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DISCOVER

2019

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RESEARCH | SCHOLARSHIP | INNOVATION

EXTENDED REACH

With professors finding success at the National Institutes of Health's top funding tier — where impact is greatest on the treatment of cancer, stroke and other conditions — the university is finding creative ways to help more researchers achieve at this level.



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RESEARCH | SCHOLARSHIP | INNOVATION

Generous support. National recognition. Expanded research impact.



Welcome to the 2019 edition of *Discover* magazine. Marquette University aspires to be among the most innovative and accomplished Catholic and Jesuit universities in the world. Each year as we prepare our next issue of *Discover*, I am so impressed and proud to be able to tell you about some of the many ways that we live out our mission through scholarship and research.

In this year's edition we feature Kristy Nielson's groundbreaking work on dementia; Craig Andrews' research on marketing and public health; Bryan Rindfleisch's scholarship on previously overlooked historical experiences of indigenous Americans; Lisa Grabert's leadership in the study of bipartisan Medicare reform efforts; and the health-related research that has led to a campus record number of active R01 awards from the National Institutes of Health this year. In addition, we profile the work of 10 outstanding faculty engaged in cutting-edge research, scholarship and creative endeavors in the Research in Brief section, and the Bookshelf features 11 recently published books. Our annual Spark section features six more examples of how Marquette faculty and students are making an impact in the world through their innovative and entrepreneurial endeavors. Among the Spark highlights are this year's launch of the Northwestern Mutual Data Science Institute, a major partnership between Northwestern Mutual, Marquette and the University

of Wisconsin-Milwaukee; and the opening of the new interdisciplinary research space, the Athletic and Human Performance Research Center.

Each spring when we gather to celebrate some of the many scholarly accomplishments of our faculty at the Distinguished Scholars Reception, it is obvious that Marquette attracts outstanding scholars committed to their disciplines and to the educational experience of our students. On behalf of these talented faculty, I would like to express our gratitude to benefactors who help recognize research excellence and provide support that fosters future scholarly exploration, discovery, innovation and collaboration. As noted in the NIH R01 article, the donor-supported R01 Challenge has contributed to growth in this prestigious external funding. The Explorer Challenge, also supported by generous donors, has seeded numerous innovative campus projects led by faculty, staff and students and received national recognition this year as a model that other universities could adapt to foster innovation. Thank you for helping make this and so many other opportunities possible.

Visit marquette.edu/innovation to discover more ways that Marquette innovates.

Dr. Jeanne M. Hossenlopp
Vice President for Research and Innovation
Marquette University

Editor
Stephen Filmanowicz

Art director
Sharon Grace

Editorial team
Sarah Koziol
Jennifer Russell
Kaley Rohlinger (intern)

Illustrations
An Intricate Picture:
Title design, ship and canoe
elements by Michael Crampton

Fixing Medicare from Within:
Stephanie Cowan Dalton

Extended Reach:
Stuart Brier

We appreciate your feedback
on *Discover*. Please send all
comments to the editor at
stephen.filmanowicz@marquette.edu.



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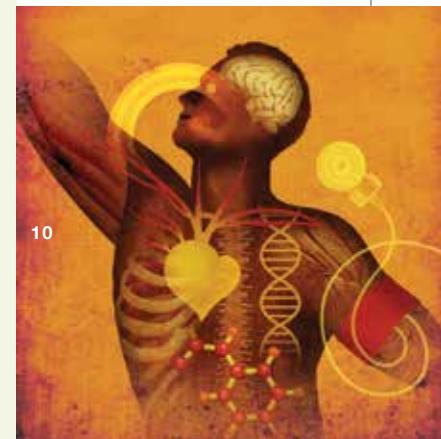
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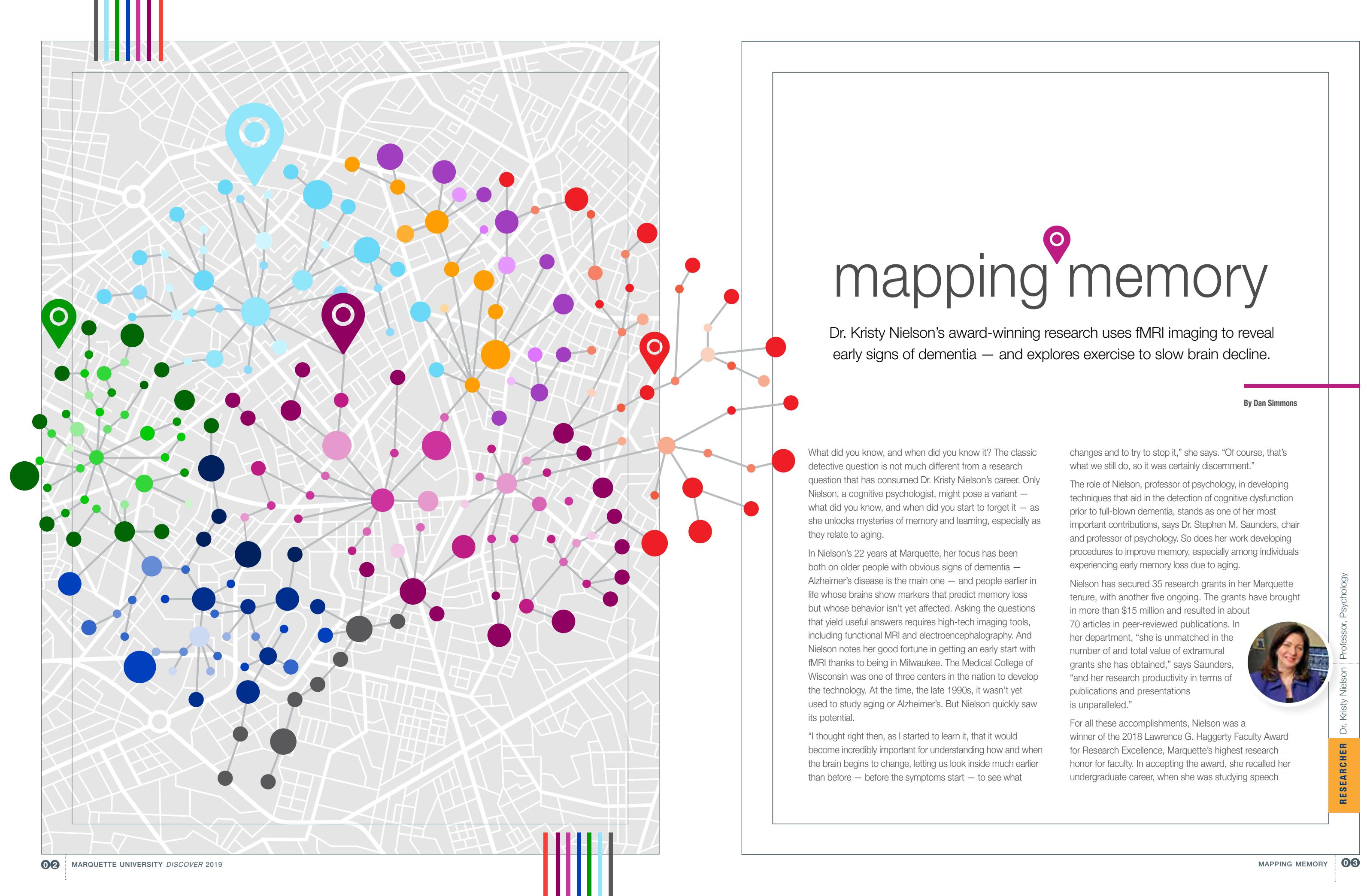
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33 BOOKSHELF







Early access to emerging fMRI technology helped Dr. Kristy Nielson make breakthroughs in detecting brain changes that precede dementia. EEG technology figures significantly in her work too.

pathology and thinking of becoming a chef. "Then I fell completely in wonder and in love with the brain during a brain dissection class," she says. "I volunteered as a research assistant for three different professors and became the teaching assistant for that brain dissection class. And then I blinked, and here we are."

During that span, Nielson's Aging, Imaging and Memory Lab has established itself as a recognized leader in research on memory with a partner list of researchers, universities and labs from around the world. Using technology such as the aforementioned fMRI and EEG scanning, the lab investigates how memory can be made stronger and how the brain ages. Students use the lab to search for the roots of Alzheimer's disease and dementia (she's earned a reputation as a generous mentor too).

Nielson has directed multiple long-term studies that identified extensive functional brain region differences associated with Apolipoprotein-E ε4, a genotype present in some people that increases their risk for late-onset Alzheimer's. These inheritable differences are apparent prior to any measurable cognitive problems and predictive of future decline. In fact,

using fMRI imaging, Nielson has helped reveal the brains of high-risk carriers of the genotype engaging at an earlier age in activity through which aging brains compensate for decline — essentially working harder to perform memory tasks.

In earlier phases, this increased brain activity masks decline among carriers of this genotype (referred to as e4, for shorthand), until eventually these efforts fall short. "Then the system is essentially 'tapped.' When there is enough damage that further compensation is not possible, the brain activity actually reduces, which is associated with cognitive decline."

Nielson's development of techniques that help detect cognitive dysfunction prior to full-blown dementia stands as an important contribution, as does her development of memory-boosting procedures for those with early memory loss.

Fortunately, regular exercise has proved protective in e4 carriers, improving their ability to compensate for declining brain integrity — a promising line of research Nielson is pursuing through two major National Institutes of Health grants with partners at the Cleveland Clinic, University of Maryland and elsewhere. "We are doing a clinical trial of exercise to examine whether brain function and cognition improve and are better maintained over time in those at risk for Alzheimer's as a result of exercise," she says. "We are also examining the ways in which exercise might have its protective effects. We are particularly studying whether exercise reduces inflammation in the brain that APOE e4 is known to increase."

With additional NIH support, Nielson is also working to understand the role improved cardiovascular health plays in maintaining brain function, specifically how well a person's autonomic nervous system regulation responds to difficult thinking tasks. "Thinking requires more oxygen to the brain cells, increased blood flow," she says. "But older adults have poorer regulation, a lessened ability to respond quickly, and those with e4 have even poorer regulation. However, through exercise, this regulation can be improved, so we are beginning to study whether interventions targeting improvement in autonomic nervous system regulation could improve cognition and decrease the rate of cognitive decline in those at risk."

At the cutting edge of science with implications for how millions live out their later years, Nielson is driven by unflagging passion. "I'm never bored. And I'm really, really lucky to get to do what I love."

Nielson would like to give a shout-out to university retirees and particularly the Marquette University Retirees Association for playing a key role in her research, including providing volunteers to participate in her research.



PROOF IN LABELING

A reviewer read every word of Dr. Craig Andrews' 299-page doctoral dissertation for the University of South Carolina. "This is nice," she said. "But why don't you research something important?"

The words stung, Andrews says, especially given the source: his own mother. Shortly afterward, she pointed out congressional hearings on proposed alcohol warnings, held at the time with no consumer research to cite.

