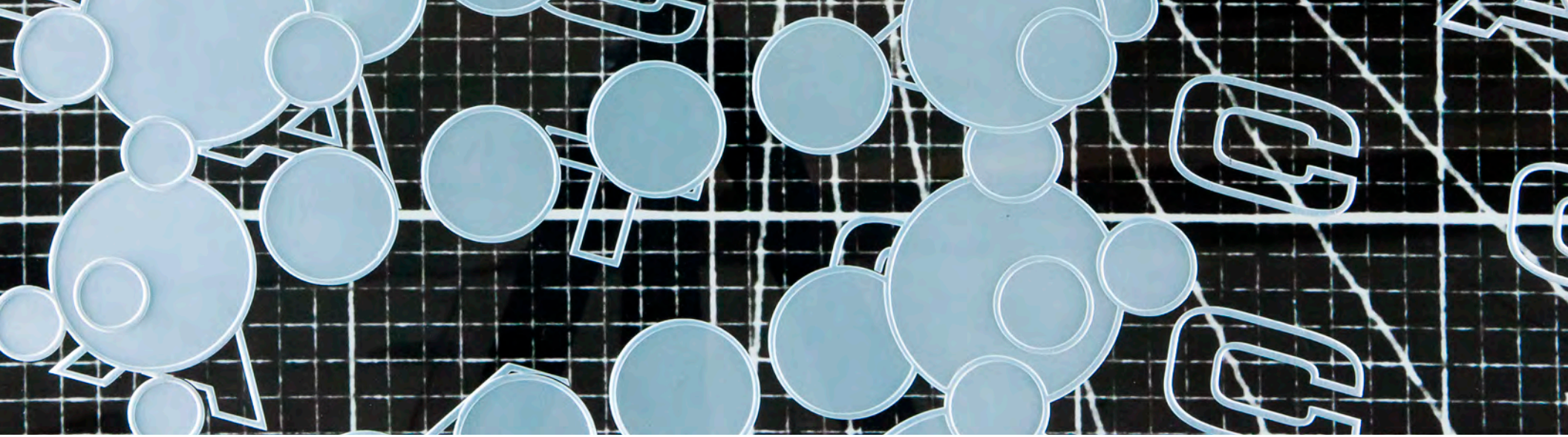
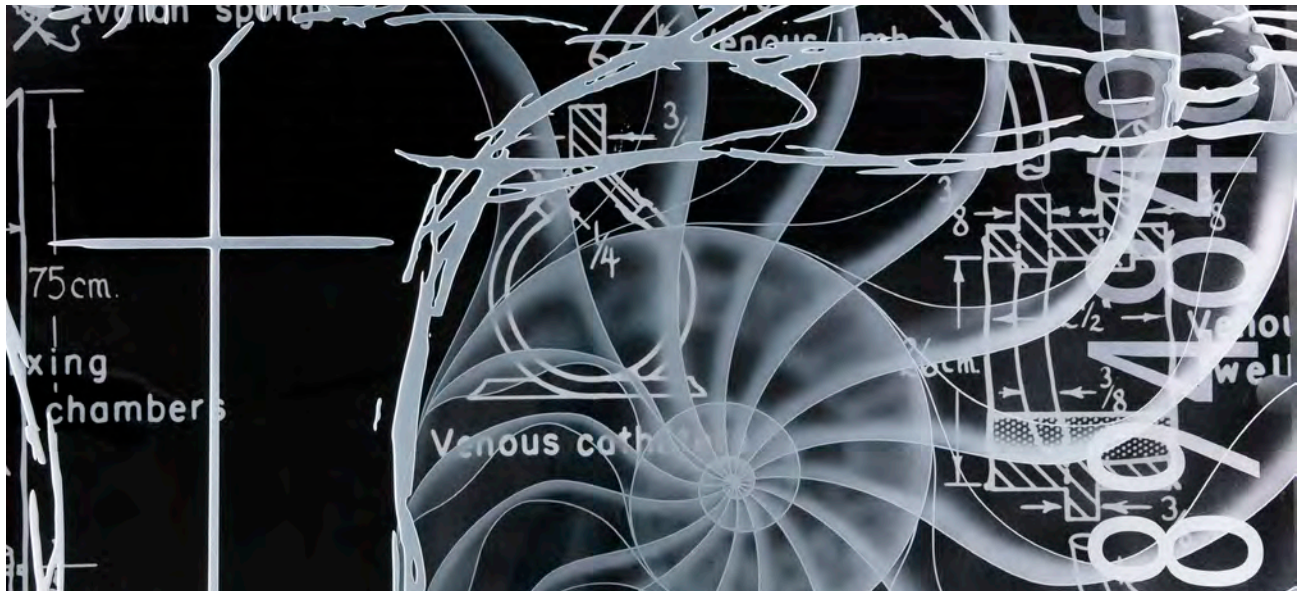


2010 annual research report

University of Minnesota



Submitted to the Board of Regents by R. Timothy Mulcahy, Vice President for Research on December 10, 2010. Designed by Andria Peters. Photos by Tim Mulcahy.

executive summary

Continuing a positive trajectory started five years ago with its strategic positioning initiative, the University of Minnesota once again posted significant gains in key research performance metrics in FY2010, reflecting its status among the nation's elite research universities. Grants and contracts awarded to University faculty topped $823 million in FY2010, marking a 36% increase over the FY2009 award total. Even after excluding the contribution of American Recovery and Reinvestment Act (ARRA) funding, the FY2010 sponsored awards total increased 23%. Impressively, every unit across the University posted an increase, reflecting the breadth of the University's successful efforts to improve overall research productivity.

Faculty and staff mounted strong responses to new funding opportunities associated with the ARRA. Since it was announced in 2009, faculty and staff have submitted 963 applications for funding and have been successful in securing 348 awards. These awards have provided more than $208 million to support research at the University, much of which will establish key research facilities, initiatives, and programs that will provide important competitive advantages for University researchers in the post-ARRA era. The impressive success to date will undoubtedly place the University among the ARRA leaders nationally.

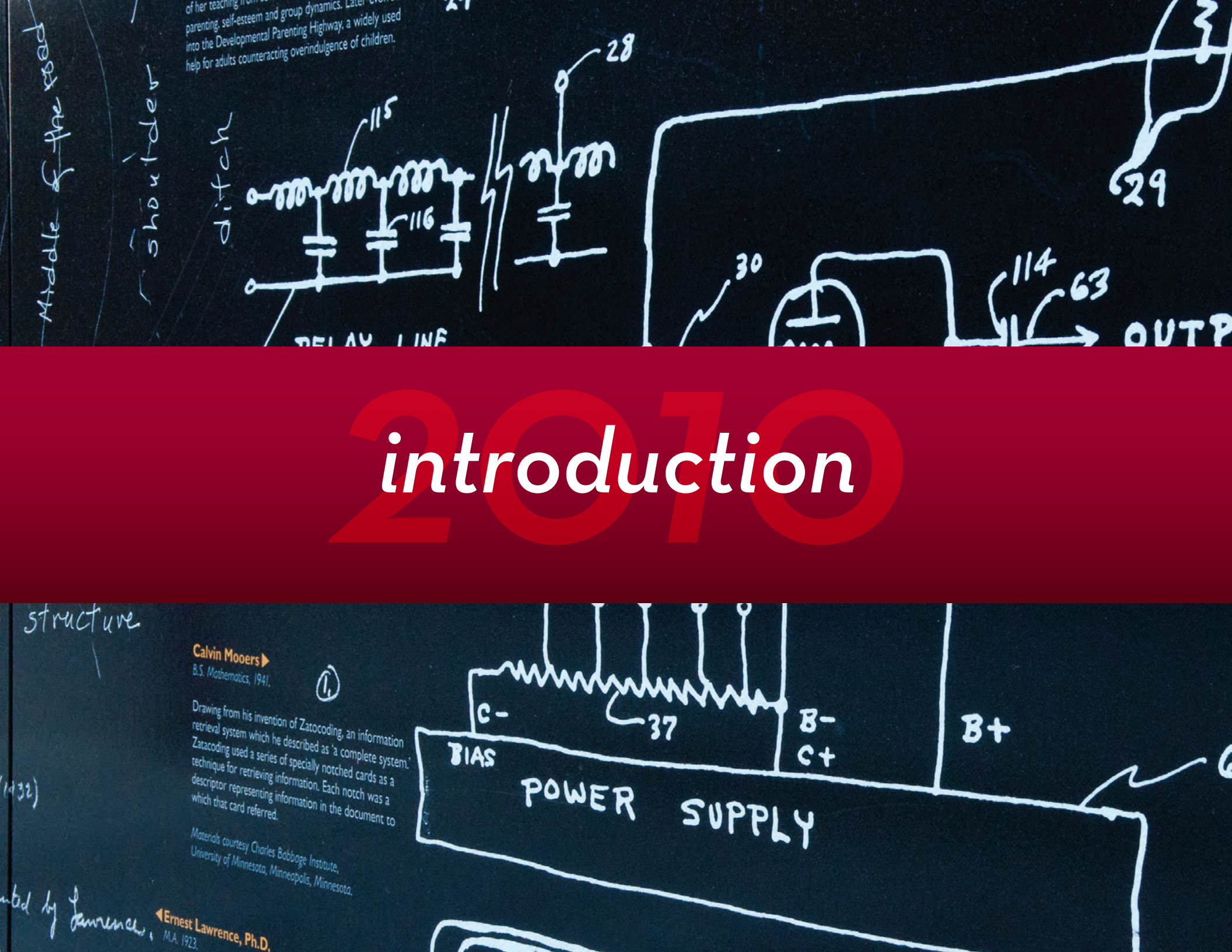
According to the 2009 national R&D expenditures published recently by the National Science Foundation, the University ranked 10th among the nation's top public and private research universities. The reported R&D expenditure total of $741 million represents an impressive increase of 8.5% over the 2008 total. This growth in volume improved the University's ranking among its public research peers from 9th to 8th, continuing an impressive climb in the rankings from a 10th place position among public universities as recently as 2005. This notable improvement reflects a 41% increase in total R&D expenditures since 2004, the third-largest growth rate among the top 20 universities in the country and the second-largest among public universities. Over this same time period, total R&D expenditures at all U.S. universities increased 28% while expenditures at the top 20 universities increased 27% on average, signifying that the University significantly outperformed its peers on a percentage basis during this interval. Other ranking systems, described in the full version of this report, demonstrate that the University retained its position of prominence among its academic peers in 2010.

The Office for Technology Commercialization (OTC) reported an increase in several key metrics that are used to track the performance of the University's technology transfer program. More importantly, OTC has established stronger relationships with faculty and potential licensees of University technology. Improved responsiveness and a new entrepreneurial approach to invention protection and marketing have resulted not only in an increased number of disclosures, filings, and licenses, but also to an increase in their quality and value to the University. The current technology pipeline is strong and growing. In FY2010 University-based technologies were at the core of 8 startup companies, the most startups since 2000. Revenue from technology commercialization activities has been reinvested in support of the University's core mission, supporting fellowships, faculty development, research programs, and infrastructure.

While the metrics included in this annual report provide quantitative measures that can be used to gauge relative research performance, no system of metrics can accurately portray the true impact that the University's research and scholarship have on the world. To paraphrase Einstein, it is just these things that cannot be "counted" that should "count" most to us. Although "measures" of impact remain elusive, impact can often be appreciated through the description of the work itself. This annual report therefore provides a sampling from many examples of faculty work that underscores the local, national, and global impacts of the University—impacts that currently defy easy measure but are worthy of recognition and pride.

FY2010 was clearly a great year for the University and its journey toward its goal to be one of the best public research universities in the world. While it is most appropriate to pause and reflect with satisfaction on a year of productive research growth and accomplishment, the University must set its sights forward in anticipation of major challenges looming on the immediate horizon. Anticipated state budget cuts, the abrupt end of ARRA funding, and a congressional agenda that will likely dash hopes for increased federal support for university-based research are all realities that will impact future performance and could threaten the health and well-being of research universities and the society that benefits from their activities.

The University must succeed, not merely survive, in the uncertain years ahead. This will require perseverance, diligence, innovation, and continued adherence to sound strategic action that aligns with and supports the research mission.


2010
introduction
Middle of the road
shoulder
ditch
115
116
28
29
30
114
63
RELAY LINE
structure
Calvin Mooers
B.S. Mathematics, 1941.
Drawing from his invention of Zatocoding, an information retrieval system which he described as 'a complete system.' Zatacoding used a series of specially notched cards as a technique for retrieving information. Each notch was a descriptor representing information in the document to which that card referred.
Materials courtesy Charles Babbage Institute, University of Minnesota, Minneapolis, Minnesota.
Ernest Lawrence, Ph.D.
M.A. 1923.
C-
37
B-
C+
B+
BIAS
POWER SUPPLY

In December of each year I have the distinct privilege of updating the Board of Regents on the status of the University of Minnesota's research enterprise. My intent in offering an annual report is to provide the Regents with a summary of our annual research statistics and to document progress toward our strategic goal of emerging as one of the top three public research universities in the world. As has been true of previous annual reports, the 2010 version will again rely on various metrics and ranking systems to chart the University's progress toward its strategic objectives over time and to provide a basis for comparison with peer institutions.

