



FLORIDA INSTITUTE FOR HUMAN & MACHINE COGNITION

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Dear Friends,

I hope you have weathered the past year and the many challenges we have all faced as a result of COVID-19. We, like many others, had to limit access to our buildings for a while. Although it created inconveniences, it didn't put a stop to the research and innovation that we are known for here at IHMC.

Our exoskeleton team is a good example. Despite COVID-19, the team overcame significant obstacles to compete as one of five international finalists in the \$4 million Mobility Unlimited Challenge sponsored by the Toyota Mobility Foundation. Led by Dr. Robert Griffin, the exoskeleton team also participated virtually in the 2020 Cybathlon, an international competition for people with disabilities supported by modern assistive technology, an event that attracted 51 teams from 20 countries (pages 3-7).

A new project funded by the Department of Energy, and in collaboration with Sandia National Labs and Georgia Tech, will develop and test advanced wearable robotics technology to support the workforce engaged in DOE's nuclear remediation projects.



Some other IHMC highlights you'll find in the newsletter:

- Since our founding in 1990, IHMC has focused on the development of science and technology that leverages and extends human performance. Our research toward that goal has focused primarily on artificial intelligence, robotics, computer science, and related fields. In recent years, we have expanded our research scope to include a range of biological means to extend the performance and resilience of our elite military forces, astronauts, and others.
- On page 8, you'll read about our Chief Science Officer, Dr. Tim Broderick, and a DARPA-sponsored initiative called the Peerless Operator Biologic Aptitude project, or Peerless. Tim and his colleagues are tasked with developing a revolutionary platform that integrates an understanding of information-dense molecular expression systems, predictive models, and real-time in vivo sensors to enhance the training and resilience of elite operators.
- As a member of the National Security Commission on Artificial Intelligence, I've spent the past two years helping draft a 756-page report for the President and Congress that provides a blueprint for the development of AI and associated technologies that will allow us to address the national security and defense needs of the U.S. The report was just released and stresses that the nation presently is unprepared to compete in a future enabled by AI. The commission's most significant finding is that the U.S. could soon be overtaken as the world's AI superpower by China (page 9). I realize hardly anyone has time to read a 756-page report, but the executive summary, which can be found at NSCAI.gov, is worth checking out.
- While we had to postpone our popular evening lecture series last year, we were able to continue our educational outreach through our Science Saturdays program for elementary school children (pages 14 and 15) and our award-winning podcast STEM-Talk. The International Academy of Digital Arts and Sciences singled out STEM-Talk last year as one of the five best podcasts in the world in the science and education category (pages 16 and 17).

Despite the challenges of the past year, our scientists were able to lay the groundwork for new projects that will elevate our research in 2021. We accomplished a lot of good things in 2020, but it was this groundwork that has given us strong momentum as we head into the coming year. So, stay tuned. I think you'll be impressed with what's on the horizon for IHMC.

Ken Ford

Ken Ford

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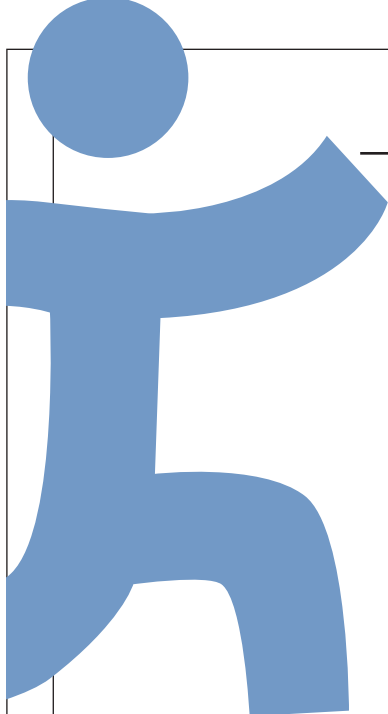
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IHMC's exoskeleton team competes as finalists in two international competitions

The exoskeleton team at IHMC pulled double-duty in 2020, competing as finalists in two international competitions designed to highlight the impact that exoskeleton technology can have on improving the everyday lives of people with lower-limb paralysis.

IHMC was one of five finalists from around the world to receive a \$500,000 grant as part of a \$4-million competition sponsored by the Toyota Mobility Foundation. The grant allowed IHMC to further develop its exoskeleton prototype that had previously placed second in the 2016 Cybathlon, the world's first international competition for people with disabilities supported by modern assistive technology. Sponsored by the Swiss Federal Institute of Technology, the Zurich event attracted 66 teams from 25 countries.

For the 2020 Cybathlon, 51 teams from 20 countries competed virtually this past

fall rather than in Zurich because of the COVID-19 pandemic. The Mobility Unlimited Challenge sponsored by the Toyota Mobility Foundation had scheduled its five finalists to travel to Tokyo following the Olympics this past September, but also due to COVID-19 turned the Challenge into a virtual competition with teams competing from their home bases.

