



## Remarks by Brian Herman, Vice President for Research, University of Minnesota

Presentation to Board of Regents, December 11, 2015

Annual Report on the Status of Research & Commercialization of Intellectual Property (FY2015)

### Welcome

I am honored to present the annual “State of Research” report as Vice President for Research at the University of Minnesota.

### Research Priorities

I came here to make a difference, and I know that you, as our governing board, are focused on ensuring that the University of Minnesota remains and grows as a top public research university—for our state, its people, its economy, and its connection to the world.

- In July 2013 I described a set of overarching principles that should drive our research enterprise. These were:
  - Produce **excellence**
  - Be **transformative**, lead not follow
  - Advance **transdisciplinary** work
  - Focus on critical, **global challenges**
  - Present real, **measurable results**
- Those five principles underscore our **research strategic plan**, Five Years Forward through Collective Inspiration and Discovery.
- Today, I will present our **performance measures for FY 2015**, including:
  - The **annual and ten year trends** of sponsored research funding at the University;
  - our **progress in commercializing technology** developed by our talented researchers;
  - an **analysis** of our research enterprise compared to our regional, national and global peers;
  - and **significant progress and promising new directions** that are part of our research strategic plan.

### State of Research

Here are a few ideas I hope to leave you with today.

- Our **research enterprise continues to grow and thrive**, even in the face of **flat federal support** for research.
- Our report shows the **increasing importance of collaboration**, both public-private and academic partnerships; and it shows that we are diversifying our funding base.
- Our challenge moving forward is **sustaining our research enterprise in an unstable environment**. We have some answers, we see some success, especially in our own efforts to create partnerships, but we need to continue to grow a research funding

model that can keep the academic enterprise thriving—generating knowledge, educating students, and providing the ideas that can make our lives better.

## Research Statistics

### Awards by Source

I will move now to talk about funding that was **awarded** in Fiscal Year 2015.

- University of Minnesota faculty and staff competed successfully for **\$754 million in externally sponsored research awards** in FY2015, **up 1.8% from FY2014**.
- \$754 million is a **record level** of externally sponsored research funding for the University (when you remove one-time awards from the American Recovery and Reinvestment Act or ARRA).
- This **1.8% increase** continues a sustained growth trajectory since FY2012.
- The **federal awards portion of this sponsored research funding was \$463 million (more than 60% of our awards portfolio)**, down 5.5% from the previous year, largely due to a drop in NIH awards.
- Business & Industry funding was **up more than 40%** in FY2015, the largest such increase in the past decade. **This funding source now accounts for more than one out of ten external research dollars.**
- Private funding –the amount you get when you combine Business & Industry and Other Private categories-**was up 13.7%**.
- These increases in non-federal sources demonstrate an **increasing diversification** of our research portfolio, a shift that **we have, very intentionally, tried to facilitate** through the research programs I'll touch on in a moment.
- Let me share two examples of new projects that **exemplify public-private and inter-institutional collaboration.**

### John Deen/USAID

- **John Deen** in the College of Veterinary Medicine is leading a five-year award of up to \$50 million from USAID for the **One Health Workforce project**, which aims to train and deploy the skilled health care workforce that nations need to battle the spread of infectious diseases — particularly those that pass between animals and humans. This **international, transdisciplinary effort** involves multiple U of M colleges, Tufts University and 24 other universities across Africa and Asia.

### Center for Sustainable Polymers/Marc Hillmyer

- In FY2015, the Center for Sustainable Polymers was awarded a prestigious **phase II grant from NSF** that will significantly enhance its efforts to transform how plastics are made and “unmade”; i.e., how they degrade.
- One researcher at the center, **Kechun Zhang [KECH-un SZHONG]** of the Department of Chemical Engineering and Materials Science, received the U of M Early Innovator award for his invention of a renewable, sugar-based alternative to petroleum that could be used **to create plastic bags that break down easily in the environment** rather than clogging landfills for many decades.

