STL MADE

GREATER ST. LOUIS PLANT AND AGRICULTURAL SCIENCES SUMMARY

ALLIANCESTL
St. Louis Regional Economic Development

OVERVIEW

Greater St. Louis is home to a world-class aggregation of research centers, institutions and companies focused on engineering biological and agricultural processes to create products that help sustain the global population.

St. Louis location provides access to the nation's agricultural wealth. According to the U.S. Department of Agriculture, about 77% of all U.S. corn acres and 81% of all U.S. soybean acres are within 500 miles of St. Louis. The region has a long history as a business center that supports the surrounding agricultural economy.

EDUCATIONAL INSTITUTIONS

Washington University in St. Louis (www.wustl.edu), is a national powerhouse in biomedical research. It has been a perennial top ten recipient of National Institutes of Health grants. Washington University was ranked 19th among the Top American Research Universities in 2018 by the Center for Measuring University Performance.[i] Washington University School of Medicine was ranked 6th in the nation for research in 2021.[ii]

The Washington University Biology Department includes the Jeanette Goldfarb Plant Growth Facility, Natural Sciences Learning Center, Departmental Imaging Center, DNA Sequencing Facility and 2,000-acre Tyson Research Center.

The **Genome Institute at Washington University,** (http://genome.wustl.edu), one of three major genome centers in the United States, focuses on the large-scale generation and analysis of DNA sequences. The Institute plays a leadership role in The Human Genome Project which is constructing the clone map. The Genome Institute contributed to 25% of the finished sequence. To better understand the human genome sequence and to advance the study of biology, the center sequenced the genomes of other species. The Genome Institute has also been involved with the Maize Project, Non-Human Primates, Human Gut Microbiome Initiative, The Cancer Genome Atlas and Genomics of Acute Myelogenous Leukemia. The Genome Institute is also sequencing and analyzing the genomes of various plant and animal pathogens.

The Maize Project involved sequencing the corn genome. The Genome Institute was the lead institution for this project. They were sponsored by the National Science Foundation, the U.S. Department of Energy and the U.S. Department of Agriculture.

Saint Louis University (www.slu.edu) opened the $80.5 million Edward A. Doisy Research Center in 2007 to focus on research in the health sciences.

SLU's Biology Department works with the Donald Danforth Plant Science Center, Missouri Botanical Garden and St. Louis Zoo. They also conduct research at their Reis Biological Field Station.

Southern Illinois University Edwardsville (www.siue.edu) – has approximately 600 undergraduate and graduate level students in its biology program. The 35-acre Gardens at SIUE is designated as a Signature Garden by the Missouri Botanical Garden and serves as a laboratory for research and conservation.

University of Missouri – St. Louis (www.umsl.edu) is home to the Whitney R. Harris World Ecology Center. The Center focuses on conservation of tropical and temperate ecosystems. Partnerships with the Missouri Botanical Garden and St. Louis Zoo enhance their graduate biology programs.

Innovative Technology Enterprises (ITE) (www.ite-stl.org), is a life science convergence facility. It is located by the UMSL campus, Lambert-St. Louis International Airport and within minutes from area hospitals and other incubators. IT Enterprises, a 56,300-square-foot incubator, houses multiple startup companies in the high-growth fields of information technology and life sciences, providing necessary wet lab space, bench space and supercomputing.

KEY PLANT RESEARCH AND AGRIBUSINESS COMPANIES

Bayer is a world pioneer in plant biotechnology and genomics. Bayer consolidated their Global Seeds & Traits Headquarters in their Crop Science Division in St. Louis after their acquisition of Monsanto with its 4,900 regional employees. In 2017, Monsanto invested $1.5 billion in research and development.[iii]

DuPont Pioneer is the agricultural business arm of DowDuPont, a seed manufacturer for farmers in more than 90 countries. In 2017, Pioneer collaborated with the Donald Danforth Plant Science Center to research and improve food security crops, like teff, sorghum and millet. The partnership will greatly enhance the current state of "nutrition and economic stability for smallholder farmers and their families.[iv]

KWS SAAT AG, one of the four world leading plant breeding companies, selected St. Louis in 2014 as the location for its U.S. Plant Research Center. The Center is staffed by scientists in the areas of plant molecular biology, plant physiology, plant cell and developmental biology and bioinformatics. KWS is the fifth largest seed producer worldwide based on sales.

