with both the University of Wisconsin-Madison (UW-Madison) and a consortium of southeast Wisconsin schools in the Milwaukee area. Each region hosts translational research programs such as the Institute for Clinical and Transitional Research (ICTR) and the Clinical and Translational Science Institute (CTSI), which are closing the gap between academia and business. The universities continue to generate a strong talent pool and attract nearly $1 billion in bioscience research and development (R&D) funding from federal, state, and business sources. In addition to UW-Madison, the Milwaukee Medical Research Complex includes six institutes, driving strong medical research in Wisconsin. As a result, these research institutions have been a growing source of patents in the bioscience sector.

While overall funding for R&D has been strong and steadily increasing by 1% each year, there are opportunities for growth. Industry collaborations currently represent less than 3% of Wisconsin’s bioscience funding, but as neighboring states have shown, academic research and technology commercialization is a lucrative field to pursue.

Wisconsin has a number of established and emerging technology transfer programs, such as the Wisconsin Alumni Research Foundation (WARF), which have been instrumental in commercializing patents through the licensing of university research. Meanwhile, translational research programs are being developed at universities and non-academic research centers such as the Marshfield Clinic Research Foundation and Aurora Health Care. These aim to strengthen research-industry ties to advance technologies and therapies.

In this report, we will take a closer look at the multiplier effect the bioscience industry has on Wisconsin and how it can further expand to become the regional and national powerhouse in the field.
Investment Environment

Wisconsin has an active investment capital network, and has attracted outside financing and acquisition capital into both the bioscience and healthcare IT sectors. The angel community, in particular, has supported a number of deals annually, creating a positive environment for emerging companies. An example includes the Qualified New Business Venture (QNBV) program which accelerates funding for new businesses.

Angel investment in QNBV-certified companies has ranged from $8-$15 million across approximately 25 deals annually for the biotechnology and healthcare IT sectors. The Act 255 tax credit program has created a multiplier effect, drawing non-QNBV investments and grants to the tune of $766 million, in addition to the $269 million of total qualifying investments across all business sectors in the 2005-2013 period.

New businesses and early-stage companies also appear to be leveraging several federal programs (e.g., SBIR/STTR, Biomedical Advanced Research and Development Authority).

While Wisconsin appears to have a strong angel network, there is a perceived gap surrounding further types of investment capital including both debt and equity. Venture capital investment, for example, has been fairly inconsistent in the past and industry participants believe that there is an opportunity to better market and attract this type of funding at scale.

Several tech transfer programs (e.g., WARF, UWM Research Foundation, WiSys) and other mentorship programs (Merlin Mentors) are trying to bridge the gap between innovators and investors that occurs in other biotech investment hubs.

Economic Impact

In 2013, the total economic contribution of the bioscience industry in Wisconsin included almost $27 billion in economic output and $716 million in total state and local taxes. In 2013, the Wisconsin bioscience industry’s direct, indirect, and induced labor income contribution totaled $6.5 billion.

On the jobs front, the bioscience industry directly employed nearly 36,000 workers in Wisconsin in 2013 and indirectly contributed nearly 70,000 additional jobs to the state economy. The industry had an average employment multiplier of almost three, making it second to only energy in number of jobs created for each bioscience industry job. These workers were also well compensated—the average salary for bioscience positions is $73,241, exceeding the private sector average wage in Wisconsin by more than $30,000 and contributing over $6.5 billion in employee compensation in 2013.
Who is BioForward?

BioForward is a member-driven state association that serves as the primary voice of Wisconsin’s bioscience industry, through advocacy in government regulations and legislation, STEM education, and through demonstrating the positive impact the industry has on the state.

BioForward is a state chapter of the national Biotechnology Industry Organization (BIO) and has affiliations with PhRMA, MDMA, MITA, and AdvaMed. Founded in 1987, the entity comprises over 200 members across diverse sectors, including drug development, medical devices, research tools, biofuels, and food and agriculture.

What is BioForward’s Role?

BioForward works with its members to provide support and advocacy, and acts as a central resource for Wisconsin bioscience. The organization stands to play a pivotal role in driving success in the Wisconsin bioscience industry through these areas:

**INVESTMENT**

Opportunities exist for greater bioscience investment activity by changing the perception of the availability of funding resources and quality investment opportunities of emerging growth companies. BioForward actively markets investment opportunities to international bioscience hubs, highlights start-up success stories, and industry collaborations.

