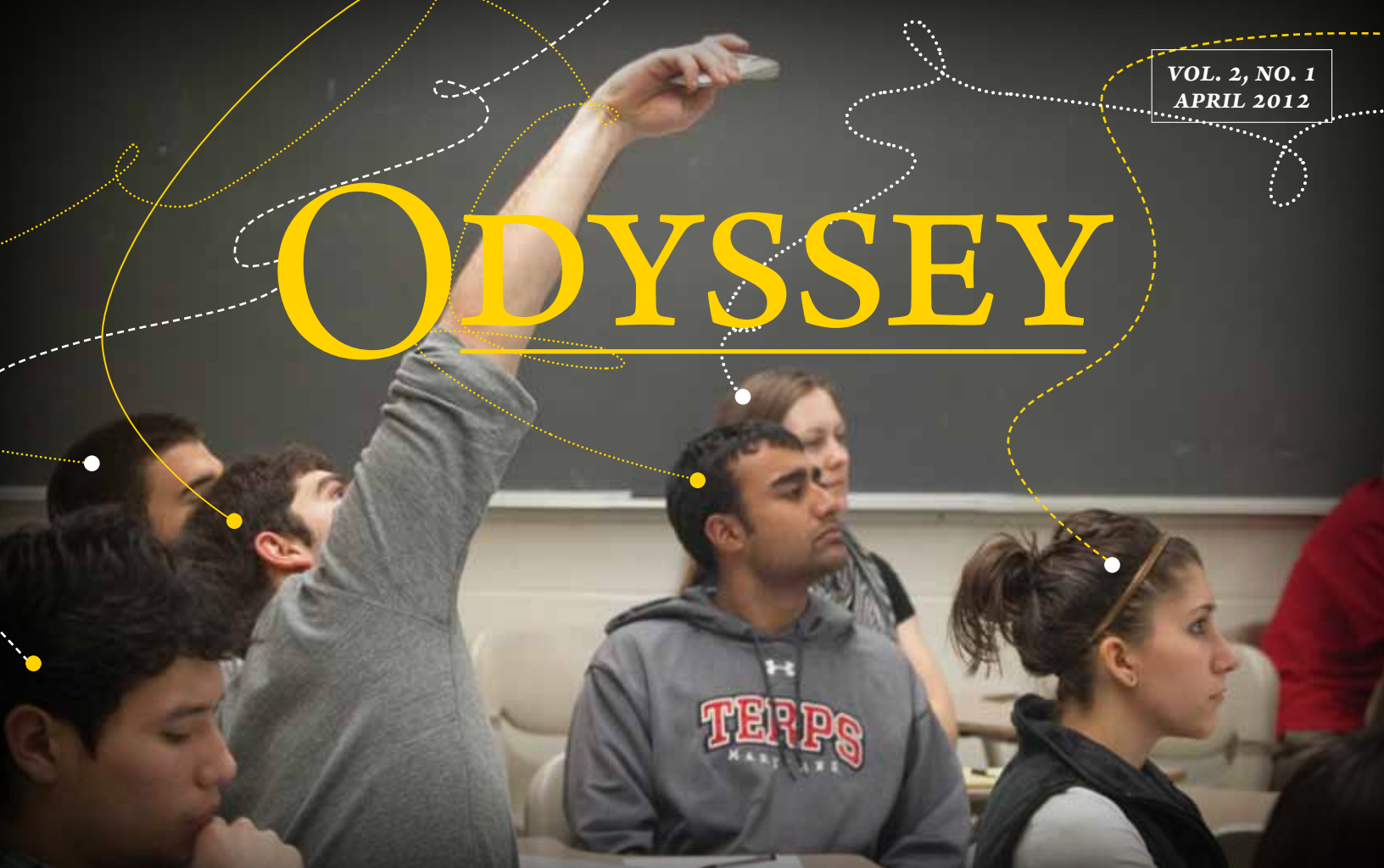


ODYSSEY



TRANSFORMING TEACHING AND LEARNING

INNOVATIVE APPROACHES ENGAGE UNDERGRADS IN THE CLASSROOM, LAB AND BEYOND

Enter the traditional science class of decades past and you would likely find a professor at a podium presenting a lecture from prepared notes using the technology of the day—an overhead projector. Enter that same class in 2012 and you will find active learning and discovery supported by the latest multimedia technologies and designed to prepare students for the higher-level thinking required to succeed in the 21st century workplace.

“Today’s students are less oriented to sit passively in a lecture hall and have information transmitted to them. They expect to be fully engaged in the learning process,” says CMNS Associate Dean Robert Infantino. They use wireless “clicker” devices to weigh in on professors’ questions, work in small groups

to solve problems, and actively engage in classroom discussions and problem-based learning.

An interdisciplinary approach to learning in CMNS has resulted in new classes such as *Calculus for the Life Sciences*. “Increasingly the problems of scientific importance occur at the interface of traditional disciplines,” says Infantino, pointing to areas like biophysics, bioinformatics and genomics. In fact, initiatives from the American Association for the Advancement of Science and the National Research Council urge an interdisciplinary approach to science education. Created by the merger of two colleges in 2010, CMNS offers the perfect structure for facilitating interdisciplinary collaborations between the mathematical, biological, chemical, physical and computational sciences.

There’s also an increased emphasis on engaging students in laboratory research and experiences beyond the classroom. “Our students are immersed in an environment where new knowledge is created,” says Infantino. “This puts them at the leading edge of the discipline, outpacing what is offered in the textbooks.” The CMNS Center for Teaching and Learning, launched in 2006, helps faculty members infuse their courses with dynamic research-oriented case studies and activities.

In the pages that follow, discover how innovations in undergraduate education sweeping across the college are engaging students more fully in the learning experience.

(CONTINUED ON PAGE 4)





Dear Friends and Colleagues,

I am pleased and honored to lead the new College of Computer, Mathematical, and Natural Sciences in one of the nation's pre-eminent public research universities, the University of Maryland. Since my arrival a few months ago, I have met with hundreds of individuals, including students, faculty, staff, alumni, friends and leaders.

The warm welcome extended to me has contributed to a smooth and seamless transition to my new position. I am extremely grateful to everyone for their support, especially Steve Halperin, the first dean of CMNS, and the unit chairs

and directors who continue to offer their advice as I take on this exciting challenge.

Within our college, we are continuing to build on our strong tradition of academic excellence. Across many disciplines, we are internationally recognized, and we will continue to aspire to the highest level of achievement in every department and unit. As you will read throughout this issue, a number of programs within CMNS are national models in the area of undergraduate student engagement. Our student-centered, interdisciplinary approach is raising the level of student interest in the sciences and in academic research. Our mission remains to make path-breaking discoveries, to educate students to become leaders of their generation, and to best serve the greater community.