His mother's tough love and research idea sparked a eureka moment and launched what is now a 35-year career that has earned him a reputation as one of the world's leading authorities on marketing and public health issues.

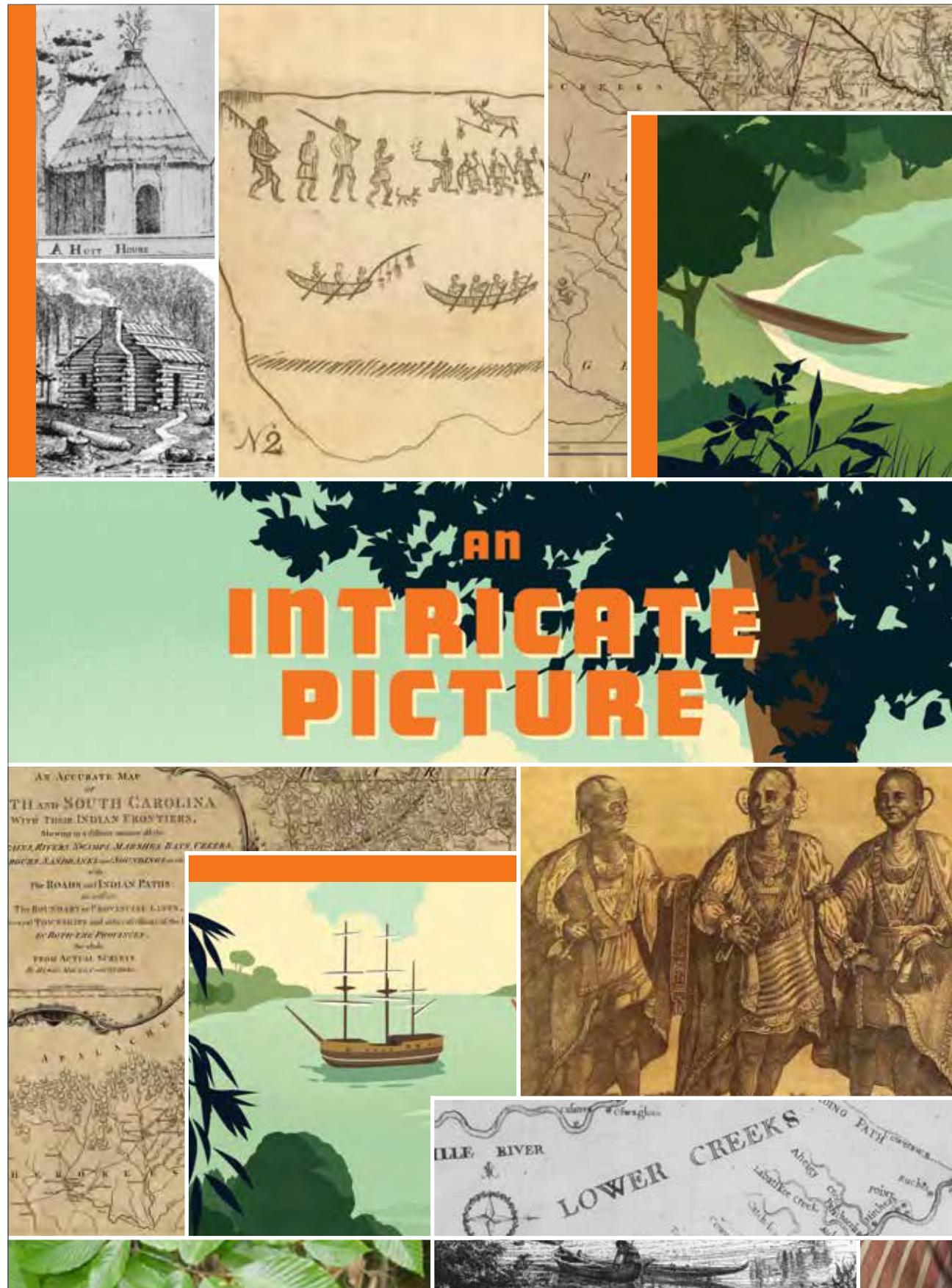
For this cumulative record of distinction and influence, Andrews, professor and Charles H. Kellstadt Chair of Marketing, was awarded Marquette's highest research honor in 2018, the Haggerty Faculty Award for Research Excellence.

Andrews has analyzed such disparate subjects as food nutrition labels and warning labels for tobacco products to children's behavior online — drawing the link between marketing and behavior. He credits two sabbaticals spent embedded in government offices in Washington, D.C., with propelling his research, the first at the Federal Trade Commission in 1992 to 1993 and the next at the Food and Drug Administration in 2013 to 2014.

At the latter, as a senior scholar/social scientist, he played a key role in researching and implementing "The Real Cost," a tobacco prevention campaign credited with reducing the youth smoking population in the U.S. by about 350,000 people. It built upon yet another of the scholar's stints advising government — helping steer the Wisconsin Tobacco Control Board's \$6.5 million anti-smoking ad campaign in 2002 to 2004.

Andrews' research has found that dire health warnings on cigarette packaging can significantly increase young smokers' desire to quit, but that teens respond to the labels in slightly different ways than young adults. As he reports in a new academic paper in the journal *Nicotine & Tobacco Research*, targeting campaigns to the specific proclivities of each group can significantly improve their success.

Dan Simmons



Engraving (top left, second image) courtesy of ©John Carter Brown Library / Brown University. Engraving (bottom right quadrant) of three Muscogee Indians courtesy of Hargrett Rare Book and Manuscript Library / University of Georgia Libraries.

By Matt Hrodey

DR. BRYAN RINDFLEISCH IS WRITING THE OVERLOOKED COMPLEXITY OF INDIGENOUS AMERICAN POLITICS, TRADE, CULTURE AND INTERTRIBAL RELATIONSHIPS INTO THE EARLY CHAPTERS OF AMERICAN HISTORY.

Dr. Bryan Rindfleisch wants to change how early American history is theorized and taught, starting with his own classroom. Too often, entire populations are referred to as "natives" organized into "bands" or "war parties" that ply the "wilderness," carrying out massacres and "scalpings," he argues in a 2017 article. Even in top-level conferences on the subject, the old words crop up.

To make a dent in the issue, the assistant professor of history gave his students the power to interrupt him when he used dated nomenclature, and he interrupted them. "It was a sobering experiment," he writes, "but by the end of the semester, students remarked about the incredible change in the ways they talked about and thought about indigenous Americans and their histories and cultures. These were real people now."

Rindfleisch's upcoming book, *George Galphin's Intimate Empire: The Creek Indians, Family, and Colonialism in Early America* is part of his mission to illuminate how indigenous Americans really interacted with Europeans. As an obscure Irishman, George Galphin traded with Creek people living in western Georgia and built a trusting relationship with them, taking over the nearby Silver Bluff plantation in the 1750s and marrying a Creek woman, Metawney, from a prominent family.

Metawney came from a nearby Creek town called Coweta that Rindfleisch describes as "cosmopolitan" in that it was a crossroads for the Creeks, Europeans, escaped slaves and other peoples. Indigenous communities like Coweta, he says, kept the peace for the most part and "are probably the most adaptable cultures that have ever existed."

Galphin got started in the Americas as a deerskin trader and quickly established himself as a trusted go-between for the Europeans and Creeks, who were also known as the Muscogee. The son of poor linen weavers, Galphin brought over some of his relatives, and his busy plantation house became a thimble-sized melting pot. According to Rindfleisch, the richness of European-Native American relations and the many peaceful interactions are easy to overlook alongside acts of violence perpetrated by both sides. Creeks traded with Europeans for guns, and the Europeans traded with Creeks for canoes.

By the end of the French and Indian War in 1763, the English were the only Europeans remaining in modern-day Georgia, and they approached Galphin for help in acquiring Creek lands in the western reaches of the state. He brokered two land deals ceding Creek territories to the English and so became less of an ally and more of a manipulator. The sweeping Treaty of Augusta in 1773 surrendered 2 million acres of Creek land, shortly before the start of the Revolutionary War.

Galphin had provided an interesting window into his time, but for Rindfleisch's planned second book, he wants to further explore Native American history outside the influence of Europeans. A perennial problem with early American history, he says, is how it seems to require the presence of Europeans when there's plenty to talk about without them.

As a young academic, he's already won a string of awards, including a Marquette Way Klingler Young Scholar award in 2018 and several fellowships that will run through at least 2019: Knox College's Bright Institute Research Fellowship in Early American History, The University of North Carolina at Chapel Hill's Archie K. Davis Fellowship and the National Endowment for the Humanities' Digital Native American and Indigenous Studies Fellowship.

With this scholarly support, Rindfleisch is returning to familiar ground: The Creeks and nearby Cherokees have a dense interwoven history he plans to mine further. Among his findings so far is that certain members of the Creeks held dual titles with the Cherokees, allowing them to act as diplomats or go-betweens during times of war. Similar relationships existed between the Chickasaw and Choctaw tribes of present-day Tennessee, Alabama and Mississippi, so Rindfleisch submitted an article on these individuals to the prestigious *Journal of Southern History*, which prints very little indigenous history, to test if he could break through.

To his surprise, his paper was quickly accepted for publication, and he did a scholarly fist pump. It was a departure for the journal normally focused on the Civil War and the "old South."



RESEARCHER

Fixing Medicare From Within

Former D.C. policymaker Lisa Grabert is harnessing data from legislation she helped create to make health care perform better for Medicare patients.



By Melanie Lawder, Comm '14

For health policy researcher Lisa Grabert, it was a graduate class on physician profiling that flipped a switch in her psyche, setting her on the path to specialization in the health policy field.

The gist of the class was straightforward: Specific physicians are better at treating specific populations of people, and if you match the right doctors with the right patients, patient outcomes will improve.

The contents of that watershed class fascinated Grabert, and the promise of improving patients' health through data inspired her to choose health care as her focus. "I thought, 'Wow, that's kind of amazing that you can have the power to steer patients to better or worse health care options based on data and analytics,'" Grabert recalls. "And I thought, 'This is it. This is what I want to do for the rest of my life....' And why not do it at the largest payer in the world, which is Medicare?"

Using data to change behavior and incentivize better health care outcomes for Medicare patients is at the heart of Grabert's research endeavors. The Washington insider, who has held roles in the federal government's executive and legislative branches, came to Marquette last June through a novel joint appointment with Georgetown University. As a College of Nursing visiting research professor, Grabert is in the unique position of studying the implications of Medicare legislation that she helped craft and pass.

That legislation stems from Grabert's nearly six years as a high-ranking senior aide for the Ways and Means Committee in the U.S. House of Representatives, where management of Medicare was a recurring focus. Providing health insurance coverage to nearly 60 million Americans, 84 percent of them over 65, the program is considered by both political parties to be in financial peril, although Republicans and Democrats differ on how they should tackle the problem. In serving the past three Republican chairmen of the committee, Grabert has largely focused her policy work and research on payments, and the creation of a more cost-efficient, fiscally sustainable Medicare system that yields better patient outcomes.

