

# ihmc



FLORIDA INSTITUTE FOR HUMAN & MACHINE COGNITION

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Dear Friends,

As many of you know, STEM (science, technology, engineering and mathematics) is at the heart of what IHMC is all about. In an effort to acquaint people with some of the most interesting people in the world of science and technology, we launched, in March, a podcast that highlights the fascinating work that these scientists do.

Called STEM-Talk, the podcast is a bimonthly interview show co-hosted by IHMC research scientist Dawn Kernagis. It features interviews with renowned scientists, engineers and technologists. If you want to know the story behind the recent discovery of gravitational waves, why sleep is vital to health and longevity, or the scientific secrets to longevity, you can find out on STEM-Talk. These are just a few of the topics in a rich array of insights and novel information that STEM-Talk shares with a vast public. STEM-Talk got off to a running start, making the #1 spot on iTunes' New and Noteworthy podcasts for weeks in a row. Stay tuned for more interviews, which can be found on our STEM-Talk web site, [stemtalk.us](http://stemtalk.us)



The feature article in this newsletter is on a long-standing area of IHMC research excellence –natural language processing. Read about how IHMC researchers are helping bridge the gap between humans and computers, as they teach computers to talk, process language conceptually, and read the medical literature—all with the goal of improving human life. In this article, you can also get to know the NLP researchers themselves, in short profiles of several team members who are taking this important field in new directions.

In other IHMC news, we are pleased to report that construction on our new building in Pensacola, which is adjacent to our present location, is proceeding nicely and we look forward to hosting a grand opening celebration in the fall.

This summer, we welcomed a large new group of research interns in Pensacola and Ocala. We also hosted the inaugural year of robotics camp in Pensacola, and the fourth year of the camp in Ocala. At both locations, middle and high school students immersed themselves in the field of robotics and got to meet some of IHMC's researchers.

We hope you had a wonderful summer and we look forward to welcoming you to our new research building soon.

Best wishes,

Kenneth M. Ford, Director

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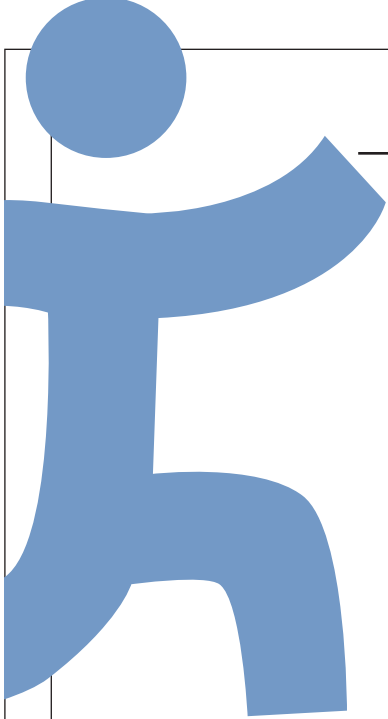
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# Communicating with computers

For many people, “communicating with computers” means cursing at your computer when it breaks down or simply does not work. “Do what I mean, not what I say” is a mantra with which any computer user could identify. A group of IHMC researchers has set out to make this command a reality by bridging this gap in understanding and making “communicating with computers” a means to share goals and ideas, not just cause frustration.

IHMC senior research scientist James Allen and colleagues work in natural language processing, developing systems that can take in human language in multiple genres, such as news articles, phone conversations, books, scientific papers and text messages, and produce representations of meaning to fit the task at hand. This research would enable a new generation of automated personal assistants, significantly more useful than current automated assistants such as Apple’s Siri and Microsoft’s Cortana.

Allen’s team finds the term “natural language processing” to be a bit constraining. “It conveys a mechanical process,” Allen explained. “We often stress that we work on natural language understanding, which means we’re bringing in common sense knowledge and other capabilities in order to understand what a person means when they say something.” For example, a literal natural language processing system might conclude that the phrase “Can you reach the salt?” is a question about someone’s ability to reach a seasoning. But in order to respond by passing the salt, rather than just answering with an affirmative “Yes, I can reach the salt,” a system needs to understand the underlying motivation of why the person said the phrase.

On a deeper level, the computer should act as a collaborator and help humans achieve their goals. The computer is not simply a passive assistant taking instructions from the human, but an active partner in the conversation, offering solutions, jointly exploring options and availing itself of the human’s expertise to work on problems. While communication is inherently multi-modal, at the heart of this human-machine collaboration is language, namely a computer’s understanding of language in a way that mirrors, but does not strive to mimic, that of humans.

Allen recently received a significant five-year grant from the DARPA Communicating with Computers (CwC) program to develop the computer’s capability for deep language understanding and collaborative problem solving. The research is specifically organized around three tasks, each emphasizing a different aspect of understanding language in context.

The first use case, called “Blocks World,” uses building blocks—literally, blocks that toddlers could play with—to explore the collaborative construction of simple structures such as towers and toy buildings. This domain emphasizes connecting language to perception of the physical world, learning new concepts, and collaborating on planning the structures. As an example, the human and the computer might work together to build an arch, but the computer does not initially know what would count as an arch in this toy world. It will have to communicate with the human to understand the goals and learn the definition of an arch, and then work with the human to build the object, taking into account other constraints as well, e.g., that all the blocks should be blue. A

## Dr. Lucian Galescu

**Hometown:** Vaslui, Romania

**Education:** B.S. mathematics and computer science, Cuza University; Ph.D. computer science, University of Rochester

**Joined IHMC:** 2003



Lucian was first introduced to natural language processing as an undergraduate at the University of Cuza. Working with his advisor, Lucian thought that the field presented “a very difficult problem that’s not going to have an easy solution.”

He followed his instincts and came to the U.S. to pursue a Ph.D. in computer science at the University of Rochester, where he worked with Dr. James Allen and focused on speech recognition.

Allen recruited him to IHMC in 2003. His present research is focused on enabling computers to decipher meaning from scientific literature.

“There are millions of papers being published each year. No one has time to read all of them,” Lucian said. Instead, computers can help come up with a roadmap of those papers—at a speed no human could ever approximate. “Doing it by computer is really our only hope.”

Lucian and his wife Gabriela enjoy the local independent film scene, classical music concerts, and gardening.

dialogue that illustrates all these features is shown in Figure 1. At first glance, this domain can seem trivial and rather far removed from real-world applications. How will a computer that can talk about toy blocks help with, for example, curing cancer?

**Human:** Let's build an arch.  
**Computer:** What is an arch?  
**Human:** An arch is two blocks with another block on top of them.  
**Computer:** OK. Here are three blocks.  
**Human:** Oh, and I'd like to use blue blocks.  
**Computer:** OK, but I only have two blue blocks.  
**Human:** OK, use a green one instead.  
**Computer:** OK. How's this?  
**Human:** The two lower blocks need to be further apart.  
**Computer:** OK. How's this?  
**Human:** That's great.

