

From the Department Chair...

I am delighted to have this opportunity to tell you about some of the exciting activities and accomplishments of faculty and students in the Department of Zoology.



Fred Dyer

It has been several years since we communicated broadly with alumni and friends, and this newsletter can give only a glimpse of the many stories we have to tell. I hope that it will whet your appetite and lead you to look for more information in our web site or, better yet, to get in touch with us to share your stories.

When I began as chairperson in 2003, the department was entering a period of transition owing to the retirement of several faculty members. This challenged us to rebuild the faculty so as to maintain the strength of our research and educational programs while providing an opportunity to rebuild in the context of a renewed vision of the department's mission.

The pace of change in biological sciences demands that academic departments continually redefine themselves

to keep research and educational programs at the cutting edge. We have sharpened our strategic focus to emphasize integrative animal biology. Specifically, the department's programs integrate across levels of organization (from gene to ecosystem), they integrate studies of biological processes with studies of the evolutionary function of these processes, and they integrate laboratory and field approaches to biology.

This integrative emphasis positions us to play a central role in the biological sciences. Our faculty are pursuing exciting questions at the forefront of cell biology, development, ecology, and evolution. Their research programs employ advanced methods in microscopy, molecular biology, genomics and ecological modeling, and are helping to transform our understanding of complex biological systems.

While building research programs, we have remained committed to providing the highest quality educational experience for students. For our 650 undergraduate majors, we offer a diversity of concentration areas and a broad array of exciting upper-level courses. We have preserved a prominent role for laboratory courses which we

believe are indispensable for a solid education in biology. In addition to traditional courses, we are using new technologies to teach biology, both in online courses and in hybrids of online and classroom courses. Outside the classroom, we are promoting research experiences through the Program for Undergraduate Research in Life Sciences. In addition, we are expanding our off-campus internship programs and currently have superb Study Abroad courses in Kenya, Rwanda, and the Galápagos.

At the graduate level, we are proud to have one of the strongest doctoral programs in the College of Natural Science. Over the past ten years our students have received the largest share of recruiting fellowships offered by MSU and have received more NSF graduate fellowships than all other MSU science departments combined.

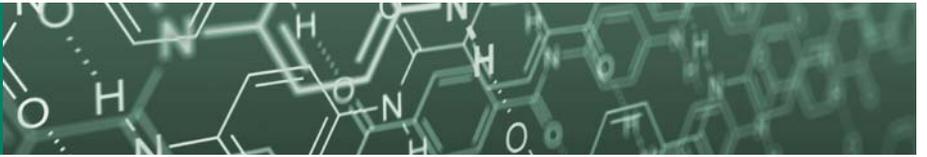
This newsletter describes our initiatives and accomplishments in more detail. I hope you will agree that there is a lot to be proud of within the department. A more complete picture can be found at our web site. We also invite you to connect with the MSU Zoology group on Facebook or the college group on LinkedIn.

We look forward to hearing from you and encourage you to keep in touch and share with us your career accomplishments.

Sincerely,
Fred C. Dyer
Chairperson, Department of Zoology

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Faculty High-5's and Transitions

David Foran and the MSU Forensic Science Program were featured in September as the top video story on the Discovery Channel. The “DNA Survives Bomb Blast” video showed how students of the program learned to identify the manufacturers of improvised explosive devices. Also, Foran’s work on London’s 1910 Crippen murder case was featured on PBS’s first episode of *Secrets of the Dead* in October.

Kay Holekamp’s research with spotted hyenas has been the focus of many news stories over the last year, including stories in the *New York Times*, *Smithsonian* magazine, BBC, NPR and other media. This past summer, students in her lab started the *Notes from Kenya* blog where they share stories and photos from the ongoing research in Kenya. Holekamp has also recently been named the director of the Ecology, Evolutionary Biology and Behavior Program at MSU.

