

appalachian

explorations

Research and Creative Endeavors at Appalachian State University

Fall 2006



Ozone in the Smokies

**Researcher
examines its effects
on native plants**

Comments from the Provost



"The major purposes of scholarship, including research, writing and other creative activities, are threefold: to serve as a basis for instruction, to ensure a vital and intellectually engaged faculty, and to contribute to the advancement of knowledge."

– Appalachian State University Mission Statement

The above excerpt from the Appalachian State University Mission Statement sets the tone for scholarship at Appalachian, and today's faculty members are even more engaged in scholarship than they were when this statement was adopted in 1995. At the same time, scholars on our campus continue to see these three areas of instruction, faculty engagement, and the advancement of knowledge as connected in very specific ways.

As you will read here, scholarship and instruction are linked in a growing number of faculty-student collaborations, in research initiatives that have an instructional component, and in research into how students learn. Many faculty members are vitally engaged in projects that have practical applications to everyday life in our state, as evidenced by the work described here on healthy eating and on the impact of ozone on the environment. In addition, scholars continue to contribute to essential bodies of human knowledge, for example by preserving the history of an indigenous art form such as southern gospel music. Simply put, our faculty members use their scholarship to educate the next generation while simultaneously providing both immediate and long-term benefits to society. The resources to support this scholarship come from a wide variety of sources and include an increasing amount of external funding from state, federal, and private agencies.

I encourage you to read this issue of Appalachian Explorations, in which you will find articles about education, health, history, astronomy, and the environment. Please follow our progress as we continue to develop and deepen our scholarship during a particularly creative era in this institution's history.

Sincerely,

Stan R. Aeschleman
Provost and Executive Vice Chancellor

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Cover photos: Great Smoky Mountains National Park, courtesy of Richard Weisser and SmokyPhotos.com. Inset, an ozone-damaged leaf courtesy of University Photographer Mike Rominger.

Students as Consumers?

Yes, says an education researcher. Give 'em what they want and they will learn even more.



By William Purcell '94

Every Wednesday Larry Korterling buys a copy of USA Today to check out that week's top-rated cable television shows.

"Yep, there it is," Korterling says, pointing to the list. "World Wrestling Entertainment's Monday night 'RAW.'"



Larry Korterling

Professional wrestling has millions of fans who pack arenas and buy merchandise. No one does a better job of listening to the consumer than the WWE, he said. They survey fans, conduct focus groups and use other market research tools to discover exactly what fans want, even which wrestlers fans want to win.

"And then they give it to them," said Korterling, a professor in the Department of Language, Reading and Exceptionalities in the Reich College of Education. "We must do this in education to improve our schools, prevent dropouts and help every student succeed."

After 12 years of research and more than \$3 million in federal grants – much of those dollars related to improving special education and preventing dropouts – Korterling has found that the key to school improvement is simply viewing students as consumers. Listen to them and give them what they want, he recommends.

Regardless of gender, age or scholastic ability, Korterling has found that students all want the same things from school:

- teachers who care about them
- teachers who help them succeed
- better relationships with adults
- more group work
- choice in assignments
- more technology in the classroom

Korterling advocates annual school-wide student surveys and surveys in each classroom. He wants to see what students think is working and not working, what they need and don't need.

"Businesses that thrive respond to consumers, those that don't fall by the wayside," said Korterling, who has taught at Appalachian since 1992. "NASCAR adopted the WWE model and has experienced 20 percent growth a year since. Imagine our schools if students felt the same enjoyment from and loyalty to education that NASCAR fans and wrestling fans feel for their sports."

After surveying students, Korterling shares their consumer data with teachers. Most teach-

ers find creative and innovative solutions once they truly know what students want. His grants support them financially with the resources and training they need, especially for purchasing and using laptops, LCD projectors, digital cameras, iPods and other advances that can help students learn.

Listening to the student consumer makes school more enjoyable – and that plays a big role in keeping teachers in the profession and preventing students from dropping out, according to Korterling.

"Teachers have a great day when students enjoy school," he said. "Unfortunately, at many schools enjoyment and creative teaching is not encouraged, or understood."