Figure 1: A simple conversation in the Blocks World

The key challenge here is teaching computers how we, humans, talk. For example, we often use physical terms and references to convey abstract concepts, sometimes without even recognizing it. "Physical concepts serve as a foundation for higher-order, abstract reasoning and communication," said IHMC Research Scientist Dr. Ian Perera. Note that he uses the physical metaphor of a foundation to convey an abstract relationship where the thing being supported depends on what lies underneath. This is an example of the kinds of concepts you find in a physical domain such as Blocks World. "Most people are entirely unaware of their reliance on these metaphors they use in everyday language, and the blocks world domain allows us to teach that knowledge of how people speak to the system so that it can recognize our language and understand it."

'Work on this bridge' – yet another physically-based metaphor – between the

concrete and the abstract, does not stop there. A key thrust of the CwC project is to build a set of universal "building blocks" of concepts and the means by which they can be composed into bigger, more complicated concepts. For example, you might describe a staircase of blocks as a group of towers, with each tower being taller than the previous one. But to use this knowledge to build a staircase, you have to know that a tower is comprised of blocks and that you can make a tower taller by adding a block to the top. This kind of knowledge, which comes naturally to people, is absent in even the most sophisticated computer systems available today. To make computers understand how we conceptualize the world, we have to break everything down into their fundamental components. What is a column, and how does it differ from a row? And then, what does it mean to build columns of blocks around something? And once we have done this

“ The key challenge here is teaching computers how we, humans, talk. ”

deconstruction, how does the computer put the pieces back together?

The IHMC team's approach has its roots in the early days of Artificial Intelligence, when most AI techniques relied on logical formalisms rather than the statistical techniques common today. Statistical methods often simply provide you with the most likely answer, but cannot tell you why or how the system arrived at a particular answer—a requirement for effective communication. With logic, however, the computer has at its disposal its entire reasoning process, and the human can expand on that knowledge or correct it. One can describe step-by-step how to build a staircase, and the system

## Dr. Archana Bhatia

**Hometown:** Delhi, India

**Education:** B.S. mathematics, University of Delhi; Ph.D. linguistics, University of Illinois

**Joined IHMC:** 2015



Archana became interested in natural language processing as a Ph.D. student at the University of Illinois, where she got involved in a "tree banking" project for which she focused on the syntactic and semantic structure of her native Hindi language. A native of Delhi, she studied math as an undergraduate.

Following her Ph.D., she did a post-doc at Carnegie Mellon University, where she worked on computational modeling of semantics and pragmatics to make translating from one language to another more natural. She is fluent in English and Hindi and knows some German as well.

Archana likens her present research to "teaching a computer to be able to understand linguistic expressions." That means getting a computer to distinguish between the "compositional meaning" of a phrase such as "look out," which would be someone literally looking out of, say, a room; or the non-compositional meaning that someone should take care or be on guard.

Archana lives in Ocala and in her spare time, she enjoys all sorts of outdoor activities, such as running, swimming, driving in horse country, and visiting the nearby beaches.

can identify when the task has been completed and how it might be extended to larger staircases or structures that are more complicated.

In the second CwC use case, biocuration, a human and computer are tasked with developing new models of biological processes such as the mechanism by which a cancer cell disrupts normal body functions. The machine must draw upon a vast store of knowledge and work together with the human to make conceptual connections that are yet to be discovered. Just as a human researcher would pore over countless papers to find some unexplored combination of ideas or some sort of unstudied phenomenon, the human-computer does the same, as well as search through multiple databases containing biological mechanisms.

The key advantage offered by the collaborative problem-solving process between the human and the computer is the ability for each to wield their individual strengths. Humans can make use of their creativity and intuitions, while the computer can make use of its ability to search the literature and the databases available to it. But in CwC, the goal is to go beyond simply having the computer be a means to access knowledge. It should also be able to propose its own solutions based on the knowledge it has. In essence, it should be able to help even when the human does not know the right questions to ask. Figure 2 shows a simple conversation that gives a flavor of the interactions.

Here we start to see the importance of physical metaphors even when dealing with abstract concepts. Imagine the system knows that one uses the steps of a staircase to reach a location – it is a small jump to consider that one follows steps in a process to reach a goal or state in a model. And being able to use context to interpret the human's expressions is just as important. For example, the term

**Human:** I want to find a treatment for pancreatic cancer.  
**Computer:** 88% of cancer patients have a mutation in the KRAS protein that keeps it activated.  
**Computer:** But I don't know any drugs targeting KRAS.  
**Human:** Let's look at what we know about KRAS. I know that KRAS activates the Raf protein, which activates Erk. And Erk activation drives cancer progression.  
**Human:** Are there any known Raf inhibitors?  
**Computer:** Vemurafenib and GDC-0879 are known Raf inhibitors.  
**Human:** Is Erk inactivated if I add Vemurafenib?  
**Computer:** <<runs a simulation of the model after adding Vemurafenib>>  
**Computer:** Yes, my model shows that Erk is inactivated.

Figure 2: Human and computer interaction

Ras (which stands for Rat sarcoma) can refer to a particular protein, a family of proteins, the gene that codes for the production of the Ras protein, and more. This context could come from anywhere – the model being discussed, the ongoing dialogue, or even the human's goal that the computer might infer.

Context is even more vital in the third CwC use case, collaborative composition, in which the computer and the human(s) jointly create a live multi-media event. While the IHMC team is working on storytelling through language, other performers in the CwC program are developing systems to create music and movies as well. "It's the wildest collaboration," Allen said. "The computer is essentially having to come up with a good continuation for an ongoing story. It pushes into the notions of our creativity. How do you come up with something that's interesting and coherent?" Coherence requires a notion of context beyond what has been said in the dialogue – making a coherent and engaging story requires drawing from our knowledge of how the world works and

## Dr. Ian Perera

**Hometown:** Collegeville, PA

**Education:** B.S. digital media design, University of Pennsylvania; M.S. computer science, University of Rochester; Ph.D. natural language processing, University of Rochester

**Joined IHMC:** 2013



During college, Ian thought that he would pursue a career in making video games and 3D movies. But after one class in artificial intelligence, followed by a summer program in natural language processing at Johns Hopkins University, he became hooked on a new field of study.

While working with video games entailed mostly engineering problems, he said, the field of natural language processing probed deeper, into philosophical issues that begged questions such as: "Why do we communicate? What are the limitations of language in communication?"

Ian pursued his Ph.D. with Dr. James Allen and met Dr. Ken Ford at a conference. Ford offered him an internship, and then, a job. At IHMC, Ian works with blocks to help a computer understand meaning. The idea is to go beyond syntax and semantics to represent words with blocks.

Ian's Ph.D. thesis looked at children's learning strategies and whether those strategies are transferable to computers.

Ian works in the Ocala office and resides in Orlando. He also writes poetry, plays piano, and paints.

playing with the audience's expectations and predictions. But creativity is even trickier to pin down – how do we make a computer not just be a tool in a creative process, but also a contributor?

The inspiration for how one might demonstrate this comes from an early 20th-century game invented by the Surrealists, called “Exquisite Corpse,” where people take turns adding sentences to a story or extensions to a work of art to create something both cohesive and unique. In this case, one of the collaborators will be a computer, using its knowledge of the world and how stories work to incrementally add to a story. To test whether we can build computers that can understand what makes a good story, we have been collecting a large database of short, five sentence stories, using crowd sourcing on Amazon Turk. Each person is instructed to write a five sentence story, with a clear beginning and end, that draws from simple experiences of everyday life.