Richard Lenski has launched a course titled “Experimental Evolution.” Microbes are the main organismal focus of the course, which has attracted graduate students with a broad range of interests and backgrounds, including ecology, genetics, and evolutionary interests in animals and plants. Lenski received widespread attention last summer after an article he co-authored, “Historical contingency and the evolution of a key innovation in an experimental population of *Escherichia coli*,” was published in the *Proceedings of the National Academy of Sciences*. Lenski was elected to the academy in 2006.

Catherine Lindell’s article “The value of animal behavior in evaluations of restoration success” was the top-accessed article in the journal *Restoration Ecology* in 2008. Lindell described the ways animal behavior studies can be used to evaluate the success of restoration efforts.

Elena Litchman and **Alex Shingleton** each recently received NSF CAREER awards. Litchman studies freshwater and marine phytoplankton ecology. Shingleton studies the relationship between the size of organisms and the size of their organs. NSF CAREER awards are given to junior faculty who are undertaking outstanding research in their field, and coupling it with professional development related to education.

Pam Rasmussen was among the team of ornithologists who identified a new species of bird from the Togian Islands of Indonesia – *Zosterops somadikartai*, or Togian white-eye. The description of the bird appeared in the March 2008 edition of *The Wilson Journal of Ornithology*. Rasmussen is assistant curator of mammalogy and ornithology at the MSU Museum and recently authored a field guide *Birds of South Asia: The Ripley Guide*.

RETIREMENTS

- Surinder Aggarwal - cell biology
- Steve Bromley - developmental biology
- Thomas Burton - community ecology
- Neal Band - developmental biology
- John Giesy - environmental toxicology
- Donald Hall - community ecology
- Mukta Webber - cell biology; cancer

NEW DEPARTMENT FACULTY

- Jenny Boughman - Evolutionary ecology; mechanisms of speciation in three-spined sticklebacks
- Ian Dworkin - Evolutionary genetics of development in *Drosophila*
- Elena Litchman - Community ecology in aquatic ecosystems
- Kyle Miller - Cellular neuroscience; transport in axons
- Nathaniel Ostrom* - Biogeochemical cycling in oceanic and lake ecosystems
- Peggy Ostrom* - Biogeochemical studies of contemporary and extinct ecosystems
- Alex Shingleton - Evolution and development of size and shape in insects
- Barry Williams - Evolutionary and population genetics; genetics of adaptation in yeast

* The Ostrom’s transferred to the department from the MSU Department of Geological Sciences.

THOMAS WHITTAM

We are sad to report the passing of Thomas Whittam, Hannah Professor of Bacterial Evolution. He was a renowned expert on bacterial evolution with a focus on pathogens that cause food-borne diseases. He was a faculty member in Zoology, Microbiology and Molecular Genetics, and the National Food Safety and Toxicology Center. Tom passed away in December 2008 after his struggle against a brain tumor.

Hill Marks 37 Years of Teaching and Research at MSU

Professor Richard Hill has been working with students and conducting research in the zoology department for 37 years. In his role as associate chairperson, Hill has integrated teaching and research in a manner which has helped define the culture of the department while making strong connections with generations of students.

“From the day I started my Ph.D. work, I saw myself wanting to do both teaching and research,” Hill said. Hill teaches ZOL 483: Environmental Physiology. The class explores how physiology and function relate to ecology.

Hill recently finished editing the second edition of his popular textbook, *Animal Physiology*. The new edition will be printed in four languages and is used by educators around the world.

“I have invested a lot of time teaching and the book is a manifestation of that endeavor. All the while, I’ve always tried to be involved in something creative in the research field,” Hill explained.

Hill’s research focuses on the metabolites of organisms that represent symbioses between animals and algae, notably reef-building corals and giant clams. Working with Dan Jones at the MSU Mass Spectrometry Facility, Hill discovered a set of compounds in coral organisms that may act as protective agents against light stress.

“The biggest single threat to corals is a problem called bleaching, and it is on the rise worldwide,” Hill explained. Bleaching is caused by a disruption in the relationship between a coral animal and its symbiotic algae. The loss

of algae associated with bleaching can be fatal for coral because algae produce food they share with the animal.

