

ODYSSEY

CMNS RESEARCHERS EXPLORE IMPACT OF CLIMATE CHANGE

AT THE EDGE OF
CMNS
DISCOVERY

CYBERSECURITY CENTER DRAWS ON EXPERTISE OF CMNS

The College of Computer, Mathematical, and Natural Sciences (CMNS) is at the forefront of the university's new cybersecurity initiative that aims to stimulate public-private partnerships and address national vulnerabilities, including those facing industry. The new Maryland Cybersecurity Center (MC²) adopts a holistic approach to cybersecurity education, research and technology development, stressing comprehensive, interdisciplinary solutions.

The university's proximity to the nation's capital and close interactions with key federal agencies make College Park a unique place for the center. Maryland leads the nation in information technology jobs, and more than half of the nation's Internet traffic passes through the

Washington, D.C., metropolitan area.

"Cybersecurity is one of the biggest threats facing the nation, but also one of the greatest opportunities for Maryland universities, businesses and federal labs to work collectively and strengthen our national defense and economic security," says Gov. Martin O'Malley, whose CyberMaryland plan envisions the state as the epicenter of work in the field. "This bold initiative will complement the work of CyberMaryland, and I look to it as a national model for developing a response to the threat of cyberdisruptions."

A number of faculty in the college's Department of Computer Science are currently deeply engaged in cybersecurity research,

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COLLEGE OF
COMPUTER, MATHEMATICAL,
& NATURAL SCIENCES



UNIVERSITY OF
MARYLAND



Dear Colleagues, Students, Graduates and Friends,

I write this last letter to you as Dean with mixed emotions. I hope you share my deep pride in the extraordinary quality of our college. The range and depth of fundamental discovery here is simply breathtaking, and the commitment to education in its finest sense is unsurpassed in any science college in the nation. We have built powerful partnerships with our neighbors at the Goddard Space Flight Center, the National Oceanic and Atmospheric Administration, and the National Institute of Standards and Technology, and more partnerships are on the way. And, as I shook the hands of the hundreds of remarkable

graduates this May, I realized that they represent perhaps the greatest contribution of all.

I also hope you share my firm confidence that the future will make what is past “merely prologue.” In this last year (in fact, in eight short months) together we have achieved a goal many thought far too ambitious to undertake in just one year. Together, we combined two colleges into a single, smoothly functioning, fully integrated powerhouse. Now biologists, chemists, computer scientists, mathematicians and physicists are collaborating within a single college to attack key questions about the basic mechanisms in living creatures. And our biologists in ecology will be collaborating with physical scientists to couple the physics and chemistry of the land, sea and air with our understanding of the biosphere to learn more about how our planet works as an integrated system. I am certain that this is only the start of a new and even more exciting chapter in our history.

Finally, I write with a deep sense of gratitude for having had the honor and privilege to lead an extraordinary college. From the summer of 1999 when I arrived from Canada through to today, I have been blessed with colleagues and friends of extraordinary capacity, and from whom I have had unstinting and unfailing support. I want to thank you all—whatever has been achieved was achieved together.

As you will read elsewhere in this, our first edition of, *Odyssey*, our new dean, Dr. Jayanth Banavar will begin his term on August 15. It is possibly the best compliment that could be paid to CMNS that such a distinguished biophysicist and engaged academic leader would enthusiastically look forward to devoting his energy and ideas to serving as our dean.

Steve Halperin, Dean

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Chemistry and Biochemistry Department Honored for Diversity Initiatives

The National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCChE) has awarded the University of Maryland the 2011 NOBCChE Presidential Award for Outstanding Partner in Academia. The award recognizes the Department of Chemistry and Biochemistry, under Chair Michael P. Doyle’s leadership, for exceptional efforts in providing members of the NOBCChE student chapter and wider minority communities with increased academic and professional development opportunities. As a direct result of Doyle’s efforts, enrollment of African-American students in the Chemistry and Biochemistry Ph.D. programs has climbed steadily over the past five years. Doyle accepted the award on behalf of the university at the 38th Annual Meeting of NOBCChE in April. ■



Simon, Hendricks Address Graduates

Nicholas J. Simon III, B.S. ’76, Microbiology, managing director of Clarus Ventures since the firm’s inception in 2005 and general partner for MPM Capital’s Bioventures III Fund, encouraged May graduates of the College of Chemical and Life Sciences (CLFS) to pursue their passion to make a difference in the world and an impact on others. “Apart from our health and relationships, time is our most valuable asset, and I want you to make the most of it,” said Simon, who spent more than a decade at Genentech, during which time its capitalization grew from \$1 billion to \$60 billion.

Some 424 students graduated from CLFS on May 19, 2011, including 19 Ph.D. students, 25 Master of Science students, and 380 Bachelor of Science students. Simon explained how, by pursuing his passion, he has created a venture capital firm that is funding promising treatments for Alzheimer’s Disease, macular degeneration, and scoliosis, among other disorders.

John S. Hendricks, founder and chairman of Discovery Communications, the nation’s number one nonfiction media company, urged May graduates of the College of Computer, Mathematical, and Physical Sciences (CMPS) to follow their curiosity, noting “a daydream powered by the engine of curiosity and fueled by knowledge is a force to be reckoned with.” Hendricks created Discovery Channel in 1985 and has been the driving force behind its dramatic growth, including the expansion of Discovery Communications to current global operations in more than 180 countries and territories with more than 1.5 billion cumulative subscribers.

Some 219 CMPS graduates, including 38 Ph.D. students, 12 Master of Science students, and 169 Bachelor of Science students, received their degrees on May 20, 2011. Hendricks urged all graduates to daydream about what they want to explore and accomplish throughout their lives. ■

SIMON LEVIN

Uncovering Nature's Hidden Patterns

*Infectious diseases, economics and wildebeest herds might not seem to have much in common, but they all provide fodder for world-renowned researcher **Simon Levin, Ph.D. '64, Mathematics**. These are but a few of the complex systems that Levin has analyzed throughout his 46-year career in academia, seeking the patterns governing their operations. A pioneer in theoretical ecology, Levin, recipient of the 2011 CMNS Distinguished Alumnus Award, currently serves as the George M. Moffett Professor of Biology and the director of the Center for BioComplexity at Princeton University.*

Much of Levin's research marries mathematics with biology, yielding new understanding about natural phenomena. In the 1970s, Levin was instrumental in launching the field of spatial ecology, which uses statistical analysis to examine natural patterns of dispersal and movement across geographic areas, looking at everything from seed dispersal to the movement of wildebeest herds. His work on understanding the dynamics of ecosystems, from marine systems to forests, has been instrumental in building a baseline measurement and predictive tools for environmental change, including climate change.

Levin is most famous for his work on complex adaptive systems and their components that operate on different scales yet interact and react to both the environment and to one another. For example, as your eyes scan this article, your neurons and synapses work together on the smaller, cellular scale. Using mathematics, Levin showed how to integrate a system's different scales, quantifying how the parts interact, connect and provide feedback to one another. His 1992 landmark paper on this topic, "The Problem of Pattern and Scale in Ecology," was the most cited paper in the field of ecology and environment published in the 1990s, with more than 3,000 citations to date.

NOVEL APPLICATIONS FOR MATHEMATICS

Behind Levin's mathematical genius is the solid grounding he received at the university. "I wanted to specialize in applied mathematics and Maryland was—as it is today—a leader in the field," says Levin, who completed his doctoral studies at Maryland's Institute for Fluid Dynamics and Applied Mathematics, the predecessor of today's Institute for Physical Science and Technology.

