The University of Massachusetts

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FY2013
Annual R&D Expenditures Report

February 2014

UMASS President's Office • *Institutional Research*

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TOTAL R&D EXPENDITURES – UMASS SYSTEM AND CAMPUSES

LIFE SCIENCES R&D EXPENDITURES

Introduction

The *FY2013 Annual Research and Development Expenditures Report* presents information on the research and development expenditures for the University of Massachusetts System. This report is based on data that our five campuses provide to the National Science Foundation (NSF) through its Higher Education Research and Development Survey (previously known as the annual Survey of Research and Development Expenditures at Universities and Colleges). In addition to the FY2013 data, this report also provides trend data in many cases.

The report is comprised of two sections: Total R&D Expenditures (pages 1-14) and Life Sciences R&D Expenditures (pages 15-17).

Major Highlights:

- **UMASS Total R&D Expenditures** – Total FY2013 R&D Expenditures for the University of Massachusetts System was reported at $591.12 million, which represents a one percent decline from the FY2012 total of $597.48 million.

- **Growth in Total R&D Expenditures (UMASS versus All U.S. Institutions)** – In FY2012 (most recent comparison data available), while the UMASS system reflected an annual growth rate of two percent over the previous year, All U.S. Institutions reflected a growth rate of one percent.

- **UMASS R&D Expenditures in Science and Engineering** – In FY2013, an estimated $525.17 million (89%) of our R&D expenditures were in the sciences and engineering (S&E).

- **UMASS State Ranking in Total R&D Expenditures** – Among Massachusetts colleges and universities, UMASS ranked 3rd in Total R&D Expenditures, behind only MIT and Harvard. In 2012, UMASS comprised nearly one-fifth (18.4%) of the Total Expenditures of all MA institutions. UMASS, MIT, Harvard and BU together account for 79% of the academic science and engineering R&D expenditures in the state (Rankings based on FY2012 data).

- **UMASS R&D Expenditures by Funding Source (FY2013)** – In terms of funding sources, 62% is from the federal government, 27% is from institutional sources, 3% is from state and local government, 4% from businesses, 4% from non-profit organizations, and 1% is from other sources (e.g., private foundations).

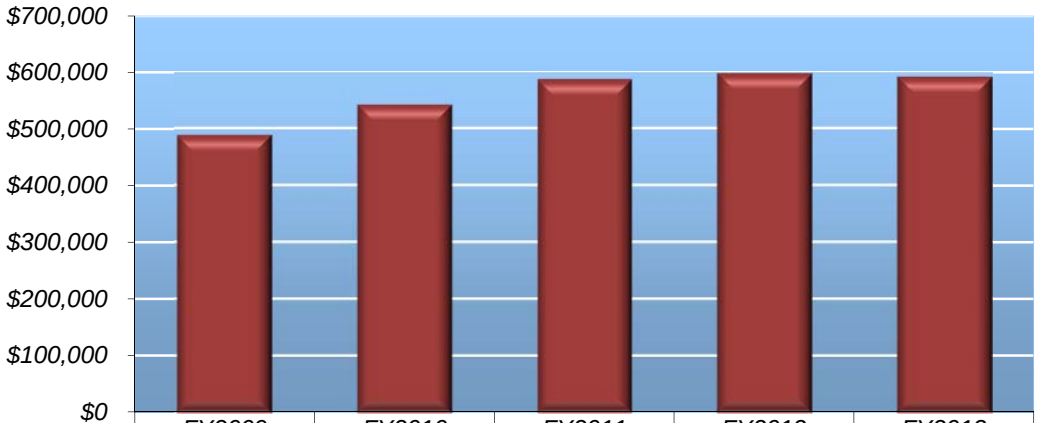
- **UMASS Areas of Funding Growth** – Between the reporting cycles FY2012-13, industry/business sponsorship grew slightly from 7% to 8%, and institutional funds increased two percentage points from 25% to 27%. State and local government funding also increased slightly from 2% to 3% of all funds. Federal funding dropped from 65% to 62% of all funds.

- **Life Sciences Continues to Comprise More Than Half of all R&D Expenditures at UMASS** – At $329 million, the life sciences constitute more than half of UMASS's total R&D expenditures (55.7%). FY2013 distribution of R&D expenditures by field is:

Life Sciences	55.7%	Social Sciences	3.3%
Physical Sciences	8.4%	Other Non-Sciences/Engg.	3.6%
Engineering	11.4%	Psychology	1.7%
Computer Sciences	4.4%	Mathematical Sciences	0.5%
Environmental Sciences	3.2%	Other Sciences	0.3%

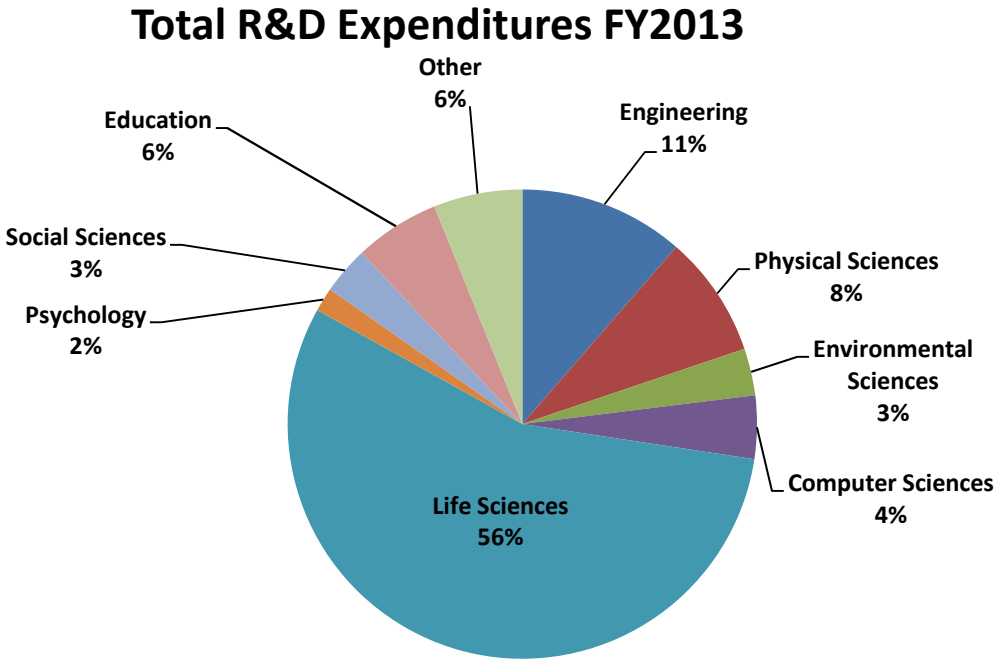
UMASS System

Total R&D Expenditures FY2009 - FY2013



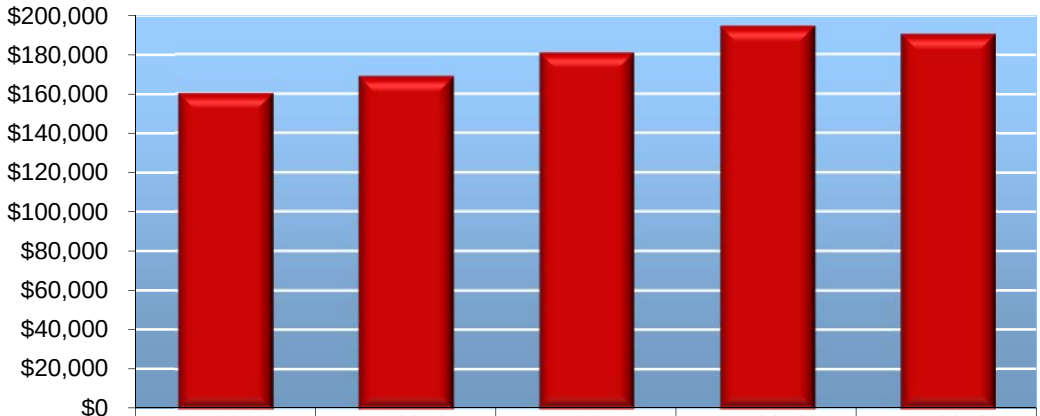
	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$489,060	$542,666	$586,708	$597,480	$591,121
Annual Growth	12.4%	11.0%	8.1%	1.8%	-1.1%

FY 2010 figures have been revised from the FY 2010 R&D Report publication ($542,668).



Amherst

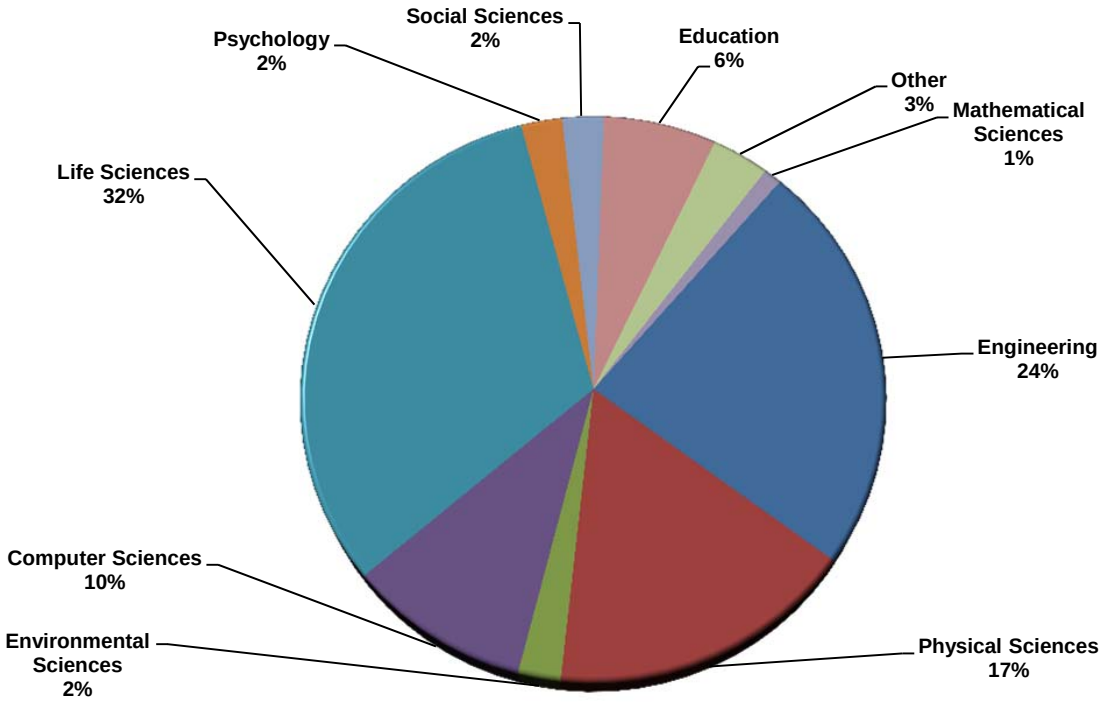
Total R&D Expenditures FY2009 – FY2013



	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$160,666	$169,141	$181,297	$194,775	$190,739
Annual Growth	2.5%	5.3%	7.2%	7.4%	-2.1%

