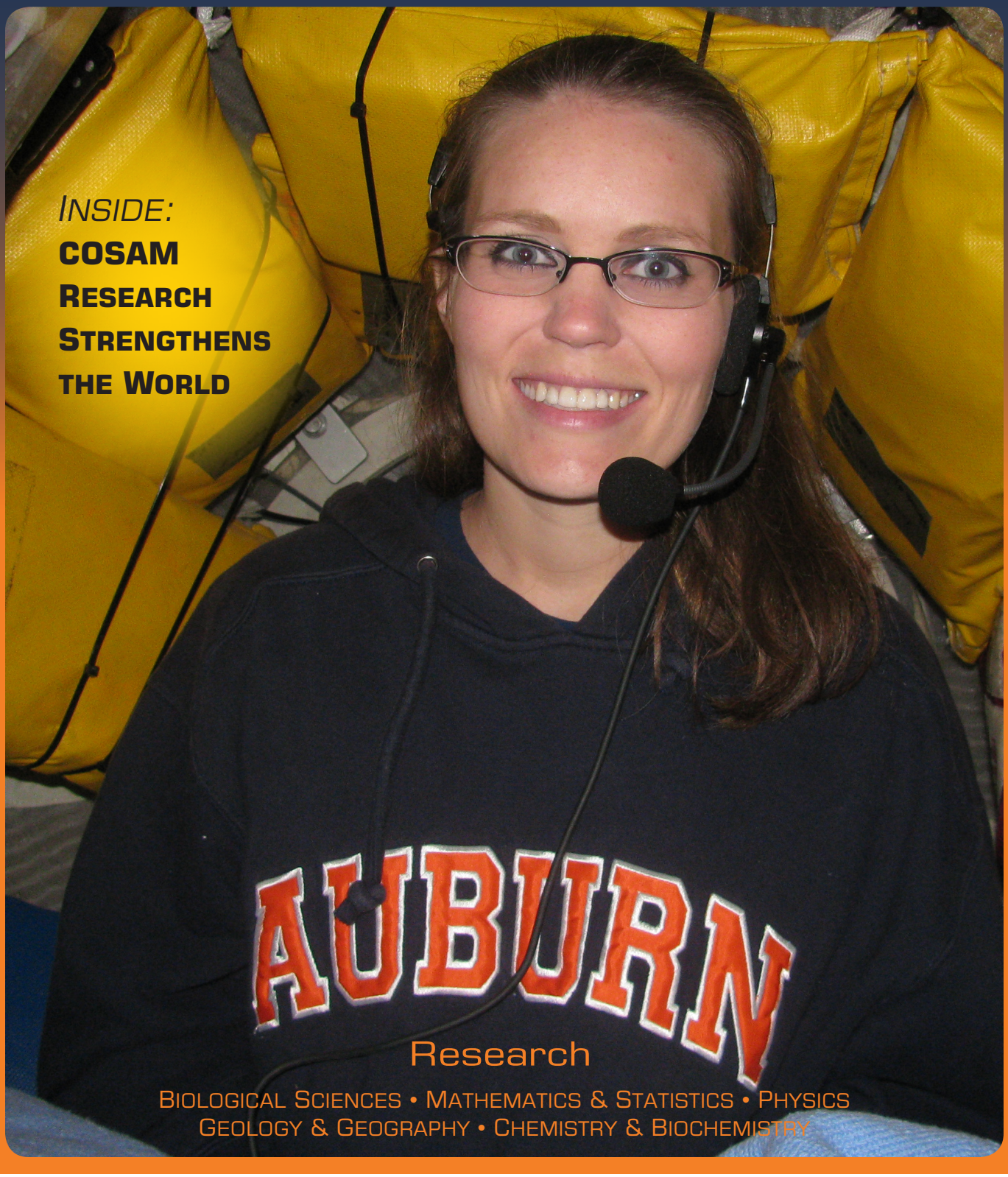
AUBURN UNIVERSITY

Spectrum

COLLEGE OF SCIENCES AND MATHEMATICS



INSIDE:

COSAM RESEARCH STRENGTHENS THE WORLD

Research

BIOLOGICAL SCIENCES • MATHEMATICS & STATISTICS • PHYSICS
GEOLOGY & GEOGRAPHY • CHEMISTRY & BIOCHEMISTRY

"Research and discovery are the fuel for academic scholarship."

-Dr. Marie Wooten

On the Cover

Last fall, Biological Sciences Professor Dr. Ken Halanych lead a team of veteran marine biologists on a research cruise in the Gulf of Mexico to study marine invertebrates. Dr. Halanych and his research team, in support of COSAM's outreach mission, were interested in introducing the wonders of their work with deep sea life to future scientists. For the October 2009 research cruise, Dr. Halanych included Drake Middle School science teacher, Erin Edmondson.

Edmondson, a 2008 Auburn honors graduate with a degree in Biomedical Sciences, is currently a seventh-grade life sciences teacher at Drake Middle School in Auburn. For the six-day research cruise, Edmondson's on-board reporting included pictures, daily articles and blog entries back to her classroom via the mission Website.

A MESSAGE

From the Associate Dean of Research

Marie Wooten

Spectrum magazine highlights the creative scholarly endeavors of our faculty and students in the College of Sciences and Mathematics. Though we have been faced with decline in state budgets, the 2009 American Recovery and Reinvestment Act (AARA), also referred to as the Federal Stimulus Plan or Recovery Act, provided a flurry of grant-writing activity in early 2009. The stimulus initiative was designed to jump start the U.S. economy through federal spending in areas such as education, energy, health care, housing and transportation. The goal was to put Americans to work, improve infrastructure, and allow for enhanced or continued research.

