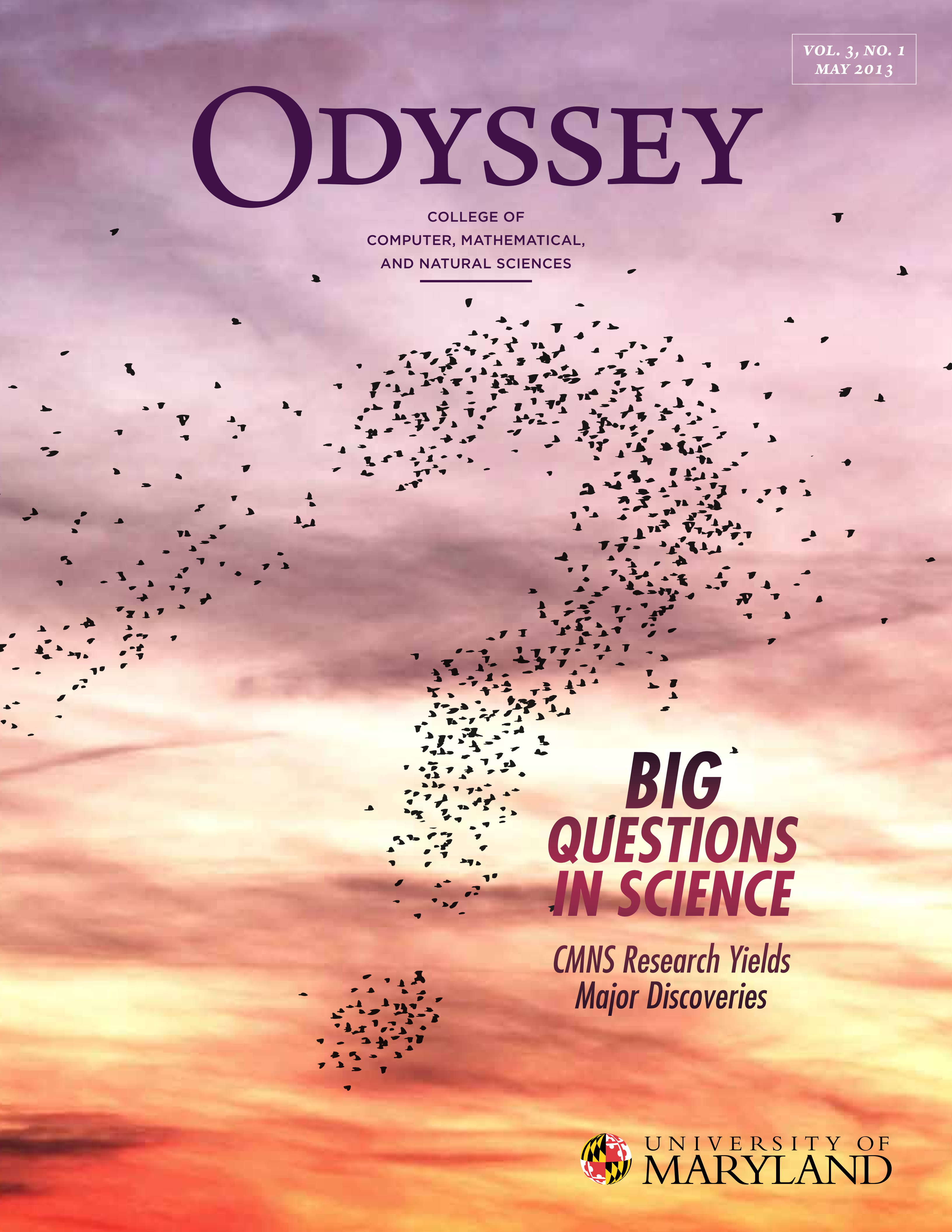
VOL. 3, NO. 1
MAY 2013

ODYSSEY

COLLEGE OF
COMPUTER, MATHEMATICAL,
AND NATURAL SCIENCES



BIG QUESTIONS IN SCIENCE

CMNS Research Yields Major Discoveries

UNIVERSITY OF MARYLAND

ON THE COVER

CAN A MATHEMATICAL MODEL EXPLAIN HOW BIRDS FLOCK? MATHEMATICS PROFESSOR KONSTANTINA TRIVISA CONSTRUCTS MODELS THAT CAPTURE COMPLEX PHYSICAL SYSTEMS, SUCH AS THE DYNAMICS OF FLOCKING BIRDS. (SEE PAGE 13.) A FLOCK OF BIRDS ON THE COVER FORM A QUESTION MARK TO OPEN THIS ISSUE ON BIG QUESTIONS IN SCIENCE.

Dear Friends,

Thanks to your generous support, our college continues to reach the highest levels of academic and research excellence. We have been increasingly successful in attracting truly exceptional students, faculty and staff. We have vibrant new faculty members conducting research in diverse areas, including black holes, aquatic environments, ecophysiology, Bayesian statistics, solid state chemistry, complex and Riemannian geometry, cybersecurity, and the Higgs boson, to name just a few. Our core mission is to advance research in our college and to create greater opportunities for our students.

In the last six months, we recognized the accomplishments of some of our senior faculty. Jim Gates, the University of Maryland Regents Professor of Physics, was awarded the National Medal of Science by President Obama. This is the highest honor bestowed by the United States government upon scientists, engineers and inventors. We are very proud of Jim for his work in string and particle theory and for embodying the best values of the college. He joins Distinguished University Professor Rita Colwell, who received the medal in 2006 for her groundbreaking work addressing health issues emerging from infectious disease.

We honored the lifetime achievements of Distinguished University Professor and University of Maryland Regents Professor Michael E. Fisher for his work in physics, chemistry, mathematics and the life sciences. Professor Fisher is a member of the Institute for Physical Science and Technology and the Department of Physics and a recipient of numerous awards, including the Wolf Prize and the Queen's Medal.

Jack Minker, Computer Science and University of Maryland Institute for Advanced Computer Studies, advocated for the human rights of scientists around the world for four decades and chronicled his correspondence with members of the global scientific community and his efforts to help them gain freedom in his book *Scientific Freedom and Human Rights: Scientists of Conscience in the Cold War*. A book reception for Jack, one of the founders of our premier Department of Computer Science, recognized his selfless work on behalf of fellow scientists.

A nuclear physicist during the Cold War in the former Soviet Union, Distinguished University Professor of Physics Roald Sagdeev was a top advisor to Mikhail Gorbachev. A symposium and birthday celebration for him included discussions of space and plasma physics and international relations.

A conference titled "An Open World of Physics" recognized the research career and birthday of Sankar Das Sarma, the Richard E. Prange Chair and a Distinguished University Professor in Physics. The speakers included three Nobel Laureates.

The Department of Chemistry and Biochemistry held a reunion/symposium to honor Professor and Chair Mike Doyle for his birthday. Many of Mike's former and current students and co-workers turned out for the special event.

The fearless ideas generated by all of our faculty members, staff and students are making an impact across campus and around the world. University of Maryland President Wallace Loh champions this innovative and entrepreneurial spirit. In this issue, we are pleased to share examples of how that spirit is driving research and discovery within the college.

Jayanth Banavar
Dean

Phillips Urges Graduates to Make a Difference

Commencement is not the end but the beginning of the next stage of life for graduates, Nobel Laureate in Physics William Phillips, a fellow of the university's Joint Quantum Institute and the National Institute of Standards and Technology, told attendees at the December 20 Commencement ceremony in the Comcast Center. He encouraged students to embrace the wonderful gift they have received: an education that has prepared them to think like a scientist.

CMNS awarded some 224 bachelor of science degrees, 111 master of science degrees and 103 doctoral degrees at the commencement ceremonies. Commencement Speaker Phillips urged graduates to welcome the next stage, where "you will find your voice—the way in which you will use your unique blend of talent and scientific discipline to make a positive difference in the world." ■

Banavar photo by John Consoli / Phillips photo by GradImages / Cover photo illlustration by Loretta Kuo

Tobin Marks Discovers Catalysts to Create Sustainably Produced Plastics

Chemistry Grad Recognized for Industry-changing Innovations

TOBIN MARKS PRESENTS "PLASTIC SOLAR CELLS WITH ENGINEERED INTERFACES" AT THE COLLEGE'S 2012 HOMECOMING ALUMNI FESTIVAL. MARKS WAS INDUCTED INTO THE CMNS CIRCLE OF DISCOVERY AND RECEIVED THE 2012 DISTINGUISHED CHEMISTRY ALUMNI AWARD.

While Benjamin Braddock may not have heeded the advice of his father's friend in the 1967 movie "The Graduate" about the great future in plastics, Tobin Marks, B.S. '66, chemistry, has helped create that future for the industry.

Green Technology Solutions

Marks, the Vladimir N. Ipatieff Professor of Catalytic Chemistry and Professor of Materials Science and Engineering at Northwestern University, is a world leader in developing new catalysts to help create recyclable, environmentally friendly, and sustainably produced plastics and elastomeric materials. Catalysts accelerate the creation of molecules or materials without being consumed and have wide-ranging applications, including the activation of enzymes in biology, the synthesis of therapeutic drugs and the large-scale production of coatings, fertilizers and plastics.

Marks's research has helped scientists understand the requirements to make and break specific chemical bonds and design new catalytic processes that have led directly to multi-billion dollar industrial innovations. He also has demonstrated how metals from unusual parts of the periodic table, such as rare earth elements, can be used as efficient catalysts with fewer undesired by-products. His work has resulted in enormous savings in energy and scarce resources and will play a major role in new technologies such as solar cells made from plastic and printing processes to make transistors and other electronic devices.

"The coming decades will present mankind with technical challenges threatening our quality of life," says Marks. "I believe that chemistry offers defining concepts and tools, and hence limitless opportunities, to better human life in many ways."

The 2011 Dreyfus Prize in the Chemical Sciences winner was honored for developing new industrial catalysts and broadening the understanding of their chemical structures and how they work. The $250,000 award, given by the Camille and Henry Dreyfus Foundation, recognizes exceptional and original research in a selected area of chemistry that has advanced the field in major ways.

Marks received his Ph.D. in inorganic chemistry from the Massachusetts Institute of Technology. He has been on the Northwestern faculty since 1970, and his research accomplishments have been recognized worldwide, including the U.S. National Medal of Science and election to the National Academy of Sciences, membership in the National Academy of Engineering, and numerous awards from the American Chemical Society and many international organizations. He is on the editorial boards of nine major journals; consultant or advisor for six major corporations and start-ups; and has published 1,075 research articles and holds 215 U.S. patents. Marks is also a member of the University of Maryland Alumni Association Hall of Fame.

