

National Institutes of Health (NIH) 2017

The National Institutes of Health (NIH), part of the U.S. Department of Health and Human Services, is the largest source of funding for medical research in the world. Its mission is “to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.”¹ NIH is comprised of 27 Institutes and Centers, each with a specific research agenda.² More than 80% of the \$32.3 billion NIH budget goes to funding researchers outside the NIH – at more than 2,500 universities and research organizations.³

The Boston Planning & Development Agency

We strive to understand the current environment of the city to produce quality research and targeted information that will inform and benefit the residents and businesses of Boston. Our Division conducts research on Boston's economy, population, and commercial markets for all departments of the BPDA, the City of Boston, and related organizations.

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Boston: Leader in NIH Awards for 22 Consecutive Years

2016 marked the 22nd consecutive year that Boston received the most NIH funding of any U.S. city. Forty-two Boston institutions received 3,592 NIH awards for more than \$1.85 billion in funding. This total represents 7.5% of all NIH spending and 72% of all NIH funding in Massachusetts. Eight Boston organizations received over \$100 million in NIH funding, reinforcing Boston as a powerhouse in medical research.

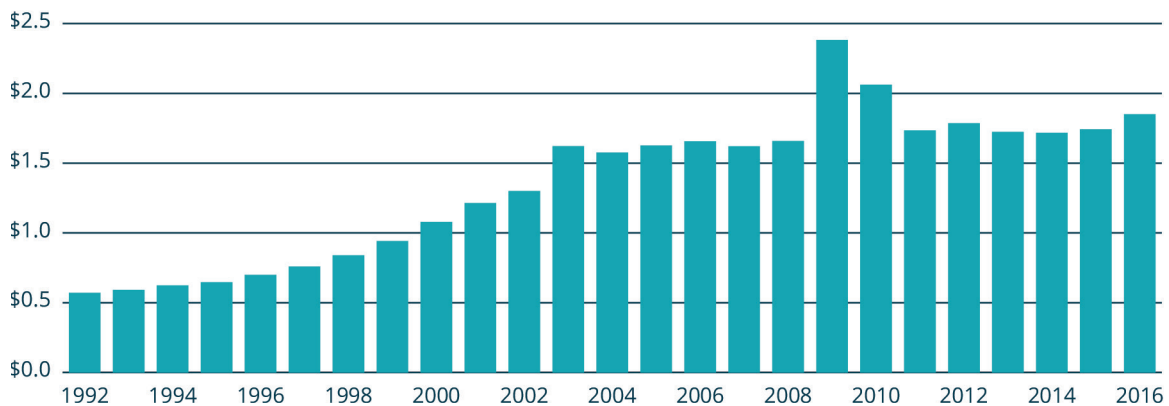
Since 1992, Boston has received over \$34 billion in NIH funding. Boston's NIH funding reached a record high in 2009 due to economic stimulus dollars created by the American Recovery and Reinvestment Act (ARRA). After 2009, funding levels decreased as ARRA ended, but Boston's annual NIH funding has remained over \$1.7 billion since 2011.

Boston's Top Recipients Of NIH Funding FY2016

Organization Name	Awards	Funding in Millions
Massachusetts General Hospital	796	\$364.98
Brigham and Women's Hospital	570	\$349.52
Harvard Medical School	373	\$195.16
Children's Hospital Corporation	318	\$147.76
Boston University Medical Campus	254	\$135.95
Beth Israel Deaconess Medical Center	256	\$132.23
Dana-Farber Cancer Institute	217	\$128.1
Harvard School of Public Health	183	\$123.1
Total of Top Boston Recipients	2,967	\$1,576.8

Source: National Institutes of Health "NIH Awards by Location and Organization FY2016," BPDA Research Division Analysis

Boston NIH Awards: FY1992-2016 in billions of dollars



Source: National Institutes of Health, "NIH Awards by Location and Organization," FY1992-FY2016, BPDA Research Division Analysis

Top Funded U.S. Cities

In Fiscal Year 2016, the only other U.S. city with close to Boston's level of NIH funding was New York City, a city of thirteen times Boston's population. Boston received \$2,765.12 in NIH funding per capita in FY2016, the highest per capita funding among

the top 10 funded cities. Following Boston and New York are Seattle, Philadelphia and Baltimore for cities with the most NIH funding. These five cities received around 25% of the total NIH funding.

Top Five U.S. Cities In NIH Funding FY2016
in billions of dollars



Source: National Institutes of Health, "NIH Funding by Location and Organization," FY2016, BPDA Research Analysis

Top Funded Organizations

Two Boston organizations were among the top 20 funding recipients in the United States: Massachusetts General Hospital and Brigham and Women's Hospital. They received a total of 1,366 awards and

over \$714 million in funding. Their combined funding represents about 28% of all funding in Massachusetts and 39% of Boston's entire NIH funding.

