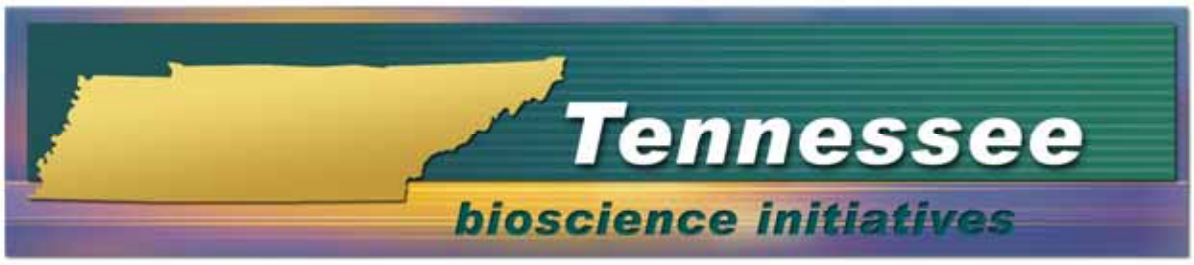


Overview and Summary of Recent Initiatives

Much of the biotech activity in Tennessee is focused on what the state terms **The Innovation Valley,** situated at the axis of I-75 and I-40. The University of Tennessee (UT) science programs, Governor Phil Bredesen's stated commitment to high-tech recruitment, and Oak Ridge National Laboratory's (ORNL's) $1.6 billion in capital investments and nearly $1 billion annual program budget form the underpinning for the state's biotech effort. This includes a $20 million joint recruiting effort shared by the state and the entity that manages ORNL, an additional $8 million state investment in the Joint Institute for Biological Sciences (JIBS), and other joint research institutes that are coming online, some in Oak Ridge and some in Knoxville.

A new area of focus for the state is alternative fuels. Governor Bredesen, in early 2006, created an interagency working group charged with developing an alternative fuels strategy for Tennessee, focused on biodiesel and ethanol. Representatives of six state agencies will form the **Governor's Interagency Alternative Fuels Working Group.** Those agencies are the state departments of Agriculture, Economic and Community Development, Environment and Conservation, General Services, Health, and Transportation.

A number of state-supported organizations promote the biosciences in Tennessee including **Innovation Tennessee** (a new entity under development to replace the former Technology Development Corporation) and the **Memphis Bioworks Foundation.** The nonprofit Memphis Bioworks Foundation leads a collaboration of public, private, academic, and government organizations to build upon the bioscience industry already in the Memphis economy and to establish the area as an internationally recognized center for the development and commercialization of biomedical technology. The foundation is funded by state and local governments, grants, and private donations. Among others, its partners include **Southwest Tennessee Community College, the University of Memphis, and UT.**

Building Bioscience R&D Capacity

Research programs

The Joint Institute for Biological Sciences, funded by the State of Tennessee, will support research and teaching programs in genomics, bioinformatics and computational biology, molecular structural biology, proteomics, and biomedical technologies. JIBS will encompass both fundamental and applied research and development across a spectrum of systems, from microbial to mammalian. Included in JIBS is the Genome Science and Technology Graduate School offered jointly by UT and ORNL.

Ten of the state's research institutions—including ORNL, UT, Vanderbilt, St. Jude Children's Research Hospital, and Meharry Medical College—jointly contribute to the **Tennessee Mouse Genome Consortium.** This consortium supports geographically distributed projects using resources at the facilities of any of its members.

Faculty development programs

The State of Tennessee is investing funds to recruit and support approximately 20 exceptionally accomplished researchers who will have joint appointments as tenured professors at UT and distinguished research staff at ORNL. This **Governor's Chair (GC)** program seeks to catalyze the development of cutting-edge research under the auspices of four joint institutes between UT and ORNL: Biological Sciences, Computational Sciences, Neutron Sciences, and Advanced Materials Sciences. The GC appointments include an ongoing discretionary research fund equal to 12 months' salary.

The Tennessee Higher Education Commission sponsors a **Chairs of Excellence Program.** Started with $44 million in state funding in the mid-1980s, the endowment has reached $205 million. Among the chairs supported are 19 in the biosciences at the UT Health Science Center in Memphis.