MilliporeSigma (formerly Sigma-Aldrich), part of Merck KGaA, is the world's largest producer of biochemical and organic chemical products. They offer over 150,000 different products to researchers and manufacturers through their operations in 40 countries and St. Louis location. In 2014, Merck acquired Sigma-Aldrich for $17 billion. St. Louis is home to MilliporeSigma's largest employment base, with more than 2,000 employees in the Greater St. Louis area. The company plans to redevelop their headquarters in downtown St. Louis, ultimately moving 100 jobs from outside St. Louis City and St. Louis County.[v]

SELECTED START UPS

Benson Hill Health Systems is a research and development company working to "unlock the natural genetic potential of plants."[vi] One of its major current projects is developing CropOS, a platform which "integrates crop data and analytics" to "unlock the global genetic potential of plants"- harnessing the power of information technology to advance sustainable agriculture.[vii]

They are planning an expanded headquarters in the new 160,000 square foot EDGE@BRDG building after receiving a $65 million venture capital investment led by Google Ventures in 2018.[viii]

CoFactor Genomics is a DNA sequencing company, which has just opened a new headquarters in the CORTEX district. Formerly of the Human Genome Project at Washington University in St. Louis, CoFactor's scientists are currently working on utilizing the power of RNA to develop treatments for cancer, termed immune-oncology.

NewLeaf Symbiotics is a research and development company working to introduce beneficial plant bacteria to corn, soybean, wheat and other crops. The company develops solutions and seed technologies to increase crop yield and reduce pesticides' negative impact on the environment. The agricultural startup recently announced plans to expand the square footage of its R&D facility in St. Louis.[ix]

Edison Agrosciences is an innovative agricultural company that develops technology to assist with the production plant-based industrial materials. After receiving funding from BioGenerator and Missouri Technology Corp, the company moved its headquarters from North Carolina to St. Louis. The company recently announced its new rubber technology, named HAYSTACK, which will help the company be "more efficient in finding rubber production genes in sunflowers."[x] Finding an alternative source to rubber trees, which are often in short supply, may reduce shortages.

Evogene is an Israeli-based company focusing on research involving seeds, chemicals and bio-pesticides. The company hosts and collects data for biological questions and organizes the information into four main databases. In 2016, the biotech company opened a research facility at the Bio-Research and Development Growth park.[xi]

RESEARCH & INNOVATION ORGANIZATIONS

The St. Louis area is strongly committed and united in its effort to drive the industry forward. Since 2001, the area's top civic and academic leaders have worked to coordinate the area's development as a center for research and commercial activity in the plant and medical sciences. These efforts have culminated in the formation of **BioSTL** (http://biostl.org) dedicated to fostering research and commercialization through investment and collaboration.

39 North (39northstl.com) – 39 North is a new 600 acre innovation district connecting the Danforth Center, BRDG Park, Bayer Crop Science, the Helix Center Incubator, Yield Lab and more than 50 companies. The Master Plan for the District was launched in 2016, and more than $8 million in infrastructure projects are underway.

Donald Danforth Plant Science Center (www.danforthcenter.org) Founded in 1998, the Donald Danforth Plant Science Center is a nonprofit research institute with a mission to improve the human condition through plant science. The Center's has more than 350 employees from more than 20 countries and 26 scientific teams. Center scientists are plant biologists, computer scientists, engineers, statisticians and educators who have collaborative research projects around the globe. In addition, the Danforth Center's $50 million in core facilities such as research grade greenhouses serve as a resource to agtech commercial enterprises.

