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WORCESTER POLYTECHNIC INSTITUTE

WPI RESEARCH

DISCOVERY & INNOVATION WITH PURPOSE

MARCH 2024 ISSUE

## AI and Mindfulness for Pain Management

WPI researchers received $1.6 million from the National Institutes of Health, with the potential for a total of $9 million, to determine whether artificial intelligence (AI) can help doctors steer people dealing with chronic pain away from potentially addictive opioids and toward mindfulness-based approaches. This study uses machine learning to predict which patients would benefit from mindfulness-based stress reduction (MBSR) for pain management. WPI researchers include Emmanuel Agu, Harold L. Jurist '61 and Heather E. Jurist Dean's Professor of Computer Science; Jean King, Peterson Family Dean of Arts and Sciences; Carolina Ruiz, Associate Dean of Arts and Sciences and Harold L. Jurist '61 and Heather E. Jurist Dean's Professor of

Computer Science; Angela Incollingo Rodriguez, assistant professor of psychological and cognitive sciences, Zheyang Wu, professor of mathematical sciences, and Benjamin Nephew, professor and assistant research professor of biology and biotechnology.

Read full story here →

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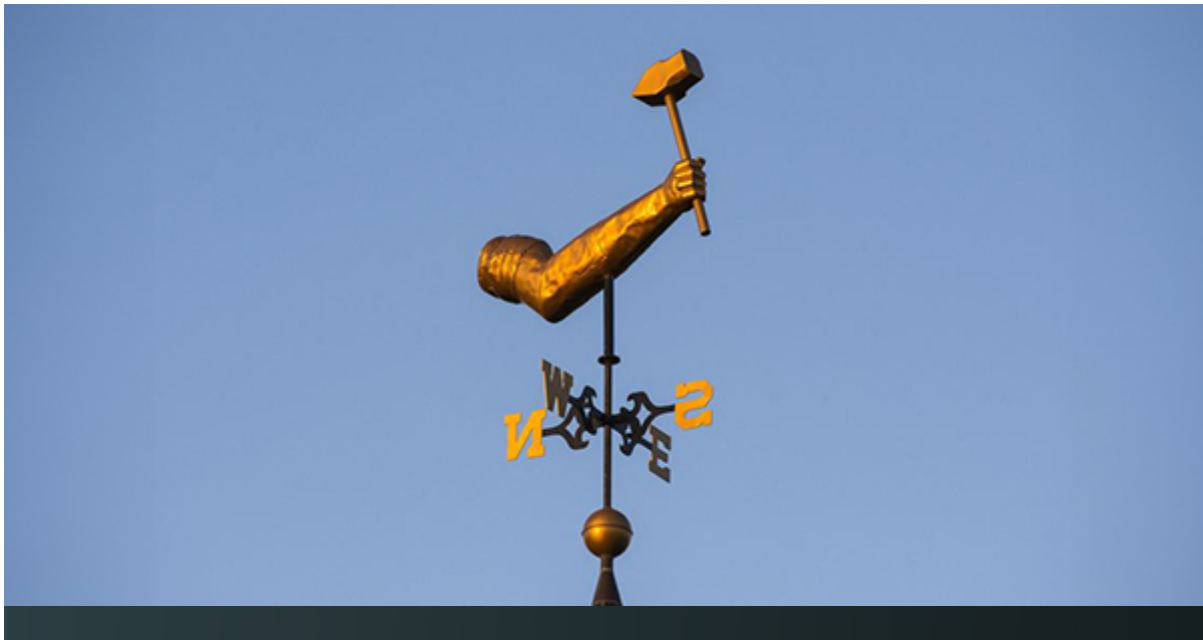
WPI Awards Promotions and/or Tenure to Faculty Members

WPI announced promotions and/or awards of tenure for 31 full-time faculty members, including the first nine faculty members to be awarded tenure through a new tenure track that recognizes excellence in teaching. The tenure track for teaching faculty was established in 2021 and is separate from the university's traditional tenure track, which recognizes faculty members for excellence in both teaching and research. "Tenure and promotion recognize the significant contributions that each has made to our students and to the wider community of scholars," said Art Heinricher, interim senior vice president and provost.

"They are exceptional teachers and advisors, internationally recognized scholars in their disciplines, and leaders for the future of WPI and for higher education."