Several faculty members in the College received ARRA grant awards from either the National Institutes of Health (NIH) or the National Science Foundation (NSF) totaling almost $1 million for six projects. The awards were granted through competitive peer-review process. The NIH alone received 20,000 proposals for consideration. Thus, the process was highly competitive. New awards were given through the peer-review AARA program to the following faculty: Drs. Mark Liles and Paul Cobine (Biological Sciences), Bill Hames (Geology and Geography), Andreas Illies (Chemistry and Biochemistry), Krystyna Kuperberg, A.J. Meir, Weixan Shen, (Mathematics and Statistics) and Ed Thomas (Physics). These funds will provide salary support for students and fellows, as well as furnish the means to purchase small equipment, attend conferences to disseminate findings and meet software needs. When considering the downward trend that many institutions have faced in external funding, our faculty has demonstrated exemplary resourcefulness in continuing to maintain steady funding from competitive sources. We are also proud of the efforts of Amy Thomas who joined our staff in August 2008 to assist in writing grant proposals. A licensed attorney, Thomas brings a level of talent that has directly impacted the research funding COSAM has received. This past fiscal year COSAM faculty garnered $12 million in funding, which contributes to a vibrant research portfolio composed of three- and five-year awards totaling $28.5 million.

Research and discovery are the fuel for academic scholarship. The formula for academic success is comprised of innovative faculty research + challenging academic programs + high-quality students = exceptional opportunities. Our faculty and students continue to lead the way in developing programs of international acclaim and distinction. This issue of *Spectrum* provides a glimpse of the creativity and passion exhibited by faculty in this College. Join me in reading about how quality faculty inspire the next generation through their research and teaching endeavors. Stories that capture the research programs of both established and junior faculty have been included from each of the five academic departments.

Marie W. Wooten

Marie W. Wooten, Ph.D.
Professor
Associate Dean for Research

Aaron Rashotte

Biological Sciences Research Update, By Christy Truitt

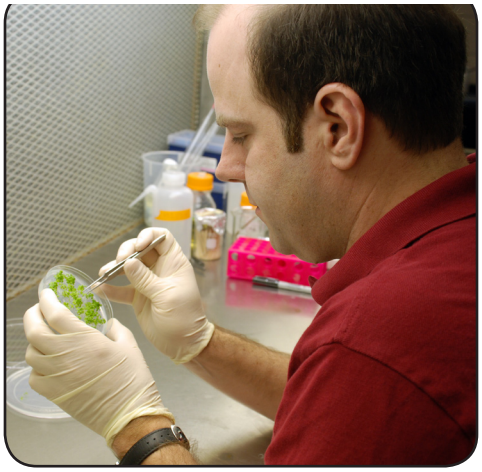
Healthy Leaves = Healthy Tomatoes

As one of the major vegetable crops produced in the United States, it's no wonder that much of the study of tomatoes focuses on yield. But Dr. Aaron Rashotte, assistant professor of Biological Sciences, is using a United States Department of Agriculture (USDA) grant to study how other tomato organs, namely leaves, contribute to the overall health of the vegetable.

"To make a better fruit requires you to have a better plant in its totality," says Dr. Rashotte. "We are looking to do that by focusing on leaves." With the three-year grant totaling some $380,000, Dr. Rashotte plans to increase general knowledge about the growth and development of tomato leaves through examining the regulation of tomato-leaf shape and development by the hormone cytokinin.

Dr. Rashotte first investigated cytokinin-regulated transcription factor genes (CRFs) and their role in the cytokinin-signaling pathway during his years as a post-doctoral researcher giving him unique advantage as principal investigator of this study. He explains that the more we learn from studying mutations in CRF genes that have altered leaf shape, the more we can apply that knowledge to hormonally regulate normal leaves. Dr. Rashotte writes that the extended treatment of plants with cytokinin reduces leaf size and leaf complexity, resulting in plants with smaller, more simple leaves. Understanding how this hormone does that could lead to the generation of bigger and better leaves. Cytokinin is also involved in a range of other plant growth and developmental processes of great agronomic importance, as seen in new studies linking cytokinin signaling and perception to nodule formation and nitrogen fixation in legumes.

Prior to Dr. Rashotte's work, there was little known of how cytokinin affects the way a plant grows, especially relating to leaf development. Through this grant, Dr. Rashotte's research will increase general knowledge about the growth and development of tomato leaves through an examination of this hormone, therefore helping to improve a major vegetable crop whose sales total more than $2 billion annually.



About Dr. Rashotte:

Dr. Rashotte received his undergraduate degree in Biological Sciences from Florida State University and his Ph.D. in Plant Sciences from the University of Arizona. After he received his Ph.D., Dr. Rashotte held two post-doctoral positions, first at Wake Forest University and then at the University of North Carolina, Chapel Hill. He joined the Auburn University faculty in the summer of 2007. A native of Tallahassee, Fla., Dr. Rashotte says it is nice to be back in a town that loves football. "I am a Florida State fan but I do go to Auburn games. Luckily, both Auburn and Florida State have an equal loathing for Florida, and Auburn and Florida State don't play one another very often, which is nice," says Dr. Rashotte.