Bio-Research and Development Park (BRDG Park) (www.brdg-park.com) – The Bio Research & Development Growth (BRDG) Park at the Donald Danforth Plant Science Center helps companies span the transition from innovative ideas to commercial success. BRDG and EDGE@BRDG cover 270,000 square feet and serve as a vital resource to startups, mid-stage companies, and international companies that have established their North American headquarters in our ecosystem, an on-site workforce training and equipment loan program, and as a beacon for attracting talent and investment. Tenants have access to more than $50M in core technologies at the Danforth Center and interactions with some of the world's top scientists.

AgTech Next (www.agtechnext.org) – AgTech NEXT is an annual event for industry leaders, investors and entrepreneurs who will gather to debate, collaborate and unite to tackle questions of national and global importance including food production, soil health, food sustainability, food waste, and food security. The 2020 event theme is "Risks and Rewards" and will be held on May 4 – 6 at the Danforth Center.

Helix Center (www.helixcenter.com) – The St. Louis Economic Development Partnership operates this incubator near the Danforth Plant Science Center. Helix Center has both wet and dry labs, office space and access to shared resources at the Danforth Center. There is a related Helix Fund that provides seed money through equity co-investments, loans and grants.

Yield Lab is a St. Louis business accelerator that invests $100,000 venture capital investments in several ag-tech startups annually. The Yield Lab was cofounded in 2014 by the former CEO of NOVUS International, a major St. Louis based animal health and nutrition operation.[xii] Yield Lab supports these startups with funding, mentoring and support. At the Yield Lab, they have made it their mission to enable entrepreneurs to sustainably revolutionize agri-food systems. Yield Lab has expanded to locations in Argentina, Ireland and Singapore.[xiii]

BioSTL (www.biostl.org) was formed in 2001 as a regional organization to promote the development of biosciences in Greater St. Louis through a range of initiatives. Programs include startup creation and investment (BioGenerator), strategic business attraction (GlobalSTL), physical environment (including the Cortex Innovation District and BioGenerator Labs), entrepreneur support (BioSTL Fundamentals), venture capital, workforce, and public policy.[xiv] In 2019, BioSTL announced plans for a $44 million renovation of the Crescent building in Cortex that will house its accelerator, BioGenerator and its other startups under one roof. Once completed, it will offer office and lab space for bioscience companies.[xv]

BioGenerator (www.biogenerator.org) is a virtual commercialization and technology transfer center under the direction of BioSTL. BioGenerator provides assistance, space and often seed funding to promising, early stage biotech companies.

The Cortex Innovation Community *(www.cortexstl.com)* is a collaboration of Washington University in St. Louis, Saint Louis University, University of Missouri-St. Louis, Barnes-Jewish Hospital Foundation and the Missouri Botanical Gardens. It is building one of the nation's largest innovation districts in the area between the medical schools of Washington University and Saint Louis University. That area contains one of the highest concentrations of NIH-funded scientists in the U.S.

The 200-acre Cortex innovation district is home to 425 companies[xvi] and almost $1 billion in private investment from 2015-18, including a $100 million investment by **Wexford Science and Technology**, out of what is projected to be a mixed-use development with 750 companies and 15,000 employees.[xvii] Julie Wagner, *nonresident senior fellow at Brookings and president of the Global Institute on Innovation Districts,* is quoted as, "Cortex is no longer a strong example of an innovation district in the U.S.; it is now held up as a model for districts around the world. The reason for this is that the story of St Louis embodied what so many other districts and their regions are currently facing: a weak real estate market, limited VC investment, a tendency for startups to leave to more capital- and ecosystem-rich locales. Cortex, while more than a decade in the making, tells the world what can happen with strong, risk-taking leadership and deep intentional moves to stimulate their local and regional economy."[xviii]

Cambridge Innovation Center opened its first location outside of Boston with 30,000 sq.ft. in Cortex. In 2014, they expanded to an additional 87,000 sq.ft. as they took over the management of the Center for Emerging Technologies, a 92,000-square-foot incubator that develops startup companies in biotechnology, biomedical engineering, advanced materials and electronics. CET was previously recognized by the National Business Incubation Association as one of the top 10 incubators in the country. The formation of CIC@CET in June 2014 allows local entrepreneurs to benefit from the innovative potential of both facilities.[xix] Venture Café, held at Cortex Commons, is the largest weekly innovation event in the world.[xx] Dougan Sherwood, the Managing Director of CIC's St. Louis branch, is confident the region as a whole will benefit from the opportunities emerging at Cortex: *"We're completely doubling down on this whole idea of St. Louis being this incredible place for entrepreneurship and innovation."*[xxi]