A Transformative Experience

"When I attended summer orientation my freshman year, it was the first time I stepped foot on a college campus," remembers Marks, who is a first-generation college graduate. Marks lived on campus in Damascus Hall, a converted Army barracks, for one year before commuting to the university for the remaining three years. "I remember driving through blizzards on University Boulevard going back and forth from school," recalls Marks. "I made many friends at College Park, it was an enjoyable time."

He also remembers working his way through school starting at the university's Poultry Research Center on campus. "I fed chickens on Sunday afternoons," recounts Marks. "My job in the chemistry department was much more enjoyable."

Through the years, Marks has tracked down a few classmates and kept up with departmental updates on alumni. "I have looked at yearbooks online, and it is good to see the campus evolving," he notes.

As a college professor, he now understands, "A good undergraduate education is transformative, you are such a different person when you leave the institution. I did not truly appreciate the transformative experience I had at Maryland."

He judges his career success by "how many students I have helped and how my discoveries have made the world a better place. There is a real satisfaction in seeing your students grow and succeed, but my first passion is discovering new and useful things." ■

Photo by Thai Nguyen

BIG QUESTIONS IN SCIENCE

CMNS Research Yields Major Discoveries

By Beth Panitz

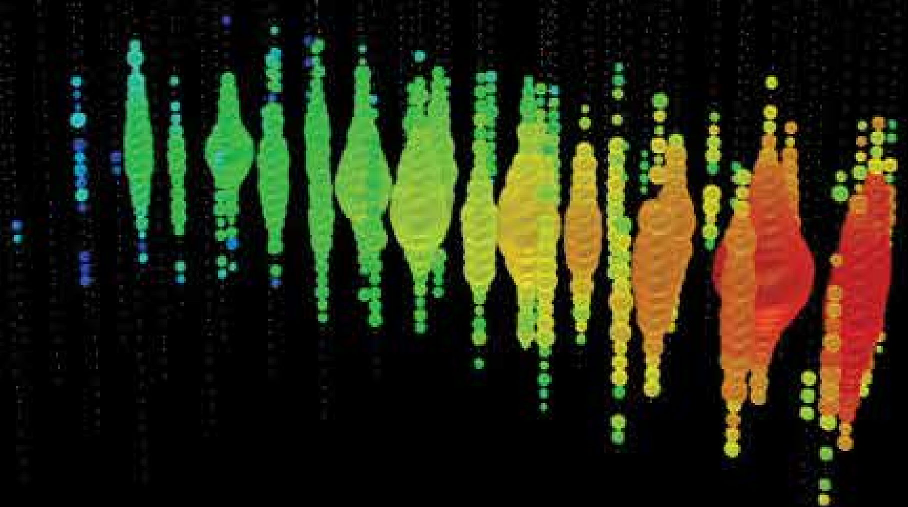
CMNS RESEARCHERS ARE ON A MISSION. Throughout the college, nearly 1,000 research and tenure-track faculty members, along with their students, are seeking answers to many of science's fundamental questions. "Our dedicated researchers are on the edge of discovery in the never-ending quest for information to add to their discipline's body of knowledge and unlock some of science's biggest mysteries," says CMNS Dean Jayanth Banavar.

That relentless pursuit of scientific breakthroughs is made possible, in part, by the generous support of a host of federal and corporate partners, who last year alone invested more than $180 million in the college. That investment has yielded strong returns.

On the pages that follow, read more about the big questions CMNS researchers are tackling and the answers they are discovering.

Photo illustration by Loretta Kuo

1 What do tiny neutrinos reveal about the universe?



The thermometer reads -25° F, but that doesn't stop Physics Associate Professor Kara Hoffman from putting on her parka and snow boots and heading into the frigid Antarctic air. While it may be winter break 2012 in College Park, it is summer at the South Pole and prime time for construction on Hoffman's latest experiment. Donning a hard hat, Hoffman helps the crew drill 200 meters into the Antarctic ice to install a unique subsurface telescope covering nearly 100 square kilometers that can detect some of the tiniest particles in our universe—neutrinos.

"Neutrinos are basic building blocks of our universe," says Hoffman. By exploring their properties, she believes, we can learn more about the nature of galaxies and supernovae and unravel astrophysical phenomena occurring millions or even billions of light years away.

Neutral and nearly massless, neutrinos move at light speed and are difficult to detect. They travel from space in straight lines without interacting with anything. In fact, billions of them pass through our bodies unnoticed every second.

Through her work on two NSF-funded projects, Hoffman is expanding our understanding of these tiny particles, which could also tell us more about cosmic rays, high-energy protons that bombard Earth, some having more kinetic energy than a professional baseball pitch. Hoffman notes: "The question is: what could accelerate them to such high energies?" Tracking cosmic rays to find this celestial particle accelerator is elusive because the magnetic field along their path bends the electrically charged particles. But neutrinos offer a clue.

Just as Galileo's optical telescope opened a new lens on space exploration, so do neutrino telescopes. "Galileo studied the heavens by looking at light or photons," notes Hoffman. "Today we can gather different information about the skies by looking for neutrinos."

Hoffman leads the development of the Askaryan Radio Array (ARA), a neutrino telescope that uses radio frequency, which transmits best through very cold ice, to detect the particles. Plans are underway for 37 subsurface clusters of radio antennae. In addition, she is a major contributor to the IceCube Neutrino Observatory, completed in 2010, which detects neutrinos inside a cubic kilometer block of ice at the South Pole.

"Whatever produces cosmic rays should also be producing neutrinos," says Hoffman. Traveling in straight lines, their origins are easier to discern. "If we can find some area of the sky where the neutrinos cluster—a twinkling spot of neutrinos—then we can figure out what is accelerating matter to such high energies," says Hoffman. ■

BILLIONS OF NEUTRINOS PASS THROUGH OUR BODIES UNNOTICED EVERY SECOND.

KARA HOFFMAN HELPS WITH THE CONSTRUCTION OF THE ARA NEUTRINO DETECTOR LOCATED NEAR THE SOUTH POLE.

Neutrino event reconstruction by IceCube Neutrino Observatory / Hoffman photo by Melany Zimmerman

2 Was Einstein correct?

Black holes may hold the answer to one of science's biggest questions: Does Albert Einstein's theory of general relativity hold true?

"Black holes are places where gravity has gone crazy," says Astronomy Professor Christopher Reynolds, director of the college's Joint Space Science Institute, a partnership with NASA Goddard Space Flight Center. "They have the strongest gravitational fields in the universe. They suck in everything, even light." Those properties make them the perfect natural laboratory to study Einstein's predictions about gravity.

While black holes themselves are undetectable, the super-hot gases spiraling into them emit radiation that can be detected by X-ray telescopes. Reynolds seeks a better understanding of black hole dynamics by examining data from instruments like NASA's Chandra X-ray Observatory and the European Space Agency's X-ray Multi-Mirror Mission (XMM-Newton) that must remain in orbit thousands of miles into space to capture the X-rays.

"According to Einstein, space is like a rubber sheet that can bend," says Reynolds. "Black holes can twist the space around them." Using the X-ray telescope observations, Reynolds can calculate how quickly a black hole is rotating and begin to examine this "twisting of space."

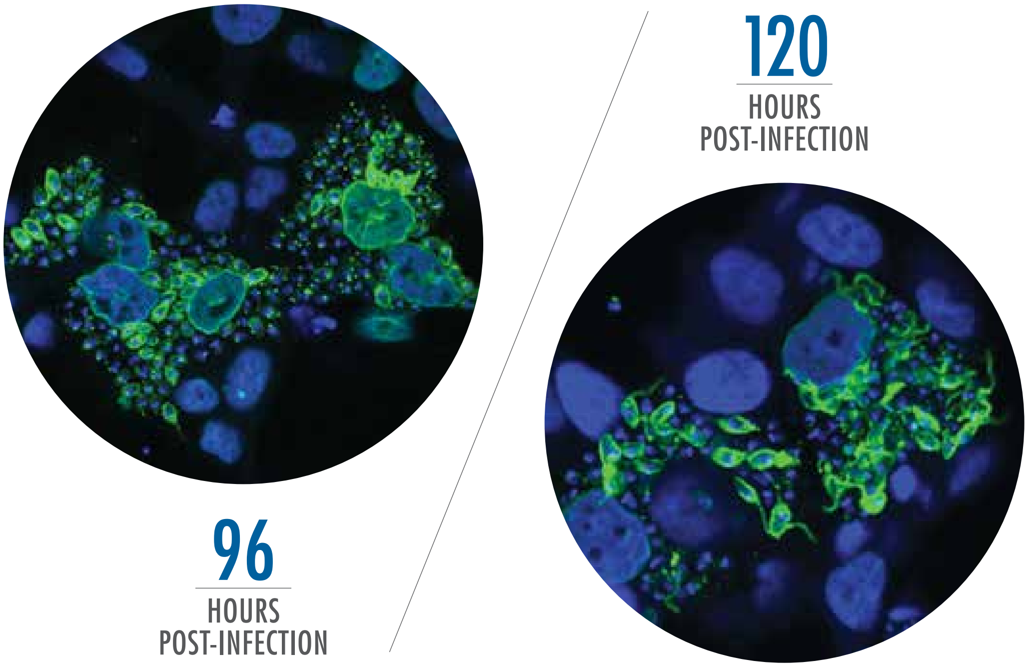
Current data supports Einstein's theory, but most scientists predict there is a glitch somewhere.

"There's a disconnection between the two major pillars of physics —general relativity and quantum mechanics. They make fundamentally different assumptions," says Reynolds, whose research is funded by NASA. "Most physicists think Einstein's theory has to give."

The search for answers is limited by current technology, which collects X-ray light from only a relatively small area and "does not allow us to track changes in the X-ray spectrum of accreting black holes in order to truly test Einstein's assumptions," says Reynolds, who is optimistic that future observatories will shed more light on the mysteries of black holes. He serves as a science advisor for the European Space Agency's proposed Large Observatory for X-ray Timing (LOFT), which is now being considered for construction with a tentative launch around 2020. "With a collection area that's nearly 100 times larger than current observatories, LOFT would enable us to study changes in the spectra of black hole systems in exquisite detail," says Reynolds, "allowing us to conduct new tests of gravity and further our knowledge of how matter interacts with the black hole during its final 'death plunge.'" ■

Illustration by Loretta Kuo

3 How can deadly pathogens be controlled?



HUMAN CELLS 96 AND 120 HOURS AFTER INFECTION WITH THE *TRYPANOSOMA CRUZI* PARASITE, WHICH CAUSES CHAGAS DISEASE, EXPRESS A TAGGED FORM OF THE MUCIN-ASSOCIATED SURFACE PROTEINS (MASP), KEY PLAYERS IN THE INFECTION PROCESS. DNA IN BOTH HUMAN CELLS AND PARASITES IS STAINED BLUE.