Before formulating conclusions based on some of these comparative metrics, a cautionary note seems in order. Ranking systems have become an increasingly common feature of the higher education landscape in response to growing competition for recruiting the best and brightest faculty and students, as a result of increasing accountability pressures from state and federal governments, and in response to a growing imperative to set priorities and budgetary allocations based on performance data. But despite their prevalence and usage, the various systems cited by institutions of higher education to support their own ranking among their peers vary widely in terms of quality, the array of parameters measured, reporting formats, and reliability. In recognition of the growing use of ranking systems, and being mindful of their limitations, the UNESCO European Centre for Higher Education and the Institute for Higher Education Policy in Washington, D.C., founded the International Ranking Expert Group (IREG) in 2004. In 2006 IREG published the ***Berlin Principles on Ranking of Higher Education Institutions***. Among the 16 principles articulated in their report, several serve as important filters for our own research reporting efforts;

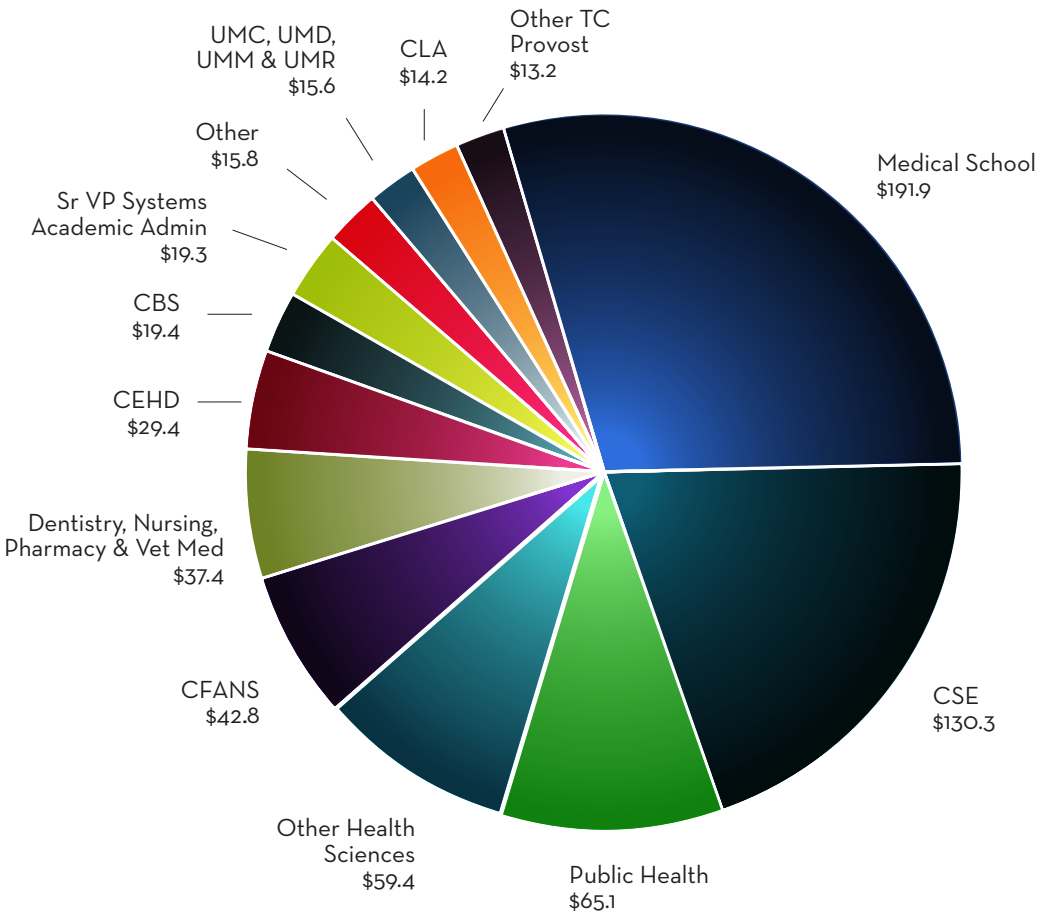
- Be transparent regarding methodology used for creating the rankings
- Choose indicators according to their relevance and validity
- Use audited and verifiable data whenever possible
- Measure outcomes in preference to inputs whenever possible

In every annual report since my first in 2005, we have adhered to the first three principles, relying heavily on normalized data collected by the National Science Foundation or other standardized data collection systems, while advising of their respective limitations. Since 2007 we have been steadfast in our efforts to provide outcome measures even though such data is very difficult to come by in any normalized system that would satisfy the first three principles, thereby allowing direct comparisons with peer institutions. In 2008 we introduced "impact" as a critical measure of academic excellence. We agreed with our 2008 President's Emerging Leaders team that *impact*, defined as "the magnitude of effect that research and scholarship have on others" is the penultimate outcomes measure of our research and scholarship and a standard of excellence that should direct our aspirations and strategies for achieving them. To that end, the 2010 report will once again highlight some representative examples of research and scholarship to illustrate how our work has local, regional, national and global impact.

Finally, it is important to once again emphasize that no single metric, or set of metrics, included in this report or reported elsewhere can accurately characterize the relative strength, quality, or prominence of any individual university or its programs, especially with respect to those core activities not directly related to research. With this understanding we hope that the Regents, University leadership, and the entire University community will find this data summary and comparative analysis useful and will view the brief discussion of "impact" as a launching pad for richer discussions and development as the University continues its journey towards its strategic objectives.

2010 statistics

2.1 2010 Sponsored Expenditures by College



Total: $653.6 million

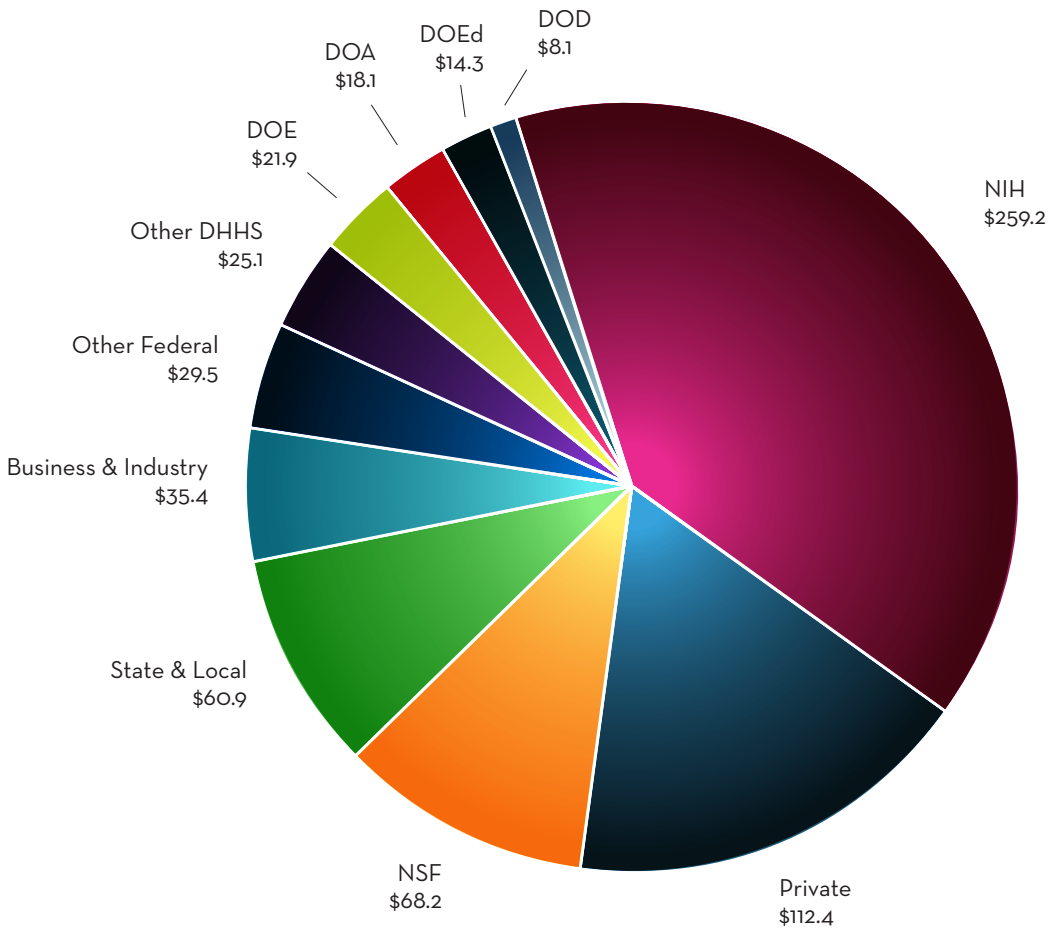
(Dollar amounts represented in millions)

Each year we report two different expenditure figures: University sponsored program expenditures and the National Science Foundation R&D expenditures. University sponsored program expenditures include externally funded research programs in all fields, while the NSF R&D expenditures measure research funding only in the areas of science and engineering, and include institutional support of research. Despite the difference in scope, there is a strong correlation between these two sets of statistics.

Sponsored expenditures at the University of Minnesota for FY2010 totaled $653.6 million, an increase of 10.6% over the previous year. Since expenditures lag behind the awarding of support, this significant increase in expenditures in FY2010 was somewhat unexpected since there was a notable decline in awards reported in FY2009.

While the overall distribution is consistent with results recorded over the past decade, a number of colleges and units did report impressive growth in research expenditures over FY2009. Notable increases were recorded by the College of Science and Engineering (23%), the College of Biological Sciences (14.6%), the College of Food, Agricultural and Natural Resource Sciences (13.2%), and units reporting to the Senior Vice President for System Academic Administration (13.1%), including Extension, Community Outreach and Youth Development, Public Engagement, and other offices. The Other Health Sciences group, which includes the Masonic Cancer Center, Obesity Prevention Center, Institute for Health Informatics, National Center for Food Protection and Defense, and many other centers and institutes, recorded an impressive 38.4% increase.

2.2 2010 Sponsored Expenditures by Source



Total: $653.6 million

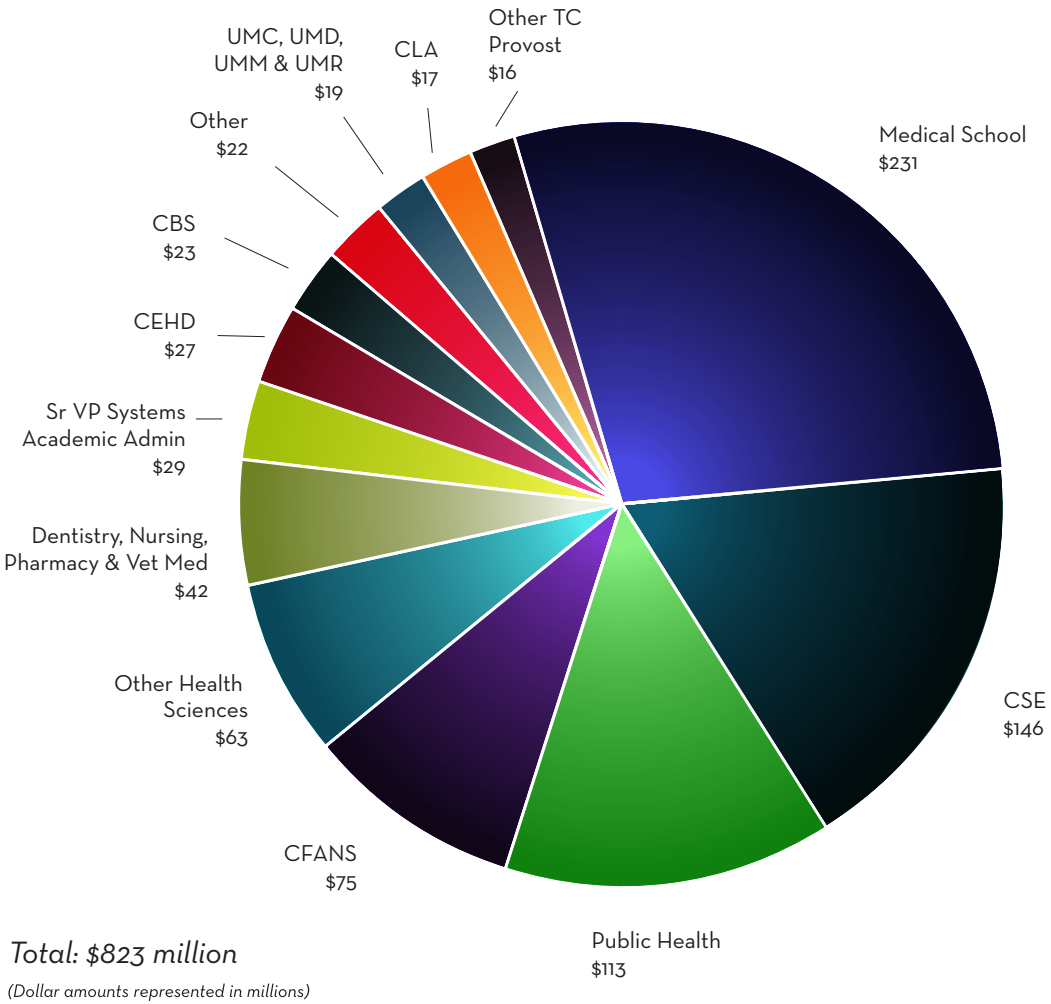
(Dollar amounts represented in millions)

Figure 2.2 shows the distribution of sponsored expenditures, which include externally funded research programs in all fields, by funding source for FY2010.

