



VIRGINIA ADVANTAGES

Life Sciences



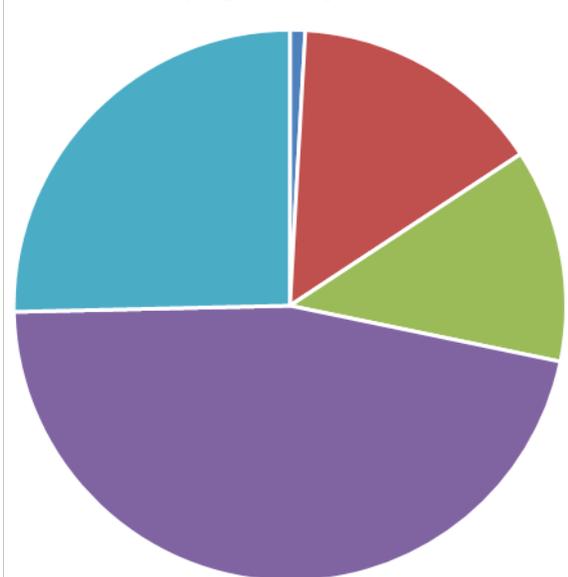
**VIRGINIA ECONOMIC
DEVELOPMENT PARTNERSHIP**

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Life Sciences Employment in Virginia

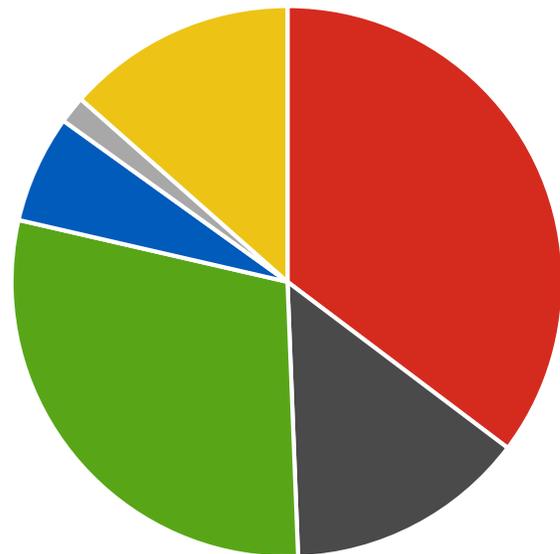
Virginia's Life Sciences Industry employs over 25,400 people at more than 1,000 businesses. Research, Testing, and Medical Laboratories account for 46% of Virginia's Life Sciences employment and 32% of its businesses. Bio-Science Related Distribution accounts for 25% of Virginia's Life Sciences employment and 46% of its firms. Drugs and Pharmaceuticals production accounts for 15% of Virginia's Life Sciences employment and 6% of its companies. Medical Devices and Equipment production accounts for 13% of Virginia's Life Sciences employment and 15% of its firms. Agricultural Feedstock and Chemicals production accounts for 1% of Virginia's Life Sciences employment and 2% of its businesses. Virginia's Life Sciences Industry has an estimated direct economic impact of \$7.6 billion and supports an additional \$5 billion in economic activity around the state.

Employment by Sector



- Agricultural Feedstock & Chemicals
- Drugs & Pharmaceuticals
- Medical Devices & Equipment
- Research, Testing, and Medical Laboratories
- Wholesalers & Distributors

Employment by Region



- Central Virginia
- Hampton Roads
- Northern Virginia
- Southern Virginia
- Southwestern Virginia
- Valley Region

KEY SECTORS

Research, Testing, and Medical Laboratories

Virginia's Research, Testing, and Medical Laboratories sector employs over 11,800 people and consists of more than 345 firms. The Life Sciences industry in Virginia benefits from a unique combination of global companies, start-ups, and university R&D.

- AlBioTech
- ATCC
- Battelle
- Howard Hughes Medical Institute
- LabCorp
- Pharmaceutical Product Development
- PRA International
- Quest Diagnostics
- SRI International
- True Health Diagnostics

Pharmaceuticals

The Pharmaceutical sector in Virginia employs almost 3,800 people and consists of 66 firms. Virginia's pharmaceutical products include prescription and over the counter medications, as well as materials used in research and testing.

- Abbott Laboratories
- C B Fleet
- Fareva Group
- Merck
- Novozymes Biologicals
- Teva Pharmaceutical Industries

Medical Devices

Virginia's Medical Devices and Equipment sector employs over 3,100 people and covers more than 160 firms. Medical devices made in Virginia include implants, digital imaging equipment, and precision instruments.