"We're already spending too much on our credit card and, at some point, we're not going to have enough money," she says about Medicare. "So we need to figure out how to do more with even less."

Grabert is now studying implications of the bipartisan Improving Medicare Post-Acute Care Transformation

(IMPACT) Act of 2014, one of the most significant measures she helped turn into law. It requires the standardization of publicly reported data by facilities that provide post-acute care to patients under Medicare, creating valuable data streams that Grabert can now examine through her research.

One piece of information reported under the law is a patient's function level when discharged from a health care facility. Grabert and her team of researchers have begun harnessing that data to measure and monitor the performance of these facilities based on patient outcomes and then create a model that grades facilities accordingly. That rating could then be tied to an incentive curve so that high-performing and low-performing facilities receive bonuses and penalties, respectively.

Ultimately, the model could give health care facilities fiscal incentives to ensure that more patients leave a facility with a function level as good or better than they possessed before they sought treatment. "If Congress, in their infinite wisdom, at some point were to take up a true value-based purchasing program — where they actually pay for the outcome of increasing (patient) function — they'd have a model to look at," Grabert says about the research.

Grabert's research docket also includes study of the unintended consequences of a site-neutral payment policy that went into effect through her authorship. In that case, the policy — which aims to ensure that Medicare pays equalized rates for the same service regardless of whether it's performed at a hospital or physician's office — deterred some health care systems from acquiring and investing in new facilities. Grabert plans to explore how such effects can be avoided in the future.

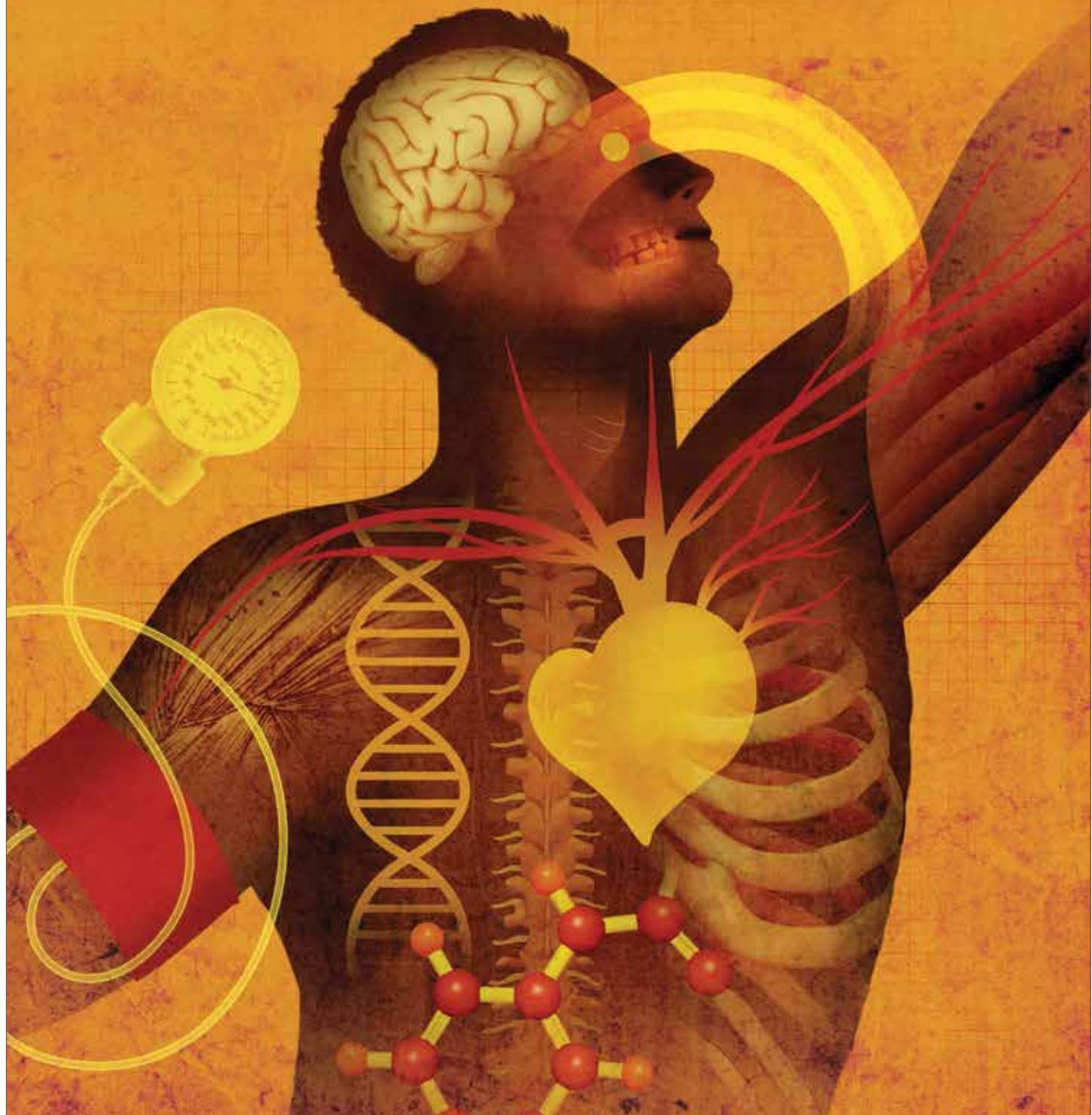
Her position is funded by the Institute for Critical Care for three years, during which she'll split time between Marquette and Georgetown. She taught a graduate course on health policy, and her in-depth knowledge of Medicare has been an asset in unpacking complex health policies to students, faculty and other Marquette community members, says a grateful Dr. Janet Wessel Krejci, dean of the College of Nursing, who adds, "Our nurses need to be empowered on health care policy so that they, in turn, can help patients and communities maneuver and leverage the health care system to their advantage."



Lisa Grabert
Visiting Research Professor, Nursing
RESEARCHER

Extended Reach

With professors finding success at the National Institutes of Health's top funding tier — where impact is greatest on the treatment of cancer, stroke and other conditions — creative ideas are helping more researchers achieve at this level.



By Allison Dikanovic, Stephen Filmanowicz and Guy Fiorita

In her own words, Dr. Jennifer Evans was "a naive graduate student" in behavioral neuroscience — exploring the role of the brain's master clock, the suprachiasmatic nucleus, in regulating sleep cycles, metabolism, insulin release and other bodily systems — when she struck gold with one of her ideas.

At the time, researchers studying the body's circadian rhythms, and the potential havoc wreaked by disrupting them, were stymied by an inability to get inside a working brain to experiment on the clock. But Evans wondered: Could cellular components of the clock be induced to get profoundly out of sync and then removed from the brain? Could these master clock cells continue to function in a culture dish to help researchers understand how the cells communicate with one another? Could various harvested cell types be activated or impaired to yield insights on their roles in the clock's workings?

Evans sought out internships and a postdoctoral fellowship to give herself the technical knowledge to test these ideas. After promising initial findings, she presented them at conferences to impressed colleagues. By the time she joined Marquette's College of Health Sciences in 2013, the sky was the limit — if only Evans could obtain the significant sums she'd need to hire graduate and undergraduate assistants, purchase equipment, activate a full research plan and have the financial flexibility to take necessary risks. "In my first one and a half years at Marquette, I must have submitted 20 grant applications," she recalls. "I applied to every potential funder I could find."

Evans, now an associate professor of biomedical sciences, invested special care in her applications to the National Institutes of Health. Accounting for 27 percent of the external dollars awarded to Marquette researchers, the NIH is the university's largest single source of research funding, a significant way for faculty members in health-related fields to advance promising research ideas. (The next largest funder, the U.S. Department of Education, accounts for 9 percent.)

The numbers are impressive. NIH grants currently fund 35 faculty research projects at Marquette. These range from mentored K01 and R00 awards for post-doctoral fellows and new faculty members to a substantial \$2.5 million award through the U01 program, which funds research conducted

jointly by university and health care industry partners. Four R21 grants to Marquette fund high-risk exploratory research, while 14 projects across campus receive funding through the R15 program for midsize and smaller research universities.

Then there are R01 grants, NIH's gold standard, reserved for the projects with the strongest science and most significant potential health benefits. Marquette faculty members currently serve as lead investigators on projects funded by 12 such grants, nearly \$20 million powering the impressive array of science profiled in these pages,

the pursuit of novel solutions in critical areas such as cancer care, stroke recovery and cardiovascular disease treatment.

Fortunately for Evans, two of the applications she submitted met with success, and one of those was an NIH R01 grant totaling \$1.7 million. "Excitement, relief and a sense of accomplishment and pride in being able to compete at that stage" are emotions Evans recalls feeling when the news was confirmed. And to be sure, there was nothing easy about competing for this grant, which went through two rounds of consideration (and redrafting) before getting to "yes."

"Grant writing in general is a very exacting, demanding competitive sport. And NIH R01 grants are the big leagues," she says. "It's also a good process for getting the best science. That challenge causes people to think deeper about their science, to think about the best way to conduct the research and how it might translate and impact the world around you. They demand you tell them that, so you think about those things." Besides putting Marquette on the map as a significant site for circadian rhythm research, the grant has opened an array of doors for Evans, including collaboration with a top scientist, her co-investigator Dr. Murray Blackmore, who is helping her develop new genetic approaches to manipulate master clock cells.

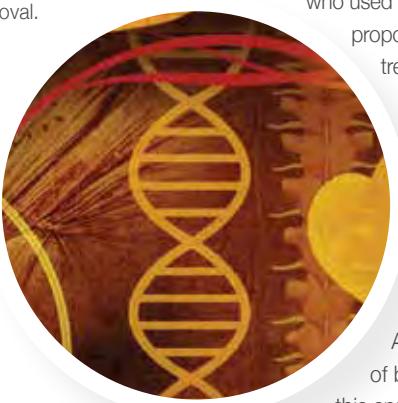
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Dr. Jennifer Evans

With the number of active R01 grants climbing here recently, Marquette is aiming higher. In support of the ambitious goal in Marquette's strategic plan to rapidly expand research funding, the university has established several initiatives to boost faculty NIH success, including:

- Facilitating grant-writing workshops, panels and institutes that teach best practices and provide mentorship.
- Sponsoring a set of five challenge grants per year to faculty members whose applications achieve high scores from NIH but miss out on approval. The \$30,000 internal awards help the faculty members gather more preliminary data and strengthen follow-up requests for funding.
- Creating a summer cohort to help early- and mid-career researchers clarify their research aims and write more compelling applications for various grants inside and outside NIH, not necessarily R01s.
- Adding a grant-writer position to the Office of Research and Sponsored Programs.
- Adding a research faculty fellow in the Office of Research and Innovation.



bore scientific questions and instead to "start with the why" — a clear expression of the larger purpose served in conducting this research. That's what will excite decision-makers at the NIH and other large funding sources.