To test whether a system can understand what a good story is, we have developed the Story “Cloze” test. We show a person or the computer the first four sentences of a story, and then they have to choose which of two options was the actual ending of the story. An example is shown in Figure 4. In experiments with human subjects, they can identify the correct ending with near 100% accuracy. Current computer methods, running without commonsense knowledge, can

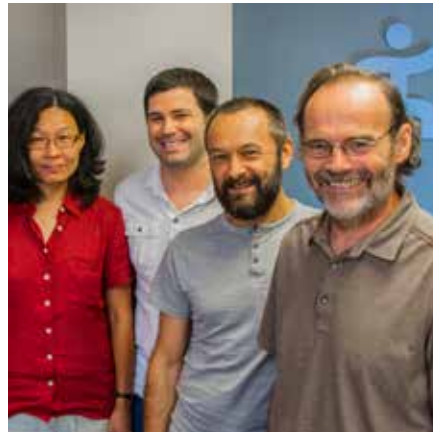
**Context:** Tom and Sheryl have been together for two years. One day, they went to a carnival together. He won her several stuffed bears, and bought her funnel cakes. When they reached the Ferris wheel, he got down on one knee.

**Ending 1:** He proposed to her and she said “yes”!

**Ending 2:** He wiped the mud off his boots!

Figure 4: The Story “Cloze” Test

only perform at random—with about 50 percent accuracy. We are currently using the story database to learn a wide range of commonsense knowledge and hope to show that as the system learns more about the everyday world, it will be able to perform better and better at the Story Cloze Test!



From left to right: Choh Man Teng, Adam Dalton, Lucian Galescu, James Allen

Claiming that a computer with a vast knowledge of previous stories is actually being creative when creating or adding to a story remains a deep philosophical issue. However, as T.S. Eliot said, “Immature poets imitate; mature poets steal... bad poets deface what they take, and good poets make it into something better, or at least something different.”

Riding on the wave of Big Data, there is certainly plenty to steal from. But to put these scraps of building blocks, biological processes and stanzas into a cohesive whole, and to effectively pursue joint goals with humans (or other computers), the researchers at IHMC will have to imbue computers with the ability to understand how we think, talk, and create. In doing so, we move beyond the idea of computers as tools and into the idea of computers as fellow collaborators, potentially useful in any task that we care to teach the computers about. Building simple structures in the blocks world just happens to be one of the first steps. ✨

## Dr. Choh Man Teng

**Hometown:** Hong Kong

**Education:** B.S. computer science, Chinese University of Hong Kong; Ph.D. computer science, University of Rochester

**Joined IHMC:** 2000



Choh Man is a veteran IHMC research scientist. She started working at IHMC in 2000, having just completed her Ph.D. with Dr. Henry Kyburg, a professor of moral philosophy and computer science at the University of Rochester who was also affiliated with IHMC.

Choh Man works on ontology and lexicon development: the reasoning, rather than the linguistic, part of natural language processing. As she describes her work, “Developing the general common sense concept of the world to understand language, regardless of which one.”

She also works on uncertain reasoning, which she describes as: “When you don’t have every piece of information available to you, most people can navigate the world pretty smoothly. We try to develop maps that will do the same.”

Choh Man took a two-year sabbatical in Portugal, teaching at the New University of Lisbon. She speaks English, Cantonese and Mandarin. She lives in Pensacola and often bikes to work. She enjoys kayaking, sailing, and glass blowing.

## IHMC to compete in Cybathlon in Switzerland

A team of roboticists from IHMC will be competing in October in the Cybathlon, a competition for disabled athletes using advanced technologies to be held in Zurich, Switzerland.

IHMC is one of twelve international teams, and the sole U.S. entry, competing in the Powered Exoskeleton Race. Research Associate Mark Daniel, who injured his spine almost nine years ago and has been using a wheelchair ever since, will be competing in the race, with an exoskeleton that he has been helping to design and test at IHMC's robotics lab.

IHMC Senior Research Scientist Peter Neuhaus is leading the project. "The event is a good fit with our previous work. We've been helping people

with paralysis walk for about six years now," Neuhaus said.

"A lot of our work lately has been getting our new exoskeleton together," Neuhaus continued. "We've made some

advances in our actuation technology, so we wanted to be able to take advantage of that."

Seven people and lots of gear from IHMC will be traveling to Switzerland for the event.

The team is partially relying on corporate and individual sponsors to help defray the costs of competing. Thus far the team has seven sponsors: Scivation, the Dalton Family, Allied Motion, Futek, Elmo Motion Control, Lord MicroStrain Sensing, and Star Prototype.

The ultimate goal of developing an exoskeleton is to increase walking speed and balance—and "hopefully get to the point where the person can walk almost as fast as an able-bodied person," Neuhaus said.

Both mobility and speed will be aspects of the Powered Exoskeleton Race. Daniel has been rolling in his wheelchair up to 15 miles a day to prepare for it. ✦



Mark Daniel

## Dr. Bill Dalton named to Florida Inventors Hall of Fame

The Chairman of IHMC's Board of Directors, Bill Dalton, is one of seven people who will be inducted into the 2016 Florida Inventors Hall of Fame in September.

Dalton, an oncologist and CEO of M2Gen®, a subsidiary of Moffitt Cancer Center & Research Institute in Tampa, received the prestigious honor for developing Total Cancer Care™, which are personalized protocols used for the treatment of cancer and decision tools



Bill Dalton

used by clinicians throughout the world. It has one of the largest bio-repositories and data warehouses in the U.S.

Dalton holds ten U.S. patents. He was formerly CEO and President of Moffitt Cancer Center, and prior to that, deputy director of the cancer center and associate center director for clinical investigations. He also founded and chaired the Department of Interdisciplinary Oncology at the University of South Florida, where he is professor of oncology. ✦

## IHMC scientist inducted into Women Divers Hall of Fame

IHMC Research Scientist Dr. Dawn Kernagis became part of a prestigious group of women last spring, when she was inducted into the Women Divers Hall of Fame (WDHOF). Kernagis, who joined IHMC in 2015 from Duke University, was one of six women to be inducted this April.

The WDHOF is a non-profit, professional honor society that recognizes outstanding women divers who have made substantial contributions to the exploration, understanding, safety, and conservation of the underwater world.

Kernagis, who has been diving since she was a teenager, said that she has long admired the women in the WDHOF. “Some of them are women I’ve looked up to since middle school, when I first knew I wanted to dive.”

Kernagis’ first dive, as a high school sophomore, was at Ginnie Springs, and she has since completed 1,400 dives.

She was a diver and project dive



Dawn Kernagis

manager for an international dive team exploring Wakulla Springs and the surrounding cave systems from 1996-2007, where she directed several world record-breaking deep cave dives, including the historic connection and swim-through cave dives between Turner Sink and Wakulla Springs in 2007.

