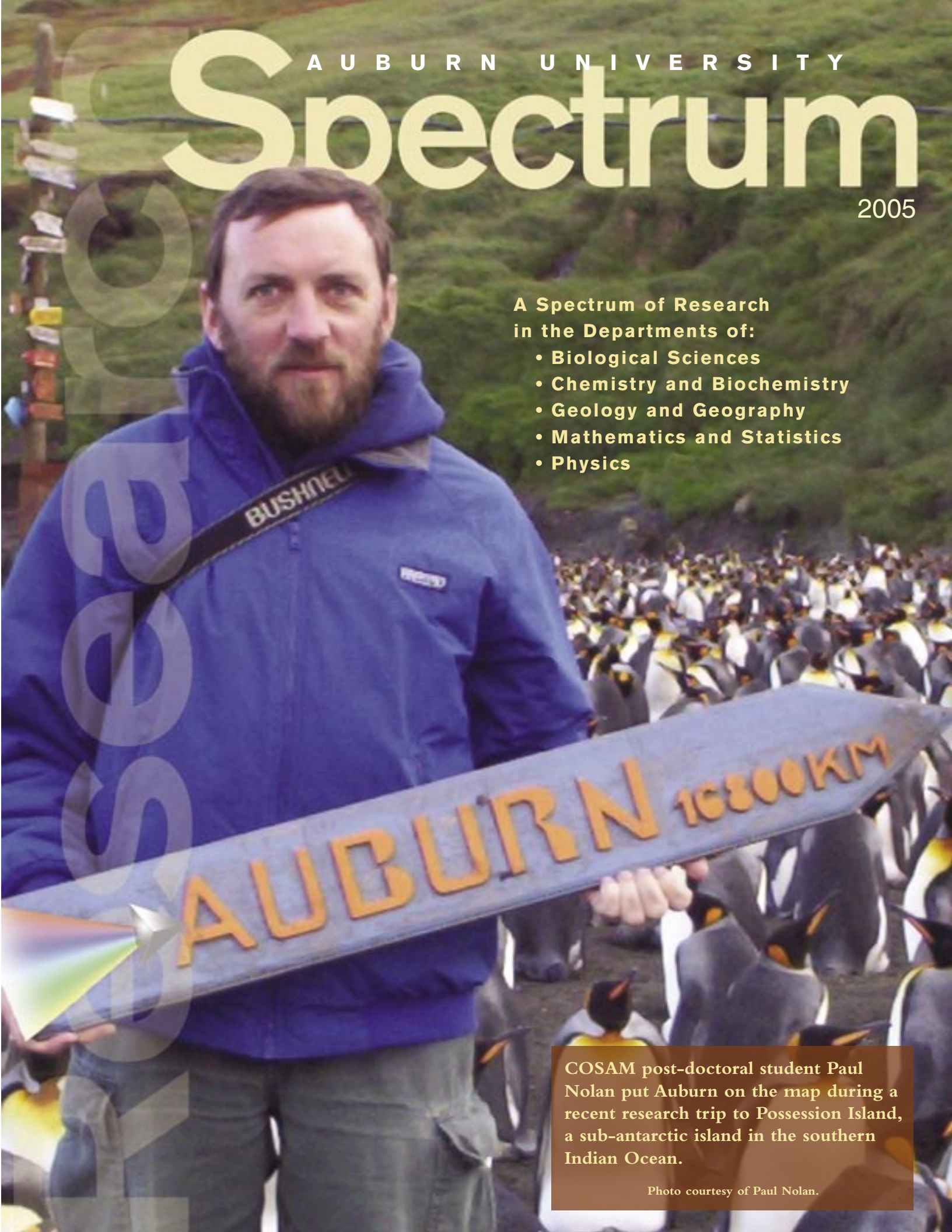
AUBURN UNIVERSITY

Spectrum

2005

A Spectrum of Research in the Departments of:

- **Biological Sciences**
- **Chemistry and Biochemistry**
- **Geology and Geography**
- **Mathematics and Statistics**
- **Physics**



COSAM post-doctoral student Paul Nolan put Auburn on the map during a recent research trip to Possession Island, a sub-antarctic island in the southern Indian Ocean.

Photo courtesy of Paul Nolan.

ASSOCIATE DEAN FOR RESEARCH

Marie Wooten

In its sixth year, *Spectrum* continues to highlight the research endeavors undertaken by the faculty and students in the college. The key to a scholarly environment is attracting talented faculty who in turn attract quality students. Together, student and mentor fuel the discovery process. Over the past two years we have had a significant number of faculty hires that will strengthen existing research areas and enhance our instructional capabilities. As the face of the Auburn campus changes, so does the research landscape. Plans have been approved and funded for creation of a research park to stimulate development of intellectual property and small business. To keep pace with strides in this area, the college has created the new position of research coordinator. This individual will be responsible for assisting with the development of intellectual property and technology transfer.

Research is driven by ideas, but reseachers still need modern facilities with sophisticated instruments to conduct high-end computing, probe the structure of molecules, or examine ways to harness energy. Therefore, a major emphasis undertaken by the college has been to acquire equipment that will impact the research abilities of numerous faculty and train our students in a modern environment with cutting-edge technology. In this issue of *Spectrum*, we review the major equipment purchases from the past year, the operational principles of this equipment, and the types of scientific questions that can be addressed by these instruments. In this regard, approximately $1.4 million has been provided to support acquisition of new equipment or upgrades to existing equipment.