Numerous professors have now benefited from the university's challenge grants. "I can't emphasize enough how important these internal grants are to help push people forward and allow them to apply for bigger grants," says Dr. Allison Hyngstrom, who used a challenge grant to hone a well-scored proposal to use ischemic conditioning, a treatment incorporating a blood pressure cuff to improve blood flow to muscles during exercise, to help those struggling to walk after experiencing a stroke. "The seed money is really, really important to help you build momentum in a project."

In complete agreement is Dr. Edwin Antony, former assistant professor of biological sciences. The recipient this spring of a \$1.2 million R01 award to study proteins involved in DNA repair, he asked

Marquette research officials to inform the anonymous donor underwriting the internal challenge grants of the "critical role" these funds played in his recent NIH success.

With their real potential to yield human health benefits now or down the line, NIH-funded projects help demonstrate how Marquette's research aspirations are about more than improving the university's reputation, says Katherine Durben, executive director of Marquette's Office of Research and Sponsored Programs. They help advance Marquette's mission as a Catholic, Jesuit university in pursuit of justice, she says. "Part of social justice is improving the quality of health for all. Clearly the NIH and Congress believe that goal is important as well, which is why researchers need to include the public health relevance of their projects in their grant proposals."

Serving as the first research faculty fellow is Dr. Sandra Hunter, professor of exercise science and an accomplished researcher herself, who co-leads an R01-funded project with Dr. Robert Fitts, professor emeritus of biological sciences. When not in the lab or classroom, Hunter works as the fellow, facilitating collaboration among faculty members and providing resources and insight for faculty at different points in their researching careers.

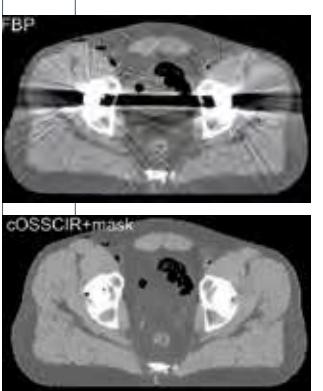
Drawing on lessons from her own NIH learning curve, Hunter mentors others on the importance of a well-managed timeline, effective collaborations, strong mentorship and a well-framed written proposal as necessities of a successfully funded project. One of her most important pieces of advice is to get past the mechanics of research methods and small-



Dr. Taly Gilat-Schmidt

Clearer spectral CT images — even in highly challenging cases

For more than a decade, Dr. Taly Gilat-Schmidt, associate professor of biomedical engineering, has been driving advances in computerized tomography imaging, developing algorithms to improve the diagnostic value of CT images without increased radiation doses to patients. CT scanners in medical



Even with standard correcting algorithms applied (top image), an orthopedic rod can obscure the exact size and shape of cancerous tumors. Applying the new algorithm to the image in a computer simulation yields a clear image (bottom image).

centers around the world, for example, incorporate software she co-developed that smartly selects the most motion-free images of cardiac arteries from the numerous images generated by a single scan.

With the new \$1.4 million R01 grant, Gilat-Schmidt and her team are using that algorithm to solve a medical problem — the glare and distortions that metal objects such as orthopedic rods or screws create in CT images. Even with standard correcting algorithms applied (top left), the artifacts can obscure the exact size and shape of cancerous tumors. Applying the new algorithm to the image in a computer simulation yields a clear image (bottom left) that could allow oncologists to pinpoint and irradiate tumors with less damage to surrounding tissue. "We were shocked at how well our algorithm did. But this is a simulation," says Gilat-Schmidt, whose challenge now is to achieve similar imaging results in real world conditions and to work with physicians at MCW to demonstrate the technology's value in treating people with cancer.

Dr. Jennifer Evans, \$1.74 million

The disruption of circadian rhythms has been linked to diseases such as cancer, cardiovascular disease, obesity and immunodeficiency. Evans, associate professor of biomedical sciences, is analyzing how suprachiasmatic nucleus neurons interact with each other to control circadian behavior. The insights are used to develop therapies for health risks linked to circadian rhythm disruption.

Dr. Robert Fitts and Dr. Sandra Hunter, \$2.8 million

Do older adults fatigue faster because of inefficiencies in muscle fiber rather than central nervous system fatigue? Hunter, professor of exercise science, and Fitts, professor emeritus of biological sciences, address this question using a novel exercise-training program and fiber-differentiated cellular examination, while developing mobility-extending exercise regimens leveraging muscle fibers least susceptible to fatigue.



**Dr. Paul Gasser, \$2 million**

Gasser, associate professor of biomedical sciences, and fellow neuroscience faculty members are examining the neurobiological mechanisms that contribute to increases in relapse vulnerability in cocaine addicts during periods of stress. The project focuses on the regulation of dopamine levels in specific brain regions by a transport mechanism that is blocked by glucocorticoid stress hormones. The findings will be used to improve treatment and management of addiction.

Dr. James Kincaid, \$1 million

Kincaid, the chair and professor of chemistry, is using Raman spectroscopy, which provides a structural fingerprint for reaction intermediates that exist for only millionths of a second, to gain molecular-level insight into two enzymes involved in steroid biosynthesis, CYP17 and CYP51. A deeper understanding of their structure and reaction pathways may help to develop drugs for diseases like atherosclerosis and prostate cancer.

Dr. John LaDisa, \$1.5 million

LaDisa, Eng '00, Grad '01, '04, associate professor of biomedical engineering, is studying the connection between coarctation of the aorta, a congenital cardiovascular disease, and hypertension. Using fluid dynamics and associated cell culture analysis, LaDisa's team characterizes changes to the aorta causing hypertension. Results will yield new treatment criteria.



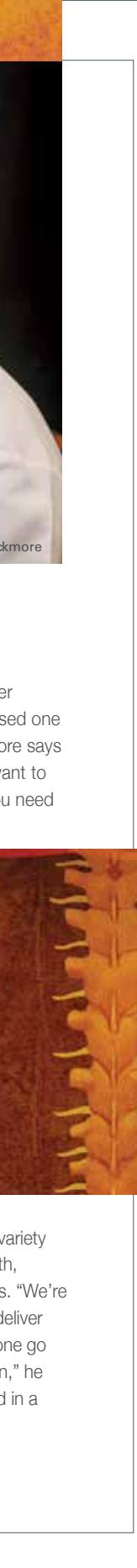
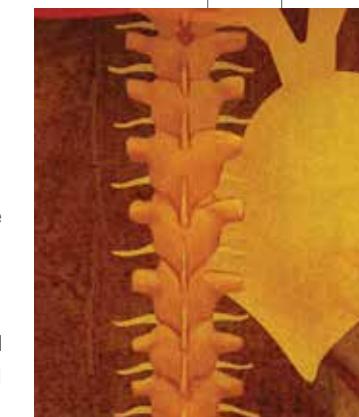
Dr. Murray Blackmore

At a research crossroads, the path also taken

Dr. Murray Blackmore arrived at Marquette in 2013 with a research project ready for top-level funding. With support from an NIH R01 grant, the then-assistant professor of biomedical sciences was soon studying a gene that could help damaged spinal nerves grow, with the potential of restoring movement to a body that had lost it.

Several years into the project, Blackmore and his team were spurring "robust regenerative" spinal nerve growth using a technique called stem-cell bridging to insert the pro-regenerative gene, KLF6, harvested from a virus, into the DNA of mice with damaged spinal cords. "That was the good news. The bad was that the animals in the study were not seeing any benefits in increased function or mobility," says Blackmore. Blackmore was at a crossroads, facing a choice between two possible solutions. The first involves improving the function of nerve fibers his team has already grown — possibly through rehabilitation or electrical stimulation. "Or maybe the axon has a targeting problem we need to correct, or it's connecting to the wrong cell," says Blackmore. The other

path is to aim to grow more and better axons. Although the initial research used one transcription factor to do so, Blackmore says nature is more complicated. "If you want to turn on a bunch of genes in a cell, you need a combination of transcription factors. It's a matter of finding the right combinations."

**Dr. John Mantsch, \$2.6 million**

The chair and professor of biomedical sciences is studying the neurobiological processes through which stress regulates prefrontal cortex function to promote drug use. Apart from helping to develop treatment methods for addiction, the findings will help explain how stress affects how we control impulses and make decisions.

Dr. Brian Schmit, \$1.6 million

By measuring tendon tap reflexes, voluntary muscle activation, and blood flow below and above the injury, Schmit, Eng '88, professor of biomedical engineering, is studying the regulation of cardiovascular systems during muscle activity in people with incomplete spinal cord injury (SCI). The results will help develop new exercise training and therapy treatments for people with SCI.

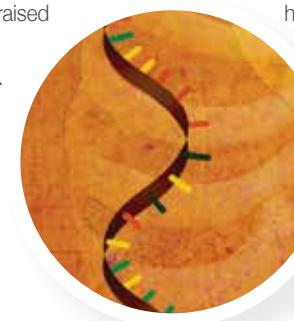
Dr. Robert Wheeler, \$1.9 million

Wheeler, associate professor of biomedical sciences, is examining with Mantsch how unpleasant experiences negatively affect people with underlying psychiatric disorders. The goal is developing behavioral and pharmacological therapies to help manage these effects.

Dr. Nicholas Reiter

Championing RNA, tackling cancer

Among the three primary biomolecules of living cells, much attention has been lavished on DNA, with its elegant double-helical structure and role as part of the blueprint of our genome. Proteins are praised as workhorses, turning fuel into cell productivity.

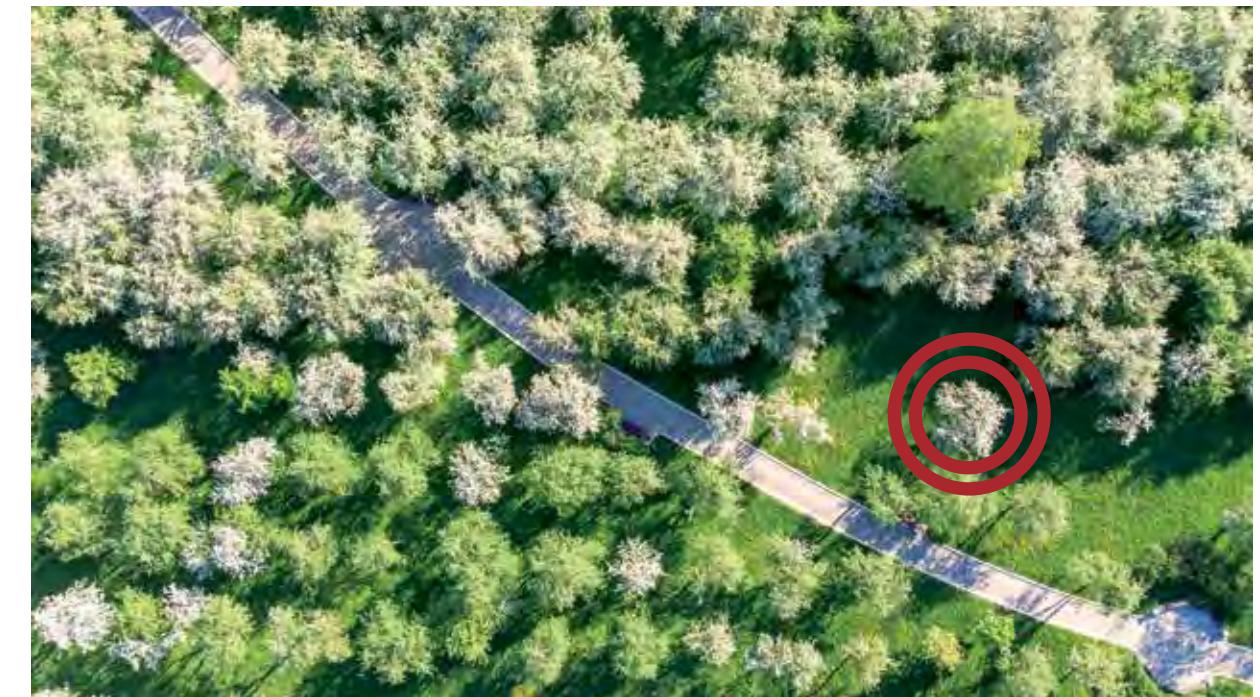


RNA, meanwhile, has often been described in humbler terms. "RNA was thought to be this flexible and unstructured molecule," says Dr. Nicholas Reiter, assistant professor of chemistry. "It was thought to be this intermediary ... a means to get to the real machinery of the cells."

