MARQUETTE UNIVERSITY

explorer challenge

MARQUETTE UNIVERSITY | BE THE DIFFERENCE.

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Transform Marquette. Transform the World.

As a leading Catholic, Jesuit university, Marquette's vision is to promote the greater glory of God and the well-being of humanity. One way we achieve this is to embody a spirit of interdisciplinary curiosity, research, innovation and entrepreneurship to transform and improve ourselves, our community and our world.

From this vision was born the **Explorer Challenge**. Open to all members of the Marquette community — faculty, staff and students — the Explorer Challenge is an annual competition that provides seed funding for projects that advance our strategic plan, *Beyond Boundaries,* and builds infrastructure for internal and external collaboration and partnerships. The Explorer Challenge especially encourages interdisciplinary, collaborative projects and community-based partnerships in pursuit of finding solutions to pressing societal concerns and urges teams to take some initial risks and be creative in planning for sustainability.

Explorer Challenge projects touch the lives of many. On campus these projects promote academic excellence and personal development in our students, raise our research profile among external funders and other universities, and develop internal efficiencies. Across our community — and around the world — our projects are transforming the trajectories of individuals and families, disrupting health and economic inequalities and, above all, renewing a sense of hope.

Through its first four years, **Explorer Challenge** has awarded nearly **$7.5 million to 84 initiatives,** which, in turn, have garnered more than **$24 million** in external grants and other revenue, **returning Marquette's investment by 225 percent.**

To learn more, visit marquette.edu/innovation/the-explorer-challenge.php.

Transformation is who we are.

DR. JEANNE M. HOSSENLOPP

VICE PRESIDENT FOR RESEARCH AND INNOVATION

The Explorer Challenge, Marquette's distinctive approach to building an inclusive campus community of innovators, continues to demonstrate impact on the university, the Milwaukee community and the broader world. We are so proud of the accomplishments of the students, faculty and staff whose creativity and commitment to making the world a better place is evident in their projects. In this second annual report, we feature profiles of some of the projects launched during our first four years (through the end of fiscal year 2019), as well as updates on projects featured in our previous report. The cumulative impact of the projects piloted through the Explorer Challenge continues to grow!

In fiscal year 2019, Marquette was recognized nationally by the University Economic Development Association (UEDA) for the Explorer Challenge, which received the Award of Excellence for Developing Innovation. As the Explorer Challenge continues to encourage innovation among the Marquette community, so too does it evolve to meet the needs of society: Recognizing that true innovation requires diverse perspectives, the Explorer Challenge now (beginning with the fiscal year 2020 competition) requires integrating inclusive practices into projects.

We deeply appreciate the many donors who have made the Explorer Challenge possible. Marquette is truly a national leader in providing opportunities for students, faculty and staff to all participate in a common initiative, and we look forward to a future of continued impact!

"Every year we ask faculty, staff and students for Explorer Challenge proposals that will make a difference for our campus and community and they never disappoint — always going far beyond our expectations."

Dr. Michael R. Lovell
President, Marquette University

Transform Marquette

Marquette faculty and students share a commitment to lifelong academic excellence and the transformation of the whole person: physically, intellectually, spiritually. These values are embedded within every Explorer Challenge project, from encouraging innovations in educational and professional development experiences for both pre-college and Marquette students to supporting high-end research that addresses the critical challenges of today.

FACULTY

CONCRETE, HEAL THYSELF

Although cracks in your home's driveway might be unsightly, there are a myriad of situations in which cracked concrete can cause serious problems in our nation's infrastructure of roadways, bridges, water and sewer lines, buildings, dams and more. These cracks will impede the full capacity and shorten the service life of the infrastructure and will require billions of dollars to repair. **Dr. Baolin Wan** is looking at ways to add tiny capsules of adhesives into the concrete. Once cracking begins, the capsules break to release the adhesive, thereby healing the concrete and ensuring that infrastructure can continue to serve at full capacity without additional cost of repair. An unanticipated obstacle in this project was that no one in the market was making the polyurethane microcapsules that Wan needed to work with, so after conducting his own research, he was able to produce the capsules himself.

26
Students have worked on Dr. Baolin Wan's projects

INNOVATOR PROFILE

DR. BAOLIN WAN

Associate Professor,
Civil, Construction and
Environmental Engineering

Dr. Baolin Wan researches the behavior of reinforced and prestressed concrete structural elements; fiber-reinforced polymer (FRP) composite materials; natural fibers and nanomaterials in structural members; field testing and nondestructive evaluation of bridges; and ice for construction. A recent project sees him researching ways that wastewater grit, a byproduct of municipal wastewater treatment that normally ends up in landfills, can be used for better pothole fill.

