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Desert News and Views:

An EEB Alumni Newsletter

Issue 3, Winter 2005

A newly-discovered mammal from the Santa Rita Mountains has been named *Notiosorex cockrumi* in honor of UA Professor emeritus E. Lendell Cockrum. Story on pg. 5 (Photo: Robert Baker)

Another year of growth (El Niño!) is underway in the Sonoran desert. This fall EEB welcomed 13 new graduate students and Assistant Professor Joanna Monti-Masel (of Oxford University) to the department. Joanna is a theoretical biologist who, among other things, works on the evolution of prions. This month saw the arrival of Assistant Professor Scott Saleska from Harvard University, who works on ecosystem ecology. Two more faculty hired this year will be joining us next fall: community ecologist Peter Chesson and behavioral biologist Anna Dornhaus. Three faculty members are currently on sabbatical: Mike Rosenzweig is publishing and lecturing from the Missouri Botanical Garden, Teri Markow is collecting data in Arizona and Mexico for Drosophila studies, and Department Head Rick Michod is a Fulbright Scholar at the École Normal Superieure in Paris!

The new cohort of graduate students are proving to be talented and passionate young scientists. Outstanding continuing students were celebrated at the annual Welcome Seminar in August: Alice Boyle and Kevin Oh received the Silliman Award and Jessica Cable was honored with the Hoshaw Award.

Staff transitions have been many this year, but EEB has been lucky to find hard working and capable people to fill administrative vacancies. The University of Arizona's new BIO5 Institute recruited Business Manager Kate Riley and Academic Advisor Kathleen Landeen this summer—we greatly miss them. After a few moments of panic we were fortunate to replace Kate as Business Manager with Joanne Cortez who has quickly become a bright spot in the front office. Suzanne LaClair was hired as Receptionist just before the fall semester, and soon moved into a new Administrative Assistant position that was created to aid the EEB advising team! Wendy Isner now aids students and faculty in the Receptionist position. And, before I forget it, I am sitting in Rick Michod's Department Head chair for this academic year.

Other department news: Director of Science Education & Outreach Katrina Mangin has recently secured a CATTS (Collaboration to Advance Teaching Technology & Science) Fellowship to create an Insect Discovery outreach program! EEB graduate student Laura Carsten will take the lead in developing the new program, which will be based on the highly successful Marine Discovery (http://marinediscovery.arizona.edu). The Insect Discovery experience will be offered to local schoolchildren beginning fall 2005.

And, finally, I am happy to announce that undergraduate Kirsten Sellheim, chosen as the department's Outstanding Graduating Senior for the December 2004 Commencement, has also been selected as the overall College of Science Outstanding Senior! We are very proud of Kirsten and the work she has done in Dan Papaj's lab and elsewhere.

So we are having an exciting and good year here in EEB. I hope the same is true for you, wherever life has taken you. I encourage you to contact us with any questions, comments, or suggestions for the content and format of this newsletter. Best wishes to all of you for the new year!

— Larry Venable, Interim Department Head

Desert News and Views
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We welcome your input for future issues.
Please direct inquires to:
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Awards and Achievements

About the Hoshaw Award.....

The Hoshaw Memorial Award was established in memory of Robert W. Hoshaw, a longtime EEB faculty member. The Hoshaw family established this award to recognize EEB graduate students that demonstrate excellence in their field. Students are nominated for this award based on their academic record and their potential contribution to the field of ecology and evolutionary biology. Preference is given to those students who show excellence in a particular undertaking, such as outstanding performance in preliminary exams, publishing a manuscript, or preparing a paper for a national or international conference.

Hoshaw Award 2004: Jessie Cable

By Jessie Cable

I am interested in how ecophysiological processes are influenced by climate variation, specifically how soil respiration responds to precipitation in the desert southwest. Biological processes in arid and semiarid ecosystems are driven by discrete inputs of precipitation or "pulses." It is not well understood how respiration responds to precipitation pulses, and how variables that affect soil moisture availability modify this response. These are important areas of research because some climate change predictions for the southwestern U.S. include shifts in the timing and magnitude of precipitation events. It is unclear how such a shift will affect large CO_2 exchange processes, such as respiration, and potentially feed back to regional climate.

