

TENNESSEE'S LIFE SCIENCES INDUSTRY: TARGETED FOR GROWTH



LIFE  SCIENCE
tennessee

HIGHLIGHTS:

Life sciences has experienced dynamic growth over the past decade worldwide and is expected to continue its growth trajectory into the future. Tennessee's life sciences industry is positioned to participate substantially in that growth and dramatically expand its footprint in this sector over the next five to 10 years.

Tennessee's industry improves the health and quality of life here in Tennessee and across the globe. As a whole, the industry focuses on:

- agricultural feedstock and biofuels,
- drugs and pharmaceuticals,
- medical devices and equipment, and
- research, testing and medical laboratories.

All three major regions across the state have businesses and major institutions involved in life sciences

- West Tennessee is the home of St. Jude Children's Research Hospital, and is the second largest center for orthopedic devices in the U.S., as well as a leading distribution and logistics hub for the entire industry.
- Middle Tennessee is home to Vanderbilt University, one of the nation's top federally funded research universities and medical centers, one of the state's largest biotechnology company and numerous other life science companies. The area also serves as a hub for many of the nation's largest health care services companies.
- East Tennessee serves as one of Tennessee's premier locations for biofuels, pharmaceutical and chemical research and commercialization. The area is home to Oak Ridge National Laboratory, one of the largest federal laboratories in the country, a major chemical company and the University of Tennessee as well as other colleges and universities.

Approximately **738** life science businesses exist in Tennessee, employing more than **26,000** Tennesseans. Those employees earn an average of \$69,000 annually. Nationally, every one new life science job creates 5.8 additional jobs, creating a ripple affect that Tennessee experiences as well with its industry.

Investment in life sciences has been substantial in Tennessee and it is expected to grow in the coming years. More than \$1.1 billion was privately invested in the industry in Tennessee from 2004 to 2009 alone. From the government side, the National Institutes of Health (NIH) infused \$580 million in 2009 in life science research, up 32 percent in Tennessee compared to 14 percent nationwide since 2004. Each NIH dollar invested in Tennessee generates \$2.32 in new business activity, putting the state in the Top 10 for economic activity created by NIH funding.¹

Investment spurred overwhelming growth in Tennessee's agricultural feedstock and chemicals industry. That subsector is two and a half times more concentrated than that of the nation, and employment grew by 116.1 percent from 2001-08 in Tennessee.

The State of Tennessee and the University of Tennessee have coordinated a \$70 million investment in biofuels initiatives along with Genera Energy and DuPont Danisco Cellulosic Ethanol with the goal of commercial-grade production by 2013. At nearby Oak Ridge National Laboratory, researchers have pinpointed a single, key gene in a microbe that could help streamline the production of biofuels from non-food sources.

In 2008, biopharmaceutical companies in Tennessee supported \$9.6 billion in economic output, which represents the value of goods and services produced by the companies and its ripple effects. According to the Pharmaceutical Manufacturers Association, Tennessee's biopharmaceutical companies employed 8,235 people directly and 40,636 indirectly. Direct payroll reached nearly \$464 million.

The growth in biologistics has resulted in companies such as Bayer, Johnson & Johnson, Lilly, Merck, Medtronic, Smith & Nephew and Wright Medical Technology choosing Tennessee as centers for product manufacturing and distribution.

Tennessee's extensive higher education system conferred 2,467 life science degrees in 2008 with a majority being baccalaureate or higher. In addition, Medtronic, Smith & Nephew and Wright Medical Technology have expanded their operations as a result of the industry's growth.

EXECUTIVE SUMMARY

The life sciences industry heals, fuels and feeds the world. It is one of the fastest growing industry segments in the United States, employing more than 1.3 million people in the research and development of pioneering therapies, medical devices, improved agricultural products and practices as well as alternative energy production processes and industrial products.

This diverse and rapidly growing industry already has contributed significantly to Tennessee's economy. Tennessee now has an immense opportunity to target the life sciences for future investment and create a catalyst for the state's economic growth.

The life sciences industry includes companies in the fields of biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, cosmeceuticals, food processing, environmental biology, biomedical devices, and organizations and institutions that devote the majority of their efforts in the various stages of research, development, technology transfer and commercialization.

Current estimates indicate that approximately 738 life science businesses exist in Tennessee employing nearly 26,000 Tennesseans. Tennessee's life sciences employees earn more than \$69,000 on average, 73 percent more than the average private-sector wage of about \$40,000.

Leading life science companies in Tennessee – including Smith & Nephew, Medtronic (formerly Sofamor Danek), Wright Medical, BioMimetic Therapeutics, Cumberland Pharmaceuticals, GTx, ICON, and other leading pharmaceutical companies such as Merck and GlaxoSmithKline – have a significant impact on Tennessee's economy. Memphis is the second largest orthopedic/medical device community in the world.

Tennessee also is a leading state in the increased worldwide attention on biofuels, employing advanced research and innovative partnerships to produce alternative fuel from agricultural and forest-based products. The State of Tennessee and the University of Tennessee have coordinated a \$70-million investment in this area, along with Genera Energy and global joint venture DuPont Danisco Cellulosic Ethanol, with the goal of commercial-grade production by 2013. Memphis Bioworks Foundation has established the AgBioworks Regional Initiative to create a regional supply chain for alternative crop development and a replicable biorefinery program.

Across the state, Tennessee's leading academic and research institutions – such as Vanderbilt University, the University of Tennessee, Oak Ridge National Laboratory and St. Jude Children's Research Hospital – are dedicated to advancing life sciences through research, education and workforce development, as well as creating partnerships that take innovations to the marketplace through technology transfer programs.

Numerous organizations across Tennessee – including Life Science Tennessee, Tennessee Technology Development Corporation, TNInvestco, Memphis Bioworks, Memphis Research Consortium and BioTN – are working together with companies, government and academic institutions to foster growth through workforce development, economic development, access to capital, advocacy and industry support.