To better inform our faculty of key areas in the sciences and mathematics we have begun to host a yearly symposium to bring recognized experts to share an overview of their research areas. This year we highlighted the areas of biomathematics and bioinformatics. The college's faculty and students continue to enhance the research profile of the university by garnering national and international recognition for their scholarly efforts and by competing with their peers for more than $6 million in annual funding. Profiles contained in this issue are those of world-class researchers working to solve complex questions in the physical, mathematical, and life sciences. By examining the spectrum of questions posed in these areas, you will gain a deeper understanding of the passion for discovery within Auburn University's College of Sciences and Mathematics.

Worley Receives Award as Outstanding Chemist

Dave Worley, a chemistry professor, was recently awarded the 2004 Charles Stone Award, given annually to an outstanding chemist in the southeastern United States.

The Carolina Piedmont Section of the American Chemical Society (ACS) presents the Charles Stone Award each year to an outstanding Southeastern chemist who has made contributions to the field "through activities in the scientific community, public outreach, education, and research." Worley received a monetary award and plaque in recognition of his accomplishments, and spoke about his research to the Carolina Piedmont Section of the ACS on Nov. 15, 2004, when he received his award.

By Elizabeth Farnsworth

Physics Professor Receives Alumni Professorship

Francis Robicheaux recently received an Auburn University Alumni Professorship.

The Auburn Alumni Association funds the Alumni Professorship program because of its desire to support distinguished faculty. The program rewards faculty recognized by their peers and colleagues for making outstanding and exceptional contributions to the university's academic programs.

Considered by his peers as one of the leading theoretical atomic physicists, Robicheaux has received numerous accolades for his work, including the National Science Foundation Young Investigator Award and being elected as a Fellow of the American Physical Society.

Chemistry Professor Receives International Research Award

Eric Bakker, an Alumni Professor in the Department of Chemistry and Biochemistry received the 2004 Roche Diagnostics Prize for Sensor Technology during the Seventh Annual European Conference on Optical Chemical Sensors and Biosensors in Madrid, Spain.

Upon selection by an independent, international scientific committee, Roche Diagnostics presents the international award every two years to a young scientist under the age of 42 for his/her outstanding achievements in the fields of chemical sensing and biosensing. This is only the second time this award has been given.

Bakker's contributions have potentially important applications in medicine and environmental studies and have led to a significant lowering of detection limits in biosensor technology, thus making it preferable in many situations to competing techniques which are either more expensive or less convenient to utilize.

Dobson Receives Fulbright Award

F. Stephen Dobson, a biological sciences professor, was named a winner of a Research Award from the prestigious Fulbright Traditional Scholar Program, a cultural exchange program that provides grants for graduate students, scholars, teachers, and other professionals to visit abroad each year.

Approximately 800 American faculty and/or professionals are sent abroad through this program each year, with representatives from all areas of study. "The awards are highly competitive, so it is a special privilege for Auburn to see one of its own receive this prize," said James Barbaree, chair of the Department of Biological Sciences.

By Elizabeth Farnsworth

Cherry Receives Charles Reid Barnes Life Membership Award

The American Society of Plant Biologists presented Biological Sciences Professor Joe H. Cherry with the Charles Reid Barnes Life Membership Award for his more than 43 years of excellence in research, teaching, mentoring, and professional service to the plant biology community.

The Charles Reid Barnes Life Membership Award is the oldest and most prestigious award given by the society. It is presented each year in recognition of a biologist's meritorious work and dedication to the society.

A past secretary and president of the American Society of Plant Biologists, Cherry's leadership was instrumental in the emergence of the society as the strong international organization supportive of plant science research and education that it is today.

Birds, Bats, and Biology: Mendonca Studies Animal Reproduction

By Elizabeth Farnsworth

A bird swoops over the computers and past the cabinets as a harried grad student runs after the escapee, net in hand. A few disgruntled bats chirp noisily from underneath their blanket-covered cages, and Mary Mendonca is nodding as she talks into the phone. "Fifteen minutes till the tortoises will be here?" she says. "All right, just do the best you can."

Things are always busy—and lively—in her lab, but that's just the way Mendonca, an associate professor in COSAM's Department of Biological Sciences, likes it.

"I come from an ecology background, but I really wanted to know why the animals were doing what they were doing in terms of physiology," Mendonca said.

"I combine three fields. I look at molecular mechanisms controlling behavior, and then relate that to the ecology and the evolution of the animal. A lot of scientists get more and more narrow and try to know every detail of a little enzyme pathway. I don't find that very interesting—I'd rather look at multi-disciplinary kinds of questions where you have to incorporate molecular, ecological, and evolutionary ideas. The study area that really integrates all that is reproduction."

As she studies animal reproduction and biology, Mendonca, with the help of eight graduate students, is currently focusing on four particular groups: bats, birds, gopher tortoises, and amphibians.

The mechanisms that drive bat reproduction are fascinating, says Mendonca, because bats mate at a time of year when their reproductive steroids are low and their sexual gonads are regressed. While it is surprising that bats are able to mate without being driven by sexual hormones, this behavior is not all that different from the way that humans act. It is possible that the brains and neuro-endocrine pathways of bats could be a good model system for studying human brains.