Although Dr. Rashotte enjoys attending football games, tending to his container garden, and photography, most of his spare time in the last three years has been focused on establishing himself on The Plains. "I am finally at the point where my lab is in full swing: I currently have two doctoral students and a third one coming in this fall; I have a number of undergraduates working with me; I am starting to get some papers out for publication; and I am doing research," says Dr. Rashotte. "I feel like I am finally at the point where I have wanted to be for a very long time in terms of my work and my research."

Visit Dr. Rashotte's Website for more information on his research at www.auburn.edu/~amr0008/.

Christian Goldsmith

CHEMISTRY RESEARCH UPDATE, BY CANDIS HACKER BIRCHFIELD

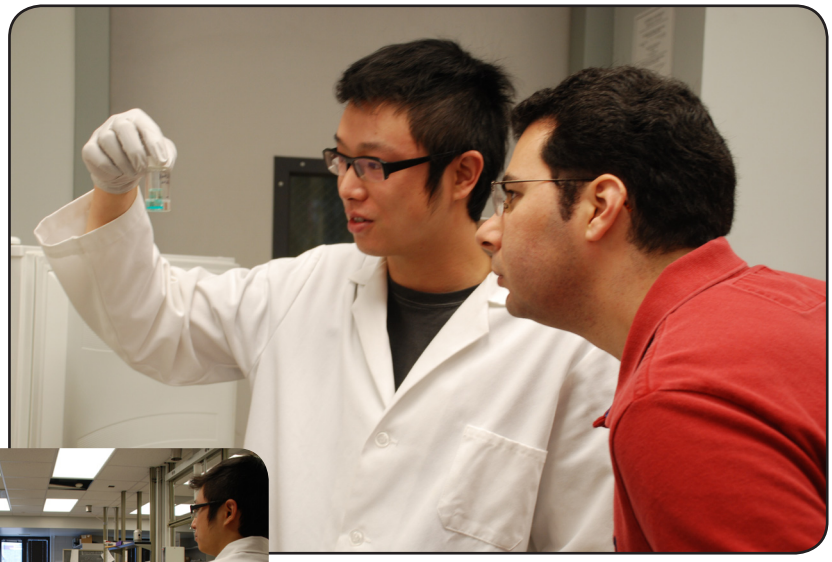
Dr. Christian R. Goldsmith, a professor of inorganic chemistry at Auburn University, is currently pursuing two major research projects. The first involves developing small molecule sensors that would allow physicians to directly detect reactive oxygen species within the body. Reactive oxygen species are believed to contribute to the pathology of various cardiovascular and neurological diseases, such as Parkinson's and Alzheimer's Diseases. The redox-active MRI contrast agents being prepared by Dr. Goldsmith's lab will identify the aberrant oxidative activity associated with these diseases and may thereby enable both earlier diagnoses of these conditions and a better understanding of disease progression.

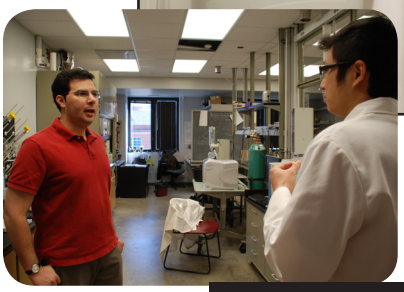
The aim of his second project is to develop catalysts for difficult organic transformations, specifically the activation of carbon-hydrogen bonds. It is Dr. Goldsmith's intent to create a more efficient means of converting these bonds into carbon-halogen groups, which are more synthetically useful. Improved halogenation reactions would streamline the development and manufacture of many pharmaceuticals. Improved halogenation reactions would also allow us to use existing- and limited- petroleum reserves more efficiently. For this research effort, Dr. Goldsmith was awarded a $100,000 grant from the American Chemical Society's Petroleum Research fund.

About Dr. Goldsmith:

Dr. Goldsmith received his A.B. (*artium baccalaureus*) in Chemistry from Harvard University and his Ph.D. in Chemistry from Stanford University. Following graduation from Stanford and before his arrival at Auburn, Dr. Goldsmith was a National Institutes of Health postdoctoral fellow at the Massachusetts Institute of Technology. "When I interviewed at Auburn, I saw that there was a really good group of chemists already in place and the department was on the rise," reflects Dr. Goldsmith. "The talent of my colleagues drew me here, and I felt it would be a good place to work for the next 20 to 30 years." Originally from Boston, Mass., Dr. Goldsmith says that although he enjoys living in the South, he misses watching Boston Red Sox games regularly. However, his true passion is chemistry. "I just love seeing how things work," says Dr. Goldsmith. "I love understanding how molecules react with one another and using that insight to address real-world problems."

For more information on Dr. Goldsmith, visit his Website at www.auburn.edu/cosam/departments/chemistry/faculty_staff/goldsmith.





Dr. Goldsmith and graduate student Wenchan Jiang inspect a crystallizing metal complex (above) and talk science (left).

Mark Steltenpohl

Geology Research Update, By Candis Hacker Birchfield

Three hundred million years ago, the north-south trending Pangaean Mountain range extended more than 10,000 km., spanning the breadth of the supercontinent Pangaea. One hundred million years later, the mountain belt was cut in half. Today, the southern half of this ancient range is called the Appalachians, and the northern half, located in Great Britain, Norway and East Greenland, is called the Caledonides.