In my dissertation research, I am examining how soil microbial and root respiration responds to precipitation pulses, with the influence of plant community composition, soil type, and season on soil conditions. My research combines gas exchange measurements with stable isotopes to gain a more mechanistic understanding of how pulses drive respiration.

I am addressing the following questions:

1. How is the response of soil respiration to precipitation pulses affected by woody plant encroachment into semi-arid grasslands?
2. How do soil surface, season, and plant species affect the response of soil respiration to precipitation pulses?
3. How does precipitation pulse frequency and magnitude affect microbial crust CO_2 exchange?

Jessie Cable

Silliman Award: Alice Boyle and Kevin Oh

EEB graduate students Alice Boyle and Kevin Oh both received a Silliman Award this year. The awards are given for excellence in research that focuses on birds and is presented annually as a memorial to James Silliman, graduate of the department of Ecology and Evolutionary Biology.

Alice works on an altitudinal migrant avifauna in Costa Rica, focusing on the ecological and evolutionary relationship between these frugivorous birds and their food plants.

Kevin is interested in reproductive behaviors and the evolution of sexually selected traits. Through his work he asks how natural selection acts on mate choice and how this may in turn affect the strength of sexual selection in a wild population of birds.

Brian Enquist named as one of *Popular Science*'s "Brilliant Ten"

The October 2004 issue of *Popular Science* included the 3rd annual selection of the top ten young scientists to watch: the "Brilliant 10." Included in this list is EEB's Brian Enquist, for his work with scaling laws. From the introduction: "We have pounded on the doors of academe, scrutinized professional journals, and scoured the rosters of awards-granting organizations to select 10 scientists to watch—people who are gaining recognition from their peers yet remain virtually unknown to the public. What unites them is passion, intellectual curiosity and—in more cases than you might expect from earnest workaholics in white lab coats—a quirky sensibility." The profile of Enquist can be found at http://www.popsci.com/popsci/science/article/0,20967,703240,00.html

Brian Enquist

Profiles of New Faculty

Joanna Monti-Masel

Joanna Monti-Masel

Joanna joined the EEB faculty as an Assistant Professor in August 2004

By the age of 17, I knew I wanted to be a mathematical biologist. I knew quite a bit of pure math as a result of training for the Australian team competing in the International Mathematical Olympiad. On the other hand, I knew no biology at all. But I'd read in a newspaper that the completion of the human genome project was going to lead to a fundamental revolution in biology as great as the advances in physics in the early twentieth century, and that this revolution would be led by biologists with skills in math. It said so in print, so it had to be true, and I signed up for a biology major at the University of Melbourne with a minor in mathematics.

Fortunately, I loved biology. I didn't love the lab, though: one year's research in molecular and cellular neuroscience was enough to give me a clear understanding of my own clumsiness. I dithered for a while about doing a Ph.D., and went off to travel the world instead. I talked to a few potential supervisors across the globe before going on retreat in Dharamsala to study Tibetan Buddhism instead. A bout of dengue fever brought me back to earth and home in time for interviews for the Rhodes scholarship. These interviews were successful, which settled matters in favor of Oxford. There I was privileged to work with Bob May, Martin Nowak and Vincent Jansen, in what was an incredibly exciting and intellectually stimulating environment that involved no lab work.

My Ph.D. (or rather my D.Phil.: Oxford always likes to be different) was on how prions manage to replicate despite having no DNA or RNA. I went on to analyze and compare different strategies to stop prions replicating. The U.K. was in the grip of fear about mad cow disease and new variant Creutzfeldt-Jakob disease, and so the time and place couldn't have been better. There were very few theoreticians in the field and exceptionally high quality data already available from the literature, so it was a great opportunity.

Prion experiments take years to do, however, so by my postdoc I was ready to try something else, rather than sit around waiting for new data to appear. At a conference in Austria, I had seen Ernst Fehr present data on what humans do when you make them play out dilemmas of game theory for stakes of real money. He showed that when all known explanations for human cooperation are excluded by experimental design, significant levels of cooperation remain and retain many quantitative trends. Here was some fascinating new data in search of an explanation. I joined Marc Feldman's diverse research group at Stanford and set to work on the problem. I came up with a model in which humans are incapable of distinguishing causation from correlation. This leads them to act as though by cooperating, they could cause others to cooperate, even though they know that no causation is possible, only a correlation. I made a mathematical model of this idea, and it explained the data perfectly.