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WPI Receives Award for Undergraduate Research

For its efforts in fostering a culture of innovation, inquiry, and academic excellence in student research, WPI was awarded the prestigious Council of Undergraduate Research (CUR) 2023 Award for Undergraduate Research Accomplishments (AURA). According to the CUR press release, "WPI exemplifies how investing in their faculty and students, showing passion for undergraduate research, and building a career-readiness mindset around undergraduate research provides a model for many other campuses to follow." WPI's focus on project-based learning is present in all aspects of the educational curriculum, including research opportunities in core courses, as well as in the humanities and arts requirement, Great Problems Seminar, Interactive Qualifying Project, and Major Qualifying Project.

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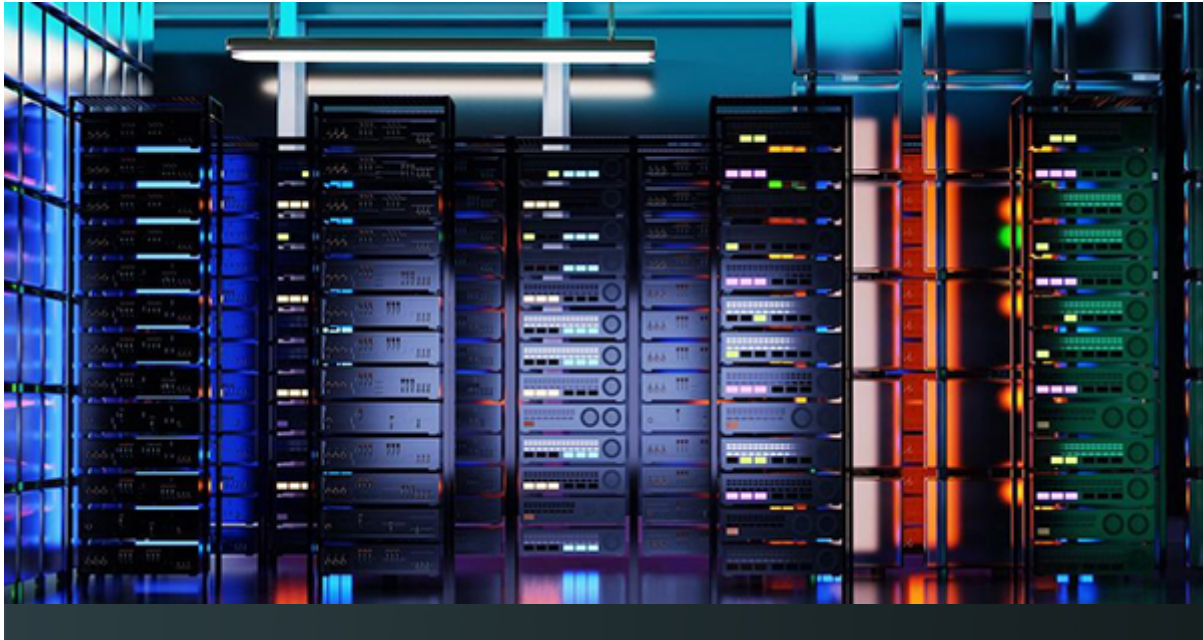
Improvements to AI Infrastructure Will Aid Research and Learning

WPI has created a new task force aimed at improving artificial intelligence (AI) infrastructure for workplace, research, and learning spaces. The goal of this group, composed of faculty and staff and led by Chief Information Officer Vijay Menta, is to invest in computing infrastructure to ensure that the university stays at the forefront of AI. The task force will also focus on AI-related security and privacy issues, as well as training opportunities. Representatives from all four of WPI's schools are involved, in addition to WPI experts in research computing, scientific data, and data security.

Read full story here →

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MEDIA COVERAGE

[President Wang Joins Massachusetts AI Task Force — *Axios Boston*]

Governor Maura Healey has appointed President Grace Wang to the state's Artificial Intelligence Strategic Task Force. Wang and 24 others on the panel, including those from higher education and the financial and tech industries, will make recommendations later this year to leverage AI across the Massachusetts economy to stimulate job creation and advance key sectors. Massachusetts's largest industries, higher education, and state operations could all potentially be transformed by AI as the technology expands. This task force aims to turn Massachusetts into an "applied AI hub" and to understand how AI can influence and transform various industries, including healthcare, biotech, education, and robotics.