Levin's world-class education at Maryland opened his eyes to a host of areas to which mathematics could be applied, including biology. "Institute Director Monroe Martin encouraged me to follow my own interests, even though they were outside the traditional areas of mathematics," Levin appreciatively recalls.

Motivated by his love for both applied mathematics and his fiancée, who insisted he complete his degree before they wed, Levin earned his doctorate in three years. (Forty-seven years later, Levin and his wife Carole have two children and four grandchildren.) Through a postdoctoral fellowship at the University of California, Berkeley, Levin applied mathematics to physiology problems, but soon shifted his focus to a different branch of biology that became his lifelong passion—ecology. He joined Cornell University one year later as an assistant professor of mathematics, with a focus on ecological problems—a rare approach at the time. "In 1965 most mathematics departments were not ready for a real commitment to applications, especially biology," says Levin. At Cornell, however, Levin found ecologists eager to collaborate. He soon became a member of the Division of Biological Sciences and in 1974 was appointed chair of its Ecology and Systematics Section.

Growing up in Baltimore, Levin loved the outdoors, taking family hikes every weekend and spending summers swimming and canoeing. His appreciation for nature gained new meaning in the 1960s with the burgeoning environmental movement. "There was increasing awareness of Earth's finite resources," says Levin. "I became more and more concerned about environmental problems, and was driven to do work to solve the problems of humanity."



BLENDING ECONOMICS & ECOLOGY

In 1992, following a 27-year career at Cornell, Levin joined Princeton University's Department of Ecology and Evolutionary Biology. While he still explores ecological issues, Levin has expanded his scope to also look at the patterns behind economic and social systems. His current research examines collective decision-making in animal populations, such as why fish school together and how birds flock. He applies his findings to deepen the understanding of collective decision-making in human societies. "Economic and ecological systems are very similar," explains Levin. "They're both made up of individual agents pursuing their own selfish agendas. It doesn't matter whether you're talking about humans or organisms utilizing limited resources."

Levin has received a string of awards for his accomplishments, including the MacArthur Award from the Ecological Society of America and the Kyoto Prize for Basic Science, but what makes him proudest are the successes of the students he has mentored through the years. As he teaches the next generation of theoretical ecologists, he cites his professors at Maryland as role models. "I admired their enthusiasm for communicating mathematics and their ability to help foster my passions and interests," says Levin. "I strive every day to bring that same enthusiasm to my students." ■



OUR EVER-CHANGING ENVIRONMENT

CMNS RESEARCHERS EXPLORE
IMPACT OF CLIMATE CHANGE
ON THE ENVIRONMENT

LIKE CLOCKWORK

for more than 40 years, each summer Biology Professor David Inouye heads to the Rocky Mountains to study the local wildflowers. “I head there after final exams in late May,” says Inouye. “I used to find the snow just beginning to melt and the flowers starting to bloom.” While the professor’s schedule remains the same, the flowering schedule has shifted due to changing environmental conditions brought about by climate change. Nowadays, more often than not, Inouye misses the onset of the flowering season and tasks a research assistant with gathering the early data.

Early-blooming flowers are just one of the many climate-change phenomena that CMNS researchers are exploring. Global climate models point to rising temperatures and increased variability in precipitation, which can set off a chain of environment-altering events, says Antonio Busalacchi, director of the college’s Earth System Science Interdisciplinary Center (ESSIC). Higher temperatures, which lead to melting polar ice caps and rising sea levels, are literally just the tip of the iceberg. “We can also expect to see more floods and droughts and more extreme weather events overall,” says Busalacchi. “The wet parts of the world are getting wetter, and the dry parts are getting drier.”

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CHANGES FROM LAND TO SEA

The complex interplay between the physical environment and the biological world is triggering a host of changes in the environment, and the broad array of scientific expertise in CMNS translates to an impressive range of research on changes in the cryosphere, atmosphere, oceans and waterways, land surface, and marine and terrestrial ecosystems. “We now have an appreciation that these components, as well as human influence, are all coupled, and that there is feedback to the system,” says Busalacchi. “Within the next 50 years, we will likely produce accurate environmental forecasts that predict how the environment will change, be it from season to season or decade to decade.” In the meantime, CMNS researchers, representing the full range of expertise in the life sciences and physical sciences, are documenting significant environmental changes in plant life, animal domain, freshwater supply and disease virulence.

Winter Wildflowers and Rain-Soaked Penguins

Inouye attributes a 30-year-trend of earlier snow melt at his field site in Crested Butte, Col., some 9,500 feet above sea level, to a combination of global climate change and regional effects, such as El Niño cycles and northern Pacific Ocean temperatures.

This early snow melt causes a ripple of problems through the ecosystem. In the Rockies, the melting snow triggers wildflowers to bud. If a cold snap strikes, these early-forming buds may suffer frost damage, leading to a decline in wildflower population. That’s bad news for pollinators and for wildflower reproduction by seed.

Teaming up with a Stanford University researcher studying butterflies, Inouye discovered a correlation between wildflower abundance and butterfly population. “Without as much nectar, the butterflies lay fewer eggs,” he explains. A wildflower decline could impact a variety of organisms, including seed predators, flies that lay their eggs in the flowers, and animals up the food chain, Inouye hypothesizes. “The consequences of global climate change are showing up earlier and more strongly at high altitudes, like the Rockies, as well as at high latitudes,” he notes.

Antarctica is already facing environmental changes impacting its penguins, says Biology Professor Bill Fagan, who applies sophisticated statistical and spatial analysis to help quantify changes in penguin populations. Biology Postdoctoral Researcher Heather Lynch, who works with Fagan, explains: “Antarctica is transitioning from a cold, dry place to a warmer, wetter place.”

Lynch travels on commercial touring vessels throughout the Antarctic Peninsula to inventory three penguin species. “We are

basically hitchhikers on tourist trips,” she explains. Although cruise ships provide easy access to study sites, there are challenges. “Sometimes we sail right by a site that is important to our research.” With NSF funding, Fagan’s lab provides the expertise to analyze the sporadic and patchy data collected. Specializing in spatial ecology, Fagan leads varied research projects around the globe that explore ecological patterns and dynamics—working to understand such issues as the ecological recovery of Mount St. Helens and the migration of Mongolian gazelles.

The researchers have found that two penguin species are declining, while the third group, the gentoos, are increasing. As temperatures rise, sea ice decreases, leading to a decline in krill, penguins’ major food source. “For now, the gentoos are a climate change winner, partly because they have a more flexible diet,” notes Lynch. “They eat fish in addition to krill.”

Just as climate change is shifting the flowering season in the Rockies, it alters penguin breeding schedules in Antarctica. Traditionally, the migrant Adélie penguins nest first, seeking out the best spots. But with the changing environmental cues, the local gentoos now arrive first and settle into the prime locations, “causing a shift in the balance of power,” says Lynch, who will be starting a faculty position at Stony Brook University in the fall.

Increased rainfall also causes breeding problems. “Penguins are set up to deal with snow, not rain,” Lynch says. Severe rain ravages their nests, causing the Adélie and chinstrap penguins to pack up for the season, while the gentoos re-establish their nests. “The gentoos are going gangbusters right now,” says Lynch, “but it is possible that in 30 years the krill decrease will catch up with them.”