Her other projects include investigation of active maternal effects in birds—how and why female birds can vary their yolk composition to affect their offspring's development. She also looks at how gopher tortoises respond to stress as they are relocated from their original habitat. In addition to all this, Mendonca is considering the way that the sensitive reproductive systems of amphibians respond to contaminants and pollutants in their environment.

Mendonca said the most important thing to her is to "maintain a broad focus and look at questions from a variety of perspectives, instead of considering only one part of an issue.

"The trend is we're not doing multi-level, interdisciplinary science anymore, but that people specialize," she said. "You really need to combine these techniques and points of view to get to the relevant questions about how animals exist in their environment and how they're able to exist in their environment even if the environment is changing. To me, that's what my science is about – not being narrow, but being broad and looking at different levels to answer major questions on the immune system, on stress response, and on reproduction."

Mendonca's enthusiasm about the study of reproductive biology in animals is contagious, and as she talks animatedly about her research, her passion is obvious. With eight graduate students working on four different projects and 140 undergraduates helping in the lab during the 12 years she has been at Auburn, Mendonca has had plenty of opportunities to share her excitement for this research with younger students.

"Research and teaching go hand in hand," Mendonca said. "I think that having undergrads do research is as important as teaching 400 students in Anatomy and Physiology I, maybe even more so…I'm always bringing in little evolutionary tidbits [to the classroom] and I think they can appreciate it, because it's not just a dry recitation of facts. I hope they think more broadly about it."

Dean's Research Award Recipients

The mission of Auburn University places the departments that compose the College of Sciences and Mathematics at the focal point of the university's long-term success and its future ambitions. The departments in COSAM pride themselves in the high quality of research conducted by faculty and graduate students. To recognize these accomplishments, the Dean's Research Award is presented annually to one faculty member, two graduate students, and one undergraduate student. The recipients are determined from nominations in each of the following areas: biological sciences, mathematics, discrete and statistical sciences, and physical sciences. We commend this year's recipients and offer thanks to our alumni and friends whose annual fund gifts have provided the resources for the awards.

Thomas Albrecht-Schmitt
Faculty Recipient and Professor in the Department of Chemistry

Andriy Korchev
Graduate Recipient in the Department of Chemistry

Matthew Shawkey
Graduate Recipient in the Department of Biological Sciences

William Ashwander
Undergraduate Recipient in the Department of Biological Sciences

Dean's Undergraduate Research Fellowship Recipients

William Ashwander – Biomedical Sciences/ Pre-Medicine Major
Mentor: Geoff Hill

Daniel Boyett – Molecular Biology/ Pre-Medicine Major
Mentor: Marie Wooten

Brett Elmore – Biomedical Sciences/ Pre-Medicine and Molecular Biology Major
Mentor: Sang-Jin Suh

Kathryn Foti – Chemistry Major
Mentor: German Mills

Tiffany Kusen – Marine Biology
Mentor: Ken Halanych

Michael Paine – Biochemistry Major
Mentor: Marie Wooten

COSAM New Faculty

Nanette Chadwick
Department: Biological Sciences
Research: Marine ecology, behavioral ecology of colonial invertebrates, evolution of life history strategies, competition and symbioses in stony corals and sea anemones.

Leslie Goertzen
Department: Biological Sciences
Research: Plant phylogeny, speciation genetics; biogeography and systematics of Vitis.

Huajun Huang
Department: Mathematics and Statistics
Research: Representation Theory, Invariant Theory for Lie Groups, and Algebraic Geometry

Scott Santos
Department: Biological Sciences
Research: Microbial biology; molecular ecology and evolution; marine (coral reef) biology, symbioses

Laura Suh
Department: Biological Sciences
Research: Molecular Mechanisms of Host Microbe Interactions

A Whole New World:
Auburn Mathematics Professor Opens Doors of Discovery, Learning

By Elizabeth Farnsworth

As a girl, Wenxian Shen never dreamed that her path would one day lead her across the world to Auburn, Ala. In fact, growing up in a small village in China, Shen never even hoped that she would be able to attend a university, much less work for one. Yet years later, Shen now works as a professor in the Department of Mathematics and Statistics. She spends her time and energy conducting research, teaching students, and raising her two children.

Going through elementary and middle school, Shen never expected to have the opportunity to go to college. Because of the Cultural Revolution, there were no college entrance exams and the chance for her to attend a university was very slim. Luckily, the year Shen graduated high school was the second year the entrance exam to college was given to students in China after the Cultural Revolution, and she at least had a chance to enter the university.

"I had never seen that kind of exam before and so I had no idea what type of exam we would have and whether I would pass," said Shen, a petite woman with an easy smile. "I could not even believe it myself, but I passed the exam and was admitted to the university. I was the first college student in our whole village, and people started to think, 'We can go to college too.'"

While she has served as inspiration to an entire village and blazed a trail through universities in both China and the United States, today Shen focuses her efforts on researching differential equations and dynamical systems and on a variety of different research applications in work that is sponsored by the National Science Foundation.

"I'm mainly working on time-dependent differential equations and on analyzing many different types of applied problems," she said. "Almost all kinds of problems in nature are influenced by a certain time dependency. For example, in population models, how the population changes can depend on the seasonal variations of the external environment, while there are also certain internal variations for each population… in many problems the kind of variations is not exactly known and I'm also interested in that. The field of differential equations is huge and there are so many problems, but I focus on various dynamical aspects in 'almost periodic' time dependent equations and random differential equations."