Korterling is taking his students-as-consumers message to educators around the United States and the globe through workshops and podcasts. A five-year, \$5.2 million grant from the U.S. Department of Education earlier this year established the National Secondary Transition Technical Assistance Center (NSTTAC), which provides national and regional workshops, online resources and other services. It is housed at the lead institution, UNC Charlotte, with major help from Appalachian and Western Michigan University.

Alumnus puts belief into practice

Biology teacher Bryan Wood '96 views his students as consumers.

He and Appalachian researcher Larry Korterling worked together to survey Wood's students, and they found that students wanted more choice in assignments, more group work, more technology in the classroom and, above all, a teacher who cares about them.

Wood gives them what they want.

"I give three or four choices of projects," said the Watauga High School teacher. "Sometimes they tell me none of the three work for them and I let them come up with a project of their own such as a video, a Web page or a PowerPoint presentation."

For him, seeing students as consumers means helping them take responsibility for their education.

"Giving students choice is not easier on students, it's harder," Wood said. "They have to learn real-world concepts like

time management, teamwork and when to ask for help."

When studying cell mitosis, for example, a student who is strong in reading may choose to complete a traditional reading and study-guide assignment. Someone strong in hands-on learning may choose to create a detailed model. A student who enjoys creative writing may elect to write job descriptions for each cell part.

"They take ownership of the learning," Wood said. "I set the topic and the deadlines, but students choose how to prove they've learned the material and how to best meet that deadline."

Wood's classroom has the traditional elements of tests, exams and lecture, but most days students are spread throughout the room busy working in groups on experiments, or alone reading in a corner, researching on the computer or painting a mural on the wall. Wood moves from group to group, person to

Although designed for special education teachers at the high school level, his podcasts and presentations through NSTTAC have value for all teachers and administrators, according to Korterling.

One message Korterling has for policymakers is to shift teacher pay and rewards away from standardized test scores, which he considers an incomplete measure of effective teaching.

"Teachers don't get paid or rewarded for what students want, which is being a caring adult and helping them succeed," Korterling said.

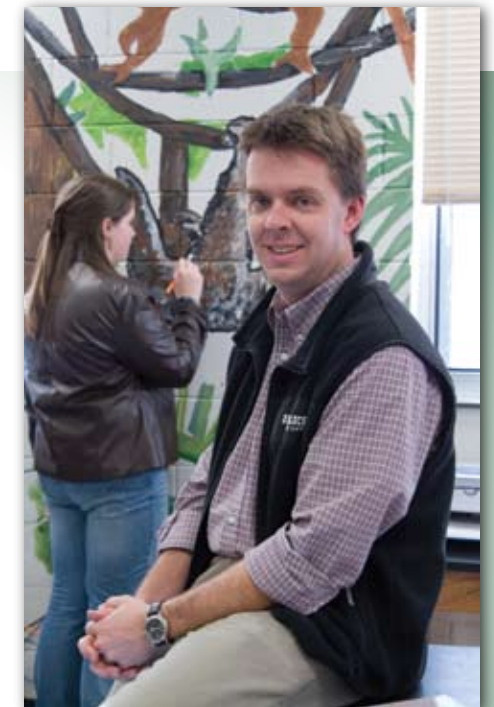
He suggests a more simple method: provide gift certificates for students to give to teachers they consider the best.

Like professional wrestlers, Korterling talks a big talk. But he walks the walk, too.

He offers Appalachian students a \$30 to \$50 refund out of his own pocket if they don't enjoy his class.

So far, no takers. AE

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Bryan Wood '96

person – answering, explaining, teaching.

"More advanced students move on to higher-level material while I review material others are struggling with," Wood said of his increased one-on-one time with students. AE

Whole Foods = Good Health

Couple say dark-colored fruits and vegetables are best, especially the antioxidant-packed blueberry