Dr. Mark Steltenpohl, of the Department of Geology and Geography, is a leading expert on the development and tearing apart of these two mountain ranges, and he maintains active research programs of the far ends of the ancient Pangaean belt, in both the Southern Appalachians and the Arctic Caledonides. In the 20 years Dr. Steltenpohl has been a professor at Auburn University, he has received research grants from the National Science Foundation, Department of Energy, Department of the Interior, American Chemical Society Petroleum Research Fund, North Atlantic Treaty Organization, and the Norwegian Petroleum Industry. His research emphasizes field-based geological mapping integrated with laboratory studies of stratigraphy, structural analysis, metamorphic petrology, and isotopic age dating.

Dr. Steltenpohl also collaborates with geologists all over the globe, including Norway, Sweden, Greenland, Poland and the United Kingdom, working to solve some of the Earth's most ancient geographical and geological mysteries so that scientists can better understand what the Earth looked like millions of years ago and how it has evolved into its present-day form.

Additionally, Dr. Steltenpohl's research efforts have included hundreds of Auburn University students who have gained hands-on experience working in the field in Alabama, Norway and East Greenland. "I have a deep commitment to and derive great satisfaction from the close supervision of my students," says Dr. Steltenpohl.

His passion and commitment to both teaching and research has translated into public recognition. He was the recipient of the Auburn University Graduate Mentoring Award in 2008-09, the College of Sciences and Mathematics Outstanding Teacher of the Year in 2006-07, the Sigma Xi Alumni Research Award in 2003, and this academic year, he was recognized at the Auburn University Faculty Awards ceremony with the Alumni Professor Award.

"I pride myself in working hard each semester to improve my classes and further develop my teaching skills," says Dr. Steltenpohl. "I am taking full advantage of state-of-the-art instructional technology equipment in our lecture rooms. I have developed PowerPoint presentations for my courses, personalizing them with slides of myself and their GTA's at work in the field and laboratory. I have placed outlines of my notes on the World Wide Web for the students to access and annotate during my lectures. Through Tavenner Publishing, Inc., I have published a workbook for my Introductory Geology course. I am most proud, however, that my teaching evaluations at Auburn University document continued effort and improvement in my courses."

About Dr. Steltenpohl:

Dr. Steltenpohl has always enjoyed the outdoors, and was even an Eagle Scout. "Something about being a scout made me a naturalist. I learned about trees and nature, and I have always been interested in science and its thrill of discovery," says Dr. Steltenpohl. Although he is interested in several branches of science, Dr. Steltenpohl didn't hesitate when choosing geological sciences as a career. "I do not like being chained to a desk, I love being outdoors, and I like to travel," says Dr. Steltenpohl. "Geology allows me to do all of those things."

Dr. Steltenpohl smiles for the camera while teaching Geology's summer field camp course in the Rocky Mountains of southern Colorado.

Dr. Steltenpohl and three graduate students prepare for a day of field research in East Greenland. (latitude 72 degrees N)

Dr. Steltenpohl examines uranium-bearing rocks in Alabama with graduate student Jessica Horwitz.

Yanzhao Cao

MATHEMATICS RESEARCH UPDATE BY CANDIS HACKER BIRCHFIELD

Dr. Yanzhao Cao of the Department of Mathematics and Statistics was recently awarded a grant from the National Science Foundation (NSF.) The award of $138,874 will fund a project entitled *Numerical Solutions of Time-Dependent Stochastic Partial Differential Equations,* which is a two-part project. The first part includes theoretical analysis where Dr. Cao will work to create fast and highly accurate numerical algorisms to solve stochastic partial differential equations, as well as conduct error analysis on both the new algorisms he constructs as well as existing algorisms. Secondly, Dr. Cao's findings will contribute to a NSF-supported project performed by an interdisciplinary team whose goal is to create numerical simulations of ground-water flow in karst aquifers. Karst aquifers provide a significant source of fresh water for both public and private use in the Southeastern United States. Dr. Cao, who is the co-principal investigator of the project, along with other team members from Florida State University, will attempt to simulate pollution transportation in the karst aquifer so they can create tools to clean out the pollution. As a team, the total NSF grant amount is $750,000.

Additionally, this project will fund several undergraduate and graduate researchers, and will allow Dr. Cao to present his findings at national conferences.

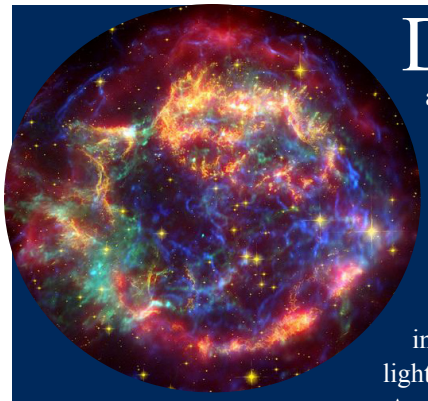
About Dr. Cao:

Dr. Cao received his undergraduate degree in Computational Mathematics at Jilin in China and his Ph.D. from Virginia Tech in Mathematics with a focus in Numerical Analysis. He was a faculty member at Florida A&M for 12 years. During that time, he held a courtesy appointment within the faculty at the School of Computational Sciences at Florida State, where he conducted collaborative research. Dr. Cao joined the Auburn University faculty in August 2008. "Living in Auburn is great. It's like coming home since I came from a small town in China and I was a born tiger according to Chinese zodiac," says Dr. Cao. "This is like a family. I am living in a small town, but surrounded by intelligent people who are world-class experts of their fields, and knowledgeable about the world. Also I really like football, and it only took me a year to become a passionate Auburn football fan."