Corals in relatively shallow water receive intense sunlight, which tends to cause photosynthesis to shut down during the day. Hill hypothesized that corals are protected from this photo-inhibition by accumulating high levels of betaines - compounds that have been found to protect crop plants from photo-inhibition.

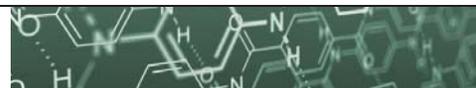
Hill tested his hypothesis by collecting ten species of coral and measuring the samples for betaines. He found that all ten had betaines, and that coral colonies in shallow waters had betaine levels almost 40 percent higher than deep-water species. These findings may help explain why some corals are susceptible to bleaching. Hill is continuing his coral research, with recent collecting trips to Curaçao and Micronesia.

This summer, Hill is leading a Study Abroad course in the Galápagos Islands. Thirteen students will accompany him as they learn about organismal biology, evolution and island ecosystems. This marks his 25th year taking students into natural environments - combining his love of teaching and research while impacting another generation of students.



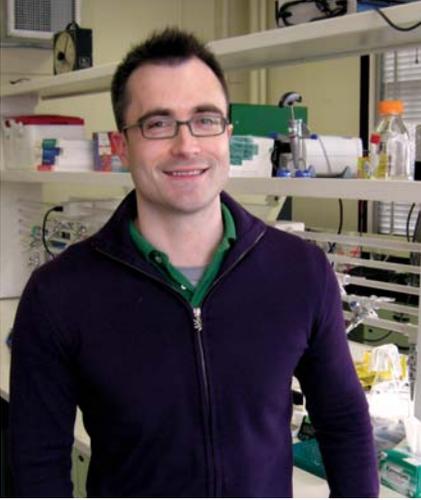
Richard Hill

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 Photography: Katy Califf, Richard Hill, Catherine Lindell, Peggy Ostrom, Gordon Shetler, Mike Steger.



Evolution Lab Engages Students

Evolution has traditionally been taught in classroom lectures, but Professor Alex Shingleton has created a new lab to make studying evolution a truly hands-on experience for students in ZOL 445L.



Alex Shingleton

“The goal of the lab is to take evolution out of the lecture hall and bring it into the real world,” Shingleton said. “In the lab, students do practical evolutionary research, much like the evolutionary research I did as a Ph.D. student and the kind of experimental evolutionary research Rich Lenski does in his lab.”

One of the experiments the class conducts is to replicate one of Lenski’s early evolution experiments with bacteria. The students grow two strains of *E. coli* in equal sized populations in a shared low glucose environment. Over ten weeks, the bacteria go through 460 generations and one of the strains mutates to better survive in the environment. The strain then begins to out-compete the other strain of bacteria, and the initial 50:50 ratio changes.

“Students can track evolution as it happens in the lab because they can see these ratios change from week to week to week,” Shingleton said. “It is

one of the few experiments where you can see evolution as it happens.

Teaching evolution in a laboratory also educates students about many basic biological laboratory techniques used by evolutionary biologists, including bacteriology, PCR, sequence analysis, sequencing, phylogenetic analysis, primer design and database searching.

“The emphasis is really on the students developing hypotheses and experiments to test those hypotheses,” Shingleton said. “They design the experiments, collect the data and analyze the data.”

Shingleton feels that embedding evolutionary biology in the scientific method provides the students with a solid education. One student stated in his course evaluation that the class “was intellectually stimulating, challenging and entertaining.” The new evolutionary lab will be offered again in fall 2009.

Providing Undergrads Primary Research Experience

Professor Alex Shingleton has developed the Program for Undergraduate Research in Life-Sciences, or PURL, which gives students mentored experience in life-science research. The program begins with a seminar for first-year students and provides opportunities to visit working labs and research institutions. The next year, students begin half-semester rotations working in different participating labs. For the final two years, students are hired as research interns in laboratories.