[Vehicles' Influence on Society – *BBC Radio 4*]

The Global School Dean Mimi Sheller was interviewed for BBC Radio 4's *Analysis* program for an episode that explores the politics around driving, traffic policy, fuel taxes, and the political power of the motorist. Sheller, a scholar on mobilities who has lived in both the US and the UK, discussed the role of the vehicle in society, lifestyle (the influence of "soccer moms"), identity, and how the pandemic changed some mindsets and behaviors around driving. She said, "Cars are part of people's identity … People treat their cars often like a family member or pet ... For many disempowered groups, the car becomes a kind of cocoon."

[Increasing Climate Change Challenges – *Boston 25*]

Climate change is challenging infrastructure like seawalls, drainage culverts, and wastewater systems. Carrick Eggleston, professor and

head of WPI's department of civil, environmental, & architectural engineering, explained to *Boston 25* that extreme rainfall is happening more frequently in New England. In some places, a storm that used to have a one in a hundred chance of happening in a given year, now has a one in eight chance of happening. Eggleston recommends that residents research where they live as conditions change to better prepare for floods and other natural disasters. Due to climate change, there is an increased cost to improving infrastructure and worsening consequences of existing infrastructure limitations.

[Testing Price Fluctuations for Fast Food – *Agence France-Presse*]

The fast-food restaurant Wendy's announced it planned to test dynamic pricing, meaning products may cost more at times of peak demand and less in off-hours. Purvi Shah, associate professor of marketing in The Business School, analyzed the risk and potential reward for the company. She explained that demand elasticity, the additional cost the consumer will accept before abandoning the company, could determine Wendy's pricing success or failure. Shah recommends that companies who want to try dynamic pricing should be transparent about it since social media is known to harshly punish any corporate missteps.

Know someone who would love to hear about WPI's research?

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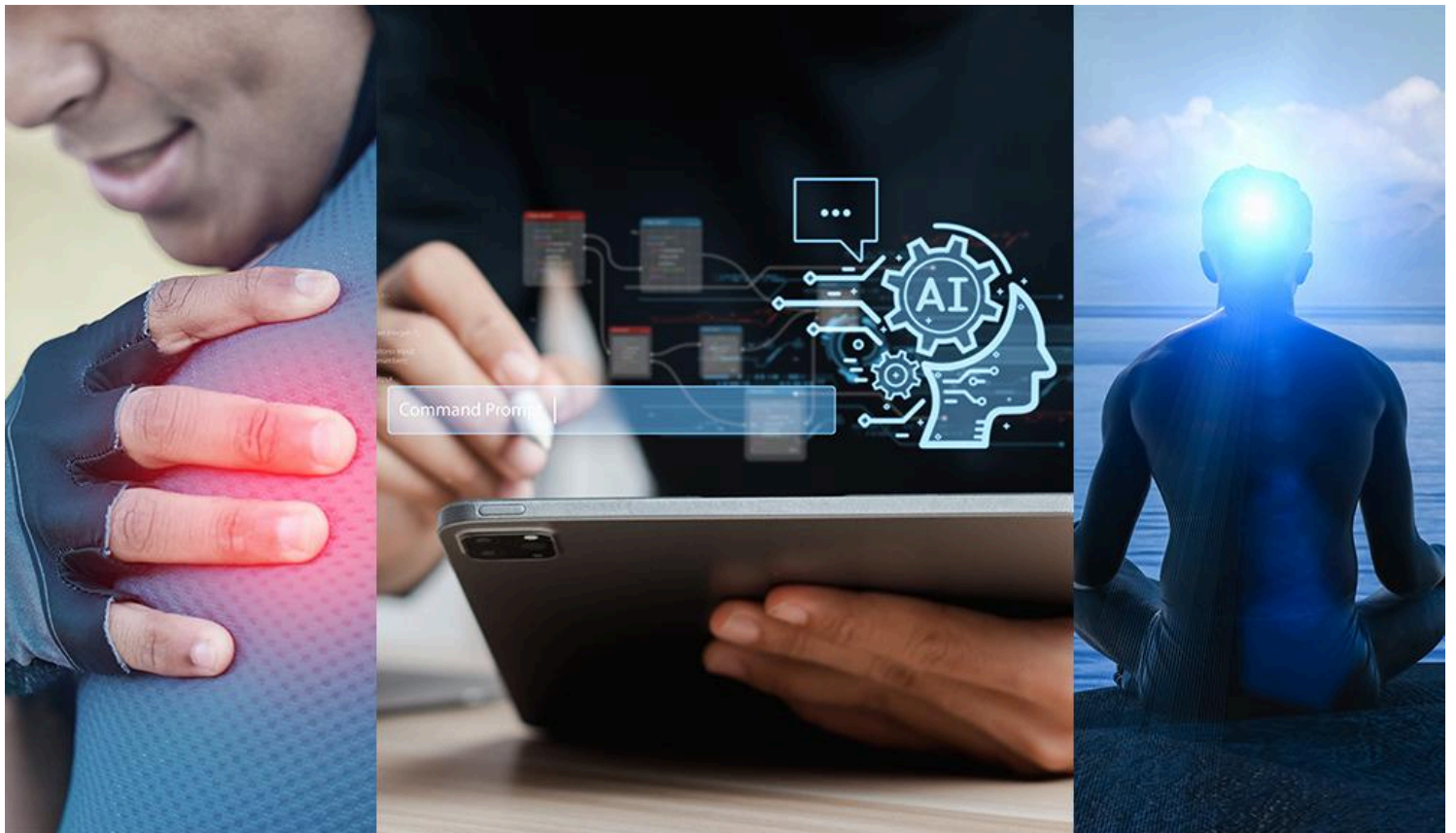Ph: +1-508-831-5000
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BEYOND THESE TOWERS

