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Needed**

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**Welcome from the Chair:**



Dr. Michael F. Antolin

Dear Friends,

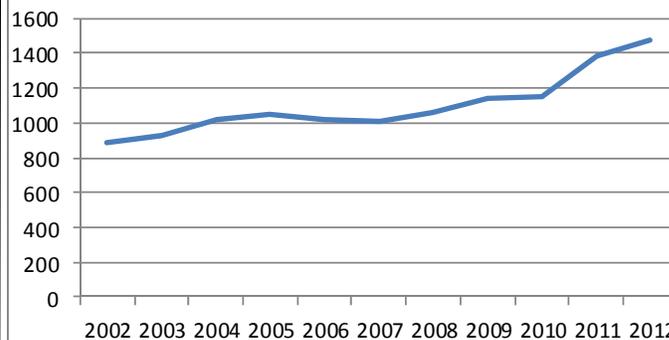
I'm happy to say that after a year-long national search, and after a year as Interim Chair, I am honored to serve as Chair of the Biology Department for the next five years.

Of course, I have big shoes to fill, as previous Chair Dan Bush moved on to become Vice Provost for Faculty Affairs. Since 2003, the Biology Department has enjoyed unprecedented success under his leadership, and we wish him all the best in his new role.

*(continued next page)*

**MY, HOW WE'VE GROWN**

**Undergraduate Enrollment - Fall Semesters**



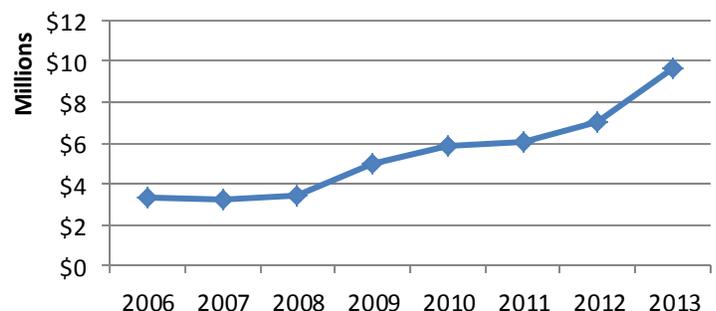
As we look forward to a new academic year, we are again thrilled and amazed at the number of undergraduate students who have chosen Biology as their primary major, second major or minor.

**In the past 10 years our enrollment grew by 66%**

In addition to the increased enrollment in our student majors, our increased research efforts are reflected in spending patterns.

**Over the last 7 years our research efforts increased 193%!**

**Biology Research Expenditures**



## WELCOME FROM THE CHAIR CONTINUED

I cannot be more thrilled to have been selected to lead the Biology program forward. We have great opportunities, but also significant challenges in an increasingly technological world. We serve the people of Colorado and have large numbers of students who are first in their families to gain a college degree. Our mission is to provide the very best science training to give all of our graduates avenues for self-awareness and advancement. We work hard to ensure the intellectual and economic well-being of Colorado now and in the future.



We have experienced strong upward growth in recent years, both in the numbers of students (now more than 1,400 Biology and Zoology majors) and in the success of our faculty in securing grants to support our research. (see charts page 1) In the last year we had close to \$10 million in research expenditures, highest in the College of Natural Sciences. In addition to our 29 faculty, we now support another 170 post-doctoral researchers, graduate students, research technicians and staff. Each year about 100 students are on the payroll working in labs or on field projects, and another 200 or so get involved in research projects through internships, independent study and Honors theses.



Drs. Medford and Reddy observing progress on an experiment

And the research in Biology is pretty exciting. We have folks working on molecular regulation of plants for biofuels and for uptake and regulation of heavy metals, sexual habits of wild tomato relatives in Ecuador, physiology of deep diving seals in the Antarctic (see related article p. 4), neurobiology of sensory perception in Trinidadian guppies, conservation of frogs in the Amazon, methane from Arctic permafrost, grassland ecosystems in South Africa, and genomes of salamanders in California, just to name a few. Next time you're in town, come see our newly renovated lobby, where we have fish tanks and video monitors that display our programs and research. If you contact faculty, you may be able to see some of the living organism we keep in other places as well!