“These experiences prepare students for entry into graduate school and makes them very competitive,” Shingleton said. “It is like the beginning of many graduate programs, yet for undergraduates it allows them to explore different options while working on a bachelors degree.”

Undergraduate Research

When Sam Rossman graduates in May, he will have a B.S. in zoology as well as the experience of conducting two research projects and a presentation at a national science conference under his belt. As part of an undergraduate research project, Rossman has been studying ecological changes in the dolphins of Sarasota Bay, Florida, in conjunction with the team of scientists in Peggy Ostrom's lab.

Rossman examined the stable isotope concentrations in dolphin tissue and teeth to determine the kind of food dolphins were eating and where they were finding the food.

Instead of swimming with dolphins in the Gulf, Rossman spent last summer in the lab analyzing the stable isotopes in dolphin muscle tissue. His work was an undergraduate research project funded from the Marvin D. Hensley Endowed Scholarship.

"I feel it was a huge advantage for me to have the research experience funded," Rossman said. "I have gained tons of hands-on experience in the lab and didn't have to worry about getting a second job during the summer."

With the muscle tissue analysis behind him, Rossman began studying isotopes in dolphin teeth this fall.

"With most marine systems, you see a very strong anthropogenic impact in the last hundred years," Rossman said. "It is something that is hard to probe because there isn't a lot of data out there beyond the last 30 years. These dolphins live long lives and by looking at their teeth we are able to derive environmental data going back 50 or 60 years."

Rossman's research showed a strong trend correlating nitrogen isotope values with age. "This is either a result of dolphins of different ages using different food resources or different habitats," Rossman said. "Based on

carbon isotope values, it appears that dolphins depend less on seagrass now than the population did fifty years ago. This points to a seagrass die off, seagrass becoming increasingly covered with algae, or a decreased utilization for a reason I could only speculate."

His passion and eagerness to learn have allowed Rossman to build a strong foundation for his career. Working alongside faculty has benefited both Rossman and his mentors.

"Sam is very passionate about the project and his work has been very inspiring to everyone in the lab," Peggy Ostrom said. "He has done solid work and I look forward to getting him out into the field."

Rossman began his research experience several years ago on a different project investigating secondary education. That first experience in Julie Libarkin's geocognition lab studied how students conceive the way the globe changes. He presented his findings on "Missing connections in student conceptions of global change" at the annual meeting of the Geological Society of America in Houston. After that experience, he connected with Ostrom and started on the dolphin project.

Rossman plans to attend an upcoming biogeochemical conference this spring. Following graduation, he is getting married and hopes to travel to Sarasota Bay before starting graduate studies at MSU in the fall.



Sam Rossman

Using Stable Isotopes to Understand Hawaiian Petrels



Peggy Ostrom and Anne Wiley in the lab examining petrel feathers.

Thousands of years ago, Hawaiian Petrels were so numerous they darkened the skies of the Hawaiian Islands. Today, they are endangered and nearly extinct. The story of their ecological history is being told by researchers who have learned to read their bones to better understand the history of the bird and protect the remaining population. Professor Peggy Ostrom and doctoral student Anne Wiley are reconstructing the ecological history of the seabird.

Ostrom and Wiley are studying stable isotopes that exist within the bone tissue of the ancient birds as well as samples from live birds.

“By looking at stable isotope signatures in the collagen inside the bones, we can learn where these birds went over the open ocean, where they were foraging and what they were eating,” Wiley said. “We can also look at the isotope signatures from modern birds to learn in a little bit more detail about what they are doing, what different populations and age groups are doing.”

Researchers look at stable isotope ratios from the tissues. The elements carbon and nitrogen have two stable forms or isotopes. For example, only 1 percent of carbon is C-13 which does not decay over time. The ratio of C-13 to C-12, or nitrogen-15 to nitrogen-14, changes depending on the kind of food birds eat or where birds forage. Ostrom and Wiley can determine the kind of diet the ancient petrels had and compare it to the petrels still alive today.