Behind all of our programs are extremely talented faculty members and staff. Our faculty members are exemplary in their chosen areas and in working across disciplines. The growing support we receive from the nation's top federal research agencies attests to the reputation of our researchers and their ability to advance ideas that matter.

In the coming months, our Board of Visitors is planning to develop task forces in two key areas: undergraduate education and entrepreneurship. This spring, the board launched its Entrepreneurship Lecture Series with "A Tale of Three Start-Ups" in mid-March.

Recently, CMNS welcomed Patrick D. Gallagher, director of the National Institute of Standards and Technology, to campus. Gallagher served as the December commencement speaker, which was especially meaningful as it marked the first such ceremony for CMNS (see sidebar).

Throughout this year, I look forward with great enthusiasm and anticipation to meeting with more of you and to engaging with the university community and members of the public and private sectors in exciting new ways. Please let us hear from you as well. Together, we can keep CMNS at the forefront of science and make even more extraordinary scientific contributions in the years to come.

Warmest regards,

Jayanth Banavar



SESYNC DEDICATION

The National Socio-Environmental Synthesis Center (SESYNC) celebrated its opening on January 30, 2012. From Left: UM Center for Environmental Science President Donald Boesch; University System of Maryland Chancellor William Kirwan; University of Maryland President Wallace Loh; SESYNC Executive Director Margaret Palmer; Maryland State Senate President Mike Miller; Maryland Governor Martin O'Malley; U.S. Senator Barbara Mikulski (D-MD); National Science Foundation Director Subra Suresh; Maryland House of Delegates Speaker Michael Busch; and Resources for the Future President Philip Sharp.

NIST Director Addresses Graduates

Patrick Gallagher, the 14th director of the National Institute of Standards and Technology (NIST) joined CMNS leaders and graduates at the December 22 Commencement ceremony in the university's Comcast Center.

The ceremony marked the first combined commencement of the recently formed college and the first commencement over which CMNS Dean Jayanth Banavar presided. Some 286 students received their undergraduate degrees, 118 students earned master's degrees, and 49 students were Ph.D. recipients.

In addressing the graduates, Gallagher attested, "You're now a national asset." In addition to their responsibility to increase knowledge of the world and tackle our most challenging problems, he believes graduates now have a key role in the workings of the economy, including idea and knowledge creation, value creation, markets and transactions, and informing citizens. Gallagher urged graduates to make work their passion and to remember their duty to give back to society.

Gallagher also serves as Under Secretary of Commerce for Standards and Technology, a new position created in the America COMPETES Reauthorization Act of 2010, and as co-chair of the Standards Subcommittee under the White House National Science and Technology Council. He previously served as deputy director for NIST and was director of the NIST Center for Neutron Research. Gallagher received his Ph.D. in physics from the University of Pittsburgh. ■

PAYING IT FORWARD

Tom and Mary Snitch Named University Honorary Alumni

If you have been fortunate enough to attain a college degree, chances are you've benefited from the help of many individuals along the way. "It could be a professor you remember for the rest of your life or a donor whom you have never met," describes CMNS Board of Visitors Member Tom Snitch, president of Little Falls Associates, Inc., which specializes in solving scientific and technological challenges in Asia.

Snitch firmly believes that one good turn deserves another. "We all share a responsibility to pay it back or pay it forward to higher education institutions with financial support, volunteer efforts or professional advice." Snitch and his wife Mary, Director of Industry Partnership and Programs with Lockheed Martin Corporation, certainly practice what they preach. The couple will be honored this spring for all of their volunteer and philanthropic support with the 2012 University of Maryland Honorary Alumni Association Membership. Their support of the university goes back more than two decades.

An 18-year member of Achievement Rewards for College Scientists (ARCS), Mary describes how her ARCS affiliation gave her a unique opportunity for hands-on experience with the university, initially with the Clark School of Engineering. "Maryland struck a chord with us. They have selected such fabulous scholars to receive ARCS awards," she notes. "The university has a magnificent way of reaching out. It was easy and natural to form the strong relationship that we enjoy today," says Mary, who also maintains ties with the university through Lockheed Martin, which annually supports up to two ARCS Foundation Lockheed Martin Scholars. The 2011 CMNS recipient is Stefanie Sherrill, a stellar Ph.D. student who is pursuing her degree in chemistry.

It was through ARCS local events that both Tom and Mary came to know then-University President C. Dan Mote and ARCS Member Patsy Mote. Over time, Tom visited with the president on campus to discuss ways

the couple could get further involved with the university. As the university's \$1 billion *Great Expectations* capital campaign launched, Tom became involved in the CMNS strategic planning process and the redesign of graduate programs in the life sciences. "Before you know it, I was on the board," says Tom, who is proud of his reputation for getting things done. He has been particularly interested in the role of science for undergraduates. "How do you take science students and help them become literate in policymaking—how do you bridge the world of hard and soft sciences?" asks Tom, who attended every open forum session for candidates for the dean position and continues to raise funds for the dean's special projects. "Tom and Mary are wonderful friends of our college," says CMNS Dean Jayanth Banavar. "They continue to be very giving of their time and their resources,

"When we see these students walk down the aisle at graduation, we know we made a great investment."

which have made enormous positive differences in so many lives."

Even though they are not graduates of Maryland, the couple embraces the university as their virtual alma mater. Tom fondly remembers the opportunity he had to lead the university's Marching Band. "At an ARCS benefit, I won a silent auction item to direct the band at a home football game. I practiced with the band and met the band members, a surprising number of whom were math and science majors. It was one of the few times in my life when I could raise my hand to 250 college students, and they followed my orders."



TOM AND MARY SNITCH

Generous supporters of the college in terms of both time and money, in 2011 the Snitches endowed a CMNS undergraduate scholarship to support students who demonstrate both academic merit and financial need. "If we can help one student who otherwise could not follow their dream in the sciences, that is a gift for us," says Tom, who notes how he and Mary welcome students into their home and also serve as coaches and mentors. "When we see these students walk down the aisle at graduation, we know we made a great investment. When one of the students that we helped receives the Nobel Prize, we want an invitation."

"We've lived in Maryland for many years and consider ourselves Marylanders," explains Mary. "Our association with the flagship university of the state is one of the great honors of our lives." ■



STUDENTS IN *PHYSICS 132* EXPERIENCE A HANDS-ON DEMONSTRATION WITH MAGNETS AND BALL BEARINGS THAT ILLUSTRATES THE PHYSICS OF EXOTHERMIC CHEMICAL REACTIONS.

BREAKING BOUND- ARIES

NEW
TEACHING
STRATEGIES
CROSS
DISCIPLINES

In 2004, a group of Department of Cell Biology and Molecular Genetics faculty members, who specialize in different facets of host pathogen interactions, began searching for a better way to fully prepare students with knowledge to last a lifetime. They found an unlikely source of inspiration: a 1980 comedy sketch called "The Five-Minute University," which was based on the premise that in five minutes you can learn what the average college graduate remembers five years after leaving school. As a starting point, the faculty members watched the infamous sketch and asked themselves: "In all seriousness, what do we want our students to remember five years from now?"