- The award, totaling **\$20 million over five years**, will build upon the work of Zhang, CSP Director **Marc Hillmyer** of the Department of Chemistry, and their many collaborators, who have already made great strides in creating high-performance polymeric materials from sugars that are **biodegradable and cost-competitive** with their petroleum counterparts.

#### **Awards by College & Campus**

- This next chart illustrates how the **\$754 million** of externally sponsored research funding is distributed within the University by college and campus.
- Those with the **largest annual increases** include the **College of Veterinary Medicine** in the **Dentistry, Nursing, Pharmacy and Vet Med** category, and Extension, which is part of the **Other** group of smaller colleges.

#### **Awards by Major Source Category (Chart)**

- This chart summarizes a **10-year distribution trend** of externally sponsored research awards for FY2006 to '15.
- **The bottom line is a ten year, 30.8% increase in awards.**
- When adjusted for inflation, all annual award funding totals to the University over that period **increased 10.8 %**.
- You can again see in this chart how we are diversifying our research portfolio.

#### **Education Advisory Board**

At a recent meeting of Senior Research Officers held by the Education Advisory Board, my peers confirmed that **diversification is the key** to a research university's ability to adequately support its research mission.

#### **Awards by Major Source Category (Table)**

- And now let's dive a little deeper into the sources of our awards, which we saw in a graph before and now see in a table.
- Here we see that federal R&D awards to the University of Minnesota have **increased by 17.6 percent** over ten years.
- However, when you **adjust for inflation**, the ten year increase becomes a very slight decrease of **0.4 %**.
- But even that adjusted amount indicates progress against the national headwinds; inflation adjusted federal R&D outlays outside of defense are **down three times more than we are (-1.5%)**.
- This table also demonstrates the diversification of our funding sources. Most prominently, **Business & Industry funding has shown a significant growth** since FY2011, going from \$43.6 to \$78.0 million.
- This trend aligns with **two significant public-private partnership strategies** launched since FY2011: the **MN-IP** (Minnesota Innovation Partnerships) program and the **Corporate Engagement Workgroup**.

- We see also here that the Other Private sources category grew the most dramatically over the ten year period, with **the largest portion of that growth due to collaborations with other Universities and Colleges.**

#### **John Donne/Herman B. Wells:**

- These multi-university relationships underscore the words of **John Donne**, who, if he were alive today and at a university, might have said, **“No researcher is an island.”**
- And the words of **Herman B. Wells**, a founder of the **Committee on Institutional Cooperation (CIC)**, the formal academic cooperation between the schools of the Big Ten, **who noted back in 1967** that academic isolation had *already* long been impractical.
- Today, collaborations with other Universities and Colleges represent **roughly half** of the FY2015 Other Private category.
  - Now if we think about it more, this is an area of continued **opportunity** for the University.
  - Today our office is **looking more deeply** at the ways that our scholars collaborate with scholars at other institutions using data on funding and publications.
  - More **scholars are collaborating across institutions**, at least in part because **technology facilitates those connections** and because **funding organizations increasingly favor these partnerships.**
  - We will be exploring how we can **support and foster effective collaborations** for our faculty and take away the **barriers** that might impede them.
  - Having met with the **Senior Research Officers** of the CIC this week in Chicago, I can tell you that all our peers at those institutions are exploring the best ways to foster their participation in large, multi-institutional grants.

#### **Award Funding by Selected CIC (“Big Ten”) Institution**

- And speaking of the CIC, as you can see on this chart, within this elite group of universities, **the U of M continued to rank third** in new award funding (Minnesota is the thick maroon line). I’ll pause here for a minute to allow you to digest this chart. *[Pause]*
- We’ll see that ranking **mirrored** in national and global ranking systems, our next topic.

#### **National and Global Analysis**

- I am now going to switch from research **awards** to research **expenditures**, which are most often used for comparing and benchmarking universities.

#### **Top 20 Institutions**

- According to the **National Science Foundation's Higher Education Research and Development (HERD) Survey** data for FY2014, the University **maintained its top 10 ranking** and **moved up in ranking from the ninth to the eighth position** among public research universities.
- Because of survey reporting requirements, the University’s **\$877 million** in research expenditures represented only the Twin Cities campus. If all U of M campuses were reported together, the total would grow to **\$901 million.**

- The other two performance measures on this slide are the **Center for Managing University Performance** and the **Shanghai International rankings**. By both these measures, the University remains highly competitive with its peers.