A New Prescription for Pain: AI and Mindfulness

NIH-funded study led by Worcester Polytechnic Institute will use AI to determine mindfulness treatments for chronic lower back pain to help patients avoid opiates

► LISTEN	00:00

Media Contact
Steven Foskett
Public Relations Manager
Marketing Communications

March 12, 2024

Worcester Polytechnic Institute (WPI) will lead a five-year study to determine whether artificial intelligence can help doctors steer people dealing with chronic pain away from potentially addictive opioids and toward mindfulness-based approaches.

The new National Institutes of Health (NIH) HEAL (Helping to End Addiction Long-term) initiative-funded study will employ machine learning, a form of artificial intelligence, to look for clues in patient data that could help doctors better determine who is likely to benefit the most from mindfulness-based stress reduction, or MBSR, in managing their pain.

"For physicians, it will be a new day," said Jean King, the Peterson Family Dean of Arts and Sciences at WPI. "To be able to predict who would respond well to non-pharmacological interventions will truly save lives."

WPI has received $1.6 million in NIH funding to start designing the trial; if the team's defined benchmarks are met, the research team and the university could receive a total of nearly $9 million in research funding over the course of the next five years.

The findings of the study could give healthcare providers powerful tools to help people avoid taking opioids that can lead to lifelong struggles with addiction. Over-reliance on opioids for pain management can have devastating consequences; in 2021, more than 16,000 people died from prescription-opioid-related overdoses, and more than 80,000 people died from overall opioid-related overdoses, one death every 6 minutes. There have been concerning increases in opioid-related deaths in Black and Native American populations.

At the same time, chronic pain is also a major concern. A recent U.S. Centers for Disease Control and Prevention Morbidity and Mortality Report estimated that more than 51 million people–more than 20% of U.S. adults–have chronic pain.

Previous studies have found that MBSR is effective in helping people deal with chronic pain, but the mindfulness-based approach does not work for everyone, and doctors and clinicians don't know exactly for whom it would work and why.

Focusing specifically on chronic lower back pain in diverse populations, the study will glean physiological data such as sleep patterns, heart rate, and general physical activity collected via fitness sensors worn by 350 participants during a six-month trial. Combined with self-reported information on depression, anxiety, pain, and levels of social

support, the data will be analyzed by custom-designed machine learning models to detect patterns that might be impossible for a doctor to notice. The information will allow the model to predict whether a patient would beneficially respond to mindfulness, helping doctors better tailor treatments for individual patients.

That predictive power could prove to be a powerful tool for physicians who previously may have been wary of prescribing mindfulness-based stress reduction, said Carolina Ruiz, the WPI Associate Dean of Arts and Sciences and Harold L. Jurist '61 and Heather E. Jurist Dean's Professor of Computer Science, who has been involved in researching and teaching machine learning for more than two decades. She added that the machine learning model used in the study will be interpretable–doctors and researchers will be able to pinpoint exactly why a patient may or may not respond well to mindfulness methods.

"It will save time for the patient—they won't have to go through a treatment that isn't going to help," she said. "It will also save a lot in healthcare costs and could be applicable to other types of pain and other types of treatment."