By William Purcell '94

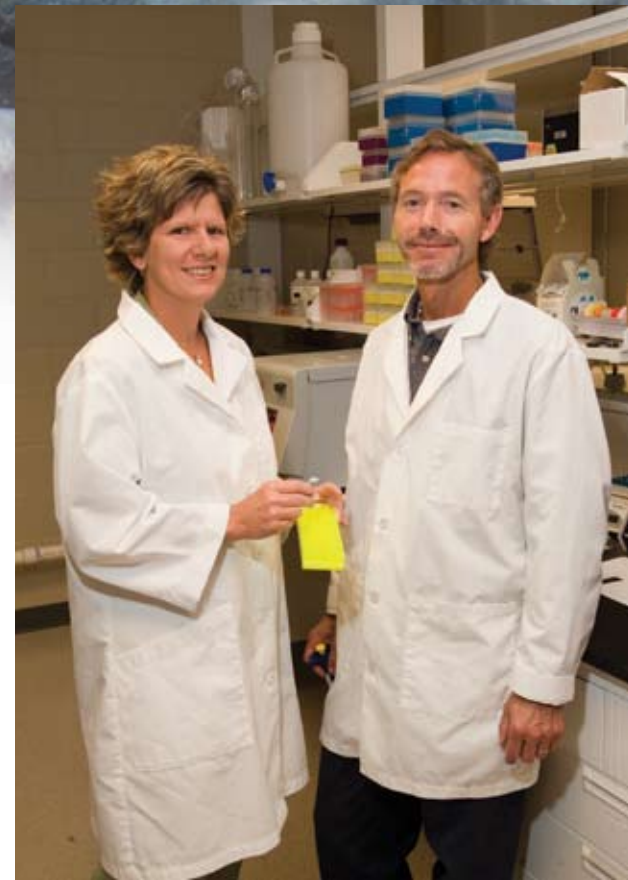
A husband and wife research team says Americans should stop depending on supplements to make up the nutritional gap and turn instead to whole foods to stay healthy, live longer and fight disease.

"Convenience is killing us," said Lisa McNulty, an associate professor in Appalachian State University's Department of Family and Consumer Science who conducts research with her husband, Steve, an assistant professor in the Department of Health, Leisure and Exercise Science. "For society, it has become how quickly can I get something, such as a pill, to take care of it all?"

For people without an overt vitamin and/or mineral deficiency, there is little scientific evidence to support the benefits of supplements, according to the McNultys. The Food and Drug Administration does not regulate the vitamin and supplement industry, so many industry claims remain unsubstantiated.

In particular, America's new obsession with the health benefits of antioxidants – thought to prevent cancer, heart disease and stroke – have more people taking large doses of vitamins C, E, A, and beta-carotene and minerals such as selenium.

That approach could be dangerous, the McNultys say. Their research shows that large-dose vitamin sup-



Lisa and Steve McNulty

plements do not always substitute for a healthy, well-balanced diet.

Their studies focus on natural antioxidants found in whole foods and in particular fruits and vegetables. Specifically, the couple have examined how blueberries – packed with antioxidants in the blue pigments of their skin – combat oxidative stress.

When humans encounter smoke, toxic chemicals, ultraviolet light or even when they exercise, their bodies undergo oxidative stress that creates free radicals at the cellular level. Free radicals damage cell walls, structures and genetic materials, which in the worst case can lead to disease such as cancer.

Antioxidants fight free radicals, neutralizing them before the free radicals can damage the body.

While the body makes its own antioxidants, it needs them from foods, too.

"Exercise, especially extreme exercise, causes damage to the body," said Steve McNulty, who is a former marathon runner. "If you are going to exercise, you must have the healthiest diet possible to fight the oxidative stress you put on your body."

He says antioxidants from whole foods not only fight free radicals, but they slow or prevent artery blockages from the oxidation of LDL-cholesterol. Additionally, the antioxidants may stop the collection of plaque on artery walls.

In one study, the McNultys had 12 runners alternate between a week of supplementing with vitamin C, a week with no supplements and a week with a cup of blueberries each day. At the end of each week the subjects ran for 40 minutes as the team tested levels of oxidative stress.

They found that the runners eating a cup of blueberries every day had the lowest levels of oxidative stress.

This finding led the couple to focus their next study on blueberries only. They expanded the study, increasing the number of subjects to 23 and increasing the dosage to a cup and half of blueberries each day. The length of the study increased, too, from eating blueberries for one week to six weeks.

The research required specialized subjects who could run for 2.5 hours. Though the subjects were well-trained runners, Steve McNulty says the findings translate to the general population.