### UMN R&D Expenditures by Source of Funds

- This next chart shows the University's level of Institutional (the line at the bottom) and Federal R&D (the middle line) spending in relation to Total spending (the top line) over a five year period.
- Now, you can see that this federal line is largely flat (it's not adjusted for inflation).
- The current two-year budget deal in Washington may help NIH in terms of additional resources, but that promising budget deal is now three months late and Congress is operating under a Continuing Resolution that expires today.
- On this chart you can see that Institutional Funding-funding from ourselves—now accounts for **29% of total U of M spending**, and it's **up 8%** from the previous year.
- It's a shift mirrored across our peer institutions, where the average increase in institutional funds was **5% nationwide**.

### Institutional Funding

- (Members of the finance committee may **notice some difference** between the way the HERD data accounts for institutional funding and the way it was presented by the University's Budget office yesterday. The HERD numbers use **a different definition of institutional funding** that allows for us to compare across institutions.)
- There are three components to institutional funds: 1) direct funding of R&D, 2) cost sharing on externally sponsored projects and 3) Facilities and Administrative (also referred to as *indirect*) costs on external projects that are not reimbursed by sponsors.

The largest component, **\$183 million of direct funding**, represents the discretionary portion of institutional R&D spending.

- When used strategically, these funds can create a **strong return on our investment**, generating further external research funding and building on Minnesota's strengths and needs, as in the case of MnDRIVE and the Minnesota Futures programs, which I will touch on in a moment. These centrally directed investments represent about a tenth of the total \$183 million here.
- With regard to the rest (approximately \$160 million), **today we can identify *where* this funding occurs within the institution, but little analysis has been done on *how* these funds are invested.**
- Going forward, the University has **an opportunity to look systematically at direct institutional funding to determine if these resources are allocated optimally, providing the best return on investment.**

The other two categories, cost sharing and under-recovered F&A costs, (\$73 million in total) are the mandatory institutional cost of doing externally sponsored research.

- Under-recovered F&A costs represent the gap between what a research sponsor pays and the actual cost of that research, which the institution (meaning us) then has to

provide. In essence, these are a **large institutional subsidy** to perform research for other sponsors.

- The federal government, our largest funder, **does not provide F&A rates that fully cover our costs**, and it caps certain categories of overhead costs (they cover in reality about 85% of F&A costs).
- Today **our federal negotiated F&A rates are 52% while our actual cost of research overhead is just under 62%**. Recently, we were able to negotiate higher rates with the federal government for 2018 and 2019, but only because we were able to demonstrate that our **costs** had increased due to new research facilities coming online.
- **Non-federal funders often provide less or even no overhead funding**, as is the case with funding from the state of Minnesota. As we diversify away from federal funding, then, this subsidy of our overhead costs has and will continue to increase.
- Ultimately, having that gap, and the consequent growth in our institutional subsidy of research **is not sustainable for the U of M, nor is it sustainable for most research universities**.
- According to some respected observers (Meranze and Newfield (2014)), it's critical for institutions to **report on and discuss the cost of research and their own institutional costs**, and to point out that static "public funding to hundreds of research universities is undermining the country's research ecosystem."
- To build **better transparency of these costs for our own researchers**, in the coming year, our office of Sponsored Projects Administration will be **reaching out to faculty audiences** to lay out the elements and drivers of Facilities and Administrative costs.

### **Erika Lee**

Even as we consider funding levels and the funding environment, we must remember that research's contribution to society and its role as a public good extends beyond just the numbers.