Moving Technology into the Marketplace

Commercializing university technology

Vanderbilt University in Nashville partnered with Cumberland Pharmaceuticals and Tennessee Technology Development Corp. to create **Cumberland Emerging Technologies (CET),** a commercialization company intended to access federal SBIR funding and other sources to commercialize intellectual property licensed from Vanderbilt. Management is provided by staff from the pharmaceutical company.

CET also has an agreement with the University of Mississippi School of Pharmacy to develop and commercialize new pharmaceutical products. The two groups will take innovative, early-stage UM research through the critical phases of development and work together to pursue grant funding for these projects, with CET providing program management.

Supporting bioscience entrepreneurs and emerging companies

ORNL's **Center for Entrepreneurial Growth (CEG),** part of its Office of Technology Transfer and Economic Development, identifies opportunities for entrepreneurs from both within and outside ORNL and links them to research and financial services. The CEG combines expertise, programs, and access to capital to develop an entrepreneurial community and assist with the development of technology-based businesses.

Making Capital Available

Pre-seed and seed capital

Tri-Cities Regional Angel Investor Network (TRAIN) recently provided an $800,000 capital investment in the East Tennessee State University (ETSU) Innovation Lab's newest tenant company, **ProteoGenesis,** a biotech company.

Venture capital

The **Southern Appalachian Fund (SAF)** is a $12.5 million venture capital fund formed to provide equity capital and operational assistance to qualifying businesses in southern Appalachia. The fund focuses specifically on companies in Kentucky, Tennessee, and the Appalachian counties of Georgia, Alabama, and Mississippi. The SAF is one of six New Markets Venture Capital (NMVC) Companies in the United States. The NMVC Program is a developmental venture capital program designed to promote economic development and the creation of wealth and job opportunities in low-income geographic areas and among individuals living in such areas.

Providing Space for Bioscience Companies

Incubators

CET announced in 2005 the expansion of its **Life Sciences Center,** located in downtown Nashville. An additional 5,800 square feet of wet-lab, dry-lab, and office space will be made available for use by early-stage life science companies. CET tenants include the **Tennessee Biotechnology Association (TBA).**

TriStar Enterprises' Biotech Incubator offers both laboratory and office space in the Van Vleet Building on the UT Health Science Center Campus. The building has 11,000 square feet of laboratory space and 11,700 square feet of office space. It is currently fully occupied.

ETSU Innovation Lab is a 15,000-square-foot small business incubator with offices, wet labs, conference rooms, and classrooms, designed to help entrepreneurs start up and grow technology-based businesses. It has been in operation since October 2002 and currently houses seven companies with 40 employees, and total annual payroll of $12 million.

Under development

UT-Baptist Research Park's initial multitenant building will include incubation facilities (see below).

The **Cool Springs Life Sciences Center (CSLSC)** will include 8,000 square feet of incubation space managed by Vanderbilt, with an option for 8,000 more (see below).

Bioscience research parks

Founded by local life-science entrepreneurs, the **Cool Springs Life Sciences Center** in Franklin is designed to accommodate the needs of bioscience and biotechnology firms, particularly those engaged in biologics, pharmaceuticals, therapeutics, and medical devices. In the future, CSLSC will house high-tech biotech, pharmaceutical, and medical device manufacturing space built to suit the unique needs of the tenants. At full build-out, the three buildings of the CSLSC are planned to encompass more than 140,000 square feet. The first of three buildings at the CSLSC is now operational. Totaling approximately 32,000 square feet, it includes Vanderbilt University's life sciences incubator. Plans are underway for Buildings Two and Three.

Under development

The Memphis Bioworks Foundation is developing the **UT-Baptist Research Park,** a state-of-the-art campus located on 15 acres in the heart of the downtown Memphis Medical Center. The research park is expected to feature 1.2 million square feet of laboratory, research, education, and business development

space. The first phase of development is a dedicated, six-story, 165,000-square-foot, world-class biotechnology research facility The Memphis Bioworks Foundation has more than $100 million in construction planned for 2006. Governor Bredesen has included in his current budget proposal $3.5 million to continue the development of this research park. Including an incubation program, the research park will also be home to the State of Tennessee's first Charter School, the Memphis Academy of Science and Engineering, which includes grades 7 through 12.