"Everyone encounters oxidative stress," Steve McNulty said. "Just the act of breathing creates it. Whether you're a marathon runner or you just walk for exercise you're going to benefit from eating blueberries and other whole fruits and vegetables that have antioxidants."

Initial results from their latest blueberry study indicate that cells that fight cancer were doubled in subjects who ate a cup of blueberries each day for six weeks.

The team's blueberry research has been funded by the North American Blueberry Council and the United States Highbush Blueberry Council. The McNultys picked blueberries because of their prominence as a crop in North Carolina and along the East Coast.

"Another reason for using blueberries is that runners can eat them and still run," Steve McNulty said. "We could have picked prunes, but I don't think that would have worked out well for our test subjects."

Having also studied two of the most popular large-dose supplements, vitamins C and

E, as part of larger interdisciplinary research team at Appalachian, the two researchers have concluded that taking large doses of these supplements lacked any benefit and was even detrimental to health.

In those studies, runners took approximately 10 times the Recommended Daily Allowance (RDA) of vitamin C and suffered worse immune systems for it. Triathletes taking large supplements of vitamin E also had increased damage to the body.

"Our bodies are very finely balanced and they don't like manipulations to them," said Steve McNulty.

Taking small amounts in a multi-vitamin meeting RDA levels is safe; however, the McNultys emphasize that fruits and vegetables already have the same vitamins and minerals in the right amounts naturally.

The McNulty message is simple: Vitamin and mineral supplements should never be used to substitute for a healthy, well-balanced diet. They also advise avoiding over-supplementing the body with more than the RDA of certain vitamins and minerals.

Vitamins A and E are fat soluble, for example. Any excess amounts are stored by the liver and in fatty tissues, which creates a risk of toxicity.

Yet, despite growing evidence of the benefits of eating more whole foods like blueberries, Americans continue to buy into the myth of dietary supplements – making the growing industry's advertising tough to compete with.

"The message of eating a well-balanced diet with plenty of whole foods, including fruits and vegetables, has been out there for a long time," Lisa McNulty said. "The problem is that no one is listening." ^{AE}

The McNultys can be reached at mcanulty1@appstate.edu, (828) 262-2630, or mcanultysr@appstate.edu, (828) 262-7151. See related links: www.hles.appstate.edu and www.fcs.appstate.edu

The McNultys recommend eating seven to 10 servings of fruits and vegetables a day. In all foods, Lisa McNulty suggests the darker the better:

- ✓ Pick sweet potatoes over white.
- ✓ Take spinach instead of iceberg lettuce.
- ✓ Remember, the darker the pigment the greater the natural antioxidants.

"It can be fun," she said. "If you're going to drink wine and eat chocolate, at least choose red wine and dark chocolate."



THE POLLUTING OF A PARK

By Kate Cahow

From 1989 to 1998, ozone levels doubled in the Great Smoky Mountains National Park, contributing to its status as one of the National Park Service's worst parks for air pollution.

And, although 1999 was one of the worst years on record for ozone levels in the park, levels since then have been dropping, with 2004 being one of the lowest years.

"There are things going on here that help to explain changes in ozone levels in the park," said Howie Neufeld, a biology professor at Appalachian State University whose research has focused on the impact of ozone on native plant species in the park.

"The 1990s were particularly hot, dry years," he said. "That type of weather is particularly conducive to making ozone. And, six to eight of those years were some of the region's hottest years."

What these data illuminate, according to both Neufeld and Jim Renfro, the Air Resource Specialist with the Great Smoky Mountains National Park, is that emission controls and weather patterns are the most important determinants of what ozone and other air pollutants are doing and will continue to do in the park and elsewhere.

"We know that hot, dry, stagnant air exacerbates ozone, and that cool weather combined with emission reductions reduces levels," said Renfro. "As we continue to monitor ozone, we need to be aware of the long-term trends and cycles associated with both weather patterns and emission controls."

The current long-term trend of ozone in the region is downward, due mainly to the Clean Air Act's ability to reduce peak ozone effects, said Neufeld.

"But, according to modelers who work with global climate change, levels of ozone are predicted to rise, especially in the world's more industrialized nations."

