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Accelerating Discovery: Research Annual Report 2018

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ACCELERATING DISCOVERY

WESTERN MICHIGAN UNIVERSITY



Research Annual Report 2018

ACCELERATING DISCOVERY

Research Annual Report
2018



Terri Goss Kinzy, Ph.D.
Vice President for Research

Message from the Vice President for Research

Long gone are the days when we could sit by and idly take the position that the value of a college degree, and the contributions of a research university to the state, its region and the nation are self-evident. In these uncertain times, academic inquiry and the value of research endeavors are roundly criticized or made light of by public officials and political commentators.

Given this cultural context, it is imperative that major research institutions such as Western Michigan University demonstrate our value and the significance of what we do to all our constituencies. I want you to know that it is my intention, and that of our new president, Edward Montgomery, to be a leader in the state in articulating the value of research and the direct impact that it has in the lives of people.

As a public research university, Western Michigan University's economic footprint in Southwest Michigan is substantial, with an annual impact of \$1.6 billion. That means our return on investment in the local and regional community is 15 times greater than the state's support of WMU. Furthermore, our impact on our region exceeds the total amount the state invests in all its state universities combined. The Office of the Vice President for Research is part of that economic impact, yet we are even more proud of the difference our research is making to harness and direct that impact in the lives of the citizens of the State of Michigan.

This past spring, for instance, we hosted two symposia—one that focused on autism and one that highlighted our research related to mobility. We brought in Lt. Gov. Brian Calley and state Sen. Margaret O'Brien to be part of those discussions. Similarly, we hosted our first Innovation Networking Session on Opioids this past year, which pulled together faculty and researchers to develop research collaborations to address this critical national issue.

As I share with you my first annual report on behalf of the research enterprise at Western Michigan University, it has been a privilege to join this hardworking team in OVPR. I thank my colleague, Dr. Sherine Obare, associate vice president for research, for her leadership as interim vice president prior to my arrival at WMU. In addition, her hard work in launching the Office of Undergraduate Research and Creative Scholarship has served us well.

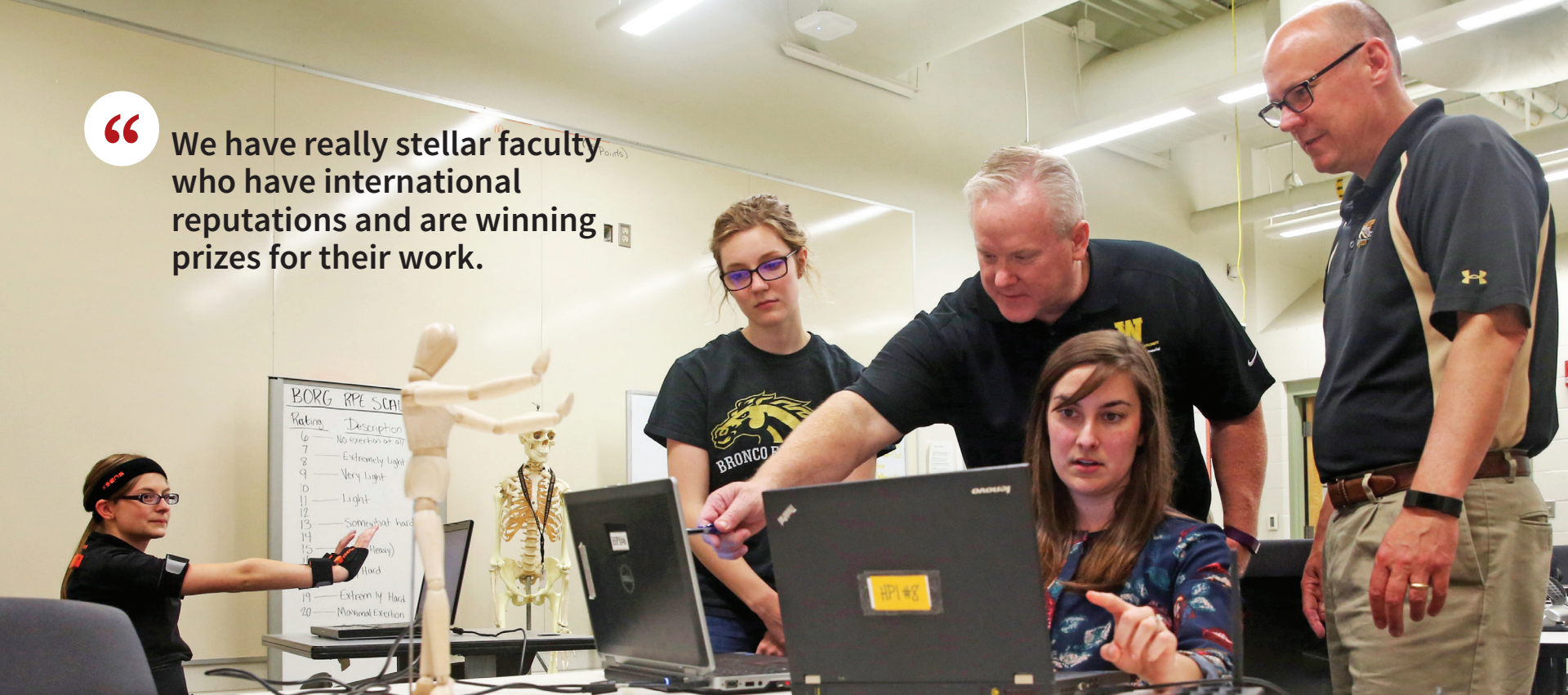
As we move into 2019, we will continue to look for ways to build on our successes, add services, and accelerate the discovery process. We hope you will join with us. WMU, as a Carnegie high-research university, is committed to a discovery enterprise that improves lives. Our office offers the infrastructure and personal support to advance that commitment. To that end, we are dedicated to research development and capacity building in order to have a tangible impact on all the communities we touch.