<p>BY THE NUMBERS: <i>An Overview of Life Sciences in Tennessee</i></p>	<p>738 Life science businesses in TN</p>
	<p>26,000 TN employees in the life sciences industry of our state</p>
	<p>\$69,000 Average wage of a life sciences employee in TN</p>
	<p>73% Higher wage than the average private-sector wage of about \$40,000</p>

WHAT ARE THE LIFE SCIENCES?

Life sciences, sometimes referred to as biosciences, are a diverse group of sectors and activities with a common link – they apply knowledge of the way in which plants, animals, and humans function. The industry spans different markets and includes manufacturing, services and research activities. By definition, the life sciences are a unique industry cluster and are constantly changing to incorporate the latest research and scientific discoveries.

The industry is defined as including the following four sectors:

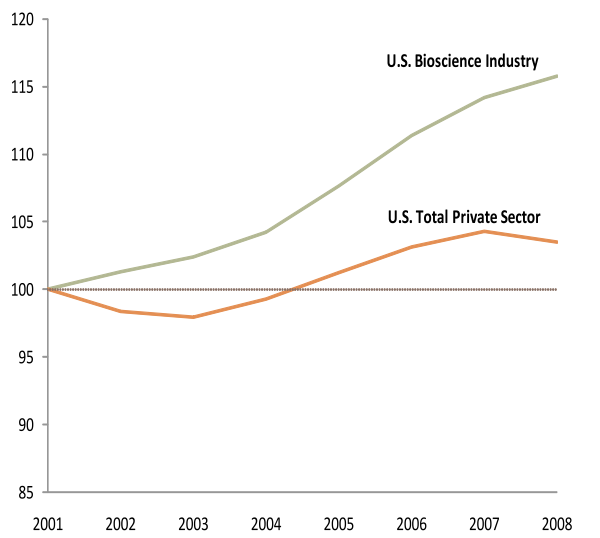
- agricultural feedstock, chemicals, and biofuels
- drugs and pharmaceuticals
- medical devices and equipment
- research, testing and medical laboratories

Tennessee also has a specialized sub-category in the life science sector termed Biologistics. Biologistics is a targeted sector for Tennessee (West Tennessee, in particular) dealing with logistics, warehousing and distribution of biomedical products across the marketplace.

LIFE SCIENCES: High-Growth, High-Wage Industry

Nationally, bioscience employment growth – led by research, testing and medical labs – greatly outpaced overall national employment growth in 2001–2008. There are an estimated eight million bioscience jobs. On a national basis, 5.8 additional jobs are created for every one new bioscience job.

In the U.S. the overall bioscience sector paid average annual wages of \$77,595 in 2008, \$32,366 more than the average annual wage of the total U.S. private sector. Real earning for bioscience industry workers has increased by 10.1% since 2001, compared with 3.2% for the U.S. private sector.



Overall Private-Sector Employment v. Life/Bioscience Industry

Source: Battelle/BIO State Bioscience Initiatives, May 2010

Drugs and Pharmaceuticals	\$ 93,378
Finance and Insurance	\$ 85,274
Research, Testing, & Medical Laboratories	\$ 80,785
Total Biosciences	\$ 77,595
Professional, Scientific, and Technical Services	\$ 74,354
Agriculture Feedstock & Chemicals	\$ 72,279
Information	\$ 70,780
Medical Devices & Equipment	\$ 63,606
Manufacturing	\$ 54,392
Construction	\$ 49,014
U.S. Total Private Sector	\$ 45,229
Real Estate and Rental and Leasing	\$ 43,239
Transportation and Warehousing	\$ 42,969
Health Care and Social Assistance	\$ 42,150
Retail Trade	\$ 26,181

Source: Battelle/BIO State Bioscience Initiatives, May 2010

AGRICULTURAL FEEDSTOCK AND CHEMICALS, BIOFUELS



Tennessee is a leader in the agriculture and biofuels subsector with more than five percent of the nation's overall employment in the industry, and has a specialized concentration in agricultural bioscience. Employment in Tennessee's agricultural feedstock and chemicals industry is two and a half times more concentrated than that of the nation, and employment in agricultural feedstock and chemicals grew by 116.1% from 2001–08 in Tennessee.

This subsector of the life sciences industry applies to the processing of agricultural goods for the production of organic and agricultural chemicals and biofuels. Biofuels are liquid fuels produced from waste biomass, special energy or biomass crops as well as the stalks of wood, wheat or corn. These liquid fuels are primarily used in the transportation sector and contribute to attaining U.S. energy-related goals, including increasing energy security and reducing the environmental degradation linked to traditional transportation fuels.

Knoxville and Memphis appear in the nation's top 25 cities with the largest employment levels in agricultural feedstock and chemicals. The University of Tennessee, Genera Energy LLC (a subsidiary of the University of Tennessee Research Foundation) and DuPont Danisco Cellulosic Ethanol, LLC are collaborating to develop a next-generation biofuel produced from non-food sources (a \$75-billion global market opportunity). In 2007, the State of Tennessee made a \$70-million, 5-year commitment to the project with the goal of commercial-grade production by 2013. This project could yield as many as 4,000 new jobs in biorefineries and related industries in Tennessee's rural areas.

The Memphis Bioworks Foundation was awarded a \$2.9 million Energy Training Partnership Grant under the American Recovery and Reinvestment Act Green Jobs Training Program. The two-year initiative will fund programs to train area workers for jobs in energy efficiency and renewable energy occupations. AgBioworks, an initiative of Memphis Bioworks Foundation and BioDimensions, is dedicated to developing new agricultural technologies and processing to supply abundant food, biofuels and biobased products, all of which are increasingly important globally.