The study, dubbed Integrative Mindfulness-based Predictive Approach for Chronic low back pain Treatment, or IMPACT, will bring together a diverse group of researchers at WPI, UMass Chan Medical School, and Boston University Chobanian & Avedisian School of Medicine. Along with King and Ruiz, WPI faculty researchers include Emmanuel Agu, the Harold L. Jurist '61 and Heather E. Jurist Dean's Professor of Computer Science and MPI, Angela Incollingo Rodriguez, assistant professor of psychological and cognitive sciences, Zheyang Wu, professor, mathematical sciences, and Benjamin Nephew, assistant research professor, biology and biotechnology.

Meet the team

∨ **Ben Nephew**

∨ **Zheyang Wu**

∨ **Angela Incollingo Rodriguez**

Agu's expertise in analyzing sensor data using smartphones and fitness trackers will play a critical role in the study. The devices will track several data points, but Agu said of particular interest to researchers will be participants' circadian rhythms–sleep and wake cycles.

"Sleep has an immense impact on our overall health," said Agu, who is a co-principal investigator on the study. "An individual in pain is more likely to experience broken sleep, which can lead to a host of other health issues. Mindfulness-based approaches may help participants sleep better, which can reduce some of those other risk factors."

The study will include racially and ethnically diverse populations typically underrepresented in both the research and practice of mindfulness-based stress reduction, despite being at increased risk for stress, chronic pain, and the associated adverse outcomes they bring. Participants will be recruited from the Boston metro region through Boston Medical Center and Cambridge Health Alliance, and from the Worcester region through UMass Chan and WPI.

∧

> **For physicians, it will be a new day. To be able to predict who would respond well to non-pharmacological interventions will truly save lives.** »

Jean King
Peterson Family Dean of Arts and Sciences

> JEAN KING

Partners on the grant and community leaders are excited for the work to begin.

Dr. Natalia Morone, associate professor of medicine at Boston University Chobanian and Avedisian School of Medicine, a primary care physician at Boston Medical Center, and a co-principal investigator on the study, said the key will be identifying specific markers that indicate people will respond to mindfulness treatment. "We are doing this in an innovative way because we are using machine learning to figure this out" Morone said. "I am very excited to partner with my colleagues at WPI and UMass Chan to accomplish this study. It has the potential to help many people."
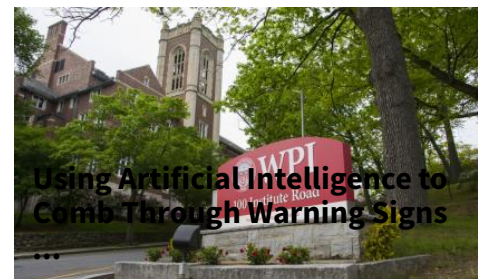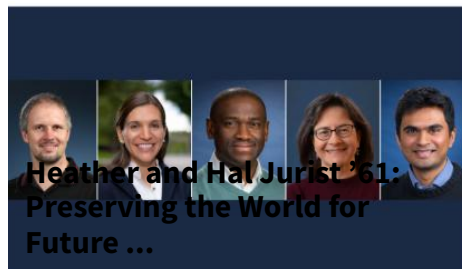
Dr. David D. McManus, the Richard M. Haidack Professor in Medicine and chair and professor of medicine at UMass Chan, said the medical school will bring invaluable experience to the study gained from overseeing the cores of prominent studies, such as the Framingham Heart Study, National Institutes of Health Rapid Acceleration of Diagnostics (RADx) initiative, and the Risk Underlying Rural Areas Longitudinal (RURAL) study.

"The wealth of knowledge accumulated through the administration and management of critical components in these studies positions us at the forefront of groundbreaking research," McManus said. "Our enthusiasm is heightened as we join forces with WPI and BU under the capable leadership of Jean King."

Dr. Matilde Castiel, commissioner of health and human services in Worcester, said AI is a tool to help the healthcare system deliver better and more personalized care.

"I am thrilled that WPI will use AI to address chronic back pain and make an impact on the opioid epidemic, which is truly a public health emergency not only in our city and state, but nationally," Castiel said. "This intervention can decrease the reliance of opioids for chronic back pain and provide a more targeted approach that is specific to the individual."

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WPI Announces Faculty Promotions and Tenure Awards

For the First Time, Professors Who Focus on Teaching Receive Awards of Tenure

February 28, 2024

Worcester Polytechnic Institute (WPI) today announced that 31 full-time faculty members have been promoted and/or awarded tenure. For the first time, those awarded tenure include faculty members from the university's tenure track for professors who focus on excellence in teaching.