- CLA's **Erika Lee**, director of the University's **Immigration History Research Center**, recently published **The Making of Asian America**, a book that narrates the deep-rooted history of Asian Americans and their role in American life, from the arrival of the first Asians in the Americas four-and-a-half centuries ago to the present day.
- It's an **important and wide-ranging work**, and in it you'll find discussions of immigration, citizenship and xenophobia that **seem very familiar** to our present day. The parallels, the lessons and the context can help inform our public policy conversation today.
- The book has received **great reviews** in the New Yorker and the Los Angeles Times and was chosen as an Editor's Choice by the New York Times, where Prof. Lee was again quoted this week on the debate over immigration.

### **Technology Commercialization**

- Let's move now to the **Office for Technology Commercialization**, which had continued **strong performance and productivity** in FY2015.

- We've included an **expanded annual report** for technology commercialization as an **insert** to our printed annual report on research that you have today.
- Nearly all metrics show growth over the previous fiscal year.
- Our ability to commercialize is **increasingly recognized as important by the State of Minnesota**. This chart indicates that the University has met the State's biennial appropriations performance goal of a 3% increase on invention disclosures between FY2014 and FY2015.
- Our technology commercialization is increasingly viewed as an opportunity by business and industry. New licenses were up significantly, from **154 licenses to 268 licenses**.
  - That's a tribute to our MN-IP program, which allows companies streamlined access to University technology. There were **69 new MN-IP sponsored research agreements** in FY2015. MN-IP has now been adapted in **several versions** to meet the needs of more and more companies and to bring more University ideas off the shelf to the marketplace.
  - Additionally, a **record 16 startup** companies were launched in FY2015, topping the previous year's high performance.
- Our technology commercialization operations are **recognized by our peers**:
  - the U of M was one of only three institutions awarded an **NIH Research Evaluation and Commercialization Hub (or REACH) grant**, which, combined with matching funds from the U, will total \$6 million over three years;
  - three of our technologies received **National Innovation Awards** from **TechConnect**;
  - and the journal *Nature Biotechnology* ranked OTC in the **top five best Life Sciences technology transfer offices**.

### Startup Highlights

Startups are probably our most recognizable route for bringing innovations to market

- This is the **sixth consecutive year** we've had a record number of startups, and they were launched across **many different sectors** of our economy.
- **Twelve of those 16 companies** are located here in Minnesota.
- Three U of M startups utilized the significant seed investments provided by our new **Discovery Capital Program**. The three companies have identified \$3 million in outside capital thus far, **yielding a 5:1 ROI**.
- And since the OTC Venture Center was formed in 2006, University startups have raised in aggregate **over \$205 million in outside investment capital**.

### Strategic Program Accomplishments

Now I'd like to turn our attention to some of the work we are doing to ensure our research enterprise thrives into the future--part of our takeaway message today about sustaining our research enterprise.

## Five Years Forward

As I mentioned at the beginning of the presentation, here are the cornerstones of our research strategic plan. *[pause]*

### Advancing Human Research Protections – Enhance Research Excellence

OVPR has adopted human participant research improvements as part of the “Enhancing Research Excellence” **cornerstone** of our research strategic plan. As the audit and compliance committee heard earlier this week, and as you can see here, much progress is being made on advancing our human research protections.

- Last week, I was pleased to attend our **day-long conference on human research** participation attended by over 400 people in-person and more than 1,000 people online. The dialogue at the conference surfaced some of the **most pressing** issues facing all research institutions including consent, ambiguous and inconsistent state laws, and conflicts of interest.
- The University is working on changes to our policies related to all of these issue areas.
- Once fully implemented, **our updated policies, education and processes** will ensure that the well-being of research participants remains at the center of all University research activities and will establish a program that will serve as a national model.

### MnDRIVE by the Numbers – Advance Transdisciplinary Partnerships

- MnDRIVE is a **prime example** of a transdisciplinary partnership between academia and Minnesota.
- Since MnDRIVE began in 2013, **\$34.5 million** has been authorized for more than **210 projects**...across the **four research areas**...involving **629 researchers**...in **103 departments, 21 colleges** and **three campuses**. They’ve also attracted more than **144 external partners**.
- Because of this work and collaboration, MnDRIVE researchers have leveraged **\$57 million** in state, federal and corporate funding.
- MnDRIVE collaborators have also submitted 41 disclosures for inventions.