A handwritten signature in black ink that reads "Terri Goss Kinzy". The signature is fluid and cursive, written in a professional style.

Terri Goss Kinzy, Ph.D.
Vice President for Research

“

We have really stellar faculty who have international reputations and are winning prizes for their work.



Ergonomic Research Engineering

Investing in students and research at WMU

In a university context, the idea of “research” may conjure images of lab-coated faculty staring intently into microscopes while neophyte student lab assistants are consigned to washing beakers, uninvolved in the discovery process.

But research and creative inquiry is as diverse as the world itself, and WMU is a place where graduate and undergraduate students are involved in this scholarly work. The summer research edition of W Magazine highlighted some of this world-impacting scholarship that occurs at WMU, be it in the lab, the field, or the trading floor, to name a few of the many contexts in which research and creative activity occurs.

Faculty take students into these diverse contexts both to learn as well as to make meaningful

contributions. In so doing, WMU professors benefit society through their investigations and findings while at the same time they are developing the next leaders in research.

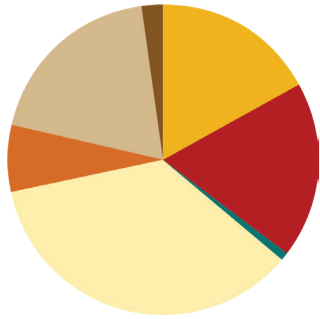
“We have really stellar faculty who have international reputations and are winning prizes for their work. But they are also very accessible,” says Dr. Carla Koretsky, dean of the College of Arts and Sciences. “They are student-focused. They wouldn’t be working at Western if they weren’t interested in teaching.”

As a longtime geosciences researcher and someone who traces her own career back to a professor who invited her to join his lab, Koretsky, in turn, has always looked for the most curious, hard-working students to join her in her

research projects. She’s not alone. Many faculty members involve students in their projects, and studies have found that these experiences are high impact practices that enrich student learning. “I really enjoyed working with graduate and undergraduate students. And we have strong, talented and motivated undergraduates,” she says. “If you take the most-talented undergraduates at Western, I would put them up against the best undergraduates at Harvard any day of the week.”

FY18 AWARDS BY UNIT

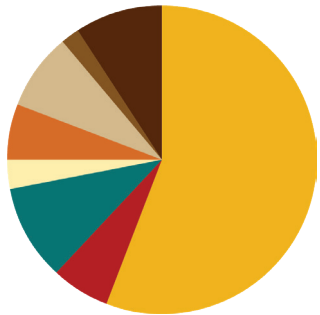
JULY 1, 2017 TO JUNE 30, 2018



Central Administration	\$4,455,196	17.27%
College of Arts and Sciences	\$4,675,313	18.12%
College of Aviation	\$192,974	0.75%
College of Education and Human Development	\$9,079,048	35.18%
College of Engineering and Applied Sciences	\$1,821,588	7.06%
College of Fine Arts	\$2,398	0.01%
College of Health and Human Services	\$5,020,089	19.45%
Haworth College of Business	\$455,000	1.76%
The Graduate College	\$103,735	0.40%
Total Funds Recovered	\$25,805,341	100%