To further support the industry, the State of Tennessee allocated \$1.5 million to the Tennessee Department of Transportation (TDOT) to develop a Biofuel Green Island Corridor network along Tennessee's interstate system and major highways. Additionally, TDOT allocated \$480,000 in funds from the federal Congestion Mitigation and Air Quality Improvement (CMAQ) program to support the installation of biofuel stations. As of September 2010, there were 33 E85 pumps and 29 biodiesel pumps open to the public in Tennessee. TDOT is continuing to help establish more E85 and biodiesel pumps to give citizens and travelers renewable fuel options across the state.²

BIOTECHNOLOGY AND MEDICAL RESEARCH

Tennessee ranks among the top in the nation for states receiving federal National Institutes of Health (NIH) funding. In fact, Tennessee's NIH funding increased 8.7 percent from 2004–2009, while funding in the U.S. decreased by 4.7 percent. Since 2004, bioscience academic research and development expenditures have grown by 23.5 percent. Each year, Tennessee receives more than \$2.2 billion in combined annual research among its academic and federal research institutions of which \$580 million of that is NIH funding into the state.

NATIONALLY-RANKED RESEARCH INSTITUTIONS

The rich resources available through Tennessee research institutions have both built and supported the industry's growth in the state.

East Tennessee State University Research Foundation & Innovation Lab

ETSU's Quillen College of Medicine received more than \$9 million in research funding in 2010 for innovations in many bioscience areas including cardiology, pharmacology, primary care, bone loss and cancer.

The ETSU Innovation Laboratory is an economic development initiative partnered with the Tennessee Small Business Development Center and the ETSU Entrepreneurial Leadership Program. The Innovation Lab offers a full-service small business incubator designed to support entrepreneurs and investors to affect the successful establishment of technology-based start-up and spin-off businesses in order to achieve technology transfer, create jobs, and enhance economic development within the region.

East Tennessee State University Research Foundation (ETSURF) was incorporated by the Tennessee Board of Regents as not-for-profit in 2002. The principal mission of ETSURF is to support research, scholarly and artistic activities at ETSU. ETSURF is the administrative and fiduciary entity for the ETSU Innovation Laboratory, manages ETSU intellectual property, and accepts and administers selected contracts and grants from private industry, foundations and other non-governmental agencies.

Meharry Medical College

Meharry Medical College was founded in 1876 to improve the health and health care of minority and underserved communities by offering excellent education and training programs in the health sciences; placing special emphasis on providing opportunities to people of color and individuals from disadvantaged backgrounds, regardless of race or ethnicity; delivering high quality health services; and conducting research that foster the elimination of health disparities.

Meharry has more than 200 full-time faculty members who examine biological, behavioral and other factors that contribute to the disproportionate burden of poor health outcomes borne by minority and underserved populations. All of the areas of research emphasis at Meharry represent areas of health disparities for people of color, in general, and African Americans, in particular. Major areas of research are brain and behavior, cancer, HIV/AIDS, obesity and diabetes, injury prevention, and women's health.

University of Memphis FedEx Institute of Technology

The University of Memphis FedEx Institute of Technology, The FedEx Institute of Technology is a research catalyst, engaging collaborative inter-disciplinary research teams to drive innovation, commercial technology realization and corporate partnerships. The Institute's engagement efforts bring the U of M in touch with a wide contingent of the corporate, government and non-profit leaders, decision makers and innovators of Memphis and Shelby County.

The FedEx Institute of Technology promotes the development of new, interdisciplinary research centers within the Institute and across the University of Memphis. The Institute's leading research supporting the life sciences industry includes research in bioinformatics, health care and technology and musculoskeletal disciplines.

The Institute also supports the growth of existing research labs with seed funding technology tools, in-kind contributions, professional services, and marketing and public relations support.

The Institute cultivates new research funds for the researchers through their corporate and government partners and supports economic development via technology transfer.

Oak Ridge National Laboratory

Oak Ridge National Laboratory, a division of the U.S. Department of Energy, conducts biotechnology research with a focus on bioenergy and industrial biology to bring additional renewable energy sources and innovative conversion technologies from biomass.

Managed by UT Battelle, a partnership of the University of Tennessee and Battelle Memorial Institute, Oak Ridge National Laboratory's research supports the U.S. Department of Energy (DOE) mission in scientific discovery and innovation, clean energy, and nuclear security. ORNL has a staff of about 4,600 and an annual budget of more than \$1.65 billion. Major research initiatives include accelerating biomass production and conversion for energy and materials; delivering sustainable transportation solutions; advancing the understanding of climate change impacts; and providing science and technology for global security.

ORNL's bioenergy program focuses on achieving the national goal of reducing oil imports through abundant biomass resources, reliable biofeedstock supply systems and innovative bioconversion technologies for producing bioenergy and biobased products.

Sarah Cannon Research Institute

Sarah Cannon Research Institute (SCRI) is a global strategic research organization focusing on advancing therapies and accelerating drug development. SCRI is one of the largest clinical research programs, conducting community-based clinical trials in oncology, cardiology, gastroenterology and other therapeutic areas through affiliations with a network of more than 500 physicians in the United States and United Kingdom. Additionally, SCRI offers management, regulatory and other research support services to drug development sponsors and strategic investigator sites across the country.

Through the careful work of multiple investigator sites and hundreds of principal investigators across the country, SCRI is able to offer clinical trials that have benefited thousands of individual patients and in some cases, changed the standard of care for all.

St. Jude Children's Research Hospital

The mission of St. Jude is to advance cures and means of prevention for pediatric catastrophic diseases through research and treatment.

The diverse research at St. Jude ranges from discovery-focused and hypothesis-driven laboratory studies to clinical trials of specific medications, treatment regimens and other therapeutic interventions. St. Jude seeks to translate knowledge acquired through basic research into novel approaches for clinical diagnosis and treatment. At the same time, clinical and laboratory-based investigators use the challenges encountered in the clinic to focus the efforts of their research.