Missouri Botanical Garden (www.mobot.org) is one of the three leading research-oriented botanical institutions in the world, which operates the world's most aggressive research programs in tropical botany and which employs about 30 Ph.D. botanists in research in St. Louis and another 20 around the world.

The Missouri Research Park is the St. Louis region's first business park exclusively designed for technology and research companies. The 200-acre research and development park currently employs more than 2,000 individuals. It is home to Novus International Research Center, AFB International, among other agricultural and biotechnology companies.

T-REX (http://downtowntrex.com) is a premier tech business incubator in Downtown St. Louis. Formed in 2012, T-REX has their own 800,000 sq. ft. building. It is comprised of 5 floors of offices, conference, flex and events space. Over 100 startups as well as several support and funding organizations are housed here. Startups have access to shared space, gigabit fiber, mentoring and other support.

ST. LOUIS PLANT SCIENCE ASSOCIATION HEADQUARTERS

American Soybean Association (www.oilseeds.org) Represents U.S. soybean farmers through policy advocacy and international market development. The ASA is the collective voice of over 21,000 U.S soybean producers across the United States.

Botanical Society of America (http://botany.org) The BSA was formed in 1893 to promote the study of botany and research into plant uses. BSA relocated to St. Louis in 2003. Their mission is to promote botany, the field of basic science dealing with the study and inquiry into the form, function, development, diversity, reproduction, evolution and uses of plants and their interactions within the biosphere.

Missouri Botanical Garden (www.mobot.org) Botanical garden and research center. The Missouri Botanical Garden seeks to inspire and educate all members of our local region about the benefits of being good environmental stewards through responsible and sustainable use of natural resources.

National Corn Growers Association (www.ncga.com) Association advocating the interests of its members in such areas as ethanol and co-products, biotechnology, research and business development, farm and rural development, trade and transportation.

National Corn-to-Ethanol Research Center (www.ethanolresearch.com) Ethanol research institute. The NCERC conducts research and findings for industrial and institutional clients. Their mission is to facilitate the commercialization of new technologies for producing fuel ethanol more effectively.

St. Louis Agribusiness Club (www.stlouisagclub.org) - Regional Agribusiness group. The club provides educational, networking and professional development for members.

United Soybean Board (www.unitedsoybean.org) Soybeans research and promotion organization. The 73 farmer-directors of USB oversee the investments of the soy checkoff to maximize profit opportunities for all U.S. soybean farmers.

U.S. Soybean Export Council (www.ussoyexports.org) Connects producers with opportunities to improve human nutrition and livestock production. This council helps build a preference for U.S. soybeans and soybean products.

World Agricultural Forum (www.worldagforum.org) The WAF provides a platform for dialogue between those who can impact agriculture, sustaining the lives and livelihood of the world's population by meeting the growing needs for food, fuel and fiber.

GREATER ST. LOUIS PATENT ACTIVITY

Greater St. Louis has a significant flow of patent applications. Data on utility patents granted from 2011 to 2015 show 3,830 utility patents granted originating in Greater St. Louis, ranking 31st among U.S. metro areas. In 2015, Greater St. Louis was 34th among U.S. metro areas with 779 patents.[xxii]

Within the utility patents granted from 2011-2015 that originated in Greater St. Louis, the following table lists the top four, all related to the significant health care and plant research conducted in the region.