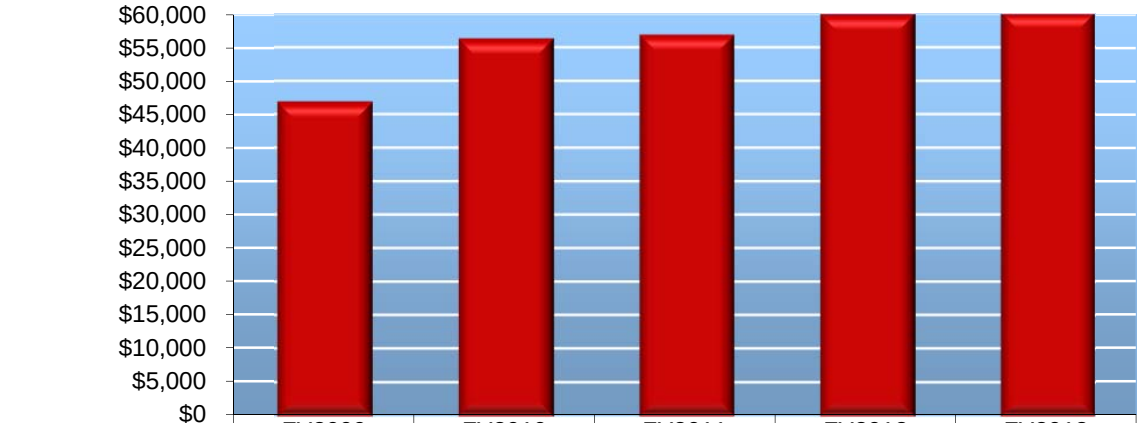
Note: UMA FY2010 figures have been revised since the FY2010 R&D Report publicaton.

Total R&D Expenditures FY2013



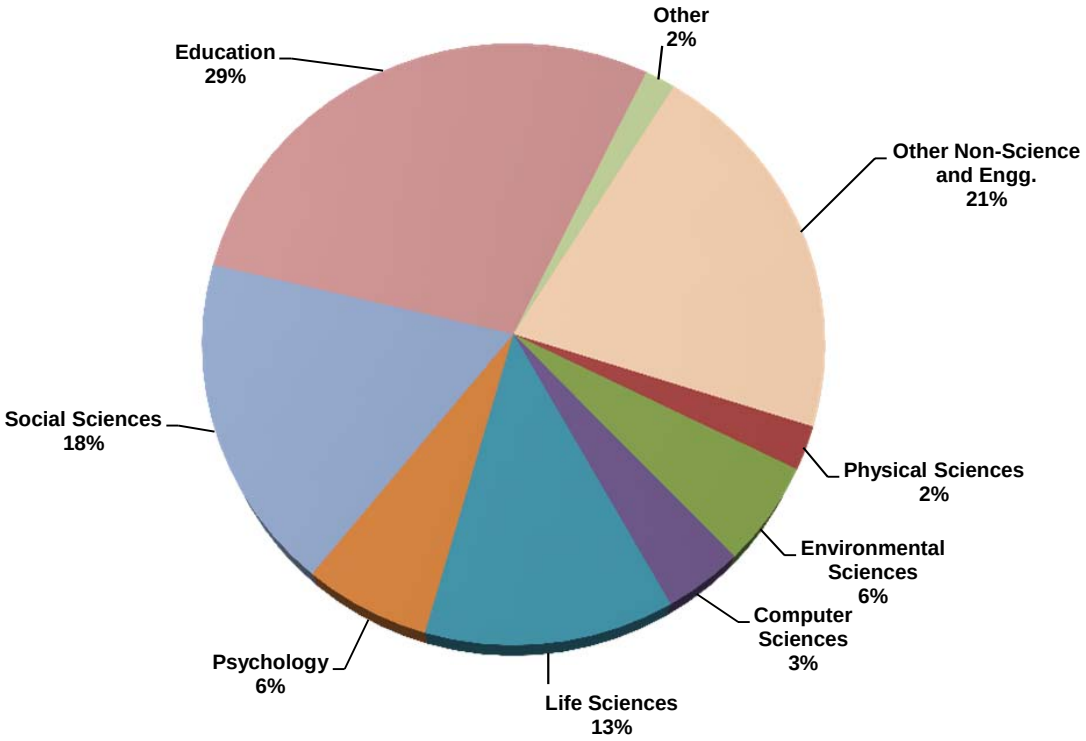
Boston

Total R&D Expenditures FY2009 – FY2013



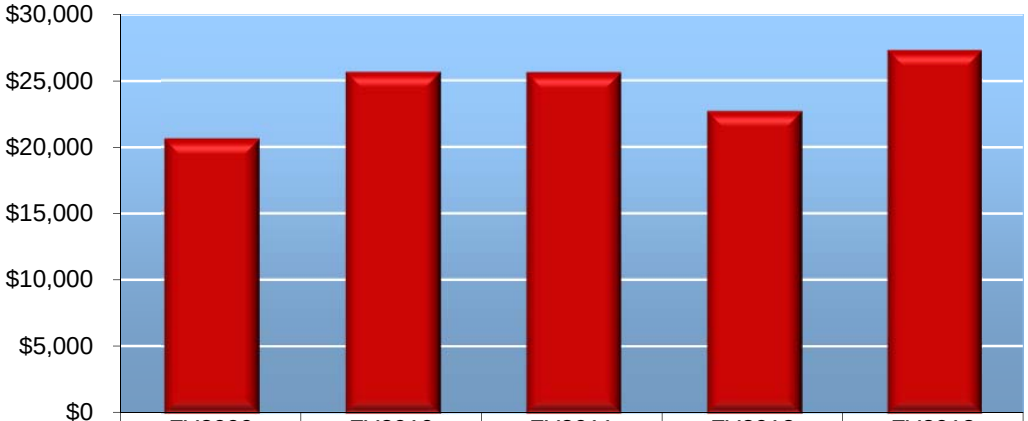
	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$47,028	$56,416	$57,040	$60,086	$60,380
Annual Growth	23.7%	20.0%	1.1%	5.3%	0.5%

Total R&D Expenditures FY2013



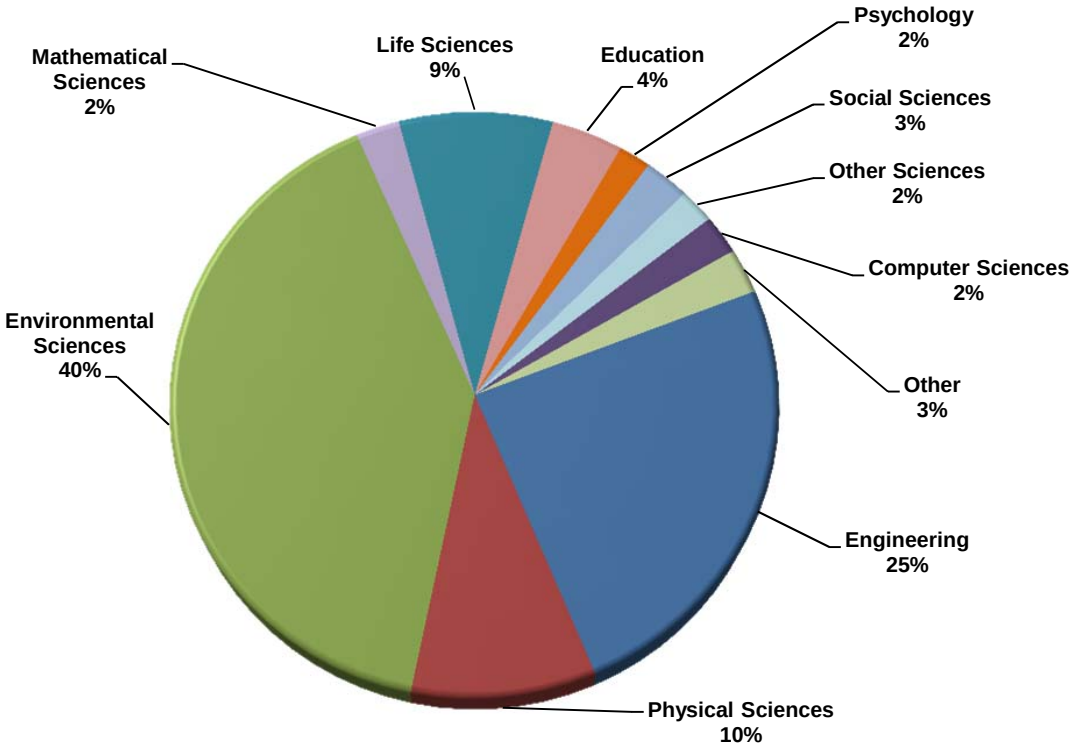
Dartmouth

Total R&D Expenditures FY2009 – FY2013



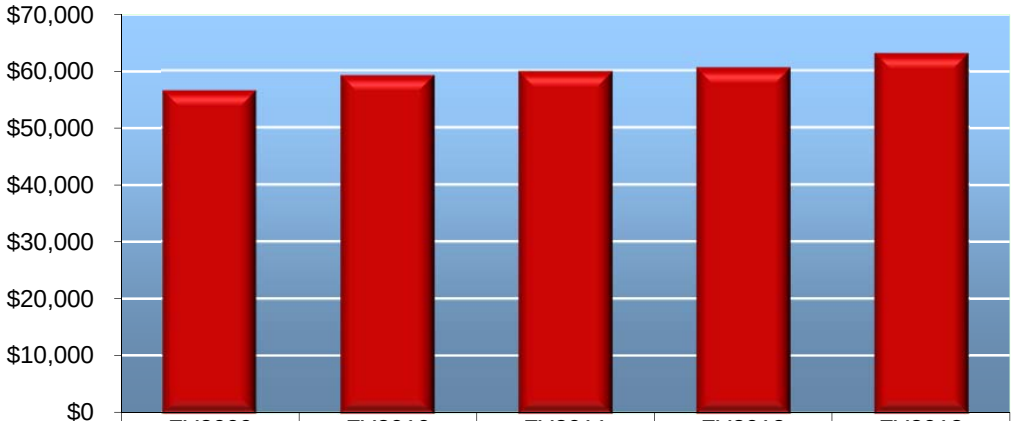
	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$20,669	$25,725	$25,644	$22,732	$27,326
Annual Growth	-1.2%	24.5%	-0.3%	-11.4%	20.2%