Still early in his career, Reiter is among the leading scientists revealing the relationship between RNA's newly discovered structural diversity and its involvement in myriad cell functions. It's a role he's played since his NIH-funded post-doctoral years, when he mapped out the near-atomic-level structure of

an essential RNA-centric enzyme, ribonuclease P, that helps process all transfer RNAs, the key communicators of protein synthesis. The result showed that RNA, much like protein machines, has rich structural complexity and helped close the book on Nobel Prize-winning 1980s research that discovered catalytic RNA. Funded by a \$1.55 million R01 award, Reiter is using X-ray crystallography to define the mechanism by which a non-coding RNA, TERRA, acts in genome surveillance at the ends of chromosomes. The TERRA RNA is made during times of cell stress and interacts directly with cancer-associated proteins that are overactive in the prostate, brain and other organs — largely in situations where "cancer cells seek to be immortal," says Reiter. Knowledge of these RNA-protein interactions may help in the development of more selective therapeutics designed to curb cancer cell proliferation.





INTELLIGENT IMAGING

Using cameras and algorithms, Dr. Henry Medeiros helps computers “understand” complex processes.

As an undergrad research assistant using images to understand how bacteria colonies were populating in a petri dish, Dr. Henry Medeiros never envisioned how this technology would evolve. Now, as an assistant professor of electrical and computer engineering in the Opus College of Engineering, Medeiros is using similar techniques to develop computer vision applications for manufacturing, agriculture and security advancements.

“Computer vision research began 60 years ago, but in the first 50, progress was very slow,” Medeiros says. With recent advances in machine learning, the field now is evolving at a much faster pace, and Medeiros thinks, “It’s a great time to be a part of that.” With even “more significant advances developing over the next decade,” Medeiros’ research seems to be surging with the technology tide.

Computer vision describes how computers can be programmed to “understand” information from digital images or video in order to perform tasks that humans typically do. Think facial recognition security on a mobile phone. Or driverless vehicles that track surrounding vehicles and pedestrians. Both apply computer vision in different ways.

With funding from the U.S. Department of Agriculture, Medeiros’ research team and USDA researcher Dr. Amy Tabb are using computer vision techniques to combat the world’s food security crisis. To predict fruit orchard productivity and better manage crops and harvesting, growers have traditionally used workers to



manually count the number of flowers shortly after blooming. Medeiros’ project aims to improve bloom estimation by applying novel image understanding methods combined with recently developed multi-target tracking algorithms to analyze series of apple tree images collected manually, by ground robots or by drones under natural, challenging conditions that include imperfect weather and terrain. The result is faster, more accurate estimation.

Another project, funded with a three-year \$299,930 grant from the National Institute of Standards and Technology, aims to measure the performance of a robotic manipulator mounted on an automated guided vehicle, or AGV. The team is investigating how well the robotic vision system can identify test points on a mapped artifact while both the AGV and manipulator simultaneously move. This technology, currently used in space exploration and military operations, is being tested for use in manufacturing assembly.

Medeiros’ lab is also deploying computer vision technology to identify and track passengers and baggage at simulated airport security checkpoints on a project funded by the Department of Homeland Security, and to measure river basin levels during peak flows to help mitigate stormwater runoff and untreated wastewater emptying into Lake Michigan, with civil engineering colleague Dr. Walter McDonald. Given computer vision’s seemingly endless potential, Medeiros’ research opportunities are sure to keep growing.

SARAH KOZIOL, ARTS, '92

FOUND IN TRANSLATION

In Japan on a Fulbright, a scholar uncovers opportunities to build awareness of U.S. foreign policy law.

With his expertise in foreign relations law and fluency in Japanese, Ryan Scoville was uncommonly qualified for the work he did in Tokyo last semester illuminating an aspect of international relations he believes deserves more attention.

The associate professor of law received a Fulbright grant to further his interest in how foreign governments, legal scholars and other specialists, particularly those in Japan, understand U.S. foreign relations law. That body of law “involves everything from parts of the Constitution that pertain to foreign policy to statutes such as the War Powers Resolution,” says Scoville. If foreign officials view aspects of the law differently than we do, “there can be confusion or conflicting expectations, which can operate as a hindrance on U.S. relations with allies and countries that are not so friendly.”

Hosted by Sophia University, a Jesuit research university in Tokyo, Scoville spent the four-month grant period interviewing people at the Ministry of Foreign Affairs, the Ministry of Defense, think tanks, universities and international law firms. He also collected Japanese-language publications on U.S. foreign relations law at the National Diet Library, Japan’s equivalent of the Library of Congress, and university law libraries.

His conclusions? “Formal programs of study and training on U.S. foreign relations law are essentially nonexistent in Japanese academia and within the government,” says Scoville. He found just a handful of academics writing on the subject, contributing to a tradition of scholarship on U.S. foreign relations law in Japan dating to at least the 1930s. But he did find individuals carving out deep pockets of U.S. foreign relations law knowledge on a “need-to-know basis,” including officials at Japan’s Ministry of Economy, Trade and Industry, which is mired in bilateral trade negotiations with the Trump administration.

Seeing opportunities in the knowledge gaps he discovered, Scoville aims to facilitate more interaction between U.S. academics specializing in foreign relations law and overseas scholars and officials. And with a rising profile in the field, including a role as a managing editor for AJIL Unbound, the online companion to the American Journal of International Law, Scoville is in a good position to build on his Fulbright experience with more networking and plans for hosting future academic gatherings on the subject.

MARY REARDON



Hosted by Sophia University, a Jesuit research university in Tokyo, Scoville spent the four-month grant period interviewing people at the Ministry of Foreign Affairs, the Ministry of Defense, think tanks, universities and international law firms.



WORDS FROM WITHIN

Simulations of one's own voice, not mimicked motions of others, help speech return faster.

Imagine the immense frustration of knowing what you want to say but being physically unable to articulate it because of a stroke or other traumatic brain injury. For more than 480,000 people each year, this frustration becomes their new reality.

Dr. Jeffrey Berry, associate professor of speech pathology and audiology in the College of Health Sciences, believes that improvements on the current models for helping people with brain injuries relearn how to communicate may come from finding a closer match with how speaking is learned in the first place. He has received a \$450,000 grant from the National Institutes of Health to examine new therapies for non-progressive dysarthria, a speech disorder caused by muscle weakness stemming from stroke or brain injury.

"The current standard for rehabilitation therapy is a mimic-type setting, where automated motor behaviors present in speech — how you move your jaw, your lips, your tongue — are broken down into small chunks. It's extraordinarily difficult and extensive," Berry says. "It's like learning to play the piano at an extraordinary level one key at a time. How do you go from a single key to Rachmaninoff?"

Berry believes that auditory feedback is a key to developing more effective strategies to help people with severe dysarthria master those nearly automatic motor behaviors that most of us take for granted. "In this study, we're looking at how what you hear affects how you learn, or relearn, to move your tongue, lips and jaw for speech," Berry says.

In his lab, patients connect to a speech synthesizer that is manipulated using their own motor controls. The resulting auditory outputs don't sound like their voices; they're closer to a text-to-speech program on a computer. But self-agency, the simple fact that the speech sounds result from their motor behavior, allows their brains to identify them with their own speaking.

"There are different neurological pathways involved in processing auditory information, and one of the things we know is that listening to yourself speak, as opposed to listening to someone else, excites different networks in the brain," Berry says. He anticipates that through this mechanism of auditory processing, using the voice synthesizer, patients will develop a less conscious method of actual speech, almost like an auditory motor reflex.

"Our hope is that this auditory processing will cause the motor function to compensate over time, which will help the patient rehabilitate more quickly and more effectively," he says.

JESSE LEE



Berry believes that auditory feedback is a key to developing more effective strategies to help people with severe dysarthria master those nearly automatic motor behaviors that most of us take for granted.



Dr. Jeffrey Berry's treatment improves on a rehabilitation standard that he compares to "learning to play the piano at an extraordinary level one key at a time."



TRAUMA-INFORMED TREATMENT GOES TO SCHOOL

After years of advances in treating child behavior problems, the Behavior Clinic pilots care in a new setting.

Under founder Dr. Robert Fox, now an emeritus professor of counselor education and counseling psychology, the Behavior Clinic established an influential home-based treatment model for children with serious behavior problems, including those whose tantrums, nightmares and other issues stem from traumas they've experienced but can't yet understand.

And the clinic continues to innovate. Two years ago, the clinic's partners — Marquette's College of Education and Penfield Children's Center — began piloting school-based interventions through a new clinic in the Penfield Montessori Academy on Milwaukee's Near West Side.

Offering trauma-informed treatment for students and their families, the school clinic provides therapies ranging from mindfulness exercises and yoga to multitiered programs that include weekly home visits and parenting guidance. It also expands opportunities to train graduate students in the program's treatment methods, says Dr. Alan Burkard, chair and professor of counselor education and counseling psychology, and the Behavior Clinic's consulting psychologist.

Piloted with two-year funding from the Argosy Foundation, Zilber Family Foundation and Bader Philanthropies, the elementary school clinic has ushered in broader ways of serving children and families, including small group sessions tailored to children dealing with challenges such as an incarcerated parent or the loss of a loved one. Screening

"indicates that about 70 percent of students at the school show some exposure to trauma," says Burkard, significantly higher than in a typical school. Approximately 10 percent of academy students now receive in-home trauma treatment.