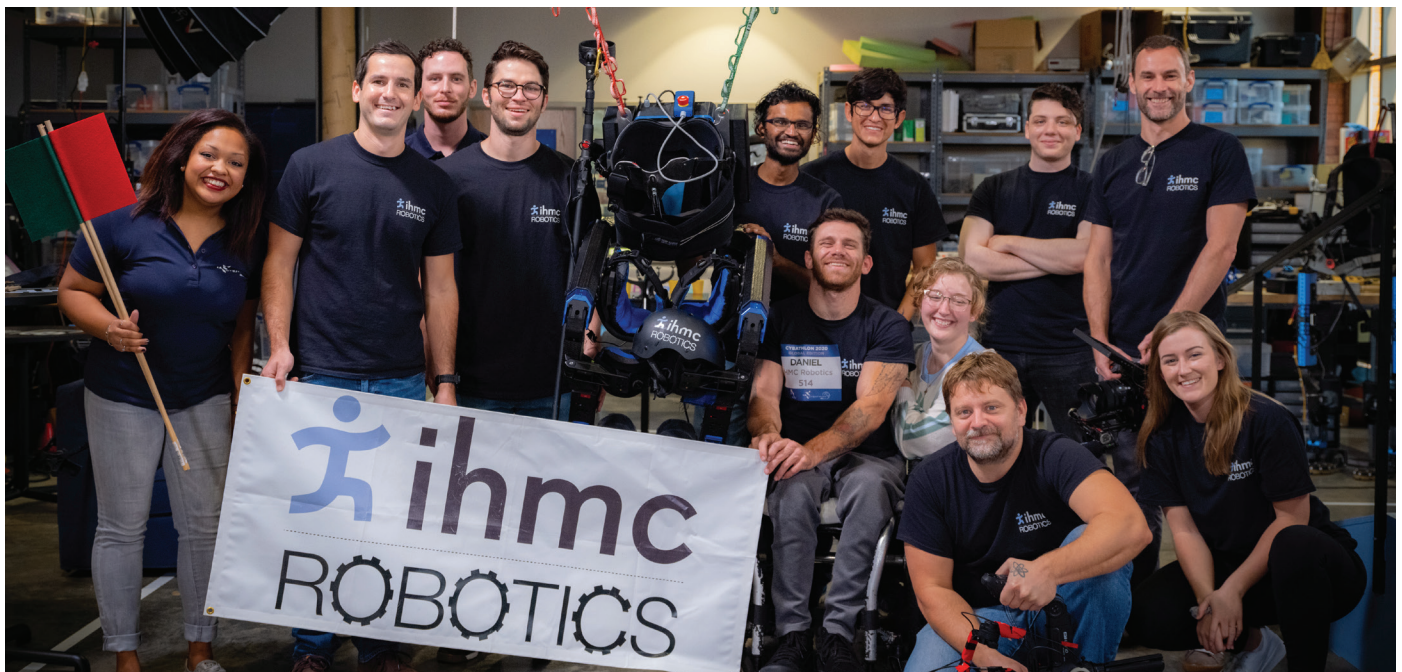
Despite staff changes and a pandemic that altered the landscape for the exoskeleton team, IHMC was a runner-up in the Mobility Unlimited Challenge and placed fourth in the world in the Cybathlon's exoskeleton competition.

"It was amazing to see what the other teams were able to do," said Dr. Robert Griffin, who leads IHMC's exoskeleton team. "But it felt even better to see our team and Quix stand toe-to-toe with competitors from around the world and finish strong."

Quix is IHMC's fourth exoskeleton prototype. It's a wearable robotic device with motors at the hips, knees and ankles as well as additional actuators that offer someone with lower-limb paralysis fast, stable and agile upright mobility. The device stands out because it provides people with mobility and independence that current exoskeletons, as well as wheelchairs, cannot.

The Mobility Unlimited Challenge and Cybathlon allowed IHMC to demonstrate that Quix is a game-changing technology geared toward improving the lives of millions of people with spinal-cord injuries and lower-limb paralysis. As Griffin points out, exoskeletons can go many places that wheelchairs can't. It's very possible that one day soon exoskeletons will make wheelchairs obsolete.

"The ability to make it to the finals in both these competitions is testament



IHMC's exoskeleton team that competed in two international competitions, the 2020 Cybathlon and the Toyota Mobility Unlimited Challenge.

to the team and the program at IHMC and the culture we have built here,” said Griffin. “We have this history of innovating the way that people approach walking robots and exoskeletons. We are researching a really hard subject. It’s something we are all passionate about and something we all care about. From the work being rewarding, to being able to do something really meaningful, that goes a long way in motivating us.”

MOBILITY UNLIMITED CHALLENGE

The road to the \$4 million Mobility Unlimited Challenge began in 2018 in a process that led to IHMC and four other teams in the world being selected as finalists in 2019 by the Toyota Mobility Foundation. The five teams were each given \$500,000 grants and a year to further develop their prototypes.

Ryan Klem, director of programs for the Toyota Mobility Foundation, described the challenge as a way to harness “the greatest minds in technology, design and engineering from every corner of the world” to improve accessibility for people with lower-limb paralysis. “We know we don’t have solutions yet. This Challenge is about working with the people who can help develop them.”

The Toyota Mobility Foundation asked each of the five finalists to develop assistive technology that would make drastic improvements in the independence of people with mobility impairments. IHMC’s exoskeleton stood out because of its motors that help stabilize the user. The goal, said Griffin, was to demonstrate that a user could go from a sleeping position into the Quix device and then immediately navigate the real-world environment.

Team member Mark Daniel piloted the Quix during both competitions. He is a welder by trade who was paralyzed in a car accident more than a decade

ago. Daniel has been a part of IHMC’s exoskeleton team since 2010 and is the reminder of the real-life impact IHMC’s work can have, something software engineer, Brandon Peterson, stresses.

“Imagine asking someone to hop into this device with eight powerful motors,” said Peterson, the lead software and control engineer on Quix. “This is a dangerous device if it’s not controlled exactly right. It has the potential to do serious damage. Just Mark’s personality and willingness to go for it is the main thing that enabled us to be a success. He’s such an awesome guy.”