THESE PARASITES AFFECT SOME 20 MILLION PEOPLE WORLDWIDE.

Deadly pathogens infecting human cells are all in a day's work for Associate Professor Najib El-Sayed in the Department of Cell Biology and Molecular Genetics and the University of Maryland Institute for Advanced Computer Studies (UMIACS). Under carefully controlled conditions in his campus laboratory, El-Sayed grows three related trypanosomatid parasites that afflict an estimated 20 million people worldwide, causing diseases that run rampant in the developing world, including African sleeping sickness and Chagas disease.

Through his research, El-Sayed exposes these parasites to human cells grown in the laboratory and examines what happens on a genomic level. "We're looking to see how the parasite adapts to the host and how it interferes with the host's defense mechanisms," says El-Sayed, whose research is funded by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health. "Ultimately, our goal is to help scientists develop drug targets or vaccines."

As an undergraduate biology student, El-Sayed was fascinated by parasites. "They have complex, amazing lifecycles that take them from one host to another with incredible ways of modulating the function of every host and changing it to optimize their survival," he notes. That's great for parasites, but it could be lethal for host sites, including humans.

Today, El-Sayed's research utilizes next-generation sequencing technology to follow every single one of a parasite's 10,000 genes and examine how each gene behaves during the infection process. Likewise, he studies how the host cell responds. "We're trying to understand their gene expression programs, which genes turn on and off," he explains.

In a major breakthrough, the team recently identified a subset of genes in the Chagas disease-causing *Trypanosoma cruzi* parasite that activates when the pathogen is about to enter the human cell. "That finding tells us these genes must be involved in the infection process," says El-Sayed. Further research indicated that the products of a subset of these genes, the Mucin-Associated Surface Proteins (MASP), play key roles in the infection process.

Using bioinformatics tools, the researchers then identified a set of proteins in the human host that interacts with MASP. "We theorized that if we could stop that interaction, we could reduce the infection rate of Chagas disease," explains El-Sayed. Spread by the bite of triatomine (kissing) bugs, Chagas disease is a major health problem in South and Central America. Left untreated, about 30 percent of infected individuals develop chronic symptoms, including potentially fatal digestive and heart problems.

Back in the lab, El-Sayed's team has successfully prevented human cells from expressing the pinpointed proteins. "Suddenly the infection rate was reduced dramatically," says El-Sayed, who hopes his work leads to new treatments for a number of life-threatening diseases. "More than one-fifth of the world's population live in areas inhabited by the insects that transmit these parasites," says El-Sayed. "There's a pressing need to find drugs and vaccines for these neglected diseases." ■

Photos by Jungmin Choi

4 What drives the movement of animal populations?

For seven years, researchers from Biology Professor William Fagan's lab have traveled the frigid Antarctic seas to study how environmental changes affect penguin populations. When their touring vessels stop along the Antarctic Peninsula, the researchers disembark to painstakingly count each penguin and examine their breeding, nesting and feeding patterns. Using statistical and spatial analysis, Fagan's team has concluded that climate change is upsetting long-entrenched penguin dynamics, causing the population of two breeds to dwindle, while a third increases.

Fagan's work meshes field research with theoretical models to study the movement and distribution of animal populations from penguins in Antarctica to gazelles in Mongolia and primates in Panama. The findings help address critical questions in ecology and conservation biology. "To understand the human impact on other species," says Fagan, "we first have to understand how these species use their habitats."

With NSF funding, Fagan is developing a suite of bioinformatics tools to better analyze the movements of animal populations. "There is no one-size-fits-all tool because the data sets can differ greatly," notes Fagan, who is applying the tools to three different case studies: blacktip sharks swimming off Florida's coast, whooping cranes migrating from Wisconsin to Florida and nomadic gazelles traveling up to 1,000 kilometers per year across Mongolian grasslands.

The gazelle study builds off an earlier collaboration with the Smithsonian Institution that tracked the animals adorned with GPS-enabled collars, motion-detecting sensors and satellite uplinks. "Basically, you sit back and wait for the animal to send you an e-mail telling you what it has been up to," says Fagan. The result is a long record of movement data, no matter where the animal travels—quite different than the other two data sets.

The sharks are embedded with radio frequency identification tags, which allow them to be tracked via triangulation as they swim through a fixed area. Data collection on the whooping cranes depends on the efforts of government scientists and birdwatchers across the country who identify individual birds by unique tags.

The tools should help ecologists better understand what drives the movement patterns of a specific population—be it social dynamics, territoriality, the prevalence of predators or the search for resources—and assist them in developing appropriate conservation measures. In the case of the Mongolian gazelles, effective conservation efforts will need to consider the gazelle's nomadic nature, driven by its search for food across highly variable grasslands, says Fagan, who also is associate director of research innovation at SESYNC, the National Socio-Environmental Synthesis Center in Annapolis, a multidisciplinary, five-year, NSF-funded university initiative. ■

Visualization by AMV (Animal Movement Visualizer), Kavathekar, D., et al. / Gazelle photo by Thomas Mueller

5 How do genes change functions in nature?

What do a fruit fly and a mouse have in common? More than you might think, says Entomology Professor Leslie Pick, who studies the regulatory genes that control embryo development. In the 1990s, Pick's lab created transgenic fruit flies by inserting a mouse regulatory gene into a fly genome. Using genetic tools, the researchers then expressed the mouse gene in place of the analogous fly gene. "We were amazed that the mouse gene performed a job necessary for the fly's development," says Pick. "We would have thought that the genes for developing a fly—with its cuticle, wings and six legs—would be completely different than those for a mouse."

Pick's experiment and others have changed the way biologists think and led to the launch of a new field called evolutionary developmental biology, or simply "evo-devo." The field explores two of nature's biggest wonders: the development of complex organisms from single-cell embryos and the astonishing diversity of these organisms.

Pick investigates how regulatory genes evolve to allow for this diversity. Encased in a single-celled embryo, regulatory genes act like a set of developmental instructions, controlling the expression of other genes and the cell-differentiation process. Particularly intriguing is the fact that many of the same regulatory genes appear in very different species.

Pick tracks the evolution of the ftz gene, pronounced "futz." "This gene seems to have changed more than some other regulatory genes and now regulates totally different genes than its ancestral form," explains Pick, who conducts the research with NSF funding. "In the fruit fly it regulates segment formation, but in other species it plays a different role. The gene has switched its function somewhere during evolution."

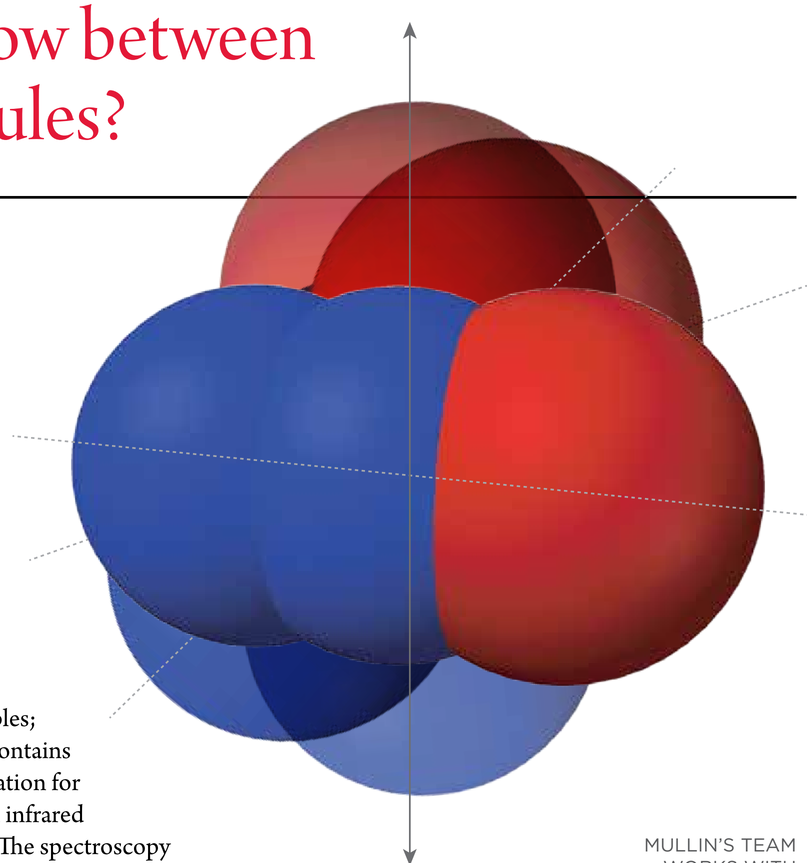
Mysteries abound about this process. "If we made these types of mutations in the lab, the embryo would die," says Pick. The question remains: How could the genes change in nature without damaging the embryo? Pick predicts: "We will find that evolution works by changing the expression and function of regulatory genes, little bits at a time, that allow the animals to survive and thrive in the wild."

Pick is serving as a rotating program director on evo-devo at NSF until June, while still maintaining her CMNS research projects. "It's been a great opportunity to view the field from a higher level and see how my research fits into the bigger picture." ■

> "IF WE MADE THESE TYPES OF MUTATIONS IN THE LAB, THE EMBRYO WOULD DIE."

Illustration by Loretta Kuo

6 How does energy flow between fast-spinning molecules?



MULLIN'S TEAM WORKS WITH SPINNING N_2O MOLECULES.