Water Temperatures on the Rise

Climate change and variability are also threatening the health of our waterways, a primary source for fresh water and seafood. Sujay Kaushal, an assistant professor in the Department of Geology and ESSIC, recently documented an alarming warming trend in U.S. rivers and streams. In a 2010 study funded by the NSF and Maryland Sea Grant, Kaushal and colleagues analyzed historical records of water temperatures of 40 U.S. rivers and streams and found that about half showed significant warming.

For example, temperatures rose an average of 0.046 degrees Celsius per year in Washington D.C.’s Potomac River from 1922 to 2006. In general, the largest temperature increases were found in waterways near urbanized areas. The increased temperatures stimulate the growth



(L-R) Opposite page: David Inouye, Heather Lynch, Sujay Kaushal; This page: Margaret Palmer, Antonio Busalacchi, Rita Colwell.



of algae and bacteria, which consume oxygen when they decompose. Rising water temperatures may also alter rates of nutrient cycling and reduce oxygen concentrations, further contributing to “dead zones”—low-oxygen areas where fish and other marine life struggle to survive, says Kaushal.

Margaret Palmer, professor of Entomology, with a partial appointment in the University of Maryland Center for Environmental Science (UMCES) and director of the new National Socio-Environmental Synthesis Center (SeSynC, *see related story, p. 10*), also studies the effects of climate change on rivers and streams. “If river water warms too quickly—say 3 to 4 degrees Celsius in the next 25 years—the organisms living there are unlikely to adapt fast enough,” says Palmer, who also serves as director of the university’s Chesapeake Biological Laboratory. “At first we will see declines in reproductive output or survival of the young. Over time, populations of some species will decline while those species able to withstand warmer water (often non-native species) will increase.”

Her research team has found the problem is magnified in small streams in urbanized areas where temperatures spike after a rainstorm. “Fifty years from now, these temperature spikes may be as high as 7 degrees Celsius and could last for hours. This would clearly exceed the thermal tolerance limits of many native fish,” says Palmer.

Variability in rainfall—more droughts and more intense storms—could create a poor situation for our clean water supply as well, Kaushal notes. “In the dry years, contaminants build up in the watershed,” he explains. “These contaminants are flushed into the streams and rivers in the wet years.” Kaushal points to increased contamination in the Chesapeake Bay in 2003 when surging hurricane waters followed the 2002 drought. His research shows that land development amplifies the problem because “impervious surfaces funnel the contaminants to streams rather than allowing the water to slowly seep into the ground.”

Cholera Outbreak in Haiti

Climate change may be partly responsible for the recent cholera outbreak in Haiti, says Rita Colwell, Distinguished University Professor at the University of Maryland Institute for Advanced Computer Studies (UMIACS) and National Medal of Science winner. In the 1980s, Colwell discovered that the bacterium that causes cholera, *Vibrio cholerae*, naturally occurs in the environment, identifying it in Bangladesh’s rivers and estuaries. She also found that the bacterium’s abundance is affected by climate. “This was a real paradigm shift,” she

says. “Previously cholera was believed to be transmitted only from person to person.” Colwell determined that the bacterium persists in the environment, for example, by attaching to zooplankton hosts. *V. cholerae* becomes dormant under adverse conditions and reverts to an actively growing state in favorable conditions.

“*V. cholerae* becomes abundant when temperatures rise above 15 to 17 degrees Celsius,” explains Colwell, whose research on *V. cholerae* strains has taken her from Africa to Central America to the Chesapeake Bay. Higher temperatures and increased sunlight spur photosynthesis, fostering phytoplankton growth and subsequent zooplankton grazing on phytoplankton, along with a rise in the *V. cholerae* bacterium. “With climate change, we can expect to have shorter winters and longer periods of time with higher temperatures, increasing the potential for more intense cholera outbreaks,” she notes.

Haiti’s catastrophic 2010 earthquake disrupted its river system, releasing limestone into the rivers and creating an alkaline environment that is favorable to *V. cholerae* growth, according to earthquake researchers. The following summer brought warmer than usual temperatures along with torrential flooding and turbulence due to Hurricane Tomas. “You have all the ingredients for the bacterium to flourish in a country with poor sanitation, a country where people drink water taken straight from the rivers and ponds. It was the perfect storm for a cholera epidemic,” says Colwell, who is sequencing Haiti’s *V. cholerae* genome. “This is a wakeup call: extreme weather events—which are becoming more frequent—provide the mechanisms for cholera outbreaks in countries with poor sanitation and lacking safe drinking water.”

ADAPTING TO CLIMATE CHANGE

CMNS researchers are not only identifying the impact of climate change but are also developing ways to help society adapt. For example, Colwell has made significant strides in controlling the spread of cholera by introducing a simple filtration technique to villagers in Matlab, Bangladesh. She also has developed a prediction model using satellite imaging to detect potential outbreaks by looking at indicators such as sea temperature, sea height and chlorophyll concentrations. “We have created an important public health tool for this waterborne disease,” says Colwell, who hopes that future satellite data will also include variables such as oxygen saturation to improve the model’s accuracy.

Kaushal works to improve stormwater management and water-

shed restoration, advising local water resource managers on strategies to slow down and filter stormwater runoff before it flows into local streams. “Our job is not only to document the problems but also to propose and identify solutions to protect water quality and water quantity issues.” He works with the city of Baltimore on its sustainability plan as well as with Washington, D.C.’s Blue Plains Advanced Wastewater Treatment Plant, the largest advanced wastewater treatment plant in the world. He also works closely with the U.S. Geological Survey (USGS) and the Environmental Protection Agency (EPA).

A Triple-Threat to Malaria

Recent research suggests that warmer global temperatures are among the factors causing the mosquito-borne malaria parasite to migrate into previously unaffected areas. In hopes of slowing the spread of malaria, Entomology Professor Raymond St. Leger has developed a genetically modified fungus that kills the malaria parasite.

The finding, published this year in *Science*, grew out of St. Leger’s earlier work to combat malaria. Previously, St. Leger created a genetically modified fungus to attack the mosquitoes carrying malaria. “But the insects became resistant time and time again,” he describes, leading him to wonder: Why not attack the malaria directly? After much trial and error, his team developed a triple threat to the malaria virus—a genetically modified fungus with a human antibody gene, a scorpion anti-malarial gene, and a gene that blocks malaria’s access to the mosquito’s saliva glands.

“The fungus acts like a hypodermic,” explains St. Leger, whose work is supported by the National Institute of Allergy and Infectious Diseases, part of the National Institutes of Health. “It penetrates through the mosquito’s cuticle and injects the anti-malarial protein into the blood, basically curing the insects of malaria.” St. Leger’s team is also working on genetically modifying fungi to attack two other diseases that could be on the rise due to climate change—Lyme disease and the dengue virus.

Drought-Tolerant Designer Genes

June Kwak, associate professor in the Department of Cell Biology and Molecular Genetics, is looking at how plants respond to dry conditions in an effort to develop plants with enhanced drought tolerance and more efficient water usage. In extremely dry conditions, a plant synthesizes the hormone abscisic acid (ABA), which triggers its stomatal pores surrounded by a pair of guard cells to close and conserve water. Kwak’s research, in collaboration with colleagues from five other institutions, shows that certain mutant plants that are ABA-hypersensitive need less water to survive.