The availability of sophisticated centralized resources offers St. Jude investigators an exceptional research advantage. This includes a GMP facility capable of manufacturing clinical grade biologics, a chemical biology group capable of synthesizing and testing small molecules for therapeutic activity, and the Hartwell Center for Bioinformatics. These and other well-equipped facilities staffed with highly trained specialists are widely available to clinical and basic science investigators to support the design, implementation, analysis, interpretation, and reporting of research. The resources at St. Jude combine technology with teamwork to facilitate studies that advance the understanding of fundamental biological processes and the ability to treat or prevent catastrophic diseases of childhood.

The University of Tennessee

University of Tennessee researchers at the flagship campus in Knoxville, at the UT Health Science Center in Memphis, and at the other campuses and institutes in the statewide system are pioneering breakthrough research in the life sciences industry including pharmaceuticals, environmental biotechnology and bioenergy. UT researchers also have numerous collaborations with the other major research entities in the state of Tennessee, including the Oak Ridge National Laboratory, Vanderbilt University, and St. Jude Children's Research Hospital.

New research facilities at the UT Health Science Center include a Cancer Research Building, an NIH-funded Regional Biocontainment Laboratory for investigation of infectious diseases, and a new College of Pharmacy Building that will include an FDA-certified GMP manufacturing facility. The UTHSC campus includes colleges of Allied Health Sciences, Dentistry, Graduate Health Sciences, Medicine, Nursing and Pharmacy. Patient care, professional education and research are carried out at hospitals and other clinical sites across Tennessee. Endowed professorships, Research Centers of Excellence, and continuing relationships with research and health care facilities across Tennessee ensure that both basic science and applied research stay focused on contemporary health topics.

- Both the Regional Biocontainment Lab and the GMP facility have been designed to handle academic projects and industry contracts. UTHSC also has state-funded centers of excellence in neuroscience, molecular resources, and pediatric pharmacokinetics.
- UT's Cherokee Farm in East Tennessee is being built as the innovation campus of the University of Tennessee, to provide an infrastructure for positioning the university and the state as a world leader in collaborative research. Drawing from Tennessee's established leadership in neutron research, materials science, computational science, and energy independence and sustainability, UT's Cherokee Farm will bring both public and private research partners together to work on solving globally important challenges.

- The UT Center for Renewable Carbon at the university's Institute of Agriculture focuses on research, teaching and outreach related to bioenergy production and biomaterials processing. This center is involved with the Tennessee Biofuels Initiative, a program funded with \$70 million to construct a pilot biorefinery for research and demonstration of biomass-to-ethanol conversion technology. The center also is involved with the SunGrant Initiative, a national network of land-grant universities and federally-funded labs collaborating on establishing a biobased economy. The initiative aims to create university-based research, extension and education programs for biobased energy technologies to not only help solve America's energy needs but also to revitalize rural communities. UT's CRC is one of five regional centers for the initiative.

Vanderbilt University

Vanderbilt University and Medical Center researchers are at the forefront of posing innovative solutions to some of the most challenging questions facing us today. In 2010, United Kingdom-based Times Higher Education ranked Vanderbilt as one of the Top 50 universities in the world for life sciences. Vanderbilt is one of only 10 universities in the United States ranked in the top 20 on each of two key indicators: *U.S. News & World Report's* "Best Universities and Colleges" (ranked 17) and federal obligations for science and engineering research and development (ranked 20).

Research is one of the core missions of Vanderbilt University and is supported by more than 40 research centers in Vanderbilt University's College of Medicine alone. The University received \$521 million in external funds for research in 2009 from the National Institutes of Health, ranking the university in the top 10 for federal funding. Vanderbilt is pioneering leading studies in the life sciences including human genetics, cancer and stem cell research. The university publishes updates on its findings at news.vanderbilt.edu/research.

- Vanderbilt University's Center for Technology Transfer and Commercialization provides a variety of intellectual property-related services to Vanderbilt researchers, including innovation identification, protection, marketing and licensing. The office also works with investment professionals, angel investors and experienced management teams to identify technologies that are appropriate for a commercialization strategy involving a start-up company.
- The Vanderbilt University's Division of Sponsored Research coordinates, executes, and promotes the science, technology & humanities programs of the University in conjunction with nonprofit and for-profit organizations.

TENNESSEE'S BIOTECHNOLOGY AND MEDICAL LABORATORY COMPANIES

Biotech businesses in Tennessee have seen much success in recent years. One of the state's largest biotech companies, GTx, Inc. (NASDAQ: GTXI), headquartered in Memphis, Tenn., has an emphasis in biopharmaceuticals dedicated to the discovery, development, and commercialization of small molecules that selectively target hormone pathways for the treatment of cancer, cancer supportive care, and other serious medical conditions. GTx is pioneering new medicines including the prescription drug Faraston®, which treats late-stage breast cancer in post-menopausal women. GTx currently has products in clinical trial as well, including Capesaris™, being developed for treatment of advanced prostate cancer; and Ostarine™ for the prevention and treatment of muscle loss in patients with cancer and other diseases.

Cumberland Pharmaceuticals Inc. (NASDAQ: CPIX) is a Nashville-based specialty pharmaceutical company focused on hospital acute care and gastroenterology branded prescription products. The company's marketed products include Acetadote® (acetylcysteine) Injection for the treatment of acetaminophen poisoning. Acetadote is the only injectable product approved in the United States to treat overdose of acetaminophen, a common ingredient in many over-the-counter painkillers. Other Cumberland marketed products include Caldolor® (ibuprofen) Injection, the first injectable treatment for pain and fever approved in the United States, and Kristalose® (lactulose) for Oral Solution, a prescription laxative.