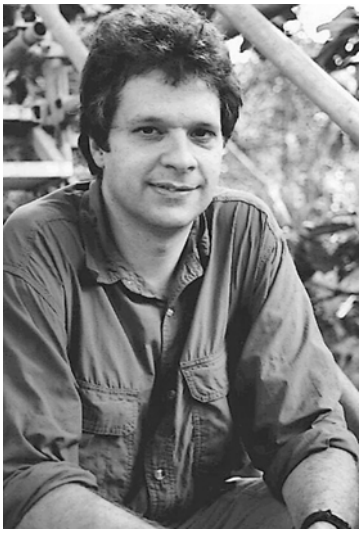
After about a year and my first manuscript on the topic, Marc Feldman gently suggested that if I wanted a job in biology at the end of my postdoc, maybe it would be a good idea to go back to doing some biology, rather than working at the interface of economics, psychology, philosophy and sociology. Human behavior is of course just a model system for animal behavior in general, but this rationalization doesn't always cut ice.

So back to prions. Heather True and Sue Lindquist had published an exciting experimental paper on the evolutionary properties of prions in yeast. Instead of causing disease, this yeast prion seemed to be promoting evolvability, by revealing latent variation beyond stop codons, and thus phenotypically exposing otherwise hidden genetic variation. Here I was in a world-class theoretical population genetics group and here was a problem with the word prion in it begging for a theoretical population genetics approach. And so I sank deep into the intricacies of the evolution of canalization, decanalization, evolutionary capacitance, evolvability, cryptic genetic variation, genetic assimilation and preadaptation. There I remain.

In Memoriam: Don Sayner

It is with sadness that we note the passing of Don Sayner, EEB teacher and photographer. For 35 years he taught a variety of courses in EEB, his favorites being Photography and Scientific Illustration. Don passed away on November 3, 2004. He will be missed.

Profiles of New Faculty



Scott Saleska

Scott Saleska

Scott joined the EEB faculty as an Assistant Professor in January 2005.

My research investigates how ecological mechanisms can be important to global biogeochemistry and climate. For example, if climate change affects the distribution and abundance of biological species (or the demography of populations within an ecosystem), will this alter ecosystem carbon cycling and atmospheric CO_2 composition, hence constituting an important feedback to climate? Such questions in biogeochemical ecology are only beginning to be addressed, yet answers are needed to advance both ecology and our understanding of climate and of earth system processes. I use multidisciplinary approaches that combine classical techniques of field ecology with advanced technology (e.g., the micrometeorological eddy covariance method, isotopic techniques) and modeling to integrate biogeochemical processes to ecosystem scales.

I am also, not incidentally, concerned about the fate of the planet. If it weren't for so many pressing practical problems in the world, I might now be doing the astrophysics I thought I wanted to do when I first went to MIT. Back then I was exhilarated by my scientific education in physics, but frustrated by its apparent lack of relevance to pressing social problems (or worse, what I saw as its socially destructive misapplication to furthering a dangerous nuclear arms race).

My first post-college job at a consulting firm for the U.S. EPA involved the problem of stratospheric ozone depletion, and I then realized that solving the environmental problems facing human society requires good science as well as good policy. And I was inspired by the encouraging response to Rowland and Molina's 1974 discovery that CFCs could deplete stratospheric ozone. Within 20 years, their Nobel-prize winning theory was universally accepted science and CFC production was banned in most of the world, illustrating how cutting-edge science can powerfully motivate environmental politics and international diplomacy and quite literally "save the world."

Since then my professional trajectory has focused on environmental science, policy, and politics. I became involved in the environmental consequences of nuclear weapons production in the U.S. and the former Soviet Union. The impact on the human dimension was again brought home to me when I measured high levels of radioactive contamination along the Techa River in Chelyabinsk, Russia (near the main production site for the plutonium that made the Soviet nuclear arsenal), a place where children still play.