“We weren’t meeting students’ needs in terms of continuity in their education,” says Daniel Stein, professor of cell biology and molecular genetics. “We had not sorted out a learning progression. In some cases, students were not retaining information; in other cases, there were gaps in the courses.” Test results indicated that students were entering upper-level classes without mastering basic information.

With funding from the Howard Hughes Medical Institute (HHMI), the 19 members of the Host Pathogen Interaction (HPI) Teaching Community adopted a holistic approach to improve student understanding, including revamping nine microbiology and cell biology courses dealing with host pathogen interactions. More than 1,000 students enroll in these courses each academic year.

“We wanted to connect our courses so that the concepts build upon each other,” explains Ann Smith, an instructor of cell biology and molecular genetics and HPI Teaching Community leader. “The ‘cover everything’ approach wasn’t working,” says Smith, who recently became assistant dean in the university’s Office of Undergraduate Studies. “We decided to boil the curriculum down to the fundamentals.”

The faculty team developed a list of 13 core competencies and created a concept inventory to use as a pre- and post-course survey to assess student growth and understanding in each class. Faculty members pore over survey results every semester, identifying gaps and problem areas to inform curricular changes. The group meets monthly to discuss teaching strategies and ways to link the courses.

“We’re not just making changes in *what* we teach, but also in *how* we teach,” emphasizes Gili Marbach-Ad, an expert in science education and director of the CMNS Teaching and Learning Center. Marbach-Ad provides guidance to faculty members as they incorporate innovative techniques, including case studies and problem-based activities, into their coursework.

With National Science Foundation (NSF) funding, the team is also developing research-oriented activities that capitalize on the research interests and expertise of faculty members. In one activity, virology students develop proposals for new antiviral drugs. “The lesson resonates because students are involved in the learning process,” says Smith. In an immunology laboratory course, student teams design experiments to address questions related to current medical issues, such as lupus and asthma. “Students go through the whole scientific process: They raise a question, propose an experiment, write up their findings and peer-review each other’s work,” says Wenxia Song, associate professor of cell biology and molecular genetics.

APPLYING LAWS OF PHYSICS TO BIOLOGY

Using hand-held personal response clickers, the students in *Fundamentals of Physics for Life Sciences* select their answers to Physics Professor Joe Redish’s question on how to define a spring constant for DNA. Moments later a bar graph indicates how many students chose each option. The class is deeply divided. Redish smiles. “Find someone who disagrees with you, and convince them of your answer!” As students break into discussion groups, Redish paces up and down the aisle, knowing that his question is helping students grapple with a difficult concept.

Piloted this year, the course is a far cry from the traditional physics classes Redish began teaching at the university in 1970. The premise is to make physics relevant to biology majors, while engaging them in the

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”

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TOGETHER IN
DISCUSSION GROUPS.



learning process and sparking higher-order thinking. “This is a major re-orientation of introductory physics to match the way biologists look at the world and to use what has been learned about effective teaching from physics education research,” says Redish, who is part of an interdisciplinary team developing a two-semester course sequence.

Karen Carleton, associate professor of biology who is helping create the physics sequence, points out that “if students can see the direct applicability of physics to biology, they are more likely to try to master it.” Carleton’s own research on fish vision straddles the two disciplines. “Organisms evolve in a world controlled by physical laws, which has big implications on what they do to survive,” she notes.

The College Park interdisciplinary team spent months debating and negotiating the details of the new physics sequence. The team decided to de-emphasize some topics taught in a traditional introductory course, such as projectile motion and torque, to make time for more relevant topics, including diffusion, molecular forces and chemical bonding. They also infused biological examples throughout the course.

The physics sequence is part of a four-university project to create and share effective models for teaching interdisciplinary science. Funded by HHMI, the four-year, \$1.6 million National Experiment in Undergraduate Science Education (NEXUS) brings together the University of Maryland, College Park; Purdue University; the University of Miami; and the University of Maryland, Baltimore County.

“The lines of separation between scientific fields are starting to blur, and the really big problems facing humanity today cannot be solved by one person in one discipline. We need to reflect that reality in the way we teach undergraduate science education, so our students are prepared to lead in health and science fields,” adds Kaci Thompson, who directs CMNS undergraduate research and internship programs and heads the College Park NEXUS team.

The four NEXUS schools all seek to address educational concerns brought to the forefront by *Scientific Foundations for Future Physicians*, a 2009 report by the Association of American Medical Colleges (AAMC) and HHMI. “The emphasis is on demonstrating student competencies in certain areas, instead of just checking off that students have taken certain courses,” explains Thompson. A new version of the Medical College Admission Test (MCAT), set for release in 2015, will reflect these competencies.

Trevor Maples, B.S. '13, General Biology, is among the 24 students in the pilot class. “When we learn about tension, we talk about how the concept relates to things such as stretching DNA,” he says. “In a traditional physics class, I would learn countless equations that never make the connection to biology.”

GIVING MATH NEW MEANING

CMNS educators are also integrating mathematics more closely with the biology curriculum. “Nationally, there is growing recognition of the importance of mathematics for the biological sciences,” says Biology Professor William Fagan, whose own research uses statistical and spatial analysis to understand ecological patterns and dynamics. “Biological research is becoming more quantitatively sophisticated, particularly in fields like biophysics, ecology, physiology and population genetics.”

A team of CMNS biology and mathematics professors collaborated on a two-semester calculus sequence for biology majors that was introduced in 2008 and honored by the university’s Center for Teaching Excellence in 2009. “We shifted the content to focus on the mathematical skills and expertise that are most relevant to the questions biologists must answer,” says Fagan. For example, the curriculum de-emphasizes integral calculus to make room for differential equations, probability and statistics.

“In a generic course, it’s hard to make the math meaningful to students. Now math can speak to the biology students’ hearts,” notes Mathematics Professor Doron Levy, who helped develop the sequence. “Increasingly, biologists, physicists, engineers and doctors are working together on problems. You need to have enough understanding of other disciplines to allow you to communicate and work together.”

In addition to lectures, students attend two discussion sessions each week—one led by a math teaching assistant and the other by a biology teaching assistant. Students complete BioModules, which “reflect current issues and are often inspired by CMNS research,” says Levy. In one BioModule students examine the mathematical relationship between sea ice and krill growth in the Antarctic Ocean. Given that Adélie penguins require a certain amount of krill as food, students are then asked to find the maximum size of a colony of Adélie penguins. In this case, Fagan’s lab is studying the effect of climate change on penguin populations.