Nashville-based Aegis® Sciences Corporation is a leading forensic chemical and drug-testing laboratory specializing in drug testing for businesses, professional and amateur sports, and pain management testing for physicians, and medical examiners. Originally founded as a sports doping laboratory in 1986, Aegis now employs nearly 250 scientists and staff providing toxicology and consulting services for medical examiners, coroners, pain management physicians, colleges, universities and high schools, professional and amateur sports organizations, crime labs and police departments, healthcare organizations, food manufacturers and large and small businesses.

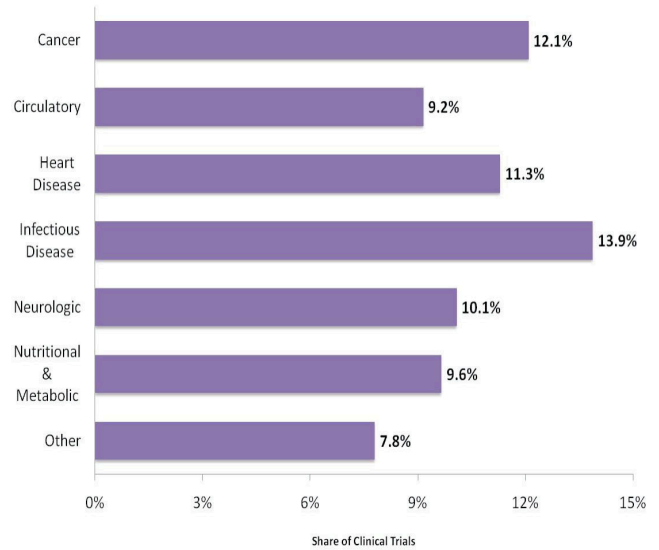
Franklin-based BioMimetic Therapeutics (NASDAQ: BMTI), specializes in products to promote the healing of musculoskeletal injuries and diseases, including therapies for orthopedics and sports medicine applications. Through the commercialization of their patented Augment™ Bone Graft, Injectable Bone Graft and Rotator Cuff Graft technology, BioMimetic is positioned to become a leading company in the field of regenerative medicine through new treatments for the repair of bone, cartilage, tendons and ligaments. In 2005, BioMimetic received marketing approval from the FDA for its first product, GEM 21S®, as a grafting material for bone and periodontal regeneration. In 2008, BioMimetic sold the rights to GEM 21S and remaining interest in the orofacial business and reinvested the proceeds in the development of products for the orthopedics and sports medicine markets.

East Tennessee's Provectus Pharmaceuticals, located in Knoxville, focuses on developing advanced therapies designed to target and destroy the deadliest cancers — melanoma, liver & breast — while eliminating side effects and to treat severe psoriasis and atopic dermatitis. Provectus has continued to grow by developing groundbreaking biotechnologies to augment vaccine production and detect viruses; preparing to spinout the subsidiary that contains our novel over-the-counter skin care products; and seeking to license patented technologies for therapeutic and cosmetic medical devices.

CONTRACT RESEARCH ORGANIZATIONS

Clinical research organizations, often called CROs, provide specialized expertise in drug and medical device product development. They are also important to the state’s life science and health care delivery industry. In 2009, Tennessee ranked 11th nationally in the number of active clinical trials with 546. Tennessee had more clinical trials active in cancer in 2009 than in any other category. Tennessee also hosted clinical trials in heart disease, infectious disease and neurology (each of which accounted for more than 10 percent of the national share of clinical trials in the same category) and orthopedics.

Tennessee is home to many clinical research organizations (CRO) – including the Sarah Cannon Research Institute (SCRI) and the global clinical research organization ICON – that are working with pharmaceutical companies from around the world to complete hundreds of clinical trials. SCRI is one of the largest, community-based research programs in the nation, conducting clinical trials in ten therapeutic areas through its affiliation with a network of hundreds of physicians. In addition there are many Site Maintenance Organizations (SMOS) that support clinical trial related services.



PHARMACEUTICALS

Tennessee is home to 27 drug and pharmaceutical companies, an increase of 28.6% from 2001. Leading pharmaceutical companies such as Bayer, Cumberland Pharmaceuticals, GlaxoSmithKline, Merck, Novartis, Pfizer and Sanofi Aventis have headquarters or major operations in Tennessee. The drugs and pharmaceuticals subsector produces commercially available medicinal and diagnostic substances. The subsector is generally characterized by large multinational firms heavily engaged in research, development and manufacturing activities to bring drugs to market.

Biopharmaceutical companies in Tennessee, in 2008, supported \$9.6 billion in economic output, which represents the value of goods and services produced by the companies and its ripple effects.³

Major pharmaceutical companies not only have distribution centers in Tennessee, but also manufacture some of the best known pharmaceutical brands. Acquisitions of companies such as Memphis-based Schering-Plough Corp., manufacturer of Claritin® and Dr. Scholl’s® products, by Merck brought a significant Tennessee investment by a top pharmaceutical company. Merck now has a manufacturing facility in Memphis.

Similarly, Sanofi Aventis purchased Chattanooga-based Chattem in 2009 which manufactured numerous pharmaceutical products including Gold Bond®, Allegra® and Cortizone-10®.

MEDICAL DEVICE

Tennessee ranks seventh in the country for the size of its medical device industry. In 2009, companies paid approximately \$275 million in wages to Tennessee residents. Between 2001 and 2008, the state showed a moderate increase in employment, even during the first year of the recession. Firms in the medical device and equipment subsector produce a variety of biomedical instruments and other health care products and supplies for diagnostics, surgery, patient care, and laboratories. This subsector of the life science industry produces goods, including bioimaging equipment, surgical supplies and instruments, orthopedic/prosthetic implants and devices, and dental instruments and orthodontics.



Numerous medical device and supply companies exist across Tennessee. One of the largest being East Tennessee-based DeRoyal Industries, a leading global manufacturer of orthopedic, surgical and wound care supplies with more than 2,000 employees. Founded by Pete Debusk in 1973, the company markets more than 20,000 products and has more than 70 U.S. patents. Mr. Debusk remains the owner and chairman of the company today.