### Transdisciplinary Research Program

- With funding from the **MnDRIVE Transdisciplinary Research Program**, a multi-disciplinary team of researchers is **developing aerial drones and computer monitoring technology** to help farmers better detect and manage the threat of pests and decrease the environmental impact of pesticide use.
- This is just one of twelve projects funded through the program, which provided nearly **\$6 million in 2014** for research projects that address three of the four MnDRIVE research areas. The program involves researchers from across 10 colleges and 24 departments.

### International research

Our research strategic plan has a goal of increasing the prominence of international research.

- Today University researchers collaborate in **152 countries** (out of 194 total) across the globe, with over 30 percent of their publications including international co-authors.
- Over the last 10 years, that collaborative international work **grew twice** as fast as U of M publications without an international author.
- Our office, along with a dedicated faculty/staff committee, analyzed existing data sources to identify **areas of greatest geographical opportunity**, and we've been discussing these ideas with University audiences, including at a **Campus Conversation** on the topic in October.
- In FY2016, OVPR will bring together U of M researchers who currently collaborate or are interested in **three high-potential geographic regions, highlighted here.**
- To catalyze promising new collaborations, OVPR will provide **seed funding** to facilitate these partnerships.
- OVPR will also bring **together academic and business leaders** from these regions along with Minnesota industry, funding agencies and philanthropies to develop new relationships that researchers can build upon.
- While highlighting new opportunities, this strategy **will not detract** from the longstanding, fruitful collaborations U researchers have already established or the work of our Global Programs and Strategy Alliance, the Institute for Global Studies, the Academic Health Center and other units.

### Research Advancement

**OVPR Research Advancement** provide seed funding for our faculty--approximately **\$20 million** annually for the three programs on this slide. As part of our focus on measurable results in our research strategic plan, I want to show the **financial and institutional impact** of these programs. You can see a good return on these investments in terms of **leveraging extramural funds**: from 5.50 to 1 to 7.50 to 1.

- The **Grant-in-Aid (GIA)** of Research, Artistry and Scholarship Program supports scholarly and artistic activities of faculty and their graduate students throughout the University.
  - **20% of GIA awards** have gone to scholars in the arts and humanities.
  - In the past five years, **\$15 million** has been awarded through the GIA program across our colleges and campuses.
- **Research Infrastructure Investment** awards help the University maintain robust, state-of-the-art equipment.
  - In the past five years, these investments have had more than 2,000 users.
  - This past year's investments ranged from a **new 3D bioprinting facility** to an **expansion of the Multisensory Perception Laboratory**, where researchers can measure audio-visual perception in a variety of simulated environments.
- The **Minnesota Futures** grants program nurtures extraordinary interdisciplinary research ideas using revenue from technology commercialization revenue sources.
  - As examples, the 2015 Minnesota Futures grants include **two projects** that advance new approaches to **disease treatment**: one is a better method for generating the **living cell lines** used in creating (and manufacturing) **advanced pharmaceuticals**, which will ensure higher quality drugs are produced, while

another explores **tooth bacteria's role** in blocking beneficial phosphates, found in tooth paste, from reaching the tooth.

### **Economic Development – UED Roadshow highlights**

In addition to our work in technology commercialization, I am proud of our Office of **University Economic Development** (UED), which helps grow and diversify Minnesota's economy as articulated in our research strategic plan.

UED helps external partners connect with resources, services and expertise at the University and its system campuses, and promotes internal collaboration.

In 2015, UED had three primary focus areas:

- It provides a **"Front Door and More"** for potential collaborators to connect with University resources and capabilities and helping University faculty and staff connect with external resources (e.g., industry). They received and dispatched over 200 requests for connectivity support and have convened University faculty with local, national and international businesses and economic development groups.
- UED co-leads the **Corporate Engagement Workgroup** with the University of Minnesota Foundation. The workgroup helped facilitate a master agreement with PepsiCo (\$2.3 million) and sponsored research funding with St. Jude Medical and Target Corp., among others.
- I was pleased to be part of UED's series of **economic development** meetings around the state. We held **nine Greater Minnesota community visits** to discuss current community needs identified by local business and economic development leaders, and explore possible areas of partnership with the University.
  - We logged over **2,000 miles** within the state, visiting **16 communities** representing **14 counties**, and we engaged with approximately **250 Minnesotans**.
  - We heard **great interest in the University's partnership** to meet workforce needs, to drive innovation and entrepreneurship, and to access to the ideas, people, and infrastructure of the University of Minnesota.
- And UED is now working with economic development agencies across the state and other higher ed institutions to see where we can **begin to meet these needs**, as well as deepen these conversations this year.