FY18 AWARDS BY SOURCE

JULY 1, 2017 TO JUNE 30, 2018



Federal	\$14,500,260	56.19%
State	\$1,503,119	5.82%
Local	\$2,515,438	9.75%
International	\$715,000	2.76%
Industry/Corporation	\$1,647,992	6.39%
Educational Institution	\$2,128,151	8.25%
Foundation	\$497,353	1.93%
Other	\$2,298,029	8.91%
Total Funds Recovered	\$25,805,341	100%

STARTUP AND PATENT DATA FOR WMU

147 WMU STARTUPS;
2014 – 2018

WMU STARTUPS
BUSINESS STARTUPS

131

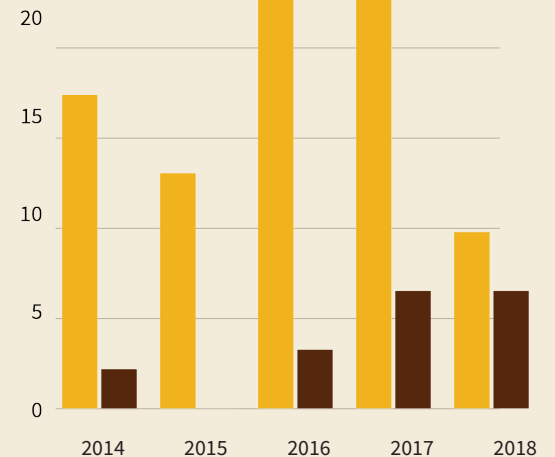
HIGH TECH
STARTUPS

16

SUPPORT FOR HIGH
TECH STARTUPS

\$1,006,250

DISCLOSURES AND GRANTED PATENTS



• Disclosures • Granted Patents

WMU central hub of national STEM work

Western Michigan University researchers have parlayed their connections with some of the nation's leading higher education organizations and a number of federal and foundation grants to position WMU as the hub of a network of national higher education specialists. Their goal: creating systemic cultural and instructional change that will boost undergraduate academic achievement.

WMU's Center for Research on Instructional Change in Post-Secondary Education (CRICPE) is led by Drs. Andrea Beach and Charles Henderson. In November 2017, they received a new \$905,141 award from the National Science Foundation to support a national network—the Accelerating Systemic Change Network, or ASCN—that builds on what they and other national researchers have learned about improving instruction in STEM disciplines (science, technology, engineering and mathematics). The network's focus will be to draw on lessons learned from contemporary higher education research to create systemic change by constructing learning environments that will improve student outcomes. Because change processes are complex and research-based STEM discipline change practices are relatively new, there previously was no organization that coordinated new initiatives and findings. Such is why ASCN was created.

Beach and Henderson say ASCN will be a bridge between explicit academic knowledge about change in the STEM disciplines and the on-the-ground knowledge and practice of active teachers and change agents. The researchers will be carefully

examining the intersection of theory and change strategies to better disseminate research as to what works in improving student achievement.

The current round of NSF funding will support a five-year network development initiative. In addition to WMU's Beach and Henderson, the work will be led by Dr. Linda Slakey of AAU and the Association of American Colleges and Universities and Dr. Maura Borrego of the University of Texas Austin. Slakey is the former director of the NSF Division of Undergraduate Education and Dean of the College of Natural Sciences and Mathematics at the University of Massachusetts Amherst. Borrego is a longtime NSF-funded researcher at the University of Texas Austin who has focused on undergraduate engineering education.

ASCN will be centered at WMU and reflect WMU's commitment to STEM education and positions WMU nationally as a leader in STEM education change.

In addition to their research roles, both Beach and Henderson are veteran faculty members at WMU. Beach is a professor of educational leadership, research and technology. Henderson is a professor of physics and director of the Mallinson Institute for Science Education.

WMU postdoctoral fellow wins NSF award

WMU's Dr. Erika Calvo-Ochoa is just one of 40 researchers in the nation to receive the National Science Foundation's prestigious Postdoctoral Fellowship in Biology.