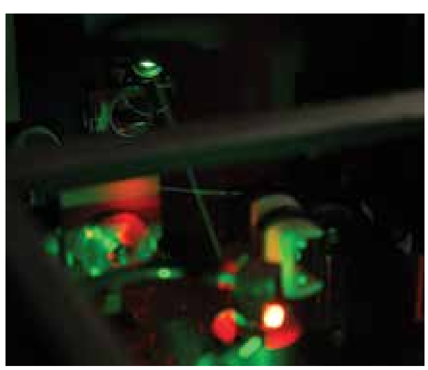
When Chemistry Professor Amy Mullin's research on high energy molecules reached an impasse, she did what great scientists have done throughout the ages—developed her own instrumentation to help her seek answers. For years, chemists have investigated how energy flows between molecules, hoping to gain insights into how chemical reactions work, but one type of molecular energy—rotation—has remained elusive. Until Mullin developed a high power optical centrifuge, no tool existed to move enough molecules into the extreme states required for study. Understanding these high-energy molecules could have far-reaching insights into plasma and combustion processes.

The optical centrifuge works by using a special combination of ultrafast laser pulses—called oppositely chirped pulses—to spin molecules into extreme rotational states. "It mimics molecules found under extreme temperature conditions in nature—several thousand degrees Kelvin," explains Mullin. "But unlike nature, the centrifuge gets the molecules rotating uniformly in space similar to many tiny, spinning gyroscopes. This gives us the potential to control the direction of reactive molecules."

The experiment fills an entire laboratory with its series of contraptions and mechanisms—oscillators, amplifiers, lenses and mirrors—covering three connected tables, encompassing 150 square feet. The centrifuge itself covers the first two tables; the final third contains the instrumentation for high-resolution infrared spectroscopy. "The spectroscopy allows us to study how the rotational energy is redistributed into other forms of energy through collisions," says Mullin.

Mullin joined CMNS in 2005 from Boston University with the dream of building this revolutionary tool. Despite naysayers in the scientific community, Mullin designed, built and began operating the centrifuge in four years. The working instrumentation wowed NSF, which granted Mullin funding to continue the project.

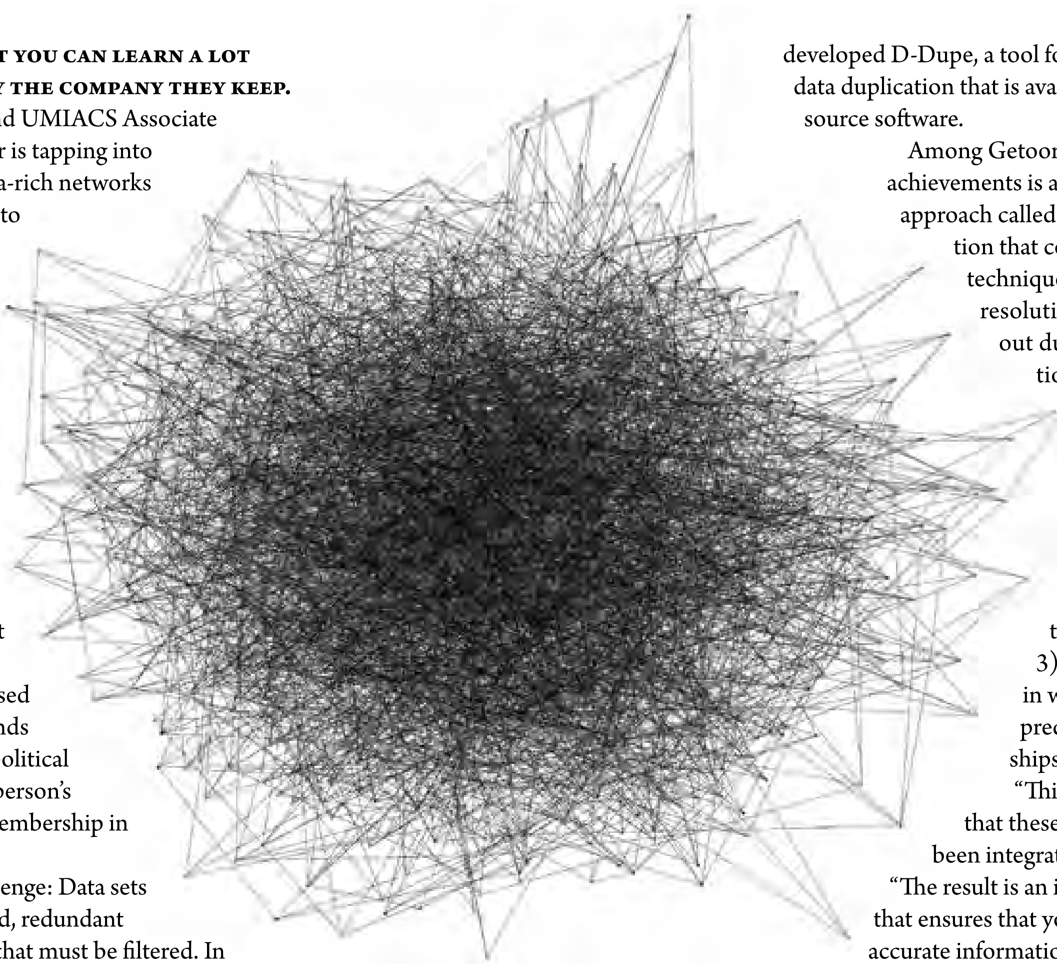
Her research is just beginning to yield insights into the dynamics at play in these molecules. "What's surprising," says Mullin, "is that once we get the molecules spinning, the spin persists even after several thousand collisions. Then it goes into translational energy." With varied molecular compounds behaving somewhat differently, Mullin's graduate and undergraduate student team members have their work cut out for them. "We have to take a lot of measurements to sort out the general from the specific," says Mullin. "But we have already sparked the imagination of many chemists and physicists by showing that we can put these molecules into extreme states." ■



PHOTOS FROM LEFT: PRECISION OPTICS RECOMBINE OPTICAL CENTRIFUGE PULSES. THE GREEN LIGHT AMPLIFIES THE POWER OF THE PULSES. THE EXTREME ROTATIONAL STATES OF N_2O ARE CREATED AND PROBED IN A LOW PRESSURE CELL.

Illustration and photos by Loretta Kuo

7 How can artificial intelligence decipher complex data?



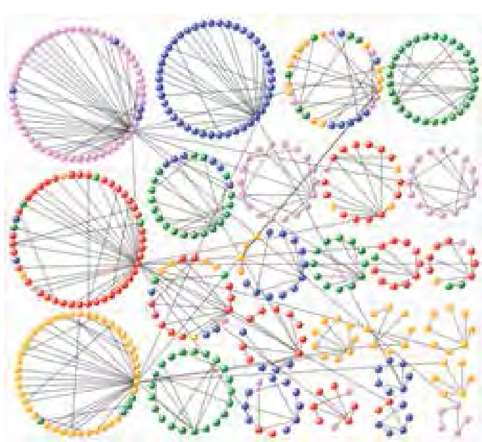
It's been said that you can learn a lot about someone by the company they keep. Computer Science and UMIACS Associate Professor Lise Getoor is tapping into the abundance of data-rich networks and using computers to understand and analyze that relational information and how it can be applied. For example, biologists can infer a protein's cellular function by examining its relationships in a protein-to-protein interaction network. Marketers can predict whether someone will buy a product based on whether their friends have bought it. And political scientists can infer a person's views by analyzing membership in online groups.

The biggest challenge: Data sets are frequently jumbled, redundant and filled with noise that must be filtered. In 2000, Getoor's doctoral research launched a new area of artificial intelligence called "statistical relational machine learning," which combines statistical approaches with relational machine learning strategies to make sense out of messy data sets. Today, her research is funded by a range of government agencies, including NSF and the Defense Advanced Research Projects Agency, and technology giants Google, Microsoft and Yahoo!

Another common problem: inconsistencies in data sets. "How do you figure out whether two similar references refer to the same entity?" Getoor poses. For example, in bibliographic information, do J. Smith, Jonathan Smith and John Smith all refer to the same person? Getoor has developed "entity resolution" strategies that tackle this problem by examining relational information. If J. Smith and Jonathan Smith have several co-authors in common, they more likely are the same entity. Getoor and her students have developed new algorithms that make use of relational information and other contextual information to improve the accuracy of entity resolution. With fellow researchers at the university's Human-Computer Interaction Laboratory, Getoor developed D-Dupe, a tool for eliminating data duplication that is available as open-source software.

Among Getoor's crowning achievements is a data-cleaning approach called graph identification that combines three techniques: 1) entity resolution, which weeds out duplicate information, 2) collective classification, where nodes are identified and labeled based on their relationship with other nodes in the network and 3) link prediction, in which the model predicts relationships between data.

"This is the first time that these strategies have been integrated," says Getoor. "The result is an improved model that ensures that you have more accurate information." Getoor plans to apply her algorithms to specific areas, including personalized medicine in which extensive data sets can be used to tailor medical treatment to each patient's individual characteristics. ■



GRAPH IDENTIFICATION TRANSFORMS COMPLEX DATA SETS (ABOVE) INTO DATA APPROPRIATE FOR FURTHER ANALYSIS (LEFT).

Illustrations by Galileo Namata

8 Why do continents exist only on planet Earth?

Distinguished University Professor and Geology Department Chair Roberta Rudnick is trying to crack a mystery that lies far beneath the ground we walk on. Rudnick studies the evolution of the Earth's continental crust. "Interestingly, none of the other planets in our solar system have continents," she points out. "Understanding continent formation can broaden our knowledge about many processes on Earth, including our own species' evolution."

Geologists agree that the continental crust formed when magma melted in the Earth's mantle, erupting to the surface. "The perplexing thing is that the continental crust is comprised of rocks that could not have come directly from the Earth's mantle," says Rudnick, "so other processes must have been involved." The crust has an andesitic bulk composition, while geologists would expect it to have a basaltic composition, like the Earth's oceanic crust and terrestrial areas on Mars and Venus. This "Crust Composition Conundrum" puzzles Rudnick, and she has traveled the globe for answers.

Her research currently takes her to Eastern China, where she looks for clues in rock samples brought to the surface through volcanic eruptions—what Rudnick calls a poor man's drill hole. "We would love to drill down and collect samples, but it's hugely expensive, and is not feasible past 12 kilometers," says Rudnick, who explains that the base of the crust is 40 kilometers deep and the underlying lithosphere is 150 kilometers below the Earth's surface.