IMPROVING ORAL SURGERIES VIA 3D PRINTING

Dr. Lobat Tayebi (center in above image) received two Explorer Challenge awards for her groundbreaking work in building better bone scaffolds and appliances for oral surgeries. Conventional scaffolds are metal and need to be removed after the area has healed. Recent advances in tissue engineering, however, have allowed scaffolds to be built of porous and degradable materials, eliminating the need for surgical removal. Although the porosity allows for new bone cells to grow, it also makes the scaffold structurally weak. Tayebi designed a novel degradable "skeleton" to stabilize the structure. Her second project focuses specifically on designing appliances used during surgeries to correct cleft lip and palates in children. A 3D scan of the mouth, similar to that done for clear teeth aligners, serves as the template from which the appliance is 3D-printed using custom polymers.

20
Students in the Tayebi Research Group

INNOVATOR PROFILE

DR. LOBAT TAYEBI

Associate Professor, Director of
Research, School of Dentistry

Complementing her work in customized 3D-printed scaffolds, Dr. Lobat Tayebi also researches treatment of complex multi-tissue oral and craniomaxillofacial defects, growth factor delivery and interfacial hard/soft tissue expansion. A holder of multiple patents and a prolific author with nearly 200 journal articles and book chapters to her name, Tayebi is the editor of Applications of Biomedical Engineering in Dentistry, *which presents an interdisciplinary approach to biomedical engineering and restorative dentistry.*

Transform Marquette

STUDENTS

KICK-STARTING A NEW GENERATION OF RESEARCHERS

With prospective students and their parents seeking learning opportunities beyond the classroom, **Dr. Rosemary Stuart** has piloted a competitive program, MU4Gold Scholars, to provide undergraduates with faculty-mentored individual research experiences right from the start of their Marquette careers. Embedded within the University Honors Program, MU4Gold offers high-achieving undergrads the opportunity to follow their own questions, develop experimental research methods and often hammer out new discoveries. An early introduction into research also gives students a head start on applying for prestigious opportunities, such as Rhodes scholarships and Fulbright fellowships. Students take courses that introduce them to the research landscape and then work with the program director to identify faculty mentors. Students not only pursue their own interests but also work as research assistants. Besides the transformative experience for students, the presence of a strong undergraduate research program raises Marquette's national and international research profile.

14%

Percentage of applicants accepted in the first two years

INNOVATOR PROFILE

DR. ROSEMARY STUART

Professor, Biological Sciences

A dynamic force across campus, Dr. Rosemary Stuart was a key player in establishing Marquette's new Office of Economic Engagement. She embodies the teacher-scholar model as the first woman to be awarded Marquette's Lawrence G. Haggerty Faculty Award for Research Excellence and also as a recipient of Marquette's highest honor for teaching. Stuart received a $900,000 grant to study mitochondrial ribosomes and was a key member of the team that garnered a $1 million grant to promote success for women and underrepresented minority faculty in STEM fields and the social sciences.

BRIDGING THE GAP BETWEEN CAMPUS AND CAREER: PROFESSIONAL SALES PROGRAM

Responding to calls from companies to increase the number of sales graduates, **Dr. Alex Milovic** used Explorer Challenge funding to start a Professional Sales Program. When entering the sales workforce, graduates from formal sales programs tend to ramp up 50 percent more quickly than non-sales-educated peers and with 30 percent less turnover. Through combinations of classroom work and hands-on internships, the program establishes a robust pipeline for students to move into advanced sales positions. Founding and sponsoring partners not only provide financial sustainability, but also offer their expertise in curriculum development and in preparing students for important sales competitions. These competitions promote Marquette as a top program for sales education; success in these competitions spurs additional corporate investment. Over its first two years, all graduates have gone on to a job, graduate school or the military, with 65 percent taking on sales roles.

43

Professional Sales Program graduates in the first two years

INNOVATOR PROFILE

DR. ALEX MILOVIC

Assistant Professor of Practice, Marketing

In addition to developing his Professional Sales Program and teaching, Dr. Alex Milovic pursues his own research interests, which involve studying persuasion and psychology from both consumer and sales practitioner standpoints. His published research explores the role envy plays in persuading and influencing sales encounters and intent to purchase. His research also focuses on issues dealing with personal selling, sales management, relationship selling, marketing education and consumer behavior.