Quix is a thing of science, but it was Daniel who helped add human touches to the device. He spearheaded the work on the areas where the device touched his body. Beyond that, the legs are carbon fiber that Daniel helped build himself.

In the Mobility Unlimited Challenge, Daniel took Quix through the routines of a typical day: get out of bed, leave the house, catch a ride and head to work. Daniel showed Quix can help him open a door, walk down inclines and access public transportation. Things, Griffin says, that easily can be taken for granted until they are taken away.

“Quix allows people who are paralyzed the ability to look someone in the eye, stand face to face with them and have conversations,” said Griffin. “The psychological impact of that is enormous. It is why Mark stood up with Quix and got coffee filters out of the breakroom cabinets. The ability to stand and wash dishes, little things that I completely take for granted, are suddenly possible for Mark with a device like this.”

At the moment, Quix is not a device



Mark Daniel demonstrates how Quix helps him navigate uneven terrain.

that people can take home and use. It is a research device designed to demonstrate what is possible. “We want to push what is possible forward,” Griffin said.

A LONG ROAD

Dr. Peter Neuhaus, who for more than a decade was the lead research scientist on IHMC’s exoskeleton efforts, left the institute at the beginning of 2020 to pursue a commercial opportunity. Several others from IHMC’s exoskeleton team also joined Neuhaus for the new venture just as COVID-19 started to become a pandemic, leaving Griffin and a handful of other engineers a small window of time to prepare for both finals.

Griffin stepped in as the new team leader. He earned a Ph.D. from Virginia Tech in 2017 with a primary research focus on the control of bipedal robotic mobility for humanoids and exoskeletons. He spent time helping IHMC in the 2016 Cybathlon before returning in 2017 as a full-time research scientist.

Griffin also currently leads the Office

of Naval Research’s SquadBot and Fast Behaviors projects, where the goal is to develop a next-generation humanoid robot called Nadia. In addition to this, Griffin is also a key researcher in the NASA Johnson Space Center’s Val-EOD project, where the goal is to develop humanoid robots to function as explosive-ordnance-disposal technicians.

New parts for the exoskeleton that IHMC had been able to order because of the Toyota Mobility Foundation’s grant began arriving just as COVID-19 started to spread and affect everyone’s day-to-day business and life. Peterson took the parts home and began assembling them during the early days of the pandemic.

“It was like, ‘Here’s the robot mostly assembled, see if you can make it work,’” said Peterson. “When COVID hit hard, I took the robot home. It was wake up, go into the next room, and start working. We could not afford to stop working for a couple of months.”

Peterson, who grew up in Pace, began working at IHMC as an intern in the summer of 2018 before becoming a

full-time researcher in 2019. He is now pursuing his Ph.D. at UCLA.

The Cybathlon competition, originally scheduled for Zurich in May, was pushed back to November, something Peterson calls a blessing in disguise. The extra time gave the team a cushion they needed.

“At home I only had the ability to tune the walking gait from what I could see. At the lab, I would get in the device, strap it on, and try it out. We lost some of that time,” Peterson said. “I made up for the lost testing by focusing on the tests I would have worked on later down the road, which ended up being more complicated than originally thought.

“It’s an absolute miracle that we were able to enter the competition and have a complete run,” Peterson said. “Just the fact we got that thing working and it was safe enough for Mark to get in it and compete and place fourth was a miracle.”

CYBATHLON 2020

The 51 teams from around the world that competed in the Cybathlon demonstrated a wide array of innovative adaptive technology. Rather than participate in person, teams competed virtually from their home bases by broadcasting their performances live to judges in Zurich.

IHMC’s main competition was a Swiss team and a Korean team with two entries. Both teams had been testing and refining their devices for quite some time. Neither of the other teams had competed in the Mobility Unlimited Challenge either, unlike IHMC, which prepared for the two back-to-back international competitions at the same time.

Peterson says the Cybathlon represented “an extremely stressful week” — one that included a snagged cord that fried some of the electronics forcing the team to troubleshoot days before the competition.

“The day before the competition we couldn’t get through a complete



Dr. Robert Griffin stepped in last year to lead the exoskeleton team.

run without the device faulting,” said Peterson. “We were just going to do the best we could... and Mark was killing it on every one of the obstacles, which made it worse because we felt as if we were letting Mark down.”

Competition day came and after one problem on the first challenge — stacking cups on a table — “the rest of the run was flawless,” said Peterson. “As Mark crossed the finish line, you could almost hear the exhale. The fact that we got a complete run in was just amazing,” Peterson said.

WHAT'S NEXT?

Since the end of the Cybathlon, IHMC has been transitioning away from assistive exoskeletons for people who are paralyzed and moving toward exoskeletons for able-bodied workforces. A new project funded by the Department of Energy (DOE) is allowing the exoskeleton team to investigate how existing and new wearable robotic systems can help workers around the country.

In collaboration with Sandia National Labs and Georgia Tech, IHMC is exploring how wearable robotic systems

can be incorporated into nuclear remediation projects. DOE’s Office of Environmental Management is responsible for addressing the nation’s legacy of nuclear weapons production as well as government-sponsored nuclear energy research.

Nuclear remediation work is physically demanding and is exasperated by personal protective equipment that includes protective suits and breathing apparatus. Because of the nature of the work and limitations imposed by the personal protective equipment, workers face a number of ergonomic injuries.