Top Five Areas of Utility Patents by Technology – St. Louis, MO-IL MSA[xxiii]

Class	Technology Class	2011	2012	2013	2014	2015	Total
800	Multicellular Living Organisms and Unmodified Parts Thereof and Related Processes	34	46	42	72	62	256
532	Organic Compounds (includes Classes 532-570)	21	39	37	27	22	146
435	Chemistry: Molecular Biology and Microbiology	32	17	29	14	28	120
047	Plant Husbandry	11	13	15	4	6	49

In several specific technology classes, where Greater St. Louis has significant research efforts, the metro is highly ranked in the number of utility patents granted from 2000 to 2015. The following table provides two selected examples.

These rankings demonstrate our specialized focus on plant sciences and biotechnology. It also shows the cities commitment to research and development in the fields of bioscience and agriculture. To put it in perspective, St. Louis MSA's 287 plant husbandry patents is more than four times the amount of the second most (Los Angeles MSA).

Top Ranked Areas of Utility Patents by Technology – St. Louis, MO-IL MSA

MSA Rank	Class	Technology Class	Patents Granted 2000 – 2015
1st	047	Plant Husbandry	287
3rd	504	Plant Protecting and Regulating Compositions	63

SUMMARY

A recent article cites multiple sources that have recognized St. Louis' progress and innovation in plant sciences, including Forbes and the Brookings Institution. In the article, President of BioSTL Don Rubin remarks that, *"Not only are there tremendous assets in St. Louis, but we put entrepreneurs on a pedestal here and give them the attention and access they need to connect with strategic partners and decision-makers in a timely way instead of somewhere like Silicon Valley or Boston, where they might spend six months or a year and not get the kinds of meetings we can facilitate for them in 48 hours. And, because costs are lower in the middle of the country, opportunities are much more capital efficient."*[xxiv]

Other top executives have realized the importance of this sector growth to the further development of the St. Louis area economy. *"The strategic master plan… is an extension of Dr. (William) Danforth's vision to make St. Louis a world center for plant science and innovation," said Sam Fiorello, who serves as chief operating officer of the Danforth Center and president of BRDG Park. "By connecting regional assets, improving mobility, creating development opportunities and additional greenspace we will enhance our ability to grow, attract and retain companies and top talent."*

In 2005, the Battelle Memorial Institute wrote:

"St. Louis has made more progress in its implementation of the plant and life sciences strategy than any other region in the country and is well on the road to becoming the leading center for plant sciences and a major center for life sciences."

SOURCES

[i] "The Top American Research Universities" 2018 Annual Report" The Center for Measuring University Performance, 2017, https://mup.umass.edu/sites/default/files/mup-2018-top-american-research-universities-annual-report.pdf, Accessed 4/6/20.

[ii] "Best Medical Schools: Research" U.S. News and World Report. 2021, https://www.usnews.com/best-graduate-schools/search?program=top-medical-schools&name=&specialty=research, Accessed 4/4/20.

[iii] "Largest Life Science Research Organizations" St. Louis Business Journal Book of Lists 2017-18, p. 50.

[iv] "DuPont Pioneer and Danforth Plant Science Center Collaborate to Apply Cutting-edge Technologies to Improve Crops for Smallholder Farmers" CISION PR web, October 17, 2017, http://www.prweb.com/releases/dupont-pioneer-crispr-cas/donald-danforth-psc/prweb14813859.htm, Accessed 12/26/17.

[v] "MilliporeSigma building $115 million headquarters outside Boston" St. Louis Business Journal, July 20, 2016, https://www.bizjournals.com/stlouis/news/2016/07/20/milliporesigma-building-115-million-hub-outside.html, Accessed 12/4/17.

[vi] "About Benson Hill" Benson-Hill Biosystems, May 29, 2018 https://bensonhillbio.com/about/#our-purpose

[vii] "Press Release: Benson Hill Biosystems Closes $25M Series B Financing" Benson-Hill Biosystems, March 28, 2017 https://bensonhillbio.com/benson-hill-biosystems-closes-25m-series-b-financing/

[viii] "Fast-growing agtech startup plots new headquarters in 39 North innovation district" St. Louis Business Journal, May 7, 2019, https://www.bizjournals.com/stlouis/news/2019/05/07/fast-growing-agtech-startup-plots-new-headquarters.html, Accessed 5/8/19.