Calvo-Ochoa studies the olfactory bulb in zebrafish to understand not only how their brains function but also how they recover from damage. Unlike humans, zebrafish can repair brain lesions. The hope is that by studying cell regeneration in zebrafish, research may discover a path by which to unlock a similar process in the human brain in cases of traumatic brain injuries or Alzheimer's disease.

Calvo-Ochoa's fellowship also has an outreach component; she works with first generation college students who are part of WMU's College Assistance Migrant Program; her goal is to inspire students from diverse backgrounds to pursue study in STEM disciplines.

With degrees in biomedical research and neuroscience already earned, Calvo-Ochoa aspires to excel in research while mentoring tomorrow's researchers.



APPLIED INNOVATION IN AVIATION SCIENCES

Aviation professor innovative in training the next generation of pilots

College of
Aviation professor
Lori Brown
has developed
a number of
augmented and
virtual reality
programs to aid
in the training of
airplane pilots
and mechanics
worldwide. These
programs are
versatile and



Lori Brown

are designed to run on IOS, Android and Microsoft's HoloLens operating systems. Brown has demonstrated her software at numerous aviation meetings, and as a result, has generated significant interest in the augmented and virtual reality programs from pilot training educational groups in several countries.

Western Michigan University has filed to register the copyrights of the software that undergirds the programs. As a next step in commercializing the product, the Technology and Innovation Advancement office at WMU is in discussion with a couple of the groups to license the copyrights to the technology, facilitating the use and development of new software in order to improve pilot training programs the world over.

WMU is listed in the **top 50**

in federal expenditures (FY17 NSF HERD) in Education research.
Among Michigan universities, only MSU ranks higher.

EDUCATION RESEARCH

Education researchers get \$12.5 million grant for school leadership renewal

Two longtime school leadership experts will use one of the largest single grants ever awarded to WMU to lead a three-year effort in order to promote leadership development in high-poverty schools across West Michigan.

The \$12.5 million award from the U.S. Department of Education will fund the High-Impact Leadership for School Renewal Project, led by Dr. Patricia Reeves and Dr. Jianping Shen, faculty members in Educational Leadership, Research and Technology.

Specifically, the project focuses on developing an extensive cohort of practicing school leaders in an effort to improve student achievement. Reeves and Shen, in their work with a pool of elementary schools in 20 West Michigan counties, will support teams of school principals and teachers by:

- Providing intense professional development and financial support for renewal projects for leadership teams in 75 schools implementing new literacy essentials;
- Placing a trained team of school renewal coaches in each project school;
- Providing an additional level of professional development support and funding for leaders in an additional 75 schools; and,
- Applying a set of proven school leadership practices for school renewal and sustainable implementation.



APPLIED AVIATION SCIENCES

WMU marketing students help Kalamazoo airport with digital makeover

Dr. Scott Cowley, assistant professor of marketing, was planning to fly out of the Kalamazoo/Battle Creek International Airport, when he saw a problem—their website was outdated, loaded with unnecessary information, and he could see that it had been hacked.



Dr. Scott Cowley

Cowley contacted the Kalamazoo/Battle Creek International Airport to offer to help; he found that a website revamp was already on their agenda, but the airport staff were unsure of where to start. Cowley's students in his digital marketing class served as starting place for the airport administration.

The first thing the Western Michigan University team recommended was for the airport to begin collecting website analytics data. Analytics is

critical in digital marketing, and at the time, the airport had no way of knowing how their website was being used or by whom.

Some of the information uncovered through the students' analyses was surprising. The students found that half of the website visitors are viewing the site on a mobile device, even though no mobile version was offered at the time, and that 90 percent of website users only look at two pages. These and other findings helped the teams solidify what was important to focus on for the redesign. Additionally, for the administration team, the need for an upgrade was validated when the class discovered the website was visited more frequently than anyone expected, even with the outdated appearance.

At the end of the project, the teams visited the Kalamazoo/Battle Creek International Airport to present their recommendations. The director of operations and maintenance was impressed.

This WMU marketing class really helped give AZO a legitimate direction to move forward with redesigning its website.

The airport staff referenced the ideas and research provided by students as they moved forward with the website reconstruction. The



WMU marketing students

project not only benefited the airport and the Kalamazoo community, but the students found the experience to be valuable as well.

WMU

has facilitated
147 START UPS.

COMMUNITY IMPACT

\$1.8 million behavioral health grant impacts underserved in community

A Western Michigan University project aims to increase the number of thoroughly trained treatment providers who work with the region's underserved and vulnerable community members.