**ADVOCACY**

Driving consistent legislative focus at the state and federal levels towards bioscience and healthcare IT is also critical. To this end, BioForward fosters a close working relationship with national affiliations, such as BIO and AdvaMed, to advance federal initiatives and maintains a close working relationship with state entities to prioritize bioscience funding, tax, and policy proposals.

**NETWORKING/COLLABORATING**

With strong bioscience talent and patent growth from research/academic hubs, there is a need for Wisconsin to educate people on the resources and business knowledge available to commercialize academic research and ideas into viable businesses. BioForward cultivates new and existing channels to connect industry participants and commercial ventures.

**COMMUNICATIONS**

BioForward actively supports the ecosystem by promoting the activities of Wisconsin bioscience companies to develop the perception of a critical mass of existing bioscience talent and commercial activity in the state.
In 2013, the total economic contribution of the bioscience industry in Wisconsin included almost **$27 billion in economic output** and **$716 million in total state and local taxes**. In 2013, the Wisconsin bioscience industry’s direct, indirect, and induced labor income contribution totaled **$6.5 billion**.

Economic output is the broadest measure of economic activity and equivalent to sales for most industries. More specifically, it represents the sales related to bioscience firms (direct output), as well as the suppliers and service-industry firms that benefit from the spending of bioscience employees (indirect and induced output).

> “Although biosciences companies are primarily located in five counties, they are having a broad impact on industries across the state, including the manufacturing sector. This is due to our high concentration of medical and therapeutic device companies that source component parts from in-state companies.”

— CEO, Venture Capital Firm
Key Economic Indicators, Influence, and Impact

Total value of ecosystem in economic output – direct/indirect

Labor income includes wages, salaries, and benefits earned by bioscience employees, employees at supplier firms, and by employees at businesses where bioscience and supplier employees spend their earnings. In 2013, the industry’s direct, indirect, and induced labor income contributed $6.5 billion to the State.

The total state and local tax contribution of the Wisconsin bioscience industry was $716 million in 2013, including state and local property, sales and use, excise, individual and corporate income, license, and other taxes.

Total employment, as measured by full- and part-time workers in the State’s bioscience industry, was over 105,000 in 2013. This includes workers directly employed by bioscience firms, by suppliers, and at companies, such as restaurants and clothing stores, where employees spend their earnings.
Average annual compensation

The average annual compensation in bioscience-related employment is **175% higher** than the overall private sector average, and has exhibited moderate growth over the past few years since the recession. While the medical device and equipment segment of the bioscience industry in Wisconsin has seen a decline in firms and employment, average wages are on the rise and are the highest in the bioscience fields. Overall bioscience pay has risen and should provide further incentive for new graduates to join the industry.

Top 5 Wisconsin Counties

Bioscience establishments are represented in 70 out of the 72 counties in Wisconsin. The major hubs of bioscience activity in Wisconsin appear to be focused in the Madison and Milwaukee regions where many research, medical device, and pharmaceutical companies are located. The counties in Wisconsin with the highest levels of bioscience activity are Dane, Milwaukee, Waukesha, Brown, and Eau Claire. Research, testing, and medical laboratories make up 65% of the bioscience and healthcare IT employment in Dane County, while medical devices and equipment make up 52% in Milwaukee County. Epic Systems Corporation, the electronic health record software company, is located in Dane County, and GE Healthcare, a major producer of medical devices and equipment, takes up residence in Milwaukee and Waukesha Counties.
Broad Range of Emerging and Mature Companies

The bioscience industry in Wisconsin is represented by a mix of sectors with successful emerging growth companies and large business supported by strong academic and research institutes. Examples include:

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![Graph showing bioscience and healthcare IT activity in Top 5 Wisconsin Counties by Revenue.](image)
Leading Bioscience Companies

Leading bioscience companies in Wisconsin play a major role in attracting talent and creating regional hubs of bioscience activity.

**Thermo Fisher Scientific**

Thermo Fisher Scientific brings in an impressive $17 billion in global sales, $4.2 billion of which are in the life sciences. With a workforce of 700 employees in Madison, the analytical instruments and specialty diagnostics company has been operating since 1956 and acquired Life Technologies Corporation in 2014.

**Promega**

Promega manufactures products to support molecular diagnostics and human identification. Its Madison headquarters employs 700. With $360 million in sales, Promega has a global reach with branches in 16 countries and more than 50 international distributors serving 100 countries.

**Accuray**

Accuray, formerly known as Tomo-Therapy, was founded in 1997 and develops, manufactures, and sells the Hi Art treatment system, a radiation therapy system for the treatment of various cancers. In 2011, TomoTherapy was acquired by the Sunnyvale, Calif.-based Accuray for $277 million; however, its core research, development and manufacturing bases are anchored in Madison.