Total R&D Expenditures FY2013



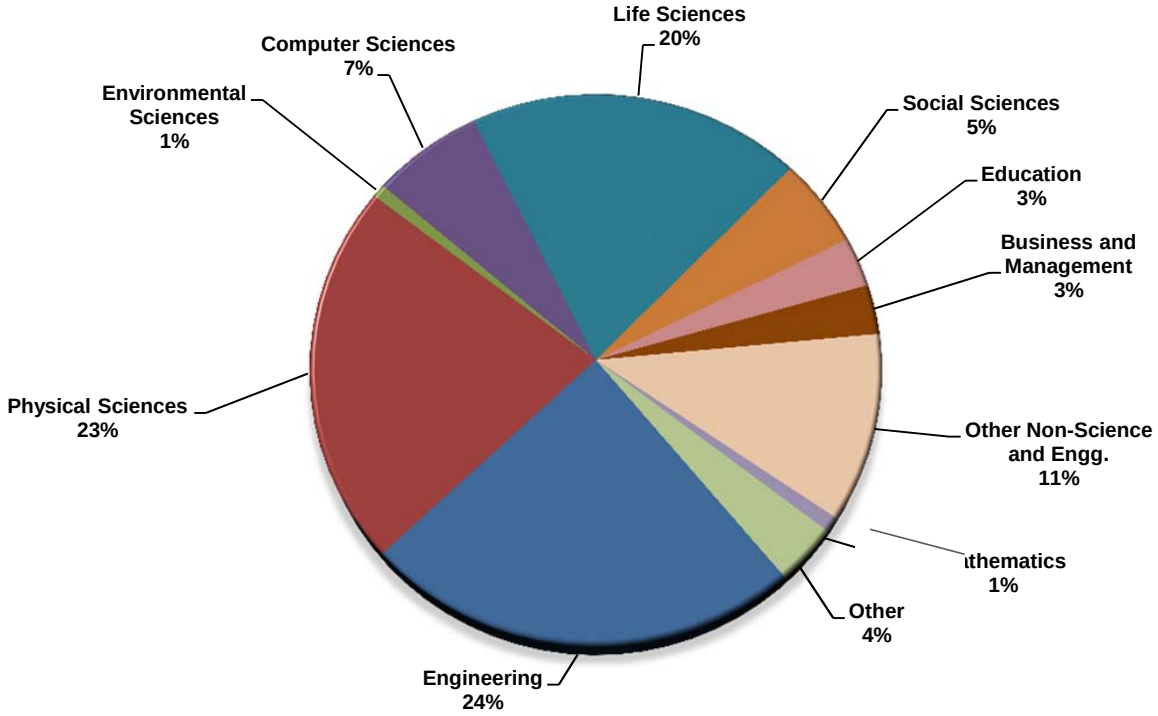
Lowell

Total R&D Expenditures FY2009 – FY2013



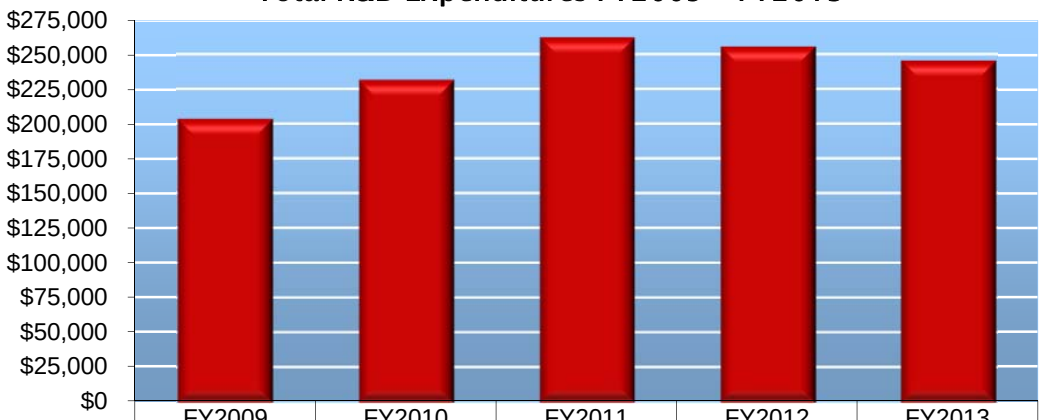
	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$56,664	$59,345	$60,013	$60,624	$63,136
Annual Growth	38.6%	4.7%	1.1%	1.0%	4.1%

Total R&D Expenditures FY2013



Worcester

Total R&D Expenditures FY2009 – FY2013

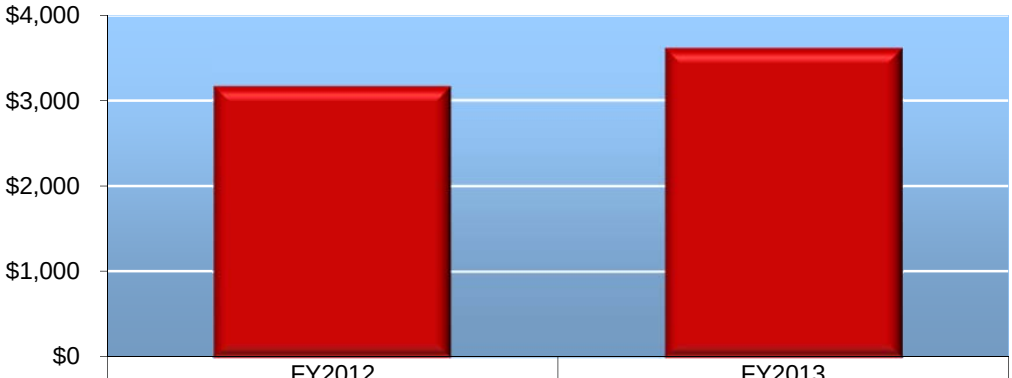


	FY2009	FY2010	FY2011	FY2012	FY2013
Total R&D ($000s)	$204,033	$232,039	$262,714	$256,090	$245,923
Annual Growth	14.2%	13.7%	13.2%	-2.5%	-4.0%

All of Worcester's R&D expenditures are in the Life Sciences.

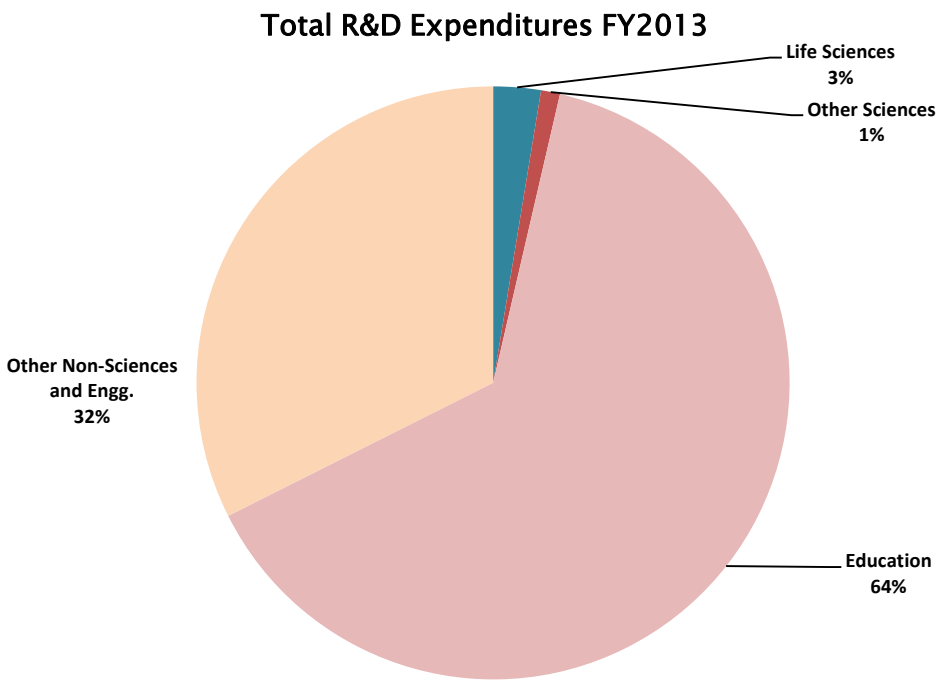
President's Office

Total R&D Expenditures FY2012 – FY2013



	FY2012	FY2013
Total R&D ($000s)	$3,173	$3,617
Annual Growth	0.0%	14.0%

President's Office (Cont'd)



FY 2013 Total R&D Expenditures by Field (Federal and Non-Federal)