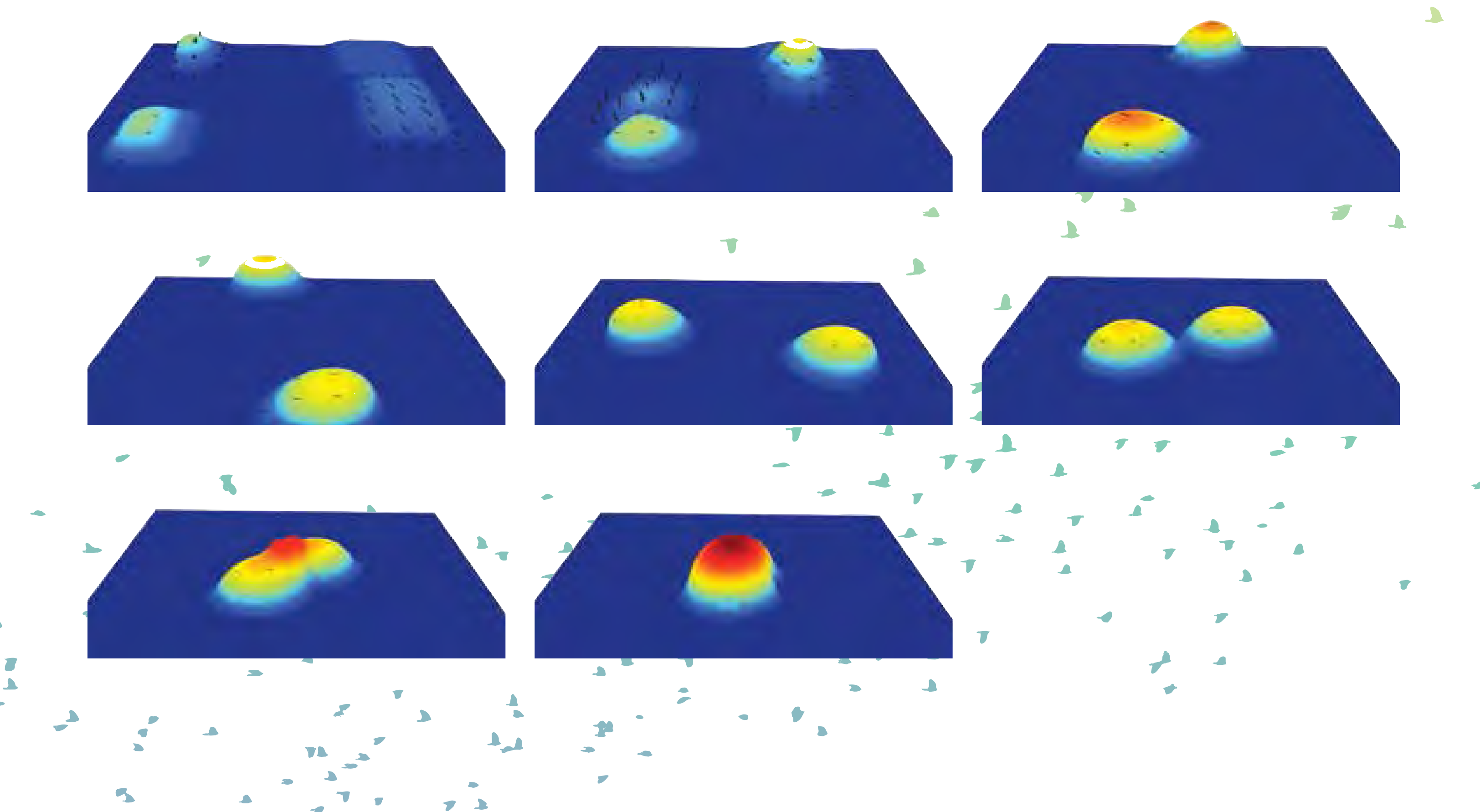
Back in the campus geochemical laboratories, her research team has analyzed the samples extensively, finding evidence to explain the conundrum. One theory, called "recycling of the lower crust," posits that millions of years ago the crust was basaltic, but that over time the denser minerals, containing iron and magnesium, accumulated in the lower crust and eventually sank into the mantle. Her lab also unearthed evidence that chemical weathering has changed the crust composition over the ages by removing soluble elements, such as magnesium.

Rudnick, an elected member of the National Academy of Sciences, is also reassessing the continental crust composition to derive a better estimate of its radioactive elements. In the past year, she and her collaborators have traveled to Central China, South Africa, Namibia, Canada, as well as Idaho and Wyoming, to collect samples from glacial tillites—rock material deposited during ice ages throughout history. The information could help uncover further mysteries of continent evolution, including how weathering of continents responded to the rise of atmospheric oxygen some 2.4 billion years ago. ■

ROBERTA RUDNICK EXAMINES AND LABELS MANTLE XENOLITHS WITH GRADUATE STUDENT JINGAO LIU AT YANGYUAN, SHANXI PROVINCE, CHINA.

Inset photo by Richard J. Walker / Earth image by Reto Stöckli, NASA Earth Observatory

9 How do mathematical models explain nature?



Konstantina Trivisa sees mathematics in play everywhere she looks, whether it's a flock of birds flying overhead, a school of fish in a stream, the ocean's waves or the blood flowing through our veins. The mathematics professor applies her expertise in nonlinear partial differential equations to model complex physical systems and to prove how existing models apply to specific phenomena. "I'm not the type of mathematician who develops an idea simply because it's beautiful mathematics," says Trivisa. "I always have an application in mind that would interest an engineer, physicist or biologist."

Take the example of biologists studying the dynamics of flocking birds. Using traditional "particle systems," the research is computationally expensive and time consuming. "With my collaborators, I constructed a model that captures the relevant phenomena, including unpredictable events, such as the presence of wind. This model can greatly reduce the computational cost of investigation," says Trivisa.

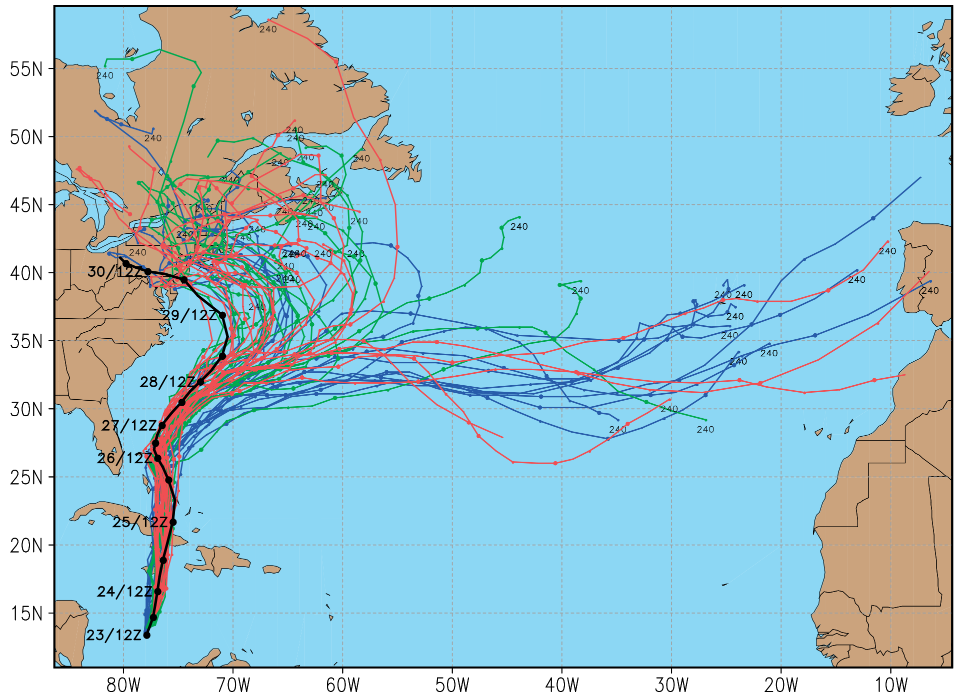
Much of Trivisa's research focuses on developing the mathematical methods to better understand fluid dynamics, materials science and phase transition processes. She received a prestigious NSF Presidential Early CAREER Award for her work, and plans to apply her mathematical skills, using a fluid dynamics and mechanics approach, to biomedical issues. She is beginning to investigate fluid-structure interaction in blood flow, which is relevant for the design of cardiovascular treatments, such as stents used to improve the flow through narrow or weak arteries.

A native of Greece, Trivisa moved to the United States in 1991 for her doctoral studies. She joined CMNS in 2000 and currently directs the interdisciplinary Applied Mathematics, Statistics, and Scientific Computation Program and is an affiliate professor in the Institute of Physical Science and Technology. "Working with a large community of scientists and engineers keeps me focused on the big questions in science," says Trivisa, who continues to foster scientific collaborations in which she can apply mathematics to provide key answers. ■

VISUALIZATION ABOVE SHOWS THE EVOLUTION OF FOUR DISTINCT FLOCKS OF BIRDS: AS TIME PASSES, THE BIRDS APPROACH EACH OTHER AND FINALLY MERGE TO ONE FLOCK AS PREDICTED BY THE MODEL.

Visualization by Konstantina Trivisa / Illustration by Loretta Kuo

10 How can we improve weather forecasting?



NCEP-GFS ENSEMBLE FORECASTS OF HURRICANE SANDY

BLUE 12Z OCT 23, 2012
GREEN 18Z OCT 23, 2012
RED 00Z OCT 24, 2012
BLACK SANDY'S ACTUAL TRACK

It may have been one of the biggest natural disasters to strike the East Coast, but Superstorm Sandy was also a scientific triumph of numerical weather prediction, says Distinguished University Professor Eugenia Kalnay, a world-renowned expert in numerical weather prediction (NWP) in the Department of Atmospheric and Oceanic Science. "I'm quite impressed by the operational forecasts of Sandy," she says. "The precipitation, the winds and even the estimation of the uncertainty of the forecasts—they were all impressively accurate."

This accuracy is due, in part, to Kalnay's own work over the past 30 years. At the National Weather Service (NWS) from 1987 to 1997, she headed the research division that develops the computer atmospheric models and the methods for "assimilating observations" used for forecasting the weather. "Our seven-day forecast is now about as accurate as a one or two-day forecast was in the 1960s," she notes. Still, weather prediction is difficult as evidenced by the storm that started in Iowa on June 29, 2012, and evolved into a "derecho" that moved eastward for more than 12 hours with very severe weather all the way to the Washington, D.C. region, leaving behind widespread devastation and power outages. Although the NWS Storm Prediction Center issued severe thunderstorm warnings along the route, further improvements in NWP means future warnings could be provided days, not hours, in advance.

One of the keys to improving weather forecasts is to ensure that atmospheric computer models start with an accurate estimate of current atmospheric conditions. As an expert on "data assimilation," Kalnay develops methods to better determine initial conditions generated from observations, such as satellite and radar information. Researchers and students worldwide use her book, *Atmospheric Modeling, Data Assimilation and Predictability*, which has been translated into Chinese and Korean.