A key tool for studying nonlinear differential equations is spectral theory of linear differential equations. Shen has investigated properties of the spectrum for time-dependent and random linear equations, and she and her collaborators recently gathered some important results about this theory.

"One result that we found very interesting is that in talking about the population models we found that an inhomogeneous environment heavily favors the population that already exists. We provided some rigorous mathematical evidence that the natural inhomogeneity of environments is important when one tries to understand population dynamics and many other kinds of problems."

Although her research is extensive and covers these areas and many others, Shen does not simply spend her time working and re-working equations. She often speaks at conferences across the globe and is currently co-organizing a conference in China. While she enjoys research and all that it entails, Shen said spending time in the classroom working with undergraduate and graduate students is also important and rewarding.

"I enjoy teaching…if you start teaching something you teach yourself while you're teaching the students," she said. "If you're teaching the students something and they're learning, you feel really good. And while you teach someone else, you also discover something new yourself. The teaching is fun…I like it."

Shen has crossed the world and conquered expectations to end up where she is today, an internationally known and respected mathematics researcher and professor. While she may not have begun her journey with Auburn, Ala., in mind, she's happy with the way things have added up.

COSAM Supports Infrastructure Enhancement

By Elizabeth Farnsworth

Thanks to funding provided by the College of Sciences and Mathematics (COSAM), several departments within the college have recently made major equipment purchases that will increase research capabilities and the profile of Auburn University.

Bioinformatics System

The Department of Biological Sciences purchased a computer system that will allow faculty and students to analyze large sets of data within a reasonable amount of time. GUMP (Genomics Using Multiple Processors), the new bioinformatics system, has been much appreciated since its June arrival.

Currently GUMP is mainly being used to study DNA in an evolutionary context. Researchers using GUMP are studying everything from microbes to mammals, on a time scale ranging from tens of thousands to hundreds of millions of years ago.

Molecular Beam Epitaxy: New Addition for Physics Department

The Department of Physics is proud of its Molecular Beam Epitaxy (MBE) machine, which provides researchers with a way to perform the most sophisticated form of expitaxial growth available. Epitaxial growth is important as scientists work to grow purer forms of thin crystalline films—used in microelectronic devices—that are free of defects or contamination in the crystal's structure.

The MBE works by using molecular beams to build the epitaxial layer of thin crystalline film one atomic layer after another, ensuring greater control of material properties, better quality and fewer imperfections in each crystalline film.

By using the MBE, researchers in COSAM's Department of Physics are trying to develop new and better electronic materials that have the ability to do things current materials are incapable of, such as working in high-temperature environments, carrying more power in a smaller area, faster devices, and blue light emission.

EPR Equipment to be Used in Department of Chemistry and Biochemistry

The Electron Paramagnetic Resonance (EPR) machine is giving faculty and students a way to study the electronic and magnetic properties of metals containing compounds, said Evert Duin, an assistant professor in the Department of Chemistry and Biochemistry.

This December 2003 addition works by looking at the "free" or unpaired electrons that are mainly found on metals. The properties of these electrons are influenced by electronic and magnetic interactions with other atoms and electrons in the direct surrounding of the free electron.

This technique is useful in the study of proteins that contains a metal center, called metallo-enzymes. "Changes on the metal or in the direct environment can easily be detected," Duin said. "In addition, you can see if proteins reduce or oxidize by looking at the appearance or disappearance of the EPR signal."

MALDI to Increase Mass Spectrometry Abilities in COSAM

COSAM has purchased a Matrix-Assisted Laser Desorption Ionization (MALDI) mass spectronomy machine, which arrived in August. This instrument provides an opportunity for the study of large molecular systems as researchers attempt to determine the masses of large molecules.

The MALDI works in a way that is similar to hitting a golf ball out of a sand trap: just as a golfer strikes the sand underneath the golf ball to push the ball out of the trap, the MALDI operates by using a laser to excite the matrix around a particular large molecule. Just as a golf ball is propelled into flight by the force of the excited grains of sand, the molecule is pushed into flight by the excitation of the matrix. Scientists are then able to measure the molecule's time of flight, which tells them the mass of that molecule.

NMR Will Boost Auburn's Research Profile, Capabilities

The Office of the Vice President for Research, in response to a proposal written by Dr. Marie Wooten, associate dean for research, has provided $900,000 to purchase a Nuclear Magnetic Resonance (NMR) device for the Department of Chemistry and Biochemistry.

This new piece of equipment will allow the department to probe the environments of magnetically active nuclei. Although Auburn already owns a 250-MHz and 400 MHz NMR, the high-field 600 MHz NMR will provide higher resolution and will help researchers as they probe the structures of large molecules such as proteins.

The NMR should increase the quality of research being produced at Auburn University and will also lead to a higher quality of education for both undergraduate and graduate students as they have access to more sophisticated forms of instrumentation. Along with acquisition of the NMR, a new faculty member will be recruited to the department to work in the area of protein structure.

Thanks to Alumni and Friends, COSAM Receives Important Equipment

By Elizabeth Farnsworth

There's a lot to be thankful for in the College of Sciences and Mathematics (COSAM) these days, says Doug Goodwin, assistant professor in the Department of Chemistry and Biochemistry. The new circular dichroism spectropolarimeter (CDS) is at the top of his list.