- Avid Medical
- Computerized Imaging References
- Dynex Technologies
- Foot Levelers
- Hollister
- K2M
- Microaire Surgical Instruments
- Origio Humagen Pipets

Growing Companies

Over the past ten years, 126 Life Sciences companies have announced plans to create 8,869 new jobs in Virginia through capital investments of \$1.4 billion. Examples include:

- ATCC
- Balchem
- Bostwick Laboratories
- Cadence
- GENETWORx
- Hollister
- K2M
- Kerma Medical Products
- McKesson
- Thermo Fisher Scientific

Life Sciences R&D in Virginia

- LifeScience-related research accounts for 51% of all academic R&D spending in Virginia
- Virginia is home to 11 Federally Funded R&D Centers and 22 FLC laboratories
- In 2015, Virginia companies or researchers received 253 SBIR awards with a total value of \$113.7 million
- In 2015, there were 74 venture capital deals in Virginia, with 8 deals in Biotechnology valued at \$46.3 million

Virginia's Major Research Universities

The University of Virginia (UVA) continuously ranks as one of the nation's best public universities and is highly regarded for its graduate engineering program and school of medicine. The University's Department of Biomedical Engineering (BME) is regularly recognized by *U.S. News & World Report* among the top 25 programs in the country for its research, educational and translational activities. The BME building is centrally located in the School of Medicine complex adjacent to a world-class Cardiovascular Research Center and Cancer Center. Faculty research, through direct and indirect grant support from federal and state agencies, corporations and private foundations, provided approximately \$311.1 million of the University's budget in 2012–13.

The Institute for Nanoscale and Quantum Scientific & Technological Research (nanoSTAR) is a dedicated multi-disciplinary team striving to advance research and development at the nanoscale. Research efforts focus on three main thrust areas: nano and quantum electronics, nanomedicine and nanotechnology for energy and the environment. (<http://www.virginia.edu>)

Virginia Tech is a leader in transgenic animal and plant technology and on the National Science Foundation's list of top research universities. Annual research expenditures were \$450 million in 2011, and Virginia Tech is aggressively pursuing its goal of becoming a top 30 research institution. Tech has 270 research faculty and 7,100 undergraduate and graduate students enrolled in life science curriculums through multiple colleges. The University's College of Engineering consistently ranks within the top 25 best engineering schools for graduate studies, and top 10 best Biological/Agricultural Engineering school in *U.S. News and World Report's* America's annual Best Graduate Schools survey.

Virginia Tech has several research institutes dedicated to the life sciences. One example is the Fralin Life Science Institute, an interdisciplinary research center that brings together scientists from different disciplines. Research supported by the Institute drives exploration and discovery in both biomedical sciences and biotechnology.

Other contributions to medical research at Virginia Tech include the Virginia-Maryland Regional College of Veterinary Medicine, collaboration with the Edward Via Virginia College of Osteopathic Medicine and the

Virginia Tech-Wake Forest University School of Biomedical Engineering and Sciences. In addition, the Departments of Chemical Engineering and Biological Systems Engineering have expertise in cGMP and pharmaceutical separation and purification. Tech's undergraduate biochemistry program is one of the largest and most highly respected programs of its kind in the U.S. (<http://www.vt.edu>)

Virginia Commonwealth University (VCU) in Richmond is one of the largest academic health centers in the nation with schools of dentistry, medicine, nursing, pharmacy and allied health professions. VCU attracts more than \$225 million annually in sponsored research and is noted for both basic and clinical research with strengths in neuroscience, immunology, cancer (Massey Cancer Center), drug design/development and the genetic origins of disease. VCU is also recognized as the premier comprehensive neurotrauma center in the world.

In recent years, the school has seen a nearly 40 percent increase in the number of grants submitted to the National Institutes of Health and an increase in awarded NIH grant dollars during a time when many research institutions are seeing a decrease in funding. The VCU School of Medicine now accounts for almost half of VCU's sponsored research awards and for 87 percent of the university's NIH funding. (<http://www.vcu.edu>)

George Mason University (GMU) is located in Northern Virginia and was one of the first schools in the nation to offer a bioinformatics doctoral program. Research in the Department of Bioinformatics and Computational Biology addresses the integration of genomic, gene expression and clinical databases; the analysis of protein structure and function; models of molecular, cellular and metabolic processes and models of regulation networks. Located adjacent to the American Type Culture Collection on the Prince William Campus, the Department is rapidly developing broad capabilities in functional genomics. (<http://www.pwc.gmu.edu>)

Eastern Virginia Medical School (EVMS) in Norfolk is a private medical school that has grown to be the largest biomedical research institution in Southeast Virginia. The school sponsors significant research through centers such as the Jones Institute of Reproductive Medicine and the Strelitz Diabetes Institute, long recognized to be at the forefront of advanced treatment and research. (<http://www.evms.edu>)

EVMS and **Old Dominion University** partnered to develop the Frank Reidy Research Center for Bioelectrics (CBE) in 2002. The CBE has grown to over 40 researchers with expertise in engineering, physics, immunology and molecular biology. Research at the center ranges from fundamental studies of electric field and plasma effects on biological cells to applied research including medical and commercial applications. Cutting edge research being conducted at the Center includes vaccine development, gene delivery, membrane physiology, biomechanical properties and tumor treatment. The Center also coordinates an International Consortium on Bioelectrics, including groups in the U.S., Japan, Germany and France. (<http://www.odu.edu/engr/bioelectrics/>)