Knowing that ABA plays a key role in a plant’s drought tolerance, Kwak seeks to identify all the behind-the-scenes players at the molecular level that regulate stomatal closure in response to ABA. Recently, he identified two proteins—MPK9 and MPK12—that help regulate the guard-cell response. Without these proteins, plants fail to close their stomatal pores efficiently, making them more susceptible to drought, says Kwak, whose research is supported by the NSF and the U.S. Department of Agriculture (USDA). With the agricultural sector being the biggest consumer of freshwater worldwide, “the goal is to manipulate plants so that they are more tolerant to drought, and we can conserve our water resources.”

MODELING CLIMATE CHANGE

At the center of the university’s climate-change research is the Earth System Science Interdisciplinary Center (ESSIC), a world leader in developing Earth system models, with an emphasis on providing data for policymakers and stakeholders. Through a collaboration between the university’s Departments of Atmospheric and Oceanic Science, Geology and Geography, the National Oceanic and Atmospheric Administration (NOAA) and NASA/Goddard Space Flight Center’s Earth Sciences Directorate, faculty in ESSIC explore how the Earth’s atmosphere, ocean, land and biosphere interact as a coupled system and the influence of human activities on this system. Established in 1999, ESSIC has received \$50 million in NASA and NOAA funding over the past four years.

Nearly 90 faculty members, research assistants and graduate students work with collaborators around the world to piece together and analyze data from a variety of sources, including a vast array of Earth-observing satellites. In addition to his duties as chairman of the Joint Scientific Committee for the World Climate Research Programme, ESSIC Director Antonio Busalacchi is at the forefront of examining the role sea-surface salinity plays in climate variability and change. His research will be essential to understanding the implications of the data from the NASA satellite, Aquarius, scheduled to launch this June. The satellite will, for the first time, provide a global view of salinity variability, a key component of the global hydrological cycle.

Developing Regional Climate Models

Developing regional climate models is a top priority for ESSIC. “Public health providers, farmers, emergency management personnel, insurance companies and policymakers are just a few of the groups clamoring for regional climate forecasting to help with decision-making,” says Busa-



UNCOVERING CLUES TO CHART FUTURE ENVIRONMENTAL TRENDS

Does history hold the key to predicting future climate changes? Paleoclimatologists—like Professor Alan Jay Kaufman and Associate Professor Michael Evans, who hold joint appointments in the Department of Geology and ESSIC—look for climate clues from the past by chemically examining samples of rocks, tree rings, corals and more. Using the college's world-class geochemical laboratory facilities, they identify the isotopic composition of elements within their samples, yielding information about past environmental conditions.

"Paleoclimatology informs us about Earth's natural pulses, providing us with a baseline for understanding today's changes," says Kaufman, who examines the rise in the planet's oxygen level 2.5 billion years ago. Kaufman also studies ancient ice ages. His research explores the connection between ancient climate fluctuations and changes to biological communities. While conducting field work in arctic-Siberia in 2009, he found evidence for an unknown ice age some 543 million years ago, which he believes played a fundamental role in the evolution of modern animals.

Evans explores the more recent past—200 to 500 years ago—to uncover new findings about El Niño-Southern Oscillation (ENSO) cycles in the tropics, where ENSO causes extreme weather such as floods and droughts. "The question is whether ENSO's behavior is going to change in the 21st century," says Evans. His research team gathers hundreds of tree core samples from Queensland, Australia. Back on campus in a new Paleoclimate Laboratory in the Chemistry Building, the researchers measure the samples' oxygen isotopic composition to track rainy and dry seasons and ENSO's occurrence.

Professor James Farquhar, Department of Geology and ESSIC, has used isotopic analysis to study environmental change occurring early in the Earth's history. This research examines correlations between the carbon and sulfur isotopic compositions of 2.6 billion-year-old rocks from South Africa. His team, led by former Maryland Geology Research Scientist Aubrey Zerkle, now at England's Newcastle University, linked oscillations of ocean methane levels with feedbacks involving an atmospheric haze. "We found a tipping point at which one climate regime flipped over to another and then flipped back," Farquhar describes. The team hypothesizes that these two regimes were linked by chemistry and biology and controlled the amount of sunlight passing through the atmosphere, causing oscillations between cooler and warmer temperatures.

Charles Delwiche, a professor of Cell Biology and Molecular Genetics, studies the early evolution of oxygen-releasing photosynthetic organisms, which date back 2 billion years. One part of his research explores dinoflagellates—algae that are 200 million years old and have several types of chloroplasts. He applies DNA-based approaches, including genomic techniques, to address questions such as how photosynthetic chloroplast organelles became embedded in plant cells. His research also examines how photosynthetic dinoflagellates remove carbon dioxide from the atmosphere. Delwiche notes: "Understanding the evolution of our environment is extremely important in our ability to understand how the global environment might change in the future." ■

lacchi. For example, regional climate information can help predict the prevalence of diseases in specific areas, while extended hurricane forecasting could assist planners in building appropriate infrastructures.

Professor Xin-Zhong Liang, one of the world's leading experts on computer-based regional climate models, joined the Department of Atmospheric and Oceanic Science and ESSIC earlier this year. He seeks to develop a fully coupled Earth system model that can examine any region around the world by looking at interactions between climate, hydrology, water quality, air quality, crop yield and the role of government regulation. Over the next three years, Liang's team will run their models on the Blue Waters supercomputer to quantify the range of climate changes expected in the 21st century. With its ability to perform up to 10 quadrillion calculations per second, Blue Waters will be the most powerful computer in the world when it comes online later this year.

"Global models are not good enough," says Liang, whose research is funded by the EPA, NOAA, USDA, NASA, the NSF and the Department of Energy. "A global model cannot help local farmers decide what crops to grow." Liang's models factor in local variants such as stream flow, soil moisture and acidity, irrigation and invasive plants. He is currently mapping thousands of crops to changing environments across the United States to identify where each will grow best.

Chesapeake Bay Forecasting System

ESSIC's Chesapeake Bay Forecasting System, led by Ragu Murtugudde, professor of Atmospheric and Oceanic Science with a joint appointment in ESSIC, looks beyond physical weather and climate to linked areas like agriculture, human health, water resources, air and water quality, transportation and fisheries. "The Chesapeake Bay is a quintessential microcosm of the world," explains Murtugudde. According to the Chesapeake Bay Foundation, the bay generates billions of dollars in annual economic activity for Maryland and Virginia, but the health of this economic gem is a major concern. "The bay's sea level is rising at twice the global rate, and temperatures are warming," warns Murtugudde. "Combined with the anthropogenic loading of nutrients, these factors are leading to an expanding dead zone."

The Chesapeake Bay Forecasting System explores issues ranging from air quality to crab harvest levels to cholera growth. At times, the issues may be at odds, says Murtugudde, noting that agricultural practices that are good for soil quality may be bad for water quality. "Our tool provides an integrative approach that informs policymakers and stakeholders about the consequences of their actions and policies and allows them to plan for changes in climate, development, crop patterns and more." ■



Left to right:
Raymond St. Leger,
June Kwak,
Xin-Zhong Liang,
Ragu Murtugudde.

College Recommended for NSF Grant for National Environmental Center

The College of Computer, Mathematical, and Natural Sciences has been recommended for a \$30 million grant over five years from the National Science Foundation (NSF) to establish a new National Socio-Environmental Synthesis Center (SeSynC). The center, which has received additional support from the State of Maryland, the University System of Maryland, the university and the University of Maryland Center for Environmental Science (UMCES), will be directed by Margaret Palmer, a professor of Entomology with a partial appointment in UMCES.