[ix] "NewLeaf Symbiotics Announces Second Close to Complete its $30MM C Round Financing" NewLeaf Symbiotics, September 7, 2017, http://www.newleafsym.com/news.php, Accessed 1/2/17.

[x] "Helix Center Startup Licenses Tech from Danforth Center" St. Louis Business Journal, April 19, 2017, https://www.bizjournals.com/stlouis/news/2017/04/19/helix-center-startup-licenses-tech-from-danforth.html, Accessed 12/26/17.

[xi] "Evogene expects to receive $8.6 million more from Monsanto" St. Louis Business Journal, April 28, 2017, St. Louis Business Journal, https://www.bizjournals.com/stlouis/blog/biznext/2016/04/evogene-expects-to-receive-8-6-million-more-from.html, Accessed 12/26/17.

[xii] "Yield Lab Officials Start Funding With $300,000 Raise" St. Louis Business Journal, Oct. 27, 2016, http://www.bizjournals.com/stlouis/blog/biznext/2014/10/yield-lab-officials-start-funding-with-300-000.html, Accessed 11/8/16.

[xiii] "Frequently Asked Questions" Yield Lab, www.theyieldlab.com/copy-of-contact, Accessed 12/1/18.

[xiv] "About Us" BioSTL, https://www.biostl.org/about-us/about-us, Accessed 9/14/20.

[xv] Post-Dispatch, Nikki Forrester St. Louis. "New BioSTL Building at Cortex Brings Support for Bioscience Startups under One Roof." Stltoday.com, 25 July 2019, www.stltoday.com/business/local/new-biostl-building-at-cortex-brings-support-for-bioscience-startups/article_d09c34a9-703c-5673-aec1-f94831d8fc97.html. Accessed, 12/27/19

[xvi] "Exclusive: Cortex taps Danforth Center exec as new CEO" St. Louis Business Journal, https://www.bizjournals.com/stlouis/news/2020/02/13/exclusive-cortex-taps-danforth-center-exec-as-new.html, Accessed 5/12/20

[xvii] "Cortex Announces Departure of Dennis Lower at the End of 2019" Cortex Innovation Community, https://www.cortexstl.com/news-and-media/articles/cortex-announces-departure-of-dennis-lower-at-the-end-of-2019/, Accessed 5/30/19.

[xviii] "Expert: Why Cortex is now the model for innovation districts around the world" St. Louis Business Journal, https://www.bizjournals.com/stlouis/news/2020/01/16/why-cortex-is-a-model-innovation-district.html, Accessed 5/13/20.

[xix] "Welcome to CET" Cambridge Innovation Center http://www.cicfaq.com/intro-to-cet/ Accessed 5/16/18.

[xx] "Venture Café" Venture Café, https://vencafstl.org/, Accessed 5/15/19.

[xxi] "Cambridge Innovation Center is Starting Bigger (and Sooner) In St. Louis" St. Louis Business Journal, June 11, 2014, http://news.stlpublicradio.org/post/cambridge-innovation-center-starting-bigger-and-sooner-st-louis, Accessed 6/12/14.

[xxii] "Patenting in U.S. Metropolitan and Micropolitan Areas, Breakout by Technology Class" U.S. Patent and Trademark Office, www.uspto.gov/web/offices/ac/ido/oeip/taf/cbsa_cls/141180cls_gd.htm, Accessed 3/9/17.

[xxiii] "Patenting in U.S. Metropolitan and Micropolitan Areas Breakout By Technology Class: St. Louis, MO-IL," U.S. Patent and Trademark Office, www.uspto.gov/web/offices/ac/ido/oeip/taf/cls_cbsa/allcbsa_gd.htm, Accessed 3/9/17.

[xxiv] "Led by BioSTL, St. Louis Bioscience Roadmap Paying Dividends" Huffington Post, Aug. 17, 2017, https://www.huffpost.com/entry/led-by-biostl-st-louis-bioscience-roadmap-paying_b_599345c0e4b0eef7ad2c01bd, Accessed 9/8/20.