Fagan also helped originate the MathBench Initiative, another effort to integrate biology and mathematics. With HHMI and NSF funding, the MathBench team has developed 40 online, interactive modules designed to supplement five fundamental biology courses for CMNS undergraduates. Using colloquial language and humor, the modules step students through mathematical concepts, exploring a range of problems from bacteria’s exponential growth to using a log scale to measure an orange’s acidity. A 2009 study found that students in a CMNS introductory biology course that incorporated nine of the modules showed significant improvement in quantitative skills, a majority of students attributing the improvement to MathBench.

A \$500,000 NSF grant is helping the MathBench team disseminate its work nationally. Thirty-three institutions nationwide have attended MathBench workshops and are working to implement the modules in their curricula.

PREPARING CYBER SLEUTHS

A new *CyberLab* course taught by computer science and engineering faculty will provide undergraduates in those two majors with critical skills to keep the nation’s computer infrastructure up and running and protect computer networks and systems from cyber attacks. “The demand for cybersecurity graduates is outpacing the supply,” says Eric Chapman, associate director of the Maryland Cybersecurity Center (MC²), which is helping develop the course. “*CyberLab* will play a vital role in preparing our students for the cybersecurity workforce.”

Set to debut in the fall, *CyberLab* is just one of the education initiatives offered through MC², which was launched in 2010 to provide an interdisciplinary approach to cybersecurity education and research. Faculty from an array of other fields, including information sciences, business, public policy, social sciences and economics, along with representatives from government and industry are among the center’s collaborators.

CyberLab will provide an intensive laboratory experience, designed to give students an edge in the job market. “The course is a tool-based introduction to cybersecurity, from detecting and preventing intrusions, to attesting to the integrity of hardware, to analyzing software to look for vulnerabilities,” says Michael Hicks, MC² director and an associate professor in Computer Science and the University of Maryland Institute for Advanced Computer Studies. Hicks, along with fellow computer science faculty members Jeff Foster and Jonathan Katz, will team-teach the upper-level course with two electrical and computer engineering faculty members. Lockheed Martin is providing \$20,000 in seed money to help develop the course.

This semester, the center also launched an innovative computer science course that will prepare the next generation of cybersecurity professionals while helping to safeguard the university’s Internet services. An independent study course, *Secure Maryland*, trains students to find and fix vulnerabilities in campus Internet services.

Hicks is advising computer science faculty members on how to infuse cybersecurity models throughout their courses. “All computer science majors need to learn about secure programming.” He is also collaborating with colleagues campus-wide to incorporate the topic into non-technical courses. “Cybersecurity can be approached from a variety of perspectives, including policy, economics and criminology.” ■

ONLINE RESOURCES

For more information about undergraduate education opportunities and innovations in CMNS, visit the following websites:

CMNS Teaching and Learning Center www.cmns-tlc.umd.edu Integrated Life Sciences Program www.ils.umd.edu

College Park Scholars Program www.scholars.umd.edu MathBench Biology Modules www.mathbench.umd.edu

Host Pathogen Interaction Teaching Community www.cbmg.umd.edu/hpi National Experiment in Undergraduate Science (NEXUS) www.hhmi.org/grants/office/nexus



total

IMMERSION

*Students Live and Breathe Scholarship
Through Living-Learning Programs*

FOR HELEN CHEUNG, B.S. '15, GENERAL BIOLOGY, FINDING STUDY PARTNERS WHO SHARE HER PASSION FOR SCIENCE IS A CINCH—the eighth floor of LaPlata Hall is full of potential candidates. Cheung is among 54 participants in the Honors College's Integrated Life Sciences (ILS) program, the campus's newest living-learning program in which students with similar academic interests live in the same residence hall. "ILS is like a family," says Cheung. "We help each other with any problems from solving homework questions to taking care of sick hallmates."

Students in living-learning programs are more likely than their peers to experience a smooth transition into higher education and to build, maintain and utilize healthy social networks, according to a

national study of living-learning programs. "There's an enormous synergy that can be accomplished with a living-learning program," says Todd Cooke, ILS director and a professor in the Department of Cell Biology and Molecular Genetics. "Students are living and breathing scholarship in the classroom and in the residence hall. This is the first step in developing their professional networks."

Launched in fall 2011, the CMNS-sponsored ILS program takes an interdisciplinary approach and explores how the fundamentals of life sciences apply to everything from nanotechnology to ecosystem analysis. "This is an extraordinary time in the life sciences," says Cooke. "We are developing new genomic and mathematical tools for





TODD COOKE WITH ILS STUDENTS IN AN ACCELERATED ORGANISMAL BIOLOGY COURSE.

characterizing life and life's processes, and we want to share this excitement with the next generation of life scientists." Honors College Director and Physics Professor William Dorland adds, "ILS places Maryland's most academically talented students squarely in the middle of rapidly growing, exciting fields of science."

The program's interdisciplinary nature attracts students like Tingrui Zhao, B.S. '15, General Biology and Computer Science.

"During high school, I took chemistry and biology courses the same year, and it offered a glimpse into the value of connecting the dots between the disciplines," says Zhao.

The two-year program includes accelerated courses in organismal biology, genetics and genomics, and biomathematics. Through active learning strategies, students design computer models of biological processes, work in small teams to solve problems, and create the equations for concepts such as fluid flow and diffusion. The goal is to help students develop the competencies and learning objectives outlined in HHMI's *Scientific Foundations for Future Physicians*, which apply not only to pre-med students but to most undergraduate life science majors. "The ILS program serves as an incubator for educational reform," says Cooke. "It's a place to pilot courses that we

hope to eventually offer to all students in the life sciences."

In a capstone course, students develop skills to tackle current research problems, including mathematical modeling, interpreting scientific literature and using basic genomic tools. Working in small groups, they propose how they would address a modern challenge, such as the development of an HIV vaccine.

Students also pursue a research project on campus or at a local research institution. "With the university's geographic advantage, we can place our students in internships where they learn about the discovery of new knowledge," says Cooke, who is cultivating

COLLEGE PARK SCHOLARS offers 11 interdisciplinary living-learning programs, including three sponsored by CMNS that focus on exploring science, helping students develop critical thinking skills, and differentiating between science and pseudoscience. Day trips and weekend outings to astronomy observatories, science museums and research facilities enrich the coursework, expose students to possible internship and research opportunities, and foster bonding among participants.

Life Sciences

Founded in 1994 as one of the original four Scholars programs, Life Sciences provides a broad, interdisciplinary perspective on the biological sciences. Colloquia feature guest speakers on evolution, ecology, bioethics, medicine, nutrition and more. "Students gain an understanding that life sciences can prepare you for so much more than a career in the health professions," says Director Reid Compton. "Life sciences is about ecology and natural history, evolution, technology, ethics, conservation and education, as well as biomedicine." Trips to the Museum of Natural History, National Library of Medicine and Walter Reed National Military Medical Center provide experiential learning, and an annual freshman Labor Day weekend camping trip

helps forge student ties. Travel-study opportunities include a trip to Belize each January and summer trips to Australia and Alaska to study the culture, local environment and biodiversity.