IHMC’s collaboration with Sandia and Georgia Tech is exploring the usefulness of custom-designed exoskeletons that DOE could use for its workforce. The three organizations are also establishing an exoskeleton testbed to evaluate the efficiency of existing devices and the effectiveness of modifications to other commercial devices.

IHMC is responsible for the design of a novel lower-body exoskeleton to help workers carry the necessary personal protective equipment needed for DOE remediation sites. The role of

this device will be to transfer the heavy loads that workers will have to carry on to the exoskeleton, which will eliminate the stress that humans feel on their musculoskeletal system.

“The goal is to decrease the overall physical burden on workers,” said Griffin. “This will reduce injuries, increase worker efficiency and extend the working lifespan of DOE employees involved in remediation projects.”

Griffin also points out that with the design and manufacture of an exoskeleton like this, a number of new research avenues will open up for IHMC. If the new device is able to help people carry these heavy loads and increase the efficiency of workers, there will be a number of cross-industry applications for the exoskeleton team to pursue.

“With an aging workforce, what we’re hoping for is that after five years, workers don’t have the same physical wear and tear that they have now,” said Griffin. “This is technology that along with personal protective equipment not only protects the outside of the body, but wearable technology that can also protect the inside.” 



Quix engineer Vishnu Aishwaryan Subra Mani cheers on Mark Daniel during the Cybathlon.

Dorr receives prestigious DARPA appointment and also named ACM fellow

IHMC Senior Researcher Dr. Bonnie Dorr has been named a fellow of the Association of Computing Machinery (ACM). She is one of 95 fellows ACM is honoring this year for contributions in computing and information technologies.

Dorr is the associate director of IHMC's Ocala branch. She is recognized as one of the nation's leaders in the field of natural-language processing. Her induction into ACM follows Dorr's appointment by the Defense Advanced Research Projects Agency (DARPA) to its Information Science and Technology Study Group for a three-year term.

"Bonnie is so worthy of her DARPA appointment as well as the recognition she received from ACM," said IHMC CEO Ken Ford. "Bonnie's expertise extends from cybersecurity to social computing to artificial intelligence. It is no surprise that Bonnie is getting all of this attention."

ACM has members from around the world who work in AI, cloud computing, computational biology, data science,



Dr. Bonnie Dorr

software engineering, human-computer interaction, virtual reality and other areas. The ACM Fellows program recognizes the top one percent of the association's worldwide membership.

Together with her colleagues at IHMC, Dorr has established the new field of Cyber-Natural Language Processing, which intersects the expertise of cyber security, social computing, AI and natural language processing. Her interests focus on cyber-event extraction and natural language understanding for detecting attacks, discerning intentions of attackers, and thwarting social engineering attacks.

That is one of the reasons DARPA invited Dorr to join a handful of other scientists and engineers from across the country to become part of a study group that will provide independent assessments of advanced information science and technology as it relates to the U.S. Department of Defense.

Since joining IHMC in 2014, Dorr has led several DARPA projects, including the design of a system to detect and thwart social engineering attacks on the U.S. She is also working on an Intelligence Advanced Research Projects Activity project for AI-inspired extraction of multiple viewpoints. ✦

James Allen honored as one of nation's top scientists

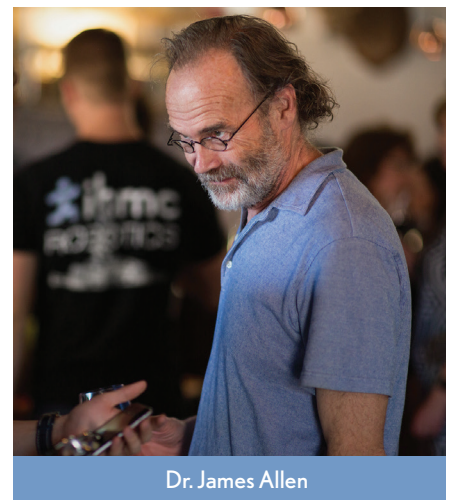
IHMC Associate Director and Senior Research Scientist, Dr. James Allen, has been elected to the rank of AAAS Fellow by the American Association for the Advancement of Science.

Each year the association elects members whose efforts to advance science and its applications are considered distinguished and scientifically valid. Allen's official election as a Fellow was held at the association's annual meeting in February, which was held virtually because of COVID-19. AAAS specifically cited Allen for his "broad contributions

to artificial intelligence and natural-language understanding, including seminal contributions in temporal logic."

In addition to working at IHMC, which he joined in 2006, Allen also has an appointment as the John H. Dessauer Professor of Computer Science at the University of Rochester in Rochester, New York.

"This is such a well-deserved honor for James," said IHMC CEO, Ken Ford. "Throughout his career, James has been a thought leader in the advancement of artificial intelligence." ✦



Dr. James Allen

Ford helps draft AI report for President and Congress

The United States is unprepared to compete in a future enabled by artificial intelligence and could soon be overtaken as the world's AI superpower by China, according to a report to the President and Congress by the National Security Commission on AI.

IHMC Director and CEO, Dr. Ken Ford, helped draft the 756-page report, which was two years in the making. It offers strategies and recommendations to strengthen and protect the nation's economy, technology and national security. The 15-member commission also calls for significant investments to expand research, development, and deployment of artificial intelligence and other related advanced technologies.

The Commission worked on its report in close collaboration with Congress, the White House, and federal agencies. Commissioners were asked to consider the methods and means

necessary to advance the development of artificial intelligence, machine learning, and associated technologies to comprehensively address the national security and defense needs of the U.S.