I loved the work, but I went back to graduate school because I wanted to learn about how living systems actually worked, not just how they were contaminated by waste products of human industry. I discovered and fell in love with ecology, in particular the interdisciplinary question of how ecological interactions can structure ecosystem biogeochemistry. My dissertation work with John Harte at U.C. Berkeley, on an ecosystem warming experiment in the Rocky Mountains of Colorado, showed that warming-induced shifts in plant community composition can be a more important carbon-cycle feedback to global climate change than the warming effects on soil respiration (previously assumed to be the key mechanism in most global models).

My work continues to focus on ecology, with a sufficiently large interdisciplinary twist that my four invitations to interview for faculty positions came from four different disciplinary departments: ecology, biology, an interdisciplinary environmental science and policy program, and civil & environmental engineering (ironically enough, back at my alma matter, MIT).

I am excited to have landed at UA's EEB, where I hope to build a research group to focus, initially, on four areas: (1) how forest ecology and demography combine with natural disturbance dynamics to control carbon cycling and trace gas fluxes in old-growth Amazon forest (continuing work from my post-doc with Steve Wofsy at Harvard); (2) using new measurement technologies (i.e., tunable laser absorption spectroscopy) to measure the isotopic composition of fluxes of CO_2, with the hope that this will widen our window onto the physiological and ecological mechanisms controlling whole-ecosystem carbon exchange; (3) how science and economics can together better inform solutions to global warming (some of this in collaboration with my wife, Kirsten Engel, who teaches here at the law school); and finally: (4) the biogeochemical ecology of my new home, the arid and semi-arid ecosystems of the desert southwest, which is a new ecosystem for me.

Multiple Loci

Many of us have interests and talents completely outside of the lab and the field. This new column will allow a glimpse at other facets of our faculty and students. This third contribution was written by David Hearn, who received his Ph.D. from EEB in the fall of 2004.

I love to get dirty. Something about mud has attracted me since a very young age. When I was a young tot, I used to dig giant holes in the backyard, fill them with water, and stir until a marvelous mud bath awaited. My attraction to mud has not diminished with age, but it is fair to say I have a slightly more refined taste. Instead of an amorphous well of muck, I've attempted to hone my skills over the past 15 years to mold that muck (clay actually) into something aesthetically pleasing and useful in the kitchen.

I suppose the muck education all started when I was around 5 years old. I threw a tantrum in a pottery studio to get my mom to buy some clay. She didn't buy the clay, but she did do something much better—she signed me up for a one-on-one pottery class. I came to the class with mental images: large pots with curly lips. Somehow, what was in my head didn't work out on the wheel. The lip didn't quite match the intricate image in my mind. It would never have worked; not enough spatial dimensions in the real world. Instead, I made what functioned best as a paper weight.

Several years passed, and I picked up clay again in high school. The teacher was kind enough to let me come in before school started to work on the potter's wheel. "Thin, even walls, thin, even walls" was my mantra for the next few years. Slowly, but surely, pots began to take form. College came, and I used the time I didn't have to take independent study credits to make pots. Something of an obsession, I used to sneak in late at night through the window that never quite shut. I'm not sure whether it was the place or the pottery, but it felt quiet, calm late at night.

My forays into the library began, targeting books about Japanese pottery in particular. Amazing potters from Japan constructed huge vessels that seemed as if dug from earth. Their glaze was nothing but ash that landed on them during firing, melting, and creating splendid designs out of randomness. Hidden behind rough, warped exteriors, their forms concealed the mastery required for construction. Here were the pots I wanted to make—natural, random, functional, humble, their histories coded in their lines, their shapes, their glazing.

Sitting on the wheel, the world diminishes to you and the clay. The clay will never quite accept the images in your mind—the delight is in coming to know the clay, allowing its earthly origins to shine as it reveals itself in your hands—a mug whose lip feels just right on your lips, a mug that balances in the hand, a mug that looks small, but fills with more than promised. Dress it with just the right glazes to unify foot, body, and lip. Pottery is surprise, exploration, beauty in randomness. It is accepting clay's stubbornness, and encouraging clay's full potential. Like science, as exploration continues, subtleties emerge, challenges appear, and perception of the craft develops in tandem with technique.

The early days of the mud pools culminated in refined muck in auctions for fund raising, commissions for artwork, and the great satisfaction of seeing a familiar pot being used to make bread. Most importantly, the pottery-making process promotes focus, relaxation, and the satisfaction of watching a complete product emerge in one sitting—all important perks for the frazzled graduate student!