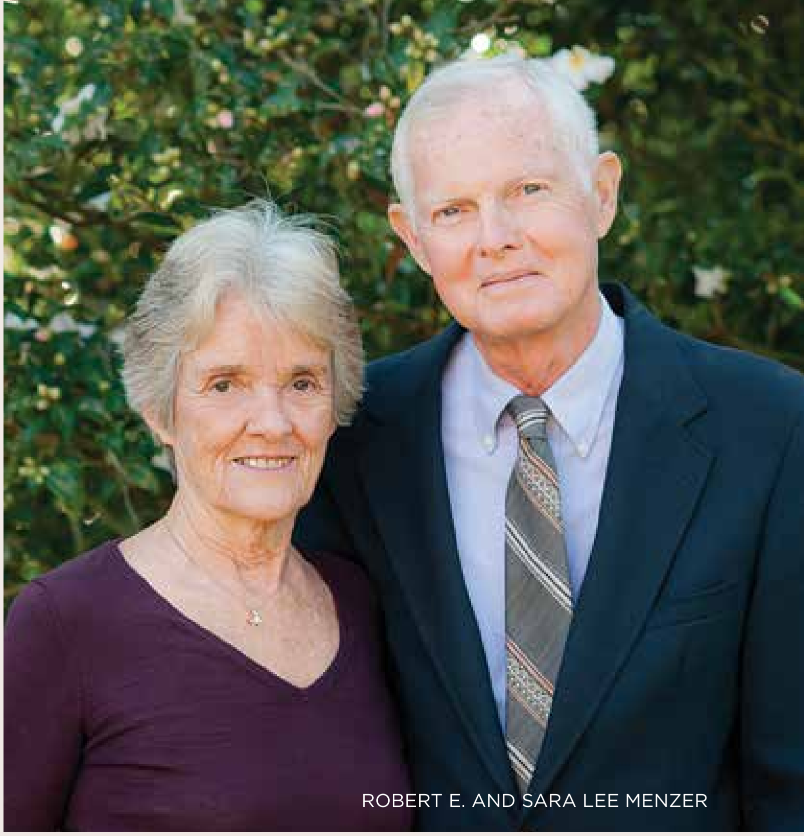
Kalnay and Distinguished University Professor James Yorke founded the college's Weather & Chaos group, which has made groundbreaking improvements in data assimilation systems and numerical weather prediction, graduating some 20 doctoral experts in the process. Kalnay is also a pioneer in ensemble forecasting, a technique that she developed and implemented operationally 20 years ago at the NWS. "Instead of making a single forecast, we use slightly different initial conditions and create an ensemble of 20 forecasts," she explains. "This way, we can predict forecast uncertainty by examining where these weather forecasts agree or disagree, making them much more useful." The introduction of this information extended forecasts from three to seven days beginning in the mid 1990s.

More recently, the ensemble approach has been combined with data assimilation in the Local Ensemble Transform Kalman Filter, a method developed by Brian Hunt, a professor in the Weather & Chaos group, and adopted by several countries for operational weather prediction. In the future, the approaches could have other important applications as well. "The ideas of ensemble prediction and data assimilation could be adopted to improve forecasts of other types, such as economic forecasts," adds Kalnay. ■

Ensemble forecasts by Eugenia Kalnay / Earth photo by NASA GOES Project / Kalnay photo by John Consoli

Robert Menzer Establishes Award to Honor Grandson

MEES Founding Director Helped Develop Standards on Pesticide Use



ROBERT E. AND SARA LEE MENZER

Decades before the popularity of organic farming and the promotion of organic fruits and vegetables in restaurants and grocery stores, Robert E. Menzer, M.S. '62, entomology, was studying the effects of pesticides on fruits and vegetables at the university. While a sophomore and president of the science club at Northwestern High School in Hyattsville, Md., Menzer connected with Entomology Professor Louis Dittman and spent his high school summers working at the university's Plant Research Farm in Fairland, Md., just seven miles outside of College Park.

"Pesticide toxicology was a wide open field for a young biologist," recalls Menzer. Even while pursuing his undergraduate degree at The University of Pennsylvania, he continued to work on the farm. "I helped to establish the pesticide residue analysis lab and conduct the studies to establish the proper guidelines for crop treatments," says Menzer, who ran the lab for two years while he pursued his master's at Maryland. Following doctoral studies at the University of Wisconsin in pesticide toxicology, he returned to the university in 1965 to run the Department of Entomology's Toxicology Lab.

"Pesticides that contained phosphorus were in rapid development at the time," explains Menzer. "Some pesticides were being used prematurely with little known about their behavior in the environment. We studied how specific chemicals degraded in plant and animal systems." Menzer's work led to restrictions on certain chemicals and has been used by the U.S. Environmental Protection Agency (EPA) in developing regulations on chemicals used in pesticides. Menzer also has served on the Safe Water Drinking Committee and the Toxicology Committee of the National Research Council formulating national standards for safe drinking water.

(L TO R) REID EVANS MENZER'S PARENTS, KENDALL AND R. ERIC MENZER, AND SISTER FRANCES.

Menzer is the founding director of the university's Marine Estuarine Environmental Science (MEES) graduate program. Created in 1978, it has grown into the University System of Maryland's largest graduate program in the environmental sciences. The program was groundbreaking in its interdisciplinary, multi-campus approach and its use of distance learning technology, according to Menzer.

His love of the program led him and his wife, Sara Lee Menzer, to create the Reid Evans Menzer Memorial Graduate Award with a $100,000 gift in honor of their grandson, who was just 14 years old when he died tragically as a result of a skateboard accident. "Reid was a very intelligent child, an inventor. At age ten, he asked for and received a microscope for Christmas and enjoyed studying and photographing nature." The award is made annually to any MEES graduate student with superior academic merit and achievement.

In 1989, Menzer was named director of the EPA's Gulf Breeze Environmental Research Laboratory in Florida, one of the nation's most highly regarded labs in estuarine chemical toxicology, to explore pollution problems in estuarine systems. Later, when the EPA reorganized its Office of Research and Development at its National Center for Environmental Research, Menzer was named a senior science advisor, where he helped to initiate the Science to Achieve Results (STAR) program and created joint programs with other federal agencies.

Last year, Menzer made another generous donation of nearly $100,000 to support the construction of new offices and digital classrooms for the MEES program, which moved from Cole Field House to H.J. Patterson Hall in summer 2012. The new, large classrooms are equipped with state-of-the-art electronics to transmit and receive lectures thoughout the state. These capabilities will allow the MEES program to offer more courses over the interactive video network to increasing numbers of students and improve the quality of the lectures. The new space will be dedicated on May 16 in recognition of Menzer's leadership and generosity to the university.

Today, Menzer still visits the university when he travels to the area as a consultant for the Hazardous Substances Data Bank Science Review Panel of the National Institutes of Health. Most of his time is spent enjoying the view from his Florida home, which sits on a bluff overlooking Pensacola Bay. An avid gardener, he says, "I use pesticides when needed, but sparingly. We are just happy to have flowers in the garden all year round." ■

Photos by Daly Photography

PERSISTENCE PAYS OFF

LAURA WEBER CONDUCTS RESEARCH ON CORAL REEFS OFF THE COAST OF BERMUDA THROUGH A STUDY ABROAD EXPERIENCE WITH THE BERMUDA INSTITUTE OF OCEAN SCIENCES.

Photo by Donald Gerasimchik

From identifying plants at the base of Mt. Saint Helens outside Portland to studying the coral reefs of Bermuda, **Laura Weber**, B.S. '12, biology, participated in as many research projects as possible during her CMNS career.

She encouraged that level of involvement among her peers as the student speaker for the CMNS December 2012 Commencement. "We need to appreciate each day for the opportunities that we have, for the obstacles that we can overcome, and for the renewed chance of improving ourselves for the better," she told commencement participants.

When Weber transferred to CMNS in spring 2010, she "understood the importance of hands-on experiences and making connections to active researchers." That summer she traveled with Biology Professor Bill Fagan's research group to Mt. Saint Helens for three weeks to participate in ecology field research. Weber helped conduct vegetation surveys, characterizing different types of habitats. The research was used by the U.S. Forest Service and as part of a doctoral study on the correlation between vegetation and types of birds. "We were up at the crack of dawn at the site and spent 12 hours identifying plants and shrubs and measuring the width and diameter of trees," Weber describes.

The trip confirmed Weber's desire to work in nature. "It was so peaceful and beautiful to be surrounded by nature, to appreciate it and actively become part of it. I realized I was becoming a scientist," recalls Weber.

She also gained experience as an undergraduate teaching assistant for an organismal biology course and served as a volunteer undergraduate research assistant in Biology Associate Professor Karen Lips's lab. There she sampled and analyzed bacteria and fungi on salamander skin to identify antibiotic properties that could be used to control a fungus attacking frogs. "All of these experiences were helping me prepare for life as a graduate student," says Weber.

As recipient of the Erik P. Young, M.D., International Travel Study Abroad Award, Weber spent fall 2012 at the Bermuda Institute of Ocean Sciences, where she took a scuba-diving research methods course and collected specimens for her independent research project focusing on the interaction between microbes and corals while completing coral reef ecology and invertebrate biology courses. Weber is now working at the Woods Hole Oceanographic Institute's Marine Chemical and Geochemistry Department in Massachusetts analyzing both the microbial and chemical components of coral mucus as part of the Guest Student Researcher Program.

This fall, she hopes to begin her graduate studies with a focus on coral reef microbiology. "I want to investigate microbe assemblages that live on coral and improve coral survival rates in stressful, changing environments," Weber explains. "We need to learn why corals in Indonesia and the Pacific may adapt to climate change better than those in the Caribbean."

Through all of her varied research experiences, Weber has learned valuable lessons. "Keep seeking opportunities, no matter what the probability of getting that scholarship or internship. Be persistent, and take risks. Every experience will help you become the scientist you are meant to be." ■

NOAA AND UMD RESEARCHERS WILL WORK COLLABORATIVELY AT THE NOAA CENTER FOR WEATHER AND CLIMATE PREDICTION, ONE OF THE NEWEST ADDITIONS TO M SQUARE.

National Weather and Climate Prediction Center Opens

The National Oceanic and Atmospheric Administration's (NOAA's) Center for Weather and Climate Prediction is now a centerpiece of M Square, the University of Maryland Research Park. The center brings more than 800 NOAA employees from several different buildings to one location in an innovative, state-of-the-art facility designed by a team of architects led by Roger Schwabacher, M.A. '99, architecture.