This equipment came to COSAM thanks to the PRISM (Promoting Research in Sciences and Mathematics) Award, a program funded by alumni and friends of the college, that encourages faculty to cross departmental lines and work together on important interdisciplinary research.

"PRISM is designed to enhance interdisciplinary research within COSAM, and to increase the research profile of Auburn University," Goodwin said of the award. This most recent award is the second of its kind and provided $100,000, allowing COSAM to purchase the CDS.

The circular dichroism spectropolarimeter that Goodwin—and others in the Department of Chemistry and Biochemistry, as well as the Department of Biological Sciences—works with came to Auburn in June, after the PRISM was awarded to the CDS proposal in mid-March.

"My lab and others have been traveling to other universities to do circular dichroism," Goodwin said. "It's hard to overstate how beneficial it is to have the instrumentation right down the hall as opposed to two-and-a-half hours away… it's very easy to make adjustments to design a better experiment; you can make progress a lot faster."

The CDS is important because it helps scientists to discover structural information about particular molecules as they study the way those molecules absorb light. This equipment is particularly important when it comes to working with asymmetrical molecules. Scientists alternate exposing these molecules to right and left circularly polarized light.

Asymmetrical molecules absorb these two types of light in different ways, and the information gained from observing the interaction of these molecules with polarized light is crucial when it comes to investigating biological systems. Asymmetry is a common feature for nearly all biological molecules, which is why CDS is so useful as scientists study various biological systems.

"The more we understand structurally about biological systems, the better able we are able to manipulate them for human health, agriculture, and all of these things," Goodwin said.

Thanks to the funds provided by the PRISM award, Goodwin and countless other COSAM faculty members are able to enjoy this important piece of equipment.

"I look at PRISM as something that's really special, because it's something where COSAM alumni and friends have decided it's important to give back to Auburn in a way that's going to advance research at the university," he said. "I think that's really valuable and I want to be sure that they hear a very loud 'thank you' from us…this is something that is making Auburn stronger and taking it into the 21st century."

No Atom Left Unturned

By Elizabeth Farnsworth

Mitch Pindzola, a professor of theoretical atomic physics within the Department of Physics, has received much recognition for his excellence as a teacher and researcher, and is currently serving as the 2004-2007 Scharnagel Professor (a professorship established by AU grad Margeurite Scharnagel to recognize outstanding accomplishments in teaching, research, and service in the sciences and mathematics). He concentrates his research on electron-ion scattering, multiphoton processes, and proton-atom scattering.

"One of the main topics we're studying is atomic structure and its dynamics," Pindzola said. "How does an atom rearrange itself if it has 92 electrons around a nucleus? What is the shell structure of the atom and can we tell probabilities that the electrons will hop from one shell to the next? If we hit the atom with an electron, what's the probability of those electrons on the atom rearranging themselves? If we shine light on it, what's the probability that light will get absorbed and knock electrons off? We're considering all sorts of questions like these."

Pindzola's passion for physics is obvious as he talks, and his enthusiasm for the field is contagious whether he's talking about the research of his students or the international scope of the field of physics. All of the ongoing work in the Department of Physics is important to him, and he is excited to share what is going on within the department right now.

"The world of physics is international in scope and it's quite different from many professions in that you work in an international community," he said, emphasizing the current diversity represented among both faculty and students in the Department of Physics.

These students and professors from all over the globe are presently tackling some intriguing challenges, including electron collisions, photon interactions, ion-atom collisions, and countless other physical problems. Often collaborating with other scientists across the world, regularly conducting research (from Auburn) on computers in faraway places such as California or Europe, and traveling frequently, physics demands cooperation between these researchers as they work for new breakthroughs in their field.

"I think collaboration is typical in the department. It's not something unusual for physics departments," Pindzola said. "It really is an international effort in a wide variety of things."

For Pindzola, physics is all about researching and investigating the basic building blocks of the universe. It's exciting, he said, to know that the work he and the other faculty and students in the department are doing is having an influence on many different subjects.

"Atoms and molecules are everywhere in the universe. They're in your body, they're in the upper atmosphere, they're floating around in stars, they're everywhere. Everything we do has an impact on a wide variety of fields at the basic level," he said.

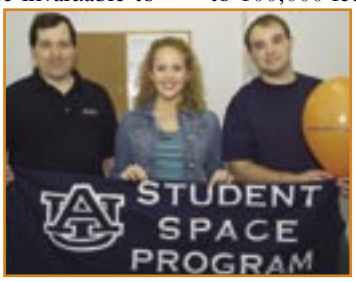
Student Spotlight

Students Reach for the Stars with the Auburn University Student Space Program

By Elizabeth Farnsworth

When Ben Spratling looks up into the night sky, he isn't just wondering what's out there. Spratling, a 22-year-old physics major, has already worked with other undergraduate students through the Auburn University Student Space Program (AUSSP) to design, build, test, and launch their own spacecraft. According to Spratling and others involved with the program, the experiences and opportunities available through AUSSP are invaluable to students in today's competitive world.

"Regardless of previous knowledge or experience, this group offers more to the students of Auburn than any other," said Luther Richardson, a current Auburn student and high school physics teacher in Columbus, Ga. Richardson is actively involved in AUSSP and has served as the program's lead scientist. "It takes something special inside of a person to start from the birth of an idea and stick with it until it reaches the stars. To reach the lofty goals of AUSSP, student members need to be motivated, proactive, and they must work together as a real team."