### **Convergence Colloquia**

- As we outlined in our research strategic plan, promoting a **culture of serendipity** is central to connecting researchers across departments, colleges and disciplines—and with colleagues and communities outside of the University—to think creatively and cultivate new ideas.
- The **Convergence Colloquia** is a series of day-long, multi-disciplinary gatherings that explore emerging research opportunities and societal challenges.
- They are **action-oriented think tanks** that bring together U of M researchers with private, public and nonprofit stakeholders in focused, facilitated discussions.

- **Four colloquia**, on smart cities and infrastructure, aging, health equity, and renewable energy have been held in calendar year 2015 and **one more**, on sustainable food systems, is happening here in McNamara today. There are four more planned in 2016.
- We've had energetic and successful participation, with **340 participants from** 14 Twin Cities colleges, UMM and UMD, 40 nonprofits, Met Council, state agencies and 25 private companies.
- Already, **29 proposals** have been submitted for follow-on **Serendipity Grants** of up to \$30,000 to kick start ideas and new collaborations.
- Two Serendipity Grants recently awarded were for:
  - A **"Smart-Food-Flows"** database to track and map food supply chains in the Minneapolis area to improve sustainability of local food production;
  - And a **Family caregiver study** with Wilder Foundation and Blue Cross Blue Shield to explore new interventions, services and policies for working family caregivers and their employers
- Our serendipity work has already attracted the interest of significant funders. **McKnight Foundation recently awarded \$150,000 for additional serendipity grants.**

#### State of Research (revisited)

- As we've seen, our **research enterprise** continues to grow and thrive, despite flat federal support and increased competition.
  - As a University, we will continue to **diversify our research support.**
  - Our office will continue to work toward more efficient systems for our researchers as they prepare and submit grants—especially large multi-institutional grants--and manage their compliance.
- Our research statistics show the **increasing importance of collaboration**: public-private and multi-institutional partnerships, national and global connections.
  - We need to find every opportunity to **deepen and seed our culture of collaboration**, in the spirit of MnDRIVE and our Serendipity work.
  - We must also **remove barriers to collaboration**; as funders seek to reap the rewards of broad collaboratives--of team science--we have to look at our academic culture, which, I think few people would disagree, rewards individual achievement over teamwork at some of the most critical points of a researcher's career.
  - Let's talk about how we can collaborate down the hall, across the campus, between universities, and across international borders.
- In the end, a **new model for academic research enterprises** is needed to keep the academic engine thriving, generating ideas that make our lives better.
  - We are a large, complicated institution that **struggles to be nimble.** We have an opportunity to look at whether our **investments in research (money, space, people)** are providing the best return both in terms of societal impact and fiscal effectiveness.
  - As federal support remains uncertain, we need to better understand what the **true costs of research** are and communicate them transparently to our faculty.

We need to have frank discussions with our funders, federal and otherwise, about those true costs, and that we, as an institution, will not be able to cover an increasing share of that cost for externally funded research.

- We have to find a **better balance**.
- To conclude, the University continues to make steady progress in **growing its research enterprise** across a broad array of disciplines and ideas.
- Our progress is a tribute to the creative and dedicated people of our research community, who have continued to advance academic scholarship, address global challenges and develop breakthrough research in an increasingly competitive research environment.
- We still have a **considerable distance** to go to reach a sustainable model for a research university. I'm confident we need to deepen the kinds of partnerships I've highlighted here today, be they public-private, university to university, or international, but there are challenging questions for us, and **I look forward to our conversation**.