Dr. Cao teaching his graduate-level class, Numerical Solutions for Partial Differential Equations

Stuart Loch

Physics Research Update By Candis Hacker Birchfield



Dr. Stuart Loch of the Department of Physics performs research in the field of theoretical atomic physics. He was recently awarded a $163,400 grant from the National Aeronautics and Space Administration (NASA) to act as principal investigator performing research on supernovae. "A supernova occurs when a star which has used up all of its hydrogen fuel collapses at the end of its life and then explodes in a nuclear reaction that can briefly outshine the light from the entire galaxy," explains Dr. Loch.

A supernova explosion is caused by a nuclear reaction as elements such as carbon and oxygen are fused together, resulting in the creation of new elements. Dr. Loch, along with his collaborators, who include Dr. Connor Ballance, Dr. Mitch Pindzola, Dr. Tim Kallman, Dr. Mike Witthoeft and Dr. Una Hwang, will specifically study the elements chromium, manganese, cobalt and nickel. "Not a lot of research has been done on these elements in relation to supernova explosions," says Dr. Loch. "We can't actually take samples because they are so far away, so we are restricted to looking at what we can see on earth, which is light. Each element gives off a specific light, sort of like a fingerprint."

Utilizing two of NASA's space telescopes, Suzaku and XMM-Newton, Dr. Loch will get an up-close look at the supernovae to discover light patterns in relation to chromium, manganese, cobalt and nickel. In order to predict what light is given off, new atomic data for these elements will have to be calculated. "We actually have to look at the electron-impact excitation to determine what light is given off by these specific elements," says Dr. Loch.

Dr. Loch will enlist the help of Auburn student Charles Malespin as they calculate electron-impact excitation data using a supercomputer and a set of quantum mechanics computer codes called R-matrix codes. "The supercomputers have lots of processors that allow us to calculate the atomic data in a reasonable time," says Dr. Loch. "The data is expected to be very accurate and will be used in existing NASA software to analyze and diagnose the light seen from four bright supernova remnants."

Dr. Loch's research will not only add to the understanding of these four supernovae, it will also allow scientists to make a more accurate estimate of the age of the supernovae in general. "Scientists will also be better able to test models that demonstrate why the supernova occurred," says Dr. Loch. "We will have a better understanding of which models could be correct and which ones are not correct."

Dr. Loch helps students in his PHYS 5100/6100 class, Astronomical Spectroscopy, set up their computers for a lesson in calculating energy levels of astrophysically abundant elements.

"Any element on the periodic table that is heavier than iron was probably made in a supernova explosion. Supernovae are also key in producing elements heavier than oxygen, and in spreading elements throughout the universe," says Dr. Loch. "Thus, you might say that some of the material contained in each of us came from stars that exploded as supernovae."

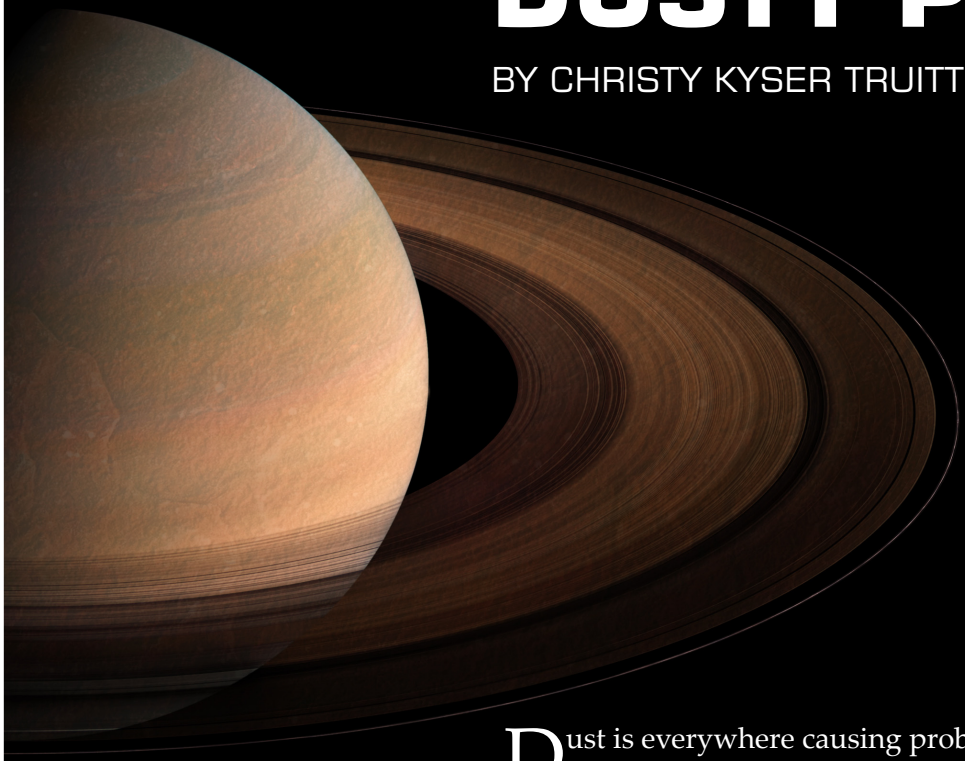
About Dr. Loch:

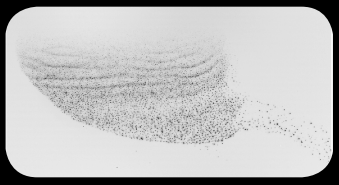
Dr. Stuart Loch received his undergraduate (Bachelors of Science in Physics, honours 1st class) and graduate (Ph.D. Physics) degrees from the University of Strathclyde, Scotland. "I like being able to deduce things from fundamental rules that I can understand," says Dr. Loch of what drew him to physics. While he was at Strathclyde, Dr. Loch learned of Auburn University from one of his graduate supervisors who had spent time in Alabama working on The Plains. As a result, when Dr. Loch was offered an opportunity to work at Auburn as a postdoctoral researcher, he took the position. Then, in 2006, Dr. Loch was hired as a full-time assistant professor at Auburn University. "This is a great job for me because I like to teach and I like to do research," says Dr. Loch.