**Aldrich Chemical Company**

Aldrich Chemical Company of Milwaukee merged with Sigma Chemical Company of St. Louis in 1975 to form Sigma-Aldrich. Now a $2.8 billion dollar corporation, it employs more than 1,400 people in Wisconsin who are based out of Milwaukee, Madison, and Sheboygan. The life science and hi-tech company focuses on enhancing human health and safety and is a manufacturer and distributor of chemicals, biochemicals, and other products.

**Epic**

Epic is a $2 billion dollar healthcare software company that attracts talent from Wisconsin and the coasts. Employing more than 7,800 people, the company is located in Verona, Wisconsin and sells integrated electronic medical records (EMR) and revenue cycle management (RCM) systems.

**GE Healthcare**

GE Healthcare has its Life Care Solutions, Magnetic Resonance, and Molecular Imaging and Computed Tomography operations in Wisconsin, in Madison and Waukesha. According to its economic impact study, GE Healthcare directly and indirectly generates $3.8 billion per year in Wisconsin, creating and supporting more than 21,000 jobs.
Key Industry Drivers

What are the most important factors that drive companies’ decision to invest in a state? At the top of the list, according to bioscience industry participants, is the availability of high-quality talent. Next on the checklist is whether the academic and research environment can provide an existing pool of talent and ideas for investors to tap into. After that, they look at a state’s capital and available resources, which are critical for getting early-stage companies off the ground. The last important factor to evaluate is the state’s tax, legislative, and regulatory climate. Entrepreneurs and investors view state policies as vital to promoting investment.
The Importance of Research Institutions in Wisconsin’s Ecosystem

Within Wisconsin’s borders are nearly 50 academic and research institutions that not only turn out talented graduates, but also serve as a rich environment to generate ideas and technologies that are translated into commercial products. Universities are also a magnet for bioscience investment because they provide human capital, intellectual property, and research funding.

The Wisconsin Research Engine

With over $1 billion in annual research expenditure, the University of Wisconsin-Madison is seen as a major draw card for potential investors. In conjunction with local entrepreneurial initiatives and other academic institutions, it drives and sustains talent and investment in biosciences.

Partner organizations such as Wisconsin Alumni Research Foundation (WARF) promote technology transfer and research commercialization. Annual innovation days and competitions further foster an entrepreneurial environment and serve as conduits through which employers can identify high caliber students for future employment. The UW-Madison campus offers over 35 graduate programs that span the entire bioscience field.

Bioscience Research Expenditures

Academic institutions in Wisconsin have historically placed a strong focus on bioscience research, and industry participants expect the trend to continue, fueling a continuous stream of innovation and talent.

Funding of bioscience research has remained steady over the past five years; however, bioengineering and biological engineering have seen a surge. Between 2010 and 2013, the amount of funding for those areas more than tripled, from $7 million to $22 million.

While federally financed programs remain the main source of funding, universities and industry sources have driven growth in the funding of R&D programs since 2010. Although the United States still lags behind other countries, including China and Germany, in terms of industry investment, this is a growing source of funds for academic institutions. In the face of declining external funding, colleges and universities are increasingly devoting their own institutional funds toward their R&D efforts.

Similar to other states, R&D expenditures in Wisconsin are mostly funded by federal agencies and institutions; however, Wisconsin has an opportunity to increase funding through industry collaborations.
Degrees Conferred in Biosciences

Wisconsin’s pool of talent is steadily growing, with the number of bioscience and computer science degrees increasing by 4% every year since 2009. Graduates with computer science degrees support a robust healthcare IT industry. In addition, there is a high growth of degrees conferred in key subsectors: life sciences, medical and veterinary science, agriculture, and food and nutrition.

“Wisconsin is one of the capitals of life sciences in the country. We have large medical schools, agriculture schools, and pharmacy schools. Engineering is even geared toward biology and bioengineering...We have more than 35 bioscience majors in Wisconsin [the UW system], and we are the number one state by number of STEM degrees,” said a director of medical engineering at the Morgridge Institute.

Industry participants mention that Wisconsin universities are able to generate a strong talent pool; however, they perceive much of this talent to be lost to coastal hubs. Some say that despite the high quality of the schools, a large fraction of graduates move away because of the perception of a lack of economic opportunity. However, the tides have shifted recently and local job optimism has improved, directly impacting Wisconsin’s ability to retain talented bioscience graduates.