"It is an honor to congratulate these remarkable members of our WPI community," said <u>Arthur Heinricher</u>, interim senior vice president and provost. "Tenure and promotion recognize the significant contributions that each has made to our students and to the wider community of scholars. They are exceptional teachers and advisors, internationally recognized scholars in their disciplines, and leaders for the future of WPI and for higher education."

All promotions and awards of tenure take effect July 1, 2024.

Tenure at WPI, like other U.S. colleges and universities, has long been a distinction awarded to faculty members who focus on both teaching and research. Other faculty members hired to focus on teaching typically worked under short-term contracts and did not have the opportunity to pursue tenure.

Beginning in fall 2021 and after years of discussions among faculty, administrators, and university trustees, <u>WPI launched a second tenure track</u> for the teaching faculty. <u>A total of 43 individuals were appointed to the track</u> over the past three years and received titles of assistant, associate, or full professor of teaching.

The following faculty members are the first to be awarded tenure on WPI's teaching track:

- <u>Marcel Blais</u>, professor of teaching in the Department of Mathematical Sciences

- <u>Esther Boucher-Yip</u>, professor of teaching in the Department of Humanities and Arts

- <u>Farley Chery</u>, associate professor of teaching in the Interactive Media and Game Development Program

- <u>Destin Heilman</u>, professor of teaching in the Department of Chemistry and Biochemistry

- <u>Ryan Madan</u>, associate professor of teaching in the Department of Humanities and Arts

Top row, from left: Marcel Blais, Esther Boucher-Yip, Farley Chery. Middle row from left: Destin Heilman, Ryan Madan, Buddika Peiris. Bottom row, from left, Geoffrey Pfeifer, Elisabeth Stoddard, Sarah Wodin-Schwartz

- <u>Buddika Peiris</u>, associate professor of teaching in the Department of Mathematical Sciences

- <u>Geoffrey Pfeifer</u>, associate professor of teaching in the Department of Integrative and Global Studies

- <u>Elisabeth Stoddard</u>, associate professor of teaching in the Department of Integrative and Global Studies

- <u>Sarah Wodin-Schwartz</u>, associate professor of teaching in the Department of Mechanical and Materials Engineering

"Five years after a group of dual mission and teaching mission faculty members first conceived of the idea, today's announcements bring to life with real examples the power and promise of a teaching path to tenure," said Mark Richman, WPI's secretary of the faculty. "At this historic moment, we should congratulate our newly tenured colleagues for their outstanding achievements; we should be proud of the WPI faculty, administration, and Board of Trustees for their forward thinking; and we should redouble our efforts to share our institutional model with all colleges and universities looking to properly value the contributions of their teaching faculty."

In addition to the nine teaching faculty members who have been awarded tenure, six other faculty members are being promoted to full professor, eight are being awarded tenure and promoted to associate professor, and eight more are being promoted to associate or full teaching professor.

Mahdi Agheli has been promoted to associate teaching professor in the Department of Robotics Engineering.

Mahdi Agheli

Andrea Arnold has been awarded tenure at WPI and promoted to associate professor in the Department of Mathematical Sciences.

Andrea Arnold

Marja Bakermans has been promoted to teaching professor in the Department of Integrative and Global Studies.

Marja Bakermans

Mehul Bhatia has been promoted to associate teaching professor in the Department of Mechanical and Materials Engineering.

Mehul Bhatia

Berk Calli has been awarded tenure at WPI and promoted to associate professor in the Department of Robotics Engineering.

Berk Calli

Danielle Cote has been awarded tenure at WPI and promoted to associate professor in the Department of Mechanical and Materials Engineering.

Danielle Cote

Yarkin Doroz has been promoted to associate teaching professor in the Department

Michael Johnson has been promoted to teaching professor in the

Greg Lewin has been promoted to associate teaching professor in the

Yarkin Doroz of Electrical and Computer Engineering.

Michael Johnson Department of Mathematical Sciences.

Greg Lewin Department of Robotics Engineering.

Chun=Kit Ngan

Chun-Kit Ngan has been promoted to associate teaching professor in the Data Science Program.

David Olinger

David Olinger has been promoted to professor in the Department of Aerospace Engineering.