Competitive funds awarded by federal agencies again accounted for 68% of the University's total sponsored expenditures. The National Institutes of Health (NIH) led the way with 40% of the total, followed by the National Science Foundation at 10%. Other federal agencies accounted for the remaining 18% of total sponsored expenditures. The remaining 32% of FY2010 sponsored expenditures reflect grants or contracts awarded by private organizations (17%), state and local governments (9.3%), and business and industry (5.4%).

In comparison to FY2009, the University's $259 million in NIH sponsored expenditures in FY2010 represents a 6.5% increase, a nice rebound from the 6.7% decrease reported in FY2009. Expenditures attributable to awards from the Department of Energy (DOE) and other Department of Health and Human Services Agencies increased significantly over the previous year, with DOE expenditures nearly tripling in FY2010 to a total of $22 million. Sponsored expenditures from private organizations reached a total of $112.4 million, an increase of 15.8% over FY2009. Business and industry showed a nice rebound in sponsored expenditures to $35.4 million, an increase of 11%.

2.3 2010 Sponsored Awards by College



Total: $823 million

(Dollar amounts represented in millions)

The University was awarded a total of $823 million in sponsored awards in FY2010, a dramatic 36% increase over FY2009. Excluding FY2010 ARRA awards from the totals, the increase still amounts to 23%. Part of this increase is attributable to a delay in the release of a number federal awards, including several major awards that would have been registered in FY2009 under normal circumstances. However, in spring 2009 various federal agencies were scrambling to evaluate proposals and award funds allocated to them under ARRA, causing a delay in the processing of other awards and their subsequent registry in FY2010. Even after accounting for this shift, the increase in sponsored awards in FY2010 denotes an impressive performance by University faculty and staff, particularly when placed in the context of the reduction in research productivity noted in last year's report.

As shown in figure 2.3, the overall distribution of sponsored awards in FY2010 among University colleges and units is consistent with previous years. There were significant increases across a broad range of units, demonstrating the depth and breadth of the University's research enterprise. Units that posted substantial increases over the previous year include the School of Public Health (74%/$48.2 million), the College of Biological Sciences (68%/$9.2 million), and the College of Veterinary Medicine (51%/$5.8 million). The Other Health Sciences group more than doubled its awards to a total of $62.7 million, and the Medical School increased its awards by 26%/$47.6 million.

American Recovery & Reinvestment Act Results

University researchers submitted 963 proposals for ARRA funding, a truly impressive response to this historic opportunity. To date researchers have received 348 awards with a total amount of $208,362,699. Some of the larger awards to date include:

$40,064,000	Marvin Marshak – CSE – U.S. Department of Energy
$17,640,000	Robert Craven – CFANS – USDA National Institute of Food & Agriculture
$7,981,677	Fotis Sotiropoulos – CSE – U.S. Department of Energy
$7,798,106	Kamil Ugurbil – Medical School – NIH National Center for Research Resources
$6,000,000	Robert Kane – School of Public Health – US Dept. of Health & Human Services AHRQ
$5,145,705	Julie Jacko – AHC Shared Units – DHHS Office of the National Coord for Health
$3,737,763	Darren York – CSE – NIH National Center for Research Resources
$3,453,917	Mark Paller – Medical School – NIH National Center for Research Resources
$2,954,832	Selwyn Vickers – Medical School – NIH National Center on Minority Health
$2,862,333	Irma Pearl McClaurin – Sr. VP, System Acad Admin – U.S. Dept. of Commerce
$2,200,000	Lawrence Wackett – CBS – U.S. Department of Energy
$2,000,000	Alexander McBean – School of Public Health – Center for Medicare & Medicaid Services

t2.1 Technology Commercialization

Over the course of the past three years the Office for Technology Commercialization (OTC) has not only revamped its operations, it has adopted more standard metrics to monitor the effectiveness of the organizational and operational changes that we implemented in 2007 in an effort to revitalize the University's technology transfer operation. Some of the statistics cited in Table 2.1 deserve explanation in light of the intentional changes introduced as part of that transition.

As part of its operational restructuring, OTC adopted key business metrics to guide management of the University's intellectual property (IP) portfolio. In addition, it introduced the use of new output metrics, including the number of current revenue-generating agreements and the number of outgoing material transfer agreements (MTAs) in FY2008. The nadir in both disclosures and patent filings in FY2007–FY2008 correspond to the period in which the leadership, personnel, and new direction for OTC were undergoing transition. Those figures have rebounded nicely in the past two years. The steady decline in the number of patents filed from FY2005 to FY2007 and the steady increase since reflect the implementation of the changes noted above.

Despite persistent challenges posed by the nation's economy, there are a number of positive technology commercialization results to report for the past fiscal year. The number of invention disclosures from faculty increased 5%, an important indicator of a robust IP pipeline. Thanks to a rigorous, industry-based stage-gate evaluation process, only disclosures that are judged to have significant potential are selected for protection and further development. While the number of innovations selected for patent filings was essentially unchanged from last year, the value of our current patent portfolio continues to grow. The number of new license agreements rebounded significantly over last year, increasing more than 50%, and the number of current revenue-generating agreements increased by 30%. These are noteworthy achievements in light of the challenging economic circumstances referred to above.

As we have alerted the Regents on previous occasions, beginning in FY2010 technology commercialization revenue began to decline due to the

University Technology Commercialization Data
(Dollar amounts represented in millions)

	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010
Disclosures	251	230	193	217	244	255
New U.S. Patent Filings	104	84	51	52	65	66
New Licenses	86	85	77	63	44	67
Startups	1	3	4	2	3[b]	8
U.S. Patents Issued	54	29	44	37	n/a	n/a
Current Revenue Generating Agreements	n/a	n/a	n/a[a]	281	306	399
Gross Revenues	$48.7	$57.8	$65.2	$86.9	$95.2	$75.2
Non-Glaxo Revenues	$5.6	$6.8	$8.5	$7.9	$8.7	$8.6
Outgoing Material Transfer Agreements	n/a	n/a	n/a	67	106	171

expiration of patents on Ziagen, the blockbuster AIDS treatment licensed to GlaxoSmithKline that has accounted for the majority of the University's commercialization revenue for a number of years. As depicted in Table 2.1, gross revenues declined nearly $20 million in FY2010 due to the expiration of a number of foreign patents for Ziagen. The Ziagen royalty stream is expected to continue a steady decline over the next two years as U.S. patents on the compound expire. OTC has developed a strong strategic plan to optimize the return from commercialization of other University technologies to partially compensate for the Ziagen revenue loss, but blockbuster licensing deals comparable to Ziagen are very few and far between. Our intent in restructuring OTC four years ago was to establish a technology transfer environment at the University that would encourage the disclosure of transformative technologies and maximize the probability of success should a blockbuster opportunity materialize. As noted above, the evidence to date suggest that the revised operations and licensing strategies have already had a positive impact on non-Ziagen revenues and projections based on the net present value of technologies in the pipeline suggest that continued growth can be expected.

There has been increasing political pressure on OTC to launch new startups based on University technologies. Critics often cite the activity reported by peers as evidence that the University was underperforming in this arena. Part of the perceived output problem reflects the very deliberate and rigorous assessment completed by OTC prior to agreeing to the launch of a new venture. We believe such a deliberate approach to startup launches is prudent because of the great financial risk the University assumes in such opportunities. A significant proportion of the startup output criticism, however, reflects how the University has reported startup activity in the past. In reporting to the Regents and others we only reported those companies that were originally conceived of, developed, and launched by OTC. This is a far more conservative standard than that utilized by peers. In FY2010 we adopted a definition of "startup" that more closely aligns with that recommended by organizations like the Association of University Technology Managers and the British Venture Capital Association.

The revised definition describes a startup as follows:

> *An enterprise that bases its existence in majority on IP developed from a University of Minnesota research program. Examples include: a new company formed and led by a CEO in Residence; a new company formed and led by an external executive; a new company formed and led by a researcher; an existing company that redefines its business with University IP; an Internal Business Unit.*

Adoption of this commonly used definition permits a more accurate comparison between startup launches from the University and those of many of our peer institutions. Employing this revised definition, in FY2010 a total of eight startup companies were launched. A brief description of each startup is included on the following page.

Introduced this past year, Internal Business Units (IBUs) are a new, innovative approach to moving University technologies from the lab to the marketplace. They address a select subset of technologies that are nearly market ready but need some limited investment and market development in order to be more attractive as startup opportunities. Specific criteria must be met in order for a technology to be considered for an IBU, including: the technology must be in an advanced stage of development (approximately three to four months from being ready for first sale); market research must determine that there are insufficient distributors in the market, or that the technology comprises a new market; and, that a minimum of 25 potential customers exist. Thus, IBUs are not a mechanism for bridging a broad "valley of death," or incubating technologies that will require a long period of development or significant seed funding, but rather represent an "incubation" strategy for new company development.

IBUs are another innovative tool in the University's technology transfer toolbox, providing additional opportunities to launch startup companies based on University research and helping to drive Minnesota's economic growth and create jobs.

FY2010 Startup Companies Based on University Technology

R8Scan	Developing an innovative cytometry instrument that tracks and measures individual cells, providing unprecedented detail into the dynamics of cellular growth. The information generated is essential to improving production processes in biotechnology, as well as drug discovery and development.
Hennepin Life Sciences	Working to develop and market a safe and effective treatment that will radically change the way women and health care professionals approach the prevention and treatment of vaginal infections, with a specific emphasis on sexually transmitted infections (STIs).
CaSTT	Commerce and Search for Technology Transfer is an e-commerce and marketing framework for technology transfer offices in universities and research institutions. CaSTT includes a shopping cart, search-engine optimization (SEO), and a license agreement terms and conditions builder that will accelerate marketing and selling efforts.
Miromatrix	Commercializing the groundbreaking tissue engineering research of Dr. Doris Taylor. The technology licensed to Miromatrix holds the promise of one day enabling the replacement of entire human organs with non-transplantable organs, harvested from either animals or donors, which are stripped of their cells and recellularized with cells from the recipient or compatible donor cells.
NeurEndo Pharma	An early-stage pharmaceutical development company focused on the evaluation and development of compounds for the treatment of obesity and pre-diabetes management.
Early Learning Labs	Marketing a tool for monitoring ongoing growth and development of preschool children. The tool is a combination of a test kit and a Web-based management and reporting framework and is designed for schools, teachers, and early education specialists.
XO Thermix	Creating a medical device with exothermic ablation technology coupled with novel balloon delivery techniques. The company's first product will be a medical device that treats chronic venous insufficiency (CVI) with a significant reduction in procedure time, which could lower cost, and much less patient discomfort than current treatments.
NewWater	Will offer a biocatalyst-based drinking water filtration technology that can reduce atrazine concentrations to acceptable levels. Atrazine is a selective herbicide that is widely used by farmers in the United States to control broadleaf weeds and grasses, and in recent years the safety of atrazine has been the subject of much debate among scientists.

Investments Made with Technology Commercialization Revenue

Research infrastructure is critical to the University's continued competitiveness and progress towards its strategic research objectives. However, external funds to support our critical research infrastructure needs are very limited, and forecasts for the immediate future suggest that this situation won't improve anytime soon.

By Regents policy one-third of the revenue generated from patent and licensing through the University's technology commercialization efforts is distributed to the Office of the Vice President for Research (OVPR) to be used in support of the University's research mission. Given current financial challenges, this seems an opportune time to enumerate the many critical University initiatives that have been and continue to be supported by revenue derived from Ziagen and many other University technology commercialization achievements.

Creation of $50 Million 21st Century Graduate Fellowship Endowment

This unique matching fund doubles the impact of gifts of $25,000 or more that are designated to endow graduate fellowships. Graduate students are an indispensable part of the intellectual fabric of a great research university such as the University. The recruitment of high-quality graduate students is a key factor in ensuring that the University remains among the world's top institutions in many fields. But competition for students is intense, and to strengthen the University's ability to attract top students it must increase the level of financial support that can be offered through endowments such as the 21st Century Graduate Fellowship Fund.