This means that scientific investigation, such as Neufeld's, into the impact of ozone on both the natural world and human health will continue to be of interest and value to both the scientific community and the world's many inhabitants.

Ozone, the good and the bad

Neufeld says that people need to know that there is both "good" and "bad" ozone.

Researcher's work
illuminates impact
of toxic ozone within
the Great Smoky
Mountains and how
its levels respond
to weather and
policy changes.



Biologist Howard Neufeld

Background photo courtesy of Howard Neufeld.

The Polluting of a Park



An ozone-damaged tulip poplar leaf.

“Ozone in general is a very damaging molecule. High concentrations are not needed for it to cause injury or damage,” he said.

“Good ozone is in a layer of the atmosphere starting about 10 miles up from the earth’s surface. It is considered good because it shields us from ultraviolet radiation. If this ozone were destroyed, it would be detrimental to all forms of life.”

Chlorofluorocarbons, or CFCs, are chemicals that were used by industry in refrigerants, cleaning solvents and aerosol sprays. The chlorine-containing compounds are highly destructive to good ozone. Just one chlorine molecule can break down hundreds of thousands of ozone molecules.

“The Montreal Protocol was signed in the 1980s to stop production of these compounds,” said Neufeld. “That one treaty has been the most successful environmental policy in history, and has helped to keep further damage being done to this beneficial ozone.”

Bad ozone is located on the surface of the earth. It is both naturally occurring and manmade. There is always a low level, or background level, of ozone in the environment. Lightning, for example, is a natural source. Man-made sources derive from volatile organic compounds (VOCs), or sources such as power plant emissions, dry cleaner fumes and gasoline fumes.

“Ozone is considered a secondary pollutant,” said Neufeld. “It is made when VOCs interact with nitrogen oxide in the presence of light. Once again, the best conditions to make ozone are hot, sunny, stagnant days.”

For the Great Smoky Mountains National Park, its battle with ozone appears to be an unfortunate case of geographic configuration.

“You might think of the park as existing between two gears,” said Neufeld. “One gear is swirling over the Ohio valley and the upper Midwest, depositing in its wake industrial pollutants that react with light to form ozone. The other gear is bringing pollutants up from Texas, Louisiana and Tennessee. All this is assembling right over the park.”

The canary in a bird cage

Neufeld’s nearly 20 years of research in the Smokies have resulted in a body of knowledge that can be used to understand and predict the impact of ozone.

Since 1988, when Neufeld arrived at Appalachian, he has worked with a variety of researchers and funding agencies, such as the National Geographic Society, the National Park Service and the U.S. Environmental Protection Agency, to assess the impact of ozone specifically on native plants in the park. The bigger picture joins Neufeld’s work with a vast amount of data on everything

from crop damage attributed to ozone, to the human health costs associated with ozone exposure.

“Essentially, we’re dealing with the proverbial ‘canary in a bird cage,’” said Neufeld. “If plants and trees are dying in the park because of ozone, it could be an indicator of a greater change for all of us.”

According to Neufeld, when ozone gets into the cells of a plant, depending on its sensitivity to ozone, it can reduce the productivity of those cells, thus damaging not only the plant but the plant’s environment or ecosystem as well.

“Through our survey work we found that nearly 100 species, or 6 percent of the park’s flora, show symptoms such as deep purple to brown spots on the leaves, which is consistent with ozone exposure,” he said.

“In our work at Purchase Knob in Waynesville, we discovered that of the cutleaf coneflowers we were studying, some were injured by ozone and some were not. Those that were injured produced many fewer flowers per plant than those not injured, and those injured flower heads produced only 50 percent of the seeds of the uninjured plants. This is a fairly large difference, and suggests that overall genetic diversity of the plant may be reduced.”

This type of data is essential to park officials, as the park service is mandated to preserve species and genetic diversity. If researchers, such as Neufeld, can show that certain genotypes are being affected or even eliminated by ozone, then park administrators have ammunition to prompt policymakers to tighten environmental legislation.

“We know that quality of life is impaired when the environment is polluted,” said Neufeld. “Estimates are in the billions of dollars per year in the U.S. alone for lost yield and productivity of our forests and crops. This is specifically ozone related.”