Based in Chattanooga, Glenveigh Medical is a bioscience and medical technology company with a focus on obstetrics. Started in 2004 by a maternal-fetal medicinal specialist, Glenveigh moved its headquarters from Durham, N.C. to Tennessee in 2009. The company now markets Ebb™, Complete Tamponade System, providing treatment for postpartum hemorrhage, the most common cause of maternal death, as well Jetty™, a vaginal repair balloon.

Middle Tennessee is home to several companies in the medical device industry including musculoskeletal device company BioMimetic Therapeutics and Pathfinder Therapeutics, a bio-imaging device company used in surgical treatments.

Memphis is the second largest center for orthopedic devices in the U.S. and has a reputation as a Center of Excellence in the sector. The region is home to Wright Medical Technology, a company that develops, manufactures and distributes medical devices worldwide, and has more than 1,000 employees. Smith & Nephew and Medtronic, both global medical device companies, have a strong presence in West Tennessee. Smith & Nephew maintains its orthopedics division in Tennessee, employing more than 2000. Medtronic's spine and biologics businesses, which employs over 1,500 Tennesseans, is also headquartered in Memphis and accounted for \$3.5 billion, or 22%, of Medtronic's \$15.8 billion in revenue in 2010.

BIOLOGISTICS

Biologistics involves shipping medical equipment or biological materials on a tight schedule. This business sector is set to grow with continued expansion of Tennessee's life sciences industry, particularly as its research focuses more and more on personalized cures and the life sciences industry grows worldwide. Numerous life science companies already have chosen Tennessee for product manufacturing and distribution because of the state's central location and superior transportation system.

Tennessee has natural strengths that position the state well for success in biologistics. The state is centrally located and has a strong transportation infrastructure. Tennessee's location places it within a day's drive from 75% of the major markets that represent 50% of the entire United States population. The state provides immediate access to eight interstate highways: 24, 26, 40, 55, 65, 75 and 81, with 59 just southeast of the Tennessee border.

Air freight is also successful with the busiest freight airport in the world located in Memphis, with connections to any location in the world. The state has a total of six commercial airports and 74 regional and community service airports. There are numerous options for rail transportation, with three major carriers that traverse all parts of the state. Tennessee boasts 1,062 miles of navigable waterways and is centrally located on the nation's inland waterway system, connecting with river port in 21 state and three ocean ports.

Shipping powerhouse FedEx is a significant force in Tennessee's biologistics business. With headquarters in Memphis and vast operations in West Tennessee, FedEx gives the state's bioscience businesses a prime distribution advantage. FedEx plays a major role in biologistics worldwide, and in 2010 launched SenseAware in limited release to customers in the healthcare and life sciences industry who are shipping within the U.S., including Puerto Rico. SenseAware is a multi-sensor device permitted by the Federal Aviation Administration (FAA) to be used during flight on FedEx aircraft. It is a web-based service that requires no investment in software or infrastructure and provides near real-time visibility, alerts and analytics on data vital to this industry, including such information as temperature, exact location and light exposure.

A 2009 study estimated annual sales of biomedical products in the U.S. at \$294 billion, supported by biologistics services of \$13.8 billion. Biomedical sales are expected to grow to \$682 billion by 2015, according to the study, which will necessitate biologistics services of about \$32 billion. In 2008, Tennessee had an estimated 3.8 percent share of the American biologistics services market, and the study targeted an increase to 5.6 percent by 2015 (for an estimated economic impact on the West Tennessee region of \$1.8 billion in annual revenues, an estimated 10,000 new logistics jobs and as many as 6,000 additional jobs in unrelated industries).

TENNESSEE LIFE SCIENCES PARKS AND INCUBATORS

Cool Springs Life Sciences Center

The Cool Springs Life Sciences Center (CSLSC) is a 15-acre, 260,000 square foot life-sciences focused research and development campus committed to providing a world class bioscience business environment that benefits tenant companies and the biotech community by providing a unique campus, dedicated to life sciences research, development, and manufacturing. Infrastructure is in place to provide state-of-the-art systems for redundant power, HVAC, IT systems, chemical waste handling.

CSLSC provides dedicated space for well-equipped laboratory research, product development and manufacturing facilities for medical device, biotechnology, pharmaceutical and other life science-oriented companies and their support services. The range of potential research activities at CSLSC is as diverse as biomedical research itself and includes pharmaceutical and medical device development activities utilizing organic chemistry, biochemistry, molecular and cellular biology, tissue culture work, histology, nanotechnology, biomedical engineering, tissue engineering, etc. The scope of manufacturing work could range from non-technical production to high-tech cGMP microbiological clean room operations.

Cumberland Emerging Technologies Life Sciences Center

Cumberland Emerging Technologies, Inc. (CET) is a joint initiative between Cumberland Pharmaceuticals, Vanderbilt University and the Tennessee Technology Development Corporation. Located in Nashville, CET's Life Sciences Center offers flexible lab and office space, equipment and other resources to early-stage life sciences companies. In addition to all other CET Services, tenants have access to an employee benefits program, custom build-outs and the opportunity to interface with other young biotechnology companies.

CET works to bridge the development gap and bring biomedical technologies from research laboratory to the commercial marketplace. CET provides universities, hospitals, research organizations and entrepreneurs with a commercial development infrastructure for their technologies, including technology transfer licensing skills, regulatory expertise and assistance in obtaining funding for development. CET's flexible approach allows researchers to utilize one or all of its services, customizing a plan for each project.

UT-Baptist Research Park

The UT-Baptist Research Park is a growing major bioscience research complex, located in the heart of a world-class research and clinical treatment cluster in Memphis, Tennessee. Within the research park campus and close by is an array of biomedical, bioscience, research, teaching, business and logistics resources, including University of Tennessee Health Science Center, Cadaveric Training Facility, St. Jude Children's Research Hospital, Methodist Hospital, LeBonheur Children's Hospital, The Regional Medical Center of Memphis, Regional Biocontainment Lab, Vivarium (under construction), FedEx World Hub, Southwest Tennessee Community College.