Appalachian College of Pharmacy serves as the only three-year Doctor of Pharmacy program in Virginia located in the town of Oakwood. The school is dedicated to research that will positively impact the people in Central Appalachia. Research focuses on issues of importance to more rural areas such as healthcare access, pharmacy administration and practice, as well as cancer and diabetes. (<http://www.acp.edu>)

Virginia's Life Sciences Workforce

Selected Occupations	Employment	Median Salary
Biochemists and Biophysicists	500	\$80,020
Microbiologists	430	\$70,430
Medical Scientists, Except Epidemiologists	1,810	\$85,040
Chemists	1,560	\$81,270
Biological Technicians	1,800	\$40,090
Chemical Technicians	1,450	\$43,890
Medical and Clinical Laboratory Technologists	4,160	\$58,020
Medical and Clinical Laboratory Technicians	3,820	\$37,000
First-Line Supervisors of Production and Operating Workers	12,760	\$60,480
Team Assemblers	15,200	\$26,100
Computer-Controlled Machine Tool Operators, Metal and Plastic	1,140	\$38,380
Chemical Equipment Operators and Tenders	1,280	\$54,450
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	850	\$38,560
Mixing and Blending Machine Setters, Operators, and Tenders	2,100	\$37,060
Cutting and Slicing Machine Setters, Operators, and Tenders	1,710	\$49,570
Packaging and Filling Machine Operators and Tenders	6,780	\$26,250

Source: U.S. Bureau of Labor Statistics, 2016

Virginia is a Leading Gateway to the World

- Two of the nation's largest railroads, CSX Corporation and Norfolk Southern Corporation, have extensive infrastructure throughout the State
- Eleven railroads operate on nearly 3,400 miles (excluding trackage rights) of railway in Virginia, of which more than 2,800 miles are Class I—one of the strongest rail networks in the nation
- Six major interstate highways, I-95, I-85, I-81, I-64, I-77 and I-66, provide quick access to Northeast, Southeast and Midwest markets
- 14 commercial airports serve the Commonwealth, including two of the nation's busiest, Washington Dulles International and Ronald Reagan Washington National
- The Port of Virginia offers world-class shipping facilities and schedules to over 80 foreign ports and more than 200 foreign countries

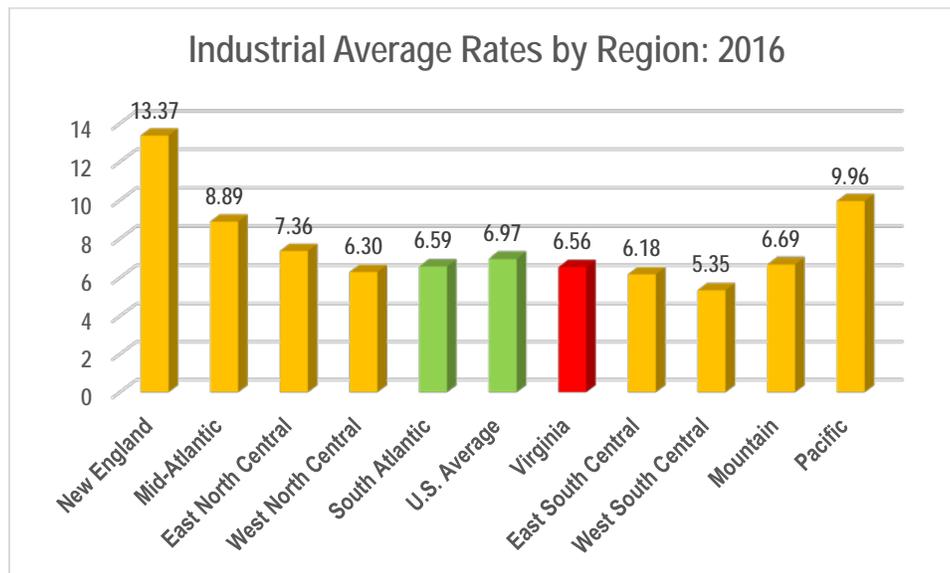


Virginia's Resources

- Highly skilled and productive workforce
- Stable energy resource pool to serve present and future residential, commercial, industrial and transportation needs
- Eight regulated natural gas companies serve the State with an extensive network of underground pipes and other gas facilities

Average Industrial Rates

- Extremely reliable electric service with very competitive rates
- Average cost per unit of electricity for the industrial sector – 6.56 cents



Rates (In cents/kilowatt-hour)

Source: Edison Electric Institute, *Typical Bills and Average Rates Report, Winter 2016*