"It's important to realize that you can't just flip a switch and have these capabilities in place. It takes steady, committed hard work over a long period of time to bring these capabilities to fruition," said Ford. "This report lays out an actionable path to an AI-enabled future which is consistent with our national values."

The U.S., according to the commission, which was chaired by former Google CEO, Eric Schmidt, is facing a serious challenge to the nation's technological dominance, a challenge that threatens the nation's economic and military power for the first time since the end of World War II. If China replaces the U.S. as the world's AI superpower, the nation

will face a multitude of economic and national security implications.

The report notes that the Chinese Communist Party is already using artificial intelligence as "a tool of repression and surveillance" at home and abroad. China's resources, plans, and progress should concern all Americans, the report noted. Although Russia does not attempt to steal U.S. technologies and intellectual property on the same scale as China, the Russian government remains an "aggressive and capable collector of technologies" that could field AI weapons just as rapidly as the Chinese are doing now.

The NSCAI report recommends that the U.S. match the significant investment that China is already making in AI. In 2017, the Chinese government issued a statement that the country's technological and AI advances will make China the global leader by 2030. 🚀



The cover of the 756-page report of the National Security Commission on Artificial Intelligence that was two years in the making.

DARPA project aims to enhance warfighter resilience

IHMC has been awarded a multi-million dollar DARPA contract to develop technology that will raise the performance of elite warfighters.

The Peerless Operator Biological Aptitude project, or Peerless, is part of a DARPA program known as Measuring Biological Aptitude, or MBA. The crux of MBA is correlating the externally observable physical, behavioral, and cognitive traits of specialized operators along with measurable elements of their biology to understand and ultimately anticipate how they will perform in various situations over time.

Peerless is being led by IHMC's Chief Science Officer, Dr. Tim Broderick, a surgeon and biomedical engineer who has been a pioneer in laparoscopic, robotic and telerobotic surgery. Prior to joining IHMC in 2019, Broderick was an academic surgeon and a DARPA

program manager. During his four years as a DARPA program manager, he conceived and established high-impact biotechnology projects that included revolutionary programs focused on precision diagnosis and treatment of military-relevant diseases and injuries. Broderick also has led multiple ground, flight and undersea-based biomedical research projects.

Broderick has assembled a world-class interdisciplinary research team to work on Peerless. Members of the IHMC team were recently at Camp Bullis Military Training Reservation just outside of San Antonio, Texas, where the team converted a clamshell building into a human-performance lab. Bullis is used primarily as training grounds for U.S. Army, Air Force and Marine combat units.

"Peerless is a good short title for this project because the goal is to help

develop and maintain peerless special forces operators," said Broderick. "We are developing a disruptive training platform that integrates novel individual and team assessments, revolutionary molecular and metabolic analysis and advanced predictive models. These models will use the latest and greatest machine learning and artificial intelligence to predict and maintain the performance of special forces operators."

Broderick pointed out that providing actionable biologic information to elite operators and units will empower them to improve their physical, cognitive, behavioral and team performance. By identifying phenotypic and molecular predictors of effective decision making under stress and resilience, the Peerless team also could improve long-term sustainability for those who serve in extremely challenging conditions. ✦



Team members who worked on the Peerless project gather outside the clamshell building they transformed into a human-performance lab.

IHMC awarded grant to improve COVID-19 forecasting

Dr. Peter Pirolli and IHMC have been awarded a grant by the National Science Foundation to develop new ways to improve epidemiological models that forecast the rate of infections and deaths related to COVID-19.

“Since the beginning of the pandemic we have seen major differences across the country in the seriousness of the spread of COVID-19,” said Pirolli, a senior researcher at IHMC and the principal investigator of the National Science

Foundation study. “Of course, there are many factors that affect the spread, but individual and collective behavior such as mask-wearing, social distancing, and hand washing is demonstrably correlated with infection rates.”

Current epidemiological forecasts of the pandemic do not take into account individual psychological and behavioral responses to ongoing events and information and how those responses change over time and vary regionally.

“People have different mindsets, consume different information diets from mainstream and online media, have different beliefs and attitudes,” said Pirolli. “They grow anxious, fatigued, or hopeful in different ways. We are bringing together computational psychological models, natural language processing, and computational epidemiology to build better forecasting and provide better tools for health officials and decision-makers.” ✦

Distinguished exercise scientist joins IHMC

One of the nation’s top researchers in exercise science has joined IHMC.

Dr. Marcas Bamman is an internationally recognized researcher known for his scientific contributions to the biology of human skeletal muscle and medical rehabilitation. He is the founder and former director of the University of Alabama at Birmingham Center for Exercise Medicine.

He joins IHMC as a Senior Research Scientist and will become part of a biologically-motivated team that IHMC founder and CEO, Ken Ford, has been forming for the past several years.

Since its founding in 1990, IHMC has primarily conducted advanced research in the fields of artificial intelligence and robotics. The past few years, however, Ford has been building a research team focused on health span, resilience and performance. IHMC is particularly focused on innovative ways to extend the capabilities and resilience of high-performing humans such as astronauts, fighter pilots, and elite special operators.

“Marcas has become known worldwide for his work in understanding the molecular responses to exercise,” said Ford. “His research is highly valued at the National Institutes of Health, the

Department of Defense, NASA and other agencies around the nation. He will be a wonderful colleague.”