A key asset within the UT Baptist Research Park is the Memphis Bioworks Business Incubator. The Incubator provides critical resources and services created to meet the needs of startup, early stage, and growth bioscience companies and creating an ideal ecosystem for successful entrepreneurship.

With more than 52,000 square feet of office and wet lab space presently available, and 230,000 square feet in development, the UT-Baptist Research Park offers ideal sites for bioscience growth – from incubator stage to thriving bioscience business.

PATENTS

Tennessee was one of the top 10 states in bioscience patents issued per million people. Approximately 1,100 patents were issued to Tennessee assignees from 2004–2009, with 2009 as the most active year with 224 bioscience-related patents being received. The patents issued were well diversified across categories, led by surgical and medical instruments.

TECHNOLOGY TRANSFER

Many Tennessee universities and research institutions, including the University of Tennessee Research Foundation, Vanderbilt University, Oak Ridge National Laboratories, the University of Memphis, St. Jude Children's Research Hospital and the Tennessee Board of Regents, have technology transfer programs that are designed to move innovations from within these laboratories to the market.

The University of Tennessee Research Foundation has supported numerous organizations in bringing ideas to the marketplace, including Genera Energy, which oversees the University of Tennessee's Biofuels initiative and is now providing ethanol fuel to the market.⁴

The Vanderbilt University Office of Technology Transfer and Enterprise Development brought a record 150 new technologies to the marketplace and recorded over \$11 million in revenue in 2009.⁵ St. Jude has issued numerous patents each year for the innovations of its researchers.

ACCESS TO CAPITAL

New programs and initiatives have opened up more avenues for funding for the life sciences industry. Private venture capital firms have begun to see the potential return on investment as the industry matures and university research projects produce commercially viable technology. Government funding still is a major source of grant and seed money for research.

TNInvestco

In 2009 and 2010, the State of Tennessee allocated \$200 million in tax credits to build a program designed to increase entrepreneurship in our state. The goal of the TNInvestco program is to jumpstart entrepreneurship and economic activity and to establish Tennessee as a hotbed of private equity and business creation. Four of the ten TNInvestcos – MB Ventures, Limestone Fund, TriStar Technology Ventures and Innova – have life sciences as a main focus.⁶ TriStar and Limestone, for example, have separately and jointly invested in medical device companies, Pathfinder Therapeutics being one such start-up company. Limestone invested in Nutraceutical Discoveries Inc., a company developing products to fight obesity and improve metabolic health. MB Venture Partners, exclusively a life science private equity investor, led a round of financing eight years ago for orthopedic device company BioMimetic Therapeutics, which later went public. That firm has 14 portfolio companies. Innova is a pre-seed, seed and early-stage investor focused on starting and funding high-growth companies in the biosciences, technology and ag-bio fields across Tennessee. Innova's portfolio includes Vaxent, an early stage company developing a vaccine for strep throat.

Therapeutic Discovery Program

In 2010, as part of the health reform law, the U.S. Treasury Department released a total of \$1 billion to support biomedical research that has the potential to produce new therapies that would decrease health-care costs and create high-quality jobs. A total of 19 Tennessee life sciences companies were awarded nearly \$7 million in credits or grants under program created by the Affordable Care Act.⁷

Tennessee ranks 24th in the nation with \$6,731,451 in grants and \$244,479 in credits spread among 19 companies.⁸ These funds will allow small companies to continue potentially life-saving research programs that might otherwise lapse for lack of resources.

SUPPORTING THE GROWTH OF THE LIFE SCIENCES INDUSTRY

Tennessee is an emerging state that is rapidly being recognized as a major player in the life sciences arena. The state has recognized life sciences as an integral part of the state's economy. Tennessee has built centers of excellence around medical devices, biopharmaceuticals, biofuels and clinical research. Capitalizing on these emerging trends is vital to the continued growth and expansion of the life sciences industry in Tennessee, and to the resulting high-wage jobs, economic opportunities and advancements and discoveries in health care, alternative fuels and beyond.

Support of industry growth in Tennessee requires support of the state's leading industry organization. Life Science Tennessee is the industry's advocacy organization within Tennessee. At the state level, the organization advocates for the increased commercialization and technology transfer in Tennessee, advancing a culture and activities that encourages and supports entrepreneurship, as well as increasing access to capital for the state's life science start-ups. Nationally, the organization works with national industry associations including AdvaMed, a leading medical device association and BIO, the Biotechnology Industry Organization on federal issues important to the industry including health care reform, sound federal policies that support the growth of the industry in the U.S. and FDA reform.

Life Science Tennessee is also compiling legislative priorities for the state and federal legislative agendas to support the continued growth of this industry in Tennessee.

Growth of the life sciences sector will require additional resources and support from organizations that are already actively engaged with the life sciences sector, including the Tennessee Department of Economic and Community Development (ECD) which has identified the life sciences as a major industry target for growth in Tennessee. ECD is leading projects that promote innovation, expansion and retention of the life sciences in industry here. Continued emphasis on programs that encourage commercialization, retention and recruitment of the industry are keys to industry growth.

Tennessee's life science industry is also supported by other leading innovation and industry organizations and program including:

- Tennessee Technology Development Council (TTDC) as the state's leading economic development on innovation. TTDC works with life sciences companies and evidence of the state's commitment to growing innovation-based jobs.