Infrastructure Investment Initiative "I^3"

A portion of the OVPR share of technology commercialization revenue was set aside over the past five years to establish a research infrastructure contingency fund that was intended to provide a resource to address major research infrastructure needs, or to support development of additional research capabilities essential to maintaining a competitive research infrastructure. The $20 million I^3 initiative, launched in July 2010, intends to address critical research infrastructure. Funding will be targeted at significant investments for shared resources that support high-end research needs as well as infrastructure needed to support scholarship in the arts and humanities.

Examples of other University initiatives that have been funded with technology commercialization revenue can be found on the following page.

Other University Initiatives Funded With Technology Commercialization Revenue

In addition to funding for the 21st Century Graduate Fellowship Fund and the I^3 initiative, more than $20 million has been provided to a broad range of initiatives across the University. Some examples are offered below:

Funding for Minnesota Census Research Data Center

Established in October 2010 as a national center of excellence, the MnRDC will help researchers to support and improve basic data infrastructure for economic, demographic and health research.

Relocation of Nuclear Magnetic Resonance Facility

In its current location, this facility would be severely affected by construction and operation of the light rail line. Funding will help move the facility to the Mayo building.

Support for the Imagine Fund

This grant program supports innovative faculty research in the arts, design, and humanities.

Creation and Funding of the Minnesota Futures Program

Modeled on the successful National Academies "Keck Futures Initiative," Minnesota Futures helps to nurture interdisciplinary ideas or methodologies to a point where they are ready for and attractive to external funding.

Support for the Institute for Advanced Study

The Institute seeks to ignite creative, innovative, and profound research and discovery in the sciences, humanities, and the arts.

Matching Funds for Major Equipment Purchases

This includes $3 million in funding for the Minnesota Supercomputing Institute's new high performance computing system to support research across a broad range of disciplines.

Innovation Investments

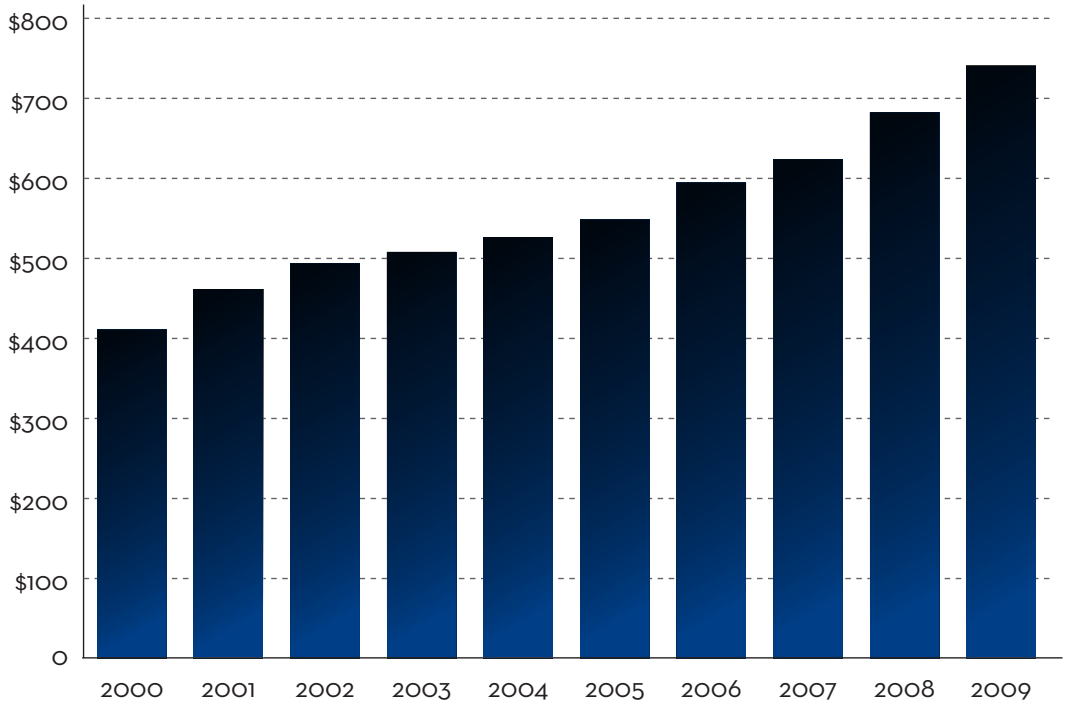
These are development investments provided to University researchers to help bridge the gap between sponsored research funding and the point where a technology can be commercialized.

2010 trend analysis

3.1 NSF R&D Expenditures

Research expenditure data provided by NSF for 2009 (the latest year for which data is available) indicate that the University's research activity grew to $741 million, an 8.5% increase over 2008. As illustrated in Figure 3.1, this increase is well above our average growth rate of 6.8% over the past five years and continues the trend of significant annual growth since 2004.

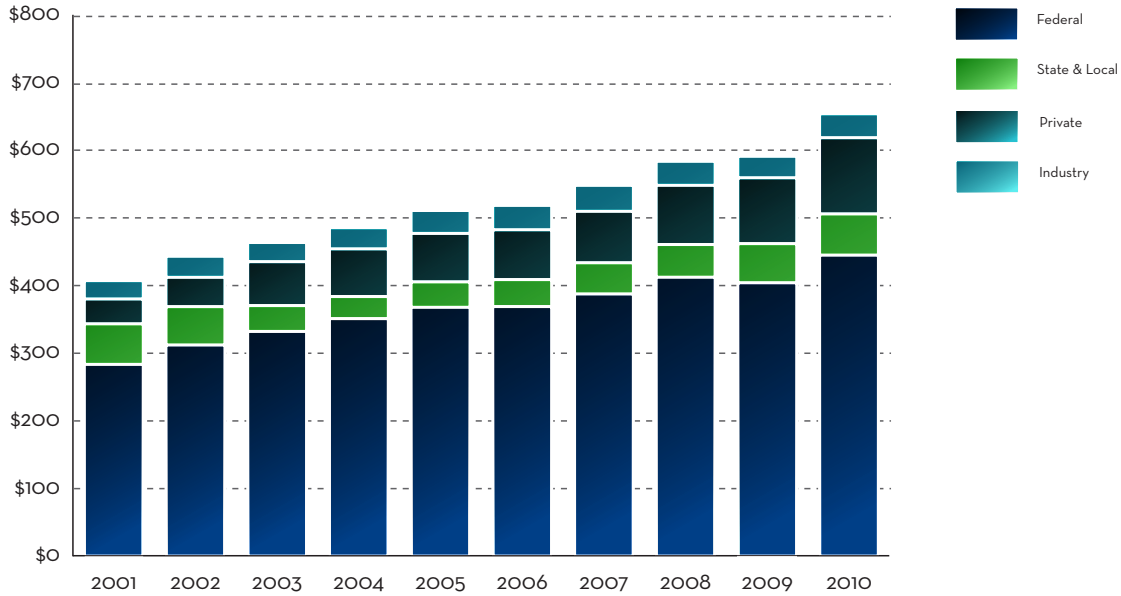
This notable improvement reflects a 41% increase in total R&D expenditures since 2004, the third-largest growth rate among the top 20 universities in the country and the second-largest among public universities. Over this same time period, total R&D expenditures at all U.S. universities increased 28% while expenditures at the top 20 universities increased 27% on average, signifying that the University significantly outperformed its peers on a percentage basis during this interval.



(Dollar amounts represented in millions)

3.2 Sponsored Expenditures by Category

Figure 3.2 shows the distribution of University sponsored program expenditures by sponsor category since FY2001. It includes sponsored expenditure data for FY2010 (unlike the NSF R&D expenditure data, which lags one year). The proportion of funding from the major source categories has remained relatively stable over the past decade, although there has been notable growth from private as well as state and local sources over the past five years.



Sponsored Expenditure Data 2001-2010

(Dollar amounts represented in millions)

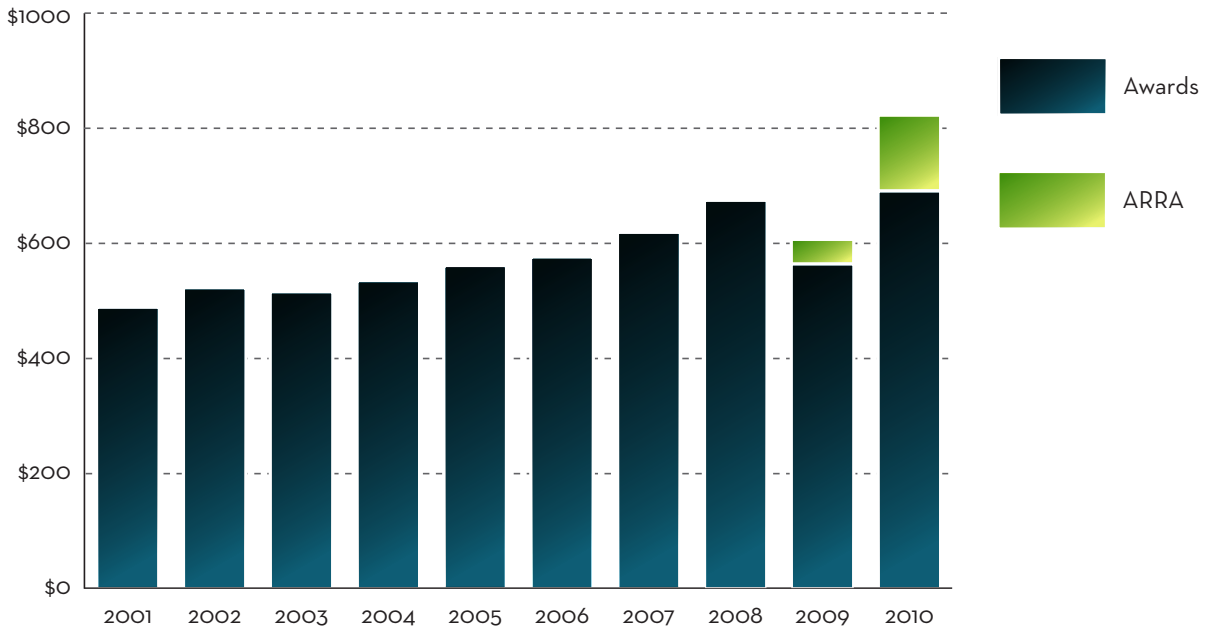
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Federal	283.5	312.0	332.2	351.0	367.8	368.9	387.4	412.2	403.9	444.8
State & Local	59.8	56.7	38.1	32.7	37.5	39.8	46.1	48.4	57.9	60.9
Private	36.7	43.4	64.8	70.3	71.7	73.5	76.1	87.4	97.2	112.5
Industry	27.2	31.1	28.5	31.3	33.9	36.2	38.4	35.5	31.9	35.4
Total	$407.2	$443.1	$463.5	$485.3	$510.9	$518.4	$548.0	$583.5	$590.9	$653.6

3.3 Ten-Year Award Trends

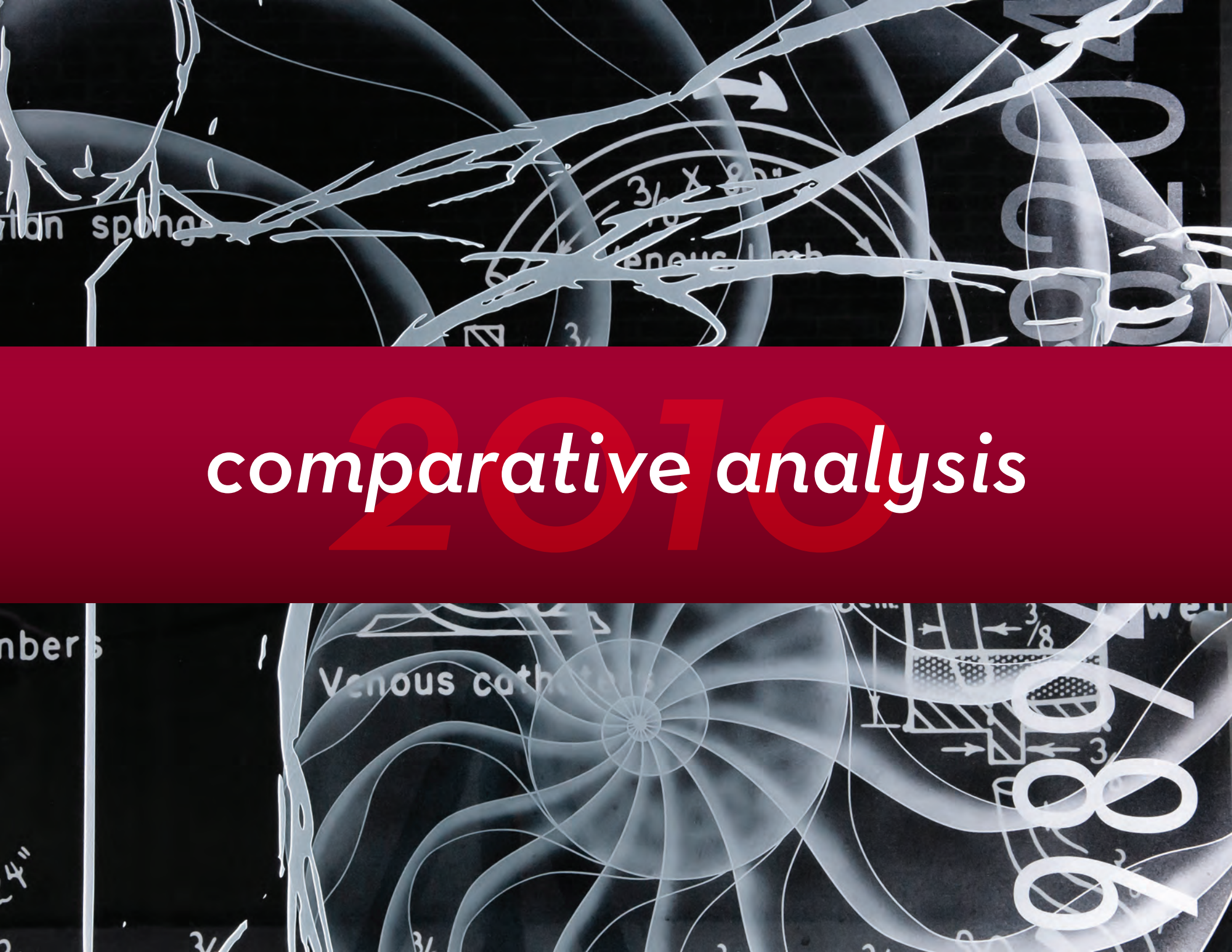
As explained in the Appendix, commonly used research metrics typically rely on two measures: research awards and research expenditures. With the University's growing reliance on the use of data to benchmark its academic and research progress, a brief reminder of the difference between these fundamental research comparators seems appropriate.