A final goal of the new clinic is furthering research on trauma impacts and program efficacy. "We conduct evaluations of the activities and classroom lessons, focusing on determining whether students are gaining the knowledge and the abilities we want them to gain," explains Burkard. For example, the classrooms contain "zones of regulation" in which students use color to match their emotions and communicate them to teachers. Measuring how much children use these tools, clinicians determine how to revisit these strategies.

The team aims to learn more about the parents of these students. "The mental health of parents is a huge issue. We see it daily," says Burkard. "We're just starting to look at how to measure it and how we might incorporate it into our treatment. Based on anecdotal information, we're pretty certain that parent mental health — and parent trauma history, in particular — has a huge impact on treatment outcomes. It seems obvious, but it doesn't appear that there's a lot of research in that area."

JENNIFER ANDERSON



Dr. Alan Burkard Chair and Professor, Counselor Education and Counseling Psychology



CARE IN THE PALM OF YOUR HAND

Professor capitalizes on cell phone convenience to address the challenges of caring for children with autism.

The difficulty in treating autism spectrum disorder is reflected in its name. Because the condition presents itself in a range of symptoms and severity levels, each patient needs treatment personalized to his or her needs. That's difficult for doctors and costly for families.

Fortunately, Dr. Sheikh Iqbal Ahamed has developed a promising solution: a cell phone app as individualized as the people it's designed to help. The professor of computer science specializes in mobile health interventions: mobile-based software that helps people manage medical conditions.

His latest app, mCARE, allows caregivers to log a child's behavior and development by answering questions that are customized based on factors identified by each child's doctor, such as cognitive function or self-destructive actions. Doctors can then securely access that information online and use it to inform treatment decisions.

Ahamed says earlier collaborations with Dr. Amy Van Hecke of the Marquette Autism Clinic "opened his eyes" to the huge costs and time requirements that come with caring for a child with autism. According to federal sources, medical costs for children with autism average four to six times higher than typical costs. Monitoring a child's health at home via an app, Ahamed realized, could reduce those bills by making doctor visits less frequent and more efficient; doctors wouldn't need



to wait for an appointment to assess a patient's progress.

The project's potential became clear when he returned to his home country of Bangladesh to learn about the state of autism there. "After some initial surveys, we found out there is nothing in terms of autism care," says Ahamed, who will become chair of Marquette's new Department of Computer Science in the fall. "People are just suffering with no treatment. We thought, if we can do this, it will have a global impact. That is what motivated me."

Through a \$393,000, two-year grant from the National Institutes of Health, Ahamed and partners from Purdue University, the University of Toronto and Bangabandhu Sheikh Mujib Medical University in Bangladesh will launch mCARE in three locations in Bangladesh. The plan echoes a 2011 project Ahamed developed with oncologist Dr. Richard Love: an app that helped terminal Bangladeshi breast cancer patients manage their pain. That app proved so effective that Ahamed's team has expanded its palliative care work to include Love's patients in Nepal.

The health care industry may be only beginning to accept mHealth as a treatment option, but Ahamed has never doubted its potential. He even plans to integrate mHealth research into Marquette's data science curriculum. "It's an area where we can grow not only locally, but also globally."

CLAIRE NOWAK, COMM '16

HOW THE AIRBNB RENTAL NEXT DOOR AFFECTS YOUR HOME VALUE

Inside the latest research from the new academic director of Marquette's Center for Real Estate

It's no secret that Airbnb has disrupted the tourism industry worldwide, but how does the 10-year-old, \$2 billion company affect the people and properties around its short-term rental properties?

That's the question Dr. Anthony Pennington-Cross, the Robert Bernard Bell, Sr., Endowed Chair in Real Estate and professor of finance in the College of Business Administration, is researching. Using eight years of Wisconsin Airbnb data, Pennington-Cross is looking at how this flexible supply of temporary lodging impacts property values.

A member of Marquette's finance faculty since 2006, Pennington-Cross studies mortgage trends, commercial property fundamentals and other urban and real estate issues. As a teenager from the New Jersey suburbs, trips to Manhattan sparked his fascination for cities, why people moved to them, or — as was the national trend when Pennington-Cross was growing up in the 1970s — why they left. To this day, he is especially curious about property value fluctuations and passionate about finding answers through research.

And this year, Pennington-Cross was named the Bell Chair, making him the academic leader of Marquette's Center for Real Estate and its undergraduate research major, ranked 11th in the country by *U.S. News & World Report*. As the program's recruiter in chief, he helps freshmen see that real estate can be more than selling single-family homes and that Marquette's program is a route to expertise in managing and evaluating commercial property — anything from marketing and selling to ownership and finance. With about 20 to 30 real estate majors graduating with bachelor's degrees each year, he's proud that the program boasts a 100 percent job-placement rate.

Pennington-Cross currently works with a graduate of Marquette's Master of Science in Applied Economics program on the Airbnb research, investigating not only Airbnb's impact on property values but also on crime rates, specifically in Milwaukee. "There's not much research on this currently, so we're trying to be early adapters," Pennington-Cross says. "It's part of a greater discussion on the shared economy. How does disruption affect an established industry and the people around it?"

ELIZABETH BAKER, COMM '17, GRAD '19



"It's part of a greater discussion on the shared economy. How does disruption affect an established industry and the people around it?"



Dr. Anthony Pennington-Cross | Professor and Robert Bernard Bell, Sr., Endowed Chair in Real Estate



PLOTTING AGAINST PLAQUE

New dental research asks: Can polymers on dentures or in toothpaste act as shields against bacteria?

Dental plaque is a fact of life even for the most disciplined brushers. Constantly forming on the teeth as bacteria colonize into a sticky, invisible film, it can wreak havoc on tooth enamel and gums if we don't remain vigilant.

Marquette University School of Dentistry's Dr. Andrew Dentino, D.D.S., wants to arm us with the best plaque-fighting weapons. The board-certified periodontist came to Marquette from a research-intensive environment at the University of Buffalo-SUNY in 1992 and has played a key role in ramping up research at the School of Dentistry. Now associate dean of research and graduate studies and director of the predoctoral program in periodontics, Dentino is extending his decades-long pursuit of plaque control, with public and private support.



Dentino's projects explore ways to attack, repel and resist plaque. He has partnered with industry giants to evaluate the anti-plaque abilities of powered toothbrushes with innovative bristle designs. A study for Braun (now part of Procter & Gamble) sought to determine whether people using its market-leading powered brush would have healthier gums and less plaque than those using a manual brush, even when given no professional usage instructions. The powered toothbrush prevailed, but the study stopped short of

evaluating it as an actual gingivitis treatment.

Building on that work, Dentino is now midway through a study designed for Sunstar, which owns consumer brands G.U.M. and Butler, to see if the company's prototype for a new powered toothbrush can effectively treat existing gingivitis of infrequent flossers.

On the repel and resist front, Dentino's research to develop "super surfaces" of synthesized polymers includes an R01 grant from the National Institutes of Health, which from 2007 to 2010 funded a collaboration to develop a membrane-like shield of phosphated acrylic for dentures. When the research team inoculated it with "every oral bug under the sun," Dentino says, none was able to colonize on the surface, which Dentino eventually patented.

This work attracted the attention of a major oral health care company, which funded Dentino's work to develop and potentially patent water-soluble polymers that could eventually boost toothpaste's ability to battle bacterial film development and maturation. "(The company) will do the next series of studies," Dentino says. "Do these polymers have a robustness that will allow them to function in the human mouth like we see them functioning in a petri dish — essentially, with saliva on top of a tooth?"

PAULA WHEELER

WALKING A SPIRITUAL PATH TOGETHER

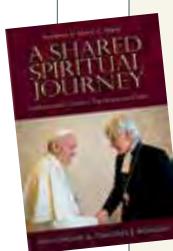
Theologian Dr. Susan Wood has helped Catholics, Lutherans and those of other faiths find common ground.

In recent decades, the Catholic Church has been asking new questions on many topics, including how to overcome the divisions that arose between Christians in the last millennium. If "the university is a place where the church does its thinking," as Rev. Theodore M. Hesburgh, former Notre Dame president, claimed, then Marquette needs faculty like Dr. Susan K. Wood, SCL, to consider these questions.

Wood, Grad '86, a Sister of Charity of Leavenworth, Kansas, returned to teach and conduct scholarship at Marquette in 2005. She twice served as chair of the Department of Theology for a cumulative eight years, starting in 2008. Regularly invited to help the church think through issues around the world, Wood has represented the Catholic Church in many international and national dialogues with the Orthodox, Lutherans and Baptists. She has also served as a guest faculty member at both the University of Tübingen in Germany — long a center of Lutheran-Catholic engagement — and at the Pontifical Gregorian University in Rome.

Her publications develop this work, including *A Shared Spiritual Journey: Lutherans and Catholics Traveling Toward Unity*, published in time for the 500th anniversary of the Reformation in 2017 and co-written with Lutheran theologian Timothy Wengert. "Since the book was about ecumenical dialogue, it was important to model that process by writing about it with a Lutheran co-author," says Wood.

In 2015 Wood co-drafted the *Declaration on the Way*:



Church, Ministry and Eucharist. The heart of this document is 32 common affirmations about the church, the ordained ministry, and the Eucharist gleaned from the last 50 years of Lutheran-Catholic dialogue. It concludes by identifying areas in which more work is needed.

These affirmations were ratified unanimously by the U.S. Catholic Bishops' Committee on Ecumenical and Interreligious Affairs and by the ELCA's Churchwide Assembly — by an overwhelming vote of 931-9. Wood attended the assembly and says of the experience: "The enthusiasm of the ELCA delegates gave an overwhelming mandate to the churches to get on with the work of reconciling division and achieving church unity. Far from today being an 'ecumenical winter' as is sometimes said, there are new reasons for ecumenical work. These include the large number of people in inter-church marriages, the shared work for social justice, and the joint witness demanded by an increasingly secular world." Continuing in this vein, as she departs to become academic dean of Regis College, a Jesuit school of theology in Toronto, Wood's latest projects include research on how the sense of the faithful (*sensus fidelium*) in different faith traditions contributes to the unity of the churches.

DR. JAKOB RINDERKNECHT, GRAD '15





IMMIGRATION ON STAGE

Sparked by his own journey, Dr. Jeffrey Coleman examines the role of African immigrants in Spanish theatre.

Two teenage stowaways from Guinea found frozen to death in the wheel bay of a jet airliner at the Brussels airport in 1999 might have faded from public memory, if not for the letter found with them. "We suffer too much in Africa. ... We need you to fight against poverty and to put an end to the war in Africa," Yaguine Koita and Fodé Tounkara wrote, addressing "officials of Europe."

In his scholarship, Dr. Jeffrey Coleman, assistant professor of languages, literatures and cultures, has turned to this letter repeatedly in illuminating problems of race and immigration in Europe, particular as seen through the lens of Spanish theatre. In considering

playwright Juan Diego Botto's dramatization of Koita and Tounkara in his play *El Privilegio de Ser Perro*, Coleman casts the boys as emissaries challenging "Europe's amnesia in regards to its colonial and neo-colonial connection to Africa."