- A strong focus on STEM education and workforce development programs by the Tennessee Department of Education and the Department Labor and Workforce Development. STEM education and workforce programs are vital to the industry. Continued improvement of K-12 math and science educational opportunities must continue to be addressed.
- The federal \$500 million Race to the Top initiative designed to highlight the state's emphasis on STEM education, as well as create new STEM charter schools like STEM Prep Academy in Nashville and MASE in Memphis.
- BioTN, a nonprofit organization that provides unique educational training and workforce development in science and technology, as well as seeks to enhance regional assets in healthcare service and technology by supporting the expansion of technologies focused in the life sciences.
- The Memphis Bioworks Foundation brings together public, private, academic and government entities in a collaborative effort to change the Memphis bioscience landscape. Established in 2001 as a nonprofit, the Foundation's leading initiatives to expand upon the community's current bioscience niches and demonstrated areas of leadership to create an internationally recognized center for the development and commercialization of bioscience technology. The Memphis Bioworks Foundation is a leadership organization, creating the programs, gathering the knowledge and assembling the resources necessary for bioscience growth in Memphis and the region.
- The Memphis Bioworks Business Association is an organization dedicated to promoting and advancing the bioscience business community in the Memphis region. The Association strives to provide programs, events and strategic communications that enable members to stay on top of the rapidly changing bioscience industry in Memphis, as well as on a national and global scale. The Memphis Bioworks Business Association provides an array of opportunities to network with other bioscience companies, industry service providers and professionals through a series of "lunch and learn" programs, mixers and communications aimed at keeping members up-to-date on trends, topics and regional developments.
- The Memphis Research Consortium, a commitment by the chief executives of The University of Memphis, the University of Tennessee Health Science Center, St. Jude Children's Research Hospital, Medtronic, Smith & Nephew, Wright Medical Technologies, Methodist Le Bonheur Healthcare, Baptist Memorial Healthcare, and the Memphis Bioworks Foundation developing initiatives that will expand Memphis' existing strengths in biomaterials, biomedical devices, and biologics (B3) with investments in regenerative medicine.

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OUR MEMBERS

Advanced Plasma Products, Inc.
 Aegagrus LLC
 AEGIS Sciences Corporation
 Allergan
 AnthroChip
 Argentis
 Atlanta Catheter Therapies, Inc.
 Baker, Donelson, Bearman, Caldwell & Berkowitz
 BioDimensions, Inc.
 BioMimetic Therapeutics
 Bioquant Image Analysis Corporation
 BioVentures, Inc.
 Bradley Arant Boult Cummings
 BTG International Inc.
 Butler, Snow, O'Mara, Stevens & Cannada
 Calhoun Marketing & Communications
 Clinipace Worldwide
 Compliant Therapeutics
 Cool Springs Life Sciences Center
 Crown Labs/Del-Ray Dermatologicals
 Cumberland Emerging Technologies
 Cumberland Pharmaceuticals Inc.
 DDN
 Dow AgroSciences
 DuPont
 East Tennessee State University
 Ernst & Young
 Frazier, Barnes & Associates
 Genentech, Inc., a member of the Roche Group
 Genera Energy, LLC
 GlaxoSmithKline
 Greater Memphis Chamber
 GTx, Inc.
 Harbert Fund Advisors, Inc.
 Harwell Howard Hyne Gabbert & Manner, P.C.
 Health Care REIT, Inc.
 Hogan Lovells US LLP
 ICON Clinical Research
 Industrial Microbiological Laboratories, Inc.
 Innova Memphis
 Insight Genetics, Inc.
 iScreen Vision Inc.

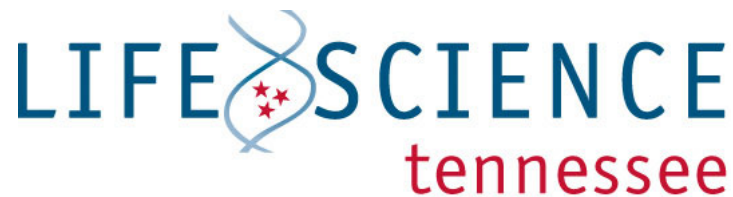
Jericho Sciences
 Johnson & Johnson
 Key Biologics, LLC
 King College
 Kraft Analytics, LLC
 Limestone Fund
 MB Venture Partners
 Medical Device Development Group, LLC
 Memphis Bioworks Foundation
 Meridian Life Science, Inc.
 Monsanto
 Nashville Area Chamber of Commerce
 Nashville Health Care Council
 Nashville Technology Council
 Neace Lukens
 NellOne Therapeutics
 NextGxDx
 Novartis Pharmaceuticals Corporation
 Oak Ridge Economic Partnership
 Oak Ridge National Laboratory
 Oriel STAT A MATRIX
 Pathfinder Therapeutics, Inc.
 Pfizer
 PhRMA
 Renewable Algal Energy, LLC
 RxBio Holdings, Inc.
 Ryan Search & Consulting
 Smith & Nephew
 St. Jude Children's Research Hospital
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 Tennessee Department of Economic and Community
 Development
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 TriStar Technology Ventures
 UT Research Foundation
 Vanderbilt University Office of Technology Transfer
 VWR International
 Waddey & Patterson
 Waller Lansden Dortch & Davis, PLLC
 Williamson County Economic Development Council
 Wright Medical

LIFE SCIENCE TENNESSEE

Life Science Tennessee is a statewide, non-profit, member organization whose mission is to advance and grow the life science industry in Tennessee through advocacy, partnerships and alignment with economic and workforce development.

The organization's members include companies, universities, research institutions, government and economic development groups, graduate students and other industry associations involved in discovery and application of life sciences products and related services that improve the health and well-being of people throughout the world.

Life Science Tennessee conducts business and economic development activities; advocates on behalf of the industry; educates the public about the benefits of life sciences research and product development; and provides a network for the exchange of ideas, information and opportunities.



For more information:

Life Science Tennessee | 222 Second Ave. North, Suite 210 | Nashville, TN 37201
615-242-8856

www.lifesciencetn.org
atrotter@lifesciencetn.org