Science, Discovery and the Universe

Participants study the nature of science through the lens of astronomy from ancient times to modern space policy and explore how the intersection of human curiosity and the scientific method has led to new space discoveries. Special colloquia examine astronomy's role in society, and visits to the University of Maryland Observatory, the Baltimore Aquarium and the Howard B. Owens Science Center Planetarium open students' eyes to the wonders of astronomy. On an overnight trip to the National Radio Astronomy Observatory in Green Bank, West Virginia, students manipulate a 40-foot radio telescope to analyze the Milky Way. "These trips are great at not only tying what we're studying to the real world, but also for community-building," says Co-Director Alan Peel,

**EXPLORE
DISCOVER**

internship opportunities at world-renowned research facilities such as the National Institutes of Health, the U.S. Department of Agriculture, and the Smithsonian Institution.

College Park Scholars is yet another campus interdisciplinary living-learning experience for freshmen and sophomores. Students live in the Cambridge residential community, which includes offices and resource rooms for faculty advisors and mentors. "A large research university can be overwhelming to an 18-year-old freshman," says Scholars Executive Director Greig Stewart. "The Scholars Program provides students with a place where they belong from the start of their college career."

The programs feature special colloquia as well as supporting courses, which apply to students' general education requirements. Sophomores complete a practicum in which they engage in an internship, research or service learning project related to the theme of their program, then present their experiences



LIFE SCIENCES SCHOLARS IN BELIZE.

at an Annual Academic Showcase. Course-work guides students through the research process, teaching them to design and implement a scientific study.

Ryan Scully, B.S. '08, Biological Sciences, a fourth-year medical student at George Washington University, says his Scholars education was instrumental in preparing him for medical school. "The Scholars colloquia began the molding process that helped me to become the person that I am today," he says. "In treating patients, we are constantly reviewing medical literature to support or argue against specific diagnoses and treatments for patients," says Scully, who plans to specialize in orthopaedic surgery. "The Scholars Program cultivated my critical and scientific thinking skills, which I now use daily to provide my patients with the best care possible using evidence-based medicine." ■

a lecturer in the Department of Astronomy. A trip to Arizona, co-sponsored by the Science and Global Change program, to visit the Lowell Observatory, the Grand Canyon and Meteor Crater, the world's best preserved meteorite impact, is offered every other year during spring break.

Science and Global Change

Launched in 2009, Science and Global Change helps students explore the evidence, causes and implications for climate and other global changes. Recognized as a world leader in climate change studies, the university offers Scholars students access to the latest research, including trips to the Smithsonian Environmental Research Center and the University System of Maryland's Horn Point Laboratory on the Eastern Shore. Travel study opportunities include an eight-day trip to the Galapagos Islands, where a chartered ship takes students from island to island to explore the ecosystem. "It's an incredible opportunity to see some of the most amazing wildlife and wilderness that remain on the planet," says Director Thomas Holtz, Jr. ■

CMNS Peer Mentors Ease the Transition to University Life



Kailin Hsu, B.S. '12, Biological Sciences, (left) clearly remembers the anxiety she felt as a

freshman trying to plan four years of academic study. "I didn't know what courses I needed; everything was a jumble to me," says the senior, who plans to attend medical school next year. With advice from her peer mentor and tips from a one-credit introductory seminar, she began to get her footing. Today, Hsu joins 20 students serving as peer mentors and teaching assistants (TAs) for a course that introduces CMNS freshmen to university life.

As TAs, upperclassmen help plan lessons and facilitate discussions for the introductory seminar, providing an insider perspective. Outside of class they assist freshmen with their academic plans and help them adjust to college life. "The peer mentor is a point person that students go to for guidance," says CMNS Director of New Student Programs Stacy Woycheck. "Mentors draw on their own experiences to provide insight about the college experience."

Hsu took on the dual peer mentor/TA role to help others, but she quickly discovered the personal benefits as she honed her communication, leadership and interpersonal skills. "I've learned that you have to treat each student as a unique case," says Hsu. "Each student is different, and I work to support their individual interests."

Casey Rice, B.S. '05, Biological Sciences, says the experience strengthened skills that she draws on as a resident specializing in family medicine at the University of Maryland Medical Center. "I sometimes need to review information several times with patients, and I try to do so in different ways. My TA experience taught me that some people are visual learners, some learn by repetition and others use a mixture of learning styles to really grasp information." ■

SCIENCE FOR ALL



JOELLE PRESSON (FAR LEFT) EXAMINES FOSSILS WITH STUDENTS IN THE I-SERIES COURSE *RACE, GENOMICS AND HUMAN EVOLUTIONARY HISTORY*.

COURSES BOOST SCIENTIFIC LITERACY FOR NON-MAJORS

the university through two series of courses designed to engage students who are not majoring in the sciences or mathematics. “Every graduate of this university will have to make decisions of significance in their lives that connect to science-related issues such as climate, health, energy, the environment and genetic engineering,” explains CMNS Associate Dean Robert Infantino. “This college has embraced the need to explore relevant topics in depth, beyond the traditional survey courses, for non-majors.”

The Marquee Courses in Science and Technology were developed in response to the national need for a greater appreciation and understanding of how science, technology, engineering and mathematics (STEM) provide solutions to the world’s challenges. The courses are taught by accomplished research faculty members, who meet regularly with Donna Hamilton, associate provost for academic affairs and dean for undergraduate studies, to discuss course development and new teaching techniques. “It was a great

concern to faculty that we had many brilliant students in other majors who will make science-related decisions in their jobs, and we were not offering courses to adequately prepare them,” says Hamilton. “Through these courses, students explore science up close, not at an arm’s distance.”

Physics Professor Jordan Goodman, who has been teaching Marquee courses since their inception in 2008, describes the concept. “We want students to see how scientists search for answers: how they collect data, build models, and make scientific judgments. These courses are mechanisms to teach how science attacks the world’s problems.” In *Physics for Decision-makers: The Global Energy Crisis*, which Goodman teaches with Physics Professor and Co-director of the Joint Quantum Institute Steve Rolston, the issues of global warming, shrinking oil supplies, biofuels and nuclear power are explored as students consider how they would make decisions to ultimately determine the survival of the planet. “These kinds of courses aim to provide students with the tools and confidence to critically evaluate information with a scientific basis,” says Rolston.