	UMA					UMB					UMD				
FIELD	Federal	Non-Federal	UMA Total	% of UMA Total	% of Field	Federal	Non-Federal	UMB Total	% of UMB Total	% of Field	Federal	Non-Federal	UMD Total	% of UMD Total	% of Field
Engineering (Total)	**$24,216**	**$20,814**	**$45,030**	**23.6%**	**66.9%**	**$191**	**$160**	**$351**	**0.6%**	**0.5%**	**$1,697**	**$5,008**	**$6,705**	**24.5%**	**10.0%**
Aeronautical & Astronomical	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	**$0**	$0	0.0%	0.0%
Bioengineering/Biomedical	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$429	**$465**	$894	3.3%	100.0%
Chemical	$ 7,882	$6,621	$14,503	7.6%	66.4%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Civil	$ 3,331	$5,141	$8,472	4.4%	73.2%	$0	$0	$0	0.0%	0.0%	$418	$715	$1,133	4.1%	9.8%
Electrical	$ 9,298	$5,379	$14,677	7.7%	74.2%	$191	$160	$351	0.6%	1.8%	$705	$651	$1,356	5.0%	6.9%
Mechanical	$ 3,422	$2,908	$6,330	3.3%	65.3%	$0	$0	$0	0.0%	0.0%	$145	$836	$981	3.6%	10.1%
Metallurgical & Materials	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$27	$27	0.1%	100.0%
Other	$ 283	$765	$1,048	0.5%	30.0%	$0	$0	$0	0.0%	0.0%	$0	$2,314	$2,314	8.5%	66.2%
Physical Sciences (Total)	**$ 21,934**	**$ 9,554**	**$ 31,488**	**16.5%**	**63.3%**	**$1,169**	**$265**	**$ 1,434**	**2.4%**	**2.9%**	**$734**	**$1,878**	**$2,612**	**9.6%**	**5.3%**
Astronomy	$ 2,997	$1,248	$ 4,245	2.2%	100.0%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Chemistry	$ 13,643	$5,591	$ 19,234	10.1%	76.4%	$530	$175	$ 705	1.2%	2.8%	$171	$1,582	$1,753	6.4%	7.0%
Physics	$ 5,294	$2,715	$ 8,009	4.2%	39.5%	$639	$90	$ 729	1.2%	3.6%	$563	$296	$859	3.1%	4.2%
Other	$0	$0	$ -	0.0%	0.0%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Environmental Sciences (Total)	**$2,886**	**$1,435**	**$ 4,321**	**2.3%**	**22.6%**	**$2,057**	**$1,283**	**$ 3,340**	**5.5%**	**17.5%**	**$4,090**	**$6,887**	**$10,977**	**40.2%**	**57.4%**
Atmospheric	$0	$0	$0	0.0%	0.0%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Earth Sciences	$ 2,886	$1,342	$4,228	2.2%	89.6%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Oceanography	$ -	$0	$0	0.0%	0.0%	$1,996	$892	$ 2,888	4.8%	20.8%	$4,090	$6,887	$10,977	40.2%	79.2%
Other	$ -	$93	$93	0.0%	17.1%	$61	$391	$ 452	0.7%	82.9%	$0	$0	$0	0.0%	0.0%
Mathematical Sciences (Total)	**$ 1,358**	**$602**	**$ 1,960**	**1.0%**	**60.8%**	**$36**	**$19**	**$ 55**	**0.1%**	**1.7%**	**$317**	**$338**	**$655**	**2.4%**	**20.3%**
Computer Sciences (Total)	**$ 12,797**	**$5,864**	**$ 18,661**	**9.8%**	**72.3%**	**$2,008**	**$420**	**$ 2,428**	**4.0%**	**9.4%**	**$212**	**$386**	**$598**	**2.2%**	**2.3%**
Life Sciences (Total)	**$ 35,086**	**$ 25,657**	**$ 60,743**	**31.8%**	**18.5%**	**$4,128**	**$3,471**	**$ 7,599**	**12.6%**	**2.3%**	**$835**	**$1,478**	**$2,313**	**8.5%**	**0.7%**
Agricultural	$ 12,645	$9,986	$22,631	11.9%	96.5%	$0	$0	$ -	0.0%	0.0%	$214	$595	$809	3.0%	3.5%
Biological	$ 15,073	$11,908	$26,981	14.1%	24.6%	$1,855	$737	$ 2,592	4.3%	2.4%	$621	$882	$1,503	5.5%	1.4%
Medical	$ 6,399	$3,262	$9,661	5.1%	7.3%	$329	$483	$ 812	1.3%	0.6%	$0	$0	$0	0.0%	0.0%
Other	$ 969	$501	$1,470	0.8%	2.3%	$1,944	$2,251	$ 4,195	6.9%	6.6%	$0	$1	$1	0.0%	0.0%
Psychology (Total)	**$ 3,169**	**$1,286**	**$ 4,455**	**2.3%**	**45.4%**	**$2,350**	**$1,516**	**$ 3,866**	**6.4%**	**39.4%**	**$175**	**$308**	**$483**	**1.8%**	**4.9%**
Social Sciences (Total)	**$ 1,317**	**$ 3,184**	**$ 4,501**	**2.4%**	**23.3%**	**$1,532**	**$9,270**	**$ 10,802**	**17.9%**	**55.8%**	**$16**	**$670**	**$686**	**2.5%**	**3.5%**
Economics	$ 467	$773	$ 1,240	0.7%	56.6%	$0	$117	$ 117	0.2%	5.3%	$0	$8	$8	0.0%	0.4%
Political Science	$ 295	$446	$ 741	0.4%	8.1%	$244	$7,265	$ 7,509	12.4%	82.1%	$0	$538	$538	2.0%	5.9%
Sociology	$ 339	$1,445	$ 1,784	0.9%	57.1%	$462	$479	$ 941	1.6%	30.1%	$16	$106	$122	0.4%	3.9%
Other	$ 216	$520	$ 736	0.4%	15.1%	$826	$1,409	$ 2,235	3.7%	45.8%	$0	$18	$18	0.1%	0.4%
Other Sciences (Total)	**$ 470**	**$588**	**$ 1,058**	**0.6%**	**61.3%**	**$0**	**$0**	**$ -**	**0.0%**	**0.0%**	**$0**	**$530**	**$530**	**1.9%**	**30.7%**
TOTAL, SCI & ENG FIELDS	**$ 103,233**	**$ 68,984**	**$ 172,217**	**90.3%**	**32.8%**	**$13,471**	**$16,404**	**$29,875**	**49.5%**	**5.7%**	**$8,076**	**$17,483**	**$25,559**	**93.5%**	**4.9%**
FIELD	**Federal**	**Non-Federal**	**UMA Total**	**% of UMA Total**	**% of Field**	**Federal**	**Non-Federal**	**UMB Total**	**% of UMB Total**	**% of Field**	**Federal**	**Non-Federal**	**UMD Total**	**% of UMD Total**	**% of Field**
Education	$ 6,976	$5,312	$ 12,288	6.4%	35.4%	$11,186	$6,029	$ 17,215	28.5%	49.5%	$734	$349	$1,083	4.0%	3.1%
Law	$ 51	$6	$ 57	0.0%	100.0%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Humanities	$ 49	$1,767	$ 1,816	1.0%	59.8%	$104	$237	$ 341	0.6%	11.2%	$50	$97	$147	0.5%	4.8%
Visual and Performing Arts	$ 61	$597	$ 658	0.3%	69.3%	$0	$15	$ 15	0.0%	1.6%	$0	$41	$41	0.2%	4.3%
Business and Management	$ 918	$1,761	$ 2,679	1.4%	52.8%	$0	$224	$ 224	0.4%	4.4%	$0	$330	$330	1.2%	6.5%
Comm., Journalism & Library Sci	$ 160	$864	$ 1,024	0.5%	96.8%	$0	$8	$ 8	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Social Work	$0	$0	$ -	0.0%	0.0%	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%
Other Non-Science and Engin.	$ -	$0	$ -	0.0%	0.0%	$163	$12,539	$ 12,702	21.0%	60.4%	$0	$166	$166	0.6%	0.8%
TOTAL, NON-SCI & ENG FIELDS	**$ 8,215**	**$ 10,307**	**$ 18,522**	**9.7%**	**28.1%**	**$ 11,453**	**$19,052**	**$30,505**	**50.5%**	**46.3%**	**$784**	**$983**	**$1,767**	**6.5%**	**2.7%**
TOTAL, SCI & ENG FIELDS	**$ 103,233**	**$ 68,984**	**$ 172,217**	90.3%	**32.8%**	**$ 13,471**	**$16,404**	**$ 29,875**	**49.5%**		**$8,076**	**$17,483**	**$25,559**	**93.5%**	**4.9%**
GRAND TOTAL	**$ 111,448**	**$ 79,291**	**$ 190,739**	100.0%		**$ 24,924**	**$35,456**	**$60,380**	**100.0%**		**$8,860**	**$18,466**	**$27,326**	**100.0%**	

Source: Campus NSF surveys. All dollars are in thousands.

Note: Percent of Total is the percentage each field represents of total campus or system R&D expenditures in all fields.

Percent of Field is the percentage of the UMass system's expenditures in a particular field represented by that campus.

FY 2013 Total R&D Expenditures by Field (Federal and Non-Federal)