Bamman, and the UAB center he founded, are recognized as world leaders in the biological mechanisms underlying exercise-induced adaptations and their clinical utility in disease prevention, treatment and rehabilitation. He is often featured in national media on how exercise-induced health benefits can impact disease prevention, treatment, and rehabilitation.

“In the later stages of my academic career, I became more and more interested in defense-related research and ways to maximize the performance and resilience of warfighters and special forces,” said Bamman. “IHMC is obviously one of the nation’s top leading-edge research institutes that I came to know quite well after giving a talk there.”

That talk led to collaborations with the IHMC and the institute’s Chief Science Officer, Dr. Tim Broderick.

“I really appreciate the leadership, vision and mode of operations at IHMC, all of which are centered on research impact,” said Bamman. “The research at the institute is highly innovative and will translate to important consequences

and scientific advances. IHMC’s current human performance and resilience research is certainly strong but is just the tip of the iceberg of the future.”

One of the first projects Bamman will work on at IHMC is a DARPA-sponsored program aimed at developing a revolutionary platform to enhance training and resilience of elite service members, called the Peerless Operator Biologic Aptitude project. It is designed to improve the biologic aptitude of warfighters and increase their adaptability and resilience. ✦



Dr. Marcas Bamman

New team members at IHMC



Dr. Kaleen Lavin comes to IHMC as a research scientist whose work will help expand the institute's research into the biological means of elevating human performance and resilience. She works closely with Senior Research Scientist Marcos Bamman as part of a team that is laying the groundwork for IHMC's proposed new Center for Human Healthspan, Resilience and Performance. She earned a Ph.D. in Human Bioenergetics from Ball State University and spent her post-doc working with Dr. Bamman at the University of Alabama, Birmingham Center for Exercise Medicine. Her research is focused on understanding the molecular mechanisms by which the body adapts and reacts to stressors such as acute exercise, training, unloading, aging, etc. She uses computational biology techniques to understand and improve human performance and resilience. Her experience with skeletal muscle biology and exercise physiology provides critical context for data interpretation and connecting molecular patterns to whole-body and systems-level health.



Dr. Kurtis Gruters joins IHMC as a visiting research scientist with a background in sensory neuroscience and applied machine learning. He earned his Ph.D. in systems neuroscience from Duke University studying audiovisual integration, where he also completed Army ROTC, and he is currently finishing an additional master's degree in computational analytics from Georgia Tech. After commissioning into active duty and completing his Ph.D., he has spent five years working with US Army Special Operations Command (USASOC) where he worked on a variety of projects ranging from mobile brain health to assessment, selection, and training for the US Army's Special Forces soldiers. His work has directly led to the establishment of the USASOC Artificial Intelligence Division. He is currently working with Senior Research Scientist, Dr. Peter Pirolli and Chief Science Officer, Dr. Timothy Broderick among others on the Peerless Operator Biological Aptitude (Peerless) project funded by the Defense Advanced Research Projects Agency.



Dr. Art Finch joins IHMC as a research scientist with more than 22 years of providing leadership consultation and coaching for a range of Special Operations units and other federal agencies. A former Army Colonel, he is a graduate of the US Army Ranger School with more than 20 combat deployments. He is recognized as an expert in team composition; training and performance optimization; leadership development and executive coaching; as well as assessment and selection and development of empirically driven selection and training programs. At IHMC he is working on the Peerless Operator Biological Aptitude (Peerless) project funded by the Defense Advanced Research Projects Agency. He earned his Ph.D. in clinical psychology from Brigham Young University and completed his residency training at Walter Reed Medical Center. In addition to his work at IHMC, he leads a private consulting practice and serves as an adjunct professor at North Carolina State University.



Dr. Toshiya Miyatsu joins IHMC as a research scientist whose work focuses on the cognitive and technological tools that can help enhance human learning, instruction, performance and assessment. He works with IHMC's Senior Research Scientist, Dr. Peter Pirolli and Chief Science Officer Dr. Timothy Broderick. He is part of the Learning through Electrical Augmentation of Plasticity (LEAP) project and the Peerless Operator Biological Aptitude (Peerless) project. Both projects are funded by the Defense Advanced Research Projects Agency (DARPA). Prior to joining the institute, Toshi served as a graduate research associate for Washington University in St. Louis and as a laboratory manager and research technician at the University of California Los Angeles. Originally from Japan, he moved to the United States in 2006 and became a U.S. citizen in 2018. He earned his Ph.D. and M.A. in Psychological and Brain Sciences at Washington University in St. Louis.

New team members at IHMC



Vishnu Aishwaryan Subra Mani joins IHMC as a research associate working with Dr. Robert Griffin and the exoskeleton team. He earned an undergraduate degree from Anna University in India before moving to the United States to study at Worcester Polytechnic Institute in Massachusetts. At Worcester, he earned a master's degree in mechanical engineering while developing mechanical components for robotic applications. He joined IHMC as a mechanical intern to work on the Quix Exoskeleton Project before becoming a full-time research associate at IHMC last fall. His goal is to design a rigid body exoskeleton for able-bodied people.



Carlos Gonzalez joins IHMC as a research associate in the Robotics Lab. He is working with Dr. Robert Griffin, Dr. Sylvain Bertrand and Dr. Jerry Pratt on developing legged robot control algorithms. He earned a bachelor's degree in mechanical engineering and a master's in electrical engineering from the University of New Mexico. After graduating, he spent two years as a research assistant in the Mechanical Engineering Department at New York University. In 2018, he joined the Dynamic Legged Systems Lab at the Italian Institute of Technology in Genoa, Italy. His primary research interest is in developing safe and robust locomotion strategies and planning algorithms for biped systems.