Top 20 Recipients Of NIH Funding
FY2016

RANK	ORGANIZATION NAME	CITY	AWARDS	FUNDING IN MILLIONS
1	Johns Hopkins University	Baltimore, MD	1297	\$651
2	University of California, San Francisco	San Francisco, CA	1208	\$578
3	University of Michigan	Ann Arbor, MI	1106	\$487
4	University of Pennsylvania	Philadelphia, PA	1107	\$479
5	University of Pittsburgh at Pittsburgh	Pittsburgh, PA	1053	\$476
6	University of Washington	Seattle, WA	885	\$458
7	Stanford University	Stanford, CA	944	\$427
8	Duke University	Durham, NC	778	\$417
9	University of North Carolina Chapel Hill	Chapel Hill, NC	871	\$412
10	Yale University	New Haven, CT	924	\$407
11	Washington University	Saint Louis, MO	878	\$407
12	University of California, San Deigo	La Jolla, CA	835	\$401
13	Columbia University Health Sciences	New York, NY	827	\$382
14	University of California, Los Angeles	Los Angeles, CA	836	\$381
15	Massachusetts General Hospital	Boston, MA	796	\$365
16	Brigham and Women's Hospital	Boston, MA	570	\$350
17	Emory University	Atlanta, GA	685	\$315
18	University of Wisconsin - Madison	Madison, WI	614	\$285
19	Icahn School of Medicine at Mount Sinai	New York, NY	542	\$284
20	Northwestern University at Chicago	Chicago, IL	577	\$268

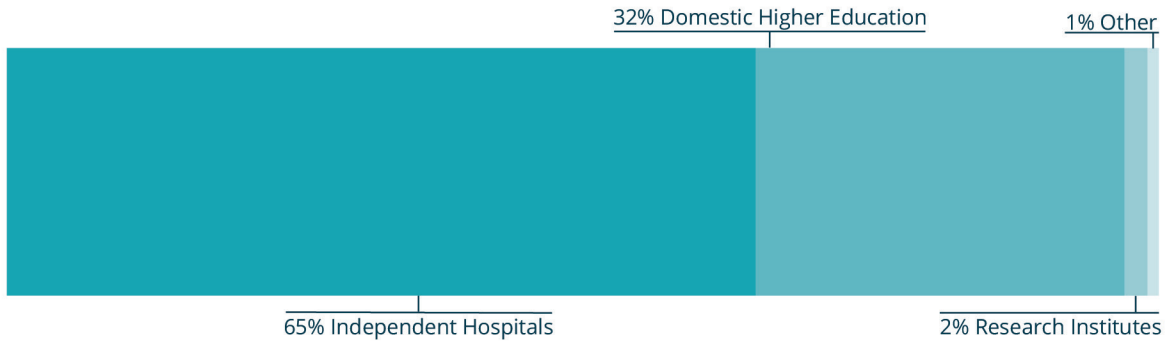
Source: National Institutes of Health, "NIH Funding by Location and Organization" FY2016, BPDA Research Analysis

Funding By Organization Type

The bulk of NIH funding goes toward hospitals and universities. However, NIH also provides vital funding to research institutes and other companies. The major research institutes that received NIH funding in Boston were the Joslin Diabetes Center and the Schepens Eye Research Institute, an affiliate of Massachusetts Eye and Ear Infirmary. Harvard Pilgrim Health Care Institute, a not-for-profit health

services company, received over \$6 million in NIH funding for a study examining environmental influences on child health.⁴ The top private companies that received NIH funding were in the biotech and healthcare industries. Other organizations receiving NIH funding included manufacturing, fitness, and software companies.

NIH Funding By Type Of Institution
FY2016



Source: National Institute of Health, "NIH Funding by Location and Organization," FY2016, BPDA Research Division Analysis

Hospitals and Health Centers

Boston is a national center for health care and medical research. There are twenty-one in-patient hospitals located within the city with a combined total of 6,079 beds in 2015.⁵ Ten Boston hospitals were granted 2,343 NIH awards totaling over \$1.2 billion of funding, representing 65% of the city's total and 47% of the state's total. The total funding amount received by Boston's hospitals alone is higher than the entire total funding received by any other city except New York.