Awards refer to commitments made by research sponsors to campus investigators, typically following an increasingly competitive peer-review assessment of the merit of the proposed research. *Expenditures*, on the other hand, reflect funds actually *spent* in support of the research activity. In a healthy, growing research enterprise awards exceed expenditures reported in any particular fiscal year because actual spending on research typically lags behind the awarding of support. The Appendix includes a more detailed discussion of these two important metrics.

Figure 3.3 illustrates the sponsored award trend since FY2001. Excluding ARRA awards, the total increased 23% over FY2009 and 2% over FY2008. With two exceptions (2002-03 and 2008-09), the University has made steady upward progress since FY2001 and increased its sponsored awards total by 41% (excluding ARRA awards from the total).



(Dollar amounts represented in millions)



2010 comparative analysis

Comparative Analysis with Other Public Research Universities

The data reported in Section III are valuable as internal guideposts for monitoring year-to-year changes in institutional performance, for providing valuable insights regarding the effectiveness of strategic decisions, and for identifying opportunities with significant growth potential. However, gauging progress toward the University's goal of being one of the top public research universities in the world requires a comparison of the University's performance relative to its peers. Such an analysis also provides insights into research productivity at the University in relation to national funding trends. This section of the report therefore provides a comparative analysis spanning the past 10 years.

Top 20 Comparison Groups

Table 4.1 (see following page) summarizes the relative ranking of the top 20 public research universities according to three commonly cited ranking schemes:

- NSF R&D expenditures
- Center for Measuring University Performance criteria (previously the Florida Center)
- Shanghai Academic Rankings of World Universities

The first two systems of comparison are limited to institutions in the United States, while the Shanghai ranking scheme provides an international assessment of performance from which domestic rankings can be derived. Each system employs different criteria and ranking schemes and is recognized as a credible system for comparative purposes, though none is without its critics.

As shown in Table 4.1, the NSF R&D expenditures system shows that the University improved its position to eighth place relative to its public research university peer group, a notable accomplishment that documents the University's continued progress toward its aspirational goals.

The University's ranking according to the other two systems remains unchanged. There was some movement among the top 10 public universities in the NSF R&D expenditures system but very little change in the relative rankings according to the two other systems. The stability of the Shanghai and Center for Measuring U Performance rankings is a reflection of the larger number of individual elements that are aggregated into the final score used by each system to establish their rankings. In contrast, changes in the NSF R&D rankings are more noticeable since a single metric is used in the rankings.

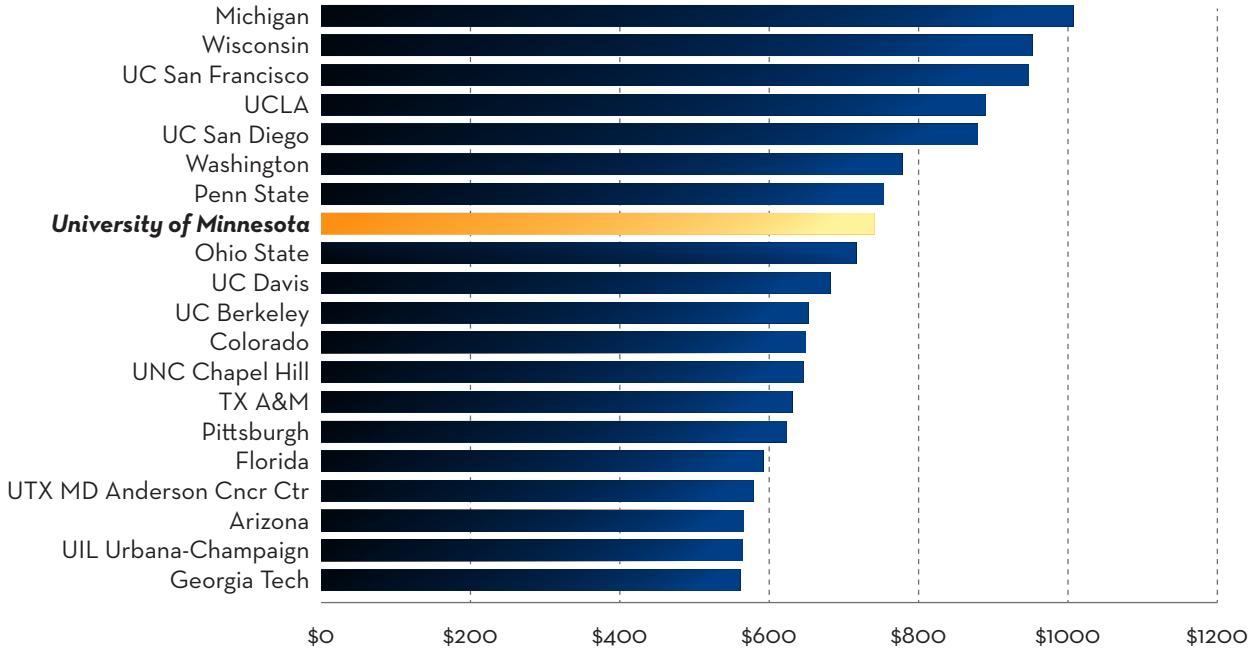
t4.1 Top 20 Comparison Group

	NSF · Public			Center for Measuring U Performance · Public	Shanghai · 2009		
	2007	2008	2009	2009	World	US	US · Public
Michigan	4	3	1	Group 1	22	18	7
Wisconsin	2	2	2	Group 1	17	15	5
UC San Francisco	1	1	3	Group 3	18	16	6
UCLA	3	4	4	Group 1	13	11	2
UC San Diego	5	5	5	Group 3	14	12	3
Washington	6	6	6	Group 2	16	14	4
Penn State	8	8	7	Group 2	45	32	15
University of Minnesota	9	9	8	Group 2	28	20	9
Ohio State	7	7	9	Group 2	62	41	23
UC Davis	10	10	10	Group 4	49	36	19
UC Berkeley	12	11	11	Group 1	3	3	1
Colorado	15	13	12	Group 7	34	26	10
UNC Chapel Hill	19	14	13	Group 1	39	30	14
TX A&M	16	12	14	Group 3	88	50	28
Pittsburgh	14	15	15	Group 1	50	37	20
Florida	11	16	16	Group 2	58	39	22
UTX MD Anderson Cncr Ctr	16	17	17	Group 8	100+	55+	30+
Arizona	13	18	18	Group 3	77	45	25
UIL Urbana-Champaign	17	19	19	Group 1	25	19	8
Georgia Tech	20	20	20	Group 4	100+	55+	30+

4.1 2009 NSF R&D Expenditures

The data compiled annually by NSF is widely acknowledged as perhaps the best basis for comparison of research volume among the nation's top research institutions, relying as it does on the compilation of a very standardized set of data satisfying common definitions from all universities receiving federal funding. As noted above, the $741 million in R&D expenditures reported to the NSF by the University of Minnesota for 2009 (the latest year for which standardized data are available) ranked eighth overall among public research universities (Figure 4.1, Table 4.1, Table 4.2). While there were some changes in rank among the top public universities, the roster of top 10 publics based on R&D expenditures was unchanged from 2008 (Table 4.2).

To earn the eighth overall ranking among public research universities in 2009 the University surpassed Ohio State University. As is evident in Figure 4.1, and as noted in previous reports, the total differential among those public research universities ranked fifth to tenth in terms of R&D expenditures is quite small, so even slight annual fluctuations can result in noticeable changes in relative rank among this group.



(Dollar amounts represented in thousands)

t4.2 NSF Top Institutions Reporting Largest R&D Expenditures

(Dollar amounts represented in millions)

2009 Rank · All		2006		2007		2008		2009		
		Total $	Rank · Public	Total $	Rank · Public	Total $	Rank · Public	Total $	% Increase	Rank · Public
1	Johns Hopkins[a]	1500		1554		1681		1856	10.41	
2	Michigan	800	3	809	4	876	3	1007	14.95	1
3	Wisconsin	832	1	841	2	882	2	952	7.94	2
4	UC San Francisco	796	4	843	1	885	1	948	7.12	3
5	UCLA	811	2	823	3	871	4	890	2.18	4
6	UC San Diego	755	6	799	5	842	5	879	4.39	5
7	Duke	657		782		767		805	4.95	
8	Washington	778	5	757	6	765	6	778	1.70	6
9	Penn State	644	8	652	8	701	8	753	7.42	7
10	***University of Minnesota***	**595**	**9**	***624***	**9**	***683***	**9**	***741***	***8.49***	**8**
11	MIT	601		614		660		736	11.52	
12	Pennsylvania	676		648		708		727	2.68	
13	Ohio State	652	7	720	7	703	7	716	1.85	9
14	Stanford	679		688		688		704	2.33	
15	UC Davis	573	10	601	10	643	10	682	6.07	10
16	Cornell	649		642		654		671	2.60	
17	UC Berkeley	546	12	552	12	592	11	652	10.14	11
18	Colorado	513		528		536		648	20.90	12
19	UNC Chapel Hill	444		477		525		646	23.05	13
20	TX A&M	493		544		583		636	8.23	14
	All R&D Expenditures[b]	47760		49493		51934		54935	5.78	
	Leading 20 Institutions	14194		14497		15244		16424	7.74	
	All Other Surveyed Institutions	33566		34996		36690		38511	4.96	

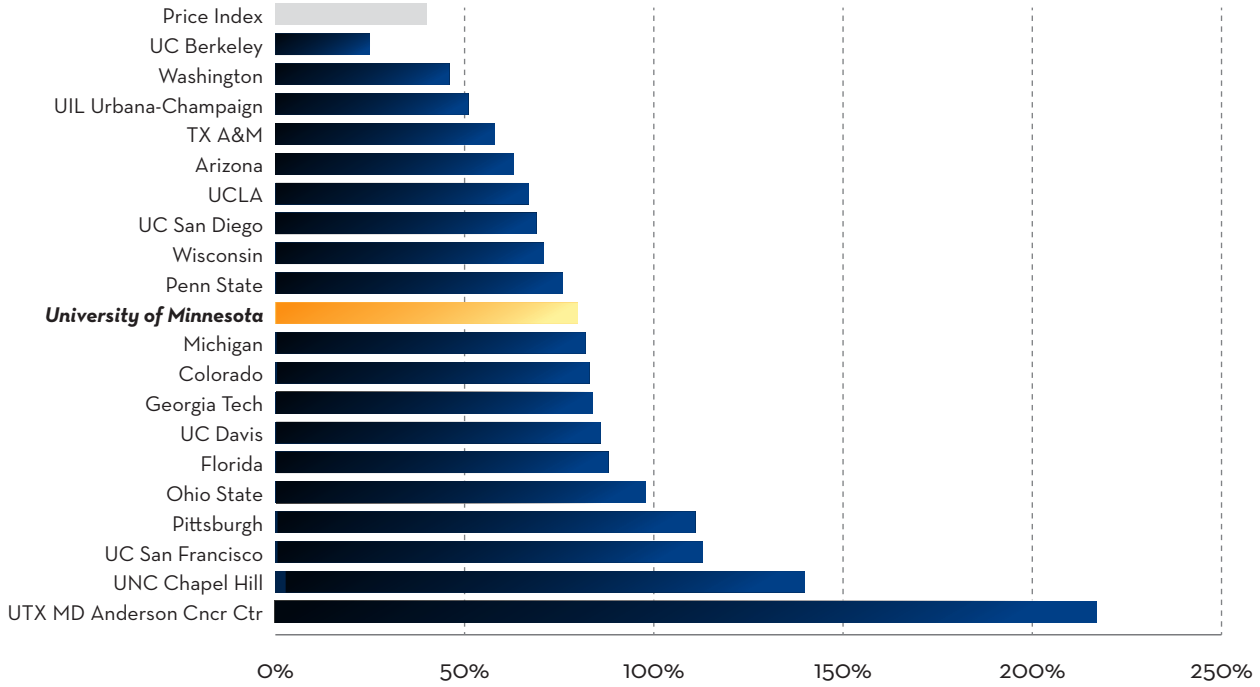
[a] *The Johns Hopkins University includes the Applied Physics Laboratory with $778M, $845M, and $945M in total R&D expenditures in FY2007–09, respectively*

[b] *Excludes R&D performed by university-administered federally funded research and development centers*

4.2 Percentage Increase 2000-2008

While static data provide a useful basis for single-year comparative rankings, an even more useful metric from a management perspective is the rate of growth of R&D expenditures over time. This measure provides information about the University's growth trajectory in comparison to multiyear growth statistics for peer institutions and in relation to changes in the funding landscape, providing feedback on the effectiveness of strategic initiatives.