Evolution of Life and Environment on Planet Earth, taught by Geology Professors Alan Kaufman and James Farquhar, explores

how life has shaped the Earth’s physical environments and analyzes evidence for the origins and diversification of life and its impact on Earth environments. “We begin by giving students a sense of space and time. For instance, we take the class outside and build a model of the solar system that stretches across campus, using a bouncing basketball as the sun and peppercorns and acorns as the planets,” says Kaufman. Class activities, or simulations, capture the basic elements of processes like the greenhouse effect, radioactivity and Earth system feedbacks. “We get students to generate data that we can use to analyze the process and uncertainties in the simulations,” says Farquhar. The course also includes field trips to the Smithsonian Institution, as well as to Calvert Cliffs to hunt for fossil shark teeth, and to Northern Virginia to view glacial deposits.

Pollinators in Crisis, taught by Associate Professor of Entomology David Hawthorne, examines why the ecosystem is losing pollinators—required for the growth of some 30 percent of our food—to environmental stress and disease. Students learn about insects, the interaction of organisms in complex ecosystems and the human–nature interface. Hawthorne draws largely from his own research, which emphasizes the interaction of genetic and

ecological forces and the evolutionary consequences. “Active learning and group projects help students develop an array of important skills while learning about where our food comes from and how ecosystem services support our quality of life,” says Hawthorne.

The influence of weather and climate on transportation, commerce, agriculture and nearly every aspect of life is explored in *Weather and Climate* taught by Atmospheric and Oceanic Science Professor Robert D. Hudson, who formerly managed the Atmospheric Chemistry and Dynamics Branch at NASA Goddard Space Flight Center. Rather than submit individual assignments, students complete three group projects. “As teams, students prepare poster presentations on issues that link weather and climate to their everyday activities, such as the impact of climate forecasting on the commodities market,” explains Hudson.

Revisiting General Education Courses

Based on the success of the Marquee courses, the I-Series courses were launched as a pilot program in Spring 2010 and will become a centerpiece of the university’s new General Education Program, which begins in Fall 2012. “We wanted to move away from broad survey courses and give students the experience of delving into creative topics that are meaningful to them and society,” says Joelle Presson, assistant dean for undergraduate academic programs.

In *Race, Genomics and Human Evolutionary History*, Presson takes students on a scientific

“It was a great concern to faculty that we had many brilliant students in other majors who will make science-related decisions in their jobs, and we were not offering courses to adequately prepare them.”



STUDENTS GATHER AROUND A BEEHIVE IN THE MARQUEE COURSE *POLLINATORS IN CRISIS*.

journey from the fossil record, tracing the lineage of modern humans through DNA. The course covers the fundamental concepts of chemical, cellular, genetic, molecular and evolutionary biology required to understand genetic diversity. “This course raises questions about the idea of race and provides a scientific way to understand human diversity,” says Presson, who challenges students to justify scientific conclusions with available data.

Astronomy Senior Lecturer Melissa Hayes-Gehrke begins *Collisions in Space: The Threat of Asteroid Impacts* with an overview of the solar system, gravity and the basics of

astronomy, “then we move to study asteroids—including how we could defend our country from them and their role in international politics.” She uses team assignments to give entering students needed experience with working in groups and sharing perspectives. “Students design a spacecraft to accomplish a specific mission within a given budget,” Hayes-Gehrke explains. “In their last project, teams present written arguments on ethical issues and other teams debate the argument. When they finish this course, students know more about asteroids than 99 percent of the population.” ■

A STELLAR ASSESSMENT TOOL

Thanks to the work of CMNS Astronomy Instructor Grace Deming, astronomy educators worldwide have a valuable tool to help them develop appropriate-level coursework. Over a decade ago, Deming spearheaded a national project to design the Astronomy Diagnostic Test (ADT) to assess incoming students in introductory astronomy courses designed for non-science majors. “Working together with astronomers at several institutions, we created a test to help instructors understand the level of students entering their courses,” says Deming.

The 21 multiple-choice content questions focus on 10 major topics, ranging from gravity

to stars. An NSF-funded project verified the test’s reliability and validity at indicating student knowledge during pre- and post-testing. Deming was amazed at the results: Many students could not explain basic phenomena, including why the moon goes through phases or why we have different seasons. “Like many astronomy educators, I assumed students knew these concepts,” she notes. “Now, I make sure to start with the basics when teaching.” Deming received the 2011 Education Prize from the American Astronomical Society for her work in developing the ADT, which is still used in astronomy courses.

TEST YOUR ASTRONOMY BASICS WITH A QUESTION FROM THE ADT:

Where does the Sun’s energy come from?

- A. The combining of light elements into heavier elements
- B. The breaking apart of heavy elements into lighter ones
- C. The glow from molten rocks
- D. Heat left over from the Big Bang

Answer: A

LEARNING

BEYOND

THE CLASSROOM

An aspiring research scientist, **Katherine Manfred**, B.S. '12, Chemistry and Physics, (*right*) began searching for hands-on experiences from day one at the college. During her first semester, she joined Chemistry Professor John Fourkas' lab, which uses ultra-fast lasers to probe and control condensed matter. "I love being in the lab," says Manfred, who was recently awarded a Clarendon Scholarship to study for three years at Oxford University, where she will pursue a Ph.D. in chemistry. "Every day there's a new challenge to overcome with the laser set-up, sample preparation or data analysis."

Manfred, who traveled to the University of Bristol in the United Kingdom to conduct research on the effects of aerosols on climate change during her junior year, is not alone in her quest for experiential learning. Whether it be on-campus research, an internship at a nearby federal laboratory, a study-abroad experience or a service learning project, CMNS students are actively seeking opportunities to enhance their education outside of the traditional classroom.

In 2011, 84 percent of the university's graduating students in the chemical and life sciences reported they participated in an internship or research project. "Our key location near the nation's capital is an incredible selling point," says CMNS Associate Dean Robert Infantino. "One of the reasons students come here is because of our proximity to national and international research institutions, including the National Institute of Standards and Technology, the National Institutes of Health and NASA."

"It's never too early for students to start thinking about the value of research, internships and other experiential learning," says Kaci Thompson, director of CMNS undergraduate research and internship programs, who reinforces that message when she visits each of the sections of the UNIV 100 course that introduces CMNS freshmen to university life. "It's critical for students to get into a setting where they can participate in the scientific process."

The college sends daily email alerts to help students identify research and internship opportunities. CMNS also offers an optional one-credit *Catalyst Seminar*, sponsored by the Howard Hughes Medical Institute, to introduce freshmen and soph-

omores to the diverse on-campus research opportunities available to them. Faculty looking for research assistants serve as seminar guest lecturers, highlighting their research needs. The seminar also covers topics of importance for student researchers, such as navigating the research process, ethics in science, and critical analysis of research papers and proposals.

Among CMNS students, service learning is also on the rise, says Infantino. In growing numbers students are offering their time and energy to better the community, with pre-med students volunteering at health clinics, environmental science students restoring areas threatened by pollution and physics majors tutoring high school students.