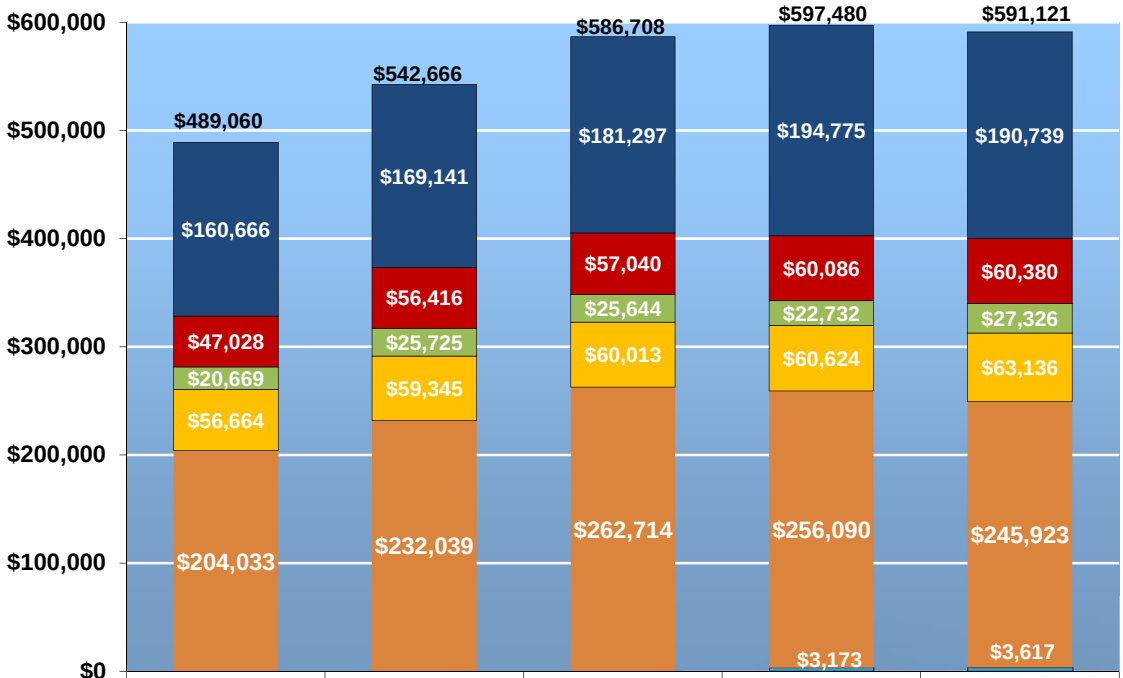
	UML					UMW					UMPO					UMass System			
FIELD	Federal	Non-Federal	UML Total	% of UML Total	% of Field	Federal	Non-Federal	UMW Total	% of UMW Total	% of Field	Federal	Non-Federal	UMPO Total	% of UMPO Total	% of Field	Federal	Non-Federal	System Total	% of System
Engineering (Total)	$ 6,728	$ 8,508	$ 15,236	24.1%	22.6%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 32,832	$ 34,490	$ 67,322	11.4%
Aeronautical & Astronomical	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ -	$ -	$ -	0.0%
Bioengineering/Biomedical	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 429	$ 465	$ 894	0.2%
Chemical	$3,163	$4,183	$ 7,346	11.6%	33.6%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 11,045	$ 10,804	$ 21,849	3.7%
Civil	$1,333	$638	$ 1,971	3.1%	17.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 5,082	$ 6,494	$ 11,576	2.0%
Electrical	$1,396	$2,001	$ 3,397	5.4%	17.2%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 11,590	$ 8,191	$ 19,781	3.3%
Mechanical	$836	$1,552	$ 2,388	3.8%	24.6%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 4,403	$ 5,296	$ 9,699	1.6%
Metallurgical & Materials	$0	$0	$ -	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ -	$ 27	$ 27	0.0%
Other	$0	$134	$ 134	0.2%	3.8%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 283	$ 3,213	$ 3,496	0.6%
Physical Sciences (Total)	**$8,875**	**$5,319**	**$14,194**	**22.5%**	**28.5%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 32,712**	**$ 17,016**	**$ 49,728**	**8.4%**
Astronomy	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 2,997	$ 1,248	$ 4,245	0.7%
Chemistry	$1,401	$2,096	$3,497	5.5%	13.9%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 15,745	$ 9,444	$ 25,189	4.3%
Physics	$7,474	$3,223	$10,697	16.9%	52.7%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 13,970	$ 6,324	$ 20,294	3.4%
Other	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ -	$ -	$ -	0.0%
Environmental Sciences (Total)	**$177**	**$315**	**$492**	**0.8%**	**2.6%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 9,210**	**$ 9,920**	**$ 19,130**	**3.2%**
Atmospheric	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ -	$ -	$ -	0.0%
Earth Sciences	$177	$315	$492	0.8%	10.4%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 3,063	$ 1,657	$ 4,720	0.8%
Oceanography	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 6,086	$ 7,779	$ 13,865	2.3%
Other	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$ 61	$ 484	$ 545	0.1%
Mathematical Sciences (Total)	**$71**	**$485**	**$556**	**0.9%**	**17.2%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 1,782**	**$ 1,444**	**$ 3,226**	**0.5%**
Computer Sciences (Total)	**$2,139**	**$1,979**	**$4,118**	**6.5%**	**16.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 17,156**	**$ 8,649**	**$ 25,805**	**4.4%**
Life Sciences (Total)	**$6,225**	**$6,183**	**$12,408**	**19.7%**	**3.8%**	**$189,159**	**$56,764**	**$245,923**	**100.0%**	**74.7%**	**$94**	**$0**	**$94**	**2.6%**	**0.0%**	**$ 235,527**	**$ 93,553**	**$ 329,080**	**55.7%**
Agricultural	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 12,859	$ 10,581	$ 23,440	4.0%
Biological	$901	$569	$1,470	2.3%	1.3%	$61,055	$16,232	$77,287	31.4%	70.4%	$0	$0	$0	0.0%	**0.0%**	$ 79,505	$ 30,328	$ 109,833	18.6%
Medical	$47	$0	$47	0.1%	0.0%	$90,501	$31,253	$121,754	49.5%	92.0%	$44	$0	$44	1.2%	**0.0%**	$ 97,320	$ 34,998	$ 132,318	22.4%
Other	$5,277	$5,614	$10,891	17.3%	17.2%	$37,603	$9,279	$46,882	19.1%	73.8%	$50	$0	$50	1.4%	**0.1%**	$ 45,843	$ 17,646	$ 63,489	10.7%
Psychology (Total)	**$280**	**$726**	**$1,006**	**1.6%**	**10.3%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 5,974**	**$ 3,836**	**$ 9,810**	**1.7%**
Social Sciences (Total)	**$946**	**$2,407**	**$3,353**	**5.3%**	**17.3%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$ 3,811**	**$ 15,531**	**$ 19,342**	**3.3%**
Economics	$134	$693	$827	1.3%	37.7%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 601	$ 1,591	$ 2,192	0.4%
Political Science	$0	$363	$363	0.6%	4.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 539	$ 8,612	$ 9,151	1.5%
Sociology	$0	$275	$275	0.4%	8.8%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 817	$ 2,305	$ 3,122	0.5%
Other	$812	$1,076	$1,888	3.0%	38.7%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 1,854	$ 3,023	$ 4,877	0.8%
Other Sciences (Total)	**$0**	**$102**	**$102**	**0.2%**	**5.9%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$37**	**$0**	**$37**	**1.0%**	**2.1%**	**$ 507**	**$ 1,220**	**$ 1,727**	**0.3%**
TOTAL, SCI & ENG FIELDS	**$25,441**	**$26,024**	**$51,465**	**81.5%**	**9.8%**	**$189,159**	**$56,764**	**$245,923**	**100.0%**	**46.8%**	**$131**	**$0**	**$131**	**3.6%**	**0.0%**	**$ 339,511**	**$ 185,659**	**$ 525,170**	**88.8%**
FIELD	Federal	Non-Federal	UML Total	% of UML Total	% of Field	Federal	Non-Federal	UMW Total	% of UMW Total	% of Field	Federal	Non-Federal	UMPO Total	% of UMPO Total	% of Field	Federal	Non-Federal		% of Total
Education	$885	$968	$1,853	2.9%	5.3%	$0	$0	$0	0.0%	0.0%	$1,854	$460	$2,314	64.0%	**6.7%**	$ 21,635	$ 13,118	$ 34,753	5.9%
Law	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 51	$ 6	$ 57	0.0%
Humanities	$0	$731	$731	1.2%	24.1%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 203	$ 2,832	$ 3,035	0.5%
Visual and Performing Arts	$0	$236	$236	0.4%	24.8%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 61	$ 889	$ 950	0.2%
Business and Management	$225	$1,612	$1,837	2.9%	36.2%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 1,143	$ 3,927	$ 5,070	0.9%
Comm., Journalism & Library Sci	$17	$9	$26	0.0%	2.5%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ 177	$ 881	$ 1,058	0.2%
Social Work	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	0.0%	$0	$0	$0	0.0%	**0.0%**	$ -	$ -	$ -	0.0%
Other Non-Science and Engin.	$792	$6,196	$6,988	11.1%	33.2%	$0	$0	$0	0.0%	0.0%	$141	$1,031	$1,172	32.4%	**5.6%**	$ 1,096	$ 19,932	$ 21,028	3.6%
TOTAL, NON-SCI & ENG FIELDS	**$1,919**	**$9,752**	**$11,671**	**18.5%**	**17.7%**	**$0**	**$0**	**$0**	**0.0%**	**0.0%**	**$1,995**	**$1,491**	**$3,486**	**96.4%**	**5.3%**	**$ 24,366**	**$ 41,585**	**$ 65,951**	**11.2%**
TOTAL, SCI & ENG FIELDS	**$25,441**	**$26,024**	**$51,465**	**81.5%**	**9.8%**	**$189,159**	**$56,764**	**$245,923**	**100.0%**	**46.8%**	**$131**	**$0**	**$131**	**3.6%**	**0.0%**	**$ 339,511**	**$ 185,659**	**$ 525,170**	**88.8%**
GRAND TOTAL	**$27,360**	**$35,776**	**$63,136**	**100.0%**		**$189,159**	**$56,764**	**$245,923**	**100.0%**		**$2,126**	**$1,491**	**$3,617**	**100.0%**		**$ 363,877**	**$ 227,244**	**$ 591,121**	**100.0%**