Engaging policymakers

If, as models predict, worldwide ozone levels rise from between a half to 2 percent a year into the next century, these new levels will affect the growth of plants, impair ecosystem functioning and reduce crop yields, said Neufeld.

“From a human health standpoint, high ozone events are linked to increased check-ins at hospitals by the elderly with respiratory problems, increased heart attacks and increased mortality,” he said. “Children are especially at risk because they breathe more rapidly and are more active, so they tend to take in more ozone. If back-

ground levels go up as predicted, just breathing the air can be unhealthy.”

Ultimately, researchers today know the potential consequences of ozone exposure, and what factors cause ozone to be a hazard to both the environment and human health. The challenge, according to Neufeld, is to continue to engage policymakers with data that can be used to write and enforce more stringent environmental policy.

“The successes we’ve had with the Clean Air Act and the Montreal Protocol show what can be done with proper legislation. Researchers need to keep gathering data to give regulators and policymakers ammunition to tighten ozone laws,” Neufeld said.

“I love the work I do,” he added. “And, I love learning about nature. The fact that the state and federal government provide me funding to learn about the living world is great incentive for me to continue my work. It’s how I choose to give back to society. And, it’s the most fun thing I can imagine doing with my life.” AB

Howard Neufeld can be reached at neufeldhs@appstate.edu or (828) 262-2683. See related link: www.biology.appstate.edu



Graduate student Ann Hayler of Asheville studies the effects of ozone on plants in a controlled environment inside Appalachian’s greenhouse.



Historian and gospel music fan James Goff

GOSPEL MUSIC'S SACRED ROOTS

Researcher's lifelong passion sparks scholarly inspiration

By Kate Cahow

James Goff is a fortunate man. As a child of rural North Carolina, he was a passionate fan of southern gospel music. Years later, as a professor in the Department of History at Appalachian State University, Goff's research provided him with the opportunity to fuel that passion.

"I grew up listening to the music of groups like The Blackwood Brothers Quartet, The Florida Boys and The LeFevres. These people were my childhood heroes," he said. "As I got into a research project on the history of southern gospel music, I had the opportunity to meet many of these people, and the good fortune to call many of them friend."

That project resulted in "Close Harmony: A History of Southern Gospel," published in 2002, and in Goff's expert status on the genre. In the book, Goff recounts the unfolding of southern gospel music from its roots in 19th-century songbook publishing to its emergence as an industry phenomenon. The story is replete with careers made and lost, studio recording sessions, television and radio shows devoted specifically to the music, and cross-country tours via old converted buses. According to Goff, the southern gospel world introduced touring by bus to the music industry.

"In the 1950s, The Blackwood Brothers bought an old Greyhound bus, refurbished it with chairs and bunks, and took it out on the road," says Goff. "Shortly after that other gospel groups followed suit, then country music groups, and finally rock 'n' roll groups."



LeFevre Trio

Goff's research into the world of southern gospel music, and his development as a scholar, can be traced to his Christian faith.

"I've never separated my work as a historian from my private life," he said. "I grew up in a Pentecostal church, and learning about the church's history has driven much of my scholarly work."

Goff's first book, "Fields White Unto Harvest," published in 1988, explores the origins of Holiness-Pentecostalism, a religious tradition that today claims more than 500 million followers worldwide.

"The movement grew out of 19th-century Evangelicalism, and emphasized the presence of the Holy Spirit through phenomena such as speaking in tongues and divine healing," said Goff.

The publishing of Goff's third book, "Portraits of a Generation: Early Pentecostal Leaders" (a co-edit-

ed volume), coincided with the publishing of "Close Harmony." While working on both this manuscript and his first book, Goff identified a connection between early Pentecostal history and southern gospel music that became the impetus for "Close Harmony."

"I discovered that the people in early southern gospel music were a mix of independent Baptists and Holiness-Pentecostals," said Goff. "People like the Speer Family and J.D. Sumner, the great bass singer who sang backup on The Elvis Presley Show. These people came out of the Holiness-Pentecostal movement. It was this connection that piqued my curiosity."

Goff began researching the history of southern gospel music in 1992. A grant from a Boone-based publication, The Singing News, enabled him to take time off from teaching in 1996 and focus on this work. Little did he know that his research would lead not only to the publishing of "Close Harmony," but would be the primary instrument in the creation of The Southern Gospel Music Hall of Fame and Museum at Dollywood in Pigeon Forge, Tenn.