These experiences inspired her to study undersea biomedical research and the genetics of decompression sickness. She conducted her doctoral research

on identifying the role of genetics in decompression sickness in divers. In 2008, she was the first Predoctoral Award recipient from the Office of Naval Research’s Undersea Medicine Program. At IHMC, Kernagis is developing new ways to optimize human performance and resilience in extreme environments, focusing on undersea diving operations.

“Her studies have led us to focus on the identification of genetic predictors or markers of stress that may indicate an individual’s susceptibility to undersea threats such as oxygen toxicity and decompression sickness, as well as the development of novel therapies to minimize the risk of these hazards affecting divers,” said IHMC Director Ken Ford.

Kernagis joined IHMC in 2015 and continues to conduct research on the body’s adaptability to extreme environments. ✨

## Dr. Ian Perera promoted to research scientist

Ian Perera is moving up in the world. He received his Ph.D. in May and was subsequently promoted to Research Scientist at IHMC this summer.

Perera completed his Ph.D. in computer science at the University of Rochester under the tutelage of IHMC Senior Scientist James Allen.

The basic premise underlying Perera’s work is to improve computers’ ability to interact with humans and help them in tasks and research. Perera initially approached those issues by studying the learning strategies of children.

When you teach a child object recognition, he said, you don’t give the child a bunch of pictures to look at once. With machine learning, you use one



Ian Perera

object at a time. Starting with a red ball, for example, the computer has to learn both what the color red is, as well as what a ball is. The researchers are helping the computer build its own lexicon so that it can be used as a tool of data mining and reasoning.

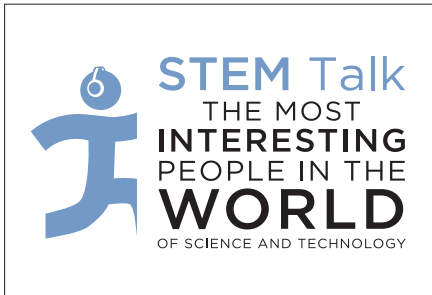
At IHMC, Perera has been working with Allen and others on natural language processing, or developing systems capable of creating representations of meaning from various sources of human language input. The end goal is to create personal assistants that are even more useful and wide-ranging than Siri.

Perera said that his promotion entails more responsibility in terms of getting grants, but the bulk of the work remains the same. He’s very enthused about the future of his field.

“I’m really excited about being about to work with computers and talk to them,” Perera said. “A computer gives us a way to manage the complexity of a task, and a lot of data.” ✨



## STEM-Talk podcast is off to a running start



The much-anticipated IHMC podcast, STEM-Talk, launched in March. The interview show, whose sub-title, “the most interesting people in science and technology,” underlies the big-name scientists, engineers, and technologists it is showcasing, debuted with an interview with longevity expert Dr. Peter Attia.

The show has featured a range of notable experts, including Vatican astronomer Guy Consolmagno, physicists Michal Turner and Barry Barish, both of whom made important contributions to

LIGO and the discovery of gravitational waves; nutrigenomics expert Rhonda Patrick, sleep expert Kirk Parsley, and many more.

Within just three weeks of launch, the podcast hit the number one spot on iTunes “New and Noteworthy” category as well as the number one spot for science and medicine.

The podcast is being hosted by IHMC research scientist Dawn Kernagis. Co-hosts include IHMC Director Ken Ford and Tom Jones, a planetary scientist, former NASA astronaut and IHMC senior research scientist.

“To hear the guests describe their work in their own words while learning how they transitioned into science or technology is inspirational for those of us who are currently scientists and hopefully for others as well,” Kernagis said.

STEM-Talk’s production team includes IHMC’s communications manager

and writer Kristine Crane, multimedia specialist Billy Howell, and videographer Jason Conrad.

“We’re thrilled to have had such a successful launch. STEM-Talk is about IHMC scientists thoughtfully interviewing other scientists, engineers and technologists,” said Ford.

“We have a strong production team, a network of esteemed guests, and hosts who are driving the interviews within a loosely narrative framework that makes the interviews accessible and interesting to a general audience of intelligent listeners. Podcasts are free, and their reach is limitless, so we are hoping that ours travels far.”

Listen to the podcast at [stemtalk.us](http://stemtalk.us), which you can also find on the IHMC web page, under the “Life” tab. You can subscribe to the podcast there, or through Stitcher or iTunes—where you can write a five-star review of STEM-Talk. ★

## Clancey named National Academy of Inventors Fellow

IHMC senior research scientist Dr. William “Bill” Clancey was named a fellow of the National Academy of Inventors (NAI) in December.

The Tampa-based NAI named 168 fellows last year, and it counts 582 fellows total in the four years that it has been naming fellows.

Clancey is most well-known for inventing a work practice modeling and simulation system, Business Redesign Agent-based Holistic Modeling System (Brahms), which is a tool for comprehensive design of work systems, relating people and automation.

Using the Brahms modeling system, scientists study the flow of information and communications in real-world work settings and the effect of automated systems. One important practical application is the coordination among air



Bill Clancey

traffic controllers, pilots, and automated systems during flights.

The Brahms system could be used to help prevent miscommunication in situations where “every single second counts,” Clancey said.

“Before Traffic Collision Avoidance System (TCAS) was deployed commercially, engineers verified that the program would give the right advice to

separate the planes. What they didn’t consider is air traffic controllers giving conflicting advice at the same time,” he added. “This is where Brahms comes in.”

As the real-world applicability of artificial intelligence becomes more widespread, Brahms could be used in situations “on earth, in air, in space, or at sea,” Clancey said.

IHMC Director and CEO Dr. Ken Ford said, “Bill joins a league of highly distinguished scientists with this recognition. He has made landmark contributions to artificial intelligence research, specifically in evaluating complex human-automation interaction in safety-critical situations.”

Ford is also an NAI Fellow, as is Alain Rappaport, who serves on the IHMC Board of Directors and is a well-known Silicon Valley entrepreneur. ★

## Dr. Ken Ford elected AAAS Fellow



Ken Ford

IHMC CEO and Director Ken Ford was elected a Fellow of the American Association for the Advancement of Science (AAAS). He received recognition for the honor in February, at the AAAS Annual Meeting in Washington D.C.

Ford was one of 347 scientists to be named a Fellow in 2015. The AAAS CEO or AAAS members, which number roughly 100,000, elect the Fellows, a tradition which dates back to 1874.

According to AAAS, Ford was selected as a Fellow “for founding and directing the IHMC, for his scientific contributions to artificial intelligence and human-centered computing, and for service to many federal agencies.”

“I am truly honored to be inducted as an AAAS Fellow,” Ford said. “The advancement of science is what we strive for at IHMC. To be recognized for it by other scientists is a reward in itself.” ☆

## IHMC scientist selected for NASA undersea mission

IHMC Research Scientist Dr. Dawn Kernagis was one of six people selected for an undersea mission to test tools and techniques for future space exploration.

The NASA mission, called NEEMO (which stands for NASA Extreme Environment Mission Operations), took place in July and August off the Florida Keys, at the Aquarius Undersea Reef Base, which is owned and operated by Florida International University.