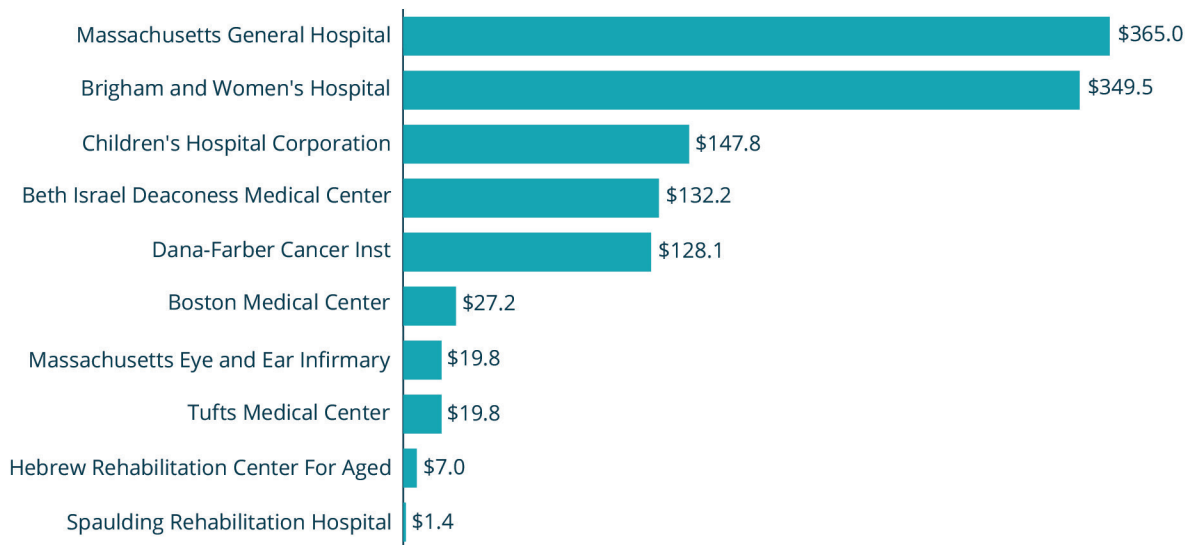
Massachusetts General Hospital and Brigham and Women's Hospital, both teaching hospitals for Harvard Medical School, were the top two NIH-funded hospitals in the United States. Massachusetts General Hospital leads the group for the 16th consecutive year with 30% of all grants to hospitals in Boston. Massachusetts General Hospital conducts the largest hospital-based research program in the United States with over 6,000 researchers and staff and 1.2 million square feet of research space, primarily in downtown Boston and Charlestown.⁶ Additional research institutions in this area that re-

ceived NIH awards include, Massachusetts Eye and Ear Infirmary, Schepens Eye Research Institute, and Spaulding Rehabilitation Hospital.

Brigham and Women's Hospital has the largest medical research program in the Longwood Medical Area, and a world famous medical campus that includes Brigham and Women's Hospital, Children's Hospital, Dana-Farber Cancer Institute, Beth Israel Deaconess Medical Center, and Joslin Diabetes Center. Harvard Medical School and Harvard School of Public Health are also located in the Longwood area, making it an epicenter of health care and medical training and research. Institutions in the Longwood area brought in over \$750 million from the NIH last fiscal year. Longwood is the largest engine that has propelled Boston to rank as the top recipient of NIH money for 22 years in a row. The Longwood Medical Area has over 46,000 scientists, researchers and staff, and over 21,000 students.⁷ The Longwood Area alone received more NIH funding than all but nine states in the United States.



Top Boston Hospital In NIH Funding FY2016
in millions of dollars



Source: National Institute of Health, "NIH Funding by Location and Organization," FY2016, BPDA Research Division Analysis

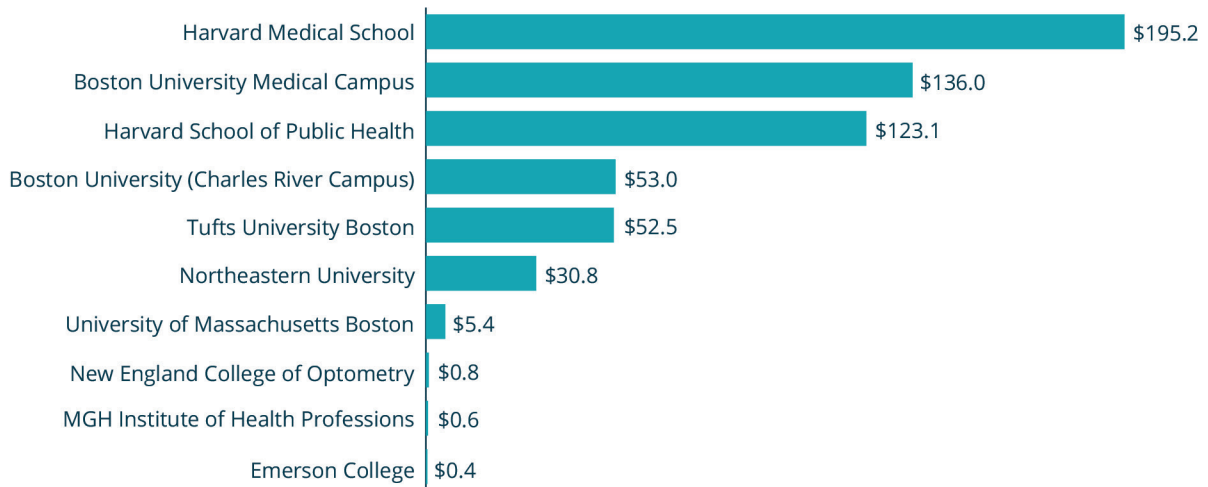
Education

Boston is also a world-renowned center of higher education. Nine of Boston's higher education institutions received 1,114 NIH awards and \$597 million in funding, a total that represented 32% of the city's total and 23% of the state's total.