From left: Luther Richardson, Stephanie Janasky and Ben Spratling.

AUSSP is a student-run organization and relies on the dedication and skills of Auburn students with a passion for science and aerospace technology. These students, who also receive class credit for the time they devote to AUSSP, work on the program's three main projects: a balloon program called Auburn University Research at Extreme Altitudes (AUREA), an earth-orbiting satellite program known as Aubie-Sat, and the Magnetic field Investigation of Mars by Interacting Consortia project (MIMIC). Auburn is one of nine universities participating in the national MIMIC project.

Through the AUREA balloon project, students are able to conduct experiments and gather important data at high altitudes from around 80,000 to 100,000 feet. In the spring of 2005, undergraduate physics students will even have the opportunity to conduct relativistic experiments as an Auburn student flies an atomic clock in a balloon to test Einstein's theory of relativity.

With a mass of only one kilogram and small enough to hold in an outstretched hand, the Aubie-Sat packs a powerful punch within its tiny size. Built and designed by students, the Aubie-Sat is Auburn's version of the Cube-Sat, a student satellite program run by Stanford and California Polytechnic universities. Although these tiny satellites face power limitations due to their small size, Spratling said "so far the Cube-Sats have shown that they have the capability to do some fairly impressive things."

The MIMIC project has captured the imaginations of students across Auburn and the nation as undergraduates work with space grant consortia across the United States to send a student satellite to Mars. The final launch to Mars is planned for 2011 and will piggyback on NASA's mission. Once arriving on Mars, the student project will head off in its own direction, but until that time, students are staying busy working on launches and experiments.

The time students dedicate to AUSSP is not inconsequential. Those involved in the space program think the rewards far outweigh the costs.

"We've found that students who are involved in AUSSP get opportunities and connections that other students don't have," said Spratling. "The things that students want like grades and recommendations and the things that they need such as experience and education in the fields that interest them are the things that AUSSP can give them. This gives students an amazing opportunity that they wouldn't get in a regular class or in a regular curriculum anywhere else on campus."

Spratling is not alone in his enthusiasm for AUSSP. "For anyone who is excited about space exploration, these experiences are without equal," Richardson said. "Student members of AUSSP gain real experiences and have fun at the same time."

Sulfur Chemistry Research and Working with Students Motivate Biochemistry Professor

By Elizabeth Farnsworth

Holly Ellis loves her job. Whether she's in the classroom teaching biochemistry or spending hours working in the lab with grad students on their latest research, Ellis, an assistant professor of biochemistry, is passionate about what she does.

"I love interaction with the students," Ellis said. "Students are what really make this place so great, and in COSAM, we have some of the brightest students. I love going into the lab and talking with my grad students about their research. Finding the answer to a problem that we're having gets me up and drives me every day."

Whether she's driven by solving problems, interacting with students, or her own inner motivation, it's obvious that something is pushing Ellis to action. Since arriving at Auburn only three years ago, she has become involved with several student organizations, including serving as Mortar Board adviser and a Camp War Eagle faculty honoree. In addition to all this, Ellis has also remained focused on her research with enzymes involved in sulfur chemistry.

Ellis has focused her research on two main areas. "One of [the enzymes we're studying] is involved in anti-oxidant protection of cells in the body," she said, "and the other is more involved in bio-degradation and the removal of pollutants. These enzymes have two different functions, but the chemistry is sulfur chemistry."

The first protein that Ellis, along with the help of her graduate students, is investigating has the potential to lead to new and innovative medicines for the treatment of problems like heart disease or cancer.

"Normally, proteins use a specific substrate, and we want to know how they take that substrate to the product and the intermediates involved in those steps," Ellis said. "Some of the systems that we work on are important in certain metabolic processes…by understanding how this protein works, then we can understand better how to develop drugs to inhibit the enzyme or to enhance it, and we can better understand the effects on the body."

The other enzyme that Ellis has focused on is found in bacteria and takes harmful substrates out of the environment. Ultimately, she hopes to see bio-degradation (using bacteria to break down environmental pollutants) play a greater role in cleaning up the environment.

Although Ellis works long and intense hours, she by no means does her research alone. She oversees a lab of five graduate students and is quick to give them much of the credit.

"I would not have my research if it wasn't for them," she said. "They're a fantastic group—they all help each other, they're all willing to work with each other. There's no competition and they're just a fantastic group of kids. I'm really lucky to have the group I have."

Ellis thinks her work with these graduate students is especially important, not only for the research they are currently conducting, but also for the future opportunities these students will face. She tries to train her students in as many different areas as possible, presenting research talks, conducting a variety of experiments, and working with many different types of instrumentation.

"When they go to find jobs, I want them to be marketable," Ellis said. "A lot of times graduate students only do one type of experiment their whole career, but in biochemistry, we train our students to learn a variety of techniques, from working with DNA to cloning to protein expression."

Symposium Stresses Interface Between Biology and Mathematics

On May 4, 2004, COSAM hosted the second annual Dead Day Symposium, "Frontiers in Mathematical Biology and Bioinformatics," which focused on the continually expanding interface between biology and mathematics.