In Tri-Cities, **University Innovation Park** is a 60-acre parcel intended to become the "middle anchor" of the MedTech Corridor concept (the other two anchors are a 130-acre, privately developed Med Tech business park and a privately operated conference center).

Addressing Talent Needs

Specialized postsecondary programs

The University of Memphis inaugurated its new undergraduate biomedical engineering degree in the fall of 2005.

An ETSU Pharmacy School has been approved for northeast Tennessee.

K-12 outreach programs

The **Memphis Bioworks Foundation** established the first charter school in Tennessee. The Memphis Academy of Sciences and Engineering, a school for grades 7 through 12 with a strong outreach to minority students, has been operating for 2 years. Memphis Bioworks has been assisting a Nashville-based group with plans to start a similar program in Nashville in the fall of 2006.

The Memphis Bioworks Foundation is working with community leaders to create the **"Bioworks Career Ladder"**—a series of new educational programs and outreach efforts. The Bioworks Career Ladder is designed to keep pace with industry demands and will offer the skills, courses, and experience required to attain each level of specialized training matched against potential jobs in the industry. The Bioworks Career Ladder includes BioEducation reform in secondary schools, skill enhancement for advanced and ongoing learning experiences, and internships

Biomedical Applications is a new course approved by the Tennessee Board of Education for schools across Tennessee. It will be offered to 11th and 12th grade students. This course has been piloted for 3 years and will be offered to all schools across the state in the 2006–2007 school year.

Contacts

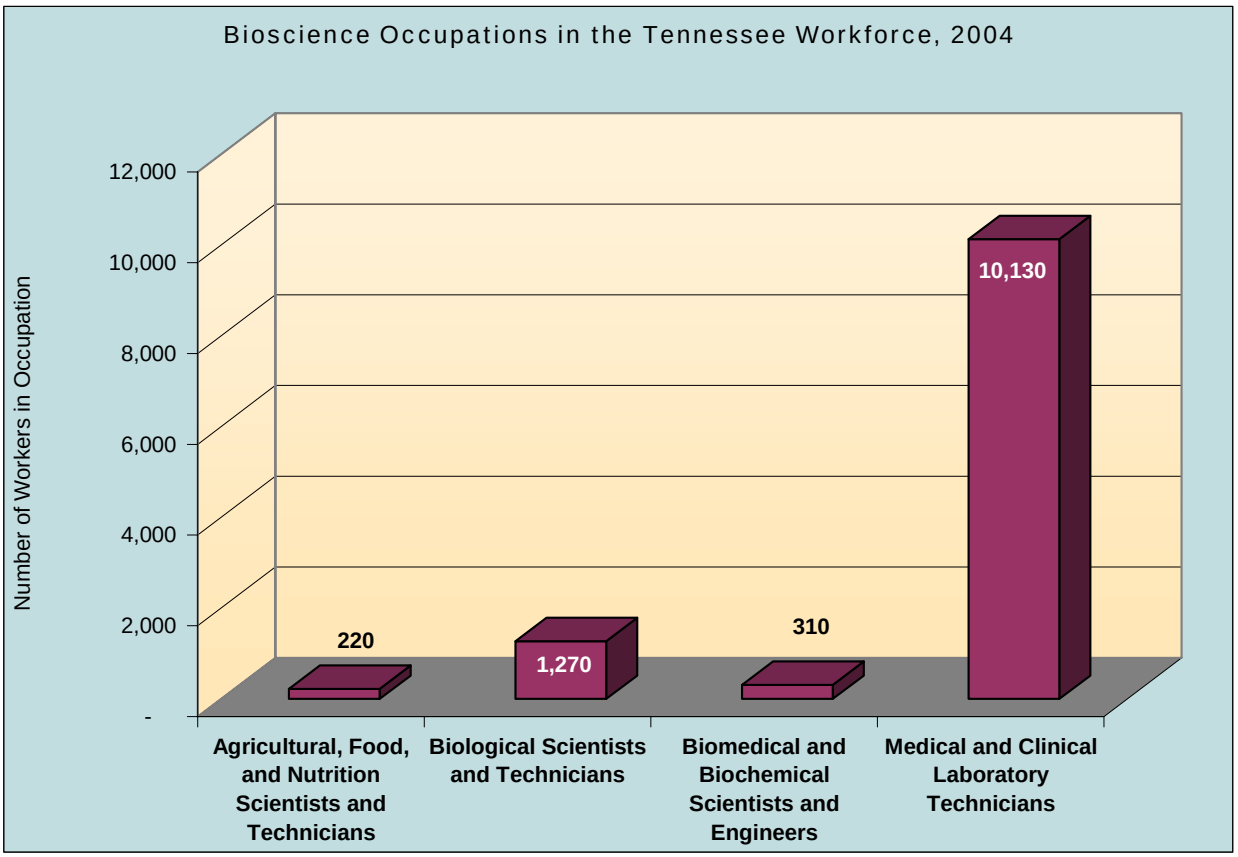
Eric Cromwell
Director of Technology
Tennessee Department of Community and Economic Development
William R. Snodgrass Tower, 11th Floor
312 8th Avenue North
Nashville, TN 37243-0405
(615) 741-1888
eric.cromwell@state.tn.us