The new NOAA center provides the nation with a broad range of environmental services—from predicting the hurricane season and El Niño/La Niña to forecasting ocean currents and large-scale rain and snow storms. The new building is deliberately next door to the UMD Earth System Science Interdisciplinary Center (ESSIC) and Joint Global Change Research Institute—leading centers on earth science, climate change and energy use. NOAA and the university have established a collaborative agreement to maximize the enhanced academic and research opportunities made possible by the new center and its location adjacent to campus. ■

UMD Joins Big 10 Conference

The University of Maryland will join the Big Ten Conference effective July 1, 2014, and also will join the Committee on Institutional Cooperation (CIC), a consortium of world-class research institutions dedicated to advancing their academic missions.

"Membership in the Big Ten Conference is in the strategic interest of the University of Maryland," says University of Maryland President Wallace Loh. "It will not only ensure the financial vitality of Maryland Athletics for decades to come, but the extensive opportunities in the CIC for collaborations with our peer AAU and flagship universities in education, research and innovation will boost the University of Maryland's ascendancy in academic excellence."

The Big Ten Council of Presidents/Chancellors welcomed the university and noted its top-ranked academic and athletic programs will be a tremendous addition to the conference. ■

Photo by John Consoli

ESSIC Receives $36 Million in NASA Funding

NASA has awarded a $36 million cooperative funding agreement to the university to continue collaborative research in the field of earth systems science. The five-year agreement funds an already established partnership between NASA's Earth Sciences Division, located at the Goddard Space Flight Center (GSFC) and the university's Earth System Science Interdisciplinary Center (ESSIC) to study and forecast impacts of the Earth's connected systems on the global and regional environment, weather and climate.

"With NASA's space-based observations and the university's research expertise in earth systems science, we can look at how the atmosphere, oceans, land surface and frozen regions interact and make predictions about future impacts," says Tony Busalacchi, ESSIC director and professor in the Department of Atmospheric and Oceanic Science.

The agreement will fund a variety of research, including the study of aerosols and human-generated pollutants that travel long distances through the atmosphere and oceans; how models and observations are used together to investigate the effects of Chesapeake Bay breezes on surface air pollution levels and deposits over the Chesapeake Bay watershed; ways to improve drought monitoring; and real-time analyses to detect falling snow on a variety of surfaces.

"The interdisciplinary research embodied by this new cooperative agreement demonstrates how the NASA/Goddard, ESSIC, and University of Maryland partnership is focused on delivering science in support of society," says Busalacchi. ■

Biology Student is UMD's First Gates Cambridge Scholar

Krzysztof Franaszek, B.S. '13, biology and economics, is the university's first recipient of the prestigious international Gates Cambridge Scholarship, which was established in 2001 with a $210 million donation from the Bill & Melinda Gates Foundation. Franaszek's research focuses on hidden points of vulnerability in the ways some viruses, such as HIV and SARS, encode the proteins that give them structure and potency. His work could lead to new virus-fighting strategies.

"Intellectual pursuits are goals in themselves. Trying to make something to help other people… that's what drives me," explains Franaszek, who volunteers as an emergency medical technician with the Branchville Volunteer Fire Department on weekends. The son of a physicist and a pharmacologist, Franaszek was born in Krakow, Poland, and emigrated to the U.S. with his family soon after the fall of Communism in Eastern Europe.

His scholarship, one of 39 awarded to U.S. seniors and recent graduates who combine academic excellence with a commitment to improving the lives of others, covers all costs for a year of post-graduate study at the University of Cambridge. A member of the UMD crew team, Franaszek plans to try out for one of Cambridge's legendary rowing clubs. ■

KRZYSZTOF FRANASZEK

CMNS Student Wins Fulbright Teaching Assistantship

Katy Rennenkampf, a CMNS senior who is triple-majoring in mathematics, English and economics, has been awarded a Fulbright English Teaching Assistantship to Indonesia for the 2013-14 academic year. Rennenkampf, who aspires to become a math educator at the secondary level, will teach English as she pursues a project on Indonesia's recent reform of its mathematics curricula. She also hopes to contribute to efforts to revitalize field hockey as a youth sport in Indonesia. Upon her return, she plans to take an assignment as a Teach for America Corps member.

A member of the Honors College, Rennenkampf has served as an Honors Ambassador and as a Maryland Images Tour Guide. She gained teaching experience as a para-educator in the Howard County Comprehensive Summer School program. ■

KATY RENNENKAMPF

Franaszek photo by John Consoli / Rennenkampf photo by Doug Findeisen

CMNS Names New Department Chairs

The college has announced new leaders for several CMNS departments, effective July 1. “This group of outstanding faculty leaders have excelled in the classroom, in their research and in managing programs and research projects,” says CMNS Dean Jayanth Banavar. “We look forward to exceptional leadership of their respective departments.”

BILL FAGAN
BIOLOGY

Bill Fagan was named chair of the Department of Biology. Fagan combines field research with theoretical models to address critical questions in ecology and conservation biology. His ongoing research falls in several areas that illustrate this melding of theory and problem-solving, including mathematical modeling of animal movement, spatial ecological dynamics, ecological informatics, and biological stoichiometry.

JANICE RUETT-ROBEY
CHEMISTRY AND BIOCHEMISTRY

Janice Ruett-Robey was named chair of the Department of Chemistry and Biochemistry. Her research focuses on physical and chemical properties of surfaces (single crystals and supported crystallites) under controlled ultra-high vacuum conditions. She was a founding investigator in the university’s Materials Research Science and Engineering Center and has served as the center’s director since 2010.

SCOTT WOLPERT
MATHEMATICS

Scott Wolpert was named chair of the Department of Mathematics. A Distinguished Scholar-Teacher Award recipient, his research focuses on Reimann surfaces, especially descriptions by Fuchsian groups, by cut-and-paste construction and by solutions of algebraic equations. He also continues to research the Weil-Petersson (WP) geometry for the Teichmueller space.

LESLIE PICK
ENTOMOLOGY

Leslie Pick was named chair of the Department of Entomology. Through her research, she seeks to understand how complex organisms develop from simple fertilized eggs and how evolution has utilized a largely conserved set of regulatory genes to generate different types of animals and body plans. Pick is currently serving as program director of the Division of Integrated Organismal Sciences at the National Science Foundation.

Photos by John Consoli / Fagan photo by Rhoda Baer

New Faculty Members Join CMNS

ASTRONOMY

Assistant Professor **Suvi Gezari** earned her Ph.D. from Columbia University. She is an expert in time-domain astrophysics, and her research interests include active galactic nuclei, the demographics and evolution of supermassive black holes, and the tidal disruption of stars by black holes. Previously, she was a Hubble Fellow working at The Johns Hopkins University.

ATMOSPHERIC AND OCEANIC SCIENCE, EARTH SYSTEM SCIENCE INTERDISCIPLINARY CENTER

Professor **Fernando Miralles-Wilhelm**, earned his Ph.D. in water resources from the Massachusetts Institute of Technology. His research expertise is in hydrological modeling with an emphasis on the simulation of physical, chemical and biological processes in aquatic environments.

BIOLOGY

Assistant Professor **Nathan Kraft** earned his Ph.D. from the University of California, Berkeley and did postdoctoral research at the University of British Columbia's Biodiversity Research Centre. Kraft studies the ecological and evolutionary forces that structure communities, particularly plant systems. His projects integrate aspects of community ecology, biogeography, ecophysiology and phylogenetics.

BIOLOGY

Professor **Mary Ann Rankin** serves as senior vice president and provost of the University of Maryland, College Park. She earned a Ph.D. in physiology and behavior from the University of Iowa. Previously she was CEO of the National Math and Science Initiative, a public-private partnership dedicated to expanding the pipeline of STEM (science, technology, engineering and math) graduates and STEM K-12 teachers. She is also a former dean of the College of Natural Sciences at the University of Texas.

CHEMISTRY AND BIOCHEMISTRY

Assistant Professor **Efrain Rodriguez** received his Ph.D. from the University of California, Santa Barbara and was a Northeast Biodefense Center Postdoctoral Fellow at the National Institute of Standards and Technology (NIST) Center for Neutron Research. His research interests include materials and solid state chemistry; inorganic materials, synthesis and characterization of transition metal compounds; preparation of metastable materials for energy applications via soft chemical methods; and functional transition metal compounds.

COMPUTER SCIENCE

Assistant Professor **Elaine Runting Shi**, who has a joint appointment in the University of Maryland Institute for Advanced Computer Studies, obtained her Ph.D. from Carnegie Mellon University. Her research focuses on computer security, privacy and applied cryptography, combining cryptography with practical system design and implementation.

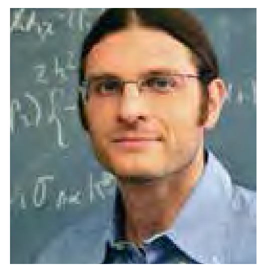
MATHEMATICS

Assistant Professor **Yuan Liao** received his Ph.D. in statistics from Northwestern University and was a postdoctoral associate at Princeton University.
He works on problems of high-dimensional modeling and Bayesian statistics.

MATHEMATICS

Associate Professor **Yanir Rubinstein** was awarded his Ph.D. from the Massachusetts Institute of Technology and was a postdoctoral fellow at Stanford University. He is currently a Sloan Research Fellow. Rubinstein's research interests include aspects of complex and Riemannian geometry, geometric partial differential equations, microlocal analysis and mathematical physics, several complex variables, and convex geometry.

PHYSICS



Assistant Professor **Alberto Belloni** was awarded a Ph.D. from the Massachusetts Institute of Technology. His current research covers electroweak physics, in particular the Standard Model di-boson and tri-boson production and the study of the production and properties of the Higgs boson.

PHYSICS

Assistant Professor **Jonathan McKinney** received his Ph.D. from the University of Illinois at Urbana Champaign. His research interests include accretion disk theory near central objects, numerical modeling, large-scale structure of the inflow and wind/jet outflow from accreting systems, GR perturbation theory, and radiative effects that modify the jet speed and structure.