Boston's successful scientific research benefits from the city's well-educated labor force. About half of residents over 25 in Boston have a Bachelor's degree or higher.⁸ As of academic year 2016-

17, there were more than 138,000 students enrolled in undergraduate and graduate programs in Boston's colleges and universities.⁹ Boston, with less than 10% of the state's population, has about a quarter of all students enrolled in colleges and universities in Massachusetts. Boston companies and institutions are able to attract and utilize students and graduates of our world class educational institutions.

Boston's NIH Grant Recipients In Higher Education FY2016
in millions of dollars



Source: National Institute of Health, "NIH Funding by Location and Organization," FY2016, BPDA Research Division Analysis

Private Companies

Immunitics, Inc., located in the Innovation District on the South Boston Waterfront, received nearly \$6 million in NIH funding in FY2016, similar to the funding the company received in FY2015. Immunitics develops diagnostic tests for diseases and pathogens and prides itself in combining the development of marketable products with fundable scientific research.¹⁰

Arietis is a biotechnology company located at the Bio Square Discovery and Innovation Center on Boston University's Medical Campus in the South End. Arietis focuses on the discovery and development of novel antimicrobial agents and received more than \$2.2 million in NIH funding in FY2016.¹¹

Cogito Health, located in Downtown Boston, develops voice analysis software for mental health monitoring and received \$1.3 million in NIH funding.¹² Klogene Therapeutics, Inc., also in Downtown Boston, was awarded about \$1.5 million in FY2016 to fund Alzheimer's disease drug development.¹³

Another Downtown company, Medical Discovery Partners, LLC, focuses on the development of innovative medical diagnostic technologies by conducting research and developing manufacturing methods for commercial production.¹⁴ Medical Discovery Partners received \$478,000 in NIH funding in FY2016.

Etiometry, located in Allston, is a Healthcare Information Technology company creating Predictive Patient Care Analytics to improve the quality of care in the intensive care unit.¹⁵ Etiometry received almost \$1 million in NIH funding in FY2016.

SQZ Biotechnologies Company is located at the Venture Development Center at UMass Boston. In FY2016 SQZ Biotechnologies received nearly \$900,000 in NIH funding for its work to facilitate cell therapies through technology to deliver materials directly into the cell cytosol.¹⁶



Boston: Leader of a Regional Powerhouse

The city of Boston is a center of biomedical research within the United States. It also benefits from collaborations with biomedical research institutions in other cities within the metropolitan area and the state. Boston shares its metropolitan area with other centers for scientific and medical research. Cambridge boasts premier research centers, particularly at Harvard, MIT, and in Kendall Square. In FY2016, Cambridge institutions received 580 NIH awards for \$334 million in funding. One example of collaboration between institutions in Boston and Cambridge is the Broad

Institute, which brings together researchers from Harvard, MIT, and five Harvard-affiliated hospitals located in Boston. Massachusetts as a whole received more than \$2.5 billion dollars in NIH funding in FY2016, allocated among 5,029 awards. Massachusetts led the country in NIH funding per capita at \$378 – about 5 times the national average. Massachusetts also leads the nation in per capita bioscience venture capital distributions and per capita bioscience related patents.¹⁷

Conclusion

Boston has earned the most NIH funding of any U.S. city for the 22nd year in a row due to its critical mass of researchers and resources. Boston has a well-educated labor force supported by world class hospitals and universities and robust life tech industries.

NIH funding to Boston researchers has facilitated dramatic breakthroughs in science that will improve healthcare and quality of life for years to come. Examples of NIH funded research include the following:

- Researchers at MGH discovered the first ever genome sites linked to depression in people of European ancestry. Researchers leveraged the statistical power of a large sample size by using innovative crowd-sourcing techniques.¹⁸

- Researchers at the Brigham and Women's Hospital found that women living with higher levels of vegetation near their homes showed improved mental health and social engagement, and that more greenery near the women's homes was linked to lower mortality.¹⁹
- Researchers at MGH found that the elimination of cancer-associated fibroblasts does not halt or slow the growth of tumors, leading to a significant new understanding of how cancer grows.²⁰

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