"Members of the Southern Gospel Music Association (SGMA) felt my research would benefit their efforts to design and build exhibits for the museum," Goff said. "They anticipated taking about 10 years to find land and raise money for the project. But, then Dollywood stepped in."

Goff was halfway through his manuscript for "Close Harmony" when the SGMA and a group from Dollywood approached him with their request.

"My involvement in the project delayed the book. But, I recognized this as an opportunity not to be missed," said Goff.

The museum opened in April 1999. Its 4,000 square feet of exhibit space are dedicated solely to the history of southern gospel music, and the many groups and individuals who made their living playing the music.

"I worked harder that year than I have ever worked in my life," said Goff. "I was up late night after night working on the book and the museum, trying to meet all kinds of deadlines. But, I've enjoyed it all."

"My brother once said something that sums it all up for me. 'Let me get this straight,' he said. 'You get paid to travel around, go to concerts, interview musicians and write about it?' I said, 'Yes. And, it's not a bad life.'" **AE**

James Goff can be reached at goffjr@appstate.edu or (828) 262-6011. See related link: www.history.appstate.edu

Archival images courtesy of Singing News magazine.



Speers Family



The LeFevres



Blackwood Brothers

Trio studies March 29 eclipse

Total solar eclipses are rare events. That's why the March 29 solar eclipse, visible along a path from Brazil to central Asia, gained plenty of attention from researchers, including three from Appalachian State University's Department of Physics and Astronomy.

With totality lasting between three and four minutes, the March eclipse offered scientists a longer period of study than many previous eclipses.

Assistant professor Adrian Daw traveled to Libya with a University of Hawaii astronomer to study the infrared and magnetic properties of the sun's corona – the faint halo of two-million-degree gas around the edge of the sun.

"The eclipse provides researchers a rare opportunity for this research on the sun's corona, as the disc of

Students present research at conference

Twenty-five undergraduates from Appalachian State University delivered 16 different research presentations at the 20th National Conference on Undergraduate Research at UNC-Asheville in April.

The presentations included five different oral sessions and 11 poster sessions representing the departments of chemistry, psychology, physics and astronomy, English, technology, and interdisciplinary studies.

"This is the largest number of students Appalachian has ever had represented at this prestigious national meeting. As a result, the students and their faculty mentors should be recognized for their scholarly endeavors," said Alan C. Utter, director of Appalachian's Office of Student Research.

the sun is blocked out by the moon," Daw said. "We can determine the magnetic field strength of the low corona from these observations."

Lee Hawkins, Appalachian's observatory assistant and engineer, traveled to the Greek island of Kastellorizo to help a Williams College team conduct experiments measuring the solar corona's temperature.

Hawkins served as the team's instrumentation engineer and took a variety of digital and film images that he plans to use for teaching and research at Appalachian (see back cover).

Assistant professor Jon Saken flew to Turkey with three teachers on an educational outreach expedition.

eclipse, provided a live Web cast of the event, and participated in an online question-and-answer session with school students around the world.

Taking teachers who in turn inspire their students has been particularly rewarding, according to Saken.

"We have impacted entire schools just by taking one teacher. Students are amazed that their teachers are going out to this exotic place and looking at this rare event. It gets them very excited about science and about the world," he said.

While in Libya, Daw also presented a talk at the International Symposium on Solar Physics and Solar Eclipses on Appalachian's research on atomic and molecular parameters of hydrogen and nitrogen. **AE**



Images © 2006 R. Lee Hawkins, Jay M. Pasachoff and Williams College.

As part of the Florida-based EclipseLive team, they taught students in Antalya about the sun and the solar



From left, Jon Saken, Lee Hawkins and Adrian Daw.