Carissa Olsen

Carissa Olsen has been awarded tenure at WPI and promoted to associate professor in the Department of Chemistry and Biochemistry.
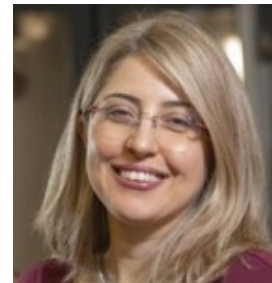

Michael Radzicki

Michael Radzicki has been promoted to professor in the Department of Social Science and Policy Studies.

Charles Roberts

Charles Roberts has been awarded tenure at WPI and promoted to associate professor in the Department of Computer Science.

Sara Saberi

Sara Saberi has been awarded tenure at WPI and promoted to associate professor in The Business

Lyubov Titova

Lyubov Titova has been promoted to professor in the Department of Physics.

Walter Towner

Walter Towner has been promoted to teaching professor in The Business School.
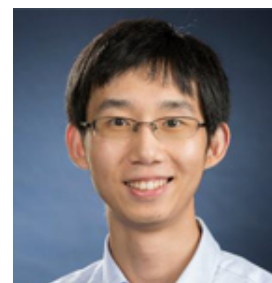

Andrew Trapp

Andrew Trapp has been promoted to professor in The Business School.

Sam Walcott has been promoted to professor in the

Eric Young has been awarded tenure at WPI and promoted to associate

Haichong Zhang has been awarded tenure at WPI and promoted to

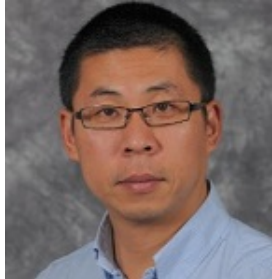**Sam Walcott** Department of Mathematical Sciences.

Eric Young professor in the Department of Chemical Engineering.

Haichong Zhang associate professor in the Departments of Biomedical Engineering and Robotics Engineering.

Yu Zhong

Yu Zhong has been promoted to professor in the Department of Mechanical and Materials Engineering.

WPI Expert Database

Faculty members and senior administrators are available to offer ideas, opinions, analysis, and commentary on issues ranging from higher education to current events, trending topics, and breaking news.

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WPI Announces 13 for Teaching Faculty

WPI Announces Faculty Promotions and Tenure Awards

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Worcester Polytechnic Institute Earns Prestigious Award for Outstanding Undergraduate Research Achievements

WPI lauded as a model for other higher ed institutions to follow

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February 28, 2024

Worcester Polytechnic Institute (WPI) has received the prestigious Council of Undergraduate Research (CUR) 2023 Award for Undergraduate Research Accomplishments (AURA), underscoring the university's commitment to fostering a culture of innovation, inquiry, and academic excellence.

CUR is a leading advocate for high-quality undergraduate student-faculty collaborative research and scholarship. The AURA acknowledges institutions that demonstrate exceptional support for undergraduate research and creative inquiry experiences in classrooms, teaching laboratories, and faculty-led research groups, highlighting dedication to empowering students to engage in meaningful research experiences.

Grace J. Wang, PhD, President of Worcester Polytechnic Institute, expressed her delight at receiving this esteemed recognition, stating, "At WPI, we are deeply committed to providing our students with transformative educational experiences in the classroom and beyond. This distinguished award from the Council of Undergraduate Research is a testament to the outstanding efforts of our students, faculty, and staff in pushing the frontiers of knowledge and advancing technologies through collaborative research efforts."

> **" This distinguished award from the Council of Undergraduate Research is a testament to the outstanding efforts of our students, faculty, and staff in pushing the frontiers of knowledge and advancing technologies through collaborative research efforts. "**
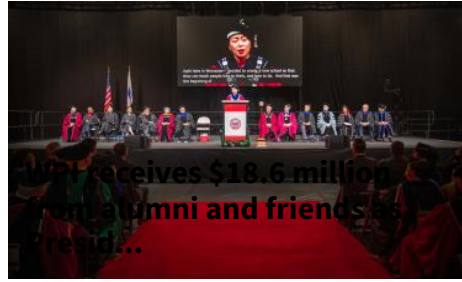>
> **Grace J. Wang, PhD, WPI President**

A leader in experiential undergraduate education and research excellence, WPI's holistic and deliberate approach to project-based education integrates research and design experiences into the entire curriculum, building a scaffold of various research projects throughout a student's journey. In addition to having project experiences in the majority of their classes, all WPI undergraduate students must complete three research projects prior to graduation, including the Interactive Qualifying Project (IQP), Major Qualifying Project (MQP), and a humanities and arts project requirement. Nearly a third of first-year students also take part in a Great Problems Seminar. This commitment to hands-on research, design, and creative inquiry ensures that WPI is empowering the next generation of innovators, scholars, and leaders who will shape the future and make a positive impact on society. WPI's rigorous experiential learning approach ensures students are not only career-ready but also career-resilient, equipped with skills to adapt to changes in the rapidly evolving fields of science and technology.