— David Hearn

David Hearn

Newly-discovered shrew named for Cockrum

By Kara Rogers of UANews.org

Not since 1977 has a new mammal species been discovered in Arizona. But a Texas Tech University professor recently identified a new species of desert shrew that he first caught in the Santa Rita Mountains nearly 40 years ago, when he was a University of Arizona graduate student.

TTU Professor Robert Baker has named the newly identified mammal species *Notiosorex cockrumi* in honor of UA Professor emeritus E. Lendell Cockrum.

"I can't help but have a bit of an ego trip about it," Cockrum said. "Thank goodness no one has named a skunk after me." A subspecies of mouse found in Kansas has also been named for Cockrum.

The *N. cockrumi* shrew is among the smallest mammals in Arizona. It weighs only as much as a penny and is about the length of two AAA batteries. The only Arizona mammals that are smaller are the dwarf shrew, found at high elevations in central and northern parts of the state, and the Western Pipistrelle bat.

Moran Elected to NAS

Nancy Moran

Story by Mari N. Jensen, UANews.org

Nancy A. Moran, The University of Arizona evolutionary biologist known for her pioneering work on the coevolution of insects and the bacteria that live within insects' cells, was elected to the National Academy of Sciences on April 20, 2004.

Her work integrates several fields of biology, including microbiology, entomology, ecology, genetics and evolutionary biology.

"Clearly she has been recognized by the National Academy as being one of the brightest scientists this country has," said Joaquin Ruiz, dean of UA's College of Science. "I'm very pleased about her being elected."

Election to membership in the Academy is considered one of the highest honors a U.S. scientist or engineer can achieve. Moran is among 72 new members and 18 foreign associates from 13 countries recognized for distinguished and continuing achievements in original research. Those elected this year bring the total number of active members to 1,949. Moran is the 27th member of the NAS in Arizona and the 20th at the UA.

"She embodies all the best of what it means to be a scholar and a professor," said Richard Michod, head of UA's department of ecology and evolutionary biology. "She has a great curiosity about the living world and about organisms, and this drives her discoveries."

Since 1990, Moran has studied the bacteria that live inside the cells of insects. Her work shows that the association is an ancient one, going back at least 200 million years. The relationship between the insects and their intracellular bacteria, or endosymbionts, is crucial for the insects.

"These fairly intimate and complex relationships between the bacteria and the host affect what the host does, what it eats and where it lives," she said. "The whole evolution of insects and other invertebrates has been in tandem with these bacteria," adding, "The insects are absolutely dependent on their endosymbionts."

Although people had known that such associations existed, little was known about them. Her trailblazing research began by chance, she says, when Paul Baumann, a microbiologist at the University of California, Davis, contacted her about a paper on aphids she'd published in the journal Science. He introduced her to the DNA techniques that could be used to investigate the genetics of the bacteria within the aphids.

"He was ahead of most evolutionary biologists in terms of knowing molecular techniques," she said. Incorporating tools from other biological disciplines was key to figuring out how insects and their endosymbionts coevolved. She said, "Part of it is a willingness to talk to someone outside your field and to learn a technique that originates outside your field."

Moran wants to understand more, on a molecular and genetic level, about what mechanisms the endosymbionts use to enter and influence their hosts. She's now collaborating with UA drosophila geneticist Therese Markow to figure out how such endosymbionts persist in the face of the insects' immune defenses.

Of her election to the academy, Moran said, "It's a really great honor," adding, "It's nice that other distinguished scientists thought so highly of me."

Margaret Kidwell, Regents' Professor emerita of ecology and evolutionary biology and the first woman National Academy member in Arizona, said of Moran, "She epitomizes what Academy membership is all about—people who have done really original and pioneering research."

Moran's other honors and awards include a John D. and Catherine T. MacArthur Fellowship in 1997 and a 1992-1993 National Science Foundation Career Advancement award.

She joined the faculty of The University of Arizona in 1986 and rose through the ranks, becoming a professor of ecology and evolutionary biology in 1996. She was promoted to Regents' Professor in 2001.

In addition to her research, she teaches undergraduate and graduate classes in evolution, symbiosis and evolutionary genomics.