The work that Ostrom and Wiley are doing is a part of a project to better understand the ecology of the petrel. The project includes paleontology, DNA analysis and radiocarbon dating.

“It is very rewarding to work so intimately with the people who are working to conserve these birds,” Ostrom said. “They are able to use the information that we give them for conservation and helping this species survive.”

In the field, Ostrom and Wiley, along with Helen James from the Smithsonian, found bones on the islands. Since the birds nest on the ground in burrows, lava tubes or caves, the bones are often found in sediment deep inside the volcanic caves on the island.

“The Hawaiian Islands have changed so much that in order to get a good perspective we cannot simply look back five or ten years,” Wiley said. “On Oahu, there used to be a huge colony of petrels. Without these bones, we would have never known they existed there.”



Anne Wiley in a lava tube searching for Hawaiian Petrel bones. Ostrom and Wiley's research was featured in the Discoveries section of the NSF web site on August 22, 2008.

Staying Connected

Send us information on your accomplishments! Visit the Connections section of zoology.msu.edu or use the enclosed envelope to send us news on your career accomplishments. You can also connect with us on the MSU Zoology Facebook group or the College of Natural Science LinkedIn group. For a glimpse into the department, visit the blogs by students and faculty at msuhyenas.blogspot.com or genesonewild.blogspot.com.

ALUMNI CLASS NOTES



Mary Dawson, BS '52, is emeritus curator of the Carnegie Museum in Pittsburgh. Her recent research project involves a rodent in Laos named *Laonastes* which belongs to a family thought to have become extinct 11 million years ago. Dawson is currently working with Richard Snider to establish a colony of these rodents at the Binder Park Zoo in Battle Creek.

Kenneth J. Boss, MS '59, is a malacologist, emeritus professor of biology and curator of the molluscan collection at Harvard University, Museum of Comparative Zoology. Boss has written articles on the careers of distinguished malacologists Dall, Thiele and Von Martens.

Wendel Johnson, BS '63, MS '65, is a professor and lead biologist at the University of Wisconsin - Marinette. He was honored last summer in the 50th Anniversary Celebration of the Moose/Wolf Studies on Isle Royale sponsored by the National Park Service and Michigan Technological University.

Ajovi Scott-Emuakpor, MAT '68, PhD '70 & '77, is a professor of pediatrics and human development and faculty member in the African Studies Center at MSU. He also serves as division chief of Pediatric and Adolescent Hematology/Oncology at the Center for Bleeding and Clotting Disorders.

Hal Caswell, BS '71, PhD '74, is a senior scientist in the Biology Department at the Woods Hole Oceanographic Institution and is involved in research on population viability

of polar bears, emperor penguins, right whales, lemurs, and endangered plants. He received the 2008 Per Brinck Oikos Award from the Swedish Oikos Society, the 2007 Ecological Research Award from the Ecological Society of Japan, and a 2007 Unit Citation Award from the U.S. Department of the Interior.

Donald Straney, BS '73, MAT '73, is in his seventh year as dean of the California State Polytechnic University, Pomona. He spent 23 years as a faculty member at MSU, including serving as department chair from 1987-95.

Mark A. Batzer, BS '83, MS '85, is the Dr. Mary Lou Applewhite Distinguished Professor in the Department of Biological Sciences at Louisiana State University. His research on *Platyopus* Genome Sequence and Analysis was one of the top 100 stories in science for 2008 by *Discover* magazine. He recently was selected as an LSU System Boyd Professor (the highest academic rank in the LSU System) and was elected a fellow of AAAS in 2007.

Mark McPeck, PhD '89, is a biological sciences professor at Dartmouth College and was elected a Fellow of the American Association for the Advancement of Science in 2008. He recently became Editor-In-Chief of the *American Naturalist*.

Sunshine Menezes, BS '95, is Executive Director of the Metcalf Institute for Marine & Environmental Reporting at the University of Rhode Island.