RESEARCH,
SERVICE
EXPERIENCES
ENRICH
LEARNING



Students in Action

SEAN MBACHU

Volunteer, Washington Hospital Center; Kids Enjoy Exercise Now; Researcher, Univ. of Minnesota; Univ. of Southern California
B.S. '12, Biological Sciences



CAREER ASPIRATION
Physician

THE EXPERIENCE

I volunteered for several medical-related organizations and facilities, including the Washington Hospital Center Emergency Room and Kids Enjoy Exercise Now, a nonprofit organization that provides free one-to-one recreational opportunities for children with developmental and physical disabilities. Through a summer research position at the University of Minnesota, I studied the reproductive capacity of the herpes virus, and at USC I pursued a project on the drug resistance of brain tumors. These experiences solidified my desire to pursue a medical career.

LESSONS LEARNED

Research has nurtured my love for science and provided a great opportunity to collaborate with mentors and fellow students. Volunteering has helped me develop a strong sense of compassion for others. Compassion and empathy cannot be taught in the classroom or by reading a book.



DORIS HOUG

Summer Intern, Microsoft Tellme Mountain View, Calif.
B.S. '12, Computer Science

CAREER ASPIRATION

To work in the fields of human-computer interaction (HCI) and user experience (UX)

THE EXPERIENCE

From the first day, no one spoke to me as "just an intern." I was asked for my opinions, suggestions and help, and was given lots of freedom to design my project on software development for speech technologies. I've accepted a job offer from Microsoft.

LESSONS LEARNED

It was helpful to work alongside people in the industry; you can't gain that kind of experience in the classroom. I discovered my interest in HCI and UX.



BRYAN HOLDER

Undergraduate Teaching Assistant (TA) Department of Astronomy
B.S. '12, Astronomy and Physics (double major)

CAREER ASPIRATION

Astronomy professor

THE EXPERIENCE

The most enjoyable aspect is the interaction with students through questions and answers. That's when the real learning takes place.



EMILIJA MILJKOVIC RENKE

Research Assistant University of Maryland Institute for Bioscience and Biotechnology Research
B.S. '12, Biological Sciences

CAREER ASPIRATION

Pharmaceutical-research scientist, specializing in antibiotic resistance

THE EXPERIENCE

Growing up in Serbia in the 1990s during the Balkans conflict was not easy. In this impoverished country, where few medications were available, antibiotics became a cure-all. Witnessing the misuse of these drugs influenced my decision to study science. Due to Serbia's political instability, I came to study in the United States four years ago. A Howard Hughes Medical Institute Undergraduate Research Fellowship allows me to fight the silent killer: antibiotic resistance.

LESSONS LEARNED

My work focuses on developing alternative treatments for antibiotics, using enzymes produced by bacteriophage. I've received excellent mentoring, advising and full support to develop my skills as a scientist.

LESSONS LEARNED

Teaching the introductory astronomy courses has helped me master the basic concepts and given me confidence in public speaking. The first semester I taught, I would get butterflies in my stomach before every discussion session. Now, as a senior, the discussion session is the most relaxing part of the week. This experience will put me ahead of the curve in grad school and help prepare me for becoming a professor.

Research Demonstrates Effect of Aerosols on Weather and Climate

Research led by Zhanging Li, Professor of Atmospheric and Oceanic Science, provides the first clear evidence of how aerosols—soot, dust and other small particles in the atmosphere—can affect weather and climate. The findings could have important implications for the availability, management and use of water resources in the United States and around the world.

The study demonstrated how increases in air pollution and other particulate matter in the atmosphere can strongly affect cloud development in ways that reduce precipitation in dry regions or seasons, while increasing rain, snowfall and intensity of severe storms in wet regions or seasons. The study found that under very dirty conditions, the mean cloud height of deep convective clouds is more than twice the mean height under crystal clean air conditions.

“The probability of heavy rain is virtually doubled from clean to dirty conditions, while the chance of light rain is reduced by 50 percent,” says Li, who is also affiliated with Beijing Normal University. “Our findings have significant policy implications for sustainable development and water resources, especially for those developing regions susceptible to extreme events such as drought and flood.” For more information, see www.atmos.umd.edu. ■

ALUMNI HIGHLIGHTS

Penrose (Parney) Albright, M.S. '82, Ph.D. '85, Physics, has been named director at the Lawrence Livermore Laboratory, in Livermore, Calif. Prior to joining the lab as principal associate director of global security in 2009, he worked with Civitas Group as a homeland security consultant in Washington, D.C. He has served as assistant secretary in the Department of Homeland Security, assistant director in the Office of Science and Technology Policy and, concurrently, senior director in the Office of Homeland Security in the White House.

Ricky Arnold, M.S. '92, Marine-Estuarine-Environmental Sciences, a NASA astronaut, served as the University's December 2011 Commencement speaker. In March 2009, Arnold was part of a 14-day mission aboard the shuttle Discovery. He completed two space walks to make installations to the International Space Station.

Jennifer Mattei, B.S. '82, Zoology, is director of the Professional Science Master's Program

in Environmental Systems Analysis and Management at Sacred Heart University in Fairfield, Conn.

Mike Mayo, B.S. '85, Computer Science, a bank-stock analyst for Credit Agricole Securities USA, recently published his memoir, *Exile on Wall Street: One Analyst's Fight to Save the Big Banks from Themselves*, that offers a behind-the-scenes look at the nation's biggest financial institutions and the numerous holes that still exist in the nation's financial system. He has also testified before Congress on ways that companies keep damaging information from investors.

James Wigand, B.S. '78, Zoology, has been named director of the Federal Deposit Insurance Corporation's (FDIC) newly established Office of Complex Financial Institutions, with responsibility for the review and oversight of bank holding companies with more than \$100 billion in assets. Prior to accepting this position, Wigand was deputy director of the agency's resolution division for 13 years.

In Memoriam

Herbert Hauptman

Herbert Hauptman, Ph.D. '55, Mathematics, died October 23, 2011, at the age of 94. Hauptman was co-winner of the Nobel Prize in Chemistry in 1985 for developing mathematical methods for deducing the molecular structure of chemical compounds. After World War II, in which he served as a Navy ensign, Hauptman began working at the Naval Research Laboratory. He joined a nonprofit biomedical research institute, the Medical Foundation of Buffalo, in 1970, becoming the research director in 1972, then president for many years. Hauptman, a member of the National Academy of Sciences, was inducted into the university's Alumni Hall of Fame in 1995 and received the President's Distinguished Alumnus Award in 2003.