Dr. Ann Chapleau, associate professor of occupational therapy, and Dr. Jennifer Harrison, assistant professor of social work, were awarded a four-year, \$1.8 million grant for behavioral health workforce education and training from the U.S. Health Resources and Services Administration. The grant will support IPEER, WMU's Interprofessional Peer Education and Evidence for Recovery project, which is a joint initiative of the Department of Occupational Therapy and the School of Social Work.

Chapleau and Harrison created IPEER to enhance interdisciplinary education for social

workers, occupational therapists and peer specialists, and to expand the number of these



Dr. Ann Chapleau



Dr. Jennifer Harrison

professionals who are available to serve rural and medically underserved communities in southwest Michigan.

The IPEER project connects the educational training and direct service provided through WMU's College of Health and Human Services with numerous off-campus partner organizations where students complete their required fieldwork.

Organizations where that collective training takes place include the Kalamazoo Psychiatric Hospital, Southwest Michigan Behavioral Health and the Recovery Institute of Southwest Michigan, as well as community mental health programs and their providers in Allegan, Barry, Berrien, Branch, Cass, Calhoun, Kalamazoo, Ottawa, St. Joseph and Van Buren counties.

ENVIRONMENTAL STUDIES

Researcher works to save bats from deadly fungus



Dr. Maarten Vonnhoff

The fungal disease white nose syndrome (WNS) threatens the bat population in the United States and Canada. Millions of bats have died from WNS since it was first spotted in upstate New York in 2006 before spreading to 33 states and seven Canadian provinces. The disease has been observed in 11 bat species, with the hardest hit species being the northern long-eared bats (98% mortality), little brown bats (90-95% mortality), and tricolored bats (90% mortality).

The fungal disease works insidiously while the bats hibernate, growing into the skin of bats and suppressing their immune system. Once they emerge from hibernation, they have a massive

inflammatory response that results in tissue damage, dehydration and changes to their blood chemistry.

Dr. Maarten Vonnhoff, director of the Institute of the Environment and Sustainability and biology professor explores the use of the biopolymer chitosan, a powerful antimicrobial agent, as a possible treatment. Supported with nearly \$767,000 in grants from the U.S. Fish and Wildlife Service, the National Fish and Wildlife Foundation, Bat Conservation International, and the Nature Conservancy, Vonnhoff studies how chitosan kills the fungus that causes WNS.

HEALTH TECHNOLOGY

Research that impacts the lives of women, children, and healthy pregnancies

Over the past decade Dr. Robert Bensley has secured \$10.1 million in external funding for his



Dr. Robert Bensley

research related to wichealth.org, the leading Women, Infants and Children (WIC) Internet-based nutrition education and behavior change program in the U.S. This online program has impacted over 5 million WIC clients across 35 states and Indian tribes.

Bensley is a professor and co-coordinator of public health programs in the

School of Interdisciplinary Health Programs, as well as director of the eHealth Innovations Group at Western Michigan University.

In the classroom, Bensley specializes in health behavior change interventions and teaches a Master of Public Health (MPH) course focusing on health communication and marketing. He also has global experience, teaching in South Africa as a Fulbright Scholar, where he focused on sharing his research interests about how to utilize technology to communicate messages to bring behavioral change.

A prolific researcher, Bensley has years of experience working with populations through grant-funded program development, implementation, evaluation, and research related activities. Cumulatively, he has served as the project director and principal investigator

on over 200 externally funded contracts, totaling over \$12 million, most of which support the development and implementation of technology-based behavior change programming associated with child feeding and weight management.

\$10.1 million

secured in external funding
over the past decade.

Gilmore Foundation grant provides new instruments to one-fifth of the Marching Band

The Bronco Marching Band represents the University and the Kalamazoo community when performing live for close to a quarter of a million people annually. In so doing, it plays a vital role in bringing recognition to the Kalamazoo community and WMU, both at sporting competitions and national events during the holidays.

The Gilmore Foundation donated \$150,000 this past year to underwrite the purchase of dozens of new instruments for the Bronco Marching Band. The physical activity of performing in a marching band coupled with transportation to and from events results in considerable wear and tear on instruments. The previous drumline and brass instruments, purchased in the 1990s, for instance, had exceeded the typical five- to seven-year lifespan to the point that performance level was starting to be compromised.

As a result, the Gilmore Foundation grant directly benefits the 65 students who will play these instruments as well as the sonic signature of the entire 320-member band.