Source: Campus NSF surveys. All dollars a

Note: Percent of Total is the percentage ea

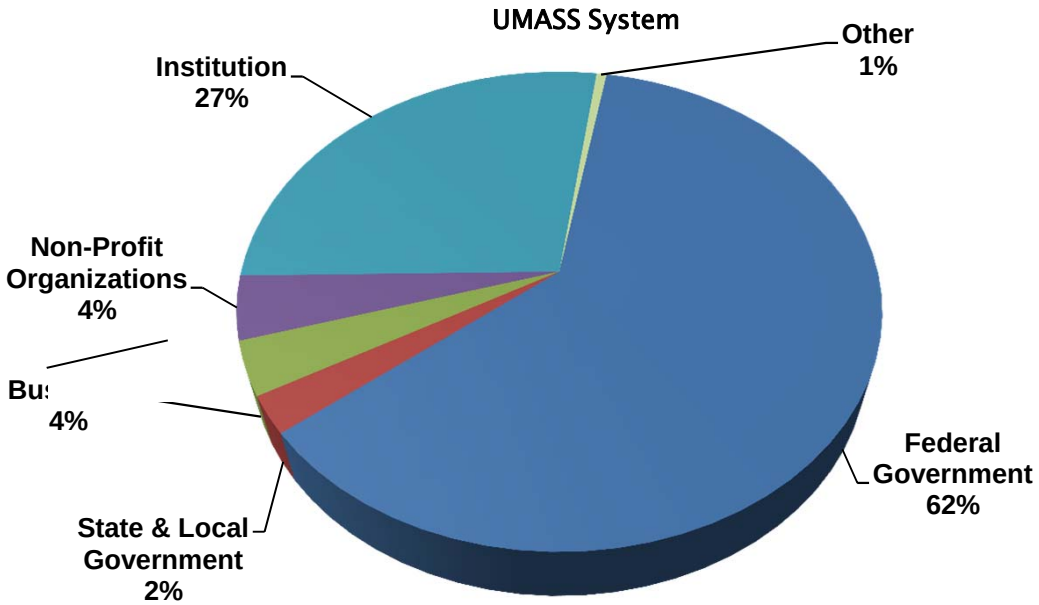
Percent of Field is the percentage of t

Total R&D Expenditures
UMASS System FY2009 – FY2013



	FY2009	FY2010	FY2011	FY2012	FY2013
UM Amherst	$160,666	$169,141	$181,297	$194,775	$190,739
UM Boston	$47,028	$56,416	$57,040	$60,086	$60,380
UM Dartmouth	$20,669	$25,725	$25,644	$22,732	$27,326
UM Lowell	$56,664	$59,345	$60,013	$60,624	$63,136
UM Worcester	$204,033	$232,039	$262,714	$256,090	$245,923
UM President's Office	$0	$0	$0	$3,173	$3,617

Total R&D Expenditures
by Source of Funds FY2013
UMASS System



Source: Campus NSF surveys. All dollars are in thousands.

Note: UMA FY2010 figures have been revised since the FY2010 R&D Report publicaton.

R&D Expenditures by Source

(Dollars in Thousands)

	FY2005- FY2009									FY2010 - FY2013					
	Total R&D Expenditures (S&E)									Total R&D Expenditures					
	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09		1-Year Change FY08 - FY09		FY10	FY11	FY12	FY13	1-Year Change FY12-13	
						$	%	$	%					$	%
Amherst	$127,487	$136,057	$141,351	$152,884	$156,216	$28,729	22.5%	$3,332	2.2%	$169,141	$181,297	$194,775	$190,739	-$4,036	-2%
Boston	$18,148	$21,056	$25,952	$30,272	$36,637	$18,489	101.9%	$6,365	21.0%	$56,416	$57,040	$60,086	$60,380	$294	0%
Dartmouth	$19,452	$19,171	$19,538	$20,431	$19,343	-$109	-0.6%	-$1,088	-5.3%	$25,725	$25,644	$22,732	$27,326	$4,594	20%
Lowell	$23,852	$27,635	$34,824	$36,486	$52,431	$28,579	119.8%	$15,945	43.7%	$59,345	$60,013	$60,624	$63,136	$2,512	4%
Worcester	$149,267	$156,452	$157,469	$178,614	$204,033	$54,766	36.7%	$25,419	14.2%	$232,039	$262,714	$256,090	$245,923	-$10,167	-4%
President's Office												$3,173	$3,617	$444	14%
System	**$338,206**	**$360,371**	**$379,134**	**$418,687**	**$468,660**	**$130,454**	**38.6%**	**$49,973**	**11.9%**	**$542,668**	**$586,708**	**$594,307**	**$591,121**	**-$3,186**	**-1%**

	FY2005- FY2009									FY2010 - FY2013					
	Federal R&D Expenditures (S&E)									Federal Total R&D Expenditures					
	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09		1-Year Change FY08 - FY09		FY10	FY11	FY12	FY13	1-Year Change FY12-13	
						$	%	$	%					$	%
Amherst	$66,921	$69,642	$71,974	$79,736	$80,163	$13,242	19.8%	$427	0.5%	$97,937	$107,683	$202,149	$111,448	-$90,701	-45%
Boston	$6,326	$8,610	$9,152	$12,001	$13,536	$7,210	114.0%	$1,535	12.8%	$24,527	$26,958	$33,275	$24,924	-$8,351	-25%
Dartmouth	$9,852	$9,515	$11,456	$13,087	$9,667	-$185	-1.9%	-$3,420	-26.1%	$12,236	$13,657	$10,979	$8,860	-$2,119	-19%
Lowell	$17,608	$18,741	$20,045	$22,406	$23,083	$5,475	31.1%	$677	3.0%	$25,550	$27,960	$26,786	$27,360	$574	2%
Worcester	$130,680	$136,141	$131,226	$145,113	$145,834	$15,154	11.6%	$721	0.5%	$178,293	$208,244	$202,149	$189,159	-$12,990	-6%
President's Office												$1,655	$2,126	$471	28%
System	**$231,387**	**$242,649**	**$243,853**	**$272,343**	**$272,283**	**$40,896**	**17.7%**	**-$60**	**0.0%**	**$338,543**	**$384,502**	**$476,993**	**$363,877**	**-$113,116**	**-24%**

	FY2005- FY2009									FY2010 - FY2013					
	State & Local Government R&D Expenditures (S&E)									State & Local Total R&D Expenditures					
	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09		1-Year Change FY08 - FY09		FY10	FY11	FY12	FY13	1-Year Change FY12-13	
						$	%	$	%					$	%
Amherst	$3,873	$5,684	$5,638	$4,699	$5,439	$1,566	40.4%	$740	15.7%	$4,567	$3,166	$4,358	$3,041	-$1,317	-30%
Boston	$2,481	$1,662	$1,207	$701	$949	-$1,532	-61.7%	$248	35.4%	$3,652	$2,417	$1,356	$5,693	$4,337	320%
Dartmouth	$5,039	$5,069	$2,210	$1,641	$1,312	-$3,727	-74.0%	-$329	-20.0%	$657	$821	$1,313	$1,462	$149	11%
Lowell	$180	$601	$969	$1,088	$1,466	$1,286	714.4%	$378	34.7%	$1,910	$1,745	$1,941	$3,288	$1,347	69%
Worcester	$139	$35	$0	$895	$5,265	$5,126	3687.8%	$4,370	488.3%	$1,506	$1,290	$647	$804	$157	24%
President's Office												$1,101	$556	-$545	-50%
System	**$11,712**	**$13,051**	**$10,024**	**$9,024**	**$14,431**	**$2,719**	**23.2%**	**$5,407**	**59.9%**	**$12,292**	**$9,439**	**$10,069**	**$14,844**	**$4,775**	**47%**

Source: Campus NSF surveys. All dollars are in thousands.

Note: Prior to the FY 2010 reporting cycle (FY 2005-FY 2009), R&D Expenditures data by Source represents Science and Engineering figures only; Due to changes in the NSF Survey for the FY 2010 reporting cycle (and moving forward), R&D Expenditures by Source data now comprises Total R&D Expenditures figures: Science and Engineering plus Non-Science & Engineering. For reference purposes, historical data FY2005-FY2009 will be maintained until the next 5-year trend data is complete. Note 2: UMA FY2010 figures have been revised since the FY2010 R&D Report publicaton.

R&D Expenditures by Source (Cont'd)

FY2005 - FY2009 / FY2010- FY2013

Industry-Sponsored R&D Expenditures (S&E) / Industry-Sponsored Total R&D Expenditures

	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09 $	5-Year Change FY05 - FY09 %	1-Year Change FY08 - FY09 $	1-Year Change FY08 - FY09 %	FY10 Business	FY10 Non-Profits	FY10 Total	FY11 Business	FY11 Non-Profits	FY11 Total	FY12 Business	FY12 Non-Profits	FY12 Total	FY13 Business	FY13 Non-Profits	FY13 Total	1-Year Change FY12-13 $	1-Year Change FY12-13 %
Amherst	$4,724	$5,934	$5,195	$8,182	$8,505	$3,781	80.0%	$323	3.9%	$6,234	$6,675	$12,909	$6,048	$6,476	$12,524	$6,485	$6,102	$12,587	$7,614	$5,450	$13,064	$477	4%
Boston	$0	$0	$275	$552	$333	$333	NA	-$219	-39.7%	$91	$5,902	$5,993	$188	$4,933	$5,121	$160	$2,670	$2,830	$97	$3,219	$3,316	$486	17%
Dartmouth	$1,252	$1,680	$762	$807	$816	-$436	-34.8%	$9	1.1%	$633	$392	$1,025	$503	$301	$804	$519	$334	$853	$425	$208	$633	-$220	-26%
Lowell	$4,755	$4,423	$5,222	$6,299	$6,772	$2,017	42.4%	$473	7.5%	$4,460	$1,779	$6,239	$3,726	$2,426	$6,152	$3,914	$2,983	$6,897	$4,303	$1,115	$5,418	-$1,479	-21%
Worcester	$8,018	$9,465	$16,266	$15,192	$14,090	$6,072	75.7%	-$1,102	-7.3%	$14,198	$14,524	$28,722	$11,747	$15,747	$27,494	$9,749	$14,278	$24,027	$8,795	$14,948	$23,743	-$284	-1%
President's Office																$60	$427	$487	$19	$418	$437	-$50	-10%
System	**$18,749**	**$21,502**	**$27,720**	**$31,032**	**$30,516**	**$11,767**	**62.8%**	**-$516**	**-1.7%**	**$25,616**	**$29,272**	**$58,703**	**$22,212**	**$29,883**	**$52,095**	**$20,887**	**$26,794**	**$47,681**	**$21,253**	**$25,358**	**$46,611**	-$1,070	-2%