John S. Toll

Professor Emeritus John S. Toll, former president of the University of Maryland College Park (UMD), and the first chancellor of the University System of Maryland, died on July 15, 2011. After serving as chair of the Department of Physics and Astronomy from 1953 to 1965, he left the university to serve as the founding president of the State University of New York at Stony Brook. Toll returned to the University of Maryland as president in 1978 and was appointed by then-Governor William Donald Schaefer to serve as the first chancellor of the new 11-university system in 1988. When Toll left the Chancellor's Office in 1989 and returned to the Department of Physics, the Board of Regents conferred upon him the status of chancellor emeritus and, in 1991, established the John S. Toll Professorship in Physics. He subsequently served as president of Washington College, returning to UMD in 2004 to teach physics in the building that, since 2002, carried his name. Toll was a Guggenheim Fellow, held leadership roles in dozens of organizations, and received national and international honors and honorary degrees.

Memorial contributions can be made to support the Undergraduate Prize in Physics. Checks can be made payable to UMCPF and forwarded to: University of Maryland College Park Foundation, 4511 Knox Road, Suite 205, College Park, Maryland, 20740-3380. ■

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Ben Bederson, Computer Science and UMIACS, was elected to the Association for Computing Machinery's Special Interest Group on Computer Human Interaction's (SIGCHI) CHI Academy in recognition of his contributions to the field of human-computer interaction.

Alessandra Buonanno, Physics, a premier theorist in the field of gravitational waves, was named a fellow of the American Physical Society.

Michael Hicks, Computer Science and UMIACS, was named director of the university's Cybersecurity Center (MC²). His research focuses primarily on developing and evaluating techniques to improve software reliability and security.

Raymond St. Leger, Entomology, was elected a fellow of the Royal Entomological Society of Britain, which promotes the dissemination of knowledge in all fields of insect science and facilitates communication between entomologists.

Two faculty members were elected 2011 Fellows of the Institute of Electrical and Electronics Engineers (IEEE): **Thomas Antonsen**, Physics and IREAP, for contributions to the theory of magnetically confined plasmas, laser-plasma interactions and high power coherent radiation sources, and **Ben Shneiderman**, Computer Science and UMIACS, for contributions to human-computer interaction and information visualization.

CMNS Faculty Named AAAS Fellows

Eleven CMNS faculty members were named fellows of the American Association for the Advancement of Science (AAAS), the world's largest general federation of scientists and the publisher of the journal *Science*. The honor recognizes the scientifically or socially distinguished efforts of researchers to advance science or its applications. The new fellows are:

- **Tony Busalacchi**, Atmospheric and Oceanic Science and Earth System Science Interdisciplinary Center, for contributions to the earth sciences, particularly the understanding of tropical oceanic processes and the development of interdisciplinary collaborations across the earth sciences.
- **Catherine Emily Carr**, Biology, for contributions to neurobiology, particularly for work on temporal coding and for serving as co-director of the Neural Systems and Behavior course at Woods Hole Oceanographic Institution.
- **Rama Chellappa**, University of Maryland Institute for Advanced Computer Studies (UMIACS) and Electrical and Computer Engineering, for contributions to image processing and computer vision, particularly model-based approaches to image and video-based modeling and recognition.
- **Thomas D. Kocher**, Biology, for contributions to molecular evolutionary genetics, particularly for studies of animal mitochondrial DNA and the evolution of African cichlid fishes.
- **Dan Lathrop**, Physics, Geology, Institute for Research in Electronic and Applied Physics (IREAP) and Institute for Physical Science and Technology (IPST), for novel turbulence experiments and diagnostics uncovering the effects of rotation, magnetic fields and long-range quantum order in superfluid helium.
- **Karen Lips**, Biology, for research contributing to the discovery and understanding of amphibian population declines, including outreach to the public and communication with the media.
- **John Mather**, Physics, for outstanding scientific leadership of NASA's astronomy missions including his Nobel Prize-winning Cosmic Background Explorer and the future James Webb Space Telescope.
- **Steve Rolston**, Physics and Joint Quantum Institute, for research with ultracold atoms, particularly the development of optical lattices and ultracold plasmas.
- **Raman Sundrum**, Physics, for fundamental contributions including anomaly-mediation in supergravity theories and the "Randall-Sundrum" mechanism within higher-dimensional warped compactifications and associated phenomenological implications.
- **Gerald Wilkinson**, Biology, for contributions to basic research in behavioral ecology and service as a program officer at NSF, university graduate director and department chair.
- **John Weeks**, Physics, Chemistry and Biochemistry, and IPST, for seminal contributions to the statistical physics of liquids, interfaces and other condensed-phase systems.

ODYSSEY

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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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DYNAMICDUO GUIDES GENERATIONS OF STUDENTS TO ACADEMIC SUCCESS

Dalo, Jordan Combine 63 Years of University Experience

The year was 1985. **Linda Dalo** wanted to spend more time with her five-year-old daughter. **Cecilia Jordan** was expecting her first child and worried about balancing a family with a full-time job. Both women were at a crossroads in their administrative careers when they approached Professor John Corliss, then chairman of the Department of Zoology, with an interesting proposition. They wanted to share a job in the department's undergraduate office.

"For 16 years we shared an administrative position in zoology," recalls Dalo. "I worked Monday through Wednesday mornings, and Cecilia worked Wednesday afternoons through Friday." Their arrangement pre-dated the use of computers and email. "We would leave copious, typed notes for one another so we knew where to pick up with our work," says Jordan. "It was very progressive of our chair and dean, and the arrangement gave us time with our children."

To further provide continuity, the two would meet for lunch each Wednesday, a tradition they continue to uphold. "We have a wonderful friendship that has grown over the years. We've seen each other through a lot of changes, personally and professionally," says Dalo. Their common bond: "We enjoy working with students. After nearly 30 years, it has been so gratifying to see so many students leave the college and pursue successful careers," adds Jordan.

Nine years ago, Dalo took a full-time position as a program management specialist in the CMNS undergraduate academic program office, working closely with Joelle Presson, assistant dean for undergraduate programs. Jordan remains as a program management specialist in the biology department, which now encompasses zoology. For the last four years she has taught *UNIV 100*, the freshman orientation course, during the fall semester.

Throughout the years, their commitment and dedication to students, the college and the university has not gone unnoticed.



FOR 63 YEARS AND COUNTING, LINDA DALO (LEFT) AND CECILIA JORDAN HAVE SERVED THE COLLEGE AND ITS STUDENTS

Both women have received the college's Staff Excellence Award. In 2008 Dalo received the President's Distinguished Service Award, and in 2005 she received the Board of Regents Staff Award, an honor Jordan received in 2011.

"Lots of students have cried on our shoulders and celebrated happy moments in their academic careers," explains Dalo. "One of their biggest worries was about getting into medical school." Technology is now helping maintain alumni ties to CMNS. Through LinkedIn, Dalo has reconnected with many CMNS graduates. "There are many doctors, dentists and other professionals that still keep in touch." ■