She is also on the editorial board of the Public Library of Science and on the steering committee for the Section of Biological Sciences for the American Association for the Advancement of Sciences.

The National Academy of Sciences is a private organization of scientists and engineers dedicated to the furtherance of science and its use for science and the general welfare. Established by a congressional Act of Incorporation signed by Abraham Lincoln in 1863, the Academy acts as an official adviser to the federal government, upon request, in any matter of science or technology.

Outreach News

New summer programs for teachers

By Katrina Mangin

EEB has two new summer programs for teachers. In Genes, Biotechnology and the Environment (ECOL 408L/508L), students explore the heat stress genes of insects. In the process, they engage in a genuine research experience and explore ways to teach evolution in their classrooms. Day one of the class found students collecting insects around campus on a record-breaking hot day in June. A surprising diversity of insects were found from butterfly gardens and unusual plants around campus. Each student then extracted DNA from their insect, amplified one of its "heat shock" genes, and prepared the DNA for an automated sequencer. The goal was to compare the gene sequences of their insects to those available online for other insects. They could then construct a tree to determine evolutionary relationships. Since the genes for heat shock are highly conserved, they were able to compare the same gene from bacteria to plants to insects. There is no clearer evidence for evolution than the similarity in the DNA sequences of distantly related organisms, with similarity increasing with relatedness. In summer 2004, the course housed twelve high school teachers, four undergraduates and a graduate student. The course and a follow up program in schools during the year are funded by a grant from the National Science Foundation to Nancy Moran and Katrina Mangin in EEB. Teachers in the course are offered $600 scholarships. In summer 2005, students will explore the diversity of bacteria in desert soils. For more information, see http://eebweb.arizona.edu/courses/biotech/

The second summer program is a course held in the Galapagos, Ecuador (ECOL 496O/596O). Teachers from the USA spend three weeks on the Galapagos islands, learning biology and teaching in a school on the island of San Cristobal as a community service project. The U.S. teachers and the Galapagos children explore the local environments together, visiting tide pools and traveling to the highlands to revegetate forests with native trees unique to the Galapagos. It is a win-win situation: the children get a chance to practice their conversational English, while our teachers learn the fascinating plants and animals that occur only on the Galapagos Islands. This course

Galapagos iguanas

also has a focus on evolutionary biology. Many U.S. teachers use the Galapagos Islands to teach evolution in their classrooms. They return home with first-hand experience of the unique flora and fauna of this laboratory of evolution, and many stories to tell their students. We are establishing a joint program between the children of both countries, where the children share studies of the unique animals and plants found in their local environments. This course is funded by the tuition of students and donations from Basha's Supermarkets and private individuals. For more information, see http://eebweb.arizona.edu/courses/galapagos/

Contact Katrina Mangin, instructor for both of these programs, for more information (626-5076, mangin@u.Arizona.edu).

Ph.D. degrees awarded in calendar year 2004

Asher Cutter (advisors: Leticia Aviles & Sam Ward): "Breeding system evolution and sex ratio in *Caenorhabditis*"

Kim Powers (advisor: Leticia Aviles): "Prey abundance and the evolution of sociality in the spider genus *Anelosimus* (Theridiidae)"

Arturo Acero (advisor: Don Thompson): "Systematics and biogeography of the tropical sea catfishes of the New World (Siluriformes: Ariidae)"

Don Falk (advisors: Tom Swetnam & Rob Robichaux): "Scaling rules for fire regimes"

David Hearn (advisor: Lucinda McDade): "Growth form evolution in *Adenia* (Passifloraceae) and a model of the evolution of succulence"

Jacob Russell (advisor: Nancy Moran): "Coevolution and consequences of symbioses between aphids and maternally transmitted bacteria"

Matt Saunders (advisor: Michael Nachman): "Nucleotide variability within and around G6PD, a locus under positive natural selection in humans"

Keep us posted:

Name _____ Other degrees _____

Change of address? (Circle which you prefer as a mailing address)

Home address	Business Address
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_____	_____
Phone _____	Phone _____
e-mail _____	

Employer and job Title _____

New job? Married? Kids? Take a trip? Retired? See a classmate? Send us your news for future newsletters:

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In future issues, we will use this space to report on additional alumni, faculty, and graduate student news.

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