“We are retaining more talent than we used to because of positions available in companies. We used to train people and then lose them because they felt there weren’t that many jobs. In today’s environment, Wisconsin is increasingly a place where employees feel they can grow and succeed in the bioscience field.”

— CEO, Wisconsin bioscience company
Driving Entrepreneurial and Start-up Efforts

Patents Published

The emphasis on research funding at Wisconsin universities has driven growth in bioscience patents through 2014, peaking in 2013 with 754 patents filed. Patents published in Wisconsin have grown at a double digit pace since 2009, consistent with other Midwestern states. Despite the increase, industry participants stated that, broadly speaking, the national environment has become more challenging in recent years, with patents more difficult to obtain. Wisconsin has been impacted by the same trend.

Wisconsin has had 3,000 patents granted over the past 5 years.

Technology Transfer

Situational Analysis

Technology transfer and commercialization programs provide an invaluable resource for students and academics to convert their ideas into viable enterprises.

For example, many successful startups were established through technologies licensed from the Wisconsin Alumni Research Foundation (WARF), including TomoTherapy, NimbleGen, Mirius Bio, and FluGen.

“There are a lot of untapped talent and ideas here that are ready for take-off. We provide mentoring for startups. There’s the physical space that we provide, but we’re also helping with accessing capital and advice.”

—CEO, Innovation Accelerator
Strength of Wisconsin Angel Investors

In addition to federal and state funding programs, Wisconsin’s angel community has historically supported a number of deals, creating a positive environment for emerging bioscience companies. The angel investment community is perceived as a boon to emerging companies; however, there has been an inconsistent pipeline investment and a perception of a lack of strong start-up activity in the state.

Flow of Capital into Startups

Venture capital investment and deals have grown since 2009, albeit inconsistently. Industry participants believe there is an opportunity to market bioscience to funds to generate greater activity. While Wisconsin’s average deal size is consistent with most Midwestern states, some of the larger states have seen a greater number of deals. Wisconsin’s deal environment lags behind that of its neighbors and would benefit from outreach to the broader venture capital community and promotion of the local investment opportunities. In order to drive its bioscience industry, Wisconsin needs to actively promote its large, high-caliber investment opportunities to attract national venture capital funds and other private equity financing.

Building Value to Last: Business Success Stories

Several companies in Wisconsin have successfully attracted funding.

**Stratatech** was formed to commercialize a discovery made at UW-Madison, developing regenerative skin tissue for therapeutic and research uses. The company received $47.2 million in grant funding from federal grant provider BARDA. The five-year award will support the preclinical, clinical, regulatory, and technological development activities needed to gain FDA approval for StrataGraft, a skin tissue to treat thermal burn injuries. This demonstrates that there is opportunity for other bioscience companies in Wisconsin to receive funding from specialized government agencies such as BARDA, advancing their own technologies.

**Cellular Dynamics International (CDI)** was acquired for $307 million in 2015, as its buyer, FujiFilm, sought entry into the area of cell-based drug discovery support services. CDI’s products are used by biopharmaceutical companies for drug discovery and screening, to test the safety and efficacy of small molecule and biological drug candidates, for stem cell banking, and in the R&D of cellular therapeutics. This demonstrates Wisconsin’s biotech capabilities and attractiveness to international investors.

**Dohmen Company**, which was founded as a family business in 1858 in Milwaukee, is a fitting example of a success story. Dohmen provides intelligent outsourcing solutions to the life science industry, enabling clients to accelerate growth, preserve capital, and minimize risk. Within the past three years Dohmen has acquired eight additional companies and combined five, creating a new model known as Dohmen Life Science Services. This demonstrates the ability of established Wisconsin firms to undertake aggressive inorganic growth strategies and target both Wisconsin-based, and out of state, companies for acquisition.

In the past, high-potential start-ups acquired by larger bioscience companies typically moved operations out of Wisconsin; however, a number of companies have decided to stay in Wisconsin and now provide the strong bioscience talent and environment the state requires.

Select examples of companies that decided to stay in Wisconsin:

- TomoTherapy, acquired by Accuray
- Epicentre, acquired by Illumina
- Danisco, acquired by DuPont
Summary and Conclusions

As this white paper detailed, the bioscience industry in Wisconsin is vibrant, growing, and economically prosperous. The trends point to steady growth for both firms and employees, with wages predicted to see moderate growth. Leading bioscience companies continue to attract talent and create regional hubs of bioscience activity. Wisconsin’s strong academic base generates a highly skilled talent pool and a rich research environment with funding, as well as many opportunities to bridge innovative ideas with commercial business. Wisconsin enjoys an active investment capital network that supports start-up activity in the bioscience and health IT sectors. Additionally, new start-up businesses and early-stage companies are taking advantage of both federal funding programs that Wisconsin offers. Key areas of expansion include more focused efforts to attract international industry collaborations.