But this excitement also creates challenges. While we work to give our students as many opportunities for the hands-on experiences that are key to future success, we always have more students in need of scholarships and research fellowships to support these activities. We have an award-winning faculty (Dr. Diana Wall was the

2013 Tyler Prize winner, the most prestigious prize given each year for recognition in the environmental sciences). Being able to provide endowed Chairs in Biology will help us keep this talented crew in place. Finally, we have one endowed lecture series, the Thornton-Massa Lecture, which each year brings a marquee-level scientist to Fort Collins for a public lecture on modern issues in plant biology.

We are proud to be the Biology Department, we take special pride in the accomplishments of our alumni, and we want to hear your stories.



Newly renovated lobby attracts s students

## MEET MIKE ANTOLIN, DEPARTMENT CHAIR

Arriving in the Biology Department in 1992 from the University of California, Riverside, (and originally from rural PA near Gettysburg), Dr. Michael (Mike) Antolin has been selected to lead Biology into the new millennium as our new Department Chair.



Mike Antolin

For many years he taught Introductory Zoology (350 students each time) and Introduction to Evolution, so many of you may have been in one of his classes. Also active in promoting science education in Colorado, he is one of the charter members of the advocacy group “Colorado Citizens for Science,” which reviews and comments on issues like science teaching standards for CO public schools.

Regarding his disciplinary focus, Antolin says, “I consider myself an evolutionary and population biologist. I continue to teach courses in evolution and population genetics, and for about the last 15 years I’ve focused on infectious diseases. “

He continues, “Folks in my lab have been working on the effects of plague on Black-tailed prairie dogs in northeastern Colorado. This plague is caused by the same bacterial pathogen responsible for massive human epidemics in medieval Europe, during what’s known as the Black Death in the 1300s. Native to Asia, the pathogen was accidentally introduced into North America in the early 1900s and now resides in wild rodent populations in the western U.S.



A Black-Tailed Prairie dog *Cynomys ludovicianus* at Paignton Zoo in Devon, UK

*Photo by: Nilfanion used with permission*

“We focus on the epidemiology of plague in relation to climate variability, flea vectors, and rodent communities that surround prairie dog colonies. We use genetic analyses to trace transmission pathways in nature. More recently we also initiated work on the genetics of chronic wasting disease in mule deer in northern Colorado. This neurodegenerative disease is similar to what’s been called ‘mad cow disease’ in Europe, and is caused by a mis-folded infectious protein called a prion.



Antolin supports the mule deer population in the Rockies

“My research tends to be interdisciplinary and collaborative, and we have the good fortune of having great colleagues here at Colorado State and in Fort Collins to help us employ molecular genetic methods to trace transmission pathways, to carry out lab experiments to help understand the infection process, and mathematical models population models to understand epidemiology of disease in natural populations.”

In his spare time Dr. Antolin enjoys reading biographies and travel books, puttering in the gardens at home, backpacking throughout the West, and winter sports like skiing and ice hockey.

## EXTREME PERFORMER ADAPTATIONS IN MAMMALS PROVIDE INSIGHT FOR HUMAN HEALTH

If you've ever wondered how a hibernating animal manages their fat stores, or how dolphins can exercise their muscles under water for extended periods without coming up for more oxygen, then you would love to visit some of the labs in the Department of Biology.

A group of professors are focusing their research to understand how animals in extreme environments adapt to those environments, and then ask "are those adaptations applicable to and potentially able to solve certain human conditions." The labs of Don Mykles, Greg Florant and Shane Kanatous explore these important questions with the expectation that the learning acquired here will advance the field and make new strides in human physiology.



Dr. Shane Kanatous

Kanatous focuses on adaptations in skeletal muscles in mammals who are "extreme performers." To find those extreme performers, Kanatous looks to the sea. Inspired by his original goal of becoming a marine biologist, he works with the ultimate in extreme performers, diving mammals.