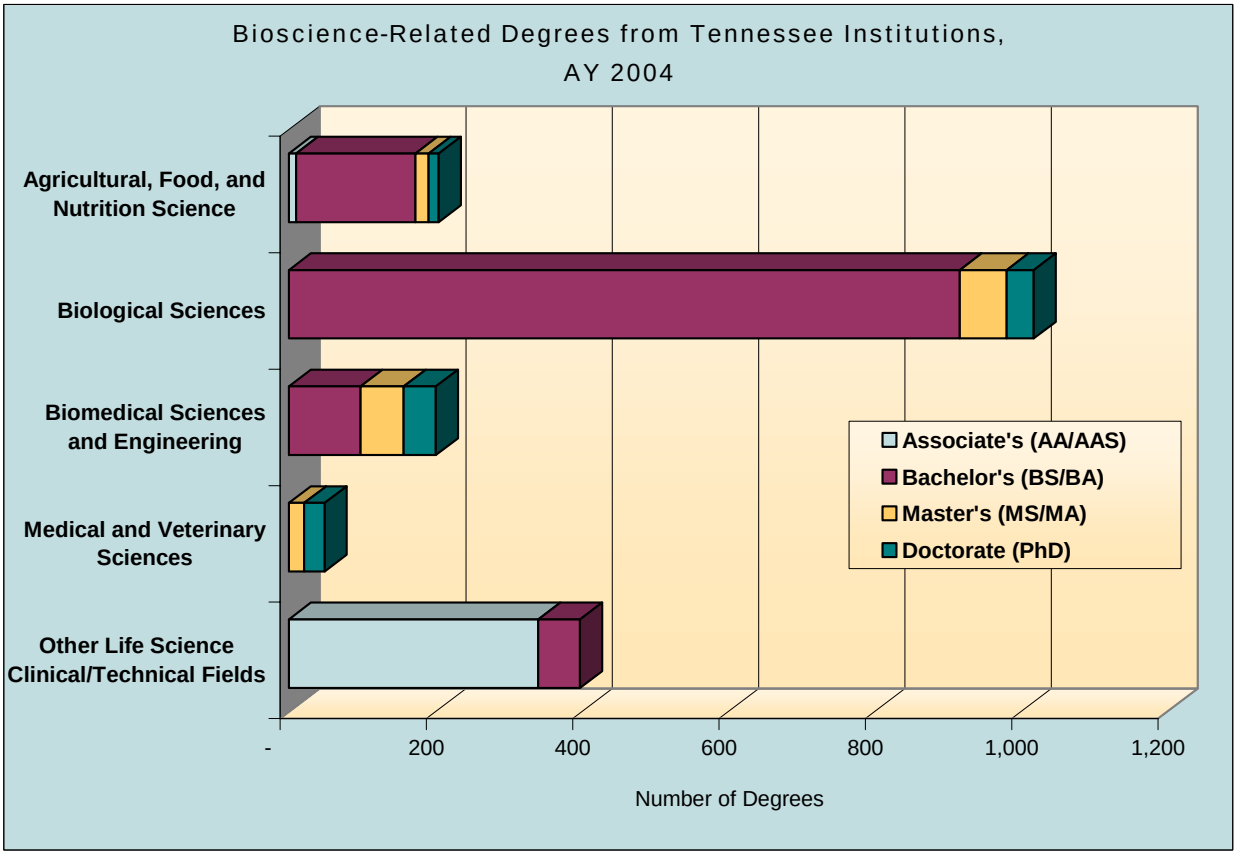
The Tennessee Biotechnology Association (TBA) is a statewide organization of leading scientists, researchers, academicians, clinicians, legislators, and business professionals working to foster, develop, and support the life sciences in Tennessee. The TBA serves as an information clearinghouse that supports life science education, research, health care, and technology transfer programs. The organization also works to enhance access to capital for existing biotechnology companies, as well as support business recruitment to Tennessee or outside investment in Tennessee companies, research, and technologies.