"Whereas the past century has seen mathematics undergirding chemistry and physics research, the dawning of the new century is seeing biology turning to the tools and techniques of mathematics to address its research objective," said COSAM Dean Stewart Schneller. "These are exciting times for the interdependence of biology and mathematics."

The connection between science and mathematics is deep and well recognized in COSAM, said Mark Carpenter, a professor in COSAM's Department of Mathematics and Statistics and chair of the symposium's organizing committee.

"In particular, the biological sciences, which include computational, theoretical, and experimental biology, have led to extremely interesting and complicated mathematical problems. Because of this, mathematicians, statisticians, biologists, bio-chemists, and other scientists are increasingly finding themselves sitting across the table from one another as they work on modern day research projects," he said. "Mathematical biology and biomathematics represent the culmination of these collaborations and demonstrate the trend in modern day science towards multidisciplinary approaches. The purpose of the symposium was to introduce mathematicians to biological applications and to demonstrate to research scientists how collaborations with mathematicians can be fruitful in their research."

Photo caption: NMR Featured Speakers – from left: Michael Cherry of Stanford University, Mark Carpenter, symposium organizing committee chair and a professor in COSAM's Department of Mathematics and Statistics, Pilar Francino of Lawrence Berkeley Laboratory and the Department of Energy Genome Institute, Richard Simon of the National Cancer Institute, Lou Gross of the Institute for Environmental Modeling, and James Keener of the University of Utah.

In addition to Carpenter, several other COSAM faculty members donated their time to making the event a success including Colin Dale, of biological sciences; and Nedret Billor, Anotida Madzvamuse, and Bertrum Zinner, of mathematics and statistics.

Hames Named COSAM Research Coordinator

By Elizabeth Farnsworth

Bill Hames of the Department of Geology and Geography was recently named as the college's research coordinator. Hames will work to facilitate development of intellectual property in COSAM, serve as a liaison with the AU Office of Technology Transfer, and assist in endeavors related to COSAM's involvement in AU's research park.

Hames will continue to serve as an associate professor of geology, adding the new position of research coordinator to his current responsibilities.

He said he is excited about this new position and is looking forward to having "the ability to talk to other faculty about their ideas, to help to be an advocate for them, and to help encourage them in promoting their creative ideas."

Hopes are high that the creativity and inventiveness of COSAM faculty will produce many new ideas that will raise the profile of and lead to additional revenue for Auburn University. Past success stories of intellectual property (creative and innovative research and ideas that can be patented and commercially developed) include Gatorade, which was created at the University of Florida, and Google, which began at Stanford University.

The intellectual property of the faculty will also be a central feature to the success of the AU research park. Although the park only recently received final approval and will be a new step for the university, it will bring together the business and academic worlds as faculty work together with businesses to patent, commercialize, and market ideas and inventions developed at Auburn University.

"Research parks are places that expand and strengthen the research base by enabling knowledge-based, high-tech economic development," said Marie Wooten, COSAM's associate dean for research. "Silicon Valley and those types of partnerships were created by putting research parks close to universities and utilizing technologies that had been developed at the university to spin off high tech companies."

The research park will be located at the corner of South College Street and Shug Jordan Parkway near Interstate-85 and will be architecturally and aesthetically similar to Auburn University, serving as the new "gateway to campus." Groundbreaking and construction on the park should begin within the next three years.

Uncharted Territory:
Geography Professor Works with Satellite Imagery at Auburn

By Elizabeth Farnsworth

Whether hunched over a computer in Auburn examining the latest satellite images or trekking through Mexican fields, Luke Marzen has a passion for geography. Marzen, an assistant professor of geography at Auburn University, loves investigating how landscapes change over time. He does this by examining satellite images collected over a period of time, and then compares his analysis with observations he makes during field trips to the places he studies.

"My expertise within geography is called remote sensing… which is the science of making observations from a distance, using sensors [which record electromagnetic radiation]," Marzen said, sitting in his office on the first floor of Tichenor Hall.

"These satellite images allow us to gather, or track, data over a certain period of time so we can look at landscapes and see what changes have occurred without even being there. I analyze the change that happens, and then I go into the field to try to understand the processes that are responsible for change. The satellite image can only tell you so much. It can tell you what changed, but you still need to go into the field in order to see why it changed."

Marzen, who grew up in a small farming community in Iowa, never had many opportunities to travel in his childhood but described himself as always having "a sort of a wanderlust" and a fascination with maps. Today, his job has taken him from Mount St. Helen's in Washington to southern Mexico as he studies how ecosystems recover following volcanic disturbances, among other topics of interest.

Marzen has also satisfied his love of geography and travel through personal trips. In the summer of 1998, he volunteered on an environmental project in Paraguay where he was able to put his geographical skills to use as the team worked to relocate a landfill to help improve the quality of a public water supply.

He sees such travel as important "not only for my research, but also for my teaching. As a geographer, you can read about geography in a book, but until you go to a place it's really hard to grasp the processes that are going on there," he said. "Although I'm doing physical geography research, I'm also learning about cultural geography."

In his work at AU, Marzen has focused on three areas—agricultural impacts on water quality, developing remote sensing methods to assess vegetation characteristics, and investigating natural and human-induced changes of disturbed landscapes.