Auburn Professor Seeks a Way to Trap and Control

DUSTY PLASMA

BY CHRISTY KYSER TRUITT





Dust is everywhere causing problems ranging from sneezes to compromised manufacturing facilities. Dust even exists in plasma (ionized gases), creating a composition commonly known in the science community as a "complex" or a "dusty" plasma. Auburn University Physics Professor, Dr. Edward Thomas, is working with an experiment that will go all the way to space to see if he can do what seems impossible on Earth — control the dust.

The white photo above is an image of a dusty plasma "cloud" being formed in a laboratory experiment at Auburn.

Dr. Thomas explains that some 20 to 30 percent of micro-electronics is contaminated with dust particles. "In the last 10 years, most of the research on dusty plasmas has been driven by the need to understand the forces that allow electrically charged dust particles to become trapped in a plasma. If you can control the dust particles, particularly during the manufacture of computer chips, you may be able to reduce the contamination. An important way to study those forces is to perform an experiment in space" says Dr. Thomas.

Because gravity is such a dominating force, Dr. Thomas believes that its elimination will allow other characteristics of both the plasma and dust to be more apparent, therefore allowing more in-depth study of how to control the environment. Gravity is a compressing agent that keeps the whole system restricted to certain sizes. In the PK4 micro-gravity experiment, the system can expand its size enabling the study of the more subtle forces that act upon the dust particles.

Dr. Thomas has been collaborating with a group of German scientists at the Max Planck Institute for Extraterrestrial Physics on dusty-plasma research since 2001 including short sabbaticals and regular visits to the country. The PK4 collaboration started in 2008 with much dialogue followed by two more visits by Dr. Thomas to Germany in 2009. In June, Dr. Thomas presented

"If we can control the behavior of the dust, then we can see how to use dust as a tool."

-Dr. Edward Thomas

his research to his collaborators and the following September was invited to present again to the PK4 International Facility Science Team.

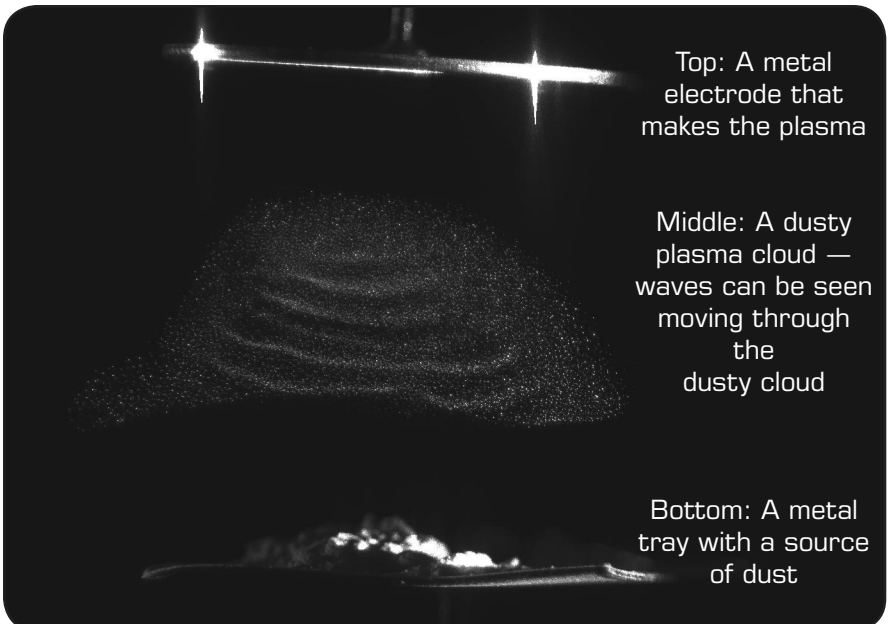
The German and Russian scientists leading the team then formally invited Dr. Thomas to join the PK4 project aimed at sending the newest dusty plasma experiment to the International Space Station (ISS) in 2011. Through a series of National Science Foundation (NSF) grants totaling some $1.5 million over the past 10 years, Dr. Thomas and his team of graduate and undergraduate students, including former Auburn Ph.D. student Dr. Jeremiah Williams and other international collaborators, will adapt a technique called particle image velocimetry to the PK4 experiment. They will perform ground-based studies in laboratories in Auburn and in Germany and then compare the data to the PK4 micro-gravity information retrieved from space.

"Some of the things we hope to discover are how to control the growth, formation and trapping of dust. If we can control the behavior of the dust, then we can see how to use dust as a tool. For example, some groups have learned how to wrap the dust grains with specific chemicals to change the surface and optical properties while other groups have developed ways to use dust to enhance the properties of solar cells and improve their ability to collect more light," says Dr. Thomas.