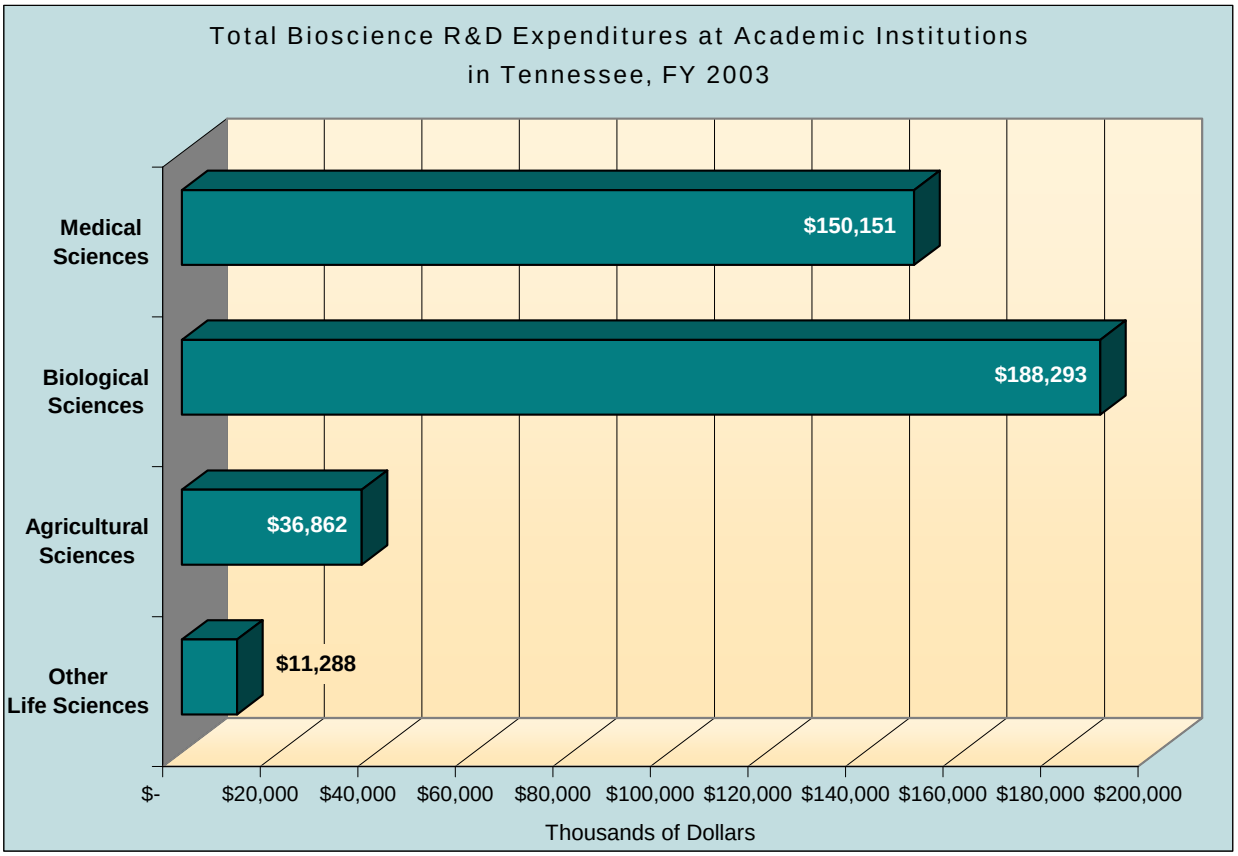
Joe Rolwing
Executive Director
Tennessee Biotechnology Association
111 10th Avenue S., Suite 110
Nashville, TN 37203
(615) 255-6270
jrolwing@tnbio.org