Studying disturbed landscapes relates directly to the work Marzen has done at volcanoes like Mount St. Helen's or El Chichon in Mexico. Through his work in remote sensing, Marzen has been able to see a detailed picture of vegetation change for the entire Mount St. Helen's blast zone, even though he was only nine years old when the volcano erupted.

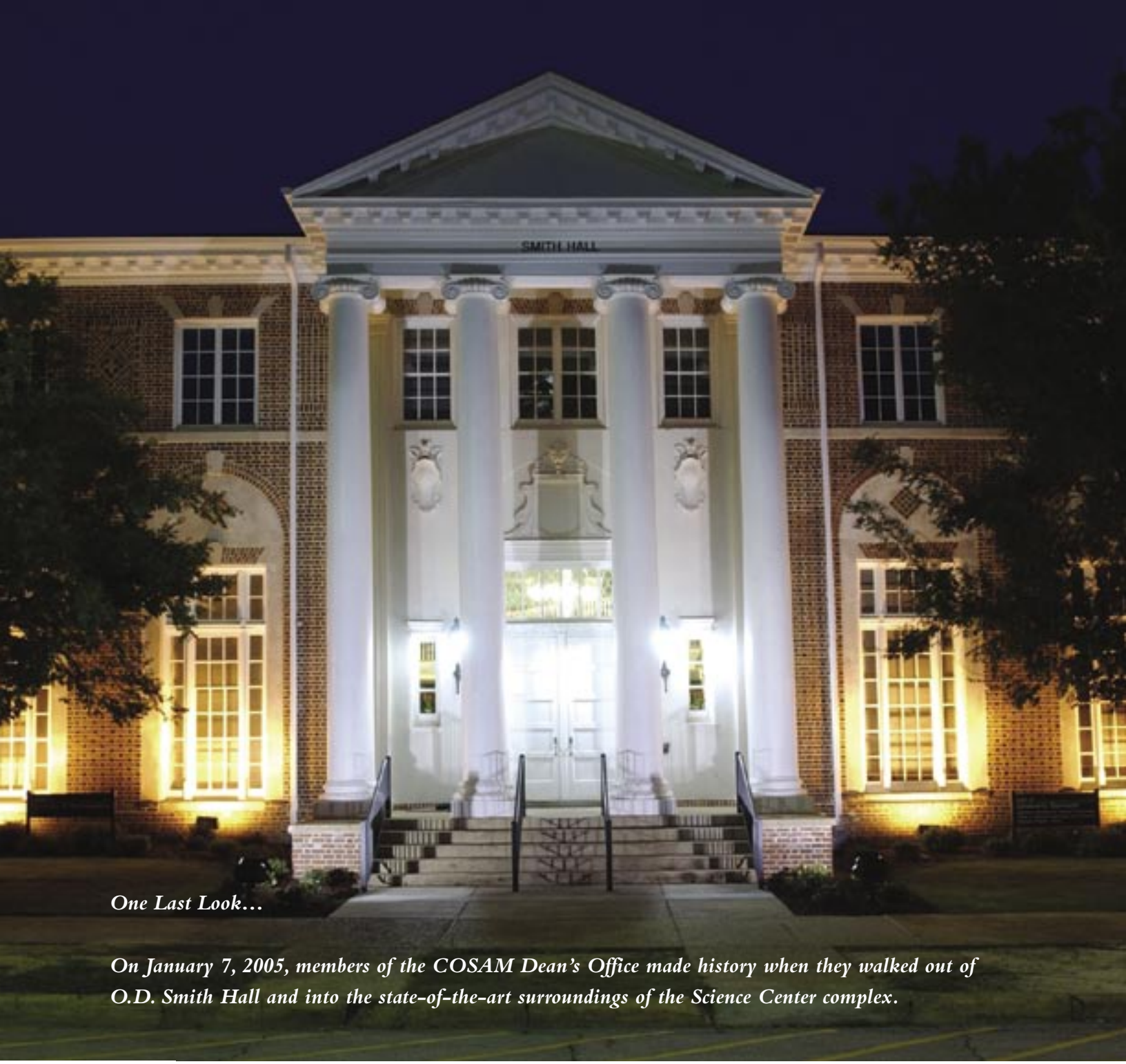
The role that humans have played in the ecological recovery at Mount St. Helen's has been crucial. For example, part of the mountain is owned by a timber company, while other sections are designated as public land. While the land owned by the timber company has regenerated very quickly, it is not as diverse as the public lands where human activity is limited.

Marzen has continued work on his other research areas, and he recently received funding to begin to study remote sensing methods in the analysis of drought.

He has also been busy working with several colleagues on campus and across the state on the development of AlabamaView, "a statewide consortium promoting research, education, and outreach of remote sensing." AlabamaView became a full member of the nationwide consortium America View in April 2004.

Marzen believes that AlabamaView will play a vital role in connecting government agencies and universities across the state and help to eliminate redundancy in the remote sensing data sets being collected. He also looks forward to involving the public in remote sensing and opening the field up for wider use.

"I want to continue to see AlabamaView develop and the consortium become stronger and take on new members in the state that will participate in advancing the goals of AlabamaView," he said. "Education and outreach can go a long way toward developing a workforce in Alabama that embraces geospatial technology and pave the way to the 21st century."



One Last Look…

On January 7, 2005, members of the COSAM Dean's Office made history when they walked out of O.D. Smith Hall and into the state-of-the-art surroundings of the Science Center complex.

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