Transform the World

By embracing and reinvigorating the Jesuit tradition of faithful service, Explorer Challenge projects champion entrepreneurial action, broadly speaking, to take on compelling societal problems within our community and across the globe. Our projects touch the lives of many beyond the campus boundaries, whether through collaborations with nonprofits, educational programs for underrepresented youth or efforts to improve access to quality health care.

CHILDREN AND TEENS

WHEN WILL I EVER USE THIS MATH?

For a new generation of grade school students, the answer is right now. With Explorer Challenge funding, **Dr. Hyunyi Jung** ran two extracurricular programs to foster sixth to eighth graders' learning of mathematical connections to the world and to train future educators how to teach these skills — mathematical modeling — to students.

These programs gave students the chance to engage collaboratively and interactively in mathematical modeling. Students, for example, developed a procedure for estimating the number of nests shown in a pelican colony to protect this endangered species. Mathematical modeling takes students beyond basic procedural exercises and gives them the more complex experience of wrestling with an open question, considering different problem-solving paths and revising mathematical solutions. The success of these two programs led Jung to garner additional grants from the Wisconsin Department of Public Instruction and the National Science Foundation.

38
Grade school students taught in two extracurricular programs

INNOVATOR PROFILE

DR. HYUNYI JUNG

Assistant Professor, Department of Mathematical and Statistical Sciences

Dr. Hyunyi Jung teaches math education courses at Marquette, including problem-solving and reasoning, mathematical modeling, and number systems and operations. Her own research digs deeper into mathematical modeling, designing environments to examine and support teacher competencies for modeling and understanding how social justice contexts affect the teaching of this skill. Her study of preservice teachers' perspectives on their opportunities to learn algebra offers valuable insights into ways to improve teacher preparation programs.

Bembé drum circle at Alice's Garden in Milwaukee

RESILIENCE THROUGH THE PERFORMING ARTS

Youth from communities that have been historically marginalized are increasingly contending with chronic stress — through violence, racial discrimination, food insecurity and poverty. **Dr. Kristin Haglund** used Explorer Challenge funding to partner with Milwaukee Public Theatre and Bembé Drum and Dance at the Bruce Guadalupe Community School to study how participating in the performing arts promotes youth development and how it can serve as an intervention for stress management. Haglund's collaboration with Bembé serves as a prime example of community-engaged research, in which researchers work long term and in tandem with community partners to not only study societal issues of pressing concern but to also initiate solutions. This partnership began in Bembé's inaugural year and has blossomed to support the growth of programming into additional schools and to the general public. Moreover, Bembé is collaborating with Marquette's Center for Peacemaking to provide music and movement therapy to students at Milwaukee Public Schools' Success Center.

60
Youth who participate in programming annually

INNOVATOR PROFILE

DR. KRISTIN HAGLUND

Professor, College of Nursing

Building on her experiences as an advanced practice nurse and her engagement with community organizations, Dr. Kristin Haglund's research generates knowledge and interventions to facilitate optimal health and psychosocial outcomes for at-risk youth. She has received awards from Marquette for excellence in diversity and inclusion, and community-engaged research partnerships. Haglund also works with Marquette's Office of Economic Engagement to support faculty and to develop a curriculum for faculty to foster their participation in community-engaged research and teaching.

Transform the World

HEALTH

The Milwaukee River; Image courtesy of Visit Milwaukee

TRENDING: ANTIBIOTIC RESISTANCE

As part of the efforts to combat antibiotic-resistant infections in Wisconsin, **Dr. Erik Munson** oversees a reference laboratory that annually tests bacterial isolates submitted by 20 microbiology laboratories. Although these isolates come from patients in clinical settings, environmental sources such as rivers and lakes are also potential reservoirs of antibiotic resistance. With Explorer Challenge funding, Munson established a repository of over 200 *E. coli* isolates from 21 statewide collection sites. The resistance profiles of the environmental *E. coli* will either correlate with the clinical resistance profiles or will predict future *E. coli* resistance patterns in clinical isolates. Assessing antibiotic resistance patterns in both clinical and environmental isolates over time can not only provide insight into emerging patterns of antibiotic resistance but can also improve clinical and pharmacological interventions to benefit patient care and public health.