Katy Hendry joins IHMC as the assistant director for sponsored grants and contracts. She has spent the past decade working in research administration. Over the past 14 years, her work experience has included working on grant proposal development, grant writing, research administration, program design and management, research integrity, and project management. She also has been involved in teaching, training and consulting. She is a graduate of the University of South Florida where she earned a bachelor's degree in Public and Cultural Communications. She received a master's degree in Leadership from Embry-Riddle Aeronautical University.



Alexis Maslyczyk is an electrical engineer who joins IHMC as a research associate working in the Robotics Lab. He is working on humanoids and exoskeletons with Dr. Jerry Pratt and Dr. Robert Griffin. Alex has degrees from the University of Technology of Belfort-Montbéliard in France; and École de Technologie Supérieure in Canada. He began his career in electric vehicles, but switched to robotics. A native of France, his three primary research interests are sensors, actuators and electronic design.



Evan Yu joins IHMC as a mechanical engineer in the Robotics Lab. He is a graduate of the California Institute of Technology where he worked with various robotics groups. His research interests are in designing novel mechanisms for robots and learning more about controls. As an intern at NASA's Jet Propulsion Laboratory, he engineered a motor-drive level winder into a tether-based research vehicle for extreme, sloped terrain that would be compact and robust enough to maneuver over difficult terrains.

Science Saturdays finds way to continue despite pandemic

IHMC had to cancel most of its evening lecture series last year because of COVID-19. It also had to cancel one of its two annual robotics camps for kids. The institute's popular Science Saturdays program, however, used science to its advantage and managed to continue the popular science-enrichment program for children despite a few setbacks because of the pandemic.

"We wanted to create a learning environment where parents could feel comfortable that their children were safe," said Dr. Ursula Schwuttke, IHMC's director of education outreach, who implemented physical distancing guidelines to ensure Science Saturday could carry on despite the COVID-19 outbreak. "In the past, children worked in teams of four or five. But last year they worked more individually. They were still able to do fun hands-on projects that were led by IHMC's scientists."

The Science Saturdays program features a variety of projects designed to increase children's interest in science and STEM-related topics. Last year the COVID-19 crisis gave kids in the program a real-time look at the impact of science on their everyday lives. And when some of the Science Saturday events had to be postponed because of the pandemic, Schwuttke designed a microbiology experiment on how to contain viruses and bacteria that children could do at home with their parents.

"We have all become more interested in how microbes spread than ever before," said Schwuttke. "I wanted to create an experiment that would better help children and their parents understand bacteria and viruses and how we might be able to adjust to living, working and learning in the presence of COVID-19."

"But working with viruses is difficult. So the experiment was designed for

children to see how microbes like bacteria and fungi grow and spread and cause illnesses like the common cold and flu, as well as viruses such as the corona virus COVID-19."

By using slices of white sandwich bread and plastic bags, children and their parents were able to see how bacteria grow and spread and under what circumstances microbes spread with the most success.

"Parents said they loved the experiment because it illustrated the benefits of washing your hands in helping to prevent the spread of colds, the flu, COVID-19 and other illnesses," said Schwuttke.

A gift of \$8,500 from Gulf Power (as well as the support of Cox Communications, the Escambia County Sheriff's Department, with state law enforcement trust fund monies, and The Florida Blue Foundation) provided the funding that allowed Science Saturdays to continue last year despite COVID-19.

"Gulf Power supports the IHMC Science Saturday program because we see the value of engaging children in

the hands-on application of science and technology," said Sandy Sims, executive director of the Gulf Power Foundation. "Engagement leads to further exploration which leads to mastery of STEM concepts – this is where the real impacts occur."

At the beginning of this year, IHMC canceled some of the Science Saturdays because of the increase in COVID cases that arose following the Thanksgiving and Christmas holidays. Instead, IHMC offered downloadable hands-on science lessons for teachers and parents. The program will continue in the fall with safety protocols still in place, as necessary.

Each Science Saturday workshop has a session for third- and fourth-graders followed by a session for fifth- and sixth-graders. Workshop activities include:

- Learning about engineering wind-resistant buildings by building simple structures out of popsicle sticks.
- Designing prototypes of robotic hands using materials such as cardboard, straws and strings.

Parents have responded positively to the in-person events and especially the safety measures IHMC implemented during COVID. A few responses from parents from an IHMC survey:

"Really impressed with the safety measures in place to have in-person sessions during this time," said one parent. "This was my son's first Science Saturday and I thought it was a wonderful opportunity and really appreciate it being offered," said another.

In terms of students, they particularly enjoyed the COVID-19 related microbiology experiment they were able to do at home with their parents using bacteria from their unwashed hands and surfaces like cell phones.

"I learned that bacteria are everywhere," said one student. "I thought it was neat and gross," said another. ✨



A student works on a paper airplane

STEM-Talk podcast celebrates a year of milestones as it nears three million downloads

The idea for a podcast came to Dr. Ken Ford on a trip to Silicon Valley in 2015. He had been thinking about ways to reach millennials and Gen-Xers the way the institute's evening lecture series reached baby boomers.

"I think the average age of our lecture series is about 60 years old," said Ford, the founder and CEO of IHMC. "It bothered me that no matter who we brought in to give a lecture, we just couldn't seem to get very many young people to attend the talk."

It was during his trip to Silicon Valley that Ford overheard someone talking about how podcasts took up nearly half the storage space on young people's iPhones and mobile devices. A year later, IHMC launched STEM-Talk, a biweekly podcast described as profiles in science.