Bronco Marching Band

ENVIRONMENTAL SCIENCES

Understanding the ecosystem of the Interdunal Waters

While great biodiversity exists in Michigan's interdunal wetlands, scientific knowledge about these rare habitats is relatively underdeveloped. Dr. Tiffany Schriever, assistant professor in biological sciences, aims to change that by focusing on how aquatic communities found within the wetlands respond to environmental variation. Support from the Michigan Sea Grant enables Schriever and her students to study and measure food webs that exist in these wetlands. Specifically, they are learning about the interconnectedness and interdependency of reptile, amphibian and insect species and how

they respond to natural and human disturbances in their habitat.

Formed within the low-lying spaces between dunes along the Great Lakes and especially prevalent along the eastern Lake Michigan coastline, these coastal wetlands provide essential ecosystem functions, maintaining the health of the Great Lakes and offering critical habitat for aquatic biodiversity. Much of the interdunal wetlands are located in Department of Environmental Quality-recognized "critical" dunes areas.

Interdunal wetlands come and go based on lake water levels. Schriever notes that due to their natural rarity and restricted range, impacts to these areas can be particularly devastating. According to the Michigan Natural Features Inventory, interdunal wetlands are classified as imperiled in the state.

Schriever's work, which tracks changes in species composition that occur over time, illuminates the connection between dunes and coastal wetlands, and offers critical insight for the management and conservation of these imperiled habitats.



Western Michigan University has risen to the **top 200** in all universities, public and private, in research expenditures in geosciences, atmospheric and oceanic sciences.

APPLIED INNOVATION

Sensor helmet for detection and tracking of concussions

Sports-related traumatic brain injuries affect 1 in 3 football players, with an estimated 4 million concussion injuries occurring annually, including injuries not reported or treated.

Unreported cases add to the risk for complications that result from the head injuries. Often the decision to continue to play is made by a quick assessment on the field by trainers or medical staff. The sensor helmet system provides concrete data points to help with the assessment.

The patented Smart Helmet Impact Sensing System uses flexible, printed electronics that create a system to be physically flexible, lightweight,

conformable and seamlessly integrated to cover the entire helmet interior with a comfort fit. It provides a “point-of-impact mapping” of any head trauma around the skull to detect and provide information for improved diagnoses.

Helmet manufacturers can put the system in existing helmets to automatically record and

communicate the occurrence of potentially dangerous impacts and track the accumulation of such impacts—in multiple areas of the head. This sensing system monitors the intensity and location of traumatic head impacts and delivers “real-time” alerts to team personnel.

Delivers “real-time” alerts upon impact.

\$318,000 Department of Defense grant supports engineering research

Engineering professors Drs. Kristina Lemmer and Claudia Fajardo, were awarded a \$318,000 grant from the Department of Defense, as part of the Defense University Research Instrumentation Program, to be used to purchase equipment for the mechanical and aerospace engineering department research labs.

At WMU, the funds will be used to purchase two systems: a tunable dye laser pumped by a solid-state diode laser—and an intensified charge coupled device (ICCD) camera. Combined, the systems will give WMU the capability to perform a variety of optical diagnostic techniques, which include high-resolution absorption, laser-induced fluorescence, and multi-photon and Raman spectroscopy.



This is a significant grant for research that can have a far-reaching impact on funding future research related to Department of Defense initiatives. The equipment primarily will be used by Lemmer in her APLE (Aerospace Laboratory for Plasma Experiments) lab to study ionization processes for alternative propellants that are used in electric propulsion systems—and by Fajardo in her CFRL (Combustion and Flow Research Laboratory) lab to study non-thermal plasma interactions with surfaces. Additionally, Lemmer and Fajardo will use the system to study plasma-enhanced combustion, particularly the ignition and combustion stability of lean mixtures.

WMU English professor pens poem as part of collection

Desk

Every thing
I say of the world
is less true of
the world

than of myself.
The desk
is a timetable,
a cliff to lean

my elbows on,
a boat to rock
asleep in, a night
in the open.

I'm having
to show up
and sit down
to hear out

whether to sleep
or reach down into
the wake of
these others.

William Olsen. (2017).
Technorage: Poems/William
Olsen. TriQuarterly
Books/Northwestern
University Press.

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Office of the Vice President for Research
1903 W Michigan Ave
Kalamazoo MI 49008-5456