138

Wisconsin clinical laboratories to which research is disseminated

INNOVATOR PROFILE

DR. ERIK MUNSON

Assistant Professor, Clinical Laboratory Science

Dr. Erik Munson is a strong advocate for improving public health. Building on his work in tracking antibiotic resistance patterns, Munson advances the mission of the Wisconsin Clinical Laboratory Network, a partnership of 138 statewide clinical and public health laboratories that ensure timely and effective responses to public health needs. His other significant research monitors and investigates the molecular diagnosis of sexually transmitted infections in high-risk populations.

DE-LAGGING THE LAG TIME BETWEEN RESEARCH AND CLINICAL PRACTICE

With a typical 17-year lag time between research and clinical practice application in health care, **Dr. Sheila Schindler-Ivens** (shown above) developed a program to help rehabilitation professionals more quickly and easily consult research evidence for clinical decision-making. The program, Evidence to Excel (E2E), was piloted in Marquette's Physical Therapy Clinic, with a focus on temporomandibular dysfunction, or TMD. Since then, E2E has put together units on cardiovascular and pulmonary physical therapy, children with congenital heart disease and motivational interviewing. To disseminate information effectively and to ensure the project's sustainability, the team established a small business entity, The Evidence Workshop, LLC. With one contract signed and two others pending during its very first year, the team looks to expand its customer base and provide a more robust web experience for clinicians during the second year of the grant.

700

Number of individuals introduced to Evidence to Excel during first year

INNOVATOR PROFILE

DR. SHEILA SCHINDLER-IVENS

Associate Professor, Physical Therapy

As director of the Neuromuscular Control of Movement Laboratory, Dr. Sheila Schindler-Ivens studies how neural circuits in the brain and spinal cord contribute to impaired limb movement, especially in people with strokes. With the results of this research, she then develops better rehabilitation methods to restore walking. Her work has led to a patent for a motor-assisted split crank pedaling device designed for people with strokes who typically have problems pedaling on conventional stationary bicycles during rehabilitation.

Transform the World

COMMUNITY

COLLABORATING WITH NONPROFITS TO IMPROVE INTERNSHIP IMPACT

Thanks to the efforts of **Dr. Ed de St. Aubin**, the Psychology Department is now offering a unique internship program for students at Milwaukee nonprofits. A demonstrated high-impact learning experience, internships allow students to integrate academic work, off-campus field experience and self-reflection. Too often, however, many nonprofits lack the resources — time, training, personnel — required to effectively use the interns to benefit the organizations. Through the psychology internships, de St. Aubin not only works with students individually, but also provides guidance, through workshops and one-on-one meetings, for nonprofits on how best to mentor and supervise interns. The program has grown significantly over its first few years, from just five interns to 19, with placements at 12 nonprofits concerned with issues such as domestic violence, LGBTQ support, decarceration and social justice.

75
Internships since inception

INNOVATOR PROFILE

DR. ED DE ST. AUBIN

Associate Professor,
Assistant Chair, Psychology

Trained broadly in life span human development, Dr. Ed de St. Aubin has several intellectual interests with a thread that connects them all: the meaning-making process and how it evolves over time and plays out in different environments. His research on meaning-making spans categories: gender and sexuality, personal ideology, intersectional identity and trauma studies, especially how people with spinal cord injuries narrate the self. His community work focuses on crime prevention and desistance, as well as post-prison reintegration.

Image courtesy of the Housing Authority of the City of Milwaukee

REMEMBERING BRONZEVILLE: A DOCUMENTARY

Much of Milwaukee's African American community can trace its 20th century roots to the Second Great Migration: the flight from a segregated and discriminatory South to the better-paying jobs of the industrial North. In Milwaukee, however, African Americans still faced housing segregation and were restricted to just one section of town, the Sixth Ward. Yet the Sixth Ward, which later came to be known as Bronzeville, became the heart and soul of Milwaukee's aspiring middle-class African American community, providing a stable environment for its residents through its many churches, social programs, and jazz and blues clubs. By the late 1940s, however, the community started to be dismantled in the name of urban renewal. Through interviews with people who grew up in the area, rare photographs and archival film footage, **Dr. Karen Slattery** and her husband, Mark Doremus, have chronicled the rich history of Bronzeville in their documentary, *Remembering Bronzeville*.