Figure 4.2 illustrates the 10-year (2000–2009) growth of R&D expenditures at the top 20 public research institutions. Over this 10-year period R&D expenditures at the University increased 80%. This corresponds to the eleventh-largest increase among the nation's leading research institutions for this 10-year interval.



2004-2009 Summary

% Growth Since 2004	Rank · All	Rank · Public
34.98	7	
30.95	10	7
24.61	13	10
30.22	11	8
15.14	18	13
23.98	14	11
54.51	2	
8.96	19	14
25.50	12	9
40.87	***3***	***2***
35.54	6	
21.78	16	
38.22	4	3
4.92	20	
33.20	9	6
16.49	17	
23.95	15	12
34.16	8	5
54.92	1	1
38.07	5	4
27.92		
27.44		
38.52		

The 10-year aggregate data presented in Figure 4.2 do not provide sufficient granularity to allow an analysis of the impact that strategic initiatives over the past five years may have had on research productivity. However, examination of the annual data since 2006 (Table 4.2) clearly reveals that the growth of R&D expenditures over this period—corresponding to implementation of many of the strategic planning strategies—has been dramatic.

The University's 2009 R&D expenditures were up 8.5% over 2008, the seventh-largest increase among the top 20 research universities, public and private. For the interval 2004 to 2009 the University's R&D expenditure total increased a remarkable 41%, corresponding to the third-largest growth rate among all top 20 research universities and the second-largest growth rate among public universities.

Without question the University has made impressive strides relative to leading peer institutions in the country in the past several years, making demonstrable progress in the direction of its aspirational objective.

R&D Expenditures in Non-Science and Engineering Fields

As noted previously, the data utilized by the NSF in reporting its annual ranking of R&D expenditures excludes those expenditures attributable to research in areas outside of the science and engineering categories (see Appendix for additional information about categories).

Nevertheless, expenditure data for these fields are available from the data compiled through the annual NSF R&D survey. In 2009, the University reported expenditures totaling $21.5 million in these fields, corresponding to approximately 3% of the all-inclusive expenditure portfolio total of $762 million. The 2009 non-science and engineering total for this category represented an increase of 18% over the 2008 total and a growth of 67% since 2005. Despite this impressive growth, the University ranked 29th overall among all institutions and 21st among public research universities in the 2009 non-science and engineering rankings. The University did not rank among the top 10 in any of the non-science subcategories.

Other Ranking Systems

Bibliometric indicators, specifically the Citation Index, were introduced as one the University's key research metrics in 2007. The Citation Index is based on the frequency with which individual publications are cited in the scholarly works of others.

Commonly used as a benchmark for the prominence of an individual researcher's impact on a respective field of scholarship, aggregate citation frequency has emerged as an indicator of institutional quality, impact, and significance. Rankings based on the number of citations for scholarly works associated with individual universities has come to serve as an indicator of the relative quality of the research for the university as a whole, or for individual areas of research or scholarly works.

Table 4.3 summarizes the 2007, 2009, and 2010 citation rankings for the University in comparison with other public universities for 20 fields of study. The 2010 rankings are based on citation data that cover the period from January 1, 2000 to August 31, 2010.

While citation statistics provide useful data about relative prominence in individual fields, by the very nature of the publication/citation cycle they tend to be lagging indicators. For example, Table 4.3 includes citation data covering a 10-year period. Citation of recent publications that might reflect the outcome of recent specific strategic efforts to enhance productivity in select areas of research will not be fully represented in the Citation Index until years later. As a consequence, the significance of annual changes in relative ranking, positive or negative, for fields shown in Table 4.3 should not be over-interpreted.

Nevertheless, when applied judiciously bibliometric indicators, including

t4.3 Bibliometric Indicators: Citation Frequency

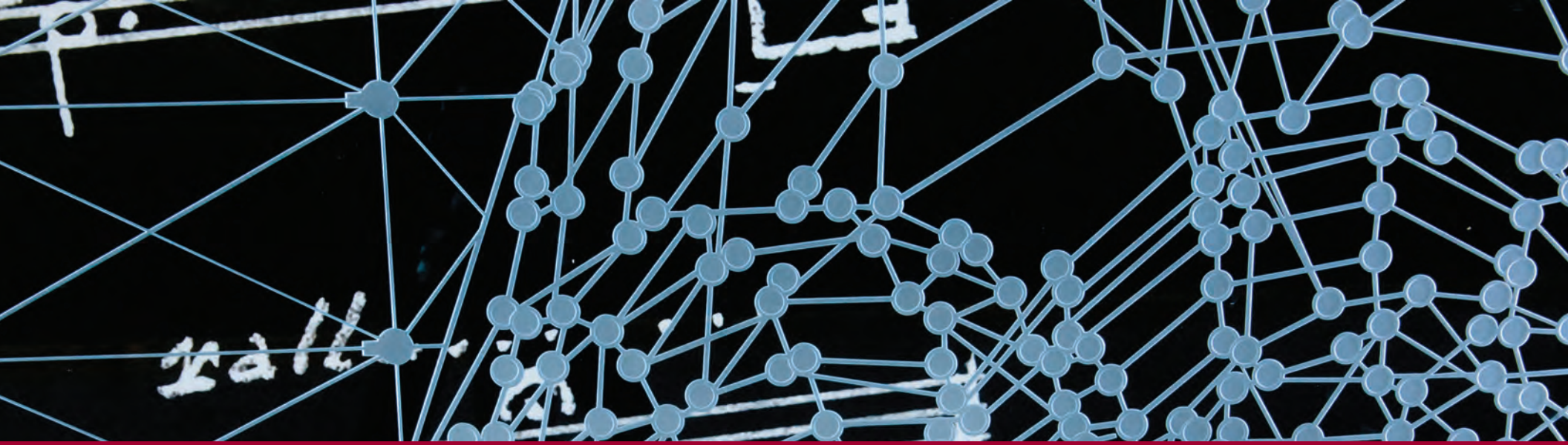
citation frequency, can provide an important measure of relative standing in key research fields. Among the 20 general fields of study included in the citation database the University ranked among the top five public research universities in three fields of study: mathematics (second), chemistry (third) and environment/ ecology (fourth). Another 11 programs rank in the top 10, giving the University a total of 14 top-10 programs at public universities.

Clearly the University's general ranking according to this statistic is comparable to its ranking among its peers on the basis of research expenditures, reinforcing the overall conclusion that the University ranks among the best public research universities in the country.

To learn more about Essential Science Indicators visit http://esi.isiknowledge.com/home.cgi

University Ranking Among US Publics: Citations

		2007	2009	2010
BIO/BIOMEDICAL	Clinical Medicine	9	8	10
	Neuroscience & Behavior	8	9	9
	Agricultural Sciences	6	6	7
	Plant & Animal Sciences	NR	9	8
	Immunology	NR	8	7
	Environment/Ecology	3	4	4
	Microbiology	NR	NR	15
	Molecular Biology & Genetics	17	17	18
	Pharmacology & Toxicology	NR	9	7
	Biology & Biochemistry	NR	15	17
PHYSICAL SCIENCE	Physics	NR	12	12
	Chemistry	4	3	3
	Geosciences	NR	13	13
	Material Sciences	8	7	11
	Mathematics	NR	2	2
	Engineering	NR	9	9
	Computer Sciences	NR	7	7
SOCIAL SCIENCE	Psychiatry/Psychology	NR	8	9
	Economics/Business	NR	8	7
	Social Sciences General	9	7	7



2010 impact

Research Impact

Although it has been said before, it deserves repeating: Numbers alone will never adequately capture the full measure of a great research university. Faculty and staff surveys conducted as part of a 2008 President's Emerging Leaders (PEL) project that was designed to explore research metrics revealed that faculty and staff overwhelmingly cited the need to assess "impact" as a way to capture the lasting influence that research and scholarship have on society at large. Many actually lamented the current trend toward reliance on statistical measures, favoring increased emphasis on the lasting impact that our scholarship and research have on the human condition as the true measure of prominence. Based on their year-long analysis, the PEL group concluded that "ultimately the importance of our research measurement efforts lies in highlighting the impact of our research on our disciplines, our community and the world. It is from the standpoint of research impact that the University will be able to more comprehensively grasp the importance of research contributions made by all disciplines across campus." Capturing impact is "paramount in fully illustrating the University's stature."

Recognizing the inherent difficulties associated with development of a system that can accurately quantitate impact, we must for the time being rely on "stories" to convey the impact of our scholarship: stories that illustrate how University research touches the lives of individuals, families, and communities. Once again this year we highlight a small representative example of scholarly activities that have had acknowledged impact locally, nationally, and globally. These vignettes are our stories—stories of which we can be rightfully proud.

Mapping the connections of the human brain

This past year the National Institutes of Health launched a major collaborative initiative to map the human brain's connections in high resolution. The Human Connectome Project is the neuroscience equivalent of the Human Genome Project of a decade ago. A detailed understanding of how brain circuitry changes during the aging process, and how it differs in psychiatric and neurologic illness, will provide a better understanding of the brain's connectivity and could lead to improved diagnosis and treatment of brain disorders.

Kamil Ugurbil, Ph.D., director of the University's Center for Magnetic Resonance Research (CMRR), will collaborate with Dr. David Van Essen from the Washington University School of Medicine to lead the $30 million Human Connectome Project (HCP).

To successfully map the complex connections of the human brain, researchers will need powerful, custom-built magnetic resonance imaging scanners and new brain analysis techniques. For decades, CMRR researchers have led the way in developing ultra high-field magnetic resonance technology and in the development of functional MRI methods used in imaging brain function. CMRR investigators will be responsible for the development of new techniques and advanced custom instrumentation for the Connectome project.

Aside from cutting-edge technology, the interdepartmental and interdisciplinary composition of the CMRR will allow University researchers to conduct a large share of the complex brain scans that will comprise the study's overall database while also developing the technology needed to measure, interpret, and model massive volumes of HCP data.

Bringing industry and academia together to make Minnesota a world leader in wind energy

A consortium of wind energy researchers led by the University will receive

up to $8 million from the U.S. Department of Energy (DOE) for fostering wind energy development in the United States. The grant will support research to improve both land-based and offshore wind generation.

Fotis Sotiropoulos, director of the University's St. Anthony Falls Laboratory and principal investigator on the project, along with a group of faculty from the College of Science and Engineering, U of M—Morris, Syracuse University, and Dakota County Technical College, will work in close collaboration with a consortium of industrial partners to help reach the DOE's nationwide goal of achieving 20 percent wind power by 2030. Industrial partners include Siemens Energy, Barr Engineering, Eaton Corporation, Honeywell, Lockheed Martin, Luna Innovations, 3M, and WindLogics.

The consortium will focus on a new 2.3 megawatt Siemens turbine to be built at UMore Park. The 80-acre experimental facility portion of UMore will be a one-of-a-kind co-laboratory where industry specialists can work together with university researchers in developing new technologies to drastically reduce the time from conceptual design to implementation in real-life wind farms. Existing wind turbines at the Morris campus will also be instrumental in research, education, and outreach.

In addition to research, the consortium will undertake an ambitious educational and training program, targeting undergraduate and graduate students, technical community students, and practicing power-industry engineers. A Web-based wind power curriculum will be made available to universities across the country, as well as opportunities for hands-on training programs, industrial internships for students, and continuing education courses for engineers.