The center will focus on environmental synthesis—finding solutions to complex environmental problems through the novel juxtaposition of existing data and expertise from diverse fields. SeSynC will attract the world's leading environmental scholars and policy experts to advance and share methods of environmental synthesis and build decision-making and policy-making capabilities on complex environmental issues.

“Through this new center, the university will provide national leadership in developing solutions to environmental problems that require the synthesis of knowledge, methods and novel ideas from a wide range of disciplines many of which are in our college, but particularly ecology, computer science and mathematics,” explains Palmer. “Funds and opportunities will also be provided for CMNS researchers to develop relevant collaborations with other researchers across and beyond the university.” Palmer notes that while CMNS

faculty played lead roles in the center proposal to NSF, researchers in disciplines such as Geography, Public Policy, Anthropology and Natural Resource Economics contributed substantially as well.

Through competitive grants funded by the center, leaders in the research, education, and policy communities will undertake projects at the center. SeSynC will also:

- Provide technical expertise, training workshops and other resources, including advanced computational and visualization tools, to help researchers and educators do environmental synthesis and teach the synthesis process.
- Support a resident postdoctoral program with university and UMCES faculty mentors.
- Support education and outreach programs for under-represented STEM (science, technology, engineering, and mathematics) students, including a minority K-12 program and a high school intern program for Baltimore, Washington, D.C., and Prince George's County students; a college-level program for the deaf and hearing impaired; and a college-level program for returning adult students.
- Collaborate with the private, public and nonprofit environmental policy partners to deliver relevant findings for legislators, businesses, educators and the public.
- Attract new employment opportunities and serve as a magnet for additional funding in the environmental sciences. ■

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Cybersecurity Center Draws on Expertise of CMNS

including Jonathan Katz, cryptography; Bill Arbaugh, operating systems; and Neil Spring and Bobby Bhattacharjee, privacy in social networks.

A concentration of courses in cybersecurity is also being developed. “As students fulfill their degree requirements, if they take a subset of cybersecurity courses, they will earn a cybersecurity certificate,” explains Larry Davis, chair of the Department of Computer Science, who says elements of the concentration were developed in conjunction with the National Security Administration (NSA). “We are seeing strong demand from local government labs and companies that want to employ students and want to partner with our faculty on research.” NSA's Laboratory for Telecommunications Sciences, located within minutes of campus, has funded research in cybersecurity systems and software and looks forward to rotating its staff members, as well as university faculty and students, between its operational center and campus.

The Maryland Cybersecurity Center is a joint project of CMNS with the A. James Clark School of Engineering, led jointly by Davis and the chair of the Department of Electrical and Computer Engineering. It will partner with other colleges, including the School of Public Policy and the Robert H. Smith School of Business. The center is seeking to recruit a new director in the coming months. “We are looking for a recognized candidate with a first-rate technical background complemented by a strong knowledge and interest in policy issues related to cybersecurity,” describes Davis, who notes that four new faculty members are being hired in addition to the director.

Private sector partners, including Google, Lockheed Martin and Science Applications International Corporation (SAIC), are also eager to work with and support the center. Additionally, MC² will work with small businesses, drawing on the university's extensive programs for technology development and commercialization, including the Maryland Technology Enterprise Institute and Office of Technology Commercialization, to bring new technologies to market and economic growth to the region. ■

GOOGLE SPONSORS NEW CYBERSECURITY SEMINAR SERIES

A new cybersecurity seminar series sponsored by Google and organized through the Maryland Cybersecurity Center was inaugurated in the spring semester. Beginning in spring 2011, Google committed to a three-year sponsorship of the new series, which will feature three seminars per semester. Google Co-founder is Sergey Brin, B.S. '93, Computer Science and Mathematics.

The series kicked off this spring with a talk by Vint Cerf, chief Internet evangelist at Google on “Can We Make the Internet Safer?” Widely known as one of the “Fathers of the Internet,” Cerf is the co-designer of the TCP/IP protocols and the architecture of the Internet. Cerf and his colleague, Robert E. Kahn, were honored with the U.S. National Medal of Technology for founding and developing the Internet. Martin Roesch, chief technology officer of Sourcefire, a leader in intelligent cybersecurity solutions, presented a seminar later in the spring semester on “Intrusion Detection and Network Security Perspectives From a Veteran.” ■

UNIVERSITY CREATES COLLEGE OF COMPUTER, MATHEMATICAL, AND NATURAL SCIENCES

Integration of Two Science Colleges Positions Campus for Greater Research, Education Opportunities

On October 4, 2010, the university integrated the College of Chemical and Life Sciences (CLFS) with the College of Computer, Mathematical and Physical Sciences (CMPS) to create the College of Computer, Mathematical, and Natural Sciences. In addition to his responsibilities as CMPS dean, Steve Halperin took on the role of CLFS dean on July 1, 2010, and since October 4 has served as dean of the combined college.

The integrated college reflects a growing trend among leading universities to strengthen the interdisciplinary education and research that is essential to effectively address major questions in science at the interface between the disciplines, as well as to help solve critical world issues, such as climate change and the environment, and the application of genomics to human health.

“Many of the key scientific challenges facing society, and many of the great questions in science itself, require an integration of ideas from a wide range of classical scientific disciplines,” says Halperin. “By integrating our two colleges, we give the university the flexibility necessary to respond effectively to these challenges. We also ensure our ability to provide programs for our students that reflect both ongoing

scientific advances and how they are accomplished.”

A 2009 National Academy of Sciences study has accelerated the trend with its call for “the emergence of a New Biology,” that integrates biologists with physicists, chemists, computer scientists, engineers and mathematicians “to create a research community with the capacity to tackle a broad range of scientific and societal problems.”

Along with six research institutes, CMNS includes the following departments: Astronomy, Atmospheric and Oceanic Science, Biology, Cell Biology and Molecular Genetics, Chemistry and Biochemistry, Computer Science, Entomology, Geology, Mathematics and Physics. Many major programs in the college are ranked among the top 10 public research universities in the nation. ■

“MANY OF THE GREAT QUESTIONS IN SCIENCE ITSELF REQUIRE AN INTEGRATION OF IDEAS FROM A WIDE RANGE OF CLASSICAL SCIENTIFIC DISCIPLINES.”

Distinguished Physicist Named CMNS Dean

Distinguished physicist **Jayanth R. Banavar**, whose research frequently involves interdisciplinary collaboration with the life sciences, has been named dean of the College of Computer, Mathematical, and Natural Sciences (CMNS). He will assume the post in August.

For the past 12 years, Banavar has led the Department of Physics at Pennsylvania State University. Much of his recent work has applied the techniques of statistical physics to solve interdisciplinary problems, explaining, for example, why biological molecules tend to curl up into helices, or to explain why coral reefs support such a rich biodiversity. Frequently, the goal has been to identify an underlying mathematical principle to provide an elegant explanation of natural phenomena.

“With an integrated scientific college, Maryland is well positioned to prepare the next generation of scientists for the types of challenges they are likely to encounter,” says Banavar. “While strength in core disciplines

is essential, the lines between them will continue to blur, and we need to educate a generation of creative researchers who can thrive in an interdisciplinary environment.”