The 16-day mission involved sending crew members some 60 feet underwater, in conditions designed to be analogous to living on the International Space Station. The crew tested a mini DNA sequencer and a medical telemetry device. They

also went on simulated spacewalks to collect marine biology samples and test underwater remote vehicles.

For every six crew members, there were a dozen research and support team members on land helping to run the mission. Kernagis kept a daily blog about her experience. Kernagis commented, upon her selection, that “The NEEMO 21 crew, researchers, and support staff are the best of the best.”

IHMC Director and CEO Dr. Ford added about this great opportunity for her, “Through her rare combination of technical diving and scholarly research

capabilities, Dawn is leading us into a new field of study at the institute, namely the optimization of human performance, resilience, and safety in extreme environments.” ☆



Six crew members were chosen for NEEMO.

## IHMC named bike-friendly work place

The League of American Bicyclists recognized IHMC as a bronze level Bicycle Friendly Business (BFBSM). IHMC joins a cutting-edge group of nearly 1,200 businesses, government agencies and Fortune 500 companies across the U.S. that have a bike-friendly designation.

The designation lasts four years. IHMC can re-apply for a higher designation.

Many IHMC employees bike to work, and in Pensacola, there are bikes provided at each building for employees to use.

Research associate Tim Hutcheson rides his bike to and from work, and home for lunch. “I’m particularly fortunate that

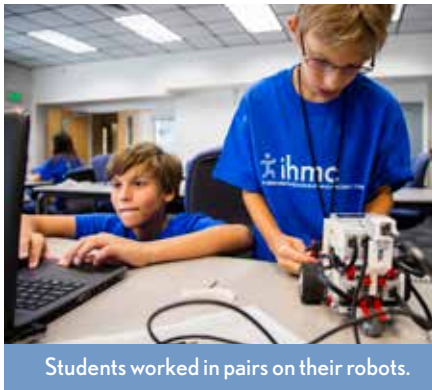
IHMC is only about 4 miles from my house, so I have a quick ride and hardly work up a sweat – but it’s enough to get aerobic exercise four times a day,” said Hutcheson.

“I get a chance to think about my job at the institute. Some of my most creative ideas come to me while riding the bike.”

## IHMC hosts summer robotics camp

A group of pre-teens huddled around a big sheet of plywood at IHMC in Ocala on day two of the Institute's Robotics Camp. Their challenge: to get the little motorized robot they'd programmed to clear an obstacle course based on several water bottles—which stood for trees in the “Orchard Challenge.”

The robot was simulating tree sprayers—which is a real activity for robots. The goal was for the robot to complete a full course through the “orchard” without knocking any of the “trees” down.



Students worked in pairs on their robots.

This summer marked Ocala's fifth robotics camp and Pensacola's first. At both locations, the one-week camps are designed to immerse kids in robotics. Jessica McCurdy, a camp volunteer and rising senior at Ocala's Vanguard High School, said that participating in the camp as a freshman was a “life-changing experience.”

“I was never interested in robotics or engineering before camp. It opened my eyes,” said McCurdy, who is the president of the robotics team at Vanguard.

She sees similar inspiration in other camp kids. “It's really nice because you can see big changes in the kids,” McCurdy said. “For some of them, their parents just make them come. It's nice that by the end of the week, they are really engaged.”

McCurdy, who wears a butterfly necklace—with a circuit board body—said that she wants to study bioengineering in college. She got the idea from one of the presentations at camp. She describes the field as “taking what mother nature gave us,” and creating designs based on that: for example, using water-resistant plants to design water-resistant clothing.

Students in Pensacola have had a similar program as those in Ocala, with one addition: tours of IHMC's robot lab, said Dr. Ursula Schwuttke, IHMC's director of educational outreach.

Schwuttke said a primary goal of robotics camp is to introduce students to computers and robots in an engaging and fun way. The camp also imparts important lessons in problem solving, team-work, persistence, and overcoming obstacles. For example, during an activity sponsored by Lockheed Martin, the kids chose their own mini motorized car to race against the other teams' cars.

“This demonstration was set up to be deceptive and therefore thought-provoking,” Schwuttke said. “The car that looked the slowest only had two wheels, so it experienced the least amount of friction on the track. Some of the cars that looked fast were made with heavier materials and turned out to be at the slower end of the range.”

These surprising results demonstrate an important lesson about design principles, she added. “You can't successfully execute an engineering design without thinking hard about it and testing different approaches.”

Payton Lacy, an eighth-grader at Osceola Middle School, whose favorite subject is math, said she went from not knowing robotics even existed,



The water-bottle obstacle course in Ocala.

to wanting a career in it afterwards. She learned that in programming a robot “the measurement for each movement has to be precise, or it will not run,” Lacy said.

Among the sponsors at both locations are Lockheed Martin, Best Buy, Career Source Florida, Renasant Bank, College of Central Florida, Cheney Brothers and FLATE. Local high school or middle school science teachers are facilitating the camps, which are based on curriculum and software from Carnegie Mellon University as well as The Lego Group.

“I love doing this,” said Greg Cruz, who has taught at the Ocala camp since it started. Cruz also teaches physics and runs the robotics club at Vanguard.

“The kids are having fun without even knowing that they are learning,” he said. “They learn how to plan, work together, and test what they've built. They run through the complete engineering process.” 🚀



Students learn about the robot lab.

# IHMC hires new team members



Geran Barton

**Geran Barton** joined IHMC as a research associate. He attended Texas A&M University. In Corpus Christi, he developed a specialty in designing robotic oil spill reconnaissance platforms. He was also a captain for offshore charter companies. In his free time, he enjoys hiking, diving and fishing. He and his wife Rachel are expecting their first child.



Antonio Bento

**Dr. Antonio Bento** is on sabbatical from the Federal University of Espirito Santo (UFES) in Brazil, where he is the robotics area lead in the mechanical engineering department. His lab does research on legged robots, exoskeletons and mechatronics applied to leg design, and effectors and robotics simulations with the UFES.



Tyson Cobb

**Tyson Cobb** is working on the Exo project. He attended the University of Central Florida. He previously worked as an R&D engineer for a large surgical device company in California. His professional interests include solid modeling and design, rapid prototyping, machining and metalworking. He enjoys rock climbing and motocross.



Kristine Crane

**Kristine Crane** is the writer/communications manager at IHMC, based in Ocala and produces the podcast STEM-Talk. She also writes for U.S. News & World Report. She was a reporter for the Ocala Star-Banner and Gainesville Sun. She writes creative nonfiction and poems and translates Italian literature into English.



Mark Daniel

**Mark Daniel** will be competing in the Cybathlon in Switzerland in October, with an exoskeleton he helped develop at IHMC. He rolls up to 15 miles a day to strengthen himself for that. He previously worked as a fabricator and ironworker. After the Cybathlon, he plans to become the first paraplegic to complete the American Discovery Trail.



David Fries

**David Fries** is an undersea technology expert with 35 patents on devices such as underwater robots and sensors. He joined IHMC as a research scientist and is working on developing an underwater learning cloud, and will work with other undersea experts in Pensacola, where he relocated this summer with his wife Carolyn.