"One of our key missions here at IHMC is to make science more accessible to people, especially young people," said

Ford. "And that's what we're trying to do with STEM-Talk."

"Trying" is putting it mildly.

Last year the four-year-old podcast aired its 100th episode and is now nearing three million downloads. Also last year, the International Academy of Digital Arts and Sciences singled out STEM-Talk as one of the world's five best podcasts in the science and education category.

The nod from the Academy, which annually hosts a competition to highlight internet excellence, isn't the only worldwide recognition STEM-Talk has earned. Two out of the past four years, IHMC's podcast has won first place in the science and medicine category of the Annual People's Choice Podcast Awards.

"What we try to do," said Ford, "is give listeners a sense that they're eavesdropping on a conversation between three scientists. I think it's a format that people enjoy. The guests we have on the show are

some of the top researchers in their fields who routinely write papers that receive considerable worldwide media attention."

Ford and IHMC Research Scientist, Dawn Kernagis, co-host the podcast, which is billed as conversations with some of the most interesting people in the world of science and technology. While several of IHMC's educational outreach programs were put on hold because of COVID-19, STEM-Talk was able to carry on by sending guests a remote setup that they could use at home for their interviews with Ford and Kernagis.

Perhaps because of COVID-19, both Ford and Kernagis received a lot more questions from listeners about topics that STEM-Talk guests talked about in their interviews. That led to Ford and Kernagis routinely recording what they refer to as "Ask Me Anything" episodes, which have now become a regular and popular addition to STEM-Talk. [✦](#)



STEM-Talk co-host Ken Ford and the podcast's engineer William Howell



STEM-Talk co-host Dr. Dawn Kernagis



DR. PASCAL LEE, EPISODE 121

Dr. Pascal Lee, director of the NASA Haughton-Mars Project at NASA's Ames Research Center, appeared on STEM-Talk to discuss NASA's Perseverance rover, which landed on Mars earlier this year. Lee also talked about NASA's search for signs of past life on Mars and provided an update on his visits to the High Arctic's Devon Island, which is Earth's largest uninhabited island and has geological characteristics similar to Mars'.



DR. GORDON LITHGOW, EPISODES 119 AND 120

Dr. Gordon Lithgow, a professor at the Buck Institute, conducts research focused on uncovering genes and small molecules that prolong lifespan through enhanced molecular stability. His study showed that naturally occurring metabolite alpha-ketoglutarate reduces inflammatory signaling and chronic inflammation. Gordon covered the role that protein homeostasis plays in aging, as well as how his studies have found that vitamin D3 improves protein homeostasis and slows aging.



DR. JULIE ANDERSEN, EPISODES 117 AND 118

Dr. Julie Andersen, a professor at the Buck Institute, conducts research into the metabolite compound urolithin-A. Her experiments have demonstrated the compound's ability to induce mitophagy, which is a recycling of mitochondria by autophagy (autophagy being the process that cleans inefficient, aging mitochondria). Julie's research focuses on the potential of urolithin-A to prevent and treat diseases such as Alzheimer's, Parkinson's, Huntington's and Lou Gehrig's disease.



DR. MARCAS BAMMAN, EPISODE 116

Dr. Marcas Bamman is a senior research scientist at IHMC as well as the former director of the University of Alabama at Birmingham Center for Exercise Medicine. Bamman is known for his research into the biological mechanisms underlying exercise-induced adaptations and their utility in disease prevention, treatment and rehabilitation. He's also expanding his research at IHMC by exploring ways to maximize the performance and resilience of elite warfighters and service members.



DR. KEN FORD AND DR. DAWN KERNAGIS, EPISODE 115

Co-hosts Dr. Ken Ford and Dr. Dawn Kernagis periodically record Ask Me Anything episodes during which they answer listener questions. In this edition, Ford and Kernagis covered questions ranging from blood-flow restriction to swimming-induced pulmonary edema to intermittent fasting. The co-hosts also discussed methylene blue and erythropoietin, which has been shown to promote the formation of red blood cells and is often used by athletes as a performance-enhancing drug.



DR. LILIANNE MUJICA-PARODI, EPISODE 114

Dr. Lilianne Mujica-Parodi is the director of the Laboratory for Computational Neurodiagnostics at Stony Brook University. Her research has revealed that neurobiological changes associated with aging can be seen in a person's 40s, much younger than was previously thought. She found that decreasing glucose and increasing ketones results in the stabilization of brain networks. She discovered that the neurobiological aging process can be prevented or reversed through dietary changes.



DR. PETER PIROLI, EPISODE 113

Dr. Peter Pirolli is an IHMC senior research scientist and a former fellow at the Palo Alto Research Center. He is known for his work on information foraging theory and his book titled "Information Foraging Theory: Adaptive Interaction with Information." Peter talked about his role as the principal investigator of a National Science Foundation project aimed at improving epidemiological models and more accurately forecasting rates of COVID-19 infection and death.



DR. TIMOTHY BRODERICK, EPISODE 112

Dr. Timothy Broderick is a surgeon, a biomedical scientist and IHMC's chief science officer. He is a pioneer in laparoscopic, robotic and telerobotic surgery. Broderick has led multiple ground, flight and undersea-based biomedical research projects and is an honorary NASA flight surgeon. He also works as an NOAA undersea saturation diver. Broderick discussed the ways he and his IHMC colleagues perform high-impact research focused on enhancing human health and performance in extreme environments.



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