Industry Subsector	Tennessee	United States
Agricultural Feedstock & Chemicals		
Establishments 2004	36	2,111
2001-2004 Establishment % Change	-4.0%	0.4%
Employment 2004	2,930	104,893
2001-2004 Employment % Change	5.9%	-6.9%
Share of U.S. Employment	2.8%	100.0%
Location Quotient	1.36	n.a.
Average Annual Wage 2004	$79,632	$63,383
Direct-Effect Employment Multiplier	5.80	10.91
Total Employment Impact	16,982	1,212,094
Drugs & Pharmaceuticals		
Establishments 2004	19	2,589
2001-2004 Establishment % Change	-9.5%	-0.6%
Employment 2004	3,136	313,207
2001-2004 Employment % Change	0.5%	2.7%
Share of U.S. Employment	1.0%	100.0%
Location Quotient	0.49	n.a.
Average Annual Wage 2004	$66,773	$79,303
Direct-Effect Employment Multiplier	4.67	9.51
Total Employment Impact	14,659	2,731,321
Medical Devices & Equipment		
Establishments 2004	270	15,190
2001-2004 Establishment % Change	2.3%	0.2%
Employment 2004	8,541	411,460
2001-2004 Employment % Change	15.0%	-3.6%
Share of U.S. Employment	2.1%	100.0%
Location Quotient	1.01	n.a.
Average Annual Wage 2004	$46,903	$56,449
Direct-Effect Employment Multiplier	3.23	4.56
Total Employment Impact	27,589	1,817,705
Research, Testing, & Medical Laboratories		
Establishments 2004	335	20,565
2001-2004 Establishment % Change	21.7%	19.4%
Employment 2004	8,025	413,550
2001-2004 Employment % Change	12.3%	8.2%
Share of U.S. Employment	1.9%	100.0%
Location Quotient	0.94	n.a.
Average Annual Wage 2004	$57,260	$65,414
Direct-Effect Employment Multiplier	2.43	3.15
Total Employment Impact	19,477	1,272,936
TOTAL PRIVATE SECTOR		
Establishments 2004	126,340	8,156,137
2001-2004 Establishment % Change	3.4%	4.8%
Employment 2004	2,247,512	109,249,195
2001-2004 Employment % Change	0.2%	-0.7%
Share of U.S. Employment	2.1%	100.0%
Location Quotient	n.a.	n.a.
Average Annual Wage 2004	$34,866	$39,003

Source: Battelle calculations -- based on Bureau of Labor Statistics QCEW data from the Minnesota Implan Group, RIMS II Employment Multipliers from the Bureau of Economic Analysis, and the Census Bureau's Economic Census.
Note: n.a. = metric is not applicable.


Bioscience Occupations in the Tennessee Workforce, 2004
Number of Workers in Occupation
12,000
10,000
8,000
6,000
4,000
2,000
-
220
1,270
310
10,130
Agricultural, Food, and Nutrition Scientists and Technicians
Biological Scientists and Technicians
Biomedical and Biochemical Scientists and Engineers
Medical and Clinical Laboratory Technicians


Bioscience-Related Degrees from Tennessee Institutions, AY 2004
Agricultural, Food, and Nutrition Science
Biological Sciences
Biomedical Sciences and Engineering
Medical and Veterinary Sciences
Other Life Science Clinical/Technical Fields
Associate's (AA/AAS)
Bachelor's (BS/BA)
Master's (MS/MA)
Doctorate (PhD)
-
200
400
600
800
1,000
1,200
Number of Degrees



	Tennessee	United States	Rank
University R&D Expenditures, FY 2003			
Total ($ thousands)	$599,723	$40,104,621	21
Life Science R&D ($ thousands)	$394,465	$24,062,088	19
Percent of Total R&D	65.8%	60.0%	
Life Sciences Per Capita	$67.53	$82.74	
Change in Life Sciences FY 1999–2003	68.1%	52.7%	
NIH Support to Institutions, FY 2004			
Total ($ thousands)	$410,584	$22,556,459	16
Per Capita Expenditures	$70.28	$77.56	
Change in Expenditures FY 2000–2004	79.0%	53.2%	
Higher Education Degrees in Bioscience Fields, AY 2004	1,871	111,329	22
Bioscience Occupations in the Workforce, 2004	11,930	616,140	18