Once the PK4 is implemented in space, the visiting astronauts will initiate the experiment with a projected run-time of 50-100 hours per year for three-to-four years. Dr. Thomas says the high-speed data will be captured by cameras as fast as 500 frames per second. The astronauts will download the data to a hard drive, which will return to Earth on the following servicing mission. Once archived in Germany, Dr. Thomas and his team can then compare the micro-gravity experiment to the data collected on Earth.

"This will give us an idea of how to control all the forces involved. This information will be beneficial to a broad-spectrum of interests, from developing ways to reduce contamination during plasma manufacturing to understanding how dusty plasmas form large structures in space like the rings of Saturn or the long tails of comets," Dr. Thomas says.

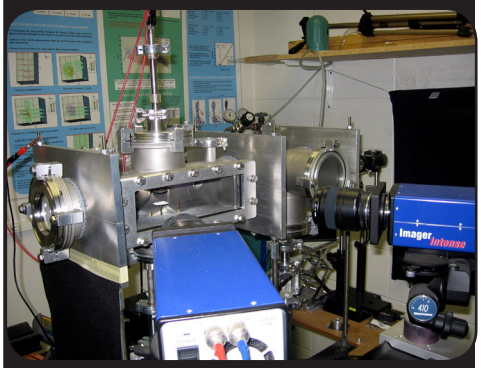
"Plus it's just really, really cool to play with things in space," he adds with a big smile.

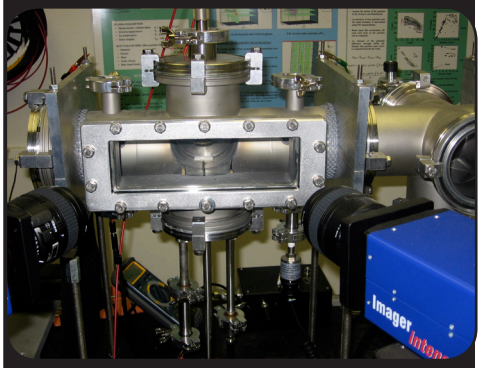


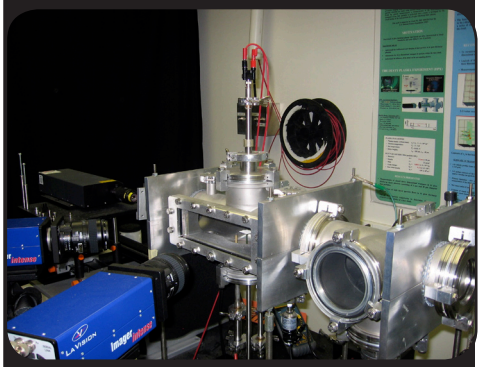
Top: A metal electrode that makes the plasma

Middle: A dusty plasma cloud — waves can be seen moving through the dusty cloud

Bottom: A metal tray with a source of dust







(above) This machine, with its power cables and fiber optic lines, is the Auburn 3D-Dusty Plasma Experiment (3DPX). The blue "boxes" are the stereo-cameras, and the chamber is made of stainless steel and aluminum.

Burning the Black Belt at the Donald E. Davis Arboretum

By: Candis Hacker Birchfield

Dee Smith, curator of the Donald E. Davis Arboretum, and her staff maintain more than 500 species of plants that are native to Alabama and adjacent states. "The Davis Arboretum has dedicated areas that represent the diverse ecosystems in Alabama," says Smith. " The various ecosystems provide an opportunity for research and education for both the University and the Auburn community. As these areas are expanded, they provide increasing habitat for birds, amphibians, insects and other organisms."

On March 4, 2010, the Donald E. Davis Arboretum staff, members of the Arboretum committee, and an interdisciplinary group of Arboretum student workers from several colleges across campus, including horticulture, biology, fisheries, forestry, and landscape architecture, gathered together to expand the Arboretum's collection of plant species by burning the Black Belt. The "Black Belt" refers to a section in the Arboretum that represents the ecosystem of Alabama's Black Belt prairies. Found in this plot of land is a huge sample of the fertile black clay soil that gave the Black Belt region of Alabama its name. Along with actual soil from the Black Belt are grasses and native wildflowers representative of the Black Belt prairies.

Dr. Les Goertzen, assistant professor of biological sciences, utilizes the Black Belt section of the Arboretum to teach his students in Systematic Botany about the native wildflowers found in Alabama. By burning the Black Belt, Goertzen anticipates that the diversity and abundance of wildflowers on display this spring and summer will increase.

"Fire is an extremely frequent and natural occurrence. We go to great lengths to suppress fire, and for good reason," says Dr. Goertzen. "However, so many native plants have evolved and adapted to a natural fire regime that fire is necessary for enhanced germination and growth of native wildflowers. The fire gets rid of overgrowth and build-up of non-native species and dead grasses, which opens up the area so the native wildflowers can get more sunshine. We will see a big difference in a month or so in the diversity of native species popping up in this area."

Dr. Goertzen says that anemones, wild onion, verbascum, mints, buttercups, blue bells and spiderwort are examples of the native wildflowers that will enjoy enhanced growth in the Arboretum due to the fire.

To see the wildflower display, visit the Arboretum in April and May. For more information call 334-844-5770 or visit the Website at www.auburn.edu/cosam/aboretum.

Dr. Les Goertzen uses a drip can to keep the fire burning.

"It will be exciting to see how the various species in the Black Belt respond to the first-ever controlled burn in the Arboretum."
-Dee Smith, Curator

Dee Smith directs volunteers as they burn the Black Belt.

Auburn employees and volunteers watch the Black Belt burn.