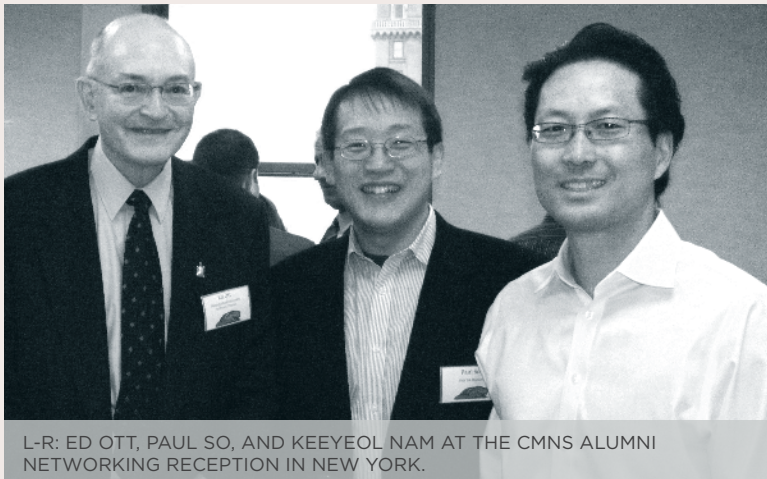
Steve Halperin, who is stepping down from a dozen years of academic leadership as dean of the college says, “The college is extremely fortunate to have an individual of the quality and stature of Dr. Banavar as its next dean. His scientific contributions alone make him a remarkable addition to our Department of Physics. Those contributions along with his breadth of vision and outstanding success at building the department he led at Pennsylvania State University make him a terrific choice as our dean.”

Banavar currently serves as Distinguished Professor and George A. and Margaret M. Downs brough Department Head of Physics at Pennsylvania State University. He received a Bachelor of Science with honors and a Master of Science in physics from Bangalore



University. He earned his Ph.D. in physics from the University of Pittsburgh. A fellow of the American Physical Society and the American Association for the Advancement of Science, he has more than 250 publications in refereed journals, 11 book chapters, a book he co-edited, and he holds three patents. ■

A MARYLAND TRADITION: *Alumni Honor Exceptional Faculty*



L-R: ED OTT, PAUL SO, AND KEEYEOL NAM AT THE CMNS ALUMNI NETWORKING RECEPTION IN NEW YORK.

THE ART AND SCIENCE OF GIVING

Paul So, Ph.D. '95, Physics, recognizes the importance of mentoring and philanthropy. An associate professor in the Department of Physics at George Mason University, So has spent countless hours teaching and mentoring young people in the field of non-linear dynamics.

So, who holds both an undergraduate and graduate degree in physics, has combined the study of art with science. He took courses in art for many years and is an accomplished artist, who now is fostering the careers of up and coming artists. A long-time philanthropist, So helped found a non-profit contemporary art gallery in Northwest Washington, D.C., called The Hamiltonian Artists. The gallery provides space and fellowships to budding contemporary artists, a number of whom are alumni of or students in the university's Master of Fine Arts program.

When it comes to philanthropy, So gives generously to causes that are closest to him: physics, education and art. He follows a sterling example set by his parents. They created a scholarship to support international students and non-citizens living in the United States who attend Harvey Mudd College in Claremont, Calif., where So and his brother received their undergraduate degrees. It was perfectly natural that So extend his generosity to his graduate alma mater. In March, he established The Yuen Sang and Yu Yuen Kit So Endowed Professorship in non-linear dynamics as a tribute to his parents and in honor of his Ph.D. advisor Distinguished University Professor Ed Ott. The Department of Physics appointed Ott as the first holder of the professorship and, at the request of So, Ott's name will be added to the endowment when he retires to recognize his mentorship in non-linear dynamics.

So and other alumni from the Department of Physics recently celebrated the establishment of the new endowment at the first College of Computer, Mathematical, and Natural Sciences Alumni Networking Reception in New York City, which was hosted by Ali Hirsa, M.S. '93, Civil Engineering and Ph.D. '98, Applied Mathematics. So is encouraging other alumni to join him in honoring Ott and reaching a \$1 million endowment in the next five years. **For more information on the endowment, please contact the CMNS Office of Development at 301.405.0486. ■**

Health Impact Award Winner Supports Higgins Fund

"I know what it takes to fund professorships: What can I do for The William J. Higgins Distinguished Scholar-Teacher Fund?" asks **Jeffrey Mechanick**, M.D. and B.S. '81, Zoology at a recent lunch with Higgins. Mechanick, along with several other former students, have honored Higgins for his dedication, inspiration, wisdom and continued support with generous gifts to the Higgins Fund over the years.



JEFFREY MECHANICK

Mechanick is in his own right a very distinguished graduate of the college. This April he was selected as its Distinguished Alumnus by the Department of Biology. Then, in early June, the university's Alumni Association honored Mechanick, Director of Metabolic Support and Clinical Professor of Medicine at Mount Sinai Medical Center's Division of Endocrinology, Diabetes and Bone Disease with a Health Impact Award to recognize his contributions to patient care.

Board certified in endocrinology, metabolism and diabetes as well as nutrition, Mechanick earned his medical degree from Mount Sinai School of Medicine and completed a residency in Internal Medicine at the Baylor College of Medicine. He then returned to Mount Sinai to complete his fellowship training in Endocrinology, Metabolism and Nutrition. In addition to treating patients at Mount Sinai, he also sees outpatients in his private office in Manhattan.

The author of more than 180 scientific publications and editor of five books, Mechanick is an officer of the American Association of Clinical Endocrinologists (AACE). Mechanick is Section Editor for "Nutrition and ICU" in *Current Opinions in Clinical Nutrition and Metabolic Care* and "Obesity and Nutrition" in *Current Opinion in Endocrinology and Diabetes*. In addition, he is past president of the American Board of Physician Nutrition Specialists and serves in editorial positions for major journals in the nutrition and endocrinology fields.

Most recently, he has been appointed to serve on the President's Council on Fitness, Sports and Nutrition (PCFSN) Science Board. "Nutrition is a vital first step toward a healthier population," says Mechanick. "We must change the mindset of Americans to eat better and to get more exercise as part of their daily routine."

For more information on the The William J. Higgins Distinguished Scholar-Teacher Fund, please contact the CMNS Office of Development at 301.405.0486. ■

FOR THE LOVE OF PHYSICS

“My husband was very dedicated to the Department of Physics, and he was particularly concerned about the quality of young professors,” says **Madeleine Joullie**, the widow of the late Physics Professor Emeritus **Richard E. Prange**, who died in 2008 at the age of 76. Prange began his career at Maryland in 1961 and played a vital role in the Department of Physics even after he retired in 2000.

Joullie, a professor of chemistry at the University of Pennsylvania, notes her husband had three loves: “physics, the University of Maryland and me. Maryland has always been a physics powerhouse,

“MARYLAND HAS ALWAYS BEEN A PHYSICS POWERHOUSE, AND RICHARD WANTED TO KEEP IT STRONG.”