Jennifer Neuwald, BS '95, earned her PhD in Biology from Washington University in 2008 and is a postdoctoral research associate in the Department of Ecology, Evolution and Organismal Biology at Iowa State University.

Siblings **Laura Sams**, BS '00, MS '03, and **Robert Sams**, BS '03, recently released the wildlife film *The Riddle in a Bottle* and children's book *A Pirate's Quest*. They have been traveling the country performing educational assemblies using the book and movie to inspire children to create their own stories about the natural world. They are currently developing films on sharks and woodland animals - based on the children's book *First Snow in the Woods*.

Craig Stricker, PhD '03, is a research ecologist with the USGS Fort Collins Science Center and one of the principal investigators at the Stable Isotope Laboratory in Lakewood, Colorado. His recent studies include the nutritional ecology of salmonids and mammals (brown bears, wolves, sea lions), global change biology, and the biogeochemistry of sulfur as it pertains to mercury methylation.

Katherine Leitch, BS '08, received a Churchill Scholarship and is enjoying life in England. She is in a research-based MPhil program studying human reproductive biology at the University of Cambridge's Department of Physiology, Development, and Neuroscience.

We want to hear from you! Send us your news at zoology.msu.edu.

Building a Virtual Classroom

Stephen Thomas has an alter ego on the internet and it has helped non-science majors better understand environmental issues. The online imposter may look similar to the real professor, yet he has a globe for a sidekick and spends his time inhabiting comic strips about environmental issues.

Last summer, the two of them taught an online version of ISB 202: Applications of Organismal and Environmental Biology - a science class for non-science majors. Thomas, who is also an artist and illustrator, created the comic version of himself so students would be able to get to know him while taking the class.

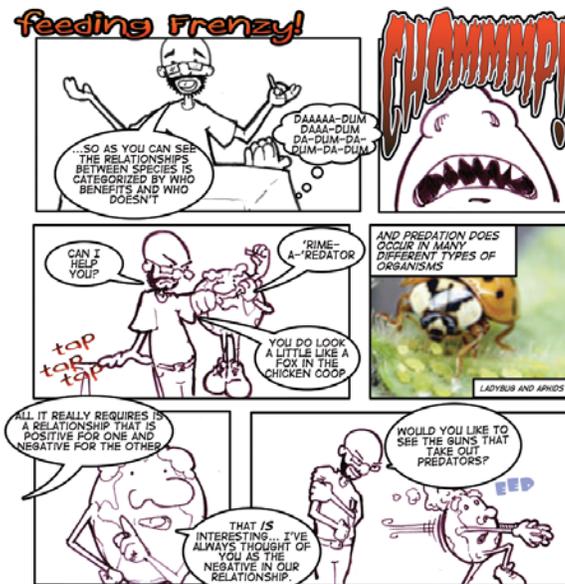
“With an online class I feel you must use the strengths of the technology to make it a better experience for students,” Thomas said. “If the fear of science is something that is difficult to overcome face-to-face, then here I can craft the way students interact with the material to overcome the fear.”

Thomas created and narrated online presentations filled with interactive graphics and movies for students to explore. Unlike a traditional classroom or lecture, students were able to watch the lectures at their own pace, replay them and read the transcript to better understand the issues.

Thomas split his class of 60 into smaller groups so they could work together. The students connected through message boards to help each other learn the material. They also completed experiments using simulation programs. Thomas says the students responded well to the new class because of the use of technology. He is now designing an online version of ZOL 355: Ecology.

Thomas is creating movies to illustrate the concepts in the lessons with stop-motion animation on a white board. The videos, which can be viewed on the *Evolartist* YouTube channel, introduce topics and conclusions from the class readings and recently published journal articles.

“A lot of students work or they have a family or other draws on their time, and having a portion of the curriculum available online allows them flexibility with their schedule,” Thomas said.



Stephen Thomas engages non-sciences majors in the virtual classroom with the use of tools like Feeding Frenzy.

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