2009 Dean's Research Award Recipients

Faculty
Kenneth Halanych
Biological Sciences

Graduate Ph.D.
Jan Pawel Boronski
Mathematics and Statistics

Graduate M.S.
Kelly Bragan
Mathematics and Statistics

Graduate Ph.D.
Sean P. Graham
Biological Sciences

Undergraduate
Michael A. Alcorn
Biological Sciences

Evolution and Distribution of the Sea Star

Department of Biological Sciences Ph.D. candidate Alexis Janosik took a 56-day research expedition to Western Antarctica headed by the British Antarctic Survey.

As part of an international team, Janosik studied the evolution and biogeographic distributions of Antarctic animals, especially sea stars. Her work with Dr. Ken Halanych of the William P. and Ruth W. Molette Environmental and Climate Change Studies Laboratory in Biological Sciences will help elucidate responses to global climate change by studying fauna in the fastest warming area on the planet.

COSAM Researcher Finds Genetic Link Between OBESITY and ALZHEIMER'S DISEASE

By Charles Martin

An Auburn University researcher has discovered a genetic link between obesity and Alzheimer's disease, which could be the first step in curing the memory-debilitating illness that affects millions of individuals, especially the elderly.

Dr. Marie Wooten, associate dean for research and professor of biological sciences in the College of Sciences and Mathematics, found that if a certain protein molecule, called p62, is absent from the brain in mice, they are much more susceptible to Alzheimer's disease.

"When we deleted the p62 gene from mice, unexpectedly they became obese and memory-impaired, leading to insulin-resistance and Alzheimer's-like symptoms," said Dr. Wooten, who has been conducting the research for 10 years through support from the National Institutes of Health's National Institute of Neurological Disorders and Stroke.

"Our work revealed that p62 plays a critical role in receptor trafficking, which supports survival of neurons in the brain," Dr. Wooten said. Receptor trafficking is a process in the brain that allows neurons, or nerve cells, to communicate information to each other. Alzheimer's disease occurs when neurons deteriorate and die, causing memory loss.

Based on Dr. Wooten's research results, the agency has awarded her continued funding for a new four-year, $1.3 million grant, "Mechanisms of Ubiquitin Trafficking in Neurons," to genetically engineer mice to have high levels of the p62 protein in the brain and to further understand the basic function of p62.

The mice will be fed a high-fat diet to induce obesity and to increase the odds of developing diabetes, allowing Dr. Wooten to see if the increased level of p62 protects the mice against Alzheimer's disease. She said the mice also will be mated to mice that have human genes implicated in Alzheimer's disease.

Dr. Wooten will observe the mice as they age and compare the occurrences of Alzheimer's disease to the percentage among normal mice or the Alzheimer mice with reduced p62.

"If the increased p62 protein keeps the mice from getting the disease or delays the onset, then we can start looking into ways to apply the findings in combating the disease in humans," Dr. Wooten said. "We also hypothesize the mice with extra p62 may be smart mice possessing an ability to learn quicker and retain information longer, given p62's role as a trafficking molecule for receptors."

The major risk factor for Alzheimer's is age. According to the NIH's National Institute on Aging, as many as 4.5 million people in the United States have Alzheimer's, which is a slow disease that starts with mild memory problems and ends with severe brain damage. There is a growing incidence of the disease which has placed a tremendous burden on the health care system, Dr. Wooten said. Obesity puts one at risk for insulin-resistance and Type 2 Diabetes, which affects 23.6 million people in the U.S., according to the American Diabetes Association.

"It is now apparent that elderly people who are obese have higher incidence of Alzheimer's earlier in life. In the past few years, clinicians have begun calling Alzheimer's as Type 3 diabetes."
-Dr. Marie Wooten

"We have known for a long time that individuals who are obese are at risk for Type 2 diabetes and that older individuals are at risk for cognitive impairment," Dr. Wooten said. "It is now apparent that elderly people who are obese have higher incidence of Alzheimer's earlier in life. In the past few years, clinicians have begun calling Alzheimer's as Type 3 diabetes."

Dr. Wooten, who is collaborating with Alzheimer's disease research centers at the University of Alabama at Birmingham and Emory University and faculty in Auburn's Scott-Ritchey Research Center, said her next research proposal would be to examine levels of p62 in the human population, looking at individuals with mild cognitive impairment and moderate to severe Alzheimer's as a function of age.

"We would like to pinpoint a biomarker or early indicator, so we could determine the likelihood of Alzheimer's when examining living persons," she said. "Currently, Alzheimer's only can be accurately confirmed in humans by examining the brain after death. The brain will have protein-fragment tangles and deposits that are believed to have blocked communication between the neurons."

Results from that study would indicate whether or not it would be feasible to develop drug compounds to enhance the amount of p62 in the brain.

"Research and development of treatments is not a short-term process, often taking many years and an interdisciplinary approach," Dr. Wooten said. "A major goal for the National Institutes of Health is to accelerate the impact that research in basic science has upon treating human diseases."

Serenity Now

Looking to get away from it all? Auburn's Donald E. Davis Arboretum, operated by COSAM, is a great place to ponder life's big questions or just shoot the breeze. The park is home to dozens of animals and plants living in common Alabama environments, from rocky hillsides to damp bogs. Located near the President's home at the corner of Garden Drive and South College Street, the Arboretum is open from sunrise to sunset every day of the year. Best of all, admission is free. Contributed by Auburn Magazine. Photo by Jeff Etheridge.

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