Rankin photo by John Consoli / Belloni photo by Nick Hammer / Gezari, Liao, Rubinstein photos by Loretta Kuo / Other photos courtesy of the faculty member

The time required to create and test medications could be drastically reduced thanks to a new computer interface and DNA self-assembly techniques for drug development pioneered by a team of researchers, including **Steven Armentrout**, Ph.D. '94, computer science, president and CEO of Parabon NanoLabs of Reston, Va. In work supported by a National Science Foundation Small Business Innovation Research grant, researchers from Parabon recently developed and began evaluating a drug for combating the lethal brain cancer glioblastoma multiforme. Parabon has partnered with a part of the Janssen Pharmaceutical Companies of Johnson & Johnson to use the technology to create and test the efficacy of a new prostate cancer drug. In December, *The Huffington Post* listed the technology as one of "the 7 Best Inventions of 2012."

David Bushman, M.S. '87 and Ph.D. '89, entomology, has been named president of Bridgewater College in Virginia. Bushman was the founding dean of the School of Natural Science and Mathematics at Mount St. Mary's University in Maryland. Previously he was president of Lees-McRae College in Banner Elk, N.C.

Research conducted by **R. Paul Butler**, Ph.D. '93, astronomy, was featured on the BBC News in November. His research team, using the Harps instrument at the European Southern Observatory's La Silla facility in Chile, found three previously unknown planets around the star HD 40307, making it a six-star planet system.

John "Jack" Callahan, B.S. '85 and Ph.D. '93, computer science, is on loan from The Johns Hopkins Applied Physics Lab to the Office of Naval Research's (ONR's) London office until June 2014. Callahan is working with ONR-Global which builds and fosters international connections, propelling the execution of long-range strategic efforts that address the future needs of the naval fleet, armed forces and international partners.

Matt Disney, B.S. '97, chemistry, received the 2013 ACS Eli Lilly Award in Biological Chemistry for the development of rational and potentially general methods to design small molecules that target and manipulate the cellular function of RNA. Disney, who earned his M.S. and Ph.D. in chemistry from the University of Rochester, is an associate professor in the Department of Chemistry at Scripps Research Institute in Florida.

Simon Kasif, M.S. '83 and Ph.D. '84, computer science, a professor at Boston University, was elected a fellow of the American Institute for Medical and Biological Engineering. A participant in the Human Genome Consortium that produced the first public draft of the human genome, he is a co-founder of the Center for Advanced Genomic Technology.

Sofia Siguel Merajver, B.S. '73, mathematics and education, Ph.D. '78, physics, received the 2013 Michigan Institute for Clinical and Health Research Distinguished Translational Mentor Award. Merajver is a professor of internal medicine and epidemiology, scientific director of the Breast Cancer Program, and director of the Breast and Ovarian Cancer Risk Evaluation Program at the University of Michigan Comprehensive Cancer Center.

Robert E. Morris, B.S. '74, chemistry, is the 2012 recipient of the NRL-Edison Chapter Sigma Xi Applied Science Award for his work in coupling novel chemometric algorithms with state-of-the-art analytic methods to provide advanced diagnostics and prognostics of Navy mobility fuels. Morris heads the Chemical Sensing and Fuel Technology Section of the Chemistry Division of the Naval Research Laboratory.

Vincent Schiavo, B.S. '80, computer science, has been named senior vice president of worldwide sales for Guidance Software in San Francisco. Previously Schiavo was executive vice president for worldwide sales for LogLogic. ■

Perfecting the Plaza

Members of the Beautification Committee visit the new Physical Sciences Complex and review plans for the center plaza area and future home of the Gluckstern Garden, funded by a gift from Liz Nuss, Ph.D. '81, Education, wife of former UMD Chancellor Robert L. Gluckstern. Committee members also viewed areas designated for a donor wall and an art gallery.

(L-R) LIZ NUSS; NICK HAMMER, COORDINATOR OF ADMINISTRATION AND DEVELOPMENT, PHYSICS; PHYSICS PROFESSOR OSCAR GREENBERG AND WIFE PEARL KATZ; PAUL SO, PH.D. '95, PHYSICS; MARY OTT, WIFE OF PHYSICS PROFESSOR ED OTT; AND SEAN DAVIS, CMNS DIRECTOR OF FACILITIES.

Alumni photo by Stephan Silipigni / Samet photo by Thai Nguyen

FACULTY HIGHLIGHTS

Jonathan Dinman, cell biology and molecular genetics, and Birich Technologies LLC have been selected by the Maryland Industrial Partnerships (MIPS) program for funding to develop a gene-silencing technology as both a research tool and potential cancer therapy.

Bill Jeffery, biology, has been awarded the 2012 Alexander Kowalevsky Medal from the St. Petersburg Society of Naturalists in Russia. The award, first presented in 1910, recognizes distinguished scientists who have made notable contributions to evolutionary morphology and embryology.

Patrick Kanold, biology, won the Burt Evans Young Investigator Award of the National Organization for Hearing Research Foundation (NOHR). The award, honoring excellence, commitment and achievement in auditory research by a young scientist, was presented by the foundation at the annual Midwinter Meeting of the Association for Researchers in Otolaryngology (ARO).

Hanan Samet, computer science and University of Maryland Institute for Advanced Computer Studies (UMIACS), received a best paper award at the 1st Annual Association for Computing Machinery (ACM) SIGSPATIAL International Workshop on Mobile Geographic Information Systems. The paper discussed the various smartphone mapping platforms with a specific comparison of Apple Maps (iOS6) and Google Maps (Android and iOS5). Samet recently was presented with the Paris Kanellakis Theory and Practice Award from the ACM for fundamental contributions to the development of multidimensional spatial data structures and indexing.

Amy Weinberg, UMIACS, has been named executive director of the University of Maryland Center for Advanced Study of Language (CASL). CASL conducts academically rigorous research in language and cognition that supports national security and brings together researchers from the government, academia and the private sector. ■

IN MEMORIAM

MOLLY KLEIMAN

Molly Kleiman, who established the Dr. Devra Kleiman Memorial Graduate Endowment in June 2010 in memory of her daughter Devra, died in December 2012. The endowment provides annual support to graduate students with outstanding academic performance and demonstrated financial need who are enrolled in the Department of Biology. Devra Kleiman, a biologist whose groundbreaking research on giant pandas and South American monkeys showed how zoos can play a critical role in preserving endangered species, died in April 2010. Kleiman was one of the National Zoo's first female scientists and is recognized for spearheading an international effort to save golden lion tamarins—small reddish-orange monkeys that live in Brazil's Atlantic coastal forests—from extinction. Kleiman served as an adjunct faculty member in the Department of Biology following her retirement from the National Zoo.

DONAT GOTTHARD WENTZEL

Donat Gotthard Wentzel died on February 20. Wentzel earned his Ph.D. at the University of Chicago and worked for six years at the University of Michigan, where he became an associate professor. He joined the University of Maryland faculty in 1964 and was a professor in the Department of Astronomy until his retirement in 1994. Wentzel was recognized for his seminal work on cosmic-ray propagation. He conducted research on cosmic magnetism and electrical currents flowing in interstellar space and on the sun, kinetic plasma physics and radiation theory. In 2003, he received the Van Biesbroeck Prize for his long-term service to astronomy. Wentzel helped develop an astronomy course for UMD students who did not major in science. The course at one time attracted more than 3,000 students annually.

ODYSSEY

Odyssey is published twice a year for alumni, friends, faculty, staff and students of the College of Computer, Mathematical, and Natural Sciences.

Alumni notes are welcome.
Please send them to *Odyssey*, CMNS Dean's Office, University of Maryland, 2300 Symons Hall, College Park, MD 20742. Send information by fax to 301.314.9949 or by email to mkearney@umd.edu.

Editor: Nancy Grund
Senior Writer: Beth Panitz
Editorial Associate: Mary Kearney
Designer: Loretta Kuo

DEPARTMENTS, CENTERS AND INSTITUTES

Department of Astronomy
Department of Atmospheric and Oceanic Science (formerly Meteorology)
Department of Biology (formerly Zoology)
Department of Cell Biology and Molecular Genetics (formerly Microbiology)
Department of Chemistry and Biochemistry
Department of Computer Science
Department of Entomology
Department of Geology
Department of Mathematics
Department of Physics
Center for Bioinformatics and Computational Biology
Center for Scientific Computation and Mathematical Modeling
Earth System Science Interdisciplinary Center
Institute for Physical Science and Technology
Institute for Research in Electronics and Applied Physics
Institute for Advanced Computer Studies
Joint Quantum Institute
Joint Space-Science Institute
Maryland Cybersecurity Center
Maryland NanoCenter
Maryland Pathogen Research Institute
National Socio-Environmental Synthesis Center (SESYNC)

COLLEGE OF
COMPUTER, MATHEMATICAL,
& NATURAL SCIENCES

University of Maryland
2300 Symons Hall
College Park, MD 20742

Gates Receives National Medal of Science

President Barack Obama named Physics Professor **Jim Gates** as one of this year's recipients of the National Medal of Science, which along with the National Medal of Technology and Innovation is one of the highest honors bestowed by the U.S. government on scientists, engineers and inventors. This year's 12 Medal of Science winners received their awards at a White House ceremony in February.

"I am proud to honor these inspiring American innovators," President Obama said in a White House statement. "They represent the ingenuity and imagination that has long made this nation great—and they remind us of the enormous impact a few good ideas can have when these creative qualities are unleashed in an entrepreneurial environment."

PHYSICS PROFESSOR JIM GATES RECEIVES THE NATIONAL MEDAL OF SCIENCE FROM PRESIDENT BARACK OBAMA.

> "They represent the ingenuity and imagination that has long made this nation great."

Gates is recognized for his groundbreaking work in supersymmetry and supergravity, areas closely related to superstring theory. In 1983, he co-authored the seminal book, *Superspace or 1001 Lessons in Supersymmetry*. He also is widely known for his work popularizing science, promoting the importance of research and science education and enlightening young people on the fun, wonder and opportunities of careers in science and engineering. In 2007, the American Association for the Advancement of Science honored Gates with its Public Understanding of Science and Technology Award.

"I am so humbled by the support I have received from the university over the years and without which my receiving of this honor would never have come to pass," says Gates, the John S. Toll Professor of Physics and director of the Center for String and Particle Theory at Maryland. "Thank you all for allowing me to represent our campus," he said in an email to UMD President Wallace Loh and other campus officials.

Gates was named a University System of Maryland Regents Professor in mid-January by Chancellor William E. "Brit" Kirwan. The honor, among Gates's most prominent faculty awards, further recognizes his exceptional academic and research achievements. ■

Photo by Sandy Schaeffer Photography