Robert Griffin

**Robert Griffin** is working in the robotics lab at IHMC. A Ph.D. student in mechanical engineering at Virginia Tech, he is working on developing a lower body exoskeleton capable of self-balancing. He worked on robot locomotion for the Shipboard Autonomous Firefighting Robot program as well as for Team VALOR in the DARPA Robotics Challenge.



Noam Josef

**Dr. Noam Josef** joined IHMC as a post-doc studying how certain cephalopods, such as octopuses, use their camouflage abilities. He is working with David Fries on developing biodegradable electronic displays that mimic cephalopods while reducing electronic waste. Josef received his Ph.D. from Ben Gurion University. He enjoys spending time with his wife and two children.



Mathew Rathbun

**Mathew Rathbun** is the receptionist at IHMC in Ocala. He was born and raised in Ocala and attends the College of Central Florida, where he is majoring in chemistry. Since high school, he has volunteered at IHMC's robotics camp and Science Saturdays. He enjoys reading scientific and medical articles. Rathbun is the first person in his family to attend college.



Trish Smith

**Trish Smith** is the research and program coordinator in Ocala. She has spent most of her career in urban and regional planning, working in state and local government as well as the private sector. At IHMC, she oversees grant coordination, and acts as general office manager in Ocala. She lives with her husband and their 13-year-old son in Morriston, where she enjoys tending to her big vegetable garden filled with herbs, greens, and lime trees.



Georg Wiedebach

**Georg Wiedebach** is a research associate at IHMC, where he had two previous internships and worked on the DARPA Robotics Challenge (DRC) team. He is originally from South Germany, near Stuttgart, and received his bachelor's degree in mechanical engineering, and his graduate studies in Switzerland. His academic interests include state perception, control and motion planning. He enjoys hiking, camping, and swimming.



Laurie Zink

**Laurie Zink** is IHMC's development and community outreach director. A love of horses originally brought her to Ocala, and she is still active with the equestrian community. She was the founder of the Marion Arts Council, and is the chair of the Ocala Municipal Arts Commission (OMAC). At IHMC, she will be working on fundraising Ocala's evening lecture series and community outreach. She enjoys riding horses and sailing.

# Summer interns join IHMC

Every summer IHMC hosts numerous summer interns from the United States and across the globe. These young women and men range in age from high school students to post-doctoral students. While many work in robotics, others work on other areas of IHMC research, including natural language understanding, cybersecurity, and agile computing. IHMC is pleased to offer this experience to young adults who wish to continue their studies and pursue careers in scientific fields. There were 28 interns this summer. We would like to call special attention to intern Suriya Kandaswamy, who was invited to speak at a White House panel on a Cybersecurity Competitions Workshop. This Workshop brought together volunteers, organizers and sponsors from three cybersecurity competitions, to better understand how these competitions can be used to create a cybersecurity workforce in the future. This is Suriya's second summer internship with IHMC.



**Kinan Alsheikh**

**Education:** Currently in the IB program at Pensacola High School  
**Hobbies:** Table tennis, ultimate frisbee



**Alex Dampier**

**Education:** Incoming freshman at the University of Florida  
**Hobbies:** Ultimate frisbee, basketball



**Eric Gordon**

**Education:** Currently at the University of Florida  
**Hobbies:** Playing the tuba



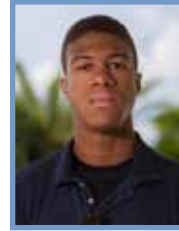
**Kareem Bataineh**

**Education:** Currently in the IB program at Pensacola High School  
**Hobbies:** Football, basketball, working with robots



**Michael Ford**

**Education:** University of West Florida, bachelor's in IT  
**Hobbies:** Electronics and computing, music, movies



**Josh Hill**

**Education:** Currently at the University of West Florida  
**Hobbies:** Playing sports and listening to music



**Serena Chen**

**Education:** Currently at Olin College of Engineering  
**Hobbies:** Coding, playing the violin, drawing snails



**Aimee Gerold**

**Education:** Currently at Georgia Tech  
**Hobbies:** Ultimate frisbee, learning French, and petting animals



**Marcus Jackson**

**Education:** Currently at the University of West Florida  
**Hobbies:** Modeling in SolidWorks, fixing cars, fishing



**Nathaniel Choe**

**Education:** Currently at Thomas Jefferson High School  
**Hobbies:** studying topics in computer science, creating websites, swimming



**Sarah Gontarski**

**Education:** Currently at West Florida High School  
**Hobbies:** Photography and lacrosse



**Suriya Kandaswamy**

**Education:** Incoming freshman at Harvard University  
**Hobbies:** Running, building robots



**Meghan Kapur**  
**Education:** Currently in the IB program at Pensacola High School  
**Hobbies:** Ballroom dancing, reading classical literature.



**Blake Ordway**  
**Education:** Currently at Pensacola Christian College  
**Hobbies:** Video games, programming



**Olger Siebinga**  
**Education:** Currently at Delft University of Technology  
**Hobbies:** Sailing, performing as a DJ, brewing beer



**Colton Keller**  
**Education:** Currently at North Dakota State University  
**Hobbies:** Traveling and the outdoors



**Zach Peltzer**  
**Education:** Currently in the IB program at Pensacola High School  
**Hobbies:** Working on cars, partner dancing



**Shriya Shah**  
**Education:** Currently a graduate student at Virginia Tech  
**Hobbies:** Reading books, traveling, cooking, playing badminton



**Don Kerrigan**  
**Education:** Currently at the University of West Florida  
**Hobbies:** Running, photography, movies.



**Chris Polack**  
**Education:** Currently at Georgia Tech  
**Hobbies:** Video production and film photography



**Stephen Tamba**  
**Education:** University of West Florida, bachelor's in software engineering  
**Hobbies:** Working on robots, coding in Java



**Koen Kramer**  
**Education:** Currently at Delft University of Technology  
**Hobbies:** Music, running, hiking, camping, watching comedies



**Nadia Razek**  
**Education:** Currently at Carnegie Mellon University  
**Hobbies:** Designing and sewing outfits



**Nick van Dijk**  
**Education:** Currently at Delft University of Technology  
**Hobbies:** Kitesurfing with his girlfriend



**Basil Kuloba**  
**Education:** Currently at University of West Florida  
**Hobbies:** Artificial intelligence, machine learning



**Hannah Rodgers**  
**Education:** Incoming first year law student at Florida State University  
**Hobbies:** Riding horses, playing soccer



**Erik Winfree**  
**Education:** Currently at the University of West Florida  
**Hobbies:** Triathlons



**Amelia Leenig**  
**Education:** Currently at the University of West Florida  
**Hobbies:** Ultimate frisbee



**Tony Saffier**  
**Education:** Currently at MIT for MBA, Received bachelor's in finance at Tulane  
**Hobbies:** Fishing, riding his Harley



**Morgan Wixted**  
**Education:** Currently at the University of Florida  
**Hobbies:** Zumba, reading

## Science Saturdays inspire kids in science

Shelby Rowe, a sixth-grade student at Grace School in Ocala, was one of twenty-one students to qualify, from a pool of hundreds of students, as a regional science fair winner and advance to the state fair in March.