According to the CUR press release, "WPI exemplifies how investing in their faculty and students, showing passion for undergraduate research, and building a career-readiness mindset around undergraduate research provides a model for many other campuses to follow."

2023 AURA awardees also include the College of Saint Benedict and Saint John's University, and the University of Florida. CUR will hold a virtual award celebration honoring this year's awardees on June 11, 2024, 2:00 – 3:30pm ET.

For more information about Worcester Polytechnic Institute's undergraduate research programs, visit: https://www.wpi.edu/project-based-learning.

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Building the AI Infrastructure at WPI

New task force eyeing AI infrastructure improvements for workplace, research, and learning spaces

▶ LISTEN	00:00

BY: STEVE FOSKETT

Artificial intelligence has captured the world's attention, but it's not new to the WPI community—the school has been steeped in AI-related teaching, learning, and research for decades. A newly formed group of faculty and staff is now looking at how to invest in computing infrastructure to ensure the university stays at the forefront of AI for years to come.

Part of the AI initiative at WPI, the AI Technology Task Force, led by Chief Information Officer Vijay Menta, is charged with ensuring that the school's computing infrastructure can handle the increased demand.

"We are a STEM school that has been leading in this area for many years, so it is a natural progression toward AI," Menta said. "We want to continue to lead in this space, and serve both existing and future students, researchers, and faculty members in this AI era."

The task force focuses on how infrastructure improvements will facilitate AI integration in three areas: research, teaching and learning, and administration. That might mean a virtual assistant to help staff transcribe meetings or develop reports, assistive classroom devices, or chatbots that guide prospective students through the application process.

"Vijay brings the right knowledge and skills to lead this collaboration," said WPI President Grace J. Wang, Ph.D. "Working with faculty governance and in consultation with faculty and staff experts, the task force will develop a comprehensive AI technology enhancement strategy that is aligned with WPI's academic, research, and operational goals. The task force will assess, analyze, and strategically plan for our emerging research, education, and administrative needs, with emphasis placed on security and ethical considerations."

Menta said the university currently has the capacity to meet the various demands on its technology infrastructure, but it's important to plan for the future. For example, students applying to WPI's new master's in AI program will likely have additional high-powered computing needs, he said.

"We're on the cusp of a great tech inflection," Menta said. "The AI Technology Task Force is basically saying 'it's great that we're going to have all these tools. But how do we make them work for us, and how do we make them work together?'"

As it continues its work, the AI Technology Task Force will examine ways to encourage interdisciplinary collaboration among WPI's four schools, both to ensure seamless integration of AI technologies and to maximize the impact of infrastructure investments across all disciplines. Also included in the task force's charge is a focus on security and privacy, and assisting with the establishment of guidelines and policies for ethical AI practices within the WPI community by working with other subcommittees.

> **" We're on the cusp of a great tech inflection. The Technology Task Force is basically saying 'it's great that we're going to have all these tools. But how do we make them work for us, and how do we make them work together?' "**

Vijay Menta
Chief Information Officer

> VIJAY MENTA

Menta is joined on the task force by Sia Najafi, executive director, academic and research computing group; James Kingsley, director of high performance computing and faculty support; Ermal Toto, director of scientific data, applications, and web development; and LeeAnn LeClerc, chief information security officer.

Representatives from all four schools are also involved: Craig Shue, computer science professor and department head from the School of Arts and Sciences; Diane Strong, professor and department head from The Business School; Berk Sunar, professor of electrical and computer engineering; Nitin Sanket, associate professor of robotics engineering, from the School of Engineering; and Seth Tuler, associate professor from The Global School.

Menta said developing training for new technology will also be a crucial component of any long-term plan and added that feedback and engagement will be welcomed as WPI plans for long-term investment in the AI space. He said that with building on the current robust training and tutoring program already in place, the university plans to introduce more courses related to AI very soon, geared toward students to assist with their coursework, and for any community members who want to learn the basics of AI. He said he expects to provide periodic updates to the university community moving forward.

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