He wants to know how mammals that live in extreme conditions are different from humans. He says, "I have to put my shoes on to walk outside in the snow, and my dog is running barefoot. How is he able to do that? Are those differences environmental or genetic, or both? How can we apply those differences to humans to improve lives?"

As he explains, "When a diving mammal such as a seal spends 90% of their time underwater, they are holding their breath for essentially 90% of their life. For the animal, this is 'normal.' A human could never do that." In order to sustain function, a mammal needs oxygen which is typically transferred through the respiratory organs. Skeletal muscle also retains oxygen in myoglobin, and myoglobin is stimulated by fat. By measuring the myoglobin, which binds oxygen in skeletal muscle similar to the way hemoglobin binds oxygen in blood, they hope to understand the connection between myoglobin and fat, and perhaps understand how the human body can use fat differently.

A person with limited cardiac/respiratory function could use more access to oxygen stores in muscle. Can the connection be made between myoglobin and fat in a way that can eventually help humans live a more satisfying life?



Graduate student Amber Schlater examines the skeleton of a juvenile male California sea lion. The re-articulated skeleton as well as the plastinized organs below are used in educational outreach.

# HERBARIUM MANAGER COMPLETES DIGITIZATION



Jennifer Ackerfield,  
Collections Manager

The Colorado State University Herbarium is continuing to keep botany going strong in the Biology Department! We recently received an NSF grant to image all 100,000 specimens in the herbarium and put them in an accessible database. The project is now complete, and the data is currently available online through the Southwest Environmental Information Network (SEINet) at

<http://swbiodiversity.org>.

Founded in 1883 with approximately 1400 specimens, the herbarium collection continues to grow. We have added over 41,000 records to the herbarium database and over 25,000 specimens to the herbarium collections since 1998.

Most specimens that are donated to the herbarium must first be mounted on acid-free herbarium paper. All specimens accessioned into the CSU Herbarium collection are databased, georeferenced, imaged and ultimately filed.

Dried plant specimens are delicate and brittle, which can cause them to deteriorate with handling. Digitization of specimens helps preserve fragile and historic specimens from over-handling and protect all specimens for long term future use. High resolution digital images allow students and researchers to view, and in many cases, verify specimen identification online.



Specimen label from 1891

Jennifer Ackerfield, collection's manager of the herbarium, has also completed writing a new *Flora of Colorado*. Presently, identifying a plant in Colorado can be quite challenging for students as well as amateur and professional botanists. The material available is either outdated, incomplete for the state, or taxonomically unstable and challenging to use. This flora uses the most easily recognizable morphological characteristics to separate taxonomic groups, as well as provides color photographs of key taxonomic characters and the local floral, bridging the gap between purely dichotomous keys and picture books of wildflowers of Colorado

## Undergraduate Research Opportunity

The herbarium also continues to foster undergraduate research, with approximately 5 undergraduate interns each semester learning collection management techniques and sharpening their botanical skills. We also have a graduate student utilizing and depositing specimens in the herbarium while she completes a floristic inventory of Red Mountain Open Space and Soapstone Natural Area.

A recent collaboration with the Shambhala Mountain Center near Red Feather Lakes undertakes a floristic inventory of their property. This project allows us to bring students interested in botany into the field and give them hands-on experience, connecting them with the local flora while giving them experience in plant collection and identification. At the same time, students are connecting with Shambhala and receiving meditation lessons and a greater appreciation for nature.



Stacks of new specimens ready to add to the data base

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# KUDOS FOR OUR GRADUATE STUDENTS

## JESSICA HEALY



Jessica joined the Florant lab in 2006 and completed her Ph. D. in 4.5 years. She recently accepted an Assistant Professor position at Austin College in Sherman, TX and credits her preparation at CSU for landing a great job in the perfect spot. Jessica is proud to have been associated with a strong program that has great faculty producing groundbreaking research that makes a difference in people's lives.