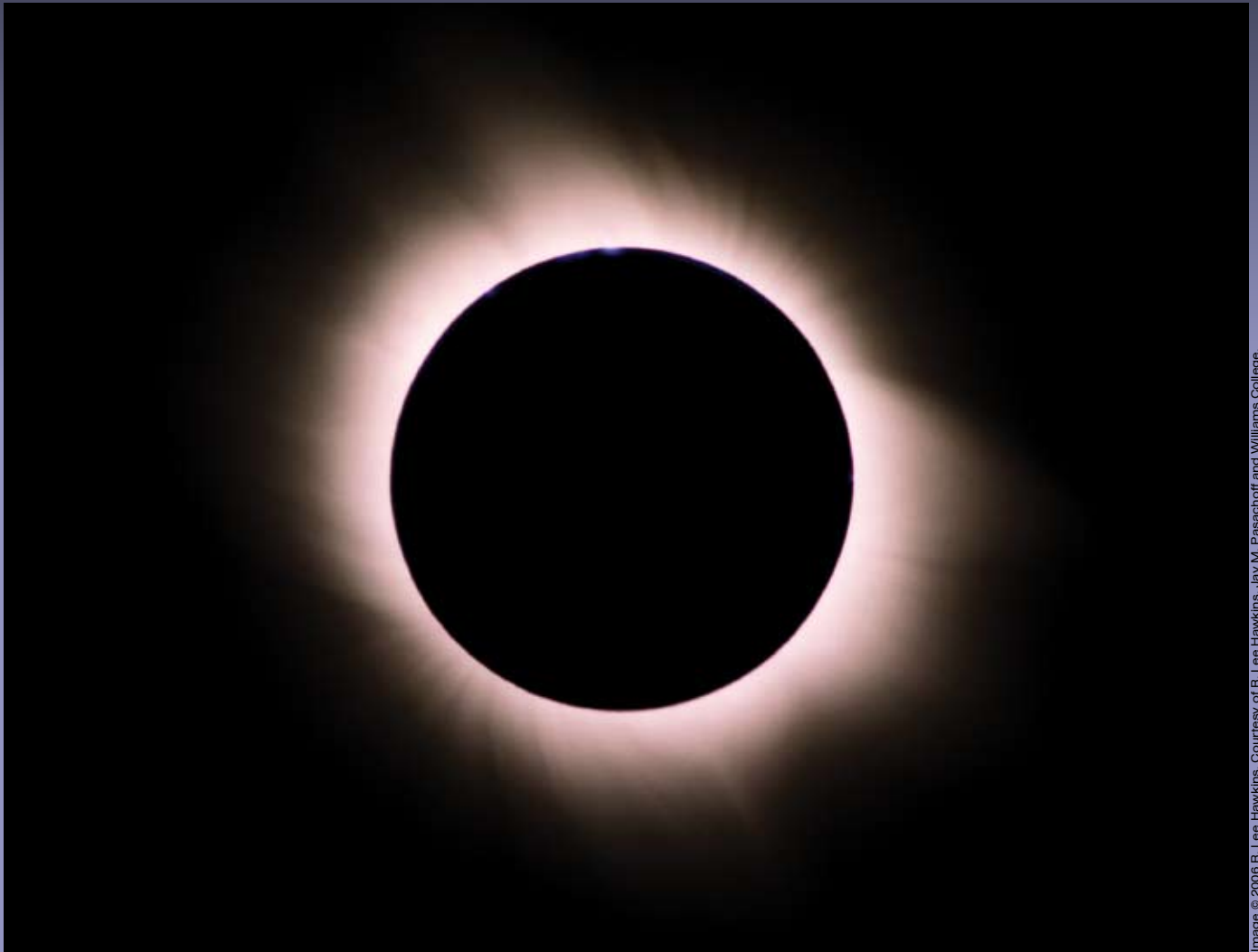


Image © 2006 R. Lee Hawkins. Courtesy of R. Lee Hawkins, Jay M. Pasachoff and Williams College.

The dancing glow of the sun's corona, as seen during a total eclipse

"The solar corona is not completely understood," says Appalachian astrophysicist Adrian Daw. Unlike most flames, which are cooler along their edges, the sun has an atmosphere hotter than its surface. Researchers around the world, including three from Appalachian, studied the March 29, 2006, eclipse to learn more about the corona's magnetic field and what contributes to its two-million-degree temperature (see story on page 15).

This photo was taken by Appalachian observatory engineer Lee Hawkins using a Nikon film camera and a 1200 mm lens.