FY2005 - FY2009 / FY2010 - FY2013

Institutional R&D Expenditures (S&E) / Institutional Total R&D Expenditures

	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09 $	5-Year Change FY05 - FY09 %	1-Year Change FY08 - FY09 $	1-Year Change FY08 - FY09 %	FY10	FY11	FY12	FY13	1-Year Change FY12-FY13 $	1-Year Change FY12-FY13 %
Amherst	$42,887	$45,773	$48,755	$49,556	$50,647	$7,760	18.1%	$1,091	2.2%	$52,426	$57,156	$ 61,924	$ 62,045	$121	0.2%
Boston	$6,731	$7,007	$11,122	$13,048	$15,993	$9,262	137.6%	$2,945	22.6%	$21,997	$22,350	$ 22,569	$ 25,830	$3,261	14.4%
Dartmouth	$3,305	$2,907	$4,855	$4,253	$7,164	$3,859	116.8%	$2,911	68.4%	$11,807	$10,123	$ 9,371	$ 16,280	$6,909	73.7%
Lowell	$1,309	$3,870	$8,588	$6,693	$21,110	$19,801	1512.7%	$14,417	215.4%	$25,583	$24,131	$ 24,880	$ 26,208	$1,328	5.3%
Worcester	$1,583	$2,377	$1,385	$2,626	$20,916	$19,333	1221.3%	$18,290	696.5%	$23,518	$25,686	$28,813	$31,516	$2,703	9.4%
President's Office												$ 384	$ 441	$57	14.8%
System	**$55,815**	**$61,934**	**$74,705**	**$76,176**	**$115,830**	**$60,015**	**107.5%**	**$39,654**	**52.1%**	**$135,331**	#######	**$147,941**	**$162,320**	**$14,379**	**9.7%**

FY2005 - FY2009 / FY2010 - FY2013

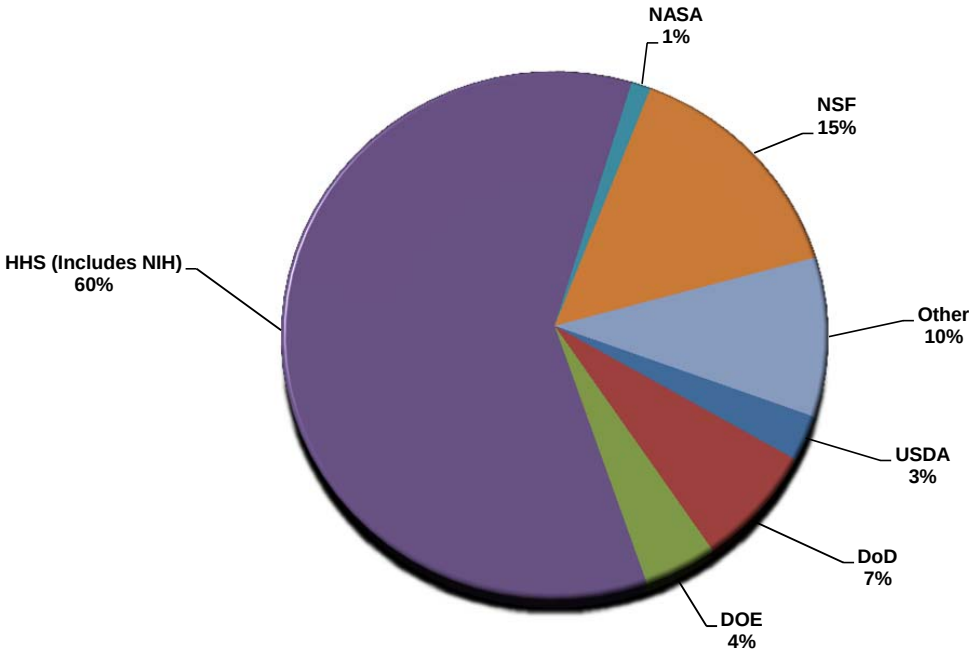
Other R&D Expenditures (S&E) / Other Total R&D Expenditures

	FY05	FY06	FY07	FY08	FY09	5-Year Change FY05 - FY09 $	5-Year Change FY05 - FY09 %	1-Year Change FY08 - FY09 $	1-Year Change FY08 - FY09 %	FY10	FY11	FY12	FY13	1-Year Change FY12-FY13 $	1-Year Change FY12-FY13 %
Amherst	$9,082	$9,024	$9,789	$10,711	$11,462	$2,380	26.2%	$751	7.0%	$1,302	$768	$626	$1,141	$515	82%
Boston	$2,610	$3,777	$4,196	$3,970	$5,826	$3,216	123.2%	$1,856	46.8%	$247	$194	$56	$617	$561	1002%
Dartmouth	$4	$0	$255	$643	$384	$380	9500.0%	-$259	-40.3%	$0	$239	$216	$91	-$125	-58%
Lowell	$0	$0	$0	$0	$0	$0	NA	$0	NA	$63	$25	$120	$862	$742	618%
Worcester	$8,847	$8,434	$8,592	$14,788	$17,928	$9,081	102.6%	$3,140	21.2%	$0	$0	$0	$701	$701	na
President's Office												$0	$57	$57	na
System	**$20,543**	**$21,235**	**$22,832**	**$30,112**	**$35,600**	**$15,057**	**73.3%**	**$5,488**	**18.2%**	**$1,612**	**$1,226**	**$1,018**	**$3,412**	**$2,394**	**235%**

Source: Campus NSF surveys. All dollars are in thousands.

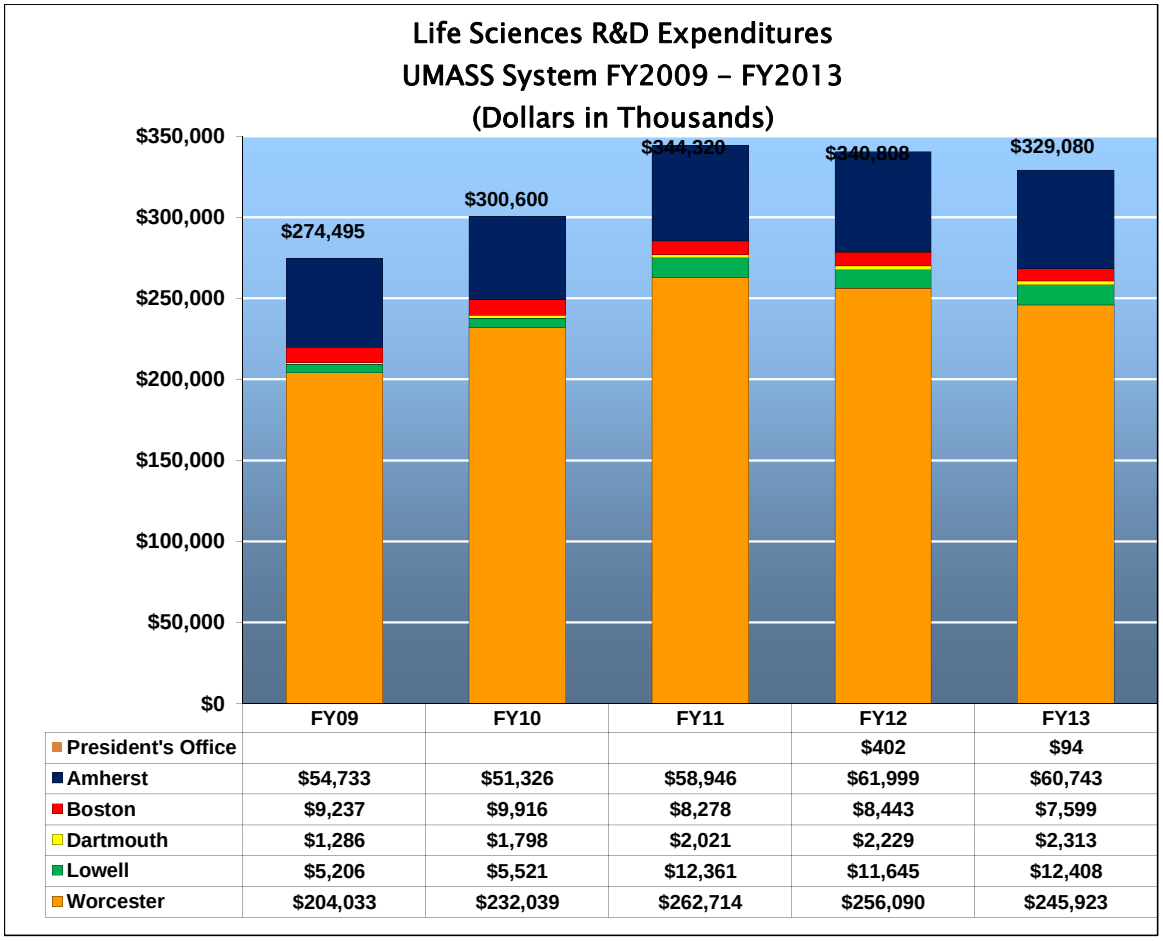
Note: Prior to the FY 2010 reporting cycle (FY 2005-FY 2009), R&D Expenditures data by Source represents Science and Engineering figures only; Due to changes in the NSF Survey for the FY 2010 reporting cycle (and moving forward), R&D Expenditures by Source data now comprises Total R&D Expenditures figures: Science and Engineering plus Non-Science & Engineering. For reference purposes, historical data FY2005-FY2009 will be maintained until the next 5-year trend data is complete. Note 2: UMA FY2010 figures have been revised since the FY2010 R&D Report Publication.