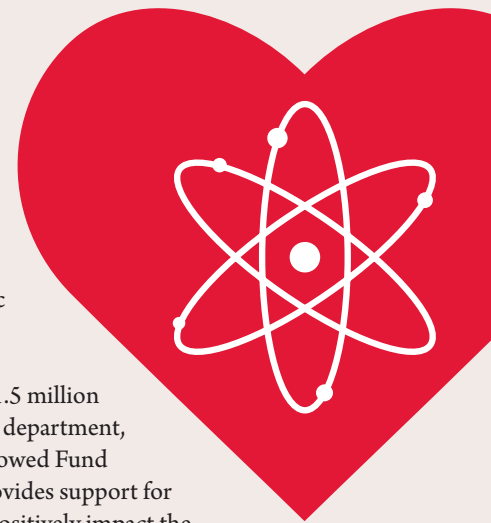
and Richard wanted to keep it strong. He knew that his gifts could help guarantee that Maryland continue as one of the most distinguished physics departments in the country.” Prange understood the importance of mentoring young assistant professors when they began their research careers. “He knew young faculty want to teach at institutions where top researchers are teaching, and he realized that a well-known and recognized chairperson attracts strong young people in the field,” explains Joullie. Prange had a strong sense of how he could support the department and, Joullie says, “I have followed his wishes.”

and Richard wanted to keep it strong. He knew that his gifts could help guarantee that Maryland continue as one of the most distinguished physics departments in the country.”

Two endowed funds have been created to support specific activities in the Department of Physics. The Richard E. Prange Endowed Chair in Physics, a \$1.5 million gift, supports a professor in the department, and the Richard E. Prange Endowed Fund for Physics, a \$500,000 gift, provides support for a variety of activities that will positively impact the department, including the annual Prange Lecture and Prize as well as start-up money for a new faculty member or group of faculty members; an award for a young faculty member who shows exceptional promise and excellence; a contribution to teaching laboratory space in the Physical Sciences Complex now under construction; support for physics majors to enter research; and fellowships for highly talented undergraduate or graduate students.

In recognition of his excellence in research and teaching and his achievements in condensed matter theory, **Sankar Das Sarma** was selected as the initial holder of the Richard E. Prange Endowed Chair in Physics and is responsible for administering the Richard E. Prange Prize in Condensed Matter Theory and Related Areas.

As a fellow professor, Joullie never questioned her husband’s motivations and his love of the university. “In academia, we prepare for the younger generation to take over,” she says. “It is important that they have everything they need. Richard’s legacy will provide for that.” ■



Board of Visitors Honors Faculty, Student

The former College of Computer, Mathematical and Physical Sciences Board of Visitors had endowed a Distinguished Faculty Award and Junior Faculty Award, with \$5,000 and \$2,500 prizes, respectively, to honor outstanding faculty and has agreed to expand these awards to the integrated colleges. The College of Computer, Mathematical, and Natural Sciences Board of Visitors has established two new honors: the Creative Educator Award and the Distinguished Graduate Student Award, each of which carries a \$5,000 prize.

The college recently announced three award winners, all of whom were selected by the Board of Visitors from nominations made by department chairs. **V. S. Subrahmanian**, Computer Science, has received the Distinguished Faculty Award. **Amy Mullin**, Chemistry and Biochemistry, is honored with the Creative Educator Award. **Michael McDonald**, Astronomy, received the Distinguished Graduate Student Award. ■

Join the CMNS Alumni Association Chapter

With the integration of the College of Chemical and Life Sciences and the College of Computer, Mathematical and Physical Sciences comes a renewed CMNS Alumni Association Chapter to engage graduates of the two former colleges as well as the integrated college.

“We want to foster a sense of community among all graduates and to help cement a sense of collaboration between students and alumni,” says Chapter President Tom Ng, B.S. ’89, Biochemistry.

From homecoming activities to new networking opportunities, the chapter anticipates sponsoring a number of events in the upcoming months to bring alumni back to campus. “Our mission is to promote and support the college in a number of ways,” explains Ng.

“We want to ensure the highest level of academic and professional excellence, and that includes creating strong career development

opportunities for current students and graduates.”

In addition to Ng, the chapter is led by Vice President Albert Epshteyn, B.S. ’01, Biochemistry, Ph.D. ’06, Chemistry; Secretary Elizabeth Read-Connole, M.S. ’92, Microbiology, Ph.D. ’00, Molecular and Cell Biology; and Treasurer Teresa McTeigue, B.S. ’84, Zoology. Executive Board members include Jeffrey Shupp, B.S. ’01, Neurobiology and Physiology; Andrew Kosiba, B.S. ’09, Geology; and Deborah A. Eason, B.S. ’81, Mathematics, M.S. ’01, Computer Science.

Graduates are encouraged to join the University of Maryland Alumni Association, which automatically includes enrollment in the college’s Alumni Association Chapter.

For more information on getting involved, contact Tom Ng at tomng@terpalum.umd.edu. ■

UM/NASA Goddard Proposal Moves to Final Round in NASA Selection Process

A university-led mission proposal, known as Comet Hopper, has been chosen to compete for final selection as a new planetary mission in NASA's Discovery Program. The team will receive \$3 million to further develop its mission proposal concept.

Comet Hopper and two other proposals were selected from among 20 submissions reviewed by a panel of NASA and other scientists and engineers. Principal investigator for the project is Jessica Sunshine, professor of Astronomy. Michael A'Hearn, professor of Astronomy, who led NASA's Deep Impact and EPOXI comet missions, is serving as deputy principal investigator.

The Comet Hopper mission would be managed by the NASA Goddard Space Flight Center in Greenbelt, Md. Other partners include Lockheed Martin, KinetX, the Johns Hopkins University Applied Physics Laboratory, University of Bern, Jet Propulsion Laboratory and Discovery Communications.

"Comets are exciting because they are dynamic, changing throughout their orbits. With this new mission, we will start out with a comet that is in the cold, outer reaches of its orbit and watch its activity come alive as it moves closer and closer to the sun," describes Sunshine. The spacecraft will be powered by a nuclear engine and will make initial contact with the comet about one light hour from Earth, approximately the distance from Earth to Jupiter.

The Comet Hopper mission would study the evolution of 46P/Wirtanen by landing on the comet multiple times and observing its changes as it interacts with the sun. Comet Hopper would observe the comet by making detailed in situ measurements



CREDIT: NASA/GSFC/UNIVERSITY OF MARYLAND

from various locations on the surface and in the innermost coma as the comet moves through its orbit. The innermost coma is the atmosphere of the comet just off the surface of the nucleus where outgassing and jets originate.

After concept studies are reviewed in 2012, NASA will select one mission to continue development efforts leading up to launch in 2012. The selected mission would be cost-capped at \$425 million, not including launch vehicle funding. ■

FACULTY HIGHLIGHTS

Alberto Bolatto, Astronomy, and **Mohammed Hajiaghaya** and **Carl Kingsford**, Computer Science and University of Maryland Institute for Advanced Computer Science, have received National Science Foundation Early Career Awards. Bolatto was funded for his research "Steps Toward a Physical Understanding of the Star Formation Law," and Hajiaghaya was funded for his work on "Foundations of Network Design." Kingsford will study "Model Based Reconstruction of Ancient Biological Networks."

Maria Cameron, Mathematics, and **Michael Levin**, Physics, have been awarded 2011 Alfred P. Sloan Research Fellowships. The fellowships are awarded annually to 118 early-career faculty in the sciences in Canada and the U.S. to recognize their achievements and potential contributions to their fields.

Michael Doyle, Chemistry and Biochemistry, has been elected president of the Chemical Society for Washington, 2011.

Jim Gates, Physics, and **Roberta Rudnick**,

Geology, have been elected members of the American Academy of Arts and Sciences.

Carter Hall, Physics, has been selected as one of five experimentalists from 100 applications for a Department of Energy Early Career Award for his application "Search for Weakly Interacting Dark Matter with Liquid Xenon."