Rowe, a long-standing attendee of Science Saturdays in Ocala, placed second in the state fair. She also received a special recognition from NASA for the motor that she made—from potassium nitrate and powdered sugar—which allowed a rocket to clear 300 feet.



Two boys work on their electronic motors at IHMC in Pensacola.

Shelby's mother, Carolyn, wrote an appreciative note to IHMC shortly after her daughter's successful competition: "I know that many of your Saturday programs were enlightening for Shelby, and she wanted to share her science fair successes with you."

For many elementary school students in Ocala and Pensacola, the two hours they get to spend doing hands-on science projects at IHMC are a highlight of the month. The sessions are held during the school year.

"I think the biggest selling point of Science Saturday is that it's a really fun

way to spend a Saturday morning," said Dr. Ursula Schwuttke, IHMC's director of educational outreach. "Those who come for the first time are sometimes surprised by how much they like science."

Sessions at both IHMC locations over the past several months have been rich and varied. They include making paper airplanes and lemon batteries to maneuvering robots and designing and printing 3-D objects.

IHMC also welcomes teachers to participate in the Science Saturdays.


Dr. Schwuttke's goal in working with teachers is for them to participate in the activities and become comfortable enough with the topic and the experiments to repeat the lesson, including the hands-on components, with their own students.

Kristina Clark, a teacher at Stanton-Weirsdale Elementary School, attended the Water Cycle session in Ocala in December.

Clark and some of her fellow teachers made

a water cycle in a bowl to observe the phenomena of evaporation, condensation, and precipitation. They also made their own aquifers by using sand, rock, and other materials.

"The power point and the hands on activities are just what our students need to really understand and implement the concepts," Clark said. "I will use this information in my classroom and share it with my fellow teachers."

"There is a great need in this area to expose the teachers and the students to real-life situations that link to our science concepts," Clark continued. 

## Science Saturdays

*Science Saturdays is a hands-on science program for kids in third, fourth and fifth grades. High school students also volunteer at the sessions, which are held one Saturday a month during the school year.*

*Past topics include biodiversity, helicopters, roller coasters, bridges, slime and secret codes.*

### FALL 2017

#### PENSACOLA

**September 24** - Bottle Rockets  
*Presented by Dr. Pat Hayes, IHMC*

**October 22** - Fun With Chemistry  
*Presented by Ms. Jamie Zigterman, American Chemical Society*

**November 19** - Macro-organisms  
*Presented by Dr. Dawn Kernagis, IHMC*

**December 17** - Roller Coasters  
*Presented by Dr. Matt Johnson, IHMC*

#### OCALA

**September 10** - Balloon Cars  
*Presented by Mr. Adam Dalton, IHMC*

**October 8** - Computer Game Design  
*Presented by Dr. Kristy Hollingshead, IHMC*

**November 5** - Food - What's in It?  
*Presented by Dr. Sunny Ferrero, Rasmussen College*

**December 3** - Secret Codes  
*Presented by Dr. Jena Hwang, IHMC*





## BRIAN SHUL

Brian Shul, one of only 94 pilots to fly the SR-71 Blackbird, the world's fastest jet, captivated a full house with his stories of Cold War missions flying perhaps the most remarkable aircraft ever built. As a young pilot Shul had also barely survived a fiery crash during the Vietnam War, an experience that ultimately inspired him to live life to the fullest. The SR-71 has the distinction of having been both the highest flying and fastest manned aircraft the world has yet seen, capable of flying with two people aboard, approximately 3,400 feet per second, an unimaginably fast speed. That's Los Angeles to Washington, D.C. in one hour, four minutes! After retiring from the Air Force, Shul turned his professional attention to nature and aviation photography and he now owns a photo gallery in California. Shul also lectured in Pensacola last September.



## DR. SHIRLEY POMPONI & DR. BILL CLANCEY

Undersea exploration is around the corner—and it will involve tasks such as scavenging for life-saving drug compounds deep in the sea. Shirley Pomponi, a research professor and executive director of the National Oceanic and Atmospheric Administration's Cooperative Institute at Florida Atlantic University, paired up with IHMC research scientist Bill Clancey in a lecture on this promising field. "Robotics are now emerging as an alternative way for us old-timers who are used to going to sea and going down in the ocean in submersibles," Pomponi said. Telepresence will also allow scientists and members of the public to view undersea exploration real-time online. In the past 40 years, Pomponi added, more than 40,000 marine-derived chemical compounds have been discovered, including two cancer-fighting drugs, a herpes medication and a potent pain medicine derived from a toxic ocean-dwelling snail.



## DR. JAY DEAN

WWII was in large part an air war—and whoever could fly the highest, it was said, was going to win. This ended up being true—as American aircraft developments sped ahead of its opponents. But at what cost to the human body? Jay Dean, a physiology professor at the University of South Florida and the director of its hyperbaric biomedical research laboratory, spoke about the physiological challenges to flight: Unpressurized planes meant that once the planes reached certain altitudes, the oxygen dropped, and the men and women in those planes suffered from decompression sickness that's comparable to the bends in deep sea divers. Significantly sub-zero temperatures also posed serious health risks. "Winning the air war was dependent on getting enough oxygen and not freezing," Dean said. As a result of these conditions, oxygen masks and G suits were developed during the war.



## DR. RICHARD MOON

Whether or not you've ever experienced altitude sickness, human physiology is wired to react to the deprivation of oxygen, said Richard Moon, an anesthesiologist and professor of anesthesiology, pulmonary and critical care medicine at Duke University. Moon compared the adaptation of the body in high-altitude environments to its adaptation undersea. "You can't survive in the sea without a lot of technology," Moon said. "Most of the adaptation has been as a result of technological changes." One example of that is altering techniques for breathing gas to affect slow decompression so divers don't get the bends. The technological developments at high altitude have not been as pronounced, but there are parallels with medicine that Moon is exploring. People suffering from heart and lung disease, for example, suffer from hypoxia, so developing a drug to induce tolerance to low oxygen would be helpful.



## DR. HARRISON SCHMITT

Geologist Harrison "Jack" Schmitt is the only scientist to have ever walked on the moon. In 1972, he was part of the Apollo 17 Mission. Schmitt engaged an overflow audience at IHMC in Pensacola on February 18th. "Your body feels like it's on a giant trampoline," he said, since body weight in space is one sixth of what it is on earth. Schmitt also talked about the technological developments in flight and rocket technologies leading up to the Apollo Mission. The rapid advances in aviation took place in a geopolitical climate that spurred competition amongst nations to develop space programs, Schmitt said. Fighter planes were developed during World War II, followed by spaceflight advancements during the Cold War. While that type of political pressure has collapsed, the space program needs to continue to develop in the U.S., particularly as India, China, and Europe have all continued to invest in space exploration.