Total R&D Expeditures
by Federal Government Agency Sources FY2013
UMASS System

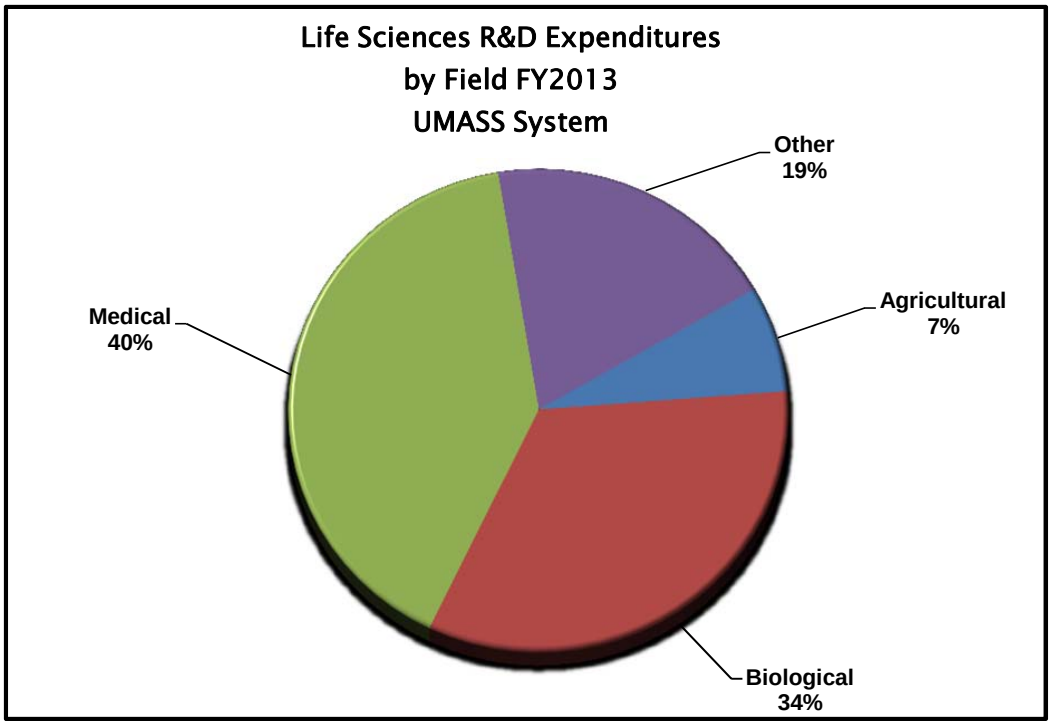


	Total Federal $	USDA	% of Campus Total	DoD	% of Campus Total	DOE	% of Campus Total	HHS (includes NIH)	% of Campus Total	NASA	% of Campus Total	NSF	% of Campus Total	Other	% of Campus Total
Amherst	**$ 111,448**	$ 9,786	8.8%	$ 11,159	10.0%	$ 13,166	11.8%	$ 20,779	18.6%	$ 2,576	2.3%	$ 38,883	34.9%	$ 15,099	13.5%
Boston	**$ 24,924**	$ -	0.0%	$ 549	2.2%	$ 329	1.3%	$ 8,290	33.3%	$ 573	2.3%	$ 5,215	20.9%	$ 9,968	40.0%
Dartmouth	**$ 8,860**	$ 250	2.8%	$ 1,561	17.6%	$ 240	2.7%	$ 201	2.3%	$ 245	2.8%	$ 2,876	32.5%	$ 3,487	39.4%
Lowell	$ 27,360	$ -	0.0%	$ 7,471	27.3%	$ 1,519	5.6%	$ 7,090	25.9%	$ 939	3.4%	$ 5,890	21.5%	$ 4,451	16.3%
Worcester	**$ 189,159**	$ 60	0.0%	$ 5,427	2.9%	$ -	0.0%	$ 181,598	96.0%	$ -	0.0%	$ 928	0.5%	$ 1,146	0.6%
President's Office	**$ 2,126**	$ -	0.0%	$ -	0.0%	$ -	0.0%	$ 388	18.3%	$ 37	1.7%	$ 285	13.4%	$ 1,416	66.6%
System	**$ 363,877**	**$ 10,096**	2.8%	**$ 26,167**	7.2%	**$ 15,254**	4.2%	**$ 218,346**	60.0%	**$ 4,370**	1.2%	**$ 54,077**	14.9%	**$ 35,567**	9.8%

Source: Campus NSF surveys. All dollars are in thousands.
Note: HHS includes NIH



	FY09	FY10	FY11	FY12	FY13
President's Office				$402	$94
Amherst	$54,733	$51,326	$58,946	$61,999	$60,743
Boston	$9,237	$9,916	$8,278	$8,443	$7,599
Dartmouth	$1,286	$1,798	$2,021	$2,229	$2,313
Lowell	$5,206	$5,521	$12,361	$11,645	$12,408
Worcester	$204,033	$232,039	$262,714	$256,090	$245,923



Note: UMA FY2010 figures have been revised since the FY2010 R&D Report Publication.
Source: Campus NSF surveys. All dollars are in thousands.

Life Sciences R&D Expenditures by Field
FY2009 – FY2013

(Dollars in Thousands)

	Total Life Sciences R&D								
						5-Year Change FY09 - FY13		1-Year Change FY12-FY13	
	FY09	FY10	FY11	FY12	FY13	$	%	$	%
Amherst	$54,733	$51,326	$58,946	$61,999	$60,743	$6,010	11%	-$1,256	-2%
Boston	$9,237	$9,916	$8,278	$8,443	$7,599	-$1,638	-18%	-$844	-10%
Dartmouth	$1,286	$1,798	$2,021	$2,229	$2,313	$1,027	80%	$84	4%
Lowell	$5,206	$5,521	$12,361	$11,645	$12,408	$7,202	138%	$763	7%
Worcester	$204,033	$232,039	$262,714	$256,090	$245,923	$41,890	21%	-$10,167	-4%
President's Office				$402	$94	$94	NA	-$308	-77%
System	**$274,495**	**$300,600**	**$344,320**	**$340,808**	**$329,080**	**$54,585**	**20%**	**-$11,728**	**-3%**

	Agricultural								
						5-Year Change FY09 - FY13		1-Year Change FY12-FY13	
	FY09	FY10	FY11	FY12	FY13	$	%	$	%
Amherst	$23,088	$21,708	$28,669	$29,881	$22,631	-$457	-2%	-$7,250	-24%
Boston	$0	$0	$0	$0	$0	$0	NA	$0	NA
Dartmouth	$531	$645	$946	$1,170	$809	$278	52%	-$361	-31%
Lowell	$0	$0	$0	$0	$0	$0	NA	$0	NA
Worcester	$0	$0	$0	$0	$0	$0	NA	$0	NA
President's Office				$0	$0	$0	NA	$0	NA
System	**$23,619**	**$22,353**	**$29,615**	**$31,051**	**$23,440**	**-$179**	**-1%**	**-$7,611**	**-25%**

	Biological								
						5-Year Change FY09 - FY13		1-Year Change FY12-FY13	
	FY09	FY10	FY11	FY12	FY13	$	%	$	%
Amherst	$23,323	$22,494	$23,276	$25,081	$26,981	$3,658	16%	$1,900	8%
Boston	$3,020	$2,537	$2,581	$2,773	$2,592	-$428	-14%	-$181	-7%
Dartmouth	$711	$1,120	$1,004	$938	$1,503	$792	111%	$565	60%
Lowell	$1,531	$1,281	$1,553	$1,999	$1,470	-$61	-4%	-$529	-26%
Worcester	$72,851	$77,718	$88,359	$91,140	$77,287	$4,436	6%	-$13,853	-15%
President's Office				$0	$0	$0	NA	$0	na
System	**$101,436**	**$105,150**	**$116,773**	**$121,931**	**$109,833**	**$8,397**	**8%**	**-$12,098**	**-10%**

Note: UMA FY2010 figures have been revised since the FY2010 R&D Report Publication.

Life Sciences R&D Expenditures by Field
FY2008 – FY2012

(Dollars in Thousands)

Medical									
						5-Year Change FY09 - FY13		1-Year Change FY12-FY13	
	FY09	FY10	FY11	FY12	FY13	$	%	$	%
Amherst	$7,237	$6,411	$6,473	$6,276	$9,661	$2,424	33%	$3,385	54%
Boston	$3,493	$4,697	$4,675	$4,345	$812	-$2,681	-77%	-$3,533	-81%
Dartmouth	$0	$0	$0	$0	$0	$0	NA	$0	NA
Lowell	$0	$0	$252	$0	$47	$47	NA	$47	#DIV/0!
Worcester	$104,417	$124,323	$133,598	$127,032	$121,754	$17,337	17%	-$5,278	-4%
President's Office				$263	$44	$44	NA	-$219	NA
System	**$115,147**	**$135,431**	**$144,998**	**$137,916**	**$132,318**	**$17,171**	**15%**	**-$5,598**	**-4%**

Other									
						5-Year Change FY09 - FY13		1-Year Change FY12-FY13	
	FY09	FY10	FY11	FY12	FY13	$	%	$	%
Amherst	$1,085	$713	$528	$761	$1,470	$385	35%	$709	93%
Boston	$2,724	$2,682	$1,022	$1,325	$4,195	$1,471	54%	$2,870	217%
Dartmouth	$44	$33	$71	$121	$1	-$43	-98%	-$120	-99%
Lowell	$3,675	$4,240	$10,556	$9,646	$10,891	$7,216	196%	$1,245	13%
Worcester	$26,765	$ 29,998	$ 40,757	$ 37,918	$ 46,882	$20,117	75%	$8,964	24%
President's Office				$139	$50	$50	NA	-$89	NA
System	**$34,293**	**$ 37,666**	**$52,934**	**$49,910**	**$63,489**	**$29,196**	**85%**	**$13,579**	**27%**

Source: Campus NSF surveys and WebCASPAR. All dollars are in thousands.

Note: UMA FY2010 figures have been revised since the FY2010 R&D Report Publication.

EPILOGUE

The *FY2013 Annual Research and Development Expenditures Report* presents information on the research and development expenditures for the University of Massachusetts System.

The NSF Survey Definition for Research and development (R&D) is "creative work conducted systematically to increase the stock of knowledge (research) and to use this stock of knowledge to devise new applications (development). R&D covers three activities defined below—basic research, applied research, and development."

It covers three activities defined below:

• Basic research is undertaken primarily to acquire new knowledge without any particular application or use in mind.

• Applied research is conducted to gain the knowledge or understanding to meet a specific, recognized need.

• Development is the systematic use of the knowledge or understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes.

Source: FY 2013 HERD Survey

What's new in FY2013 HERD Survey

• **Question 1. Row d, Non-profit organizations.** An instruction has been added to specify that funds from other universities and colleges should be reported in row f, All other sources.

• **Question 1. Row f, All other sources.** In addition to funds from foreign governments, instructions have been revised to specify that funds from foreign and U.S. universities and colleges should be reported in this row. If funds were received from another university as a subaward, those funds should continue to be reported under the original source. Also, the instructions now specify that gifts designated by the donors for research should be included in this row.

Additional highlights as well as rankings and comparative data can be found in the expanded version of this report (to be released shortly). Please contact us at the University of Massachusetts President's Office, Office of Institutional Research, if you would like to obtain a hard copy.

Barbara Velardi
Institutional Research Associate

Neena Verma
Director of Institutional Research

Adam Collins
IR Graduate Research Assistant