Bill McDonough, Geology, has been elected a fellow of the American Geophysical Union.

Margaret Palmer, Entomology, is one of 16 recipients of The University System of Maryland (USM) Board of Regents' Faculty Awards. The awards are the highest honor presented by the board to exemplary faculty members recognizing excellence in teaching, scholarship, research or creative activities; public service; mentoring; and collaboration.

Dave Thirumalai, Chemistry and Biochemistry and IPST, has been named a TUM-IAS Honorary Hans Fischer Senior Fellow by the Alexander von Humboldt Foundation and the Technische Universitat Munchen (TUM).

Professor Emeritus John Osborn Dies

Professor Emeritus John Osborn died on May 29, 2011. Osborn joined the Department of Mathematics in 1965, where he rose to the rank of full professor by 1975 and served as chair of the department from 1982 to 1985. He also served as acting or interim dean of the College of Computer, Mathematical and Physical Sciences on two separate occasions in the late 80s and late 90s.

Osborn was well known for his contributions to the numerical solutions of partial differential equations. Following his retirement in 2008, he served as a research professor to complete an existing National Science Foundation grant titled "Generalized Finite Element Methods and Meshless Methods."

Osborn was a key leader in a project, which introduced computation into the sophomore differential equations course. *The Journal of Numerical Analysis, Industrial and Applied Mathematics* devoted a special issue to numerical computing in problem-solving environments with emphasis on differential equations. The issue included an article by Osborn and his colleagues. ■

Academic Festival Celebrates CMNS Achievements

In recognition of their many accomplishments, alumni, faculty and staff were honored at the 1st annual integrated College Spring Academic Festival. Award winners included the following:

ASTRONOMY DISTINGUISHED ALUMNUS

Robert Becker, M.S. '70, Physics, Ph.D. '75, Astronomy, Professor of Physics, University of California-Davis

ATMOSPHERIC AND OCEANIC SCIENCE DISTINGUISHED ALUMNUS

Oreste Reale, M.S. '94 and Ph.D. '96, Meteorology, Research Scientist, NASA-Goddard Space Flight Center

BIOLOGY DISTINGUISHED ALUMNUS

Jeff Mechanick, B.S. '81, Zoology, Physician and Clinical Professor, Medicine, Endocrinology, Diabetes and Bone Disease, Mount Sinai School of Medicine

CELL BIOLOGY AND MOLECULAR GENETICS DISTINGUISHED ALUMNA

Camilla Olson, B.S. '75, Microbiology, Fashion Designer

CHEMISTRY AND BIOCHEMISTRY DISTINGUISHED ALUMNUS

Carl Dieffenbach, B.S. '76, Biochemistry, Director, National Institute of Allergy and Infectious Diseases

COMPUTER SCIENCE DISTINGUISHED ALUMNA

Aya Soffer, M.S. '92 and Ph.D. '95, Computer Science, Director of Information Management for Analytics Research, IBM Haifa Research Laboratory

ENTOMOLOGY DISTINGUISHED ALUMNUS

W. Jay Nixon, M.S. '73, Entomology, President, American Pest Management

GEOLOGY DISTINGUISHED ALUMNA

Carol Kendall, Ph.D. '93, Geology, Project Chief, Isotope Tracers Project, U.S. Geological Survey (USGS)

MATHEMATICS DISTINGUISHED ALUMNUS

Paul Loftus, B.S. '86, Mathematics, Managing Partner, Accenture

PHYSICS DISTINGUISHED ALUMNUS

Leopoldo Garcia-Colin Scherer, Ph.D. '95, Physics, Physicist, Autonomous Metropolitan University, Iztapalapa, Mexico

ALUMNI HIGHLIGHTS

Paul Butler, Ph.D. '93, Astronomy, has been elected a member of the American Academy of Arts and Sciences.

Steve Orndorff, Ph.D. '79, Microbiology, chief executive officer of Ariel Pharmaceuticals, a startup specialty pharmaceutical company, has been named chairperson of the Board of Directors for the Colorado BioScience Association. Orndorff previously founded Accera, and was president and CEO of Univera Pharmaceuticals.

John Shin, B.S. '93, Mathematics and Computer Science, was promoted to vice president of Software Products Development at Systems Alliance Inc., leading the engineering, quality assurance and customer supports teams responsible for the company's content management application. Prior to joining Systems Alliance, Shin was a principal consultant with Macromedia.

Richard Reynolds, Ph.D. '08, Biology, has received a National Institutes of Health Career Award for his proposal "Discovering Novel Genetic and Environmental Risk Factors for Ra in African Americans." Reynolds is an instructor at the University of Alabama at Birmingham, Department of Immunology and Rheumatology.

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.

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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 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
Maryland Pathogen Research Institute
Maryland NanoCenter
Center for Bioinformatics and Computational Biology



COLLEGE OF
**COMPUTER, MATHEMATICAL,
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 2300 Symons Hall
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GATES, RUDNICK ELECTED TO AMERICAN ACADEMY OF ARTS AND SCIENCES

Astronomy Graduate Also Named Fellow

Sylvester James Gates, Jr., director of the Center for String and Particle Theory and John S. Toll Professor of Physics, and Department of Geology Professor **Roberta Rudnick** have been elected to the American Academy of Arts and Sciences (AAAS). They are among a distinguished group of 212 new members who join one of the nation's most prestigious honor societies and a leading center for independent policy research. **Paul Butler**, Ph.D. '93, Astronomy, one of the first discoverers of extra solar planets, was also named a fellow.

"I am extremely proud that a graduate and two faculty members of the College of Computer, Mathematical, and Natural Sciences have been elected as fellows of the American Academy of Arts and Sciences," says CMNS Dean Steve Halperin. "The recognition of these outstanding members of the university testifies to the impressive quality of our graduate and research programs."

The Earth's Origins

Rudnick's research focuses on the origin and evolution of the continents, particularly the lower continental crust and underlying mantle lithosphere. Her work emphasizes integration of data from a wide diversity of sources, including petrography, petrology, major and trace element geochemistry, isotope geochemistry and geophysics. She also has begun exploring the utility of lithium isotopes in tracing crustal recycling in the mantle.



ROBERTA RUDNICK

"Attracting Roberta to Maryland in summer 2000 'topped off' our push to become a top ten department in the specialty of Geochemistry," says Geology Department Chair Michael Brown. "Roberta will take over as chair in July and will undoubtedly lead the department to even greater success in the decade to come."



SYLVESTER JAMES GATES, JR.

At the Cutting Edge of Theoretical Physics

Gates, who was recently appointed to the President's Council of Advisors on Science and Technology, is the first African American to hold an endowed chair in physics at a major research university in the United States. He is recognized for his groundbreaking, ongoing work in supersymmetry and supergravity, areas that are closely related to string theory, or what is

commonly called "the theory of everything." Such a theory could explain the origins of all matter and energy in the universe and may one day form the basis for technologies that we cannot even imagine today.

"Professor Gates' research is at the cutting edge of theoretical physics, probing the fundamental structure of nature, looking for exotic connections between string theory and information theory and anything else he can think of," says Physics Chair Drew Baden. "On top of that, he finds the time and energy to give a huge number of invited public talks on science at all levels, communicating the excitement of science and working hard to demystify it."

The new class of AAAS fellows will be inducted in a ceremony on October 1 at the academy's headquarters in Cambridge, Mass. ■