Coleman's forthcoming book, *The Necropolitical Theater: Race and Immigration on the Contemporary Spanish Stage*, examines how Spanish plays between 1991 and 2016 treat three major migrant groups: Latin Americans, North Africans (mostly Moroccans) and sub-Saharan Africans. In the case of the last group, "they never survive the play," Coleman says. They die en route, get to Spain and die from illness, or meet some other doom, such as being murdered by neo-Nazis, he explains.

By exposing these patterns, Coleman hopes to make Spanish theatre professionals more conscious of how they treat race and immigration onstage. "One thing I found troubling in the research is a lot of the playwrights weren't even conscious of the patterns they were producing or reproducing."

His own immigrant experience partially fuels his scholarly interest. Born in Ghana, Coleman came to the United States as a boy with his family, after an intermediate stay in Spain. "That's where the desire to learn Spanish actually came from when I was younger," he says. Coleman earned his doctorate in Spanish from the University of Chicago.

On a research trip, Coleman met with a collective of black actors in Madrid, leading to inclusion in a WhatsApp messaging group that keeps him informed of controversies, such as a casting debacle involving a white actor in blackface playing a black drag queen in a Spanish production of Tony Kushner's *Angels in America*.

Coleman is now broadening his research to consider representations of blackness in Spanish popular culture, including stereotypical black figures on the packaging of the Spanish candy Conguitos and the tradition in many cities of having a white actor in blackface portray Balthazar on Three Kings Day. "What does it mean," he asks, "that Spain is still propagating these types of images when there are now thousands if not millions of black citizens and migrants living there?"

JIM HIGGINS, JOUR '79

FLUENT IN FILM

In both documentary and feature film genres, Kristin Holodak is committed to visual storytelling.

Kristin Holodak's documentary *Young of the Year* explores the mystery of the roseate tern, endangered despite high birth rates and stable adult mortality trends. "Somewhere between hatching and returning to breed three years later, young terns are dying in disproportionate numbers," says Holodak, assistant professor of digital media and performing arts.

To document terns preparing for their high-risk first migration from Massachusetts to Brazil, Holodak fought through several setbacks. An initial attempt to film during nesting season was abandoned when permitting fell through. After obtaining footage of adult terns, she created an initial cut of the film but realized it failed to do justice to the bird's journey. "I believed the film was going to help the birds," Holodak says. "The birds are the birds without me, but they will have an easier time if people see my film."

Waiting a year to shoot the chicks, Holodak had her patience rewarded. Completed in 2018, her film has had six festival screenings and won four awards, including the Impact Docs Award of Merit, recognizing documentaries with great potential to inspire change.

Now working on her first feature-length film, *Enid's Wall*, Holodak is playing out a similar script involving unwavering vision, tireless commitment and peer recognition. The film is based on a short story by Jennifer Gostin that Holodak is adapting into a 90-page script. The subject matter — a mature woman, newly moved into a community "as old as the sea itself" and deciding what choices and sacrifices to make in fitting in — resonates with the filmmaker. Holodak moved frequently during her 20s and 30s, leaving her to navigate many new environments. And relocation is a constant of 21st-century Americans, she says, adding urgency to the search for belonging.

Early versions of the script have met with praise, including an official selection in the Auckland Film Festival's scriptwriting competition in New Zealand. Selection by the Stowe Story Labs brought Holodak to Palm Springs, Calif., last fall to continue honing the script in a workshop setting.

The extra time with her script — alternating with efforts to secure a producer to coordinate the project's financing and many moving parts — has only deepened her connection to her baby-boomer main character, Enid. Despite numbering more than 37 million, "rarely do the women of this generation get to see themselves in film," says Holodak. "Rarely are they everyday people with the same everyday issues as everyone else." When it debuts, *Enid's Wall* will make up for this shortcoming, and do it eloquently.

ALYSSA DUETSCH, COMMUNICATION STUDENT



Waiting a year to shoot the chicks, Holodak was rewarded for her patience. Completed in early 2018, her film has been screened at six festivals and won four awards.



SPARK

Stories of the Marquette community igniting innovation and entrepreneurial spirit.

Faculty, staff and students at Marquette are on a quest for new knowledge, new tools and new ways to reduce health and educational inequities.

1 Modeling Clean Water

Professors and their Jesuit university partners protect resources in Central America.

2 Branching Out

Partnerships with corporations and utilities expand faculty research.

3 Pop Hit

A new student-run business program helps two students showcase their startup skills.

4 Spurring Solutions

Fostering collaborative innovation, Marquette's challenge funds drive results and draw accolades.

5 Human Performance

Research in Marquette's newest facility may improve game-day performance and reduce injuries.

6 Difference Makers

Marquette hosts Force for Positive Change Awards supporting entrepreneurial social innovators.



Lake Nicaragua near Managua, Nicaragua

BETTER DATA, CLEANER AGUA

Marquette professors join research colleagues from Central American Jesuit universities to help communities in El Salvador and Nicaragua protect precious water resources.

At the center of a rural community in El Salvador lies Laguna Verde, a small crater lake that serves as the area's main source for drinking water and irrigation of crops such as coffee. It's also a recreational attraction for tourists taking boat tours. In the past few years, however, nutrient runoff from surrounding watersheds has trickled into the lake, diminishing both water quality and the residents' quality of life. Dr. Anthony Parolari, assistant professor of civil, construction and environmental engineering, aims to turn that around.

In collaboration with Universidad Centroamericana El Salvador, Parolari is co-leading a research team seeking to understand what influences the lake's water quality. In San Salvador, engineering professor Dr. Jacqueline Cativo's students are in the field collecting data such as rainfall inputs, temperatures, pH levels, dissolved oxygen and conductivity, all water-quality indicators. Back at Marquette, Parolari's research team is analyzing the data to

measure how these parameters have changed over time.

With enough data, Parolari and Cativo hope to build a computer model that could predict the lake's water quality a few months or even years in advance, which could help the community determine when and how to take action to protect the lake. "If we can show this community that we're able to collect data and make that information available, we can help them understand their impact and how to use their water resources better," explains Parolari.

Parolari's project is one of several collaborative research projects in Central America involving Marquette faculty members and students, and part of a broader commitment by the Opus College of Engineering to partner with Jesuit universities around the world.

In Nicaragua, Dr. Walter McDonald, assistant professor of civil, construction and environmental engineering, is working with water resource researchers at the Jesuit-run Universidad

Centroamericana Nicaragua to build a similar data-driven model to improve pollution reduction and flood control in and around Lake Nicaragua, the largest lake in Central America.

Students there have collected data for a model that can suggest different management action plans for the rainstorms and seasonal flooding that cause damage to homes and crops. The model tells researchers about current conditions, estimates the damage from rainstorms and informs decision makers on what flood control actions to take. A related effort is identifying areas of the watershed near Managua, Nicaragua, that may be draining pollutants into Lake Nicaragua.

For both McDonald and Parolari, these research projects are about empowering the local communities where they are working. Says Parolari, "If you think about the Jesuit educational mission, part of it is seeking knowledge and trying to understand the world around you."

MARTINA IBÁÑEZ-BALDOR, COMM '15



BRANCHING OUT

As partnerships with corporations and utilities blossom, faculty research expands in new directions.

② Government guidelines warn consumers against throwing expired or unused medications down the drain or toilet, where they can work their way into surface waters and groundwater.



With additional pharmaceutical chemicals passing through humans into waste streams, Dr. Kyana Young, a postdoctoral fellow in the Office of Research and Innovation, is exploring a potential remedy — helping municipal water facilities treat such chemicals. Young was awarded one of four initial grants through the Water Coordinated Activities on Research for the Environment project, or WaterCARE, through which the Milwaukee Metropolitan Sewerage District will fund approximately \$275,000 annually in Marquette faculty research over five years.

The WaterCARE collaboration is a shining example of the university broadening its research funding sources beyond traditional government grantors such as the National Science Foundation — an auspicious sign as Marquette welcomes its first-ever vice president for corporate engagement and partnerships, Dr. Maura Donovan, this year.

In MMSD's case, the collaboration "gives us access to expert faculty, state-of-the-art laboratories and top-notch student talent,"

says Matthew Magruder, the district's environmental research manager, "positioning the district to be a leader in resolving complex environmental issues."

Projects cover diverse areas of study. Young is building a lab-scale wastewater treatment process in Marquette's lab at the Global Water Center, modeling her system on the process at the MMSD plant. She'll conduct research using MMSD facility samples. "We are exploring alternative treatment technologies, such as advanced oxidation processes, to degrade or remove pharmaceuticals from treated effluent in a way that's cost-efficient," Young says.

David Strifling, Eng '00, Law '04, director of the Water Law and Policy Initiative at Marquette Law School and professor of law, is studying MMSD's climate change mitigation and adaptation programs. "The WaterCARE agreement takes this partnership to another level," Strifling says, "and will help drive cutting-edge water research at Marquette."

With these partnerships growing in number and generating benefits for researchers and funding partners alike, here are two more to watch:



Dr. Ronald Coutu, Jr., the V. Clayton Lafferty Endowed Chair and professor of electrical and computer engineering, is a good example of Marquette faculty members conducting research supported directly by corporations, although his "laboratory" is one of a kind.

To test the durability of "solar pavers" — Solar Roadways Inc.'s quest to turn segments of roadways and sidewalks into the equivalent of 2,500-watt solar panels — Coutu's team created something called a "heavy vehicle simulator" outside Engineering Hall.

Resembling a miniature airplane hangar resting on two tracks — but housing a 9,500-pound wheel system inside — the device subjected test panels to conditions mimicking what they could someday experience from extreme storms and fully loaded dump trucks.

With approximately \$180,000 in funding from the company, Coutu probed the mechanical properties of a prototype paver and evaluated its suitability as a replacement roadway material that also happens to generate electricity. "Specifically, we tested this unique pavement material in submerged water environments, under extreme temperature condition, and under dynamic loading," he says.

That's where the nearly 5-ton wheel system came in handy, guided by the tracks to pass or "drive" over the panels about 800,000 times to test durability. "I think it's important for Marquette because it highlights how our expertise is valued and, in this case, needed by industry to validate potential 'game-changing' sustainability technology," Coutu says.



The partnership of Northwestern Mutual, Marquette and the University of Wisconsin–Milwaukee to create the \$40 million Northwestern Mutual Data Science Institute is poised to change the regional economic landscape. "It will help build a technology ecosystem and advance southeastern Wisconsin as a national hub for technology, research, business and talent development, while creating an organic pipeline of tech talent in the area," says Gretchen Miller, Northwestern Mutual's assistant director for digital and innovation communications.