As a graduate student in Biology, she was a Teaching Assistant throughout her entire program, learning how to teach, how to build a course and how to mentor undergraduates. One of her favorite classes to teach was Mammology. She said "Students would show up on the first day not even able to spell the name of the class, and end the semester confidently trapping and studying animals. This course is especially important for pre-vet students."

She says her time in Fort Collins was the best. Living and teaching in Fort Collins with access to the mountains and bicycles and the outdoors was a highlight of Jessica's time here. Plus the fact that she could take a class in Marine Biology 2000 miles away from the nearest ocean. She said, "That was cool!"

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## PAUL BREWER

A member of the von Fischer lab, Paul was recently awarded a 2-year pre-doctoral fellowship from the USDA Agriculture and Food Research Initiative NIFA Fellowship Grant program based on his project entitled "Uncovering the mechanisms of reduced tillage effects on nutrient cycles and greenhouse gas flux: how anoxic microsites and other soil structures mediate critical cycles in agriculture."

As he explains, "This award will help expand the research from the lab to field sites and include how tilling impacts formation of anoxic microsites." Anoxic soil produces greenhouse gasses such as CO<sup>2</sup> and methane. What is not understood is how agricultural tilling impacts the production of these greenhouse gasses.

Paul is especially appreciative of the resources available to him, such as research space and access to instruments. He said, "Here, people work together and are happy to share resources and ideas. There are lots of opportunities to interact with others in the department."

He did note, however, that sources for funding graduate level research is pretty limited—the available scholarships are based on an outmoded, but classic, model of Biology. Scholarships require a student to be working in "Botany" or "Zoology," yet the discipline has expanded greatly and is grouped around things like molecular study or ecosystem biology which spans all life forms. He said, "If there were scholarships at the graduate level that included the broader questions, it would benefit more students."

Additionally, he notes that graduate study research is usually not that expensive. Many projects at this level are small and can be funded for less than \$5000.

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# VINCENT STOERGER

*Story and photos of Vince by Bettina Broeckling*



Vince Stoerger in the lab

Vince Stoerger grew up among the rural farms in Bement, Illinois (population 1,723) and was inspired to study biology by his great-uncle Raymond Valentine, cofounder of CalGene, one of the first ag biotech start-ups which was later bought by Monsanto. After graduating from Southeast Missouri State University, Vince started his research career by joining Dan Bush's lab at the University of Illinois in Champaign as a research associate.

The Bush lab's focus on understanding how plants respond to nutrients attracted Vince and spoke to his upbringing in Illinois farm country. When the Bush lab moved to Colorado State University in 2003, Vince came as well and soon after he enrolled as a graduate student.

While in the Bush lab, Vince has focused on characterizing a novel nitrate responsive transcription factor in plants that will help us understand how plants respond to nitrate, a key nutrient for plants. "Nitrate is critical for plant growth and understanding how plants respond to nitrate will hopefully help us make more efficient plants and help farmers better manage limited resources," said Vince. With a background in machine fabrication and desire to understand how things work, Vince has also been a key asset to the Bush lab and Biology department. He was instrumental in designing a hydroponic growing system for sugar beets as well as fabricating support structures for rice plants in the greenhouse. He is always willing to lend a hand for those that need help fixing instruments or help with mechanical issues.

One of the highlights of Vince's graduate career has been teaching recitation for Genetics. "Genetics is challenging for many students and it was rewarding to help students work through their problems and help them understand the concepts in a way that made sense to them," said Vince. Vince's knowledge of genetics extends beyond the classroom and research lab to his personal hobby in snake breeding. He has bred the



Saharan sand boa

*Photo by: Dave Sorenson*

normally orange corn snake to produce desirable phenotypes such as pure white, black and white, and yellow snakes. He is one of only a few to have successfully bred a Saharan sand boa.

Vince is slated to graduate in Fall 2013 and is interested in a career that combines both his mechanical skills and knowledge of plant biology. "I am keeping my options open, but would love a job designing and engineering spaces for plant growth," said Vince. In his free time you can usually find Vince outside catching rattlesnakes, fishing or dirt biking.



Vince catches air