A global approach to HIV/AIDS treatment

School of Public Health professor of biostatistics James Neaton and his colleagues have conducted the two largest HIV treatment trials to date, following more than 10,000 people in 33 countries enrolled in randomized clinical trials.

Antiretroviral therapies for HIV/AIDS are costly and complicated—huge barriers for those seeking treatment in the developing world. Neaton's team is studying strategies that decrease the use of drugs and exploring novel treatments to improve the health of those living with the disease.

Findings from several completed trials have already made a major impact on HIV care. Ongoing trials aim to curb the toxicity of HIV/AIDS drugs and potential resistance to treatment. Neaton hopes to build a global research strategy to treat HIV/AIDS. He recently submitted a proposal to the NIH to establish a collaborative network to conduct research at some 400 sites in 37 countries.

Two recent graduates launch startup company based on atrazine treatment technology

An atrazine remediation technology based on the research of University biochemist Lawrence Wackett and microbiologist Michael Sadowsky will serve as the basis for a startup company launched by two recent College of Science and Engineering graduates, Joe Mullenbach and Alex Johansson. NewWater LLC will offer a biocatalyst-based drinking water filtration technology that can reduce atrazine concentrations to acceptable levels.

Atrazine is a selective herbicide that is widely used by farmers in the United States to control broadleaf weeds and grasses. First registered for use in 1959, the Environmental Protection Agency has long required water systems to test and treat for atrazine. In recent years the safety of atrazine has been the subject of much debate among scientists, and the EPA recently initiated a new scientific evaluation to determine whether current

regulations need to be strengthened.

In NewWater's technology, enzymes developed by Wackett and Sadowsky will serve as a catalyst to initiate bacterial metabolism of atrazine, decomposing it into harmless by-products. The process does not produce a water waste stream, and it can treat to much lower levels of atrazine than can be achieved with activated carbon, the current solution. Mullenbach, a mechanical engineering major, and Johansson, a chemistry major, learned of and became interested in the technology when professor Sadowsky led a session of a Carlson School of Management course on entrepreneurship.

Collaboration helps secure grant to develop antifungal drug

Valley Fever, or coccidiomycosis, is a fungal infection that can cause fever, chest pain and coughing that typically persist from weeks to months. It's endemic to the southwestern United States, with an estimated 50,000 to 100,000 people developing symptoms each year. Some patients suffer long-term disabilities that require extensive medical treatment. At particular risk are patients with a weak immune system, including those with AIDS or recipients of organ transplants, African-Americans, Asians, pregnant women, and the elderly.

Researchers from the University's BioTechnology Institute (BTI) and Institute for Therapeutics Discovery and Development (ITDD), in partnership with the Arizona-based company Valley Fever Solutions Inc. and the University of Arizona, were awarded a $3 million grant from the National Institutes of Health to develop and study the use of the small molecule nikkomycin Z (NikZ) as a potentially curative therapy for Valley Fever. Marc von Keitz, Ph.D., director of BTI's Biotechnology Resource Center, and Vadim Gurvich, Ph.D., associate director of ITDD, are co-PIs on the grant.

Manufacturing the material for clinical trials will be an inaugural project for a new collaborative effort between BTI and ITDD. The collaboration is aimed at producing new drugs from protein-based and natural product-based materials that meet government standards for clinical testing. The collaboration's production capabilities benefit from BTI's long-established Biotechnology Resource Center and ITDD's Biotherapeutic Protein Production Facility (BPPF), a new resource created with a grant from the Minnesota Partnership for Biotechnology and Medical Genomics as a joint effort of the University and Mayo Clinic.

Major hurdle cleared in road to high-efficiency solar cells

In most solar cells now in use, rays from the sun strike the uppermost layer of the cells, which is made of a crystalline semiconductor substance—usually silicon. The problem is that many electrons in the silicon absorb excess amounts of solar energy and radiate that energy away as heat before it can be harnessed.

A team of University-led researchers recently cleared a major hurdle in the drive to build solar cells with potential efficiencies up to twice as high as current levels, which rarely exceed 30 percent. By showing how energy that is now being lost from semiconductors in solar cells can be captured and transferred to electric circuits, the team has opened a new avenue for solar cell researchers seeking to build cheaper, more efficient solar energy devices. A system built on the research could also slash the cost of manufacturing solar cells by removing the need to process them at very high temperatures.

The breakthrough comes after six years of work begun at the College of Science and Engineering in Professor Xiaoyang Zhu's lab in the chemistry department, in collaboration with chemical engineering and materials science professors Eray Aydil and David Norris and spearheaded by University graduate student William Tisdale.

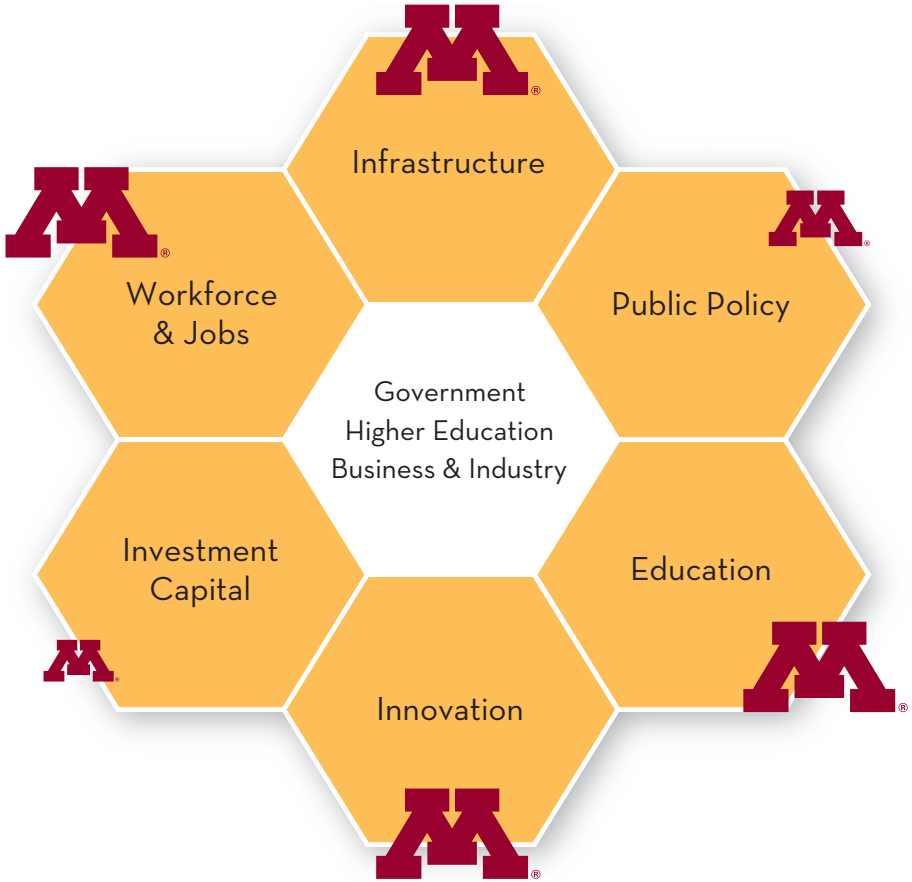
The University's Role in Minnesota's Economic Ecosystem

Research universities are increasingly called upon to serve as "economic engines" in support of efforts to spark economic development at the state and national levels. The University of Minnesota is no exception. In keeping with its land-grant tradition, the University has been and will continue to be a major contributor to the economic well-being of the state. Unfortunately, when assessing the impact of universities on economic development, legislative attention is often disproportionately focused on the contributions of technology commercialization to the exclusion of the many other prominent contributions research universities make to a healthy economic ecosystem.

The figure on this page provides a simple graphical depiction of the many facets of an effective economic ecosystem and portrays the University's contribution to each. In addition to the obvious contributions made in education, innovation, infrastructure and workforce development, the University has also assumed more direct and active roles in providing investment capital for technology development and in shaping public policy. The University's role in this latter context is worth noting.

Many states like Wisconsin, Ohio, New York, Kansas, and over 30 others have implemented creative, forward-thinking public policy that rewards and nurtures innovation, leading to its development into thriving companies. Unfortunately, the state of Minnesota is lagging far behind these highly competitive states because it lacks a comprehensive strategic program designed to establish a competitive economic ecosystem that adequately encourages and supports innovation.

We have been working over the past couple of years with partners in the public and private sector to encourage the development of just such a cohesive, statewide strategy for the nurturing and development of science- and technology-based industries in Minnesota. The University figured prominently in the successful legislative efforts that culminated in the creation of the Minnesota Science and Technology Authority in the last legislative session and actively advocated for the successful passage of the angel investor tax credit.



STAR METRICS Initiative

The Science and Technology Authority will strategically unify industry, government, and academia to enhance Minnesota's economic vitality and promote science- and technology-based innovation, business development, and job creation. The University's original concept for a state-wide initiative, coined North Star Rising, was instrumental in helping to inform the Science and Technology Authority vision and programmatic elements. A Science and Technology Authority Advisory Commission has been appointed and will research and recommend a comprehensive science and technology economic development strategy to the state legislature in January 2011. As vice president for research, I represent the University on the advisory commission and chair the program subcommittee.

With a concerted effort involving government, business and industry, and higher education, an economic ecosystem can be created that will allow Minnesota to effectively address the challenges of the 21st century. To that end, in September of this year we partnered with the University's Government Relations to host a program on economic development for state and federal legislative staff. We were very pleased with the turnout, and we believe that all participants came away with a better understanding of the University's role in and impact on Minnesota's economic ecosystem, and how we all need to work together to help create a better future for our state.

We look forward to continuing to work with our partners in government and business and industry to have a positive impact on the state of Minnesota and its economic well-being.

Interest originally expressed at the state level in getting accurate information about the impact of federally funded research on economic development and job creation has been matched by similar interest from Congress and federal funding agencies. This increased emphasis was clearly reflected in the extensive reporting requirements associated with ARRA research funding.

Federal interest has resulted in implementation of a new federal initiative that aims to monitor the impact of federal science investments on employment, knowledge generation, and health outcomes. The initiative—Science and Technology in America's Reinvestment Measuring the EffecT of Research on Innovation, Competitiveness and Science, or STAR METRICS—is being led by the NSF, NIH, and the White House Office of Science and Technology Policy (OSTP). The goal is to generate a rigorous, transparent review of the return on investment attributable to federal investments in research.

Data for the program will be generated by research institutions as part of an annual survey. The University is participating in Phase II of the STAR METRICS pilot program and will provide feedback on this important initiative. Future versions of this annual report will provide updates on the STAR METRICS initiative and will seek to incorporate some of its findings into our comparative analysis with other public research universities.

> *"It is essential to document with solid evidence the returns our Nation is obtaining from its investment in research and development. STAR METRICS is an important element of doing just that."*
>
> *- John P. Holdren*
> *Assistant to the President for Science and Technology & Director of the White House Office of Science and Technology Policy*

Faculty Recognized for Their Exceptional Research Achievements

Over the past year many University of Minnesota researchers were honored by a wide range of scholarly organizations. Some examples include:

American Academy of Arts and Sciences

Frank Bates
Chemical Engineering & Materials Science
College of Science & Engineering

MacArthur Foundation Fellowship

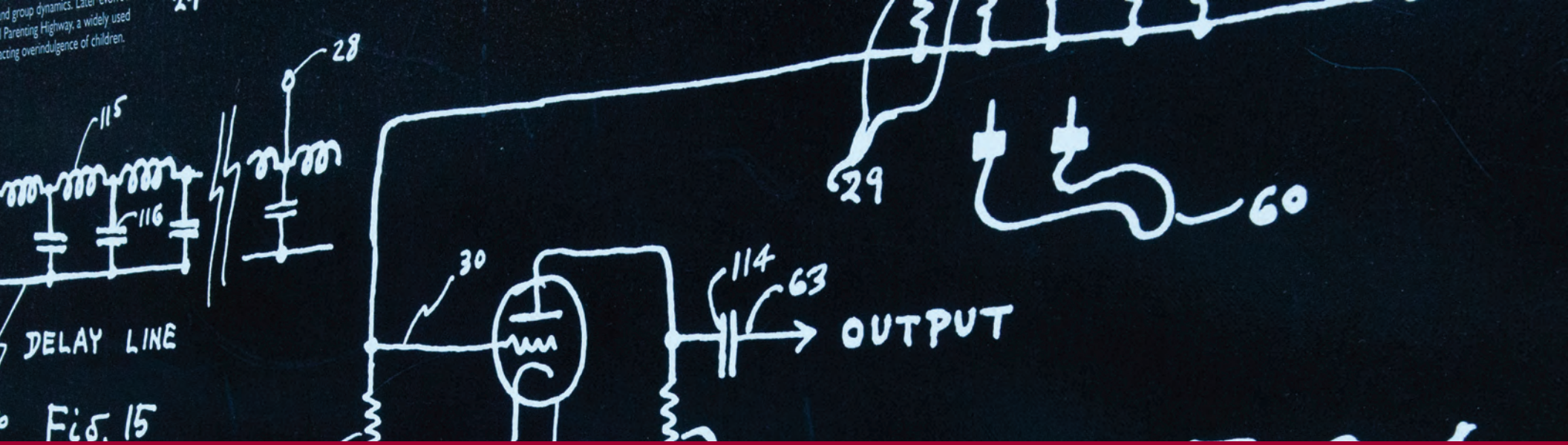
Marla Spivak
Entomology
College of Food, Agricultural and Natural Resource Sciences