Note the presence of research in that list. At Marquette, a combined \$15 million in funds from Northwestern Mutual and the university will make possible the addition of three faculty positions. One will be an endowed professor and co-director of the institute. While professors in disciplines from statistics to nursing incorporate data science into their work, the three positions represent a considerable increase in the ranks of faculty members dedicated to the discipline. "Our faculty typically spend 40 percent of their time doing research. When you're adding three faculty members, that's a substantial increase in the amount of research being conducted," says Dr. Thomas Kaczmarek, director of computing for the Department of Mathematics, Statistics and Computer Science. Five additional graduate research assistants supported by the institute will give data science research a further boost, he says. Watch the "Spark" section for details on the future impact of this work.

GENE ARMAS



POP HIT

As a student-run business program grows, two undergraduates score with a locally sourced store.

③ Holiday shoppers in Milwaukee's Walker's Point who strolled into the Nest Holiday Pop-up Shop found an inviting interior and artfully displayed products from local entrepreneurs. Although it looked every inch the kind of fashionable boutique that populates the neighborhood, it was something more: the creation of Jack Toner and Isabelle Block, both seniors in the College of Business Administration.

Opening a week before Black Friday and Small Business Saturday, the shop — and its longer-term sister venture Nest Incubator — were launched through Blue & Gold Ventures, Marquette's student-run business program in the College of Business Administration. Since its founding in the fall, the

program has been off to a fast start, fostering student-led businesses in industries ranging from food and beverage to event planning.

The example of Block and Toner reveals budding entrepreneurs growing into their roles through a combination of grit, resourcefulness and expert support, including from generous alumni. A great deal on a prime storefront space just south of Milwaukee's Third Ward came from building owner Lacey Sadoff, Comm '05, after a referral from Matt Cordio, Bus Ad '12, a Blue & Gold Ventures board member and leader in the Milwaukee startup community. For the merchandise mix, they targeted local entrepreneurs, who appreciated the additional exposure for their products.

To design a large space on a small budget, Block stepped outside her comfort zone as a finance major. "I had to think on my toes and be strategic," she says. "I used antique furniture from my old house that was in storage and paired it with modern Ikea shelving. ... I have never worked so hard on a project in my life."

Tracking their performance, the students "were disappointed with foot traffic" but had 44 percent of shoppers make a purchase, reports Toner. And with 20 entrepreneurs represented in the space, they exceeded that benchmark too — all valuable lessons from the student-run business experience.

**KALEY ROHLINGER, COMMUNICATION INTERN,
AND STEPHEN FILMANOWICZ**

IN SEARCH OF SOLUTIONS

Fostering collaboration and innovation, Marquette's major challenge funds are driving results and garnering national accolades.

④ When undergraduates began envisioning a new collaborative space for student innovation and entrepreneurship, they had somewhere to turn for help advancing the concept. They pitched it to Marquette's Explorer Challenge (then called the Strategic Innovation Fund), had their submission selected and worked with partners to turn their ideas into the vibrant 707 Hub, now one of the most popular places on campus.

The two challenges are key ways the university is forging "a campuswide culture of innovation and entrepreneurship," says Marquette President Michael R. Lovell. And now that culture-changing approach is generating national praise. The University Economic Development Association recognized The Explorer Challenge with two national innovation awards this fall. After presentations at the group's annual summit by Dr. Jeanne Hossenlopp, vice president for research and innovation, and representatives of two other finalist universities, attendees voted to award Marquette the group's 2018 Award of Excellence. The second honor was the Editors' Choice Award from the *Journal of Economic Development in Higher Education*. The organization called The Explorer Challenge "an original, scalable and sustainable solution that should be replicated."

LEAH HARRIS, COMM '18
Read the Explorer Challenge report at bit.ly/explorer-challenge.

SARAH KOZIOL, ARTS '92



PERFORMANCE BY DESIGN

Check out the collaborative research happening — already — in the newest facility on campus.

⑤ As student-athletes on Marquette's women's and men's basketball teams were tearing up the courts of the Big East this winter, Marquette researchers were keeping tabs on their movement patterns during practices, accumulating data that may lead to improved game-day performances and fewer injuries.

Tracking and deciphering this data — collected through wearable monitors more sophisticated than the activity trackers many of us wear today — is a collaborative research effort led by Dr. Kristof Kipp, associate professor of exercise science, and involving Marquette faculty from computer science, engineering and communication. The project is one of four funded by Marquette's Athletic and Human Performance Research Center pilot grants.

The AHPRC, which opened this spring, is the university's newest building gem. Next to state-of-the-art athletics training and support facilities is 5,400 square feet of dedicated research space where academic researchers from a variety of disciplines collaborate on investigations in elite athletic performance, human performance, rehabilitation, fitness data analytics and other related disciplines.

Dr. Sandra Hunter, AHPRC planning director and professor of exercise science, says the new space will allow faculty researchers to access expertise and equipment — including gold-standard exercise physiology testing systems and a DEXA bone density machine room — that had not been available to them before and that could lead to unexpected collaborations.

Dr. Jack Senefeld, H Sci '13, Grad '18, assistant planning director and postdoctoral fellow in exercise science who is housed at the facility, agrees: "It's going to be fun to see what additional projects evolve in this space. More researchers are welcome here. We're excited to see what happens with that potential."

SUPPORTING ENTREPRENEURS AS DIFFERENCE MAKERS

Marquette partners with UW–Madison's WARF to boost Wisconsin's social entrepreneurs.

6 As the first Wisconsin university with a well-established social innovation program, Marquette was the natural choice for co-producing the annual Force for Positive Change Awards, a juried program offering financial support to 10 winning entrepreneurs as they strive to solve social or environmental challenges in sustainable, just and effective ways.

Partnering with Marquette on this platform for modeling Wisconsin's best social innovation work are the Wisconsin Alumni Research Foundation and philanthropic power couple John and Tashia Morgridge. Tashia, co-founder of the TOSA Foundation, and John, chairman emeritus of Cisco Systems, initiated the awards idea with WARF to inspire entrepreneurs to make a difference in Wisconsin. "Because of Marquette's strong reputation in social innovation and research, the partnership with WARF on the Force for Positive Change program is a great collaboration for us," explains Kelsey Otero, Grad '14, Marquette's associate director for social innovation, who also manages the new student innovation space, the 707 Hub. After debuting in Madison, Wisconsin, the contest joined with Marquette in its second season for an event at the Alumni Memorial Union. A third contest with a Green Bay event is planned for November 15, 2019. Eight winners at the last event were awarded \$12,500 each to grow their companies.

One of the 2018 award winners was STEMhero, co-founded by Nate Conroy, Grad '12. The company, which provides hands-on STEM skills training for students — using interactive programs and utility data from their own homes — emerged from Marquette's innovation initiatives. "Normally, a business could not make money off of schools, but charging utilities to develop and offer school programs is genius," said judges. "The problem they identified and their solution sound fantastic and potentially transformational."

LAUREN SCHUDSON, GRAD '97

FUND THE NEXT GREAT EXPLORATION.

When you endow research at Marquette, you create opportunity and possibilities. Marquette has always fostered spirited dreamers and decided problem solvers — those with the passion for discovery. Here, researchers pursue answers to seemingly unanswerable questions, tackle new challenges, and work to find solutions to problems yet to fully surface. Endowed research and innovation initiatives may inspire something remarkable. Join the exploration; your support can Be The Difference.

To endow research and innovation initiatives at Marquette, contact Tim Weiss at timothy.weiss@marquette.edu or 414.288.6586.



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Marquette Bookshelf

Addressing Sexual Violence in Higher Education and Student Affairs, co-edited by Dr. Jody Jessup-Anger, associate professor of educational policy and leadership, grew out of her work as a co-chair of the American College Personnel Association's Presidential Task Force on Sexual Violence in Higher Education. The book outlines conceptual framing for addressing sexual violence in higher education and provides recommendations for prevention, policy and institutional leadership.

The Catholic Church in Southwest Iowa: A History of the Diocese of Des Moines by Rev. Steven Avella, Ph.D., professor of history, is the first book-length study of the history of the Roman Catholic Diocese of Des Moines, Iowa. Commissioned by the diocese to commemorate its centenary, it tells the story of key figures in the church's formation in the region.

Disclosure and Concealment in Psychotherapy, co-edited by Dr. Sarah Knox, professor of counselor education and counseling psychology, explores how self-disclosure and concealment function in building trust in client-therapist relationships.

Phonological Awareness Training Program: A Speech-Language Pathologist's Tool for Training Teachers was co-authored by Dr. Maura Moyle, associate professor of speech pathology and audiology. It serves as a complete resource for speech-language pathologists who want to promote phonological awareness

in classrooms, and contains lesson plans, exercises and training assessments for educators.

Poetry and Pedagogy Across the Lifespan: Disciplines, Classrooms, Contexts, co-edited by Dr. Angela Sorby, professor of English, examines the role of poetry in teaching and learning and argues that it is not a luxury but an important component of an interdisciplinary education, one that stimulates rich and cognitively challenging linguistic experiences.

Prisons and Punishment in America: Examining the Facts by Michael O'Hear, professor of law, synthesizes the latest scholarship on criminal sentencing and corrections to provide a thorough discussion of major policy issues in these fields.

Real Estate Finance in a Nutshell by Vada Waters Lindsey, associate professor of law, presents an overview of the law of real estate finance, including financing devices, tax issues, the mortgage market, government involvement and foreclosure.

Smart & Savvy: Negotiation Strategies in Academia is co-authored by Andrea Schneider, professor of law, and her father, Dr. David Kupfer, chair emeritus of the psychiatry department at the University of Pittsburgh. The project began when they recognized the lack of negotiation training for academics and started to develop the training

sessions, which were received with positive reactions and requests for more advanced instruction. The book serves as a framework to help academics navigate workplace communication and master negotiation skills.

The History of Childhood: A Very Short Introduction by Dr. James Marten, chair and professor of history, explores the realities of childhood throughout the millennia and how children are shaped by factors such as education, expectation and conflict.

PUBLICATION SPOTLIGHT

Westworld and Philosophy, co-edited by Dr. James South, professor of philosophy, is a collection of essays that explores the different philosophical puzzles within the HBO show, such as the nature of autonomy and the pursuit of liberation and free thought. It's a companion to the show for viewers looking to dive deeper into its philosophy.

Writes reviewer Scott McLemee in *Inside Higher Ed*, "The contributors fleshed out the background and the logic of an imagined world in which, as with a car's rearview mirror, objects may be closer than they appear."

Women, Enlightenment and Catholicism is a collection edited by Dr. Ulrich Lehner, professor of theology. It explores the cultural context of Catholic women in Europe and how they used Enlightenment values to articulate beliefs about their faith.

Marquette University P.O. Box 1881, Milwaukee, Wisconsin 53201-1881 USA

BIG IDEAS AND BREAKTHROUGHS DON'T HAPPEN BY CHANCE.



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At Marquette, there is no shortage of great ideas. Here, problem-solving, research and innovation are part of who we are. But support is needed for great ideas to be realized and breakthroughs to be made. With a gift to support research at Marquette, you can be part of something that's moving toward greatness — that will Be The Difference.

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