7
Airings on Milwaukee PBS upon release

INNOVATOR PROFILE

DR. KAREN SLATTERY

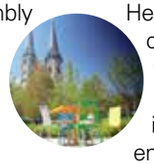
Professor Emerita, Journalism and Media Studies

Dr. Karen Slattery's Remembering Bronzeville *comes out of her long and storied career at Marquette. Slattery, now a professor emerita, has pointed her research and teaching interests toward the ethics of media. She has taught classes on ethical problems of mass communication and communication issues in television news, while her research has spanned the years from the World War II censorship code to images of mothers of soldiers during the Vietnam War and to journalism's current interrelationships with truth-telling.*

Updates

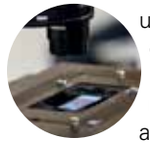
SPACEWALKING IN PLACE
Opus College of Engineering professor Dr. Joseph Schimmels' Flexible Assembly Systems Network (FASN) landed a significant grant from Woodway USA, makers of commercial grade treadmills used by professional sports teams, physical rehabilitation centers and even NASA — a Woodway treadmill is used on the International Space Station to minimize astronauts' bone and muscle density loss under zero-gravity conditions.

FASN is developing an automation system to help assemble the treadmills (left); the project is also providing valuable engineering and manufacturing experience for three undergraduate students. Explorer Challenge funding was used to renovate space in Haggerty Hall; purchase three robots; and support four students building a showcase automation system, two students building a robot gripper and another student investigating the use of a Robot Operating System as a programming platform to use in the lab.



MOVING BEYOND BOUNDARIES (OF THE 707 HUB) Fall 2019 saw the dedication of the new Henke Terrace, an outdoor courtyard connected to the 707 Hub, Marquette's innovation, entrepreneurship and maker space. The new area provides a flexible and inspirational environment for collaborating and generating ideas; it was made possible by a generous donation from Trustee Emerita Mary Henke. FY19 also saw the number of local startups and social enterprises supported by the 707 Hub increase by 15 percent.

HPAC: ACROSS CAMPUS, AROUND THE TOWN The Human Performance Assessment Core (HPAC) took part in two large NIH-funded collaborative projects between Marquette and the Medical College of Wisconsin. One project is looking to improve rehabilitation of stroke survivors, while the other helps African American survivors of prostate cancer adopt healthier lifestyles. The HPAC third annual indoor triathlon saw its largest field yet, with Marquette's own Dr. Jennifer Finn, assistant professor of history, taking laurels in the women's division.



NEW TECHNOLOGY IN HEALTH SCIENCES Explorer Challenge funding was used to purchase two key pieces of state-of-the-art technology for the College of Health Sciences. An ultrahigh-resolution confocal microscope (left) can capture images of fixed tissue and living cells at twice the resolution of older platforms. Among other uses, the microscope can view and track dendrons in living brains, supporting research into understanding the neurological processes that underlie drug addiction, the operations of circadian rhythms and how stress levels affect how we control our impulses and make decisions. An advanced fluorescence activated cell sorter is being used by researchers to study ways to stimulate nerve growth in damaged spinal cords through gene therapy and stem cell transplantation. The new equipment has already allowed Marquette to take on significant, externally funded projects that were previously unavailable to us, while raising our standing in the research community, expanding collaborative work and drawing highly regarded researchers to campus.

By the Numbers

First Four Years

FY16, FY17, FY18, FY19

ENGAGEMENT

484 Pre-proposals submitted

290 Final proposals submitted

84 **Total Explorer Challenge projects awarded**

PROJECTS

37% Funded projects that have student participation named on project team

31% Projects led by non-faculty (students + staff)

44% Funded projects with external partners

67% Funded projects involving two or more colleges or university units

69% Projects led by faculty

460 **Participants in all awarded projects**

ENTREPRENEURSHIP

6 Explorer Challenge faculty involved in tech transfer activity, including patent protection, copyrights, licensing agreements and new business startups

STUDENTS

$1M+ $1,441,500 of support for the 707 Hub through grants, donations and sponsorship

COMMUNITY IMPACT

85 Local startups and social enterprises supported by the 707 Hub through the BOOST boot camp program, Rev-Up MKE mentoring and the 707 Hub mentor-in-residence program

$1M+ $1,825,562 of grants awarded for improvements to Milwaukee's Near West Side neighborhood

FINANCIAL OUTCOMES

$7,491,169 Total dollar amount (from internal and external sources) awarded

$24,399,536 Total dollar amount of external grants and other revenues

3.25x **Financial ROI (external grants + other revenues / Explorer Challenge funding)**