National Academy of Sciences

A. Stephen Polasky
Ecology, Evolution, & Behavior / Applied Economics
College of Food, Agricultural and Natural Resource Sciences

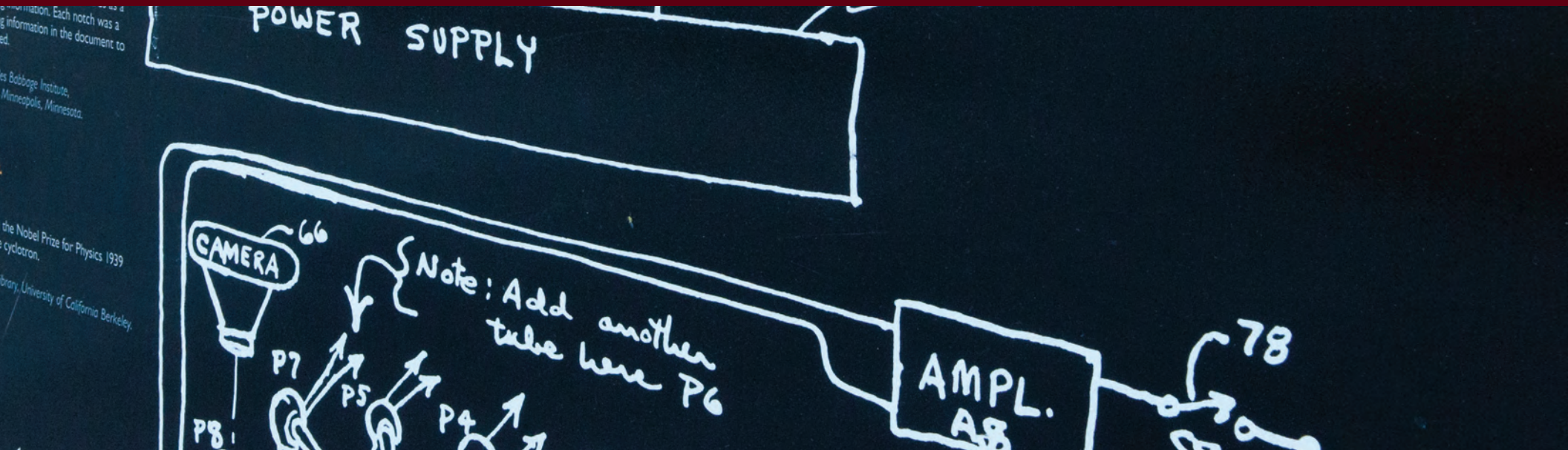
Heineken Prize for Environmental Sciences

David Tilman
Ecology, Evolution, & Behavior
College of Biological Sciences



2010

conclusion



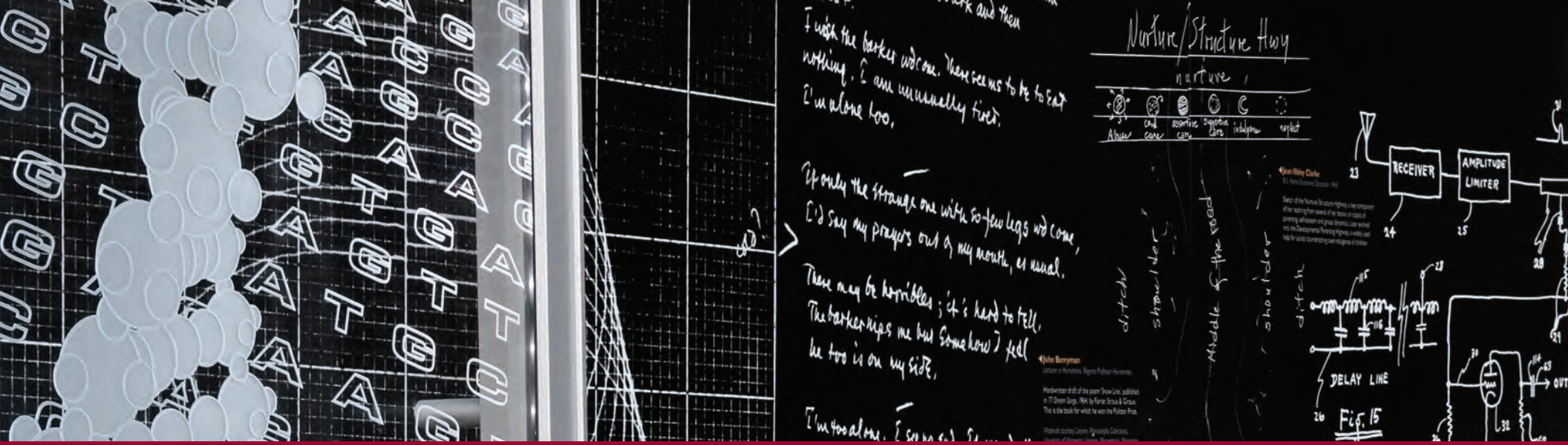
In FY2010 faculty and staff secured more than $823 million in sponsored funding to drive the University's research agenda. This represents an all-time high for the University. This accomplishment is more notable coming as it does on the heels of a decline in awards to the University in FY2009. Based on the latest R&D expenditure figures reported by the NSF, the University ranked 10th among all universities and 8th among public universities, both up one position from the previous year. Since 2004 the research portfolio has grown 41%, the third-largest growth among all institutions and second-largest among public universities. To date the University has been awarded more than $208 million in ARRA funding, including funds to support major facilities and new programs of excellence. The impact of the University's scholarship and research is broad and deep.

The strategic transformation of the University's technology transfer operation is nearing completion and all indications are that the return on the University's considerable investment in research commercialization is on a positive trajectory. The tech transfer revenue stream has provided absolutely critical funding for students, research, and infrastructure.

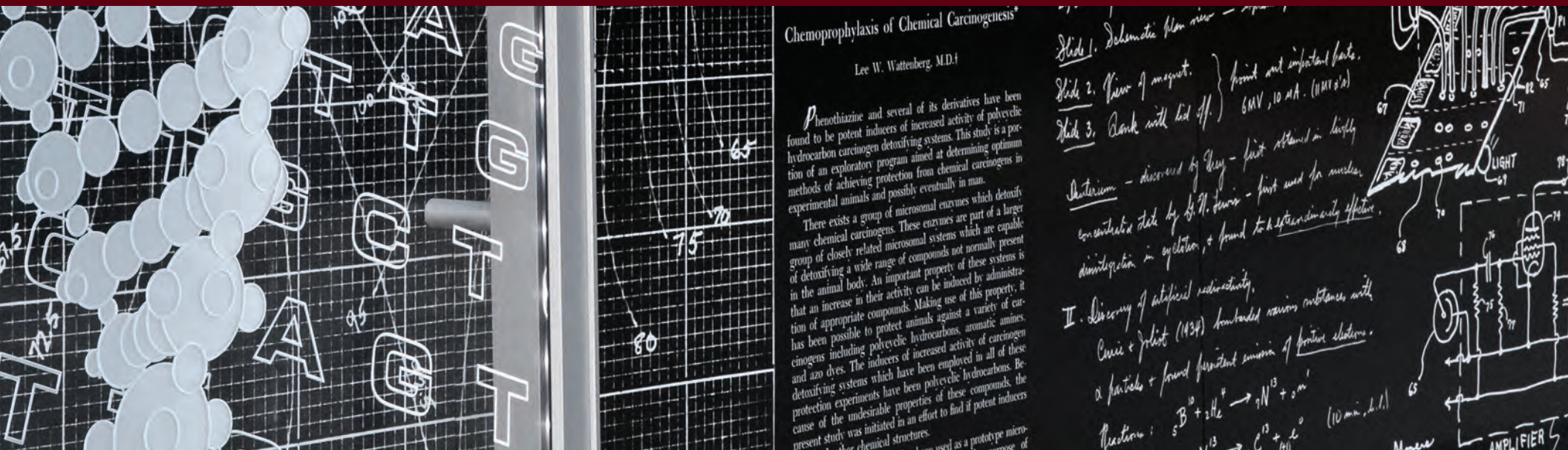
All of these accomplishments are clear signs that the University has not only retained a position among the elite public research universities in the country, it has improved its standings among this esteemed cohort. Despite many challenges, the research enterprise remains healthy.

However, the current economic situation for higher education, characterized by the decline of federal support for research, the reduced availability of state support for higher education, and the plummeting availability of institutional funds, poses a serious new threat to successful completion of the University's already daunting research aspirations. Unfortunately, these challenges arise at a critical juncture in the implementation of initiatives designed to achieve strategic objectives. Strategic initiatives must be sustained, and prioritized commitments honored, if we are to avoid the significant backslide that has occurred in the wake of each of the past state budget cuts. Success on the research front will require a greater degree of planning, coordination, leverage, and partnership than in the past. If the University is to successfully cope with an uncertain future, these partnerships must support efforts aligned with strategic directions recommended by the faculty, approved by the leadership, and endorsed by the Board of Regents. We have been, and must continue to be, smarter and more strategic in our resource allocations in the interest of increasing the capacity and quality of the research environment throughout the University.

Peter Drucker is quoted as saying, "Plans are only good intentions unless they immediately degenerate into hard work." This report highlights the outstanding outcomes from past labors and marks the beginning of the next round of hard work. Given our past successes, we can feel confident that we are up to the challenge.



2010 appendix



Awards vs. Expenditures

In reporting our research data analyses it is important to define terms commonly used to describe measures of research productivity. Research activity is usually described in terms of *research awards* or *research expenditures*. *Awards* refer to commitments made by research sponsors to campus investigators, while *expenditures* reflect funds actually spent in support of the research activity. In a healthy, growing research enterprise, *awards* exceed *expenditures* reported in any particular fiscal year since actual spending on research typically lags behind the awarding of support.

Research expenditure categories have emerged as some of the most commonly cited measures of research productivity and as a common basis for comparison across multiple research institutions. Multiple expenditure definitions exist, however, complicating the use of this metric and mandating careful evaluation before applying these measures to make direct comparisons of research performance. Fortunately, the National Science Foundation (NSF) annually compiles R&D expenditure data from research universities in the United States utilizing a standardized definition of *R&D expenditures*. Because it is one of the only standardized research data sets, NSF R&D expenditure data have become recognized as the national standard for research comparisons and arguably are the best basis for the construction of national research rankings.

For reasons too complicated to elaborate here, the University reports two different expenditure figures: *sponsored program expenditures* and the *NSF R&D expenditures*. The two metrics include different elements and differ in magnitude but they are in general proportional to each other. For the University, the NSF values are typically approximately 10% greater than our sponsored program expenditure figures for the same fiscal year.

Two additional caveats related to the use of the *NSF R&D expenditure* metric deserve comment. First, this measure focuses on research in the areas of science and engineering to the exclusion of other areas of research at a given institution. In most cases there is a strong correlation between these statistics and total research funding, so the metric remains reasonably robust for use in comparative analyses. Second, the official publication of the NSF statistics lags about one year behind the fiscal year calendar, introducing a temporal disconnect that can complicate the linkage between specific changes in research performance to specific initiatives in a timeframe useful for strategic management. For example, the ability to determine how changes introduced in 2009 influenced relative rankings among peers would not be verifiable until the release of the 2009 NSF expenditure data sometime in 2010 or 2011.

For obvious reasons this report makes extensive use of NSF research expenditure in the majority of comparative analyses. In these research analyses we are mindful of the limitations of this commonly used indicator and wish to advise readers of the same.

NSF R&D Survey Disciplines

Engineering	*Physical Sciences*	*Environmental, Mathematical & Computer Sciences*	*Life Sciences*	*Psychology & Social Sciences*	**Non-Science & Engineering*
Aeronautical/Astronautical	Astronomy	Atmospheric Sciences	Agricultural Sciences	Psychology	Education
Bioengineering/Biomedical Engineering	Chemistry	Earth Sciences	Biological Sciences	Economics	Law
Chemical	Physics	Oceanography	Medical Sciences	Political Science	Humanities
Civil	Other Physical Sciences	Other Environmental Sciences	Other Life Sciences	Sociology	Visual & Performing Arts
Electrical		Mathematical Sciences		Other Social Sciences	Business & Management
Mechanical		Computer Sciences			Communication, Journalism & Library Sciences
Metallurgical/Materials					Social Work
Other Engineering					Other Non-S&E Fields

For more information, visit www.nsf.gov
**Not included in NSF Survey rankings*

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