The bioscience industry in Wisconsin is making a large impact on the state’s economy by creating jobs, generating tax revenue, and attracting new business to the state.
Appendix

Estimation Economic Contribution Approach

Total economic contributions (direct, indirect, and induced) of the biosciences industry were estimated using a combination of publicly available data and the 2013 IMPLAN economic model of Wisconsin.

- Publicly available data were used to estimate the following direct economic contributions of bioscience:
  - The Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) provided estimates of employment and wages in the NAICS sectors that make up the bioscience industry
  - State and local contributions were estimated using tax collections data reported to the U.S. Census in annual State and Local Finance surveys.

- IMPLAN was used to estimate direct output in the bioscience industry and the indirect and induced effects:
  - Output (sales) was estimated using output per worker ratios by industry provided by IMPLAN. These ratios were compared to national ratios by industry estimated by the Bureau of Economic Analysis. Adjustments were made to certain industry segments to reduce output per worker data in the IMPLAN model to reflect more conservative national averages
  - IMPLAN is an “input-output” economic model that identifies the complex flows from producers to intermediate and final consumers within a region to calculate a set of “multipliers” that estimate the indirect and induced economic activity due to direct spending and employment in the bioscience industry. The state economic multipliers for indirect and induced impacts are driven by the input purchases by bioscience firms in the state, the percentage of each type of commodity that is purchased within Wisconsin, and household consumption patterns of employees.

Relevant NAICS Codes by Segment

Agricultural Feedstock and Chemicals
- Wet corn milling (311221)
- Soybean processing (311222)
- Other oilseed processing (311223)
- Ethyl alcohol manufacturing (325193)
- All other basic organic chemical manufacturing (325199)*
- Cellulosic organic fiber manufacturing (325221)
- Nitrogenous fertilizer manufacturing (325311)
- Phosphatic fertilizer manufacturing (325312)
- Fertilizer (mixing only) manufacturing (325314)
- Pesticide and other chemical manufacturing (325320)

Bioscience-Related Distribution
- Medical, dental, and hospital equipment and supplies merchant wholesalers (423450)
- Drugs and druggists’ sundries merchant wholesalers (424210)
- Farm supplies merchant wholesalers (424910)
Drugs and Pharmaceuticals
• Medicinal and botanical manufacturing (325411)
• Pharmaceutical preparation manufacturing (325412)
• In-vitro diagnostic substance manufacturing (325413)
• Other biological product manufacturing (325414)

Medical Devices and Equipment
• Electro-medical apparatus manufacturing (334510)
• Analytical laboratory instrument manufacturing (334516)
• Irradiation apparatus manufacturing (334517)
• Surgical and medical instrument manufacturing (339112)
• Surgical appliance and supplies manufacturing (339113)
• Dental equipment and supplies manufacturing (339114)
• Ophthalmic goods manufacturing (339115)*
• Dental laboratories (339116)*

Research, Testing and Medical Laboratories
• Testing Labs (541380)
• R&D in biotechnology (541711)
• R&D in the physical, engineering and life sciences
  (except biotech) (541712)
• Medical laboratories (621511)
• Diagnostic imaging centers (621512)*
• Software publishers (511210)*

Source: Based on Battelle industry selection

Note: *Included in this analysis but not included in 2014 Battelle definitions
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www.ey.com

About Wisconsin Economic Development Corporation (WEDC)
As Wisconsin’s lead economic development agency, with more than 600 regional and local partners, the WEDC fosters the cooperation necessary to support job creation. Our collaborative, customer-centric approach aligns resources, partners, and industries to accelerate long-term, sustainable growth. As a public-private entity formed to drive business development in Wisconsin, we are uniquely positioned to deploy funds where they are most needed to maximize economic opportunity.

www.inwisconsin.com

About BioForward
As Wisconsin’s voice in the bioscience industry bringing together companies and academic institutions, we advocate actively on our members’ behalf for public policy that supports the industry, build networks that drive innovation and economic development, and promote the sector throughout the world. We are leading the way in the bioscience ecosystem to support the translation of research into commercial applications that address unmet needs.

www.bioforward.org