### DR. KERRY EMANUEL

Kerry Emanuel was in the right place to talk about hurricanes. Pensacola’s hurricane history (with a hurricane hitting on average, every two to three years) might have brought a lot of people to his lecture. But the MIT meteorology professor talked primarily about the overall history and nature of hurricanes. The word ‘hurricane’ itself is derived from the Mayan word ‘huracan,’ and Christopher Columbus experienced one on his fourth voyage to America. Emanuel also described how the application of both paleo-climate techniques and physical principles has allowed us to make far more robust estimates of hurricane risk—specifically how changing sea level and tropical climate might affect hurricane risk over the next century. Only about 11 percent of the world’s tropical storms occur in the Atlantic, but the Atlantic storms get about 98 percent of the press.



### DR. JOAN VERNIKOS

While technology has, in many ways, made our lives easier, it has also made us less mobile. Most people lead sedentary lives, sitting in front of computer screens all day. This might be accelerating the aging process because we are not interacting with gravity as much as we should, said Joan Vernikos, a gravity expert who is known for pioneering research on harmful effects of the gravity-less environment of space on astronauts. She was formerly the director of the life sciences division at NASA and now runs a consultancy called Third Age Health. Vernikos talked about astronauts experiencing gravity deprivation syndrome—oxidative stress, insulin resistance, and fat storage—as well as the “relative G deprivation” afflicting anyone with a sedentary lifestyle, which over time, can contribute to premature aging and poor health.



### MAC STONE

Nature photographer Mac Stone got a standing ovation at his lecture, “A Journey Through America’s Everglades,” where he showed stunning pictures of Florida’s diverse landscape: from the swamps to the springs to all the wildlife “on the frontlines” of these habitats. Stone, a Gainesville native, began taking pictures during high school—in an era “before Google earth,” he said, as a way of discovering his own environs. These experiences nursed his love of nature, turning him into a conservationist. He talked specifically about environmental threats to the Everglades as well as its endangered species, but said that throughout Florida, natural surroundings and wildlife are under threat. While talking, he showed several of his pictures of wildlife, which he says “live on the front lines” of environmental pollution. Stone has also written a book entitled “Everglades: America’s Wetland.”



### DR. DAVID DIAMOND

It’s well-known that a low-carb diet is good for your waistline and preventing conditions like diabetes. It’s also good for your heart. David Diamond, a professor in the psychology, molecular pharmacology, and physiology departments at the University of South Florida, experimented with a low-carb diet, when fifteen years ago, his doctor told him that his triglyceride levels were high off the charts. Diamond had been researching saturated fat and cholesterol. Determined to lower his triglyceride naturally instead of with drugs, he found out that grass-fed cattle meat can be beneficial, while potatoes, breads, and even certain fruits, are harmful. Diamond’s findings echo research from the 1850s that conferred cardiovascular benefits to low-carb diets. But a later study, in the 1950s, linking fat to heart disease, obscured those earlier findings, leading to the stigmatization of fats.



### DR. LARRY ARNN

Winston Churchill called the U.S. “the last, best hope for mankind on earth,” according to Larry Arnn, historian, author and president of Hillsdale College in Michigan. Arnn, who, in the 1970s, became fascinated with the British statesman’s writings (Churchill authored more than 50 books), has been studying him ever since. In the 1970s, Arnn traveled to England and worked with Churchill’s official biographer, Sir Martin Gilbert. Arnn spoke about Churchill’s aversion to war and despotic regimes like Sudan. “Churchill fought in the War in the Sudan in 1895 and didn’t like the way the Islamic Republic was oppressive and how women were treated,” he told the audience. However, Churchill promised to give his “blood, sweat and toil” to defend England against Hitler. Without Churchill, the Nazis would have likely invaded the U.K., Arnn added.



### DR. JUDITH CURRY

Judith Curry was once called a “climate heretic” for her unpopular views on the possible causes of global warming. “There is little debate about global temperature rise, greenhouse warming, and sea level rise...but the reasons for the increase in temperature can be debated as human, natural, or a combination of both.” For example, carbon dioxide emissions result from agriculture and transportation, as well as electric plants. Curry would like to see more emphasis on weather prediction and long-range climate policy. She also said population increase, oceanic activity, and land use should be factored into the big picture of climate change. Curry is a professor at the Georgia Institute of Technology, where she chairs the School of Earth and Atmospheric Sciences. She writes a popular blog on climate issues called Climate Etc.



### DR. RHONDA PATRICK

Our DNA partly determines how we metabolize various foods, react to stress, and how quickly we age. Rhonda Patrick, a biomedical scientist and expert in nutritional health, shared her insights on how genetic testing for diseases susceptibility, as well as our bodies’ propensity to metabolize certain nutrients, may help us live longer—and better. Gene polymorphisms regulate the color of our hair and eyes, but they also influence the type and amount of food we should eat. Many people are also deficient in vitamin D, which disrupts metabolic function, and 45 percent of Americans do not get enough magnesium, which over time, can lead to diseases of the eye, kidney and nerves. “That [magnesium deficiency], coupled with a high refined carbohydrate diet, is like a ticking time bomb for Type-2 Diabetes,” she said.



### DR. MARK MATTSON

Just when you thought low-carb diets posed your biggest dietary challenge, consider this: fasting. In the past, many species went for extended periods without food—and famous thinkers like Plato and writer Upton Sinclair swore by periodic fasting, said Mark Mattson, chief of the lab of neurosciences at the NIH’s National Institute on Aging, and a professor of neuroscience at Johns Hopkins University. What’s more, the drive to find food—as expressed by our ancestral hunters and gatherers—can improve cognitive function. Fasting (and exercise) induces the brain-derived neuro-trophic factor protein (BDNF), Mattson said. Improved BDNF signaling has been shown to regulate glucose levels, and improve cardiovascular functioning, brain health, and mood. Fasting can also reduce the risk of various neurodegenerative diseases such as Alzheimer’s disease.



### DR. BRENT REYNOLDS

Chemotherapy drugs cost thousands of dollars and can cause a lot of side effects—without necessarily being very effective. University of Florida neurology department researcher Brent Reynolds researches low-toxicity therapies such as epidiferphane (EDP), which comprises several natural ingredients including broccoli powder and curcumin. He holds a patent for his therapeutic approach, called “Cancerna,” which uses EDP, along with a ketogenic diet that includes 60 percent fat, 20 percent carbs and 20 percent protein. Used with conventional chemotherapy, the idea is that the natural therapies protect the body from chemotherapy’s side effects. Reynolds said his treatments are influenced by yoga and Eastern medicine. He calls his overall approach “Eco-Oncology,” which is inspired by the parallel between eradicating tumors and insects.



### DR. JOSEPH SIGNORILE

Don’t treat old people like porcelain dolls; getting them to move more will help slow the aging process, said Dr. Joseph Signorile, a professor and researcher at the University of Miami School of Medicine’s Center on Aging. He has done several studies on how activities such as ballroom dancing can slow aging. With regular movements in an appropriate exercise regimen, a 75-year-old can function like a 35-year-old. Some of these exercises involve repetitive movements like transferring gallon jugs between knee-level and shoulder-level shelves. Signorile recommends a “team approach” to providing an exercise prescription specific to the person. A healthy diet and cutting out bad habits like smoking are also part of the package, as is an upbeat attitude. Signorile engaged a full house. “The aging curve is like a waterfall or a cliff,” he said. “At about age 50, it goes downward.”



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